



# CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT

Go to   
Table of Contents

## Water and Sewer Policies, Procedures, Standards and Specifications

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5100 Brookshire Boulevard  
Charlotte, North Carolina 28216

PUBLICATION DATE: DECEMBER 29, 1993

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July 27, 1995

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# IMPORTANT NOTICE

This document was created and assembled for use in planning, designing, and constructing water and sanitary sewer facilities which will be owned and operated by the Charlotte-Mecklenburg Utility Department. It is not intended nor should it be used for any other purpose.

Particular attention should be given to requirements of the North Carolina Department of Environment, Health, and Natural Resources as they relate to this document. CMUD has been granted variances from NCDEHNR regulations in instances where justification for the variance was well documented. This document includes the variances but does not specifically indicate where a variance has been made. These variances are based on local conditions, historical data, and in some cases, specialized equipment which CMUD owns and operates to maintain facilities. These variances are not necessarily appropriate for other situations or other jurisdictions.

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# TABLE OF CONTENTS

## ***I. Introduction***

- A. Purpose
- B. CMUD System
- C. CMUD Facilities
- D. CMUD Organization
- E. Utility Contact List
- F. Important Telephone Numbers

## ***II. System Planning***

- A. Ten Year Needs Assessment
- B. Five Year Capital Improvements Program

## ***III. CMUD Extension Policy***

- A. Purpose
- B. Facilities Provided by CMUD
- C. Extension of Service Required by Annexation
- D. Programs for Extension of Service
- E. Service Connections
- F. Letter of Credit for Reimbursable Program Financing
- G. Initiation/Utilization of Extension Programs
- H. Wastewater Lift Stations
- I. Other Considerations
- J. Definitions

## ***IV. Design of Sanitary Sewers***

- A. Hydraulic Design
- B. Route Selection
- C. Survey Requirements
- D. Rights-of-Way And Construction Easements
- E. Sewer Location, Spacing and Venting
- F. Conflicts With Existing And Proposed Utilities
- G. Depth And Structural Design
- H. Stream Crossings
- I. Inverted Siphon Design
- J. Protection Of Water Supplies
- K. Corrosion Protection
- L. Design of Erosion And Sediment Control Measures
- M. Bores And Tunnels
- N. Sequential Procedure For Design Of Sewer

**V. Design Of Water Mains**

- A. Fire Flow And Residual Pressure Requirements
- B. Hydraulic Design
- C. Survey Requirements
- D. Location And Depth
- E. Pipe Materials and Thickness Design
- F. Thrust Restraint
- G. Valve Location Requirements
- H. Fire Hydrant Spacing
- I. Provisions For Testing And Disinfection
- J. Air Relief Valves And Blowoffs
- K. Minimum Pipe Size And Limitations On Use Of Small Diameter Mains
- L. Conflicts With Existing And Proposed Utilities
- M. Bores And Tunnels
- N. Stream Crossings
- O. Design Of Erosion And Sediment Control Measures

**VI. Survey Standards**

- A. General
- B. Preliminary
- C. Sanitary Sewer Outfall & Trunk Lines
- D. Sanitary Sewer Street Extensions
- E. 16" and Larger Water Mains
- F. Water Mains Less Than 16"
- G. Construction Stakeout - Sanitary Sewer
- H. Construction Stakeout - Water Mains

**VII. Drafting Standards**

**VIII. Traffic Control Plans**

**IX. Permits And Encroachments**

- A. Highway Encroachments
- B. Railroad Encroachments
- C. DHS/DEM Permits
- D. Erosion Control Permits
- E. Storm Water Permits
- F. Blasting Permits
- G. Pavement Cutting Permits
- H. Burning Permits
- I. Wetlands Permits
- J. Tree Removal Permits

**X. *Engineer's Checklist for Water And Sewer Plans***

- A. Title Sheet
- B. General
- C. Water Plans
- D. Sewer Plans
- E. Contract Maps
- F. As-Built Checklist
- G. Activation/Project Final Checklist

**XI. *Environmental Assessments***

**XII. *Wetlands Permits***

**XIII. *Cross Connection/Backflow Prevention***

- A. Introduction
- B. Definitions
- C. Installation Specifications
- D. Construction Guidelines
- E. Approved Assemblies and Material Specifications
- F. Testing Requirements
- G. Certified Tester Requirements
- H. Test Kits
- I. Approved Testing Equipment
- J. Approved Testers Schools
- K. Standard Details

**XIV. *Standard Water Specifications And Details***

**Material Specifications**

- A. Pipe
- B. Fittings
- C. Fire Hydrants
- D. Valves
- E. Water Main Taps
- F. Sleeves/Clamps
- G. Residential Water Services
- H. Large Water Services
- I. Ferrous Castings
- J. Miscellaneous Steel
- K. Concrete
- L. Stone and Brick
- M. Traffic Control Devices
- N. Erosion Control

## **Detailed Specifications**

- A. Handling and Storage of Materials
- B. Connection to Existing Mains
- C. Existing Utilities
- D. Water/Sewer Clearance
- E. Excavation
- F. Pipe-Laying
- G. Installation and Assembly
- H. Installing Valves, Hydrants, and Fittings
- I. Water Main Taps
- J. Backfill
- K. Compaction
- L. Removal and Restoration of Pavement
- M. Concrete
- N. Bores
- O. Guaranteed Casing
- P. Tunnels
- Q. Blasting
- R. Testing and Inspection
- S. Repairs
- T. Restoration
- U. NCDOT right-of-way

## **Standard Details**

### ***XV. Standard Sewer Specifications And Details***

#### **Material Specifications**

- A. Pipe
- B. Manholes
- C. Miscellaneous Steel
- D. Concrete
- E. Stone and Brick
- F. Ferrous Castings
- G. Traffic Control Devices
- H. Erosion Control

#### **Detailed Specifications**

- A. Handling and Storage of Materials
- B. Connection to Existing Sewers
- C. Existing Utilities
- D. Sewer/Water Clearance
- E. Clearing
- F. Excavation
- G. Pipe-Laying



- H. Lateral Installation
- I. Backfill
- J. Compaction
- K. Manhole Construction
- L. Piers
- M. Removal and Restoration of Pavement
- N. Concrete Construction
- O. Bores
- P. Guaranteed Casing
- Q. Tunnels
- R. Blasting
- S. Testing and Inspection
- T. Repairs
- U. Abandonment
- V. Restoration
- W. NCDOT right-of-way

**Standard Details**

***XVI. Environmental Protection***

- A. Trees
- B. Air Pollution
- C. Noise Control
- D. Water Pollution
- E. Erosion and Siltation Control
- F. Standard Details

***XVII. Wastewater Lift Stations And Force Mains***

- A. Operational & Performance Standards
- B. General Provisions & Details
  - 1. Pump Stations
  - 2. Wetwell
  - 3. Valves
  - 4. Piping
  - 5. Structures
  - 6. Site
  - 7. Testing, Inspection, and Startup
- C. Electrical Specifications for Package Pump Stations
  - 1. General
  - 2. Materials and Methods
  - 3. Motors and Controls
  - 4. Electrical Power Equipment
  - 5. Lighting Fixtures
  - 6. Testing, Inspection, and Startup

**D. Standard Details**

***XVIII. Low Pressure Sewers***

- A. Design of Pressure Sewer Systems
- B. Material and Installation Specifications for Low Pressure Sewer
  - 1. Piping
  - 2. Fittings
  - 3. Valves
  - 4. Service Boxes and Lids
  - 5. Installation
- C. Standard Details

***XIX. CMUD Methods And Materials Committee***

- A. Purpose
- B. Composition And Procedures
- C. Criteria For Approval Of New Materials Or Construction Methods

**I. INTRODUCTION**

The purpose of this manual is to set forth, in a single source, the policies, planning processes, design standards, materials and construction standards and details, and regulatory requirements that apply to facilities to be incorporated in the Charlotte-Mecklenburg Utility Department's water and sewer system. As changes are made to these policies, processes and standards, the manual will be revised and updated as needed to keep it current.

The manual will be distributed to those who request it upon payment of a one time fee of \$30.00. This fee is to cover production costs and the cost of revisions to keep the document current. A list of registered manual owners will be maintained in a computer file and updates/revisions will be automatically distributed to these registered owners at their address of record. It will be the responsibility of the registered manual owners to notify the Charlotte-Mecklenburg Utility Department, Contract Administration Section, of address changes.

The manual will be reviewed annually for updating, and more frequent updates/revisions will be made as significant changes or additions are made to the material covered.

REVISION LIST

<b>REVISION #</b>	<b>DATE</b>	<b>PAGE NO.</b>	<b>DESCRIPTION OF REVISION</b>
#1	3/7/94		Major revision to all sections
#2	7/27/95		Design of Sanitary Sewer, Permits

## CMUD SYSTEM

The Charlotte Mecklenburg Utility Department, a department of the City of Charlotte, provides water and sanitary sewer service throughout Mecklenburg County, including the following cities and towns: Charlotte, Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville.

The CMUD System components and capabilities are approximately:

- 2,500 miles of water mains
- 2,500 miles of sanitary sewer lines
- 142,000 service connections
- 122 MGD water treatment capacity
- 79 MGD sanitary sewer treatment capacity

## DIRECTORY OF CMUD OFFICES AND FACILITIES

### **OFFICES**

Administrative Headquarters: 5100 Brookshire Blvd. 399-2221  
Engineering Division: 5100 Brookshire Blvd. 399-2221  
System Protection Division: 5100 Brookshire Blvd. 394-9284  
Water Distribution Division: 2035 Patton Ave. 336-2564  
Customer Service Division: 2035 Patton Ave. 336-2564  
Wastewater Collection Division: 4100 W. Tyvola Rd. 357-6064

### **RAW WATER PUMP STATIONS**

Catawba River Pump Station: End of S.R. 2002 off Mt. Holly-Huntersville Rd. 399-2331  
Davidson Raw Water Pump Station: End of Torrence Chapel Rd.

### **WATER TREATMENT PLANTS**

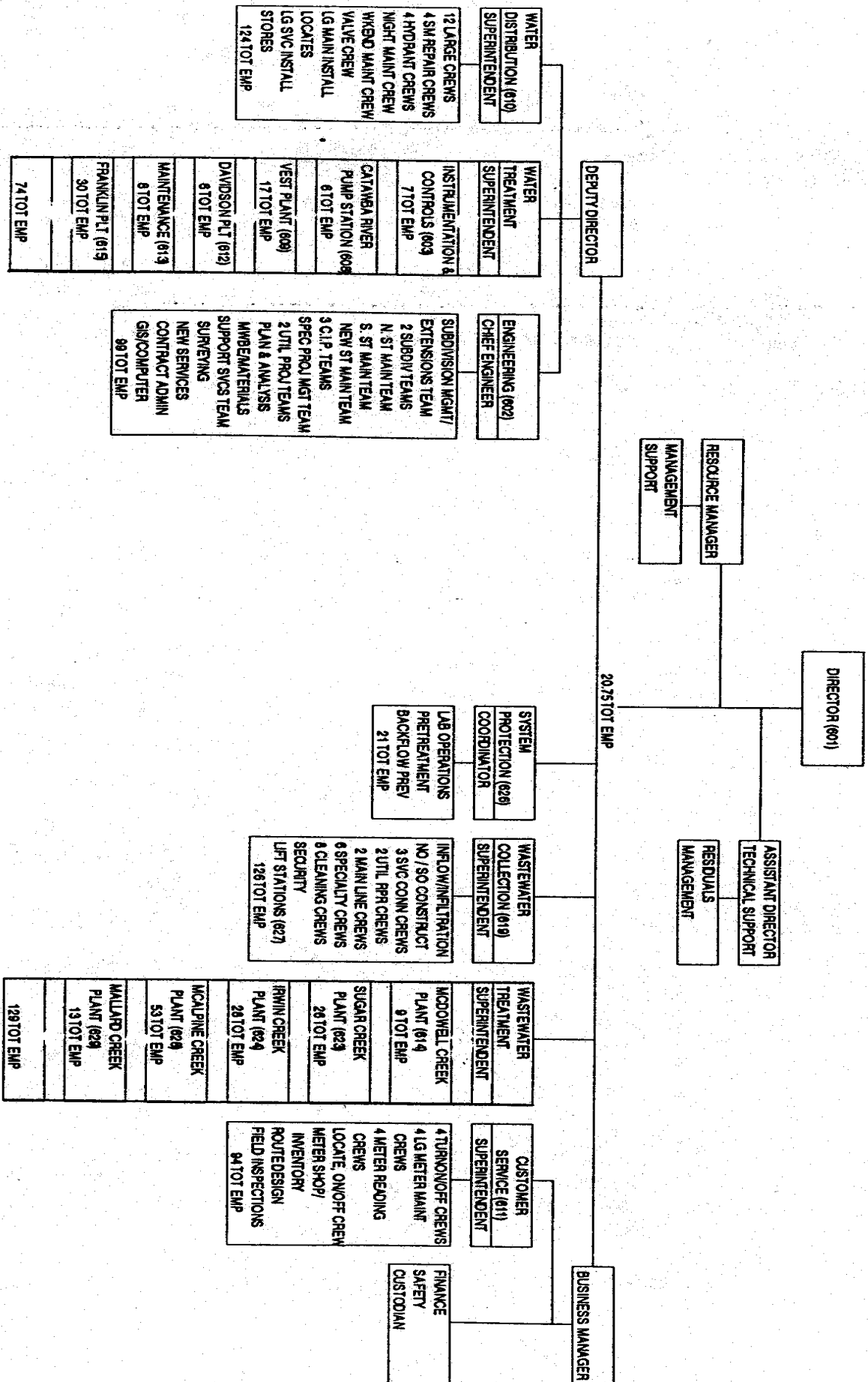
Franklin Water Treatment Plant: 5200 Brookshire Blvd. (96 MGD) 399-2426  
Vest Water Treatment Plant: 820 Beatties Ford Rd. (24.8 MGD) 336-2090  
Davidson Water Treatment Plant: 310 Walnut St., Davidson (1.2 MGD) 892-4220

### **WASTEWATER TREATMENT PLANTS**

Irwin Creek WWTP: off Billy Graham Pkwy. at end of SR 1287 (15 MGD) 357-1344  
Mallard Creek WWTP: on Mallard Creek off N. Hwy 29 (6 MGD) 547-0680  
McAlpine Creek WWTP : Hwy 521 1 mile South of Pineville (40 MGD) 542-0736  
McDowell Creek WWTP: Intersection of McDowell Creek and Neck Rd. (3MGD) 875-6443  
Sugar Creek WWTP: 5301 Closeburn Rd. (15 MGD) 553-2124

Charlotte - Mecklenburg Utility Department  
 Organizational Structure - Fiscal Year 1994

6675 TOTAL EMPLOYEES



## UTILITY CONTACT LIST

### **Charlotte-Mecklenburg Utility Department**

5100 Brookshire Boulevard  
Charlotte, NC 28216

<b>Administration/Industrial Waste Division</b>	<b>399-2551</b>
<b>Engineering/Planning Division</b>	<b>399-2551</b>
<b>Water Distribution Division</b>	<b>336-2564</b>
<b>Customer Service Division</b>	<b>336-2564</b>
<b>Wastewater Collection Division</b>	<b>357-6064</b>
<b>Water Treatment Division</b>	<b>399-2426</b>
<b>Wastewater Treatment Division</b>	<b>399-2221</b>

### **Duke Power Company**

6325 Wilkinson Boulevard  
Charlotte, NC 28214

**382-5547**

### **AT&T**

900 Franklin Avenue  
Charlotte, NC 28206

**335-2873**

### **Southern Bell Telephone**

4100 Southstream Boulevard  
P.O. Box 30188  
Charlotte, NC 28230

<b>South, Southwest Area</b>	<b>357-9549</b>
<b>CBD, North, Northwest Area</b>	<b>357-9560</b>
<b>East, Southeast</b>	<b>357-9579</b>

### **Piedmont Natural Gas Company**

P.O. Box 33068  
Charlotte, NC 28233

**525-5585**

### **Cablevision of Charlotte**

P.O. Box 34614  
Morehead Street  
Charlotte, NC 28205

**377-2228, Ext. 311**

### **Vision Cable of Charlotte**

4606 Margaret Wallace Road  
Matthews, NC 28105

**545-0136**

### **Alltel Carolina, Inc.**

Engineering Department  
P.O. Box 428  
Matthews, NC 28106-0428

**845-7644**

### **MCI Telecommunications Corporation**

377 Carowinds Boulevard  
Fort Mill, SC 29715

**1-800-288-6295**

## IMPORTANT TELEPHONE NUMBERS

Ambulance and Rescue - Emergency	911
Atlanta Poison Control Center	1-800-848-6946
CHEMTREC (Hazardous Material Spills)	1-800-424-9300
CMUD Employee Information Line (Updates)	391-5160
CMUD Safety Coordinator	391-5061
Beeper	581-1978
Emergency Management Office	
Civil Defense/Civil Preparedness	336-2412
24-hour (County Police)	336-3333
24-hour (Fire Communications)	336-2441
24-hour (Fire Communications)	336-2578
Emergency Operations Center	336-4470
Public Information Officer	336-4471
Employee Medical Services (Nurse)	336-2792
Environmental Emergency (National Response Center)	1-800-424-8802
Fire Department - Emergency	911
Fire Department - Hazardous Materials	336-2461
FMC Corporation (Hydrogen Peroxide)	554-1551
HOSPITALS	
Carolinas Medical Center	355-2000
Carolinas Medical Center Emergency Dept	355-2171
Mercy Hospital	379-5000
Mercy Hospital Emergency Dept	379-5917
Mercy Hospital South	543-2000
Mercy Hospital South Urgent Care Center	542-6544
Presbyterian Hospital	384-4000
Presbyterian Hospital Emergency Dept	384-4160
University Hospital	548-6000
University Hospital Emergency Dept	548-5600
Jones Chemicals, Inc (Leaking Chlorine Cylinders)	377-1571
Mecklenburg County Environmental Protection Department	
Environmental Spills	336-5500
(After hours call Fire Department or County Police)	336-4391 (Fax)
Mecklenburg County Police	336-3333
Mecklenburg County Police - Emergency	911
Mental Health Services - Emergency	358-2000
Poison Control Center (Mercy Hospital)	379-5827
Police Department - Emergency	911
Public Service & Information	336-2395
Bill Guerrant	377-2838
Beeper	336-9104
Jeannine Clark	333-2975
State Highway Patrol	547-0042
STATE AGENCIES - WATER	
Division of Health Services, Raleigh	
NC Department of Human Resources	1-919-733-2870
Hazardous Waste Division, Raleigh	1-919-733-2178
Mooresville Regional Office	663-1699
FAX	663-6040
Public Water Supply, Raleigh	1-919-733-2321

STATE AGENCIES - WASTEWATER

Division of Environmental Management, Raleigh	1-919-733-5083
NC Dept of Environment, Health, & Natural Resources	1-919-733-9919
FAX	663-1699
Mooresville Regional Office	663-6040
FAX	
Division of Radiation Protection	
NC Dept of Environment, Health, & Natural Resources	1-919-571-4141
FAX	1-919-571-4148

STATE AGENCIES - TRANSPORTATION

Division Office, Charlotte	596-6900
District Office, Albemarle	1-704-982-0101
State Offices, Raleigh	
Design Services	1-919-250-4128
Right-of-way	1-919-733-4420



## II. **SYSTEM PLANNING**

Return to   
Table of Contents

The Capital Improvements Program (C.I.P) and the Ten Year Needs Assessment are documents listing capital projects that have been identified by each department as necessary to provide satisfactory services to the community as well as meet future needs. The Ten Year Needs Assessment is prepared by City/County Planning and represents each department's best identification of projects necessary within a ten year time frame to meet City goals and policies. It does not require City Council adoption. The Five Year C.I.P. is a more refined document. It lists projects identified as necessary within five years. The Five Year C.I.P is developed from the Ten Year Needs Assessment and further clarifies the scope and financial factors specific to each project. The Five Year C.I.P is submitted to the Budget and Evaluation Department and requires adoption by City Council. The process of identifying and preparing the CMUD portion of these documents is similar and is described below.

### A. **Ten Year Needs Assessment**

The Ten Year Needs Assessment is a long range planning document listing projects required within a ten year time frame. The purpose of this document is to provide a long range planning tool that links the Five Year Capital Improvement Program and the Generalized Land Plan 2005 which is a 20-year planning document. For each project the following information is provided.

1. Project description
2. Cost of the project - broken down to planning/design, land acquisition, construction and equipment costs.
3. Status of the project (i.e. new, revised, returning)
4. Priority
5. The need for the project (i.e. how it relates to City goals or policies, improvements to the system.)
6. The project justification
7. How cost estimates were derived.
8. Impact statement

The Ten Year Needs Assessment is completed biannually in the fall. This document is then utilized as a planning tool for preparing the Five Year C.I.P.

### B. **Five Year Capital Improvement Program**

The Five Year Capital Improvement Program (C.I.P.) document is prepared annually and is a refinement of the Ten Year Needs Assessment. Therefore, the same information is provided for each project with a more accurate scope and cost estimate.

Capital projects basically meet one of five criteria:

1. Project that will serve the public overall, not one entity
2. Rehabilitation or maintenance of existing systems
3. Replacement of existing facilities (capacity)
4. Regulatory or legal requirements
5. Impact by outside agencies (CDOT, NCDOT)
6. Extension of service to developing areas

Every year new projects are added to the C.I.P and existing projects are reviewed and/or revised. Projects are identified mainly through long range studies, computer analysis, facility studies and maintenance of each system. In addition, Planning documents such as the district plans prepared by the Planning Department, the Generalized Land Plan 2005, population projections, the Needs Assessment, and landuse information assist in determining future capacity needs and where extension of service need to be provided. For example, many of the water projects are identified by a water distribution study conducted approximately every five years. Projects are also identified by individuals in the community such as members of the CMUD Advisory Committee, developers and engineers. All projects included in the C.I.P. are for the benefit of the overall community and not any one individual or entity.

Public meetings are held annually during the CIP process to allow the public to ask questions about projects identified and/or suggest projects. Names and addresses of people attending the meeting are taken in order to invite them in the following year. Anyone interested in being placed on this list may contact CMUD and their name and address will be added. Registered holders of this manual will be automatically added to the list of invitees.

Cost estimates are completed or revised on all projects annually. The cost estimate includes engineering, environmental assessment, land acquisition and construction costs. An inflation factor is also added into the estimate. Our goal is to make these estimates as accurate as possible. Several items are considered in sizing and determining cost such as location of project, population, expected population and landuse(or buildout), size of area (acreage) and difficulty of construction.

Each project is prioritized according to need annually in the following areas:

1. Maintenance and Rehabilitation of existing facilities
2. Replacement/Expansion of existing facilities (capacity needs)
3. Regulatory/Legal requirements
4. Improvement of service
5. Extension of service into developing areas

Most projects move up through the five years as originally scheduled. Other projects are accelerated or decelerated due to a change in scope or necessity of the project in order to provide satisfactory service to the community. The planning

tools mentioned previously (computer modeling, system studies, district plans, population projections, landuse information etc.) also assist in determining the priority of projects. An attempt is made to also coordinate scheduling of projects with other departments and agencies such as City Engineering, CDOT and NCDOT and Parks & Recreation.

The C.I.P. document along with overall maps of the existing systems and C.I.P. projects are submitted to Budget and Evaluation Department for review. A hearing is held to discuss the submittal, and the financial factors involved. The hearing usually takes place sometime in February. Further modifications to the C.I.P. are made through March. City Council reviews the C.I.P. for approval in June annually.

### **III. CHARLOTTE-MECKLENBURG UTILITIES EXTENSION POLICY**

#### **A. PURPOSE**

The purpose of this policy (“Policy”) is to establish the method to be used for the orderly and financially sound extension of the public water and sewer system. This Policy is applicable to the entire Charlotte-Mecklenburg Utilities (“Utilities”) service area. All extensions of water and sewer mains shall be dependent on adequate capacity within the existing system, approved funding for Utilities’ participation and receipt of all required permits and approvals.

#### **B. FACILITIES PROVIDED BY UTILITIES**

Utilities will provide certain basic components of the water and sewer system. These components include treatment facilities, water pumping stations, major and/or regional wastewater lift stations, water storage tanks, wastewater interceptor and trunk mains, and major water transmission mains. The purpose of these facilities is to treat, store, and convey water and wastewater throughout the service area. These facilities will be constructed and/or improved according to a Capital Improvements Program (“CIP”) which is reviewed and approved annually by the Charlotte City Council.

Utilities administers several programs described later in this Policy intended to provide smaller water and sewer mains along publicly maintained streets where individual customers may connect to receive service. Water or sewer mains may be constructed along existing, publicly maintained streets within the Utilities service area. *Publicly maintained streets* shall mean NC DOT SR numbered roads, NC or US numbered highways, or municipal streets which are eligible for Powell Bill Funds (For purposes of this Policy, all references to “street” shall be construed to refer to “publicly maintained street,” unless otherwise expressly provided). In areas where there are existing, public utilities in streets which do not satisfy this definition and extensions are requested, Utilities shall review each such request on a case-by-case basis taking into consideration the merits of each case, among other factors.

This Policy is intended to provide water and sewer service connections within publicly maintained streets when this is feasible. Except as noted in section III(D)(3), when this is not feasible, water mains or sewer mains and associated service connections may be located within access/water/sewer easements when Utilities determines that the criteria set forth below are satisfied. (The portion of this Policy providing for water or sewer lines in access/water/sewer easements is not a separate or independent extension policy. It is intended to apply only as an alternative to other portions of this Policy which provide for the extension of water or sewer lines within publicly maintained streets. Compliance with all other provisions of the applicable extension policy is required.)

- No suitable publicly maintained street exists or is proposed for construction where the proposed water and/or sewer system can be located and no other practical, acceptable means of providing public water and sewer service to residents exists as determined by Utilities.
- The access/water/sewer easement width is at least 40’ plus additional temporary construction easement as needed and is determined by Utilities to be suitable for the construction, re-construction, operation and maintenance of the proposed water and/or sewer system.

- The access/water/sewer easement is in a location and alignment that is most likely to be used as a publicly maintained street should one be built in the future;
- The access/water/sewer easement is donated to Utilities cleared of trees, shrubs, structures, wells, septic systems and any other known obstacles that could conflict with or prevent the design, construction, re-construction, operation, and/or maintenance of the proposed water and/or sewer system and is provided at no cost to Utilities. Otherwise, the grantor(s) of the access/water/sewer easement must agree to pay the full costs to clear the easement and remove the obstacles. Utilities should not be subjected to any costs for the design, construction, re-construction, operation or maintenance of the water or sewer lines in access/water/sewer easements that would not be expected if the lines were to be placed in a publicly maintained street.
- In the event conditions in the access/water/sewer easement are discovered at any time during the project that will result in unreasonable or unusual cost increases, environmental impact, or disruption to the public Utilities may terminate the project without further obligation to provide service.
- Utilities is required only to restore travel surfaces and ground conditions within the access/water/sewer easement and any temporary construction easement to a condition similar to that existing prior to construction/re-construction of the proposed water and/or sewer system and is not required to improve or expand pavement, structures, drainage facilities, or landscaping features at any time during or after the construction of the proposed water and/or sewer system. If work of this type is required by applicable law or to allow water and/or sewer construction, re-construction, operation, and maintenance, the easement grantor(s) must agree to be responsible for the costs of this work.
- The access/water/sewer easement must expressly provide that public access to the access/water/sewer easement can only be restricted in a manner that is substantially similar to restrictions to the use of publicly maintained streets.
- The access/water/sewer easement grantor(s) must agree to keep the access/water/sewer easement free from structures, fences, gates, barricades, wells, septic systems, trees landscaping, or other conditions or obstacles that could impede or limit vehicular or equipment access required to construct, re-construct, operate or maintain the installed water and/or sewer system.
- The access/water/sewer easement must provide access to water and/or sewer service for multiple, individually owned parcels of land that will have individually metered services.
- Utilities may not be subjected to any requirements or restrictions for the design, construction, re-construction, operation or maintenance of the water and/or sewer system within the access/water/sewer easement that are not typical and customary in publicly maintained streets.
- Waiver and release of liability is provided to Utilities against claims for damages that result from the design, construction, re-construction, operation, or maintenance of the proposed water and/or sewer system in the access/water/sewer easement and any overlying or adjacent travel surfaces, paved or unpaved, or any other features within the easement including damage that may occur from heavy equipment used to construct, re-construct, operate or maintain the water and sewer system.
- Utilities will not be financially responsible for the removal or relocation of the water or sewer mains, services, or appurtenances as may be needed for future changes in land use, roadway construction (including changes in horizontal and/or vertical alignment), re-grading the access/water/sewer easement or adjacent lands, or other activity that may conflict with Utilities' continued rights to re-construct, operate and maintain said water or sewer facilities.

- No other utilities, piping or cables, underground or overhead, public or private, will be permitted within the access/water/sewer easement except with prior, written approval by Utilities.
- Public water and sewer facilities constructed within an access/water/sewer easement are owned by the City of Charlotte and subject to the same ordinances, regulations, and policies as other water and sewer facilities.
- The access/water/sewer easement will be in form and substance acceptable to Utilities and shall contain such provisions as Utilities determines are reasonably necessary or convenient to provide for the implementation of this Policy.
- The property subject to the access/water/sewer easement must be the primary vehicular access for all property subject to the easement, provided that this requirement can be waived by Utilities for a parcel that has alternative access but provides necessary access to one or more other parcels

Water or sewer service will not be extended to property located beyond Mecklenburg County without the express approval of the Director of Utilities. Utilities is under no obligation to provide water or sewer service to property located outside Mecklenburg County, except as expressly approved by the Director. Utilities may refuse to extend services to property located outside Mecklenburg County or may choose to provide water or sewer services to such property under such terms and conditions as may be approved by the Director of Utilities.

### **C. EXTENSION OF SERVICE REQUIRED BY ANNEXATION**

All cities or towns must meet certain service requirements for newly annexed areas as prescribed by state law. Since Utilities is a part of Charlotte city government, Charlotte is required to extend major water and sewer facilities to involuntarily annexed areas so that involuntarily annexed property owners can secure water and sewer service as required by applicable law.

The major lines extended as part of involuntary annexation provide water lines for basic fire protection and installation of interceptor, trunk sewer mains, or common force mains required to extend sewer service to each publicly maintained (at the effective date of the involuntary annexation) street for sewer lines. Street main extensions are not provided under this Policy as part of involuntary annexation except as expressly required by law. In addition, water or sewer facilities will not be extended upon involuntary annexation to serve all or any portion of a residential subdivision subject to covenants, conditions, or other restrictions recorded in the Mecklenburg County Public Registry to the effect that sewer service in such subdivision is to be provided exclusively by means (including, but not limited to, septic tank systems) other than sewer service from a governmental authority (including Utilities) or public utility.

### **D. PROGRAMS FOR EXTENSION OF SERVICE**

#### **1. General Provisions**

Upon completion and final acceptance by Utilities of all facilities constructed under this Policy, such facilities will become the property of the City of Charlotte ("City") and the City will be responsible for their operation and maintenance.

Utilities funds shall not be used for construction of any Facility which does not offer the reasonable expectation of being feasible unless such Facility is required to fulfill statutory requirements or to maintain service to existing customers. Feasibility is determined based

on the following: the construction of the Facility is expected to generate revenue; service level Improvement; and/or environmental benefits which are in a favorable proportion to the total cost of the project.

All construction of water and sewer facilities must be performed by utility contractors properly licensed in North Carolina and approved by Utilities

All contracts for extension of mains are subject to approval by Charlotte City Council or by the Charlotte City Manager or his designee where allowed by law. All extensions are subject to review approval, and regulation by local, state and/or federal agencies as required by law.

The size, depth, and location of the mains extended will be determined or approved by Utilities based on prevailing industry standards and normal service requirements. In the event facilities designed in this manner will not satisfy the applicant's needs the applicant may withdraw the application. If the application is withdrawn, the applicant forfeits costs incurred by Utilities up to the date of withdrawal.

This Policy is intended to provide sewer mains that are capable of serving the ground floor of most buildings when the ground floor is approximately at street level and where the distance from the structure to the street, topography, other utilities, structures, natural features or other conditions does not make gravity service unfeasible. Utilities does not guarantee that any customer, and particularly customers who have basements or buildings substantially lower than the street, can be served without pumping by the property owner.

This Policy is intended to provide that the water pumping and distribution system be designed and operated to provide flow rates and pressures that meet standard fire protection requirements at the time the water mains are designed and constructed for existing land uses and construction methods. In the event that higher flow rates or pressures are required due to changes in land use, differing construction types, changes in fire code requirements, or other circumstances, Utilities will endeavor to work with the customer to satisfy the new requirements. While each case will be evaluated on its individual merits and public benefits, it may become necessary for the customer to bear some or all of the costs incurred to satisfy the higher level of service.

This Policy is intended to provide for the construction of water and sewer mains sized to provide long term service as described in the CIP. If an extension is requested which conflicts with or is in the same location as a project identified in the CIP or needs assessment, Utilities shall decide whether to extend the facility as described in the CIP/Needs Assessment or a smaller or temporary main. The decision shall be made with the following considerations:

- Funding availability from other sources
- Impact of expenditure on appropriated funds for this program
- Physical space and/or constraints of installation
- Quality of service
- Time required to provide requested service
- Other considerations unique to the circumstances

Installed facilities that are smaller than those identified in the CIP or the Needs Assessment or that are smaller than required for long term service shall be funded solely

by the applicant with no opportunity or consideration for reimbursement from Utilities. However, in all cases, Utilities retains the discretion to require appropriately sized mains be extended to serve the area. Except as otherwise expressly authorized by this Policy, this Policy shall not be construed to authorize refunding the additional cost of mains larger than those needed for the applicant's site.

The applicant must complete an application for service and pay all applicable charges at the time an extension of the system is requested except when the extension is being made exclusively under the provisions of a Reimbursable Program or is being donated to Utilities. An applicant for an extension may not cancel an application for service or extension request once the applicable fees have been paid. Neither connection fees, capacity charges, nor the applicant's share of 50/50 extensions are refundable.

## **2. Reimbursable Programs**

Capital facilities which are normally provided by Utilities (described in section II) but are not in place may be financed by a customer in order to expedite the construction of such facilities. Upon completion and final acceptance of the Facility, the customer will be reimbursed for eligible costs of the project according to the procedures and schedules described below.

If a customer wishes to expedite a project which is included in the Charlotte City Council approved CIP, a 5-Year Reimbursement Program is available. If a customer wishes to expedite construction of facilities which are not included in the CIP but which would normally be provided by Utilities, a 15-Year Reimbursement Program is available. To utilize either of these programs, the customer is required to enter into a contract with the City of Charlotte. This contract provides that Utilities will design, either with staff or by consultant, the requested Facility, acquire any necessary rights of way and permits and construct the facility either with City staff or through public bids in accordance with North Carolina General Statutes. The customer is required to pay a deposit at the time he or she executes the contract. The deposit amount should be sufficient to pay the cost of design and right of way acquisition and shall be established by Utilities. When the construction cost is determined, either from public bids or from Utilities work order, the customer is required to make available to Utilities the balance of funds to construct the project. The customer may make cash payment to Utilities or utilize an approved letter of credit (See section VI).

Under the 5-Year Reimbursement Program, the contracting customer is reimbursed all of the eligible funds he has deposited for the project. The amount reimbursed will not include any interest, carrying charges, financing costs, or other funds other than the actual face value amounts deposited by the customer. The customer will receive 20% of the eligible deposited amount in each of five annual payments. The first annual payment will be made one year from the date Utilities accepts the total project as complete and available for activation.

The customer will be required to pay any acreage fees which are applicable, including those resulting from his project. Acreage fees are not eligible for reimbursement.

Under the 15-Year Reimbursement Program the contracting customer is not guaranteed total reimbursement of eligible deposited funds. The reimbursement payments are made annually beginning one year from the date Utilities activates the total project. The Utilities



activation date begins the 15 year reimbursement period. The amount of each annual reimbursement payment will be the sum of collected acreage fees attributable to the project and 35% of sewer or water user fees which result directly from the project and are collected that year. The acreage fee is equal to the total actual cost of the project divided by the area which Utilities expressly designates at the time the contract is established to be ultimately tributary to the line. Acreage fees are applicable only to wastewater facilities. See section VII-B of this document for information on application of acreage fees to wastewater lift stations.

User fees are the periodic charges to customers for actual service received. User fees do not include connection charges or other one-time charges which are made in order to establish service. Reimbursable user fees on water mains will be based only on customers who have service connections directly off the main extended under the 15-Year reimbursement program and customers on donated mains which connect to that main. If the reimbursable main is extended through any method other than donation, user fees from the new extension will not be reimbursed to the original customer. If donated mains connect a reimbursable water main to an existing main, Utilities will determine the area on which to base user fee reimbursement based on an engineering judgment of the water flow direction under normal circumstances. Reimbursable user fees on sewer mains will be based on service connections directly to the reimbursable main and on service connections on donated sewer mains which connect to that main. If the reimbursable main is extended through any method other than donation, user fees from the new extension will not be reimbursed to the original customer. Annual payments to the customer will continue for 15 years or until the actual eligible face value amount deposited by the customer has been repaid, whichever occurs first.

### **3. Street Main Extension Program**

This Street Main Extension Program (“Street Main Extension”) provides for Utilities funded extension of water and sewer mains to serve existing single family residential dwellings or existing vacant lots which are zoned for single family residential construction and that are not regulated through the subdivision development process. Application of the Street Main Extension is subject to availability of funds and other qualifications described below. Applications are accepted and projects initiated on a first come, first served basis.

This Street Main Extension is only available to renters or owners of qualifying residential dwellings or vacant lots. It is not available to child-care facilities, retail establishments, medical buildings, churches, non-profit organizations, other governmental units, commercial buildings, industrial facilities, or any new construction or new development which is not single family residential in nature.

The Street Main Extension is not intended to be used to change the manner whereby an existing customer receives water or sewer service.

Extensions under this Street Main Extension must average at least one applicant per 1000 feet of main.

To ensure fair and equitable use of available funds, Utilities may, at its discretion, limit projects to a maximum of 1000 feet. An applicant can apply for water and sewer extensions simultaneously provided that funds are available and all requirements are satisfied for each extension.

In the event the applicant is determined to require an extension greater than 1000', the portion of the main in excess of the 1000' maximum can be offered under the 50/50 program provided that funds are available in that program and that the applicant meets all requirements of both programs at the time application is made, including the applicants share of the 50/50 cost.

Extensions of mains greater than 1000' for documented public health hazards can be made in combination with this program; for example, this program can be combined with the health hazard program to increase the distance a main is extended to 2000'. The first 1000' will be funded under the Health Hazard Elimination program. See section IV-E.

This program is applicable to low-pressure sewer systems only in zones designated by Utilities to be served in this manner where such systems are previously established.

This program may be combined with 5-year or 15-year reimbursable programs or other extension programs provided that the applicant satisfies all requirements for such programs at the time of application. This option requires the same applicant to apply for both programs simultaneously.

In the event that the funds appropriated for any fiscal year are not adequate to satisfy the requests received by Utilities, City Council may, at its discretion, appropriate additional funds to this program. If adequate funds are not available when an application is made for an extension, the customer will be offered any other available, funded, programs for which the required extension will qualify. If no other programs are available, or if the customer declines to use another program, the customer will be required to reapply when/if additional funds are appropriated.

Funds from this program can be used for planning, design, inspection, construction, and any other necessary expense directly related to the administration and implementation of this program.

If an extension requested under this program is of such a short length that mobilization costs are excessively high and/or the termination of the requested extension is not at an advantageous location, Utilities may at its discretion, continue the extension beyond the distance requested by the applicant. Funding will be from this program.

Procedures for initiating and utilizing this program are described in section G below.

#### **4. 50/50 Extension Program**

This program provides for shared funding of water and sewer street main extensions. Under this program, Utilities will fund 50% of the cost of eligible extensions when one or more customers provide the other 50%. Application of this program is subject to availability of funds and other qualifications described below.

The basis for determining the project cost will be the average cost per foot actually incurred during the previous fiscal year for similarly-sized projects.

An applicant can apply for water and sewer extensions simultaneously provided that funds are available and all requirements are met for each extension.

This program is applicable to low-pressure sewer systems only in zones designated by Utilities to be served in this manner where such systems are herein established.

This program may be combined with 5-year or 15-year reimbursable programs or other extension programs provided that the applicant satisfies all requirements for such programs at the time of application.

This program is available for the extension of mains requested by applicants which do not qualify under the provisions of the street main extension program or when funds are not available in that program. The applicant is responsible for determining whether other property owners who could utilize the extension will participate in funding the applicant share. Utilities will not consider the application complete until funds sufficient to cover 50% of the estimated cost are received.

Procedures for initiating and utilizing this program are described in Section G below.

## **5. Extension Program to Eliminate Public Health Hazards**

This program provides for Utilities funding of water and sewer street main extensions for the purpose of providing access to public utilities when the system in place has failed and is resulting in a public safety, environmental or health risk to the occupant and/or the general public.

The applicant will be required to pay applicable connection fees and capacity charges at the time the extension request is made.

The maximum length for extension of mains under this program is 1000 feet.

To ensure fair and equitable use of available funds, subsequent applications for extension of uncompleted mains which will result in a project greater than 1000' funded under this program will not be accepted until the originally requested main is available for use. An applicant can apply for water and sewer extensions simultaneously provided that funds are available and all requirements are met for each extension.

This program is applicable to low-pressure sewer systems only in zones designated by Utilities to be served in this manner where such systems are previously established.

This program may be combined with 5-year or 15-year reimbursable programs or other extension programs provided that the applicant satisfies all requirements for such programs at the time of application and pays all applicable fees.

This program is only available to existing residential dwellings.

The applicant must furnish evidence from County Health officials that a health hazard exists in order to qualify for this program. Failure of mechanical equipment does not constitute a health hazard. Dry wells or unused septic tanks do not constitute a health hazard. This program cannot be used for new construction or when a mobile home or other structure is moved onto a new site. Homes which are not occupied or are not eligible for a certificate of occupancy for any reason other than lack of sanitary sewer service are not eligible for this program. Utilities shall have the authority to determine if the intent of this paragraph is met.

Revenues from user charges can be used to finance bond programs or to fund this program directly. Charlotte City Council shall establish the funding level of this program annually with approval of the Capital Improvement Program and/or operating budget.

Procedures for initiating and utilizing this program are described in Section G below.

**6. Applicant Funded Non-Reimbursable Extension Program**

This program allows the applicant to fund 100% of the cost of water or sewer extensions which are to be constructed by Utilities forces or by contracts administered by Utilities. This program is applicable to extensions which do not qualify for any other extension programs under this Policy, if an applicant chooses this program in lieu of another, or in the event funds are not available from Utilities for other programs.

This program is applicable to low-pressure sewer systems only in zones designated by Utilities to be served in this manner.

Each applicant is required to pay connection and capacity charges in addition to the applicants cost of the extension.

Procedures for initiating and utilizing this program are described in section G below.

**7. Extension of Facilities by other Public Agencies**

Any extensions requested by other City departments or by other governmental units within the Utilities service area may be (but are not required to be) processed within the same guidelines as though an individual customer had applied. Previously approved agreements with Mecklenburg County, Davidson, Cornelius, Huntersville, Pineville, Matthews, and Mint Hill created other financing options which these governments may utilize.

**8. Extension of Service For New Development**

Utilities will not participate in the cost of street main extensions which are required strictly for subdivision of land. All such projects will be financed wholly by the developer of the land. Utilities will agree by contract to own and maintain water distribution and wastewater collection systems if these systems are designed and constructed in accordance with prevailing Utilities standards and specifications and if the existing Utilities system has adequate capacity to sustain the new development. Such contract agreements must be obtained prior to construction of the system.

Utilities has the sole discretion in approving main sizes to meet development and system needs. When larger mains are required for system needs, no portion of the additional cost is eligible for reimbursement from Utilities except for extensions constructed under the 5-Year and 15-Year Reimbursable programs.

Capacity charges are required for each service installed.

Under no circumstances shall construction begin prior to approval of the contract, issuance of all required permits, and proper notification of Utilities. Notification requirements are detailed in the contract.

If the new development contains drainage patterns that will need to be utilized to provide sanitary sewer service to existing streets, roads, or other property, Utilities will require that the owner of the property being developed record permanent rights of ways for such facilities.

## **E. SERVICE CONNECTIONS**

### **1. General Provisions**

All customers desiring water or sewer service are required to make formal application for each service and to pay all applicable fees and/or charges at the time application is made.

Water services larger than 1-inch cannot be installed without payment of a meter deposit and an application to Utilities designating the party who is financially responsible for water used from that service.

A 3/4" or 1" water service connection consists of the connection to a public water main of a service line, a meter box, and stubbed connection point for the applicant's private plumber to connect to. Larger water service connections consist of the connection to a public water main of a service line, a meter box or vault, piping to the property line, and a valve at the property line.

In-ground irrigation systems installed after July 1, 2009, are required by state statute to be separately metered. Utilities offers customers two options for metering residential irrigation systems.

- Separate service option – A new, separate service is installed consisting of the connection to a public water main of a service line, a meter box, and stubbed connection point where the applicant's private plumber or irrigation contractor may connect. An approved backflow prevention device must be installed by the customer on the customer's side of the irrigation meter. Split service option – A new service line is connected from the existing service line on the Utilities' side of the water meter. The new service line will be connected to a separate, dedicated irrigation meter and stubbed connection point where the customer's private plumber or irrigation contractor may connect. An approved backflow prevention device must be installed by the customer on the customer's side of the irrigation meter.

Utilities does not guarantee minimum water pressure or flow rates will be available to operate irrigation and/or plumbing fixtures. The customer should carefully consider the impacts that a split service option may have on available water pressure and flow rates.

A sewer service (or lateral) connection consists of the connection to a public sewer main or manhole of a service line which is extended to the street right of way line or to the sewer right of way line if the public sewer main is not at the street. The applicant is responsible for the cost of connecting their private plumbing system at that point.

All water and sewer service connections shall be constructed in accordance with the Code of Ordinances of the City of Charlotte and with all applicable building and plumbing codes.

Sanitary sewer service connections will be installed at a depth that is practical and alleviates the need for extensive or unusual construction or safety methods. Utilities does not guarantee that the depth of all sewer service connections will allow gravity flow connections. If pumping is required, the pumping equipment and installation is the responsibility of the customer and must be completed in accordance with all applicable regulations and ordinances.

Commercial, industrial, fire line, or irrigation services will be subject to requirements of the City and Utilities including industrial waste and/or backflow provisions.

## **2. Fees/Charges**

Customers applying for a new water or sewer service or extension are subject to one or more of the charges shown below.

- a. Connection Charge - This charge is based on the average actual cost incurred by Utilities to construct similar size service connections during the previous fiscal year.
- b. Capacity Charge - This charge is to recover from new customers a portion of the incremental cost of providing capacity in the treatment facilities, transmission mains, major outfalls and sewer trunks which have been constructed to allow for new development and expansion of the system. This charge is calculated each year based on the actual book value for these facilities as shown in the City's General Ledger and the system treatment capacity reflected in that value. Dividing the book value by the system treatment capacity yields a system cost per gallon per day. This cost per gallon is multiplied by the average daily consumption of residential customers to obtain the capacity charge for water and sewer separately for customers with 3/4" water services. This charge is then multiplied by the relative capacity of other meter sizes to determine the capacity charge for other size meters. The sewer charge is also based on the relative capacity of the water meter. Wastewater only customers will pay a capacity charge based on the capacity of their private water supply, except that all single family, residential wastewater only customers will pay the same capacity charge as a 3/4" meter customer. Capacity charges apply to separate irrigation meters and to split service irrigation meters and are calculated using methodology similar to that for residential water service connections.
- c. Meter deposit - This is a security deposit which varies according to both water meter size and the nature of the customer (i.e; restaurant, warehouse, etc.). Meter deposits are not required of single family residential customers.
- d. Discounts available - If a customer applies for water or sewer service in conjunction with a water or sewer extension and the service can be installed on the extension as it is constructed then the connection fee will be discounted 10%. No discount or reductions apply to capacity charges. Utilities will establish a time period prior to the beginning of construction during which other eligible customers may receive the 10% connection fee discount.
- e. Acreage fees - Acreage fees are not charged to an individual applying for service to a single, single-family residential dwelling on a lot of 1 acre or less.

Any other type of applicant will be required to pay any acreage fees if they are applicable to their site. Utilities will determine and advise the applicant of the liability for acreage fees and such fees will be paid prior to the work being undertaken. Utilities will not pay acreage fees for any extensions which are made with Utilities funds, nor will acreage fees be assessed for costs of extensions funded solely with Utilities funds.

- f. Sewer deposit - A sewer deposit is required when application is made for sewer only service; i.e., the applicant receives water service from a private well, community water system, or source other than Utilities. This is a security deposit similar to the meter deposit required for water service. Sewer deposits are not required of single family residential customers.

The following chart defines when each of the different charges is applicable:

TYPE SERVICE	CONNECTION FEE	CAPACITY FEE	DEPOSIT*
New service not installed as part of donated system	Yes Paid at time of application	Yes Paid at time of application	Yes Paid at time of application
New service installed by developer as part of donated system	No	Yes	Yes
Replacement service of same size	Yes Paid at time of application	No	No
Replacement service of larger size	Yes Paid at time of application	Partial - difference between sizes paid with application	Yes
Replacement service of smaller size	Yes Paid at time of application	No No refund of previous charges	No
Fire Line	Yes Paid at time of application	Yes Paid at time of application	Yes
Irrigation Service	Yes Paid at time of application	Yes Paid at time of application	Yes
Partial tap completion ("Paving tap")	Partial based on estimated cost to complete the tap	Yes Paid at time of application	Yes
Fire Hydrant Meter	No	No	Yes

\* Note: Deposits do not apply to residential customers



## **F. LETTER OF CREDIT FOR REIMBURSABLE PROGRAM FINANCING**

Customers who are utilizing reimbursable programs to expedite projects may use Letters of Credit as a financing method in lieu of cash payment to Utilities. This method can only be used for projects estimated to cost \$100,000 or more. The customer may elect to render to the City a non-recourse, commercial letter of credit from a bank insured by the Federal Deposit Insurance Corporation and having full-service banking facilities in Mecklenburg County in lieu of advancing other funds sufficient to pay for the entire project. Said letter of credit shall unequivocally guarantee payment by said bank to the City at such times and in such amounts as the City shall determine is reasonably necessary or convenient to have the necessary funds on hand for retainage and payments to any contractor awarded the contract to construct the extension requested by the Customer. If such an alternative is selected by the Customer, the following conditions shall apply:

1. This financing alternative must be selected, including the designation of the bank to be used, at the time a Customer requests a contract with the City for an extension.
2. A form provided by City must be used as the letter of credit, with a schedule of payment incorporated therein which is approved by the Director of Utilities. If the Customer proposes to use any variation of the form, the Customer will be required to pay the City's reasonable attorney fees in retaining experienced private counsel to review and advise the City and Utilities on the terms of the proposed letter of credit, and any related documents, and to recommend such changes, alterations or additions thereto as may be in the best interests of the City and Utilities. The City shall have the sole discretion in the selection of said counsel. The Customer shall be required to advance the estimate of such fees, as determined by the City, at the time this financing alternative is selected. Any excess funds advanced by the Customer for attorney fees shall be refunded. If the estimate of attorney fees is insufficient, the Customer shall advance the additional amount required prior to approval by the City of the extension contract. The form and contents of a Customer-proposed letter of credit and any related documents shall be approved by the City Council and shall contain such provisions as the City Council shall determine to be necessary to protect the interests of the City and Utilities. Said proposed letter of credit shall also incorporate a schedule of payment approved by the Director of Utilities. If the Customer does not accept any changes required by the City Council and if the attached form is not acceptable to the Customer, the financing alternative set forth in this sub-section shall no longer apply.
3. The City Manager is authorized to approve changes to the form letter of credit and to the estimated cost of projects qualifying for this alternative financing plan.
4. The Finance Director may refuse to accept a letter of credit from any bank: that has refused or failed for any reason to honor a draft on any letter of credit issued to the City; or if the Finance Director determines in his/her sole and absolute discretion that it is not in the City's best interests to accept a letter of credit from such bank for any reason. By seeking to use this alternative financing plan, a customer and any bank issuing or proposing to issue a letter of credit hereunder agree and acknowledge that: acceptance of a letter of credit is within the City's sole and absolute discretion; no customer is entitled in any manner to use this alternative financing plan as a matter of right; and neither the City nor any employee, officer or agent thereof shall be liable for any damage, loss, injury or claim

of any kind whatsoever arising out of the City's failure or refusal to accept an issued or proposed letter of credit, regardless of the circumstances under which such failure or refusal occurs.

## **G. INITIATION/UTILIZATION OF EXTENSION PROGRAMS**

A customer seeking to obtain water and/or sewer service must follow the procedure outlined below.

1. Request water and/or sewer service from Utilities . The request should identify the specific property to be served, the type of service requested (i.e., single or multi-family residential, irrigation, commercial, institutional, industrial, etc.), and any special capacity requirements or other specialized needs .
2. If necessary, Utilities will study the availability of the service requested and will respond to the customer with information about costs, schedule, or other issues within a reasonable period of time.
3. The Customer formally initiates application for service by paying applicable extension costs and/or connection and capacity charges.
4. Utilities shall complete design and construction including acquisition of permits, encroachments, and/or rights of way. The expected time for completion of extensions of minor (less than 1000' of 8" or smaller) mains along existing streets is less than 180 days from the receipt of the customer's complete payment. It is recognized, however, that there may be instances when, due to workload or inability to obtain permits, encroachments, or rights of way, or other reasons additional time may be required. In no event is a projected schedule binding upon Utilities or the City of Charlotte.

The projected schedule for completion of larger extensions will be determined prior to undertaking the extension. The projected schedule is established as a goal and is not binding upon Utilities or the City of Charlotte.

## **H. WASTEWATER LIFT STATIONS**

It is Utilities' policy to minimize the need for wastewater lift stations and to limit their construction within the system. The basis for this policy is that lift stations can cause disproportionate expense to provide service to a limited customer base and that failure of lift stations poses significant environmental risks.

It is recognized, however, that there are situations where lift stations are a feasible solution for providing service. Utilities will consider on a case by case basis requests to accept new lift stations in the situations described below.

1. The lift station can be eliminated by a project or combination of projects, all of which are included for funding in the approved 5-Year CIP.
2. The lift station can be eliminated by a project being done under a reimbursable program and the funds have actually previously been made available to Utilities for construction.

3. The new development is in an area designated by Utilities for service by low pressure sewer systems and the proposed lift station size and location is in accordance with the "Lake Area Sewer Study (1990)" plan.
4. The proposed lift station is at an appropriate location and has adequate capacity or expansion capacity to serve as a permanent or long term facility and gravity service is cost prohibitive or not possible due to other circumstances. Approved locations typically require the ability to serve multiple parcels of land and are not single site lift stations.
5. The construction of the proposed lift station would include elimination of one or more existing lift stations or treatment plants.
6. The construction of the proposed lift station would facilitate significant progress toward achievement of land use goals and strategies described by current, officially approved planning documents and no other reasonable options are available for service.

In all cases, the receiving system must have available transportation and treatment capacity to carry the proposed lift station discharge. Any upgrades required will be the responsibilities of the applicant requesting the lift station.

Construction of a wastewater lift station may require the customer to pay acreage fees. Acreage fees will be charged for the actual basin in which the lift station is located and for the basin which receives the discharged flow from the lift station. In either case, acreage fees are applicable only when sewer mains downstream of the lift station or its discharge point have been constructed through a reimbursable program and the contract has not been paid in full. Acreage fees will be charged to an applicant constructing a lift station when sewer mains further downstream within the same basin as the lift station are not actually receiving the applicant's flow but would be if the applicant would have constructed an extension of these mains instead of constructing the lift station.

## **I. OTHER CONSIDERATIONS**

### **1. Acquisition of Other Systems**

Utilities will, as the opportunity arises, consider the acquisition of other water/sewer systems which can be incorporated into the Utilities system.

### **2. No Guarantee of Level of Service**

Utilities does not warrant nor guarantee that the capacity, volume, pressure, or quantity of service provided will be adequate to meet the needs of any customer other than typical single family residential service. The customer is responsible for judging the adequacy of service for their intents and purposes prior to applying for service from Utilities.

The current level of service provided in any part of the water or sewer system which may be above that required to provide normal, domestic service is not guaranteed for any time in the future.

Utilities accepts customers on a first come, first served basis. Completion of studies or cost estimates for provision of service do not constitute any obligation or intent of Utilities to reserve capacity. The applicant's request for or receipt of such studies does not guarantee the applicant's ability to secure water or sewer service.

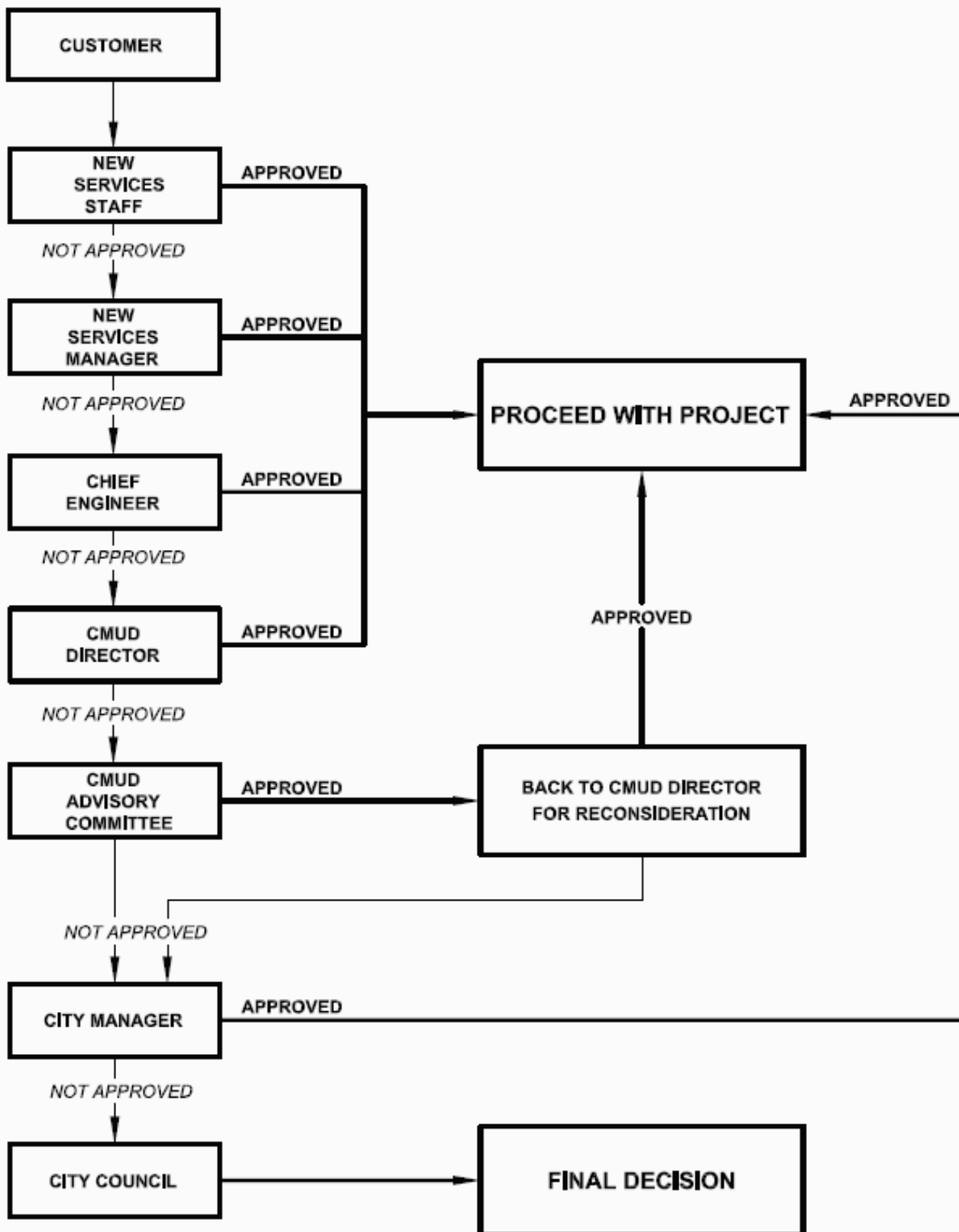
**3. Financial Assistance**

- a. Utilities is authorized to develop and administer a financial assistance program for qualified property owners to assist with the cost of connecting to the system. Utilities reserves the right to establish and modify the qualifying criteria for any applicable financial assistance. Property owners qualifying for financial assistance are not guaranteed assistance. The financial assistance award will be reviewed by the Utilities Advisory Committee and approved by the Utilities Director.

**4. Process for Appeal**

This policy has been approved by the Utilities Advisory Committee and adopted by the Charlotte City Council for implementation by Utilities and the City Manager. It is City Council's intent that Utilities apply the provisions of this policy equitably to all customers and potential customers. It is recognized that there may be situations where disagreements may develop concerning equitable treatment. In those cases, the customer may pursue the appeal process outlined on the attached chart. The burden is on the customer to demonstrate inequitable application of this Policy.

## CHARLOTTE - MECKLENBURG UTILITIES EXTENSION POLICY APPEAL PROCESS



## J. DEFINITIONS

**Access/water/sewer easement** - A permanent easement signed by the owners of all property subject to such easement that provides for: continuous and unrestricted, public vehicular and pedestrian access to the properties subject to said easement; and the construction, re-construction, operation, maintenance and repair of one or more water and/or sewer lines and associated facilities.

**Acresage fee** - An amount calculated by dividing the total cost of a wastewater project by the number of acres of property which the project has the potential to serve. The number of acres includes all property upstream of the facility and/or which is planned to be pumped to a location where it will be tributary to the project. Acresage fees are only calculated for projects which are completed under a reimbursable program.

**Activation** - Placing into service a new water or sewer main or other facility. Activation may precede final acceptance.

**Backflow** - The flow of any substance from a customer's property back into the water distribution system. Backflow can result from improper connection of pressurized equipment to the plumbing system or from accidental pressure drops in the public water system which can be caused by pipe breaks or other equipment failure. Backflow of contaminated water into the public system can create a hazardous situation to other customers.

**Capital Improvements Program** - A budget plan for provision of infrastructure and other capital needs for the community. This plan is compiled annually and adopted by Charlotte City Council.

**CIP** - Acronym for Capital Improvements Program.

**Utilities forces** - Employees of the Charlotte-Mecklenburg Utility Department.

**Common force main** - In a low pressure sewer system, a pressurized sewer pipe provided for individual customers to connect the discharge lines from their privately owned grinder pumps.

**Developer** - An individual, firm, or corporation which is improving property or is causing property to be improved by the provision of streets, buildings, or other infrastructure or by the assembly or subdivision of property.

**Domestic service** - Provision of potable water for the purposes of consumption and hygiene for an individual or family and the collection of wastewater generated from these uses.

**Drainage pattern** - A ditch, creek, berm, depression or other feature along which water, if present, would accumulate and flow naturally downhill.

**Eligible costs** - In the context of the reimbursable program for extensions, this is the total actual cost of the portions of the project which qualify for reimbursement.

**Encroachment** - Agreement with the NC DOT or railroad to place water or sewer facilities within their right of way.

**Extension** - A new or proposed water or sewer main.

**Final acceptance** - Documented agreement between Utilities and the contractor or developer of a project that the work is satisfactorily completed and that there are no outstanding claims or deficiencies. Completion of the project may also involve submittal of maps, affidavits, tax statements, or other documents that are required by contractual agreement.

**Fire line** - A water service requested and installed for the purpose of providing enhanced fire protection to an individual property.

**Fire Protection** - Provision of adequately sized water mains, water volumes, and fire hydrants at suitable intervals to allow use by fire departments in fighting fires. The level of protection varies with land use and development type.

**Gravity sewer system** - The normal type of wastewater collection system that relies on the natural, downhill flow of wastewater through pipes constructed along drainage patterns and creeks to a wastewater treatment facility.

**Industrial waste** - Non-domestic liquid wastes, including but not limited to, process or operational wastewater, groundwater remediation discharges, contaminated storm water or surface water remediation discharges, and any other non-domestic liquid waste from industrial or commercial establishments.

**Interceptor** - A larger sewer pipe usually constructed along a major creek which collects wastewater flow discharged from trunk mains. Interceptors are sometimes also referred to as "outfalls".

**Irrigation service** - A water service requested and installed for the purpose of irrigating lawns or property. Water provided through such a service does not return to the wastewater collection system.

**Lake Area Sewer Study (1990)** - A study completed by an Engineering consultant under contract with Utilities which establishes a plan for provision of wastewater collection from property which naturally drains toward one of the major lakes in the Utilities service area. This study was completed in 1990.

**Licensed utility contractor** - An individual, firm, or corporation which is licensed by the North Carolina Licensing Board for General Contractors to perform public utility and/or unclassified construction projects which have a contract value not exceeding their license limitation.

**Low pressure sewer system** - A type of wastewater collection system which utilizes individual pumping by each property owner into a common force main. This type of system is utilized along waterfront property where natural drainage patterns have been disrupted by the creation of a large lake.

**Needs Assessment** - A planning document formally prepared by each City department every two years which identifies infrastructure and capital needs of the community which are projected for the upcoming 10 year period.

**New construction or development** - The establishment or substantial improvement of streets, buildings, useable property, or infrastructure where such facilities did not exist or were not suitable for the newly intended purposes.

**Permits** - Documentation of permission by Federal, State, and/or local agencies which have regulatory jurisdiction over the construction and operation of water and/or wastewater utilities to expand or modify the public water and/or sewer system.

**Public water and/or sewer system** - The water and/or sewer pipes, storage facilities, pumping stations, lift stations, treatment facilities and appurtenances that are owned by the City of Charlotte and operated and maintained by Utilities.

**Residential dwelling** - A room or combination of rooms designed for year-round habitation, containing a bathroom and kitchen facilities, and designed for or used as a permanent residence by at least one family.

**Right of Way** - A non-possessory interest in the land of another for the purpose of constructing, reconstructing, operating and maintaining water and/or sewer facilities.

**Street main** - A water or sewer pipe installed along a street, road, or highway primarily for the purpose of providing water or sewer service to the property along that street

**Subdivision** - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, whether immediate or future, of sale, or building development of any type.

**Temporary construction easement** – A temporary right in a specific tract of land for which Utilities has entered into an agreement with the owner that grants Utilities the right to use the land for a limited period of time in order to provide space needed to construct water and sewer facilities.

**Total cost of project** - The total cost of completing a project including planning, design, surveying, drafting, inspection, administration, acquisition of rights of ways, legal services, environmental studies, permits, construction and all other costs necessarily incurred between project initiation and final acceptance.

**Transmission main** - A water pipe constructed primarily for the movement of water from one area to another. Transmission mains are usually, but not always, 12" or greater in diameter. Transmission mains usually supply water to smaller street mains.

**Treatment facility** - A plant designed and constructed for the purpose of removing pollutants and/or other impurities from wastewater or from raw water.

**Tributary** - A stream or pipe which flows by gravity or is pumped into another stream or pipe.

**Trunk main** - A sewer pipe constructed along a drainage pattern or minor creek to collect flows discharged from sewer street mains.



**User fee** - Charges which are collected for normal provision of water and/or sewer service. User fees do not include onetime charges such as connection or capacity charges, nor late fees, turn on/off fees or other similar charges.

**Utilities** – Charlotte-Mecklenburg Utilities. Where action is required or contemplated by Utilities in this Policy, *Utilities* shall refer to the Director or his designee.

#### IV. DESIGN OF SANITARY SEWERS

##### A. Hydraulic Design:

The following procedures and criteria are to be used for sizing and hydraulic design of gravity sanitary sewers. Generally, sewer outfalls and trunk mains shall be sized for the future full development of the basin using the following criteria unless more specific data is available. These design and peak flow calculations are not to be used to calculate flows for wastewater permits. Wastewater permits will be issued on the basis of current actual land use and NCDEM guidelines (i.e. 250 gpd/house, CMUD has been granted approval to use 190 gpd/house, etc.).

1. Determine Drainage Basin and Population To Be Served
  - a. Outline the major basin on 1"=200' topographic maps. Identify and outline all sub basins and identify any other basins or sub basins that will be pumping into the sewer being designed.
  - b. Using a planimeter or some other acceptable method, determine the area to be served. Include the basins or sub basins that will be pumped into the sewer. If the area is undeveloped, reduce the area by 20% to account for streets. If the area is developed reduce the area as necessary to allow for existing streets.
  - c. For each basin and sub-basin, determine the existing population, land use and zoning. Refer to the appropriate area Land Use Plan to determine trends in land use and zoning and for predictions of population growth rate.
  - d. Estimate the "build out" population in the areas to be served when the areas are fully developed according to land use and zoning projections. Table 1 may be used, along with any population projections contained in the Land Use Plan, in estimating this population.
  - e. Estimate the percentage of the "build out" population that will exist in the areas in the 50th year. This percentage should be based on growth rate projections contained in the Land Use Plan. The sewer line should be sized to serve this population.

**TABLE 1**

**GUIDELINES FOR DETERMINING DOMESTIC WASTE QUANTITIES**

Residential Areas

Single Family, Large lots	5-15 people/acre
Single Family, Small lots	15-35 people/acre
Multi Family, Small lots	35-100 people/acre

Commercial Areas

15-30 people/acre

Industrial Areas

5-15 people/acre

2. Determine The Flow:
  - a. Determine average daily flow (design flow) for residential areas by allowing 100 gallons/day/person.
  - b. Determine average daily flow (design flow) for industrial or commercial areas by applying the 100 gallons/day/person criterion. Add additional flow based on research of specific zoning and any known large water users.
  - c. Determine peak daily flow by multiplying the average daily flow by the appropriate peaking factor. The minimum peaking factor permitted by the North Carolina Department of Environmental Management is 2.5 and this factor should be used in the absence of specific design or flow data supporting a higher peaking factor.
3. Determine the minimum slope:
  - a. From topographic maps and any vertical survey control in the area, determine the average slope of the natural drainage in the area to be served. Determine whether any sections are significantly flatter than the average.
  - b. Determine whether there are obstructions (e.g. petroleum transmission mains) or natural terrain features that will limit the pipe slope.
  - c. Based on (a) and (b), establish the minimum slope for the pipeline. This should be used as the design slope.

4. Size the Sanitary Sewer Pipe:
- Use the peak daily flow for calculations with pipe flowing full. This is equivalent to using average daily flow (design flow) with the pipe flowing approximately 40% full.
  - Use Manning Equation or Charts to determine pipe size.

$$Q = \frac{1.486 A R^{2/3} S^{1/2}}{n}$$

Where  $n = .013$

$R = \text{hydraulic radius} = \frac{\text{cross sectional area}}{\text{wetted perimeter}}$

$S = \text{slope}$

$A = \text{Cross sectional area of pipe}$

- Check the velocity flowing full  
 $V = Q/A$   
Velocity must be  $> 2$  fps and  $< 10$  fps
- Check the pipe size and slope against Table 2 and adjust pipe size as required to meet the minimum design slope.

**TABLE 2**

**MINIMUM SLOPES FOR SANITARY SEWERS  
AS REQUIRED BY THE N.C. STATE BOARD OF HEALTH**

<u>Sewer Pipe Size In Inches</u>	<u>Minimum Slope In Feet Per 100 Feet</u>
8	0.40 (CMUD min. is 0.60)
10	0.28
12	0.22
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
30 and larger	Based on velocity calculations

**B. Route Selection**

1. Overlay property lines onto topographic map.
2. Make a preliminary layout, minimizing the number of parcels involved and paralleling property lines where possible. Avoid obvious construction problems where possible.
3. If the average daily flow is greater than 1 MGD and the project is greater than 3 miles in length, an environmental assessment is required. If there is any evidence of wet areas, or if any project area is shown on Mecklenburg County wetland inventory maps, a wetlands delineation is required. These should be scheduled early in the project in order that they can be considered in route selection.
4. Where an Environmental Assessment is required, obtain input from the person or firm conducting the Environmental Assessment. Minimize environmental damage (wetlands, unnecessary stream crossings, damage to tree canopy over streams, etc.)
5. If the proposed route crosses or parallels a roadway, get all other utilities, including other CMUD facilities, located. Consider the NCDOT requirements for encroachments in selecting the route.

6. Walk the project with survey party. Modify preliminary routing as necessary based on field observation of terrain features, environmental considerations, and property damage. Maintain sufficient distance from creek to protect pipe from washout.
7. Provide preliminary layout to survey party and if applicable, to firm or person conducting the Environmental Assessment.

**C. Survey Requirements**

All sanitary sewer lines shall be field surveyed under the supervision of a surveyor registered in North Carolina.

1. Vertical control shall be tied to NGS, NCGS or established CMUD vertical control points. Temporary bench marks shall be established at each proposed manhole and tied back to the established vertical control with a maximum error of  $0.03' \sqrt{M}$ , where M is the number of miles of level loop. The elevation base, NAVD 27 or NAVD 88, shall be indicated on the cover sheet of each set of plans.
2. Horizontal control shall be tied to North Carolina Grid Coordinates.
3. Centerline shall be cut and staked. Iron hubs shall be installed at all angle points and at all manhole locations.
4. Profile data shall include centerline shots at manholes and at 50 foot intervals along centerline and at all grade break points. When paralleling adjacent streams, stream bed elevations are required at each manhole.
5. Where cut or fill slopes are necessary for construction, cross sections shall be provided at fifty foot intervals along the centerline.
6. The bearing of each sewer reach (manhole to manhole) shall be shown as degrees-minutes-seconds (to least count of instrument used), and the distance between manholes shall be shown to the nearest 0.01 foot.

Sewer lines in new subdivision streets are excluded from these requirements when the sewer plan and profile is tied to proposed street layouts in a manner acceptable to CMUD. However, before construction begins, the street rough grading must be completed, the sewer lines must be construction staked and cut sheets must be provided to CMUD. Cut sheets shall be signed by an NC registered surveyor or by the contractor's designated responsible employee.

**D. Rights-Of-Way And Construction Easements**

1. Permanent right-of-way and temporary construction easements shall be provided according to Table 3. Temporary construction easements should be increased for difficult construction areas (e.g. sewers on steep slopes).

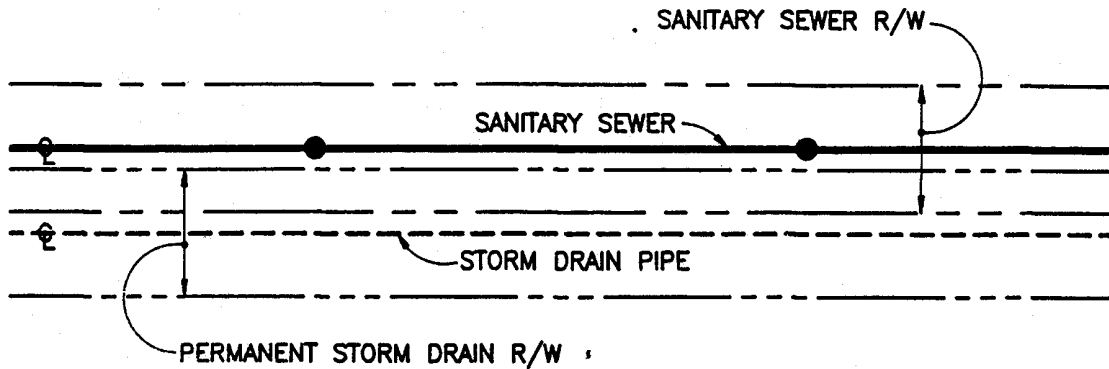
Construction within wetlands shall be limited to a disturbed width of 40', in accordance with Nationwide Permit No. 12 issued by the Corps of Engineers.

2. When a sewer must closely parallel a creek, two thirds to three fourths of the construction easement shall be on the side away from the creek.
3. A separate right-of-way map shall be prepared for each individual property crossed. All maps shall be on standard CMUD sheets, shall conform to the requirements of the standards of practice for land surveying in North Carolina, Section 1600 of The Board Rules and shall contain the following:
  - a. The entire property boundary shall be shown on the map with the proposed right-of-way clearly shown. For large properties, right-of-way details must be shown by separate insets at reduced scale. Not to scale insets may be used when necessary to clearly convey details.
  - b. Every point where the sewer center line or right-of-way crosses a property line must be tied to an identifiable property corner.
  - c. The property owners name, deed book and page where the deed is recorded, and the current property tax code must be shown on each map, including adjoining parcels.
  - d. All manhole locations must be shown, whether at angle points or on line. Show Bearings between angle points and centerline distances along lines.
  - e. Widths for permanent rights-of-way and temporary construction easements must be shown and labeled.
  - f. The parcels on a project shall be numbered sequentially, beginning with #1 at the downstream end. The parcel number shall appear in a triangle above the owner's name and in the title block.
  - g. All maps must be on 8" x 14" vellum or mylar with a standard CMUD title block. The title block shall include the following:
    - a. Title as: Sanitary Sewer to Serve: Project Name, or Water Meter Easement to Serve Project Name.
    - b. Property of current property owner, Job number, file number and scale.
  - h. Include a vicinity map and a north arrow with basis.
  - i. Proposed right-of-way must be shaded.

- j. Submit an original map and one copy with the original signature and original seal of the N.C. Registered Surveyor, as required by G.S. 47-30(M). In addition, seven (7) blue-line copies are required.
- 4. Check right-of-way maps against construction plans and make sure they agree. When a revision is made, make sure that both the plans and the affected right-of-way maps are changed and that the changes are recorded in the revision blocks on both documents.
- 5. When paralleling property lines, make the permanent right-of-way boundary contiguous with the property line. Try to keep the construction easement on the same property. Don't create a new parcel just for a construction easement unless the topography requires it (e.g. where the easement would otherwise be in a creek).
- 6. The sanitary sewer right-of-way may overlap storm drainage right-of-way according to the following Standard Detail:

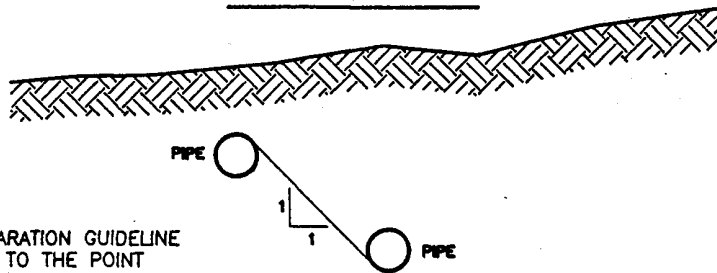


**PLAN VIEW**



THE SANITARY SEWER AND STORM DRAINAGE RIGHTS OF WAY MAY OVERLAP; HOWEVER THE PIPE & ASSOCIATED STRUCTURES MUST NOT BE IN THE OTHER UTILITY'S RIGHT OF WAY. THE SANITARY SEWER R/W WIDTHS SHALL BE AS OUTLINED IN C.M.U.D.'S DESIGN MANUAL. THIS DETAIL DOES NOT APPLY TO STORM DRAINAGE UTILIZING OPEN CHANNEL FLOW.

**PROFILE VIEW**



THE VERTICAL SEPARATION GUIDELINE WILL BE USED UP TO THE POINT WHERE THE TWO RIGHTS OF WAY ADJOIN EACH OTHER.

THE SANITARY SEWER AND STORM DRAINAGE PIPES MUST BE NO CLOSER TOGETHER HORIZONTALLY THAN THE VERTICAL DISTANCE BETWEEN THE TOP OF THE HIGHER PIPE AND THE BOTTOM OF THE LOWER PIPE. A MAINTENANCE CREW MUST BE ABLE TO DIG DOWN TO THE LOWER PIPE SLOPING THE DITCH ON A 1:1 SLOPE AND NOT EXPOSE THE HIGHER PIPE.

APPROVED BY: DATE:  
 CITY ENGINEERING W. W. [Signature] 3/1/93  
 COUNTY ENGINEERING M. K. [Signature] 3/15/93  
 C.M.U.D. Earl L. [Signature] 3/4/93

<b>CHARLOTTE-MECKLENBURG                  UTILITY DEPARTMENT                  ENGINEERING DIVISION                  CHARLOTTE, NORTH CAROLINA</b>	
Job No. _____ File No. _____ Scales: <b>PLAN N.T.S.</b> PROFILE Hor. _____ Vert. _____ As Built _____ Date _____	<b>STANDARD DETAIL</b>  <b>OVERLAPPING SANITARY SEWER                  &amp; STORM DRAINAGE R/W'S</b>
Surveyed By _____ Drawn By _____ Designed By _____	MSS _____ Project-Engr _____ Approved By _____ Date _____
Mo. _____ Date _____ By _____ Revision _____	Sheet _____ Of _____

**TABLE 3**

**RIGHT-OF-WAY AND CONSTRUCTION EASEMENTS REQUIRED FOR CMUD CONSTRUCTION PROJECTS  
(All Numbers Are In Feet)**

<b>PIPE SIZE</b>	<b>8"- 12"</b>			<b>15"- 18"</b>			<b>21"- 27"</b>			<b>30"- 36"</b>			<b>42"- 54"</b>		
	<b>RIGHT OF WAY</b>	<b>CONST ESMT</b>	<b>TOTAL WIDTH REQ'D</b>	<b>RIGHT OF WAY</b>	<b>CONST ESMT</b>	<b>TOTAL WIDTH REQ'D</b>	<b>RIGHT OF WAY</b>	<b>CONST ESMT</b>	<b>TOTAL WIDTH REQ'D</b>	<b>RIGHT OF WAY</b>	<b>CONST ESMT</b>	<b>TOTAL WIDTH REQ'D</b>	<b>RIGHT OF WAY</b>	<b>CONST ESMT</b>	<b>TOTAL WIDTH REQ'D</b>
0-6	15	15	30	20	10	30	25	5	30	25	10	35	30	5	35
6-8	15	20	35	20	15	35	25	10	35	25	10	35	30	10	40
8-10	15	20	35	20	15	35	25	15	40	25	15	40	30	10	40
10-12	15	25	40	20	20	40	25	15	40	25	20	45	30	15	45
12-14	15	25	40	20	25	45	25	20	45	25	20	45	30	20	50
14-16	15	30	45	20	25	45	25	25	50	25	25	50	30	20	50
16-18	15	35	50	20	30	50	25	35	55	25	30	55	30	25	55
18-20	15	40	55	20	35	55	25	30	55	25	35	60	30	30	60

**E. Sewer Location, Manhole Spacing, And Venting**

1. Gravity sewer lines serving drainage basins shall follow the natural drainage pattern of the basin as closely as possible. Specific horizontal alignment should be made with due consideration to property lines, topography, environmental damage, and property owner wishes. Where possible, elevations should be set so that the top of the pipeline is at least four feet below the natural grade and at least one foot below stream or drainage channel beds.
2. Sewer lines shall be laid on straight lines between manholes and at constant grade. Outside street rights-of-way and landscaped areas, manhole rims shall be at least two feet above finished grade. Within street rights-of-way and in landscaped (lawn) areas, manhole rims shall be flush with finished grade.

Manholes shall be vented, by use of vented covers or external vent structures, only as required for proper pipe ventilation and to insure proper hydraulic performance (e.g. inverted siphon manhole). As a general guideline, vents are required at intervals of approximately 1,000 feet. All non-vented manholes shall have solid covers, and all frames and covers subject to flooding or inflow from storm water shall be sealed according to current standard specifications. Manholes with external vents shall have sealed frames and covers with the vent inlet two feet above the 100 year flood protection elevation.

The number of manholes shall be held to a minimum subject to the following:

- a. Manholes shall be placed at all horizontal and vertical break points and at the confluence of two or more separate lines.
- b. Maximum manhole spacing shall be as follows:

<u>PIPE SIZE</u>	<u>MAX. MANHOLE SPACING</u>
8" - 12"	500'
15" - 27"	550'
30" - 42"	700'
Over 42"	800'

- c. For sewers 15-inches in diameter and smaller, allow a 0.2' vertical drop through each manhole. Where the grade is critical, or where the grade exceeds 5%, this drop can be reduced. No drop is required through manholes for sewers 18" in diameter and larger. Drops through manholes should be limited to prevent turbulent conditions. Outside drops should be used when the drop through the manhole is 1.5 feet or greater, according to the Standard Details. Inside drops may be allowed in special circumstances according to the Standard Details, but may only be installed in five (5) foot diameter and larger manholes. In special cases, five (5) foot diameter manholes may be required where sewer trunk lines cross streets to provide for future inside drop connections. At manholes where small diameter lines connect to larger diameter lines, match the crown of the smaller line to the crown of the upstream main line.

- d. Upstream main lines or branch lines shall normally intersect downstream main lines at a 90 degree angle or greater. Where street layouts or other design constraints make this impractical, exceptions will be considered on a case by case basis.
- e. In subdivision streets, manholes shall be no closer than 4' from the lip of the curb, as measured to the center of the manhole. Sewer pipe shall be no closer than 2' from the lip of the curb as measured to the center of the pipe.

**F. Conflicts With Existing And Proposed Utilities**

- 1. Water mains
  - a. 18-inches vertical clearance for sewer under water.
  - b. 10-feet horizontal separation for sewer parallel to water.
  - c. Ductile iron pipe required for sewer and water when these clearances are not maintained.
- 2. Storm Drains And Gas Mains
  - Sewer Under Storm Drain/Gas Line (Any Sewer Pipe Material)
    - a. > 2' clearance use 10 ft. of stone bedding
    - b. < 2' clearance use 9 ft. DIP
    - c. Backfill trench between sewer and storm drains with stone bedding when clearance is less than 30" between storm drain and sewer.
  - Sewer Over Storm Drain/Gas Line
    - a. If sewer is PVC:
      - (1) If storm drain/sewer clearance > 12" use PVC
      - (2) If storm drain/sewer clearance < 12" use 9' DIP
    - b. If sewer is VCP use 9' DIP
- 3. Underground Telephone, Cable TV and Power - Underground conduit banks shall be treated in the same manner as gas mains or storm drains. Individual telephone, Cable TV or power cables may be crossed with any type sewer pipe approved by CMUD provided that at least 12-inches of clearance is maintained.

## **G. Depth And Structural Design**

Maximum depths, trench width and bedding requirements are addressed in CMUD construction specifications (DS Section) for each type of approved pipe material. These are minimum requirements and do not negate the need for the design engineer to evaluate specific trench conditions in the design of a project. Where unstable soil conditions are known to exist in the pipe zone, structural design shall be based on a careful evaluation of the soil conditions and depth of cover. Special structural designs (e.g. pilings with pipe support cradles, etc.) shall be used where appropriate and shall be detailed by the Design Engineer.

Minimum cover for Vitrified Clay or PVC pipe shall be 3.0 feet. Minimum cover for Class IV RCP shall be 1.0 foot and minimum cover for Class V RCP shall be 6 inches. Ductile Iron Pipe or RCP with less than 3 feet of cover may require piers or concrete collars to stabilize the pipe.

Special structures such as large concrete vaults, pumping stations and all buildings shall have a foundation design based on evaluation of actual sub-surface boring and/or other pertinent tests.

## **H. Stream Crossings**

Crossings of streams shall be minimized, and streams shall be protected from erosion in accordance with CMUD erosion control specifications. Wherever possible, stream crossings shall be made with the top of the sewer pipe at least one foot below the stream bed. Depending on actual cover, stream width, flow conditions and soil conditions, the sewer pipe may require special anchorage to prevent flotation and/or washout. Each crossing must be evaluated individually. Pipe for submerged stream crossings shall be ductile iron or reinforced concrete only.

Aerial crossings of major streams and drainage ditches shall be according to current CMUD standard details. Aerial stream crossings must be installed above the 25 year flood elevation. Small streams or ditches that can be spanned with a single joint of ductile iron pipe may be anchored with concrete collars per CMUD Standard Details, provided the collars are below grade.

## **I. Inverted Siphons**

Where aerial stream crossings cannot be made because of floodway restrictions or other reasons, inverted siphons may be considered. Sufficient head and flow must be available to provide a velocity in the siphon of at least 2 feet per second at least once per day with a minimum pipe diameter of 6-inches. North Carolina DEM requires all inverted siphons to be at least dual barrel. One barrel shall be designed to achieve the above flow condition with the second barrel to absorb the maximum flows from the upstream sewer pipe.

Where minimum scouring velocity of 2 fps cannot be achieved regularly at average flows, pumping stations may be required.

**J. Protection Of Water Supplies**

Separation of sewer and water mains is addressed elsewhere in this document. Wherever possible, sewer mains shall be separated from well heads by at least 100 feet. When this requirement cannot be met, the sewer main must be constructed of ductile iron pipe. Sewer lines cannot be installed within 25 feet of private wells or within 50 feet of public wells.

**K. Corrosion Protection**

In areas where the potential for release of hydrogen sulfide gas exists, concrete and ductile iron pipe and concrete structures will be protected from hydrogen sulfide induced corrosion. These areas include force main discharges or inside drops which create turbulence, and areas where septic conditions are likely to occur.

Standard concrete pipe and manhole specifications provide for alkalinity control and/or sacrificial concrete. Wherever significant corrosion potential exists, concrete pipe and structures shall be lined with PVC sheet liner and the interior of ductile iron pipe shall be coated with polyethylene.

**L. Design Of Erosion And Sediment Control Measures**

All sanitary sewer construction plans, regardless of project size, shall include measures and/or devices to prevent erosion and to contain sediment within the limits of the right-of-way. This requirement is waived for sewers in subdivision projects where erosion control for the project includes the sanitary sewer construction and where CMUD does not monitor erosion control measures. However, where the subdivision is served by a trunk extension that is outside the project limits, erosion control design for the trunk extension must be provided.

Design of erosion and sediment control devices shall be in accordance with CMUD specifications (EP Section) and standard details for Erosion Control and with the State of North Carolina Erosion and Sediment Control Planning and Design Manual.

**M. Bores and Tunnels**

Sewer line crossings of railroads, major city streets and numbered state highways must be encased in a steel pipe installed by boring and jacking or in a dug tunnel lined with prefabricated steel plates. Minor City street and secondary roads maintained by NCDOT may be open cut with specific permission of the controlling agency and if specifically shown on the construction plans. Material and construction specifications for steel casing and tunnels shall be in accordance with current CMUD standard specifications (MS and DS Sections). The carrier pipe shall be ductile iron or reinforced concrete. Spiders shall be used on all gravity sewer lines installed within a tunnel. Spiders shall also be used for gravity sewer lines installed within steel casing when the clearance between the bell of the carrier pipe and the top of the steel casing exceeds the allowable deflection of the carrier pipe joint.

The minimum size and thickness standards for casing pipe and tunnels for various sewer line sizes and types are as follows:

**SEWER LINE STEEL ENCASING PIPE  
AND TUNNEL LINER STANDARD**

		Thickness		Recommended * Min. Tunnel
Carrier Pipe	Casing Pipe	D.O.T.	R.R.	
8-inch Ductile Iron	18"	.250"	.312"	48"
10-inch Ductile Iron	20"	.250"	.344"	48"
12-inch Ductile Iron	24"	.250"	.406"	48"
16-inch Ductile Iron	30"	.312"	.469"	48"
18-inch Ductile Iron	30"	.312"	.469"	48"
18-inch RCP	36"	.375"	.562"	48"
21-inch RCP	36"	.375"	.562"	48"
24-inch Ductile Iron	36"	.375"	.562"	48"
24-inch RCP	42"	.500"	.625"	54"
27-inch RCP	48"	.500"	.750"	60"
30-inch Ductile Iron	48"	.500"	.750"	60"
30-inch RCP	48"	.500"	.750"	60"
36-inch RCP or DIP				72"
42-inch RCP or DIP				84"
48-inch RCP or DIP				90"
54-inch RCP or DIP				96"

\*Gauge to be determined by controlling agency and/or by depth of installation.

**N. Sequential Procedure For Sewer Projects**

1. Assemble topo maps and lay out approximate route.
2. Overlay property (tax) maps on topos.
3. Prepare letter to property owners notifying them that surveyors and environmental consultants will be working.
4. Delineate wetlands and perform environmental assessment if applicable. Coordinate this work as required using consultants or sub consultants.
5. Identify R/R and NCDOT encroachment requirements.
6. Do hydraulic design and preliminary survey (level loops horizontal control etc.) if required.
7. Select route considering property lines, topo, wetlands and EA recommendations. Engineer should visit the site to confirm route selection.
8. Complete field surveys with emphasis on #7.
9. Prepare encroachment maps, with plan and profile as required, and apply for encroachments.
10. Complete plan and profile and rights-of-way maps. Check them against each other for consistency.
11. Apply for all permits.



V. **DESIGN OF WATER MAINS**

A. **Fire Flow And Residual Pressure Requirements**

When fire protection is to be provided, system design should be such that fire flows and facilities are in accordance with the requirements of the State Insurance Services Office. The minimum fire flow shall be 1000 GPM with a minimum residual pressure of 20 PSI. Minimum residential service flow shall be 10 GPM at 20 PSI residual pressure (as measured at the meter). Where these requirements cannot be met, contact CMUD Public Service Engineer for guidance.

B. **Hydraulic Design**

Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire protection.

Transmission mains 12-inches in diameter and larger shall be designed to deliver maximum daily design flow with a head loss not to exceed 5' per 1000'. Lower head loss criteria may be established based on length of main and available system head. Distribution mains 8-inches in diameter and smaller shall meet the same criteria for maximum daily domestic demand, but head losses up to 10' per 100' are acceptable for fire flow design provided volume and residual pressure requirements are met. Design shall be based on a Hazen-William "C" value of 150 for PVC pipe and 130 for ductile iron or concrete cylinder pipe.

When requested, the Engineer shall submit the calculations of fire flow requirements and domestic water demands for the project. Information concerning the available water pressures and capacity will be furnished through the Systems and Records Section upon request.

The water distribution systems and any extensions shall be designed to supply the demands of all customers while maintaining the following minimum pressures and velocity.

- 1) 40 PSI for maximum daily flow
- 2) 30 PSI for peak hourly flow
- 3) 20 PSI for instantaneous flow plus fire flow. If this requirement cannot be met due to system limitations, the minimum pipe diameter shall be 8-inches.
- 4) 4 FPS for flushing

Average daily flow may be estimated at 1500 gallons per day per acre. This estimate should be modified as necessary based on specific zoning and land use data. Maximum daily flow and peak hourly flow shall be determined as follows:

$$\begin{aligned} \text{Maximum daily flow} &= \text{Average daily flow times } 1.5 \\ \text{Peak hourly flow} &= \text{Average daily flow times } 2.1 \end{aligned}$$

Instantaneous demand for residential areas shall be based on the number of 3/4-inch service connections according to Figure 1. Instantaneous demand for business and industrial development shall be based on detailed analysis of water volume and usage patterns for the particular type of development.

Transmission mains larger than 12-inches shall be designed on the basis of the most recent system wide demand data and hydraulic modeling.

Services and meters shall be sized and locations designed in accordance with Standard Details. Minimum service size shall be 3/4" pipe with a 5/8" meter. A maximum of 20 services shall be allowed on dead end 2-inch mains and a maximum of 40 services shall be allowed on a looped 2-inch main. No 2-inch main shall exceed 1,000 feet in length.

Pressure reducing valves shall be installed on the customer side of the meter whenever the maximum system pressure at the service connection is greater than 80 PSI.

### **C. Survey Requirements**

All new water mains greater than 12-inches in diameter shall be field surveyed under the supervision of a surveyor or registered in North Carolina.

1. All existing underground utilities (water, sewer, gas, storm drains, telephone, electric power, cable TV, etc.) along the route shall be located horizontally. Where potential for significant elevation conflicts with the proposed water main exist, the existing utilities shall be exposed and elevations determined. Contact the individual utilities to determine dig up policies and procedures.
2. Vertical control shall be tied to NGS, NCGS or established CMUD vertical control points. Temporary bench marks shall be established at intervals of approximately 1000 feet and tied back to the established vertical control with a maximum error of  $0.03\sqrt{M}$  where M is the number of miles in the level loop.
3. Horizontal alignment shall be chosen in coordination with the design engineer and referenced to the edge of pavement, right-of-way line, or other identifiable feature. Center line profile shots shall be taken at 50 foot intervals with closer shots at break points such as culverts, creeks, etc. In cut sections, edge of pavement profile is required also.
4. Any requirements for private rights-of-way shall be determined in consultation with the design engineer. A separate right-of-way map shall be prepared for each individual property crossed. Refer to IV. D.3 for specific requirements for right-of-way maps.
5. Water mains 12-inches or less in diameter do not require profile views on the construction plans except, when in the opinion of the design engineer, a profile view is needed to convey a specific vertical alignment. High points and low points are to be identified for location of air releases and blow offs.

### **D. Location And Depth**

As a general rule, water mains are located only within the limits of street or highway rights-of-way. Where this is not possible because of construction conditions, underground conflicts, or requirements of the controlling agency, location in private easements may be approved by CMUD. Insofar as possible, water mains should be located out of existing paved areas and a fixed distance from the edge of pavement or back of curb. Alignment should be chosen so as to minimize conflicts with utilities and underground structures.

Depth of water lines shall be set to minimize high and low points and at sufficient depth to prevent freezing. A minimum cover of 36-inches is required except where short sections at shallower depth are required to avoid major utility conflicts. Whenever depth of cover is less than 24-inches, the pipe must be encased in concrete. Encased water mains shall have at least one foot of cover over the casing. Where centerline grade is higher than the edge of pavement, the top of the water main shall be at least 3' below edge of pavement.

**E. Pipe Materials And Thickness Design**

Complete specifications for CMUD approved water main materials are contained in the MS Section of current CMUD Water Main Specifications. The following pipe materials are approved for various applications.

<b>SIZE</b>	<b>THICKNESS</b>	<b>MATERIAL</b>	<b>SPECIFICATIONS</b>
<b>SUBDIVISION STREETS (New Streets)</b>			
2-inch ***	SDR 13.5	PVC	ASTM D2241
6-inch, 8-inch, & 12-inch	SDR 14	PVC	AWWA C-900
	Pressure Class 350	DIP	AWWA C-151
<b>DISTRIBUTION MAINS (Existing Roadways)</b>			
2-inch ***	SDR 13.5	PVC	ASTM D2241
6-inch, 8-inch, & 12-inch	SDR 14	PVC	AWWA C-900
	Pressure Class 350	DIP	AWWA C-151
<b>TRANSMISSION MAINS</b>			
16-inch - 20-inch	Pressure Class 250 (Minimum) **	DIP	AWWA C-151
24-inch & Above	*	PCCP/ECP	AWWA C-301
	Pressure Class 250 (Minimum) **	DIP	AWWA C-151

\* Thickness design per Appendix C, AWWA C301

\*\* Thickness design per AWWA C150

\*\*\* NCDHS requires 2-inch galvanized under certain conditions. See current CMUD Standard Specifications for Water Main Construction, DS Section

**F. Thrust Restraint**

Thrust restraint for water mains shall be provided by concrete thrust blocks bearing on undisturbed soil or by approved restrained joints. The bearing area for thrust blocks shall be based on the required test pressure of 200 PSI and a field determination of the load bearing capacity of the soil. Conservative estimates of soil load bearing capacities by experienced and qualified inspectors are normally allowed. However, analysis may be required by the Engineer.

Restrained joints shall be as specified in current Material Specifications (MS Section) or as recommended by the pipe manufacturer and approved by the Engineer. Restrained lengths shall be calculated by the design engineer for each application. Calculations shall be based on a test pressure of 200 PSI and skin friction coefficients supplied by the pipe manufacturer with a safety factor of 1.5.

**G. Valving Requirements**

Main line valves shall be located at all pipeline intersections and at changes in pipe diameter. Maximum valve spacing shall be 1500 feet in the distribution system and 3000 feet for transmission mains 16-inches in diameter and larger.

Two valves shall be provided at tees and three valves at crosses, with valves located either at road intersection radius points or as close to the fittings as possible. Where valves must be located away from intersections, they should be located at hydrant installations. If the line is a one way feed, the valve should be on the dead end side of the hydrant branch. Each fire hydrant shall have a hydrant guard valve between the hydrant and the main line located according to current standard details for hydrant installation.

**H. Fire Hydrant Spacing**

Current NC DHS regulations specify that a hydrant must be located within a radial distance of 1000' from each residence and 500' from each business. CMUD practice is to limit the maximum distance to 750' from the building set back line for single family and duplex residences and 500' from the building set back line for multi-family residences and businesses. These distances are measured along streets as the fire truck would travel.

**I. Provision For Testing And Disinfection**

New water mains may be tied to the existing system at one point only prior to pressure testing and disinfection. When the connection is such that the new main will be pressure tested against an existing valve, the valve will be pressure tested, prior to the connection, at the same differential pressure that will be applied during testing of the new main. If the valve does not hold constant pressure for a ten minute test period, then the connection will not be permitted until the new main is tested and disinfected. Instead a jumper connection will be provided to furnish the water for testing, disinfection and flushing. Following testing against an active valve, the valve will be opened and the line thoroughly flushed through the valve. Access to flush points for contractors and CMUD staff will be provided.

Where new mains are connected to the existing system by tapping sleeves and valves, the valves will be hydrostatically tested after the sleeve and valve have been bolted on but before the tap is made.

Temporary taps and air releases may be made to accommodate testing and disinfection with the approval of the Engineer. Wherever possible, blow offs will be located close to sanitary sewer manholes for convenient disposal of chlorinated water following disinfection.

**J. Air Releases, Air Relief And Vacuum Valves and Blowoffs**

Manual air releases shall be provided at high points on all 12-inch and larger water mains. Also, air releases shall be provided at high points on 6-inch and 8-inch water mains where air cannot be adequately released from the main through service connections. Manual air releases shall be according to current standard details.

On pumped lines or in any other application where the potential for water column separation exists, the design engineer shall evaluate the need for automatic air relief and vacuum valves and shall recommend specific valve configurations for approval by the CMUD Chief Engineer or his representative.

All transmission mains 16-inches in diameter and larger must be designed such that they can be de-watered completely within four hours through blowoffs and fire hydrants. Dead end lines shall be terminated with a 2-inch blow off according to current CMUD standard details.

**K. Minimum Pipe Size And Limitations On Use Of Small Diameter Mains**

The minimum pipeline diameter for distribution system mains providing fire flow shall be 6-inches. Two-inch diameter lines may be used within residential subdivisions only for a maximum length of 1000 feet where fire flow requirements and minimum hydrant spacing is provided by 6-inch and larger mains. No more than 20 residential customers may be served from a dead end 2-inch main and no more than 40 customers may be served from a looped 2-inch main.

**L. Conflicts With Existing And Proposed Utilities**

1. Sewer mains -
  - a. 18-inch vertical clearance for water line installed above sewer line
  - b. 10-feet horizontal separation for water line parallel to sewer line
  - c. Ductile iron pipe required for water and sewer when these clearances are not maintained.
2. Storm Drains, Gas Mains and Telephone Duct Banks - when crossing storm drains, gas main or telephone duct banks, a vertical clearance of 12-inches shall be maintained. When crossing storm drains with minimum cover, this clearance may be reduced provided specific approval of the North Carolina Department of Transportation or Charlotte DOT is obtained and provided the minimum cover requirements for water mains are maintained. Wherever the 12-inch clearance is not met, Ductile Iron Pipe must be used.
3. Underground Cables - Individual telephone, electric power and cable TV cables may be crossed with a minimum of 12-inches of clearance.

**M. Bores And Tunnels**

Water main crossings of railroads, major City streets and numbered State highways must be encased in a steel pipe installed by boring and jacking or in a dug tunnel lined with prefabricated steel tunnel liner plates. Minor City streets and secondary roads maintained by NCDOT may be open cut with specific permission of the controlling agency and if specifically shown as open cuts on the construction plans. Material and construction specifications for carrier pipe and for steel casing pipe and tunnel liners shall be in accordance with current CMUD standard specifications.

The minimum size and thickness standards for casing pipe and tunnel liners for various water main sizes are as follows:

Carrier Pipe	DOT Size	DOT Thickness	Railroad Size	Railroad Thickness	Tunnel Size*
6-inch DIP	12.75"	.250"	16"	.281"	48"
8-inch DIP	16"	.250"	18"	.312"	48"
10-inch DIP	18"	.250"	20"	.344"	48"
12-inch DIP	20"	.250"	24"	.406"	48"
16-inch DIP	24"	.250"	30"	.469"	48"
18-inch DIP	30"	.312"	30"	.469"	48"
20-inch DIP	36"	.375"	36"	.562"	48"
24-inch DIP	36"	.375"	36"	.562"	48"
27-inch PCCP	42"	.500"	42"	.625"	54"
30-inch DIP	42"	.500"	48"	.750"	54"
30-inch PCCP	48"	.500"	48"	.750"	54"
36-inch DIP					60"
36-inch PCCP					60"
42-inch DIP					72"
42-inch PCCP					72"
48-inch DIP					78"
48-inch PCCP					78"
54-inch DIP					78"
54-inch PCCP					78"
60-inch DIP					84"
60-inch PCCP					84"

\*Liner plate gauge to be determined by controlling agency and/or by depth of installation.



**N. Stream Crossings**

Water mains crossing streams shall be of ductile iron pipe or concrete pressure pipe only and shall meet current CMUD standard material specifications. The pipe shall be buried at sufficient depth to provide four feet of cover between the top of the pipe and the stream bed. The pipe and joints shall be protected against stream bed erosion, unstable subsoil conditions and any other anticipated horizontal or vertical loading. Protective measures may include rip rap, concrete encasement, driven or drilled piers at each pipe joint or use of ball and socket pipe. For large stream crossings, the Engineer may require specific designs based on subsurface soil investigations.

**O. Design of Soil Erosion And Sediment Control Measures**

All water main construction plans, regardless of project size shall include measures and/or devices to prevent soil erosion and to prevent sedimentation of streams and drainage ways. This requirement is waived for water mains in subdivision projects where the project erosion control plans includes water main construction and where enforcement of erosion control requirements is not under CMUD control. Design of Erosion and Sediment Control devices shall be in accordance with CMUD specifications and standard details for erosion control and with the State of North Carolina Erosion and Sediment Control Planning and Design Manual.

## VI. SURVEY STANDARDS

Return to   
Table of Contents

### A. General

In surveying for the alignment of sewer outfalls, extensions, and water lines, it is important for the Survey section to collect as much information as possible to assist the Design Section in preparing a clear, concise, and accurate set of construction plans and right-of-way maps. In order to assist the Drafting Technicians and Civil Engineers and to avoid confusion between the respective sections, a standard set of survey symbols, abbreviations, nomenclature, and field notes will be used by the Survey Section and are available upon request.

In preparing a set of field notes, keep in mind these general requirements of good note keeping:

1. Use a sharp pencil of medium hardness (2H or 3H).
2. Do not erase. If an item is recorded in error, draw a line through it without destroying its legibility and record the correct item above it.
3. Avoid copying notes. If notes must be copied, turn in the original notes with the copied notes.
4. Record notes in the field as you get your measurements, not at a later time from memory.
5. Make a sketch. Be sure to decide what you want to show and organize your sketch before you begin.
6. Don't crowd your sketch. If your sketch is too small, void it and start over (use a legal pad if necessary).
7. Use a straight-edge and templates in drawing sketches.
8. Show a north arrow on all sketches.
9. Use standard symbols and abbreviations on sketches.
10. Start each day's notes on a new page.
11. Show the job number and date on each page of field notes.
12. Number each page of field notes.
13. Review your notes before leaving the field to be sure they are complete.
14. Use the checklist to make sure that you have all the necessary information.

### B. Preliminary

The preliminary steps in any sanitary sewer project fall under the responsibility of the Design Engineer and the Survey Supervisor. These persons work together to make sure that all necessary information pertaining to the project is gathered together prior to assignment to the Survey Party Chief.

The information that should be gathered and included in the project folder is:

1. Topographic map(s) showing approximate route of sanitary sewer.
2. Tax map(s) showing property owners being affected and adjoining the proposed sewer route.

3. Water map(s) showing size and approximate location of existing water mains, valves, blow offs, etc.
4. Gas map(s) showing approximate location of gas mains and valves.
5. Location and elevation of available bench mark descriptions or designation of existing flow line elevation.
6. Locator service number and place to meet representatives or locating companies.
7. Project schedule showing project name and job number; this name and number should be reflected on all field notes and daily reports.
8. Available record maps and/or deeds.

The Survey Supervisor will review the project file with the Survey Party Chief prior to beginning the job. The Survey Party Chief should be certain that they understand what is required. This is the time to ask questions relating to the project, not after the job is completed.

If a problem relating to location arises, contact the Survey Supervisor and/or Design Engineer and someone will come to the site to assist you in determining the route. On all major projects, the Design Engineer should walk the project with the Survey Party Chief prior to establishing the alignment.

### **C. Sanitary Sewer Outfall & Trunk Lines**

#### **Plan view:**

Outfalls and trunk lines are the major collector lines for wastewater throughout the system. The purpose of these lines is to collect the flows within a particular basin and carry the wastewater to the treatment plants. These are gravity lines of 8" to 72" in diameter that follow the low areas of a basin.

Important points to remember in the surveying of these lines are:

1. Follow the low points of the drainage area as much as possible.
2. Maintain a working distance from any creek banks, generally 15'-20' is sufficient depending upon size and depth of line.
3. Set up the proposed line so that the line of sight is maintained between proposed manholes. Try to minimize the number of manholes needed to complete the project.
4. Proposed manholes are to be located with rebar or iron pipes of at least 1/2 inch diameter. (This helps to relocate manholes during construction.)
5. If possible, the proposed line should be parallel with and adjacent to existing property lines.
6. Locate all important physical features relating to the proposed line; i.e. locate creek, wire fences, other utility lines, property corners, buildings, large trees, R/W monuments, road and railroad crossings. A good rule to remember, "If in doubt, locate it".
7. When locating creeks, be sure to show the distance to creek banks and the width of the banks.
8. On the profile, show flow line elevation of creek and elevation of top of

- creek banks.
9. When crossing existing utility easements (gas, electric, etc.) show width of R/W or clearing and angle relationship to proposed sanitary sewer.
  10. When crossing existing roads, show the road name and number, R/W width (if known or find monuments), type surface, width of surface, and angle relationship to proposed line.
  11. Locate any significant trees within the proposed easements. These may be larger trees than the average or particular species such as walnut, dogwood, etc.
  12. Be sure to locate any significant ground features that may affect construction. Pay particular attention to rock outcrops and swampy ground conditions.
  13. Remember to follow the maximum spacing guidelines for the size sewer being proposed (see IV.E.2b).
  14. When locating for plan view, locate all features within the right-of-way and temporary construction easement (see pages 11-13 for symbols). Generally, locate within 25' of either side of centerline.
  15. Show centerline station on guard stakes at proposed manholes.
  16. All angles on the proposed centerline should be "doubled" with difference not to exceed 20" (seconds).
  17. Get backsight distance and bearing to existing manhole at beginning of the project.
  18. Trunk lines and outfalls should be "tied" to NCGS or CMUD monuments.
  19. Locate any wells within 100' of centerline of outfalls.

**Profile:**

1. On all outfalls and trunk lines, elevations must be based on NGS, NCGS, or City of Charlotte established bench marks.
2. Verify elevation of flow line, shelf, and rim of existing manhole where the proposed line begins.
3. Along proposed route, temporary bench marks (TBM) must be set at each manhole.
4. Additional temporary bench marks should be placed adjacent to any road or underground utility crossings, as well as creek crossings that may require piers or a siphon.
5. Obtain bank of creek and flow line of creek elevations at each proposed manhole.
6. When crossing overhead utilities, get elevation of lowest wire or pipe.
7. When crossing underground utilities, get depth and size of utilities.
8. At road or street crossings, get elevations along the road in either direction for 200'-300'.
9. On areas of extreme side slopes, take cross-sections to either side of centerline at least 25'.
10. Locate, size, and get elevations on all storm drainage pipes and culverts that cross or parallel the centerline.
11. If outfall terminates at an existing pump station or treatment plant, be sure to get elevations on all existing lines running to the existing station.

#### D. **Sanitary Sewer Street Extensions**

Street extensions are the collector lines whose purpose is to bring the wastewater to the trunk lines and outfalls. These lines are generally 8" in diameter, and are usually located within the right-of-way of dedicated streets. It is to these lines that the individual lateral connections are made.

Important points to remember while surveying for street extensions are:

1. Survey line must begin at an existing line, preferably at a manhole.
2. A backsight should be taken on the existing downstream manhole.
3. Show "as-built" bearing to backsight manhole, or show azimuth as taken from magnetic reading in the field. (Even if bearing is shown on "as-builts", field azimuth is helpful to verify bearings.)
4. Be sure to obtain backsight distance.
5. If it is necessary to set a "straddle" manhole on the existing line, occupy one manhole and sight the next manhole and record bearing and distance between existing manholes, then set new proposed manhole on line and record distance to it.
6. Locate proposed manholes outside of paved street surface where possible. On state maintained roads, locate proposed manholes as far as possible from the pavement.
7. Locate all physical features within the street right-of-way (or adjacent if feature could impact construction; i.e., property irons, utility poles, existing valves and meters, curbs, driveways (give type), storm drainage, planters, mailboxes, signs, fences, trees and shrubs, gas lines, telephone cable, and electric lines.
8. Locate on both sides of the street. It may be necessary to shift to the other side during design.
9. Show width of street surface.
10. When running proposed sewer on the "outside" of a curved street, station proposed manholes so that the chords do not cut the pavement surface.
11. Locate end manhole approximately 5' within the lot (sideline extended) of the lot being served.
12. If lateral has been laid from the existing structure, locate it from the end manhole.
13. If proposed line must be extended within the pavement, try to stay in one lane. Traffic must be maintained during construction.
14. P. K. nails should be used to locate proposed lines if in existing pavement.
15. Show centerline station on guard stakes at proposed manholes. If proposed manhole is in pavement, mark with paint on pavement.
16. Angles on proposed centerline should be "doubled" with difference not to exceed 20" (seconds).
17. Continue locations 100'-150' past the end manhole if the line may be extended in the future.
18. Locate any wells within 100' of centerline of proposed sanitary sewer.

### **Profile for Street Extensions:**

1. When available, elevations should be based on NCGS or City of Charlotte established bench marks.
2. If established bench mark is not available, flow line out of the existing manhole may be used.
3. Verify flow line, shelf, and rim of existing manhole where extension begins.
4. Check existing manhole to determine whether or not there is a outside drop in the manhole.
5. If a "straddle" manhole is to be use for the beginning manhole, obtain flow line, shelf, and rim elevations of both upstream and downstream manholes.
6. Set a temporary bench mark near the beginning of the line (do not use the existing rim), at the end of the extension, and approximately every 500' between if necessary.
7. Locate, size, and get elevations on all storm drainage pipes either crossing or running parallel with proposed extension.
8. Locate and get elevations of any structure (finished floor and ground) or vacant lot lower than the street. Pay particular attention to those structures with basements.
9. If there is a depression between the street main and any existing structure, run a profile to the structure.
10. Locate and get elevation of the structure to be served. If lateral is installed, get flow line elevation.
11. If proposed extension does not extend to the crest of hill, continue profile to that point. Get size and elevation of any storm drainage that may be encountered.

### **E. 16" and Larger Water Mains**

#### **Plan:**

Within the CMUD system, water mains of 16" and larger diameter comprise the main feeder lines of the system. Because of their size, they cannot easily be deflected to miss an obstruction in their routing.

Important points to remember in surveying for these lines include:

1. Initial alignment is very important to insure that the project begin without difficulty. Locate the valve and blow-off at the end of the existing line. If possible, locate another valve or locate the existing line to get alignment.
2. Locate the proposed line as far from the existing pavement as possible. Try to locate the line 5' from the right-of-way.
3. Locate all physical features along the proposed route; pavement, existing utilities, storm drainage, sanitary sewer, property corners, R/W monuments, driveways, street intersections, bridges and culverts.
4. Stations shall be measured along the arc of curve, not chord of curve.

5. If necessary to deflect proposed line, use standard pipe bends (45°, 22-1/2°, 11-1/4°).
6. At creek crossings, use 45° bends to deflect around bridge abutment.
7. When deflecting around bridge footings, line should be no closer than 10' to footing at any point.
8. Downward deflection to cross creek should be approximately 10' from creek bank.
9. Locate all street intersections with angular relationship to proposed water line.
10. Locate all major gas transmission lines with relationship to proposed water line.
11. Locate all railroad crossings with angular relationship to the centerline of railroad tracks and distance to nearest milepost.

**Profile:**

1. On all 16" and larger water mains, elevations must be based on NGS, NCGS, or City of Charlotte established bench marks.
2. Existing valve or water line elevation must be taken.
3. Along proposed route, establish temporary benchmarks near intersections and at all creek crossings.
4. Centerline profile will be taken at every 100' station, or intermediate station as necessary.
5. At all railroad or creek crossings, a detailed profile is necessary.
6. At street intersections, profile 200'-300' along crossing street for future extensions.
7. Get size and elevations of any storm drainage and sewer that is crossed.

**F. Water Mains Less Than 16"**

In some instances, it is necessary to conduct a location survey for the purpose of drafting plans for 12" and smaller lines. When surveying for 12" and smaller lines the following is required:

1. Locate all physical features within the road right-of-way along the proposed route: pavement, existing utilities, storm drainage, sanitary sewer, property corners, R/W monuments, driveways, street intersections, culverts.
2. Locate all railroad crossings with angular relationship to the centerline of railroad tracks and distance to nearest milepost.

Generally, a profile along the proposed route is not necessary. However, it is important to get a relationship from the ground to the invert of any storm drainage, sewer, water lines, or other utilities that may be crossed. If the proposed route requires a creek crossing, a profile will be required beginning at the point of deflection of the centerline and ending where the line will again parallel the edge of pavement.

## **G. Construction Stakeout - Sanitary Sewer**

CMUD is responsible for furnishing to the contractor a cut sheet for any sanitary sewer that is being built under CMUD contract.

It is the contractor's responsibility to request any needed cut sheets from the construction inspectors at least 72 hours prior to the time that he needs them.

Items to remember when construction staking:

1. When staking centerline and offsetting manholes prior to clearing, verify proposed manhole irons with plans, both angle and distance. (Alignment changes are sometimes made by design after field work is done.)
2. If there is a discrepancy between the plan and what is indicated on the ground, use the plan information.
3. Try to place first offsets for manholes outside of permanent right-of-way but within the temporary construction easement.
4. Construction stakes shall be set at every manhole.
5. If bench marks have been destroyed during clearing, set new temporary bench marks for contractor and inspectors to use.
6. Levels on all construction stakes will be double run. (This eliminates chance of error from misreading the level rod on offsets and turning points.)
7. Mark the offset from the manhole and the station number on the guard stake adjacent to each offset hub.
8. All proposed piers, concrete collars, and bores should be referenced both left and right of centerline.
9. Reference the centerline of all bores approximately 50' before beginning of bore and 50' past the end of bore.
10. Set an offset stake at any existing manhole at the beginning of the project. (Do not use existing rim as a reference, rims may be disturbed during excavation around existing manhole.)
11. Verify flow line elevations at existing manholes. Also check for drop inlets.
12. Cut sheets **are not** to be prepared in the field and given to contractor. If a situation arises where contractor must have cut sheets, the Survey Supervisor may authorize that a segment be prepared by the Survey Party Chief and a copy given to the project construction inspector for use on the project. Construction inspector will verify computations and initial original cut sheet.
13. All cut sheets will be prepared on CMUD cut sheet form.

## **H. Construction Stakeout - Water Mains**

The Survey Section provides the necessary construction staking to assist the Construction Inspectors and contractors on water main projects.

Such staking may include:

1. Stake centerline or offset for alignment of water mains.



2. Offsets and/or elevations for horizontal and/or vertical bends.
3. Grades for cut sheets on areas of critical elevation.
4. Alignment and grades for bores under road or railroads. (Construction staking for these bores will be done in the same manner as bores for sanitary sewer construction.)

## **VII. DRAFTING STANDARDS**

Return to   
Table of Contents

The standard symbols and line weights used in drafting CMUD water and sewer plans are given on the following pages. A legend of symbols is required with each set of construction plans and where additional symbols are required, they shall be clearly defined and included in the legend.

The standard scale for CMUD construction drawings is 1"=40' in plan view and 1"=4' in profile. Expanded detail drawings should be used whenever needed to clearly convey design details. Standard sheet size shall be 24" x 36" for construction plans and 8-1/2" x 14" for right-of-way and encroachment maps. All sheets must contain the standard CMUD title block format.

CAD or manual drawings are acceptable, but manual drawings must be neat, and the lettering must be clearly legible. All plans must be in ink on mylar or vellum.

Elevations must be shown at the left side of the profile section. Station numbering should increase from left to right and should be approximately above the corresponding plan view stationing. Both plan and profile must be shown on the same sheet. Sewer line drawings should run from left to right upstream.

Structures and appurtenances (vaults, manholes, hydrants, valves, piers etc.) should be labeled in plan and profile with station number and standard detail reference if applicable.

All underground obstructions are shown on both plan and profile (if applicable). Vertical clearance requirements are shown in profile and any requirements for Ductile Iron Pipe are shown.

Pipe sizes are shown on plan view and properly scaled on profile. Distance of water main from edge of pavement is shown. Drainage ditches are shown with direction of storm runoff. Erosion control devices are shown in plan view and properly labeled.





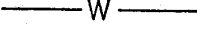






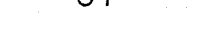




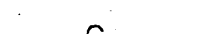




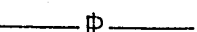

Bearings on sewer lines shall be labeled in the upstream direction.

The CMUD symbols library and title block format are available in Auto Cad upon request.

Subdivision sewer plans shall include lateral locations only to show how each lot will be served. It shall be noted on the plans that exact lateral locations are determined during construction, and that exact locations are required for as built records. Water service connections shall not be shown on plans but exact installed locations are required for as built records.

# STANDARD SYMBOLS & LINE WEIGHTS FOR SANITARY SEWER & WATER CONSTRUCTION PLANS

SHEET 1 OF 2

	SYMBOL	PEN SIZE
EXISTING $\varnothing$ SAN. SWR. _____		(1) OR .50
PROPOSED $\varnothing$ SAN. SWR. _____		(3) OR .50 DB *
EXISTING SAN. SWR. MANHOLE _____		(1) OR .50
PROPOSED SAN. SWR. MANHOLE _____		(1) OR .50
EXISTING WATER MAIN _____		(0) OR .35
PROPOSED WATER MAIN _____		(3) OR .50 DB *
EXISTING WATER VALVE _____		(0) OR .35
PROPOSED WATER VALVE _____		(1) OR .50
EXISTING FIRE HYDRANT _____		(0) OR .35
PROPOSED FIRE HYDRANT _____		(1) OR .50
WATER METER _____		(0) OR .35
UNDERGROUND TELEPHONE _____		(0) OR .35
UNDERGROUND CABLE _____		(0) OR .35
OVERHEAD ELECTRIC _____		(0) OR .35
UNDERGROUND ELECTRIC _____		(0) OR .35
UTILITY POLE / GUY WIRE _____		(0) OR .35
TOWER LINE _____		(0) OR .35
EXISTING GAS MAIN _____		(0) OR .35
GAS VALVE _____		(0) OR .35
EXISTING WATER OR SAN. SWR. R/W _____		(0) OR .35
PROPOSED WATER OR SAN. SWR. R/W _____		(0) OR .35
ROAD / STREET R/W _____		(2) OR .70
PROPERTY LINE _____		(0) OR .35

\* .50 DB = DOUBLE LINE (.75 DRAWING UNITS APART FOR 40 SCALE)

# STANDARD SYMBOLS & LINE WEIGHTS FOR SANITARY SEWER & WATER CONSTRUCTION PLANS

SHEET 2 OF 2

	SYMBOL	PEN SIZE
EDGE OF PAVEMENT _____	- - - - -	(0) OR .35
CURB & GUTTER _____	= = = = =	(0) OR .35
EXISTING IRON PIN _____	○	(0) OR .35
MARSH _____	— ♣ — ♣ —	(0) OR .35
CREEK OR BRANCH _____	— ··· — ··· —	(0) OR .35
RIP — RAP _____	— [chain link] —	(0) OR .35
TREE _____	— [tree symbol] —	(0) OR .35
BUILDING _____	— [hatched] —	(0) OR .35
RAILROAD _____	—         —	(0) OR .35
GUARD RAIL _____	— [T T T] —	(0) OR .35
PIERS _____	— [I I I] —	(0) OR .35
BRIDGE _____	— [bracket] —	(0) OR .35
FENCE ( LABEL TYPE ) _____	— X —	(0) OR .35
STREET SIGN ( LABEL TYPE ) _____	— [sign] —	(0) OR .35
STORM DRAIN / CATCH BASIN OR DROP INLET _____	— [square] —	(0) OR .35
SEDIMENT FENCE (SILT FENCE) STD. 6.62 —	— [fence] —	(0) OR .35
TEMPORARY SEDIMENT TRAP STD. 6.60 —	— [trap] —	(0) OR .35
CHECK DAM STD. 6.83 _____	— [dam] —	(0) OR .35
TEMPORARY DIVERSION STD 6.20 _____	— TD — TD — TD —	(0) OR .35
TEMPORARY STREAM CROSSING STD. 6.70 —	— [crossing] —	(0) OR .35
GROUND PROFILE _____	— [wavy line] —	(1) OR .50
ASPHALT (PROFILE) _____	— [hatched profile] —	(0) OR .35
CONCRETE (PROFILE) _____	— [dotted profile] —	(0) OR .35
GRAVEL (PROFILE) _____	— [circled profile] —	(0) OR .35

## **VIII. TRAFFIC CONTROL PLANS**

When a water or sewer line is to be installed within the travelway of NCDOT/CDOT controlled roads, a traffic control plan may be required. The traffic control plan, with the construction plans, shall be submitted to NCDOT/CDOT for review and approval. The following roadway features shall be shown on the TCP:

- . Pavement Width
- . Pavement Type
- . Speed Limit
- . Traffic Lane Designation
- . Pavement Markings
- . Traffic Signs/Signals
- . Sidestreets/Intersection Location

A Traffic Control Plan shall include the following:

- . Legend
- . Work Hour Restrictions
- . Construction Sequence/Phasing
- . Work Zone Designation
- . Sign Placement
- . Taper Length
- . Traffic Movement Designation
- . Drum/Cone/Barricade/Barrier Placement
- . Flagging Requirement/Location
- . Uniformed Police Officer Requirement/Location

The following agencies shall be contacted when preparing a traffic control plan:










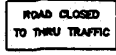










City of Charlotte Department of Transportation (704) 336-2261  
North Carolina Department of Transportation (704) 596-6900

The following publications govern the design and installation of traffic control plans and devices:

Manual on Uniform Traffic Control Devices (1988)  
Work Area Traffic Control Handbook (1990) CDOT  
NCDOT Standard Specifications for Roads and Structures (1990)  
NCDOT Roadway Design Manual

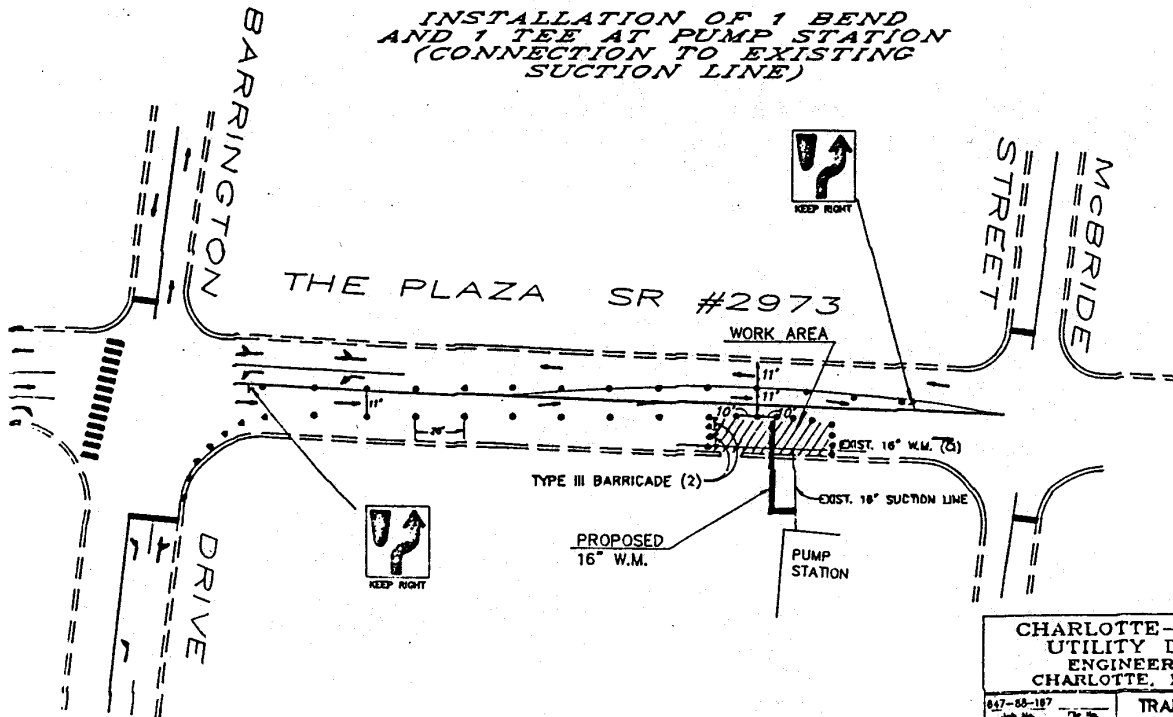
A sample of an acceptable traffic control plan is shown on the following pages:

# LEGEND

-  NON-METALLIC DRUM
-  TYPE III BARRICADE W/ WARNING LIGHT
-  POLICE OFFICER
-  FLAGPERSON
-  W20-7A OR G1
-  W6-3 OR V1
-  W4-2 OR J1
-  W4-2 OR K1
-  O&O CONSTRUCTION G20-2 OR H1
-  ROAD CLOSED TO THRU TRAFFIC R11-4
-  ROAD CONSTRUCTION 3000 FT. W20-1 OR D1,E1,F1
-  RIGHT LANE CLOSED 3000 FT. W20-5R OR M1,N1
-  LEFT LANE CLOSED 3000 FT. W20-5L OR P1,Q1
-  W12-1 OR K3
-  R4-7 OR S2
-  R1-1
-  NO LEFT TURN
-  NO RIGHT TURN
-  R3-5
-  R5-1

## PHASE 4

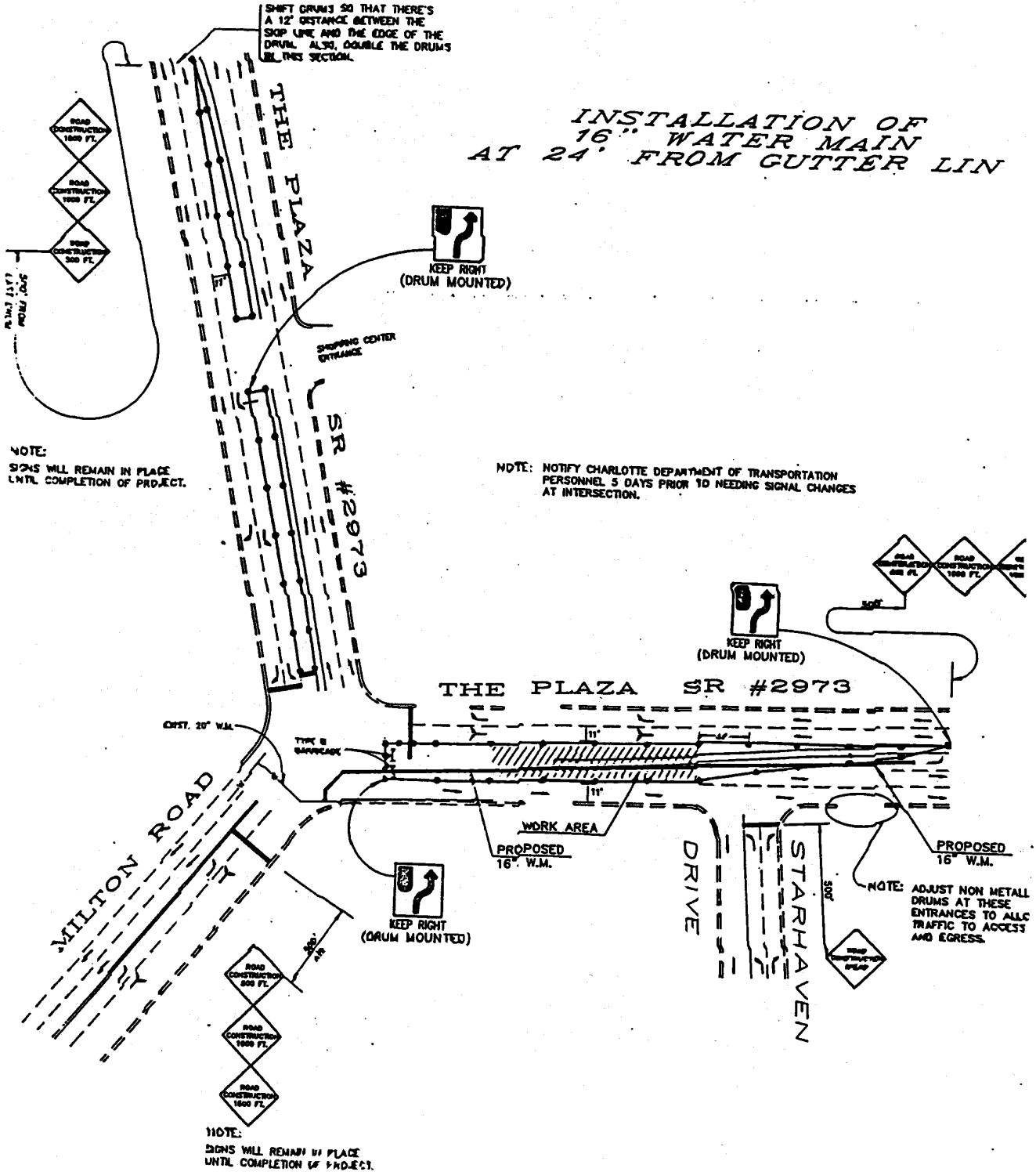
INSTALLATION OF 16" W.M.  
FROM C OF THE PLAZA  
TO THE PUMP STATION  
INSTALLATION OF 1 BEND  
AND 1 TEE AT PUMP STATION  
(CONNECTION TO EXISTING  
SUCTION LINE)



**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

847-88-187		TRAFFIC CONTROL PLAN	
Job No.	Sheet No.	FOR PROPOSED 16" WATER M	
PLAN		ALONG THE PLAZA	
PROFILE		<b>PHASE 3-5 AND PHASE 4</b>	
AS BUILT			
OC	TAB	BSH	3

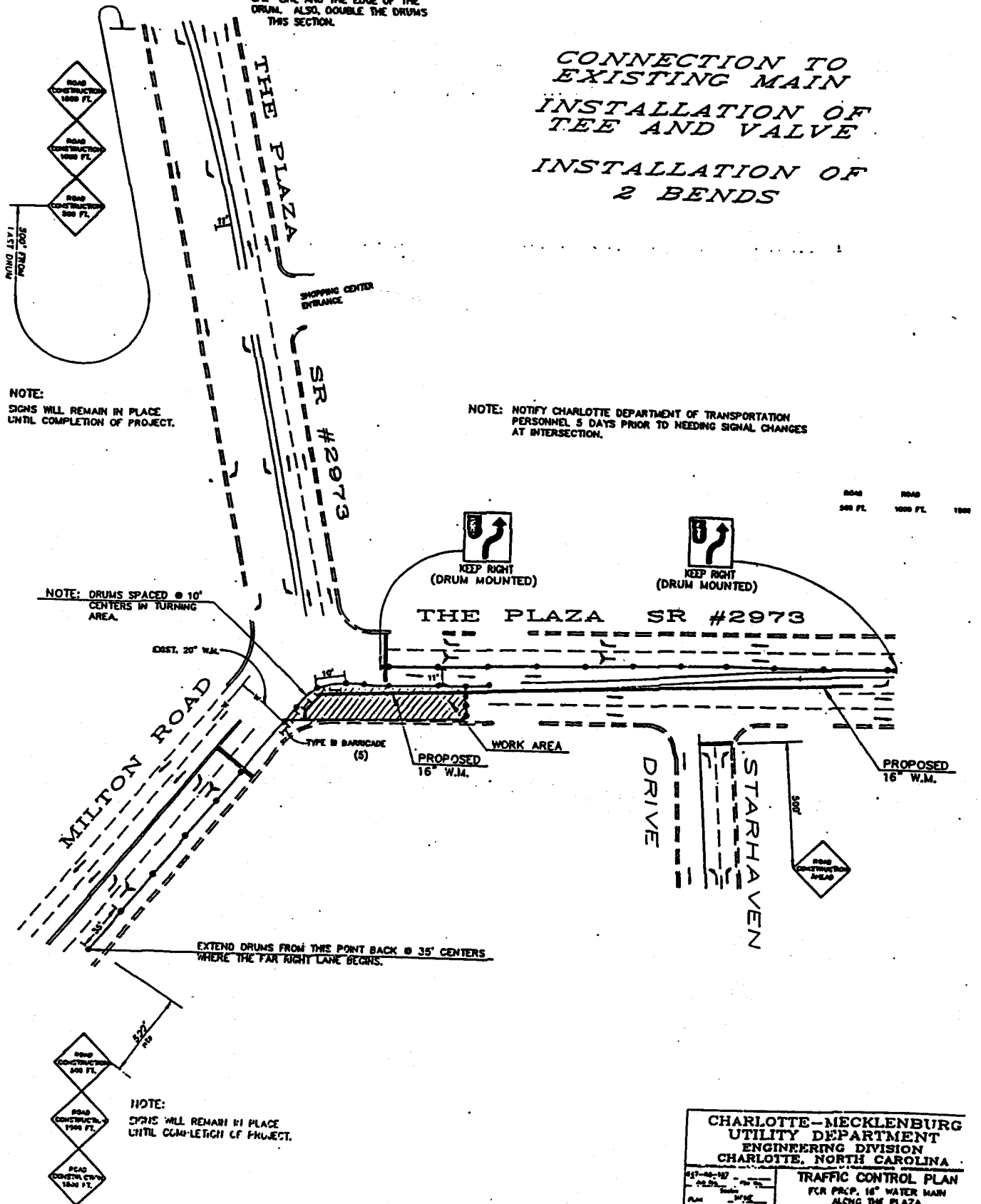
# INSTALLATION OF 16" WATER MAIN AT 24' FROM GUTTER LIN



<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
PAL-NO-117 DATE: 11/17/95 DRAWN BY: [ ] CHECKED BY: [ ] IN CHARGE: [ ]	<b>TRAFFIC CONTROL PLAN FOR PROP. 16" WATER MAIN ALONG THE PLAZA</b>		
<b>PHASE 1, PHASE 2 AND PHASE 5</b>			
DC	TAB	95H	

SHIFT DRUMS SO THAT THERE'S A 12' DISTANCE BETWEEN THE STOP LINE AND THE EDGE OF THE DRUM. ALSO, DOUBLE THE DRUMS THIS SECTION.

CONNECTION TO EXISTING MAIN  
 INSTALLATION OF TEE AND VALVE  
 INSTALLATION OF 2 BENDS



NOTE: SIGNS WILL REMAIN IN PLACE UNTIL COMPLETION OF PROJECT.

NOTE: NOTIFY CHARLOTTE DEPARTMENT OF TRANSPORTATION PERSONNEL 5 DAYS PRIOR TO NEEDING SIGNAL CHANGES AT INTERSECTION.

NOTE: DRUMS SPACED @ 10' CENTERS IN TURNING AREA.

EXTEND DRUMS FROM THE POINT BACK @ 35' CENTERS WHERE THE FAR RIGHT LANE BEGINS.

NOTE: SIGNS WILL REMAIN IN PLACE UNTIL COMPLETION OF PROJECT.

CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA	
031-02-107 02.05 PLAN PROFILE	TRAFFIC CONTROL PLAN FOR PROP. 16" WATER MAIN ALONG THE PLAZA
PHASE 1, PHASE 2 AND PHASE 5	
DC	TAB
HEM	



## **IX. PERMITS AND ENCROACHMENTS**

### **A. Highway Encroachments**

Encroachment agreements with NCDOT are required for any water or sewer facility installed within the limits of NCDOT rights-of-way. The sole exceptions are four inch sewer laterals and water service lines less than six-inches in diameter. Guidelines for design of utility lines within NCDOT rights-of-way are contained in the NCDOT Manual "Policies and Procedures For Accommodating Utilities on Highway Rights-of-Way" and all requirements in that document shall be considered in design of the facilities. Special Encroachment maps and copies of construction plans shall be provided to CMUD for encroachment application. a sample of an acceptable encroachment map is attached. All NCDOT encroachment agreements for facilities to be owned and maintained by CMUD will be between the City of Charlotte and NCDOT. The Engineer will be required to make changes as required by NCDOT, and will provide information as requested during encroachment negotiations. All contacts with NCDOT personnel regarding encroachments will be through the CMUD Contract Administration Section.

### **B. Railroad Encroachments**

Whenever a CMUD water or sewer facility enters a railroad right-of-way, an encroachment agreement between the railroad and the City of Charlotte is required. The engineer shall prepare a separate encroachment map and design data form as required by the individual railroad. Sample maps and blank forms for each railroad company operating in Mecklenburg County are attached. During encroachment negotiations, the Engineer will be required to make design changes and supply information as required by the railroad. However, all contacts with railroad personnel will be through the CMUD Contract Administration Section.

### **C. Permits**

Non discharge permits for sanitary sewer collection facilities and permits for water distribution facilities will be required before construction may commence on any project.

#### Local Permit Program:

Effective July 31, 1995, the Charlotte-Mecklenburg Utility Department has been granted approval to become a delegated authority to establish and administer a local permit program. This program will allow CMUD issuance of permits for public gravity sewer extensions and construction or alteration of the distribution system of a community water system within CMUD's utility service area. These permits will now (effective July 31, 1995) be issued by CMUD staff in lieu of the appropriate NC DEHNR/DEM agency.

CMUD delegation authority will apply to issuance of a permit for the construction and operation of new gravity sewer lines, water lines, modifications to proposed or existing gravity sewer lines and water mains within the corporate limits and areas of extraterritorial jurisdiction. CMUD would also issue permits in the county and surrounding counties where we are already providing water and sewer service.

This action was approved by the Environmental Management Commission on July 13, 1995.

#### Areas Where CMUD Cannot Issue Permit

The areas where CMUD will **not** be allowed to issue permits:

- Restricted Basins - map attached highlighting these areas;
- Pump Stations and Force Mains;
- Low Pressure Sewer;
- Water or Sewer Treatment Plants;
- Private Systems;
- Any variance from the minimum State/CMUD requirements

The Charlotte-Mecklenburg Utility Department has prepared new water and sewer application forms accepted by the appropriate agencies as part of our local permit program application. A sample copy of the water and sewer application is attached.  
Self Permitting Process (In House Design)

The following process will apply for in house design projects:

- The application will be made a part of the cover sheet of the original design plans.
- The application will be completed by the Design Engineer and submitted along with the original construction plans to the Civil Engineer III.
- The Civil Engineer III will approve and certify the application form along with approval of the construction plans.
- The original plans will be submitted to the Contract Administration Team that will assign a permit number. On sewer projects, the flow allocation will be taken and monitored against a Ablock@ capacity of flow that has been issued for each of the sewer treatment plants.
- The original plans will be submitted to the Chief Engineer for approval of the permit. In the absence of the Chief Engineer, the Director, Deputy Director, or Assistant Director will approve permits.
- Once the permit has been approved by the Chief Engineer, the project may be assigned for construction, pending approval of other documentation (highway encroachment, right of way, etc.).

- The project is inspected by CMUD staff. Before activation, the Civil Engineer III will certify completion of the project according to CMUD and State standards. A sample copy of the certification letter is attached.

#### Self Permitting (Donated)

- The application will be made a part of the cover sheet of the original design plans.
- The application will be completed by the Developer=s Engineer.
- The Developer=s Engineer will certify the application form and submit eleven copies of the construction plans to CMUD Staff. An application fee for developer funded projects must be paid by the Developer with a check made out to the Charlotte-Mecklenburg Utility Department for the current application fee. The check must be submitted as part of the permit application/construction plan review.
- CMUD Staff will approve review the application form and approve the construction plans.
- The plans will be submitted to the Contract Administration Team that will assign a permit number. On sewer projects, the flow allocation will be taken and monitored against a Ablock@ capacity of flow issued for each of the sewer treatment plants.
- The plans will be submitted to the Chief Engineer for approval of the permit.
- Once the permit has been approved by the Chief Engineer, the project may be assigned for construction, pending approval of other documentation (highway encroachment, right of way, etc.).
- The project is inspected by CMUD staff. Before activation, CMUD Staff (PE) will certify completion of the project according to CMUD and State standards. A sample copy of the certification letter is attached.

#### DEM/DEHNR Permits:

For projects that will be reviewed by the North Carolina Division of Environmental Management (sewer projects) and the Division of Health Services (water), the following process will apply:

- Three sets of CMUD approved plans must accompany the application. The controlling agency's application form must be used. These are attached for your use.
- All application fees must be paid with a check made out to the appropriate agency for the current application fee and must be furnished to CMUD with the three sets of approved plans.
- **Construction may not proceed until permits are received.**
- Upon completion, and before the facilities are activated, the Registered Professional Engineer that supervises inspection must certify that the facilities are constructed in accordance with approved plans and specifications.

Enforcement:

With implementation of the local permit program, the Charlotte-Mecklenburg Utility Department accepts responsibility for compliance of design/construction in accordance with State regulations.

Ordinance No. 329 was adopted by City Council on June 26, 1995 regarding extensions or modifications of water or sewer system. This ordinance created a new Article VI to Chapter 23 of the Charlotte City Code entitled APermits For Extensions Or Modifications Of Water Or Sewer System@. The ordinance includes requirements to obtain a permit before construction, procedures for administrative review and judicial review of permit decisions, enforcement authority, procedures for processing permit applications, and procedures for setting permit requirements. A copy of the ordinance has been attached for your information.

Also, a copy of the North Carolina Administrative Code, Title 15A Department of Environment, Health, and Natural Resources, Subchapter 18C - Water Supplies-Rules Governing Public Water Systems -Section .1800 - Local Plan Approval has been attached. This copy is current through July 4, 1994.

Reporting:

The Charlotte-Mecklenburg Utility Department will be responsible for submitting the following:

**DEM:**

- Quarterly report listing permit number, project name and flow allocation for projects permitted sent to NC DEM;

- One copy of plans and permit submitted quarterly to NC DEM.

**DEHNR:**

- Monthly report listing project name and permit number for projects permitted sent to DEHNR.
- One copy of plans and permit submitted monthly to NC DEHNR.

**D. Erosion Control Permits**

Each set of plans for a water or sewer project must include appropriate design of erosion and sedimentation control measures. If the area disturbed by the construction is one acre or more, a site specific erosion and sediment control plan must be submitted to the N.C. Division of Environmental Management, Land Quality Section. An application fee of \$25 for the first acre of disturbed area and \$20 for each additional acre must accompany the application. For developer funded projects, a check made out to the Division of Environmental Management in the correct amount must be submitted to CMUD with one set of approved plans. The application is submitted by CMUD and the permit is issued to CMUD. The review time for DEM is 30 calendar days, and the Engineer must respond to any questions and make any plan changes necessary to secure approval of the Erosion Control Plan. All construction is subject to inspection by DEM staff for compliance with the approved Erosion Control Plan. This requirement does not apply to subdivision projects where erosion control is administered under the City of Charlotte or Mecklenburg County Erosion and Sedimentation Control Programs.

**E. Storm Water Permits**

All construction projects which involve more than five acres of disturbed area must have a NPDES storm water discharge permit. The permit application, along with the approval for the erosion control plan, must be submitted to NCDEM. Land disturbing activity cannot take place until the permit is issued.

**F. Blasting Permits**

Blasting permits are required before any blasting operations for removal of rock. Permits for work within the City limits of Charlotte must be obtained from the Charlotte Fire Department. Permits for work outside the Charlotte City Limits must be obtained from the Mecklenburg County Fire Administrator's Office. Encroachment agreements with the N.C. Department of Transportation or railway companies may also contain special provisions limiting blasting operations.

**G. Pavement Cutting Permits**

Before cutting any pavement for water or sewer construction within the City of Charlotte, a permit must be obtained from the Charlotte Transportation Department, Street Maintenance Division. This permit is obtained at no cost by calling the CDOT, Street Maintenance Division. The location of the project and the name of the contractor will be required to obtain the permit.

**H. Burning Permits**

Open burning is not allowed in Mecklenburg County.

**I. Wetlands Permit**

See Section XII - Wetlands Permit

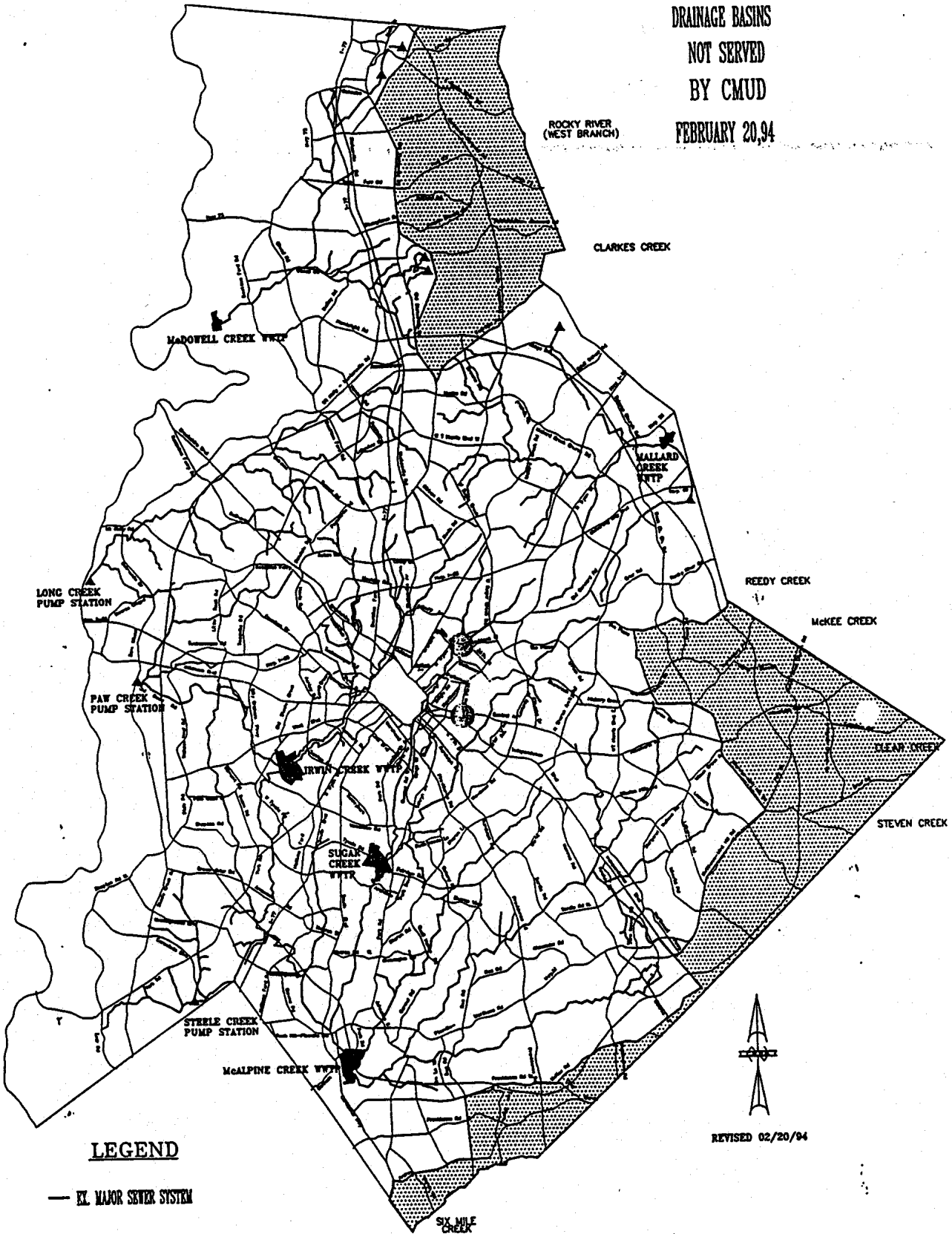
**J. Tree Removal Permit**

See Section XVI - Environmental Protection

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT

DRAINAGE BASINS  
NOT SERVED  
BY CMUD

FEBRUARY 20, 94



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**APPLICATION FOR NON-DISCHARGE PERMIT  
GRAVITY SEWER MAIN EXTENSION  
CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT**

Project Name \_\_\_\_\_  
\_\_\_\_\_

CMUD Project No.: \_\_\_\_\_

Project Type:  New construction       Relocation       Modification of Permit  
No. \_\_\_\_\_  Other \_\_\_\_\_

Volume of wastewater generated by this project: \_\_\_\_\_ gallons per day  
based on 190 gal/day/single family household x \_\_\_\_\_ households or

135 gal/day/multi-family unit x \_\_\_\_\_ units or is based on :

Wastewater Treatment Plant receiving wastewater:

- McAlpine Cr (NC0024970)       Irwin Cr (NC0024945)       McDowell Cr (NC0036277)  
 Sugar Cr (NC0024937)       Mallard Cr (NC0030210)

Nature of wastewater      \_\_\_\_\_ % Domestic      \_\_\_\_\_ % Industrial  
   \_\_\_\_\_ % Commercial      \_\_\_\_\_ % Other \_\_\_\_\_

- Origin of wastewater       Subdivision       Commercial  
    School       Industrial  
    Apartments/condo's       Other \_\_\_\_\_

List any parameter and its concentration that will be greater than normal domestic levels:

\_\_\_\_\_  
\_\_\_\_\_

If wastewater is non-domestic, describe level of pretreatment:

\_\_\_\_\_  
\_\_\_\_\_

If a pretreatment permit is required, has one been issued?       Yes       No

Has Engineer determined that downstream sewers are capable to handle this flow?       Yes       No

Permit No. for sewers immediately downstream \_\_\_\_\_

Pipe diameter of sewers immediately downstream \_\_\_\_\_

Has Engineer determined that NC DEM and CMUD minimum design standards are met by this project?       Yes       No

Complete name and address of Engineering Design Firm:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

**Professional Engineer's Certification:**

I, \_\_\_\_\_, attest that this application for \_\_\_\_\_  
\_\_\_\_\_ has been reviewed by me and is accurate and complete to the  
best of my knowledge. I further attest that to the best of my knowledge the proposed design has been  
prepared in accordance with the applicable regulations. Although certain portions of this submittal  
package may have been developed by other professionals, inclusion of these materials under my  
signature and seal signifies that I have reviewed this material and have judged it to be consistent with  
the proposed design.

North Carolina Professional Engineer's Seal, Signature, and Date:

**CMUD Permit No.** \_\_\_\_\_ **Issued** \_\_\_\_\_

Plant flow allocation recorded by: \_\_\_\_\_

Permit approved by: \_\_\_\_\_  
Earl L. Lineberger, P.E., Chief Engineer

# Application for Permit for Water Main Extension

Project Name: \_\_\_\_\_

CMUD Project No.: \_\_\_\_\_

Project Description: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Designed by: Firm: \_\_\_\_\_

Engineer: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

This application is made under and in full accord with the provisions of Chapter 130A-317 of the North Carolina General Statutes, and such other statutes as related to public water systems. CMUD has been granted authority to issue permits for extension of water mains pursuant to 15A NCAC 18C.1801. The applicant agrees that no significant change or deviation from the plans and specifications approved by CMUD will be made without the written consent and approval of CMUD or its authorized representative. A professional engineer licensed to practice in the State of North Carolina shall submit a statement reflecting that adequate observations during and upon completion of construction indicates that construction was completed in accordance with approved plans and specifications.

Permit No. \_\_\_\_\_

Approved: \_\_\_\_\_ Date \_\_\_\_\_

Earl L. Lineberger, PE, Chief Engineer  
Charlotte Mecklenburg Utility Department  
5100 Brookshire Blvd.  
Charlotte, North Carolina 28216

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**CHARLOTTE.**

July 14, 1995

Mr. J. C. Lin, Supervisor  
Environmental Health Section  
N. C. Department of Human Resources  
Public Water Supply Branch  
Post Office Box 29536  
Raleigh, NC 27626-0536

**SUBJECT: Engineer's Certification ( Complete )**  
**Water Permit Number: 95-09049**  
**CMUD Job Name: 21013 Entrada Drive**  
**CMUD Job No.: 579-94-318**

Dear Mr. Lin:

I, RONALD C. WEATHERS (Registration Number 10151), as a duly registered Professional Engineer in the State of North Carolina, hereby certify that construction of these permitted facilities has been completed in accordance with the approved plans and specifications.

If you have any questions, please advise.

Sincerely,

**CHARLOTTE MECKLENBURG UTILITY DEPARTMENT**

Ronald C. Weathers, P. E.  
Land Development Manager

cc: File

ENGCERT6.WAT/RDM/

Engineering Division 5100 Brookshire Boulevard Charlotte, NC 28216 704/399-2551  
Charlotte-Mecklenburg Utility Department



**CHARLOTTE.**

July 14, 1995

Mr. A. Preston Howard, Jr., Director  
Permits & Engineering  
North Carolina Department of  
Natural Resources & Community Development  
Division of Environmental Management  
Box 27687  
Raleigh, North Carolina 27611

**SUBJECT: Engineer's Certification ( Complete )  
Sewer Permit Number: WQ0010734  
CMUD Job Name: 7511 Pence Road  
CMUD Job No.: 379-94-747**

Dear Mr. Howard:

I, RONALD C. WEATHERS (Registration Number 10151), as a duly registered Professional Engineer in the State of North Carolina, hereby certify that construction of these permitted facilities has been completed in accordance with the approved plans and specifications.

If you have any questions, please advise.

Sincerely,

**CHARLOTTE MECKLENBURG UTILITY DEPARTMENT**

Ronald C. Weathers, P. E.  
Land Development Manager

cc: Files

ENGCERT5.SWR/RDM/

Engineering Division 5100 Brookshire Boulevard Charlotte, NC 28216 704/399-2551  
Charlotte-Mecklenburg Utility Department

ORDINANCE NO. 329  
AN ORDINANCE CREATING A NEW ARTICLE VI TO CHAPTER 23 OF THE  
CHARLOTTE CITY CODE ENTITLED "PERMITS FOR EXTENSIONS OR  
MODIFICATIONS OF WATER OR SEWER SYSTEM."

BE IT ORDAINED by the City Council of the City of Charlotte:

Section 1. That a new Article VI of Chapter 23 of the Code of the City of Charlotte is hereby enacted as hereinafter set forth:

ARTICLE VI. PERMITS FOR EXTENSIONS OR  
MODIFICATIONS OF WATER OR SEWER SYSTEM.

Sec. 23-120. Definitions.

Unless the context specifically indicates otherwise, the following terms and phrases, as used in this Article, shall have the meanings hereinafter designated:

- (a) "CMUD water or sewer system," when referring to the CMUD water system, shall mean the portion of the facilities owned by the City which are used for the distribution of treated water to fire hydrants and service connections.
- (b) "CMUD water or sewer system," when referring to the CMUD sewer system, shall mean the portion of the facilities owned by the City which are used to collect and carry wastewater to a Publicly Owned Treatment Works treatment plant but does not include such plant, pumping stations and force mains.
- (c) "CMUD Standards" refers to the document entitled "Charlotte-Mecklenburg Utility Department Water and Sewer Policies Procedures Standards and Specifications" as prepared, published and amended from time to time by the Director in accordance with Section 23-121(c), together with the CMUD Extension Policy as approved and amended from time to time by the Council.

Sec. 23-121. Permit for extension, modification of water or sewer system.

- (a) No person shall do any of the following things or carry out any of the following activities concerning a water or sewer facility which is proposed to become a part of the CMUD water or sewer system or modify any existing portion of the CMUD water or sewer system unless such person shall have applied for and shall have received from the CMUD a permit for such extension or modification and shall have complied with such conditions, if any, as are prescribed by such permit:
  - (1) Construct any water or sewer facility;

- (2) Alter, extend, or change the construction or method of construction of any water or sewer facility; or
  - (3) Enter into a contract for the construction and installation of any water or sewer facility or for the alteration or extension of such a facility.
- (b) Any person proposing to undertake any thing or activity described in sub-section (a) of this Section shall make timely and proper application on such form(s) as may be prescribed by the Director and provide such information as may be required by the Director. CMUD shall not undertake any thing or activity set forth in sub-section (a) of this Section unless CMUD first complies with the provisions of this Section. A copy of all applications for permits subject to this Section and of all approved permits and plans (including applications and related documents submitted by CMUD) shall be provided to the North Carolina Department of Environment Health and Natural Resources ("DEHNR") as DEHNR in accordance with applicable law.
- (c) All water or sewer facilities proposed for inclusion in the CMUD water or sewer system and all proposed modifications to any existing portion of the CMUD water or sewer system shall be designed, constructed and installed in conformance with applicable provisions of the CMUD Standards. The plans and specifications for such facilities and modifications shall be prepared by or under the direct supervision of an engineer licensed to practice in North Carolina. The Director shall maintain a copy of the current CMUD Standards for public inspection. The Director shall have full authority to modify the CMUD Standards, except for the CMUD Extension Policy which shall require Council approval for any change. The Director shall make such changes in the CMUD Standards (except in the CMUD Extension Policy) as may be necessary to maintain certification from appropriate agencies of the State of North Carolina under G.S. 130A-317(d) and 143-215.1(f) and applicable rules and regulations implementing the provisions thereof and any changes thereto. No modification to the CMUD Standards shall be effective until approved in writing by DEHNR. The acquisition and connection to the CMUD water or sewer system of all or any portion of a water or sewer system owned or operated by any city, county or water or sewer authority as defined in Chapter 162A of the General Statutes or by a public utility under the jurisdiction of the North Carolina Utilities Commission shall not be subject to the provisions of this Section; provided that, under no circumstances shall the City be required to acquire or otherwise permit the connection of such a system to the CMUD water or sewer system except under such terms and conditions as the City may determine to be acceptable in its sole and absolute discretion.



- (d) The denial of an application for a permit subject to the provisions of this Section shall be made in writing and shall contain each reason for the denial and CMUD's estimate of the changes in the applicant's proposed activities or plan which will be required in order that the applicant may obtain a permit. Nothing in such estimate shall preclude or otherwise bar CMUD from denying a permit which incorporates such changes, based upon changed circumstance or information not previously known by CMUD.

Sec. 23-122. Processing of applications.

- (a) Each application subject to Section 23-121 shall be accompanied by a fee in the amount which would apply, if the application were being submitted to DEHNR under such schedule or fees as it may establish. A copy of the current fee schedule for DEHNR shall be maintained by the Director and made available for inspection upon request. Any application which is not accompanied by a fee in the proper amount may be considered incomplete.
- (b) CMUD shall review the fee, plans, specifications and other project data accompanying an application and shall determine if the application and accompanying material are complete and in a form acceptable to CMUD. CMUD shall acknowledge receipt of a complete application.
- (c) The Director shall take final action on all applications not later than 90 days following receipt of a complete application. All permits shall be issued in writing. A permit may contain such conditions as the Director determines to be reasonably necessary, considering the factors on which final action on a permit can be based. Final action on any permit shall be based upon: the design, capacity and manner of operation of the appropriate CMUD water or sewer system; effectuating the purposes of all applicable rules, regulations, statutes and ordinances of the City, State of North Carolina, and the United State of America; and the CMUD Standards.
- (d) If the application is not complete, the application shall be returned to the applicant. CMUD shall advise the applicant in writing:
  - (1) How the application can be modified to make it complete and acceptable; and
  - (2) That the time for CMUD to take final action on an application does not begin until receipt of a complete, corrected application.
- (e) Any permit issued by CMUD pursuant to Section 23-121 is

subject to revocation or modification upon 30 days written notice by the Director in whole or in part for good cause including, but not limited to:

- (1) Violation or any term or condition of the permit;
  - (2) Obtaining a permit by misrepresentation or failure to disclose fully all relevant facts;
  - (3) Refusal of the permittee or its contractors, agents or employees to allow authorized employees of CMUD upon presentation of credentials to inspect or observe any activity, facility or other work required by the permittee's permit.
- (f) A notice of revocation or modification issued pursuant to Section 23-122(e) shall contain each reason for the revocation or modification.

Sec. 23-123. Enforcement.

- (a) (1) Any person that violates, fails to comply or continues to violate any provision of Section 23-121 or a permit issued thereunder shall be liable to the CMUD for a maximum civil penalty of Ten Thousand Dollars (\$10,000), per violation per day for as long as the violation(s) continues. Each day on which a violation shall occur or continue shall be deemed a separate and distinct offense. In determining the amount of the civil penalty, the CMUD shall take into account all relevant circumstances, including, but not limited to, the extent of harm caused by the violation, the magnitude and duration of the violation, any economic benefit gained through the person's violation, the person's efforts to correct the violation, the compliance history of the person against whom the violation is assessed, cost of enforcement to the CMUD, whether the violation was committed willfully or intentionally, and any other factor as justice requires.
  - (2) CMUD shall provide written notification to any person assessed a civil penalty of the assessment and the reasons therefor.
- (b) If any person violates the provisions of Section 23-121 or the terms or conditions of any permit issued pursuant thereto, a civil action may be commenced in the General Court of Justice in the name of the City for such legal and equitable relief as may be appropriate.
  - (c) The remedies provided herein are not exclusive. The CMUD may take any one, all or any combination of these actions against

any person in violation of one or more provisions of Section 23-121 or terms or conditions of any permit issued pursuant thereto.

Sec. 23-124. Hearing.

(a) The following persons are entitled to hearing pursuant to this Section:

- (1) Any person whose application for a permit under Section 23-121 is denied or granted subject to conditions which are unacceptable to such person.
- (2) Any person to whom a permit has been issued and which is revoked or modified pursuant to this Article.
- (3) Any person who is assessed a civil penalty pursuant to Section 23-123(a).

(b) (1) Any person entitled to a hearing pursuant to this section shall exercise such right as set forth in Sec. 23-124(b)(2). Such demand shall be in writing and state separately each issue to be considered and such other matters as are hereinafter required.

(2) Any person making a demand for a hearing shall deliver the demand to the Director within the following applicable time limits after receipt of notice of the action to be heard:

- (a) 30 days for the denial of a permit required by this Article or for the grant of a permit required by this Article subject to conditions which are unacceptable to the person applying for the permit;
- (b) 30 days for the assessment of a civil penalty; and
- (c) 10 days for the modification or revocation of a permit required by this Article.

(c) In the demand for a hearing to consider:

- (1) the denial of a permit, the applicant must identify separately each reason for denying the permit which the applicant contends to be improper and every basis for such contention.
- (2) a permit granted subject to unacceptable conditions, the applicant must identify separately each unacceptable condition and every basis for such contention.
- (3) the modification or revocation of a permit, the person to

whom such permit was issued must state separately each reason for modifying or revoking the permit which such person contends to be improper and every basis for such contention;

- (4) a civil penalty assessment, the person to whom such penalty was assessed must state separately each reason why such penalty should not be assessed or, if the person contends that the civil penalty was assessed in an improper amount, each reason why the amount of the penalty is improper.
- (d) (1) The hearing shall be conducted by the Director and shall be subject to such rules as have been approved by the Council or the Director as hereinafter set forth. If the demand for a hearing is not made in accordance with the provisions of this Section, the Director shall reject the demand and any right to a hearing shall be terminated. If any person demanding a hearing shall fail to comply with an order of the Director or with any rules issued by the Director or approved by the Council concerning the conduct of the hearing, the Director may reject the demand and any right to a hearing shall be terminated. Within 90 days of the receipt of the written demand for a hearing, the Director shall conduct a hearing and issue a final order or decision; provided that, a hearing to consider the modification or revocation of a permit shall be held and a final order or decision issued within ten (10) days of the receipt of the written demand for a hearing. The Director shall transmit a copy of the final order or decision to the person demanding the hearing by registered or certified mail. No further review of the Director's final order or decision will be allowed, except as set forth in Sec. 23-124(f).
- (2) The Director may submit rules to the Council for approval concerning the conduct of the hearing and any other matter associated with the hearing. Such rules may impose requirements in addition to the provisions of this Section. Upon approval by the Council, such rules shall be as effective as if set forth in this Section. The Director shall make a copy of such rules available for inspection upon the request of any person.
  - (3) The Director is authorized to take any action which is reasonably necessary or convenient in considering a demand for hearing and in resolving the issues raised therein so long as such action is not contrary to the provisions of this Article, any rules approved by the Council or other applicable law.
  - (4) The Director may appoint a hearing officer to conduct any

hearing authorized by this Section. A hearing officer shall have the same authority to conduct a hearing and reach a decision as is provided to the Director; provided that, the decision of the hearing officer shall not be final but shall be a recommended decision for consideration by the Director. The Director may approve such decision without change, reject the decision and require a new or continued hearing, or issue a different or revised decision which is supported by evidence presented at the hearing. The Director may refer a recommended decision of a hearing officer to the City Manager or his designee. In the event of a referral, the City Manager or his designee shall have the same authority to act upon a recommended decision of a hearing officer as is provided to the Director. The decision of the Director or, in the event of a referral, of the City Manager or his designee shall be final. A final order may provide that the action which is the basis for the demand for a hearing is approved without change or may modify such action in any manner that is supported by the evidence presented at the hearing.

- (5) The Director may provide for any part of the hearing to be recorded by any reasonable means, including but not limited to, audio and/or video recording, stenographer, or court reporter. A transcript of any hearing, or part thereof, which is recorded need not be prepared unless requested. The original of a requested transcript shall be filed with the Director. Each person shall bear the cost of the transcript which said person requests, including any copy thereof.
- (e) (1) (a) Each assessment of a civil penalty which has been included in a demand for a hearing in accordance with the provisions of this Section is stayed and shall not take effect until the earliest occurrence of any one of the following circumstances: the assessment of the civil penalty is approved or is modified at a hearing conducted pursuant to this Section; or the person who is assessed the civil penalty and the Director agree on the assessment.
- (b) If the assessment of a civil penalty against any person is approved or modified by the Director at a hearing conducted pursuant to this Section, the Director may require the payment of said penalty within the (10) days or such additional time as the Director may specify.
- (f) Any person against whom a final order or decision of the Director is made pursuant to the hearing conducted under this Section, may seek judicial review of the order or decision by

filing a written petition within thirty (30) days after receipt of notice of the order or decision, but not thereafter, with the Superior Court of Mecklenburg County. If not previously requested, said person shall request in writing that a transcript be prepared for every part of the hearing which was recorded. Said request shall be made at or before the time that the petition is filed. A copy of the petition shall be served on the City in the manner required by law. Within thirty (30) days after service of a copy of the petition upon the City or such other time as may be ordered by the Court, the City shall prepare and transmit to the Court the original or a certified copy of the official record of the hearing as hereinafter set forth. The official record of the hearing shall consist of:

- (1) all notices, motions and other similar documents;
  - (2) all documentary and tangible service tendered at the hearing; and
  - (3) the final order or decision. A transcript of each part of the hearing that was recorded shall be included in the official record as an exhibit, if available at the time the remaining portion of the official record is transmitted to the Court. If the transcript is not available at that time, it shall be transmitted to the Court as soon as reasonably possible after the transcript has been prepared. If testimony is taken and not recorded, a narrative summary of any testimony taken shall be prepared and transmitted to the court as an exhibit to the official record.
- (g) (1) The Director may consider petitions for remission of civil penalties assessed pursuant to this Article. A petition for remission shall be in writing and shall be signed by the person against whom the civil penalty was assessed. The petition shall include: a waiver of any and all rights of the petitioner to a hearing and judicial review of the assessment; and a stipulation that the facts are correct as set forth in the document(s) assessing the civil penalty. The decision of the Director on the petition shall be final and shall not be subject to further administrative or judicial review. In determining whether a petition for remission will be approved, the Director shall consider the following factors:
- (A) whether one or more of the factors concerning the assessment of a civil penalty in Sec. 23-123(a) were wrongly applied to the detriment of the petitioner;


- (B) whether the petitioner promptly abated continuing environmental damage resulting from the violation giving rise to the assessment;
  - (C) whether the violation giving rise to the assessment was inadvertent or the result of an accident;
  - (D) whether the petitioner has been assessed civil penalties for any prior violations pursuant to this Article or by any State or Federal authority enforcing substantially similar provisions;
  - (E) whether payment of the civil penalty by the petitioner will prevent payment for any remaining, necessary remedial action.
- (2) After submitting a petition for remission, the petitioner shall provide such additional information and records as may be reasonably necessary or convenient to the Director's consideration of the petition. The Director may remit the entire amount of a civil penalty only when the petitioner has not been assessed civil penalties for any prior violation of this Article or by State or Federal authority enforcing substantially similar provisions and the payment of the civil penalty will prevent payment of any remaining, necessary remedial action.

Sec. 23-125. Permits not transferrable.

Permits issued pursuant to this Article are issued to a specific applicant. A permittee may not assign, transfer, or sell a permit, or any right or obligation in a permit, to another person.

Section 2. This ordinance shall take effect on July 31, 1995; provided that prior to said date this ordinance shall have been approved by the North Carolina Environmental Management Commission and by DEHNR in accordance with applicable law.

Approved as to form:

  
City Attorney

**CERTIFICATION**

I, Brenda R. Freeze, City Clerk of the City of Charlotte, North Carolina, DO HEREBY CERTIFY that the foregoing is a true and exact copy of an Ordinance adopted by the City Council of the City of Charlotte, North Carolina, in regular session convened on the 26th day of June, 1995, the reference having been made in Minute Book 108, and recorded in full in Ordinance Book 46, Page(s) 445-453.

WITNESS my hand and the corporate seal of the City of Charlotte, North Carolina, this the 30th day of June, 1995.

  
Brenda R. Freeze, City Clerk

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## SECTION .1800 - LOCAL PLAN APPROVAL

Rules .1801 - .1805 of Title 15A Subchapter 18C of the North Carolina Administrative Code (T15A.18C .1801 - .1805); has been transferred and recodified from Rules .2601 - .2605 Title 10 Subchapter 10D of the North Carolina Administrative Code (T10.10D .2601 - .2605), effective April 4, 1990.

**.1801 LOCAL APPROVAL PROGRAM**

This Section implements G.S. 130A-317(d) which authorizes the certification of local programs for approval of the construction or alteration of the distribution system of a community water system. For purposes of this Section, distribution system means the network of pipes, valves, hydrants and related appurtenances but does not include pumps, storage tanks, treatment devices, wells or other facilities.

*History Note: Statutory Authority G.S. 130A-317; 1985 S.L., c. 697, s. 3;  
Eff. January 1, 1986.*

**.1802 APPLICATION FOR CERTIFICATION**

Application for certification shall be made to the Public Water Supply Section, Division of Environmental Health, P.O. Box 29536, Raleigh, North Carolina 27626-0536. Application shall be submitted in triplicate and shall designate the office or agency which will administer the program.

*History Note: Statutory Authority G.S. 130A-317; 1985 S.L., c. 697, s. 3;  
Eff. January 1, 1986;  
Amended Eff. December 1, 1991.*

**.1803 CERTIFICATION**

The Department shall certify a local approval program which satisfies the requirements of G.S. 130A-317(d). The requirements of G.S. 130A-317(d)(4) are satisfied when a local approval program provides by ordinance or local law for enforcement provisions equivalent to G.S. 130A-18 and G.S. 130A-25. The requirements of G.S. 130A-317(d)(5) are satisfied when a local approval program has a minimum staff and other resources of: a designer who is a professional engineer registered in this state and whose duty is to devote the time necessary for an effective local approval program; a technical staff, budget, equipment and facilities sufficient to support a design engineering office; and an organizational structure sufficient to carry out this purpose.

*History Note: Statutory Authority G.S. 130A-317; 1985 S.L., c. 697, s. 3;  
Eff. January 1, 1986;  
Amended Eff. February 1, 1987.*

**.1804 NOTICE**

(a) A local approval program shall submit notice to the Department of each approval of the construction or alteration of the distribution system of a community water system. The notice shall consist of one copy of the application with construction plans, any revisions made to the plans and the final approval letter.

(b) The local approval program shall provide notice to the department within 10 days of any change in staff, budget or other resources which may affect the ability to effectively carry out the plan review program.

(c) Upon completion of the construction or alteration of the distribution system, the applicant shall submit a statement to the local approval program signed by a registered professional engineer stating that construction was completed in substantial accordance with approved plans and specifications and revised only in accordance with 15A NCAC 18C .0306. The statement shall be based upon adequate observations during and upon completion of construction by the engineer or a representative of the engineer's office supervised by the engineer. The local approval program shall provide a copy of the statement to the Department.

*History Note: Statutory Authority G.S. 130A-317; 1985 S.L., c. 697, s. 3;  
Eff. January 1, 1986;  
Amended Eff. December 1, 1988.*

**.1805 DEPARTMENTAL ENFORCEMENT**

If the Department determines that a community water system is violating local approval requirements and the local approval program has not enforced its requirements, the Department may, after written notice, to the local program, enforce the requirements in accordance with provisions of G.S. 130A-17 through 130A-28.

*History Note: Statutory Authority G.S. 130A-317; 1985 S.L., c. 697, s. 3;  
Eff. January 1, 1986.*

To The Division of Human Services  
Department of Human Resources:

The .....  
(name of board, or council, authorized official and title, or owner)

of .....  
(name of city, town, corporation, sanitary district, water company, or other)

in the County of ..... State of North Carolina authorized by law to  
act for the said .....  
(name of city, town, corporation, sanitary district, water company, or other)

and to expend its funds for the water project described below, herewith submit for the counsel and advice of  
the Division of Health Services plans and specifications prepared by .....  
(engineer or firm)

..... of .....  
for the installation or construction of .....  
(describe project)

..... in  
(location of project)  
..... and make application to the Division of Health Services  
(county)

for the approval of said plans and specifications as relate to public health and the protection of public water  
supplies and public water systems.

These plans have been approved and accepted by the applicant.

This application is made under and in full accord with the provisions of Chapter 130A-317 of the North  
Carolina General Statutes, and such other statutes as relate to public water systems. The applicant agrees  
that no change or deviation from the plans and specifications approved by the Division of Health Services  
will be made except as allowed by 10 NCAC 10D .0906 or with the written consent and approval of the  
Division of Health Services or its authorized representative. The applicant agrees that a professional  
engineer licensed to practice in the State of North Carolina shall submit a statement reflecting that  
adequate observations during and upon completion of construction, by the engineer or by a representative  
of the engineers office who is under the engineers supervision, indicates that construction was completed in  
accordance with approved plans and specifications.

Remarks: \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
(Signature of Owner, Manager, Mayor, or Chairman)

\_\_\_\_\_  
(Type or Print Name Signed Above)

\_\_\_\_\_  
(Street or Box Number)

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip Code

**State of North Carolina**  
**Department of Environment, Health and Natural Resources**  
**Division of Environmental Management**  
Non-Discharge Permit Application  
*(THIS FORM MAY BE PHOTOCOPIED FOR USE AS AN ORIGINAL)*

**GRAVITY SEWER EXTENSION**

**I. GENERAL INFORMATION:**

1. Applicant's name (please specify the name of the municipality, corporation, individual, etc.): \_\_\_\_\_  
\_\_\_\_\_
2. Print Owners or Signing Official's name and title (the person who is legally responsible for the facility and its compliance):  
\_\_\_\_\_
3. Mailing address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Telephone Number: ( \_\_\_\_\_ ) \_\_\_\_\_
4. Project Name (please specify the name of the subdivision, facility, or establishment - should be consistent with project name on plans, specifications, letters of flow acceptance, Operational Agreements, etc.):  
\_\_\_\_\_
5. Application Date: \_\_\_\_\_ 6. Fee Submitted: \$ \_\_\_\_\_
6. County where project is located: \_\_\_\_\_

**II. PERMIT INFORMATION:**

1. Application No. (will be completed by DEM): \_\_\_\_\_
2. Specify whether project is: \_\_\_\_\_ new; \_\_\_\_\_ modification.
3. If this application is being submitted as a result of a modification to an existing permit, please complete:  
existing permit number \_\_\_\_\_ and the issue date \_\_\_\_\_
4. Specify whether the applicant is \_\_\_\_\_ public or \_\_\_\_\_ private.

**III. INFORMATION ON WASTEWATER:**

1. Nature of Wastewater: \_\_\_\_\_ % Domestic/Commercial ; \_\_\_\_\_ % Industrial;  
\_\_\_\_\_ % Other waste (specify): \_\_\_\_\_
2. Please provide a one or two word description specifying the origin of the wastewater, such as school, subdivision, hospital, commercial, industrial, apartments, etc.: \_\_\_\_\_
3. Indicate any parameter(s) (and their concentration) that will be greater than normal domestic levels: \_\_\_\_\_  
\_\_\_\_\_
4. If wastewater is not domestic in nature, what level of pretreatment has been provided to ensure protection of the receiving wastewater treatment facility? \_\_\_\_\_
5. If a pretreatment permit is required, has one been issued? \_\_\_\_\_ Yes; \_\_\_\_\_ No. If yes, please attach a copy of the pretreatment permit. If No, when will one be issued: \_\_\_\_\_

6. Volume of wastewater generated by this project: \_\_\_\_\_ gallons per day.
7. Explanation of how wastewater volume was determined: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**IV. DESIGN INFORMATION:**

1. Brief project description: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
2. Name of wastewater treatment facility receiving wastewater: \_\_\_\_\_
- a. Facility Permit Number: \_\_\_\_\_
- b. Engineer should provide statement of his evaluation of downstream sewers ability to accept the wastewater:  
 \_\_\_\_\_  
 \_\_\_\_\_
- c. Permit Number for sewers immediately downstream: \_\_\_\_\_
- d. Pipe diameter of sewers immediately downstream: \_\_\_\_\_
3. Summary of sewer pipe to be permitted, by diameter size and pipe material:

Diameter (in)	Length (linear feet)	Pipe Material	Circle C or N Factor & Specify Value	Minimum Slope (%)	Maximum Slope (%)	Minimum Velocity (fps)	Maximum Velocity (fps)	Minimum Cover (in)

**NOTE:** The minimum velocity must not be less than 2 fps.  
 For public sewers the minimum diameter is 8 inches.  
 For private sewers the minimum diameter is 6 inches.

4. Anchors shall be provided for sewers with slopes greater than 20 %. The anchor spacing shall be a maximum of: 36 feet separation for slopes of 21% to 35%; 24 feet separation for slopes of 36% to 50%; 16 feet separation for slopes greater than 50%.

For velocities greater than 15 fps, it is strongly recommended that measures be considered which will protect the sewers and manholes from erosion. For velocities greater than 20 fps, erosion control measures must be specified.

For any excessive slopes or velocities that will occur in any sewer line segment, what measures have been taken to protect the sewer pipe and manholes? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

5. Maximum sewer reach length between manholes: \_\_\_\_\_ linear feet.
6. This sewer line segment occurs between manhole no. \_\_\_\_\_ and manhole no. \_\_\_\_\_.
7. Does the owner/operator have the ability to clean this length? \_\_\_\_ Yes \_\_\_\_ No. For sewer reach lengths greater than 425 feet, please provide a letter from the owner/operator, stating the ability to clean the specified reach and include the equipment specifications.
8. Sewers subject to existing or planned traffic bearing loads? \_\_\_\_ Yes \_\_\_\_ No. If yes, what measures are being taken to enable the sewers to withstand the loads?  
 \_\_\_\_\_  
 \_\_\_\_\_
9. Outside drop manholes are provided where invert separations exceed: \_\_\_\_\_ feet (provide for separations > or = 2.5')
10. Identify (by manhole number) those manholes that have drop connections: \_\_\_\_\_  
 \_\_\_\_\_
11. Maximum allowable infiltration/exfiltration test rate: \_\_\_\_\_ GPD/pipe diameter inch/mile of pipe.  
 NOTE: Must not exceed 100 GPD/pipe diameter inch/mile of pipe.
12. Minimum separation distances as shown on the plans or addressed in the specifications. If a, b, or c below is no, explain in an attachment:
  - a) 100 ft. horizontal separation from wells or other water supplies? \_\_\_\_ Yes \_\_\_\_ No
  - b) 12 in. vertical separation from storm sewer or ferrous pipe sanitary sewer specified? \_\_\_\_ Yes \_\_\_\_ No
  - c) 10 ft. horiz. sep. from water mains or 18 in vertical sep. (water over sewer) or ferrous pipe specified? \_\_\_\_ Yes \_\_\_\_ No
13. Are manholes subject to flooding? \_\_\_\_ Yes \_\_\_\_ No. If yes, are manhole rim elevations 1 foot above 100-year flood level, (100 year flood elevation should be indicated on plans) \_\_\_\_ Yes \_\_\_\_ No; Or, are manholes watertight and vented 1 foot above the 100-year flood elevation ( should be shown on plans): \_\_\_\_ Yes \_\_\_\_ No
14. Identify (by manhole number) those manholes that are vented: \_\_\_\_\_  
 \_\_\_\_\_
15. Does this project involve any stream crossings? \_\_\_\_ Yes \_\_\_\_ No. If yes, what precautions or special features have been utilized to ensure protection of the sewer line and not restrict stream flow? Identify the sheet of the plans and station number where stream crossings are located: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Please note:** The Division recommends all stream crossings be located three (3) feet below the stream bed or ferrous material pipe specified. In addition, all aerial stream crossings must be located above the 25-year flood elevation. Both the 25-year flood elevation and the 100-year flood elevation should be indicated on the plans.

16. Wastewater collection systems may not be installed in WS-I watersheds. Are any of the subject wastewater collection systems located in a WS-1 watershed? \_\_\_\_\_ Yes, \_\_\_\_\_ No.

**THIS APPLICATION PACKAGE WILL NOT BE ACCEPTED BY THE DIVISION OF ENVIRONMENTAL  
MANAGEMENT UNLESS ALL OF THE APPLICABLE ITEMS ARE  
INCLUDED WITH THE SUBMITTAL**

*Required Items*

- a. One original and one copy of the completed and appropriately executed application form. If modifications to the form are required as a result of additional information requests by the Division, the additional information must be transmitted under the signature of the applicant and the actual modification must be initialed by the NC Professional Engineer.
- b. Two (2) sets of detailed plans and specifications signed and sealed by a North Carolina Professional Engineer. The plans must include a general location map, a plan view of the sewer extension, a profile of the sewer extension, and must show the proximity of the sewer extension to other utilities and natural features. Specifications may be omitted for delegated authorities. Each sheet of the plans and the first page of the specifications must be signed and sealed. Two (2) copies of the existing permit if a modification. The plans and specifications must not contain phrases (such as: FOR REVIEW ONLY, NOT FOR CONSTRUCTION, etc.) that indicate that they are anything other than final plans and specifications. However, the plans and specifications may contain: FINAL DESIGN - NOT RELEASED FOR CONSTRUCTION.
- c. The appropriate permit processing fee, in accordance with 15A NCAC 2H .0205(c)(5). The fee for sewer extensions for nondelegated municipalities is \$400. The fee for sewer extensions for delegated municipalities (applies only to those governmental jurisdictions that have specific delegation review authority, as granted by the Environmental Management Commission) is \$200. Name changes without other modifications are \$100.
- d. If the owner/authority of the wastewater treatment facility (WWTF) that will be accepting the wastewater flow from this project is different from the applicant of the project, then a letter must be provided from the owner/authority of the WWTF specifying the volume of flow that will be accepted. The letter should be a recent letter and should refer to the project by the same name as that identified on the application and the plans/specifications.
- e. If the application is being submitted in the name of a privately owned public utility, evidence must be submitted from the Utilities Commission which demonstrates that the utility is authorized to hold the franchise for the area to be served. In the case of contiguous service areas, evidence must be provided from the Utilities Commission acknowledging these areas are covered under an existing franchise.
- f. A properly executed Operational Agreement (original and one copy - form provided by DEM) must be submitted if the sewer extension will be serving single family residences, condominiums, mobile homes, or town houses and if the subject sewer extension is owned by the individual residents, a homeowners association, or a developer.
- g. A cover letter, which briefly describes the project, should be included with each application package. If necessary for clarity, feel free to include attachments to the application form. Such attachments will be considered as part of the application and should be numbered to correspond to the section to which they refer.
- h. All materials and fees submitted in support of this request for a permit become the property of the Division of Environmental Management; therefore, if the permit is not issued for any reason, the Division will return submitted materials only at its option.

Name and Complete Address of Engineering Firm: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone Number: ( \_\_\_\_\_ ) \_\_\_\_\_

**Professional Engineer's Certification:**

I, \_\_\_\_\_, attest that this application for \_\_\_\_\_ has been reviewed by me and is accurate and complete to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

North Carolina Professional Engineer's Seal, Signature, and Date:

**Applicant's Certification:**

I, \_\_\_\_\_, attest that this application for \_\_\_\_\_ has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed and that if all required supporting information and attachments are not included, this application package will be returned to me as incomplete.

Signature \_\_\_\_\_ Date \_\_\_\_\_

***THE COMPLETED APPLICATION PACKAGE, INCLUDING ALL SUPPORTING INFORMATION AND MATERIALS, SHOULD BE SENT TO THE FOLLOWING ADDRESS:***

**NORTH CAROLINA DIVISION OF ENVIRONMENTAL MANAGEMENT  
WATER QUALITY SECTION  
PERMITS AND ENGINEERING UNIT  
POST OFFICE BOX 29535  
RALEIGH, NORTH CAROLINA 27626-0535  
TELEPHONE NUMBER: (919) 733-5083**



**DIVISION OF ENVIRONMENTAL MANAGEMENT REGIONAL OFFICES (11/93)**

Asheville Regional WQ Supervisor  
 59 Woodfin Place  
 Asheville, NC 28801  
 (704) 251-6208  
 Fax (704) 251-6452

Washington Regional WQ Supervisor  
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 Washington, NC 27889  
 (919) 946-6481  
 Fax (919) 975-3716

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 (919) 571-4700  
 Fax (919) 571-4718

Avery  
 Buncombe  
 Burke  
 Caldwell  
 Cherokee  
 Clay  
 Graham  
 Haywood  
 Henderson  
 Jackson

Macon  
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 McDowell  
 Mitchell  
 Polk  
 Rutherford  
 Swain  
 Transylvania  
 Yancy

Beaufort  
 Bertie  
 Camden  
 Chowan  
 Craven  
 Currituck  
 Dare  
 Gates  
 Greene  
 Hertford  
 Hyde

Jones  
 Lenoir  
 Martin  
 Pamlico  
 Pasquotank  
 Perquimans  
 Pitt  
 Tyrell  
 Washington  
 Wayne

Chatham  
 Durham  
 Edgecombe  
 Franklin  
 Granville  
 Halifax  
 Johnston  
 Lee

Nash  
 Northampton  
 Orange  
 Person  
 Vance  
 Wake  
 Warren  
 Wilson

Fayetteville Regional WQ Supervisor  
 Wachovia Building, Suite 714  
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 Fax (910) 486-0707

Mooresville Regional WQ Supervisor  
 919 North Main Street  
 Mooresville, NC 28115  
 (704) 663-1699  
 Fax (704) 663-6040

Wilmington Region. WQ Supervisor  
 127 Cardinal Drive Extension  
 Wilmington, NC 28405-3845  
 (910) 395-3900  
 Fax (910) 350-2004

Anson  
 Bladen  
 Cumberland  
 Harnett  
 Hoke  
 Montgomery

Moore  
 Robeson  
 Richmond  
 Sampson  
 Scotland

Alexander  
 Cabarrus  
 Catawba  
 Gaston  
 Iredell  
 Lincoln

Mecklenburg  
 Rowan  
 Stanly  
 Union  
 Cleveland

Brunswick  
 Carteret  
 Columbus  
 Duplin

New Hanover  
 Onslow  
 Pender

Winston-Salem Regional WQ Supervisor  
 8025 North Point Boulevard, Suite 100  
 Winston-Salem, NC 27106  
 (910) 896-7007  
 Fax (910) 896-7005

Alamance  
 Alleghany  
 Ashe  
 Caswell  
 Davidson  
 Davie  
 Forsyth  
 Guilford

Rockingham  
 Randolph  
 Stokes  
 Surry  
 Watauga  
 Wilkes  
 Yadkin

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**State of North Carolina**  
**Department of Environment, Health and Natural Resources**  
**Division of Environmental Management**  
Non-Discharge Permit Application  
*(THIS FORM MAY BE PHOTOCOPIED FOR USE AS AN ORIGINAL)*

**GRAVITY SEWER EXTENSION  
PUMP STATIONS, AND PRESSURE SEWERS**

**I. GENERAL INFORMATION:**

1. Applicant's name (please specify the name of the municipality, corporation, individual, etc.): \_\_\_\_\_  
\_\_\_\_\_
2. Print Owners or Signing Official's name and title (the person who is legally responsible for the facility and its compliance):  
\_\_\_\_\_
3. Mailing address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Telephone Number: ( \_\_\_\_\_ ) \_\_\_\_\_
4. Project Name (please specify the name of the subdivision, facility, or establishment - should be consistent with project name on plans, specifications, letters of flow acceptance, Operational Agreements, etc.):  
\_\_\_\_\_
5. Application Date: \_\_\_\_\_ 6. Fee Submitted: \$ \_\_\_\_\_
6. County where project is located: \_\_\_\_\_

**II. PERMIT INFORMATION:**

1. Application No. (will be completed by DEM): \_\_\_\_\_
2. Specify whether project is: \_\_\_\_\_ new; \_\_\_\_\_ modification.
3. If this application is being submitted as a result of a modification to an existing permit, please complete:  
existing permit number \_\_\_\_\_ and the issue date \_\_\_\_\_
4. Specify whether the applicant is \_\_\_\_\_ public or \_\_\_\_\_ private.

**III. INFORMATION ON WASTEWATER:**

1. Nature of Wastewater: \_\_\_\_\_ % Domestic/Commercial ; \_\_\_\_\_ % Industrial;  
\_\_\_\_\_ % Other waste (specify): \_\_\_\_\_
2. Please provide a one or two word description specifying the origin of the wastewater, such as school, subdivision, hospital, commercial, industrial, apartments, etc.: \_\_\_\_\_
3. Indicate any parameter(s) (and their concentration) that will be greater than normal domestic levels: \_\_\_\_\_  
\_\_\_\_\_
4. If wastewater is not domestic in nature, what level of pretreatment has been provided to ensure protection of the receiving wastewater treatment facility? \_\_\_\_\_

5. If a pretreatment permit is required, has one been issued? \_\_\_\_\_ Yes \_\_\_\_\_ No. If yes, please attach a copy of the pretreatment permit. If No, when will one be issued: \_\_\_\_\_
6. Volume of wastewater generated by this project: \_\_\_\_\_ gallons per day.
7. Explanation of how wastewater volume was determined: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**IV. DESIGN INFORMATION:**

1. Brief project description: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
2. Name of wastewater treatment facility receiving wastewater: \_\_\_\_\_
  - a. Facility Permit Number: \_\_\_\_\_
  - b. Engineer should provide statement of his evaluation of downstream sewers ability to accept the wastewater:  
 \_\_\_\_\_  
 \_\_\_\_\_
  - c. Permit Number for sewers immediately downstream: \_\_\_\_\_
  - d. Pipe diameter of sewers immediately downstream: \_\_\_\_\_
3. Summary of sewer pipe to be permitted, by diameter size and pipe material:

Diameter (in)	Length (linear feet)	Pipe Material	Circle C or N Factor & Specify Value	Minimum Slope (%)	Maximum Slope (%)	Minimum Velocity (fps)	Maximum Velocity (fps)	Minimum Cover (in)

**NOTE:** The minimum velocity must not be less than 2 fps.  
 For public sewers the minimum diameter is 8 inches.  
 For private sewers the minimum diameter is 6 inches.

4. Anchors shall be provided for sewers with slopes greater than 20 %. The anchor spacing shall be a maximum of: 36 feet separation for slopes of 21% to 35%; 24 feet separation for slopes of 36% to 50%; 16 feet separation for slopes greater than 50%.

For velocities greater than 15 fps, it is strongly recommended that measures be considered which will protect the sewers and manholes from erosion. For velocities greater than 20 fps, erosion control measures must be specified.

For any excessive slopes or velocities that will occur in any sewer line segment, what measures have been taken to protect the sewer pipe and manholes? \_\_\_\_\_  
 \_\_\_\_\_

5. Maximum sewer reach length between manholes: \_\_\_\_\_ linear feet.
6. This sewer line segment occurs between manhole no. \_\_\_\_\_ and manhole no. \_\_\_\_\_.
7. Does the owner/operator have the ability to clean this length? \_\_\_\_ Yes \_\_\_\_ No. For sewer reach lengths greater than 425 feet, please provide a letter from the owner/operator, stating the ability to clean the specified reach and include the equipment specifications.
8. Sewers subject to existing or planned traffic bearing loads? \_\_\_\_ Yes \_\_\_\_ No. If yes, what measures are being taken to enable the sewers to withstand the loads?  
 \_\_\_\_\_  
 \_\_\_\_\_
9. Outside drop manholes are provided where invert separations exceed: \_\_\_\_\_ feet (provide for separations > or = 2.5')
10. Identify (by manhole number) those manholes that have drop connections: \_\_\_\_\_  
 \_\_\_\_\_
11. Maximum allowable infiltration/exfiltration test rate: \_\_\_\_\_ GPD/pipe diameter inch/mile of pipe.  
 NOTE: Must not exceed 100 GPD/pipe diameter inch/mile of pipe.
12. Minimum separation distances as shown on the plans or addressed in the specifications. If a, b, or c below is no, explain in an attachment (This section must be completed for all collection systems including force mains and pressures sewers):
  - a) 100 ft. horizontal separation from wells or other water supplies? \_\_\_\_ Yes \_\_\_\_ No
  - b) 12 in. vertical separation from storm sewer or ferrous pipe sanitary sewer specified? \_\_\_\_ Yes \_\_\_\_ No
  - c) 10 ft. horiz. sep. from water mains or 18 in vertical sep. (water over sewer) or ferrous pipe specified? \_\_\_\_ Yes \_\_\_\_ No
13. Are manholes subject to flooding? \_\_\_\_ Yes \_\_\_\_ No. If yes, are manhole rim elevations 1 foot above 100-year flood level, (100 year flood elevation should be indicated on plans) \_\_\_\_ Yes \_\_\_\_ No; Or, are manholes watertight and vented 1 foot above the 100-year flood elevation ( should be shown on plans): \_\_\_\_ Yes \_\_\_\_ No
14. Identify (by manhole number) those manholes that are vented: \_\_\_\_\_
15. Does this project involve any stream crossings? \_\_\_\_ Yes \_\_\_\_ No. If yes, what precautions or special features have been utilized to ensure protection of the sewer line and not restrict stream flow? Identify the sheet of the plans and station number where stream crossings are located: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Please note:** The Division recommends all stream crossings be located three (3) feet below the stream bed or ferrous material pipe be specified. In addition, all aerial stream crossings must be located above the 25-year flood elevation. Both the 25-year flood elevation and the 100-year flood elevation should be indicated on the plans.

16. Sewers may not be installed in WS-I watersheds. Are any of the subject wastewater collection systems located in a WS-1 watershed? \_\_\_\_ Yes \_\_\_\_ No.
17. Miscellaneous comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**V. PUMP STATION INFORMATION**

1. Pump Station No. or Name: \_\_\_\_\_ (A separate sheet 4 of 8 should be submitted for each pump station)
2. Name of closest downslope surface waters: \_\_\_\_\_
3. Classification of closest downslope surface waters: \_\_\_\_\_ (as established by the Environmental Management Commission & specified on sheet 5 of 8 of this application).
4. In accordance with 15A NCAC 2H .0219 (h)(3), describe the measures that are being implemented to prevent impacts on downslope surface waters, should a power failure occur at this pump station. NOTE: Alternative power MUST be addressed for every pump station in accordance with the above regulation. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

5. What size pumps are provided: \_\_\_\_\_ GPM; and how many? \_\_\_\_\_
6. What is the design total dynamic head? \_\_\_\_\_ feet
7. How many pumping cycles will occur at average daily flow? \_\_\_\_\_ cycles per hour.  
 NOTE: 15A NCAC 2H .0219 (h)(2) requires 2 to 8 pumping cycles per hour be achieved at average daily flow.
8. The following items are typically required in the design for pump stations. Check the appropriate blank to signify that these items have been provided in the design plans/specifications:

- Alternate Power Source \_\_\_\_\_
- Wet Well Vented with Screen \_\_\_\_\_
- Fillets in Wet Well \_\_\_\_\_
- Check Valves and Gate Valves \_\_\_\_\_
- Security Fencing \_\_\_\_\_
- Lockable Wet Well Cover \_\_\_\_\_
- Area Light \_\_\_\_\_
- 110V Electrical Convenience Outlet \_\_\_\_\_
- Flood/Buoyancy Protection \_\_\_\_\_
- High Water Alarm (one choice may be specified) \_\_\_\_\_ Audible and Visual \_\_\_\_\_ Auto Dialer

9. Summary of force main to be permitted, by diameter size and pipe material:

Diameter (in)	Length (linear feet)	Pipe Material	High Elevation (ft)	Low Elevation (ft)	Minimum Velocity (fps)	Maximum Velocity (fps)	Minimum Cover (in)

10. Are air release valves provided at all high points along the force main (must be provided where the elevation difference exceeds 10 feet)? \_\_\_ yes \_\_\_ no
11. Is pump station subject to flooding? \_\_\_ yes \_\_\_ no. If yes, what measures are being taken to protect against flooding?  
 \_\_\_\_\_
12. If subject to flooding, specify the 100-year flood elevation: \_\_\_\_\_ Feet MSL
13. Are there existing or planned pump stations downstream of this station? \_\_\_ Yes \_\_\_ No. If yes, the engineer shall evaluate the ability of those pump stations to adequately handle the subject flows and shall include that evaluation as an attachment to this application.

This form must be completed by the appropriate DEM regional office and included as a part of the project submittal information.

**INSTRUCTIONS TO NC PROFESSIONAL ENGINEER:**

The classification of the downslope surface waters (the surface waters that any overflow from the facility would flow toward) in which these sewers will be constructed must be determined by the appropriate DEM regional office. Therefore, you are required, prior to submittal of the application package, to submit this form, with items 1 through 7 completed, to the appropriate Division of Environmental Management Regional Water Quality Supervisor (see page 8 of 8). At a minimum, you must include an 8.5" by 11" copy of the portion of a 7.5 minute USGS Topographic Map which shows the location of these sewers and the downslope surface waters in which they will be located. Identify the closest downslope surface waters on the attached map copy. Once the regional office has completed the classification, reincorporate this completed page and the topographic map into the complete application form and submit the application package.

1. Applicant (specify name of the municipality, corporation, individual, etc.): \_\_\_\_\_  
\_\_\_\_\_
2. Name & complete address of engineering firm: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Telephone number: ( \_\_\_\_\_ ) \_\_\_\_\_
3. Project name: \_\_\_\_\_
4. Name of closest downslope surface waters: \_\_\_\_\_
5. County(s) where sewers and surface waters are located: \_\_\_\_\_
6. Map name and date: \_\_\_\_\_
7. NC Professional Engineer's Seal, Signature, and Date:

**TO: REGIONAL WATER QUALITY SUPERVISOR**

Please provide me with the classification of the watershed where these sewers will be constructed, as identified on the attached map segment:

Name of surface waters: \_\_\_\_\_

Classification (as established by the Environmental Management Commission): \_\_\_\_\_

Proposed classification, if applicable: \_\_\_\_\_

Signature of regional office personnel: \_\_\_\_\_ Date: \_\_\_\_\_

(All attachments must be signed)

**THIS APPLICATION PACKAGE WILL NOT BE ACCEPTED BY THE DIVISION OF ENVIRONMENTAL  
MANAGEMENT UNLESS ALL OF THE APPLICABLE ITEMS ARE  
INCLUDED WITH THE SUBMITTAL**

*Required Items*

- a. One original and one copy of the completed and appropriately executed application form. If modifications to the form are required as a result of additional information requests by the Division, the additional information must be transmitted under the signature of the applicant and the actual modification must be initialed by the NC Professional Engineer.
- b. Two (2) sets of detailed plans and specifications signed and sealed by a North Carolina Professional Engineer. The plans must include a general location map, a plan view of the sewer extension, a profile of the sewer extension, and must show the proximity of the sewer extension to other utilities and natural features. Specifications may be omitted for delegated authorities. Each sheet of the plans and the first page of the specifications must be signed and sealed. Two (2) copies of the existing permit if a modification. The plans and specifications must not contain phrases (such as: FOR REVIEW ONLY, NOT FOR CONSTRUCTION, etc.) that indicate that they are anything other than final plans and specifications. However, the plans and specifications may contain: FINAL DESIGN - NOT RELEASED FOR CONSTRUCTION.
- c. Two copies of all calculations, including pump selection, friction calculations, cycle time, pump curves (including system curves applicable with one pump running, two pumps running, three pumps running, etc.), and evaluation of downstream pump stations. These items must be submitted under the signature and seal of the NC Professional Engineer.
- d. The appropriate permit processing fee, in accordance with 15A NCAC 2H .0205(c)(5). The fee for sewer extensions for nondelegated municipalities is \$400. The fee for sewer extensions for delegated municipalities (applies only to those governmental jurisdictions that have specific delegation review authority, as granted by the Environmental Management Commission) is \$200. Name changes without other modifications are \$100.
- e. If the owner/authority of the wastewater treatment facility (WWTF) that will be accepting the wastewater flow from this project is different from the applicant of the project, then a letter must be provided from the owner/authority of the WWTF specifying the volume of flow that will be accepted. The letter should be a recent letter and should refer to the project by the same name as that identified on the application and the plans/specifications.
- f. If the application is being submitted in the name of a privately owned public utility, evidence must be submitted from the Utilities Commission which demonstrates that the utility is authorized to hold the franchise for the area to be served. In the case of contiguous service areas, evidence must be provided from the Utilities Commission acknowledging these areas are covered under an existing franchise.
- g. A properly executed Operational Agreement (original and one copy - form provided by DEM) must be submitted if the sewer extension will be serving single family residences, condominiums, mobile homes, or town houses and if the subject sewer extension is owned by the individual residents, a homeowners association, or a developer.
- h. The downslope surface waters classification must be determined by the appropriate DEM regional office, using page 5 of 8 of this form, prior to the submittal of the application package to the Water Quality Permits and Engineering Unit. Once the regional office has completed the classification, page 5 of 8 should be reincorporated into the application package and the entire application package may then be submitted to Water Quality Permits and Engineering Unit.
- i. A cover letter, which briefly describes the project, should be included with each application package. If necessary for clarity, feel free to include attachments to the application form. Such attachments will be considered as part of the application and should be numbered to correspond to the section to which they refer.
- j. All materials and fees submitted in support of this request for a permit become the property of the Division of Environmental Management; therefore, if the permit is not issued for any reason, the Division will return submitted materials only at its option.



Name and Complete Address of Engineering Firm: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone Number: ( \_\_\_\_\_ ) \_\_\_\_\_

**Professional Engineer's Certification:**

I, \_\_\_\_\_, attest that this application for \_\_\_\_\_ has been reviewed by me and is accurate and complete to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my signature and seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design.

North Carolina Professional Engineer's Seal, Signature, and Date:

**Applicant's Certification:**

I, \_\_\_\_\_, attest that this application for \_\_\_\_\_ has been reviewed by me and is accurate and complete to the best of my knowledge. I understand that if all required parts of this application are not completed and that if all required supporting information and attachments are not included, this application package will be returned to me as incomplete.

Signature \_\_\_\_\_ Date \_\_\_\_\_

***THE COMPLETED APPLICATION PACKAGE, INCLUDING ALL SUPPORTING INFORMATION AND MATERIALS, SHOULD BE SENT TO THE FOLLOWING ADDRESS:***

**NORTH CAROLINA DIVISION OF ENVIRONMENTAL MANAGEMENT**

**WATER QUALITY SECTION**

**PERMITS AND ENGINEERING UNIT**

**POST OFFICE BOX 29535**

**RALEIGH, NORTH CAROLINA 27626-0535**

**TELEPHONE NUMBER: (919) 733-5083**

**DIVISION OF ENVIRONMENTAL MANAGEMENT REGIONAL OFFICES (11/93)**

Asheville Regional WQ Supervisor  
 59 Woodfin Place  
 Asheville, NC 28801  
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 Polk  
 Rutherford  
 Swain  
 Transylvania  
 Yancy

Beaufort  
 Bertie  
 Camden  
 Chowan  
 Craven  
 Currituck  
 Dare  
 Gates  
 Greene  
 Hertford  
 Hyde

Jones  
 Lenoir  
 Martin  
 Pamlico  
 Pasquotank  
 Perquimans  
 Pitt  
 Tyrell  
 Washington  
 Wayne

Chatham  
 Durham  
 Edgecombe  
 Franklin  
 Granville  
 Halifax  
 Johnston  
 Lee

Nash  
 Northampton  
 Orange  
 Person  
 Vance  
 Wake  
 Warren  
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 Forsyth  
 Guilford

Rockingham  
 Randolph  
 Stokes  
 Surry  
 Watauga  
 Wilkes  
 Yadkin



FOR AGENCY USE ONLY		
DATE RECEIVED		
YEAR	MONTH	DAY
CERTIFICATE OF COVERAGE		
DATE ISSUED		
YEAR	MONTH	DAY

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM**  
**NOTICE OF INTENT REQUESTING COVERAGE UNDER THE**  
**CONSTRUCTION ACTIVITIES GENERAL NPDES PERMIT NCG010000**  
**STORMWATER DISCHARGES**

Complete this Notice of Intent (NOI) and mail to the following address

North Carolina Division of Environmental Management  
 Water Quality Section, NPDES Group  
 P.O. Box 29535  
 Raleigh, North Carolina, 27626-0535

The NOI must be accompanied with a general permit filing fee of \$50.00. The check should be made out to the North Carolina Department of Environment, Health, and Natural Resources.

Applicant Information: (please print or type)

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_  
 Zip: \_\_\_\_\_ Phone: (\_\_\_\_) \_\_\_\_\_

Project Information:

Name of project: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_  
 County: \_\_\_\_\_  
 Estimated time table of the project:  
 \_\_\_\_\_

**Physical Location**

Description:(Street address, state road number, distance and direction from roadway intersection, and attach a copy of a county map or USGS quad with the facility marked on the map.) \_\_\_\_\_

[Agency use only: Latitude \_\_\_\_\_ Longitude \_\_\_\_\_]

Stormwater discharges to

\_\_\_\_\_  
\_\_\_\_\_  
(name of receiving water  
or, if to a municipal separate storm sewer system, name of the municipal system)  
\_\_\_\_\_

Number of stormwater discharge points? \_\_\_\_

I hereby request coverage under the referenced General Permit. I understand that coverage under this permit will constitute the permit requirements for the discharge(s) and is enforceable in the same manner as an individual permit.

I agree to abide by the following as a part of coverage under this General Permit:

1. I agree to abide by the approved Sedimentation and Erosion Control Plan for this project and to keep a signed copy of the letter of approval of the plan on-site at all times. (A copy of the letter of approval of the plan must be attached to this request.)
2. I agree to not discharge any sanitary wastewater from this construction activity except under the provisions of another NPDES permit specifically issued therefore.
3. I agree that there will be no chemicals added to the discharge.
4. I agree that wastes composed of building materials will be disposed of in accordance with N.C. statutes and rules governing solid waste disposal.
5. I agree that maintenance activities for vehicles and heavy equipment will be performed so as to not result in contamination of the surface or ground waters.

I agree to abide by the provisions as listed above and recognize that the provisions are to be considered as enforceable requirements of the General Permit.

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete, and accurate.

\_\_\_\_\_  
signature

\_\_\_\_\_  
date

\_\_\_\_\_  
name of person signing above (printed or typed)

\_\_\_\_\_  
title

North Carolina General Statute 143-215.6B (i) provides that: Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained under Article 21 or regulations of the Environmental Management Commission implementing that Article, or who falsifies, tampers with or knowingly renders inaccurate any recording or monitoring device or method required to be operated or maintained under Article 21 or regulations of the Environmental Management Commission implementing that Article, shall be guilty of a misdemeanor punishable by a fine not to exceed \$10,000, or by imprisonment not to exceed six months, or by both. (18 U.S.C. Section 1001 provides a punishment by a fine of not more than \$10,000 or imprisonment not more than 5 years, or both, for similar offense.)

**CHARLOTTE FIRE DEPARTMENT  
BULLETIN #22.2  
BLASTING REQUIREMENTS**

Two types of permits are issued for blasting operations: 1) Routine Blasting permits are issued for predetermined locations or jobs that comply with Items I - III. 2) Pop Shot permits are issued for unexpected or unanticipated jobs that require the use of small amounts of blasting materials and comply with the items indicated by an asterisk (\*) in the left column and with Item IV.

**I. APPLYING FOR PERMIT**

A. In addition to submitting a fire department permit application, the following information and documentation are also required:

- \* 1. An original corporate surety bond in the minimum principal sum of \$1,000,000 or an original public liability insurance policy or certificate for the same amount. The bond and policy shall be in force for the duration of the blasting operations.
- 2. Two (2) copies of a site plan, 8 1/2" x 11", minimum size, drawn to scale and indicating the address and locations of on site and adjacent properties which may be affected:
  - a. Blasting area(s)
  - b. Inhabited buildings
  - c. Railways
  - d. Barricades
  - e. Storage magazines
- 3. Storage arrangements, quantities of explosives and method of detonation. Quantities of explosives shall be the maximum anticipated amount of explosives that may be brought to the blasting site at any one time.
- \* 4. A check made payable to the City of Charlotte for \$165.00.
- \* 5. A description setting forth the name, age, experience, address and home and business telephone numbers of the person(s) responsible for (in charge or) blasting operations.
- \* B. Permit applications and plans for routine blasting permits shall be submitted to the Fire Plans Examiners located at 700 N. Tryon Street between 8:00am and 11:00am weekdays. Telephone calls may be directed to 336-2101 for requests outside these hours.

- C. When blasting operations extend beyond the corporate limits of the City of Charlotte, permit issuance will be coordinated with the Mecklenburg County Fire Marshal's Office.

**II. CONDITION OF THE PERMIT**

- A. A blasting permit shall remain valid for the duration of the job or for one (1) year, whichever comes first, or until the certificate of insurance expires.
- \* B. The permit or a copy thereof shall be kept at the blasting site, preferably in the blasting log, and made available to the Fire Inspector for his/her review.
- \* C. The permit shall not be assigned or transferred.
- \* D. The permit shall not be issued to a person under 21 years of age.
- \* E. A holder of a permit to blast shall keep a daily record of all explosives materials received and fired or otherwise disposed of by the permit holder. Such records shall be retained for five years and shall be made available to the issuing authority upon request.

**III. CONDITIONS FOR BLASTING OPERATIONS**

- A. Twenty four (24) hour notice shall be given to the Fire Inspector at 336-2101 for the site inspection of the initial blasting activity for each different location. Exception: "Pop Shots" for which a valid permit has been issued.
- \* B. The Communications Division of the Fire Department shall be called prior to blasting at 336-2441.
- \* C. All federal, state and local laws and regulations applicable to obtaining, owning, transporting storing handling, and using explosive materials shall be followed.
- \* D. Explosive materials shall be protected from unauthorized possession and shall not be abandoned.
- \* E. Explosive materials shall be used only by experienced persons who are familiar with the hazards involved and who hold all required permits.
- \* F. No explosive materials shall be located or stored where they may be exposed to flame, excessive heat, sparks or impact.

- \* G. No smoking shall be permitted within 50 ft. (15.25m) of any location where explosives are being handled or used.
- \* H. No blasting operation shall be conducted in a manner contrary to the instructions of the manufacturer of the explosive materials being used.
- \* I. All explosive materials not in the process of manufacture, being transported, or being used shall be kept in storage magazines. Storage magazines shall comply with Federal Explosives Storage Requirements.
- \* J. When blasting is being conducted in a congested area or in a close proximity to a structure, railway, or highway, or any other installation that may be affected, special precautions shall be exercised to prevent damage and to minimize earth vibrations and air blasts. Blasting mats or other protective devices shall be used to prevent fragments from being thrown. Pre-blasting property surveys are suggested when blasting in these areas.
- \* K. Persons authorized to prepare explosive charges or to conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags, barricades, mats, or other equally effective means to ensure the safety of the general public and workers.
- \* L. Blasting operations shall be conducted during daylight hours except when authorized at other times by the Fire Marshal.
- M. Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph or steam utilities, the blaster shall notify the appropriate representative of such utilities at least 24 hours in advance of blasting specifying the location and intend time of such blasting.
- N. Precautions shall be taken to prevent accidental discharge of electric blasting caps from currents induced by radar and radio transmitters, lighting, adjacent power lines, dust and snow storms, or other sources of extraneous electricity. These precautions shall include, among others, the posting of signs warning against the use of mobile radio transmitters on all roads within 1000 ft. of blasting operations.

- \* O. If a misfire occurs, all personnel shall remain at a safe distance for at least one hour from the time of initiation. Correction of misfires shall be handled under the direction to the blaster in charge. A thorough search shall be made for unexploded charges before correction is attempted.
- \* P. All personnel shall remain a safe distance away from the area where undischarged explosives are being disposed of. Disposal of unexploded charges shall be in accordance with the N.C. State Fire Prevention Code.
- \* Q. Transportation of explosives shall comply with Department of Transportation (DOT) regulations.

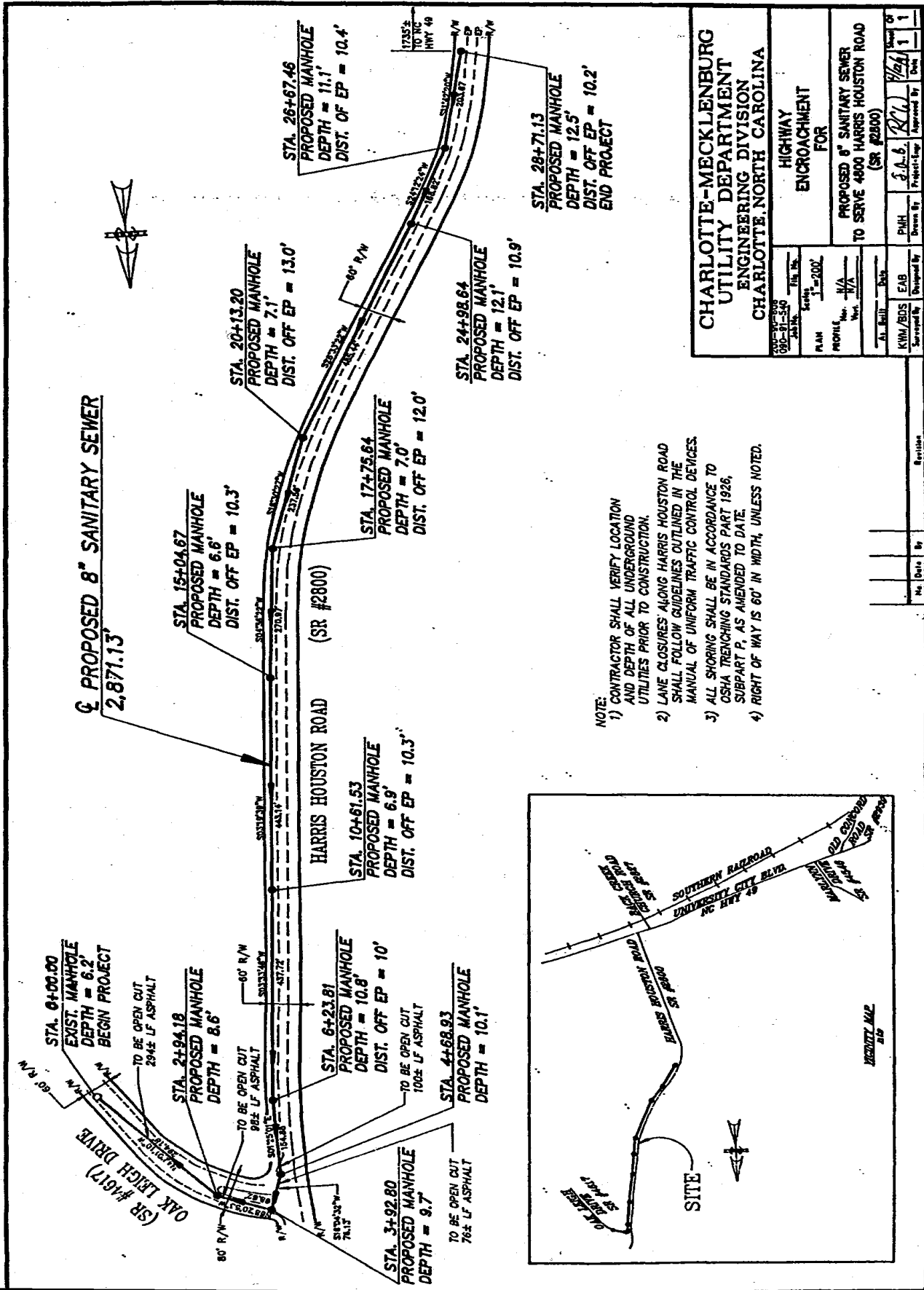
IV. POP SHOTS (\* Applicable in Addition to Below)

- A. Discharge of explosives shall be limited to 10 lbs. total.
- B. Explosives may be distributed in not more than six holes and must be discharged in a delay sequence of not more than 2 lbs. per delay shot.
- C. Explosives may not be discharged closer than 10 feet to a gas, water, electric or telecommunications line or closer than 50 feet to an occupied building.
- D. Pop Shots shall be conducted by qualified blasters only after the blast is determined to be safe.
- E. Blasting permits issued for Pop Shots shall remain valid for one (1) year or until the certificate of insurance expires.

**SHOULD EMERGENCIES OR UNFORESEEN CIRCUMSTANCES REQUIRING IMMEDIATE ATTENTION ARISE, PLEASE CALL FIRE COMMUNICATIONS AT (704)336-2441. OTHER CONCERNS MAY BE DIRECTED TO THE FIRE PREVENTION BUREAU AT (704)336-2101.**

Revised September 1992





Q PROPOSED 8" SANITARY SEWER  
2,871.13'

STA. 0+00.00  
EXIST. MANHOLE  
DEPTH = 6.2'  
DIST. OFF EP = 2,871.13'  
BEGIN PROJECT

STA. 2+92.80  
PROPOSED MANHOLE  
DEPTH = 8.6'  
DIST. OFF EP = 982 LF ASPHALT

STA. 6+23.81  
PROPOSED MANHOLE  
DEPTH = 10.8'  
DIST. OFF EP = 1002 LF ASPHALT

STA. 4+68.93  
PROPOSED MANHOLE  
DEPTH = 10.1'  
DIST. OFF EP = 762 LF ASPHALT

STA. 3+92.80  
PROPOSED MANHOLE  
DEPTH = 9.7'  
DIST. OFF EP = 762 LF ASPHALT

STA. 10+61.53  
PROPOSED MANHOLE  
DEPTH = 6.9'  
DIST. OFF EP = 10.3'

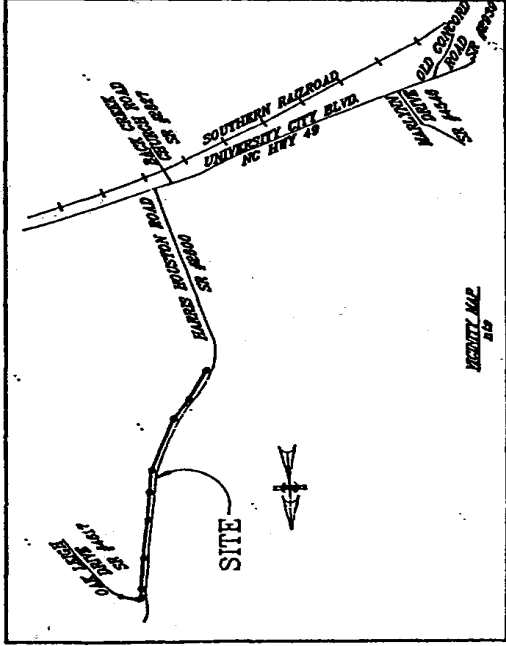
STA. 15+04.67  
PROPOSED MANHOLE  
DEPTH = 6.6'  
DIST. OFF EP = 10.3'

STA. 20+13.20  
PROPOSED MANHOLE  
DEPTH = 7.1'  
DIST. OFF EP = 13.0'

STA. 17+75.64  
PROPOSED MANHOLE  
DEPTH = 7.0'  
DIST. OFF EP = 12.0'

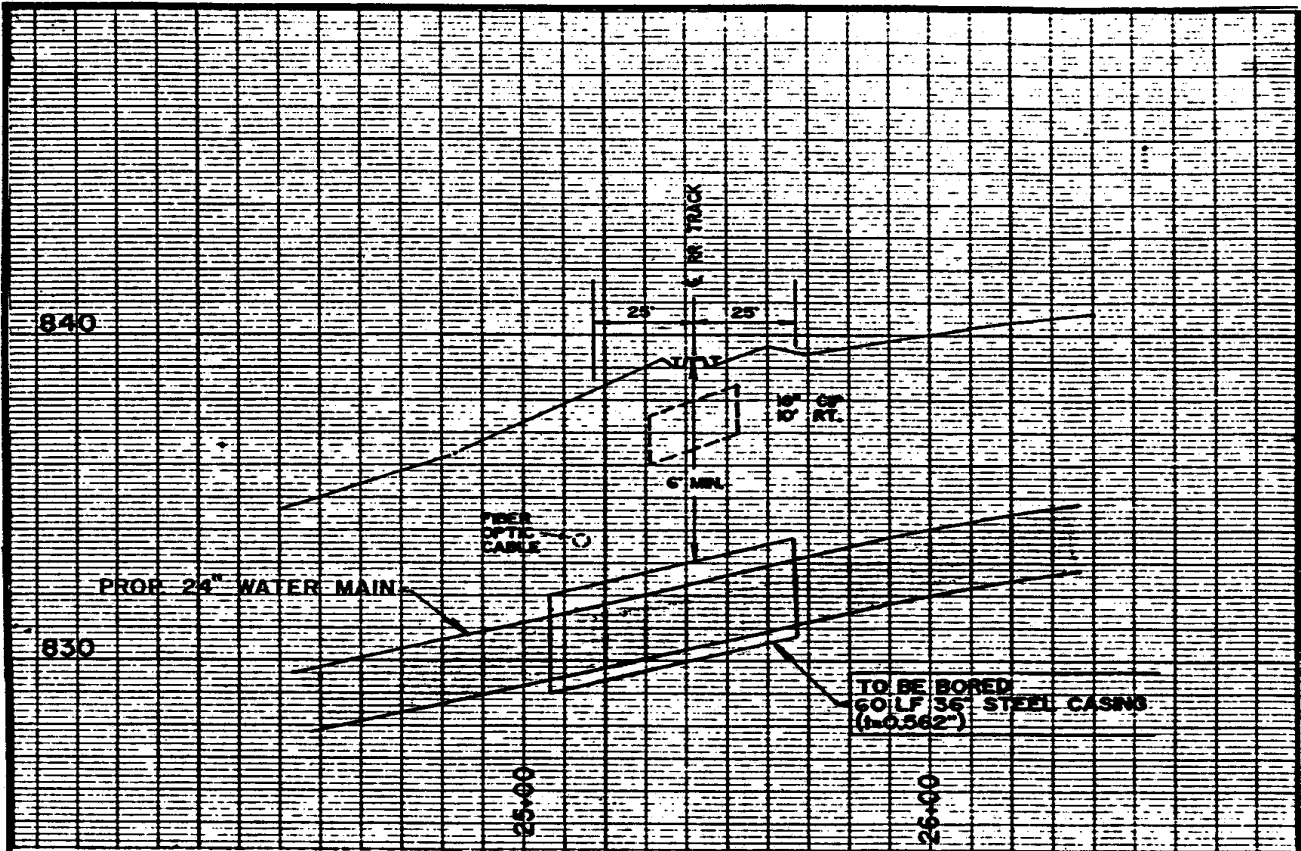
STA. 24+98.64  
PROPOSED MANHOLE  
DEPTH = 12.1'  
DIST. OFF EP = 10.9'

STA. 28+71.13  
PROPOSED MANHOLE  
DEPTH = 12.5'  
DIST. OFF EP = 10.2'  
END PROJECT



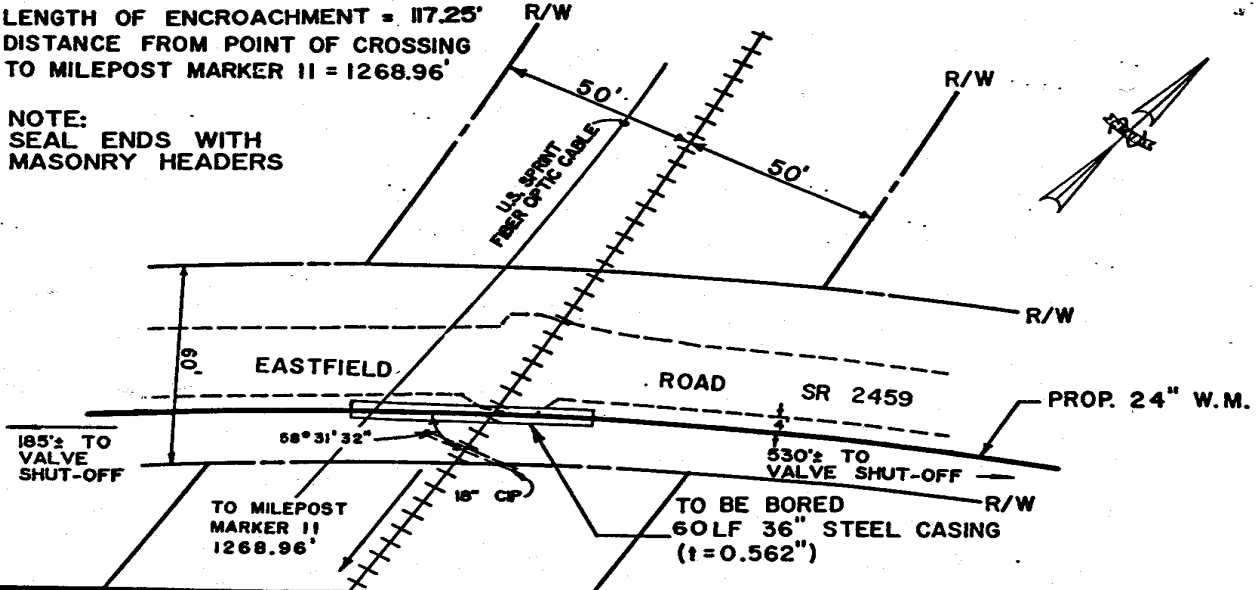
- NOTE:
- 1) CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION.
  - 2) LANE CLOSURES ALONG HARRIS HOUSTON ROAD SHALL FOLLOW GUIDELINES OUTLINED IN THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.
  - 3) ALL SHORING SHALL BE IN ACCORDANCE TO OSHA TRENCHING STANDARDS PART 1926, SUBPART P, AS AMENDED TO DATE.
  - 4) RIGHT OF WAY IS 60' IN WIDTH, UNLESS NOTED.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>	
PROJECT NO. 99-01-540 DATE 1/11/00	SHEET NO. 1 OF 1
PLAN SCALE 1"=200' PROFILE N/A	HIGHWAY ENCROACHMENT FOR PROPOSED 8" SANITARY SEWER TO SERVE 4800 HARRIS HOUSTON ROAD (SR #2800)
DESIGNED BY J.A.B. CHECKED BY R.L.G. APPROVED BY [Signature]	DATE 1/11/00



LENGTH OF ENCROACHMENT = 117.25'  
 DISTANCE FROM POINT OF CROSSING  
 TO MILEPOST MARKER 11 = 1268.96'

NOTE:  
 SEAL ENDS WITH  
 MASONRY HEADERS



	CARRIER PIPE	CASING PIPE
CONTENTS TO BE HANDLED	WATER	
INSIDE DIAMETER	24.92"	34.88"
OUTSIDE DIAMETER	25.88"	36.00"
PIPE MATERIAL	D.I.P.	STEEL
SPECIFICATIONS	PRESS. CL. 200	35,000 PSI
GRADE	TYPE II	GRADE "B" STEEL
WALL THICKNESS	0.44"	0.562"
MAX. WORKING PRESS.	65 PSI	
TEST PRESSURE	200 PSI	
TYPE OF JOINT	PUSH-ON	WELDED
INSTALLATION METHOD	JACKED THROUGH CASING PIPE	JACKED THROUGH DRY BORE

R.R. SUBDIVISION - CHARLOTTE  
 MECKLENBURG COUNTY, N.C.

CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA

661-88-281 691  
 Job No. File No.

Scale: PLAN 1" = 40'  
 PROFILE 1" = 40'

SOUTHERN RAILROAD  
 ENCROACHMENT FOR  
 PROP. 24" WATER MAIN  
 ALONG  
 EASTFIELD RD.

DC KJS KJS RMC  
 Drawn By Prepared By Approved By

1 1



APPLICATION FOR PIPE LINE CROSSING/PARALLELISM UNDER/OVER PROPERTIES AND TRACKS

Plans for proposed installation shall be submitted to and meet the approval of the Railroad Company before construction is begun. Material and installation are to be in strict accordance with specifications of the American Railway Engineering Association and requirements of the Seaboard System Railroad. Original and twelve (12) copies of this form shall be submitted, accompanied by twelve (12) lettersize prints of a drawing showing plan, elevation section of crossing from field survey, location in respect to Mile Post, width of Railroad's right of way, location of adjacent structures affecting crossing, and all information required in Figures 1 and 2 of AREA Specifications, Part 5 - Pipelines. If open cutting or tunneling is necessary, details of sheeting and method of supporting tracks or driving tunnel shall be shown.

1. Correct Name of Applicant \_\_\_\_\_ Tel.:(\_\_\_\_)\_\_\_\_\_
2. Post Office Address \_\_\_\_\_
3. Partnership - Name and initials all partners, women - given and surnames before marriage and present \_\_\_\_\_
4. If incorporated, name of state in which incorporated \_\_\_\_\_
5. Location \_\_\_\_\_ feet \_\_\_\_\_ (Direction) from nearest RR Mile Post \_\_\_\_\_ VS \_\_\_\_\_
6. Nearest Railroad Station \_\_\_\_\_ County \_\_\_\_\_ State \_\_\_\_\_
7. Within limits of public highway name \_\_\_\_\_ Fed-State-County No. \_\_\_\_\_
8. Temporary track support or riprapping required ( ) Yes ( ) No - Describe \_\_\_\_\_
9. Wires, poles, obstructions to be relocated ( ) Yes ( ) No - Describe \_\_\_\_\_
10. Product to be conveyed \_\_\_\_\_ Flammable ( ) Yes ( ) No. Temperature \_\_\_\_\_
11. Max. Working pressure \_\_\_\_\_ PSI. Field test pressure \_\_\_\_\_ PSI. Type test \_\_\_\_\_
12. Location of shut-off valves \_\_\_\_\_

13. PIPE SPECIFICATIONS:

CARRIER PIPE

CASING PIPE

Material	_____	_____
Material Specifications and Grade	_____	_____
Minimum Yield Strength of Material PSI	_____	_____
Mill Test Pressure PSI	_____	_____
Inside Diameter	_____	_____
Wall Thickness	_____	_____
Outside Diameter	_____	_____
Type of Seam	_____	_____
Laying Lengths	_____	_____
Kind of Joints	_____	_____
Total Length within RR R/W	_____	_____
VENTS: Number _____ Size _____ Hgt. above ground _____		
SEALS: Both ends _____ one end _____		
BURY: Base of rail to top of casing _____ ft. _____ in.		
BURY: (Not beneath tracks) _____ ft. _____ in.		
BURY: (Roadway ditches) _____ ft. _____ in.		
CATHODIC PROTECTION: ( ) Yes ( ) No		
PROTECTIVE COATING: ( ) Yes ( ) No Kind _____		
Type, size and spacing of insulators or supports _____		

14. Method of Installation \_\_\_\_\_  
If application is approved, applicant agrees to reimburse the Railroad for any cost incurred by the Railroad incident to installation, maintenance, and/or supervision necessitated by this pipe line installation, and further agrees to assume all liability for accidents or injuries which arise as a result of this installation. Should open cut installation be required a non-refundable charge of \$600.00 will be required to resurface tracks.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature and Title of Officer Signing Application

# SOUTHERN RAILWAY COMPANY

## APPLICATION FOR PIPE LINE CROSSING UNDER PROPERTIES AND TRACKS

Plans for proposed installation shall be submitted to and meet the approval of the Railroad Company before construction is begun. Material and installation are to be in strict accordance with specifications of the American Railway Engineering Association and requirements of the Southern Railway Company. Original and eleven copies of this form shall be submitted, accompanied by eleven prints of a drawing showing plan, elevation section of crossing from field survey, location in respect to Mile Post, width of Railroad's Right of Way, location of adjacent structures affecting crossing, and all information required in Figures 1 and 2 of A.R.E.A. Specifications, Part 5—Pipelines. If tunneling is necessary, details of sheeting and method of supporting tracks or driving tunnel shall be shown.

1. Correct Name of Applicant \_\_\_\_\_
2. Post Office Address \_\_\_\_\_
3. Partnership — Name and Initials all Partners, Women — Given and Surnames before marriage and present \_\_\_\_\_
4. If Incorporated, Name of State in which Incorporated \_\_\_\_\_
5. Location \_\_\_\_\_ Feet \_\_\_\_\_ (Direction) from nearest R.R. Mile Post \_\_\_\_\_
6. Nearest City or Town \_\_\_\_\_ County \_\_\_\_\_ State \_\_\_\_\_
7. Within limits of Public Highway Name \_\_\_\_\_ Fed-State-County No. \_\_\_\_\_
8. Temporary track support or rip rapping required ( ) Yes ( ) No — Describe \_\_\_\_\_
9. Wires, poles, obstructions to be relocated ( ) Yes ( ) No — Describe \_\_\_\_\_
10. Product to be conveyed \_\_\_\_\_ Flammable ( ) Yes ( ) No — Temperature \_\_\_\_\_
11. Max. Working Pressure \_\_\_\_\_ PSI. Field Test Pressure \_\_\_\_\_ PSI. Type Test \_\_\_\_\_
12. Location of shut-off valves \_\_\_\_\_

**3. PIPE SPECIFICATIONS:**

CARRIER PIPE

CASING PIPE

Material \_\_\_\_\_

Material Specifications and Grade \_\_\_\_\_

Minimum Yield Strength of Material PSI \_\_\_\_\_

Mill Test Pressure PSI \_\_\_\_\_

Inside Diameter \_\_\_\_\_

Wall Thickness \_\_\_\_\_

Outside Diameter \_\_\_\_\_

Type of Seam \_\_\_\_\_

Laying Lengths \_\_\_\_\_

Type of Joints \_\_\_\_\_

Total Length within RR R/W \_\_\_\_\_

VENTS: Number \_\_\_\_\_ Size \_\_\_\_\_ Hgt. above ground \_\_\_\_\_

SEALS: Both ends \_\_\_\_\_ One end \_\_\_\_\_

BURY: Base of rail to top of casing \_\_\_\_\_ ft. \_\_\_\_\_ in.

BURY: (Not beneath tracks) \_\_\_\_\_ ft. \_\_\_\_\_ in.

BURY: (Roadway ditches) \_\_\_\_\_ ft. \_\_\_\_\_ in.

CATHODIC PROTECTION: ( ) Yes ( ) No

PROTECTIVE COATING ( ) Yes ( ) No Kind \_\_\_\_\_

Type, Size and Spacing of Insulators or Supports \_\_\_\_\_

**14 Method of Installation \_\_\_\_\_**

If application is approved, applicant agrees to reimburse the Railroad for any cost incurred by the Railroad incident to installation, maintenance, and/or supervision necessitated by this pipe line installation, and further agrees to assume all liability for accidents or injuries which arise as a result of this installation.

Date \_\_\_\_\_

Signature and Title of Officer Signing Application \_\_\_\_\_

**X. WATER AND SEWER PLANS CHECKLIST**

Return to   
Table of Contents

**A. Title Page**

1. \_\_\_\_\_ Project Name and/or Subdivision Name on Cover Sheet
2. \_\_\_\_\_ Engineer's Seal and Signature
3. \_\_\_\_\_ Vicinity Sketch
4. \_\_\_\_\_ Title Block
5. \_\_\_\_\_ Tax Map And Parcel Numbers
6. \_\_\_\_\_ Name, Address & Phone Number of Developer/Owner
7. \_\_\_\_\_ Legend of Sanitary sewer and water lines, other utilities and structures, existing and proposed ground and pavement profile.
8. \_\_\_\_\_ Certification statement of lot numbers, block letters/numbers and road names.
9. \_\_\_\_\_ Sheet Index

**B. General**

1. \_\_\_\_\_ Special notes as appropriate
2. \_\_\_\_\_ Vertical Scale 1"= 4' and horizontal scale 1"= 40' or as approved by CMUD.
3. \_\_\_\_\_ All designs conform to the latest city, state and federal regulations or standards.
4. \_\_\_\_\_ Plan and Profile sheets on 24" x 36" paper with CMUD format and title block.
5. \_\_\_\_\_ An overall plan of the water and/or sewer layout, indexed to sheet numbers and a vicinity map showing project location.
6. \_\_\_\_\_ A subdivision plat indexed to sheet numbers.
7. \_\_\_\_\_ Existing water and/or sewer lines labeled with size and reference distances, and show the nearest existing valve to be used for cut-off purposes.

8. \_\_\_\_\_ Bench marks every 1000' for water and at every manhole for sewer. Elevations are tied to NGS, NCGS or established CMUD vertical control.
9. \_\_\_\_\_ Horizontal and vertical scale shown on each sheet.
10. \_\_\_\_\_ All existing or proposed rights-of-way and construction easements are accurately located and are shown on plans. Separate rights-of-way maps conforming to CMUD standards are attached. Right-of-way parcel numbers are shown and right-of-way and construction easement widths are shown.
11. \_\_\_\_\_ All existing and proposed storm sewer lines, gas, telephone, power and other utility lines, which cross or run parallel to the sewer or water lines, are shown with exact horizontal alignment. Subsurface exploration must be performed where potential conflicts exist and field changes are not practical.
12. \_\_\_\_\_ Proposed road and drainage projects are shown.
13. \_\_\_\_\_ Road names, state route numbers, and right-of-way widths are shown.
14. \_\_\_\_\_ Plan and Profile are drawn in the same direction. Stations increase from left to right.
15. \_\_\_\_\_ Proposed future water/sewer projects are shown.
16. \_\_\_\_\_ Proposed water/sewer lines are shown with reference distances from right-of-way, property boundary, buildings, other utilities, etc.
17. \_\_\_\_\_ All property corners are shown.
18. \_\_\_\_\_ Location of existing houses, buildings, fences, wells and other structures are shown on plans. Sewer lines less than 100' from wells are DIP and sewer lines are not within 25 feet of any well.
19. \_\_\_\_\_ All designs conform to the latest City and State erosion control and sedimentation ordinances, rules and regulations.
20. \_\_\_\_\_ Locations of special features are shown.
21. \_\_\_\_\_ Detail drawings of all stream crossings and storm drainage outlets with elevations of the stream bed and current water level and elevations of storm drains and catch basins are shown.
22. \_\_\_\_\_ Adjacent property owner name (s) are shown on plans.

- 23. \_\_\_\_\_ Cut and fill areas are shown.
- 24. \_\_\_\_\_ North arrow on all sheets.
- 25. \_\_\_\_\_ Where a line is to be bored or tunnelled, indicate location and length of bore or tunnel and type of pipe and casing or tunnel liner.

**C. Water Plans**

- (1) \_\_\_\_\_ Plans show all fittings, fire hydrants, and valves including sizes. Each appurtenance properly labeled.
- (2) \_\_\_\_\_ Fire Hydrant locations comply with design guidelines.
- (3) \_\_\_\_\_ All conflicts with storm sewers and other utility lines are shown with appropriate design changes shown.
- (4) \_\_\_\_\_ The specified vertical clearance has been designed and obtained at all crossings of other utilities.
- (5) \_\_\_\_\_ All water lines have a minimum of 3.0' of cover, or are protected as required.
- (6) \_\_\_\_\_ Fire hydrants and air relief valves are shown on plans and profile.
- (7) \_\_\_\_\_ Hydrants or blow-off valves are designed at major low places in the line where possible and air release valves are designed at the high points.
- (8) \_\_\_\_\_ Blowoffs or hydrants are designed at the end of all lines. Location of hydrants comply with guidelines outlined in design standards.
- (9) \_\_\_\_\_ All water services are shown in accordance with the design standards.
- (10) \_\_\_\_\_ Plans show all connections to the existing mains.
- (11) \_\_\_\_\_ Water system is designed in accordance with available pressures and fire flow and pressure calculations are included.
- (12) \_\_\_\_\_ Line location is shown relative to back of curb or edge of pavement.

- (13) \_\_\_\_\_ Approximate material quantities are listed on each sheet.
- (14) \_\_\_\_\_ Pipe sizes noted on plans.
- (15) \_\_\_\_\_ Where pipe size is not determined by Utility Department, calculations are provided with the plans.
- (16) \_\_\_\_\_ Ditch lines are shown on the plan and depth of ditches are shown on the profile at fire hydrant and large service lines.
- (17) \_\_\_\_\_ Water line stubs for future extensions are to be installed beyond the edge of proposed pavement. Horizontal alignment and profile, if applicable, are to be shown on the construction plans.

**D. Sewer Plans**

- (1) \_\_\_\_\_ Manholes and structures are labeled and standard detail reference is included if applicable.
- (2) \_\_\_\_\_ Special structures are detailed.
- (3) \_\_\_\_\_ All conflicts with water mains are shown with changes to DIP as required.
- (4) \_\_\_\_\_ VCP or PVC pipe is replaced with Ductile Iron where there is less than 3.0 feet of cover.
- (5) \_\_\_\_\_ Bearings and distances between manholes are shown on plan view.
- (6) \_\_\_\_\_ Proposed pipes and manholes are shaded on profile view.
- (7) \_\_\_\_\_ Aerial creek crossings or inverted siphons are properly detailed.

**E. Water and Sewer Contract Maps for Donated Projects**

- (1) \_\_\_\_\_ Size: 8 1/2" x 11" or 8 1/2" x 14" (CMUD Title Block)
- (2) \_\_\_\_\_ Project Name and Job number
- (3) \_\_\_\_\_ Streets with street names
- (4) \_\_\_\_\_ Lots with lot numbers
- (5) \_\_\_\_\_ North Arrow



**Sewer:**

- (6) \_\_\_\_\_ Summary of total number of manholes, total length of pipe and number of lots served
- (7) \_\_\_\_\_ Proposed and existing sewer lines with flow directions
- (8) \_\_\_\_\_ Manholes and manhole numbers
- (9) \_\_\_\_\_ Bearings on any off-street sewer mains
- (10) \_\_\_\_\_ Distances between manholes for gravity lines
- (11) \_\_\_\_\_ Force mains and distances, low-pressure mains and distances (if applicable)
- (12) \_\_\_\_\_ Pump station locations (if applicable) and access road
- (13) \_\_\_\_\_ Proposed and existing sewer right-of-ways
- (14) \_\_\_\_\_ Right-of-ways dedicated for future use
- (15) \_\_\_\_\_ Size of sewer mains (if larger than 8-inch)

**Water:**

- (16) \_\_\_\_\_ Summary of total length of water main, hydrants and number of lots served
- (17) \_\_\_\_\_ Proposed and existing water lines and sizes
- (18) \_\_\_\_\_ Lengths of proposed water lines
- (19) \_\_\_\_\_ Fire Hydrant locations

NOTE: These maps may also be used as existing facilities maps for dedication of roads to the state by changing any wording of proposed to existing.

**F. As-Built Checklist**

- (1) \_\_\_\_\_ Mark through changed stations, bearings, distances, etc. and print actual as-built station, bearing, distance, etc.
- (2) \_\_\_\_\_ Mark through "proposed" for items that were actually installed.
- (3) \_\_\_\_\_ NCPE and/or NCRLS seal and signature required on each plan sheet.
- (4) \_\_\_\_\_ Drafter's initials and date of as-built is required on each sheet.

- (5) \_\_\_\_\_ As-builts completed in ink.
- (6) \_\_\_\_\_ On each sheet, label the type and class of pipe installed.
- (7) \_\_\_\_\_ Label bores and tunnels to show steel casing/tunnel liner type, size, and thickness. Show beginning and ending stations.
- (8) \_\_\_\_\_ Mark through and redraw manholes, valves, fire hydrants, etc. when the as-built location is more than one inch (plan or profile on any scale) from the proposed location.
- (9) \_\_\_\_\_ Temporary erosion control measures shall not be as-built.
- (10) \_\_\_\_\_ Permit number shall be recorded on the cover sheet of each set of plans.

**Sewer**

- (11) \_\_\_\_\_ Show all manhole depths and rim elevations.
- (12) \_\_\_\_\_ Show as-built bearings and distances between manholes on the plan view.
- (13) \_\_\_\_\_ Show distances between manholes on the profile.
- (14) \_\_\_\_\_ Show location of all sewer laterals by station and as measured from the nearest downstream manhole along the centerline of the sewer.

**Water**

- (15) \_\_\_\_\_ All valves, hydrants, fittings, air releases, etc. shall be stationed.
- (16) \_\_\_\_\_ At offset fire hydrants, show station for tee, valve, and hydrant.
- (17) \_\_\_\_\_ Show location of all water services by station and as measured from the nearest valve along the centerline of the water main.
- (18) \_\_\_\_\_ Show details for concrete blocking.
- (19) \_\_\_\_\_ Show location and type of restrained joint pipe and/or fittings.

**G. Activation/Project Final Checklist**

**Sewer:**

- (1) \_\_\_\_\_ Construction must be complete including but not limited to pipe, backfill, manholes (including inverts, frame and cover, vents), laterals, etc.

- (2) \_\_\_\_\_ On-site right-of-way in a condition that sewer maintenance division can access the site as needed.
- (3) \_\_\_\_\_ Off-site right-of-way must be completely restored (seed, mulch, rip-rap, etc)
- (4) \_\_\_\_\_ Airtest passed
- (5) \_\_\_\_\_ Mandrell test passed
- (6) \_\_\_\_\_ Manhole test passed
- (7) \_\_\_\_\_ Step pull-out test passed
- (8) \_\_\_\_\_ Infiltration test passed
- (9) \_\_\_\_\_ Mains and manholes flashed
- (10) \_\_\_\_\_ ALL problems resolved
- (11) \_\_\_\_\_ EXISTING road right-of-way restoration must be complete (seed, mulch, pavement, concrete, etc.)
- (12) \_\_\_\_\_ Original plans as-built by NCRLS with seal and signature of PE and RLS.
- (13) \_\_\_\_\_ Copies of recorded Plat Maps
- (14) \_\_\_\_\_ Original right-of-way maps with NCRLS seal and signature
- (15) \_\_\_\_\_ Right-of-way agreement for any off-site right-of-way
- (16) \_\_\_\_\_ Original encroachment map for NCDOT takeover, if applicable

**Water:**

- (17) \_\_\_\_\_ Construction must be complete including but not limited to pipe, valves, backfill, valve boxes, fire hydrants, services, etc.
- (18) \_\_\_\_\_ Road right-of-way, valves, fire hydrants, services, blow-offs, etc. in a condition that water distribution division can access as needed.
- (19) \_\_\_\_\_ Hydrostatic test passed

- (20) \_\_\_\_\_ Chlorination completed
- (21) \_\_\_\_\_ Bacteria test approved by lab
- (22) \_\_\_\_\_ Verify certificate of accuracy for developer installed meters
- (23) \_\_\_\_\_ Curb and gutter and stone base complete
- (24) \_\_\_\_\_ ALL problems resolved
- (25) \_\_\_\_\_ EXISTING road right-of-way restoration must be complete (seed, mulch, pavement, concrete, etc.)
- (26) \_\_\_\_\_ Original plans as-built by engineer with seal and signature
- (27) \_\_\_\_\_ Copies of recorded plat maps
- (28) \_\_\_\_\_ Original right-of-way maps for water main right-of-way, if applicable
- (29) \_\_\_\_\_ Original encroachment map for NCDOT takeover, if applicable
- (30) \_\_\_\_\_ Certificate of accuracy for each meter larger than one inch, if applicable
- (31) \_\_\_\_\_ Butterfly valve factory test certificates for each valve, if applicable.

## ***XI. ENVIRONMENTAL ASSESSMENTS***

Any sewer line project that is more than three miles in length and has a design capacity of 1 MGD (average daily flow) or greater must have an Environmental Assessment completed before application to DEM for the non discharge permit. Pumping stations with a design capacity of 1 MGD or greater must have an Environmental Assessment regardless of the length of the associated collector system or force main.

Procedures for conducting Environmental Assessments and preparing reports are published by the North Carolina Department of Administration and are available through CMUD Engineering Division. A minimum of six months should be allowed for review and approval of the Environmental Assessments. Preparation time for the Environmental Assessments way vary from 60 days to several months depending on project complexity.

## **XII. WETLANDS PERMIT**

Any project that involves encroachment on wetland areas must have a wetlands permit issued by the U.S. Army Corps of Engineers in accordance with Section 404 of the Clean Water Act. It is the responsibility of the agency or design firm in responsible charge of project design to secure this permit. The procedure for obtaining permits is summarized as follows:

1. Have wetland areas delineated by a competent environmental scientist according to procedures specified by the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands".
2. Submit wetlands delineation maps to the U.S. Corps of Engineers, Asheville field office for verification.
3. Complete design of the project to minimize damage to wetlands consistent with good engineering practice and other constraints.
4. Submit project design data to North Carolina Department of Environmental Health and Natural Resources, Division of Environmental Management, Special Projects Sections for a water quality certification as required by Section 401 of the Clean Water Act.
5. Decide which type of permit is applicable according to the following guidelines:
  - a. Nationwide Permit #12. Damage to wetland areas is minor (e.g. small wetland areas adjacent to stream crossings) and the corridor width through the wetland area is less than 40 feet. No stockpiling material or spoil in wetland areas is permitted.
  - b. Nationwide Permit #26. The project is in an upland area where two year storm runoff is less than 5 CFS and the disturbed area is 10 acres or less.
  - c. Regional General Permit. The project parallels active streams, perhaps with stream crossings, with considerable encroachment into wetland areas. The maximum corridor width for a general permit is 40 feet. Spoil material and construction materials may be stockpiled within the corridor. Construction equipment can be operated outside the corridor provided the soil crust is not penetrated.
  - d. Individual Permit. Conditions of the general permit or nationwide permit cannot be met.
6. Submit permit application to the Wilmington District Office with the Section 401 Water Quality Certification from DEM. If an Environmental Assessment is required for the project, a copy of the approval letter should be included with the application.
7. A minimum of three months should be allowed for review and approval of Nationwide and Regional General Permits. Individual permits may require a one year or longer review and approval period depending on complexity and the amount of controversy generated.

### **XIII. CROSS CONNECTION/BACKFLOW PREVENTION**

#### **I. INTRODUCTION**

In today's world of advanced technology most people assume that the water they drink is safe. Few people even give a second thought to the possibility that the public water system might be the carrier of dangerous -or even fatal- bacteria, chemical, or other agents harmful to the human body. The Charlotte Mecklenburg Utility Department has long been concerned about cross connections and potential backflow conditions in plumbing systems and in our drinking-water-supply distribution system.

Most of us realize that contaminated water can easily result in disease and death if it is consumed by humans or animals, but how many are aware that the danger is present with us every day. The more complex our industry and our technology becomes, the greater the potential hazard to human health. In spite of our advanced public water systems, the potential for contamination is growing. A Backflow Prevention and Cross Connection Control Program is essential to ensure that water remains as safe as it is when it leaves the treatment plant.

The Federal Safe Drinking Water Act mandates that the water supplier be responsible for the quality of the water to the service connection. Therefore CMUD and the City must take every precaution for protecting the public potable water from backflow of dangerous substances which would endanger the public health or physically damage the public water system.

The City of Charlotte Ordinance #3077 is an ordinance creating a new Article V to Chapter 23 of the Charlotte City Code, entitled "Backflow Prevention and Cross Connection Control". This requires all industrial, commercial and irrigation customers to install and maintain a backflow prevention assembly at every service connection to the CMUD system before any branching of the private system in accordance with CMUD specifications and standard details.

Charlotte City code requires backflow prevention assemblies to be installed and maintained by the customer. The customer is required to have assemblies tested annually by a CMUD approved certified tester. If the interruption of water service would have a critical impact on your operation, two backflow prevention assemblies must be installed in parallel in order for testing and maintenance requirements to be fulfilled. This will allow one assembly to continue providing water while the other is being tested or repaired.

Note that installation of a backflow prevention assembly will prevent release of on-site pressure to the utility water mains. Therefore, it is important that a temperature /pressure relief valve be properly installed and maintained to relieve any excessive increase in on-site pressure due to hot water heating systems or other activities.



## II. DEFINITIONS

**AIR GAP SEPARATION** - AN UNOBSTRUCTED VERTICAL DISTANCE THROUGH THE ATMOSPHERE BETWEEN THE LOWEST OPENING FROM ANY PIPE OR FAUCET SUPPLYING WATER FROM ANY SOURCE TO A TANK, PLUMBING FIXTURE, OR OTHER DEVICE AND THE FLOOD LEVEL RIM OF THE RECEPTACLE. AN APPROVED, AIR GAP SEPARATION SHALL BE AT LEAST DOUBLE THE DIAMETER OF THE SUPPLY PIPE. IN NO CASE SHALL THE AIR GAP SEPARATION BE LESS THE ONE (1) INCH. AN APPROVED, AIR GAP SEPARATION IS AN EFFECTIVE METHOD TO PREVENT BACKFLOW AND SHALL BE CONSIDERED AS A BACKFLOW PREVENTION ASSEMBLY.

**APPROVED** - IN REFERENCE TO BACKFLOW PREVENTION ASSEMBLIES OR METHODS, THOSE ASSEMBLIES OR METHODS WHICH HAVE BEEN ACCEPTED BY THE DIRECTOR AS AN EFFECTIVE DEVICE OR METHOD TO PREVENT BACKFLOW.

**ASSEMBLY** - BACKFLOW PREVENTION ASSEMBLY.

**AUXILIARY WATER SUPPLY** - ANY WATER SOURCE OTHER THAN THE PUBLIC WATER SYSTEM THAT IS USED IN CONJUNCTION WITH OR IS OTHERWISE AVAILABLE TO A PRIVATE WATER SYSTEM.

**BACKFLOW** - ANY FLOW OF WATER, OTHER LIQUID, GAS, OTHER SUBSTANCES, OR ANY COMBINATION THEREOF, INTO THE PUBLIC WATER SYSTEM FROM ANY SOURCE DUE TO AN UNPROTECTED CROSS-CONNECTION, BACK PRESSURE, BACK-SIPHONAGE, ANY COMBINATION THEREOF, OR ANY OTHER CAUSE; PROVIDED THAT, THE FOLLOWING ACTIVITIES BY CMUD SHALL NOT BE CONSTRUED AS BACKFLOW: THE INTRODUCTION OF RAW WATER INTO A CMUD WATER TREATMENT PLANT; THE TREATMENT OF SUCH WATER INTO A CMUD WATER TREATMENT PLANT; AND THE INTRODUCTION OF SUCH TREATED WATER BY CMUD INTO THE PUBLIC WATER SYSTEM.

**BACKFLOW PREVENTION ASSEMBLY** - AN EFFECTIVE DEVICE OR METHOD USED TO PREVENT BACKFLOW.

**BACK PRESSURE** - ANY PRESSURE ON WATER, OTHER LIQUID, GAS, OTHER SUBSTANCES, OR ANY COMBINATION THEREOF, IN A PRIVATE WATER SYSTEM THAT IS CONNECTED IN ANY MANNER TO THE PUBLIC WATER SYSTEM UNDER CIRCUMSTANCES IN WHICH SUCH PRESSURE IS GREATER THAN THE PRESSURE ON THE WATER IN THE PUBLIC WATER SYSTEM, SO THAT BACKFLOW MAY OCCUR.

**BACK-SIPHONAGE** - ANY CIRCUMSTANCE IN WHICH THE PRESSURE ON THE WATER IN THE PUBLIC WATER SYSTEM IS LESS THAN THE PRESSURE ON WATER, OTHER LIQUID, GAS, OTHER SUBSTANCES, OR ANY COMBINATION THEREOF IN A PRIVATE WATER SYSTEM THAT IS CONNECTED IN ANY MANNER TO THE PUBLIC WATER SYSTEM, SO THAT BACKFLOW MAY OCCUR.

**CERTIFIED TESTER** - AN INDIVIDUAL PERSON WHO HAS PROVEN HIS/HER COMPETENCY TO TEST, REPAIR, AND OVERHAUL BACKFLOW PREVENTION ASSEMBLIES OF ALL TYPES AND TO PREPARE REPORTS ON SUCH ASSEMBLIES, AS EVIDENCED BY SUCCESSFUL COMPLETION OF A TRAINING PROGRAM APPROVED BY THE DIRECTOR.

**CONTAMINATION** - THE IMPAIRMENT OF THE QUALITY OF WATER TO A DEGREE THAT HUMAN CONSUMPTION COULD RESULT IN POISONING OR THE SPREAD OF DISEASE.

**CONTAINMENT** - THE PREVENTION OF BACKFLOW FROM A PRIVATE WATER SYSTEM BY AN APPROVED, PROPERLY FUNCTIONING BACKFLOW PREVENTION ASSEMBLY WHICH IS INSTALLED, OPERATED AND MAINTAINED IN ACCORDANCE WITH THE PROVISIONS OF THIS ARTICLE.

**CROSS-CONNECTION CONTROL INSPECTOR** - AN EMPLOYEE OF THE CITY DESIGNATED BY THE DIRECTOR TO ADMINISTER AND ENFORCE THE BACKFLOW PREVENTION AND CROSS CONNECTION CONTROL ORDINANCE AND PROVISIONS OF THIS MANUAL.

**CUSTOMER** - ANY PERSON WHO IS CAPABLE OF RECEIVING WATER FROM THE PUBLIC WATER SYSTEM THROUGH THE CUSTOMER'S PRIVATE WATER SYSTEM, WITHOUT REGARD TO WHETHER CMUD IS AWARE OF THE EXISTENCE OF SUCH CUSTOMER. IF SUCH PERSON DOES NOT OWN THE PRIVATE WATER SYSTEM, "CUSTOMER" SHALL ALSO BE CONSTRUED TO INCLUDE THE PERSON WHO OWNS THE PRIVATE WATER SYSTEM.

**CUSTOMER'S PRIVATE WATER SYSTEM** - THE PRIVATE WATER SYSTEM THROUGH WHICH A CUSTOMER IS CAPABLE OF RECEIVING WATER FROM THE PUBLIC WATER SYSTEM.

**CUSTOMER'S POTABLE WATER SYSTEM** - THE PRIVATE WATER SYSTEM THROUGH WHICH A CUSTOMER RECEIVES WATER FROM THE PUBLIC WATER SYSTEM FOR PURPOSES OF HUMAN CONSUMPTION.

**DEGREE OF HAZARD** - THE EVALUATION OF A HAZARD WITHIN A PRIVATE WATER SYSTEM AS MODERATE OR HIGH.

**DOUBLE CHECK VALVE ASSEMBLY** - AN APPROVED, PROPERLY FUNCTIONING ASSEMBLY COMPOSED OF TWO, INDEPENDENTLY ACTING CHECK VALVES, INCLUDING TIGHTLY CLOSING SHUT-OFF VALVES ATTACHED AT EACH END OF THE ASSEMBLY AND FITTED WITH PROPERLY LOCATED TEST COCKS. THIS ASSEMBLY MAY ONLY BE USED TO PROTECT AGAINST A MODERATE HAZARD.

**HIGH HAZARD** - AN ACTUAL OR POTENTIAL THREAT OF CONTAMINATION TO THE PUBLIC WATER SYSTEM OR TO A CUSTOMER'S POTABLE WATER SYSTEM THAT COULD CAUSE SERIOUS ILLNESS OR DEATH.

**IMMINENT HAZARD** - AN ACTUAL THREAT OF CONTAMINATION TO THE PUBLIC WATER SYSTEM THAT COULD CAUSE SERIOUS ILLNESS OR DEATH.

**MODERATE HAZARD** - AN ACTUAL OR POTENTIAL THREAT OF DAMAGE TO THE PHYSICAL COMPONENTS COMPRISING THE PUBLIC WATER SYSTEM OR A CUSTOMER'S POTABLE WATER SYSTEM, OR OF POLLUTION TO THE PUBLIC WATER SYSTEM OR TO A CUSTOMER'S POTABLE WATER SYSTEM.

**POLLUTION** - THE PRESENCE OF ANY SUBSTANCE IN WATER THAT TENDS TO DEGRADE THE QUALITY OF SUCH WATER OR ADVERSELY AFFECTS THE USEFULNESS OF SUCH WATER.

**POTABLE WATER** - WATER FROM ANY SOURCE WHICH HAS BEEN APPROVED FOR HUMAN CONSUMPTION BY THE APPROPRIATE AGENCY OF THE STATE OF NORTH CAROLINA AND/OR MECKLENBURG COUNTY.

**PRIVATE WATER SYSTEM** - ANY PIPE(S), SYSTEM OF PIPES OR OTHER ASSOCIATED FACILITIES THAT IS NOT PART OF THE PUBLIC WATER SYSTEM AND IS USED IN WHOLE OR IN PART TO MOVE OR RECEIVE WATER, REGARDLESS OF THE SOURCE(S) OF THE WATER IN SUCH SYSTEM.

**PROTECTED CROSS-CONNECTION** - ANY PHYSICAL CONNECTION OR OTHER CONDITION WHICH DOES NOT PERMIT BACKFLOW BECAUSE CONTAINMENT IS ACHIEVED.

**PUBLIC WATER SYSTEM** - THE POTABLE WATER SYSTEM OWNED AND OPERATED BY THE CITY THROUGH CMUD. THIS SYSTEM INCLUDES ALL DISTRIBUTION MAINS, LINES, PIPES, CONNECTIONS, STORAGE TANKS, AND OTHER FACILITIES CONVEYING POTABLE WATER FROM THE SEVERAL WATER TREATMENT PLANTS TO THE SERVICE CONNECTION OF EACH CUSTOMER.

**REDUCED PRESSURE PRINCIPLE ASSEMBLY** - AN APPROVED, PROPERLY FUNCTIONING ASSEMBLY CONTAINING TWO, INDEPENDENTLY ACTING CHECK VALVES WITH A HYDRAULICALLY OPERATING, MECHANICALLY INDEPENDENT PRESSURE DIFFERENTIAL RELIEF VALVE LOCATED BETWEEN THE CHECK VALVES AND AT THE SAME TIME BELOW THE FIRST CHECK VALVE. THE ASSEMBLY MUST INCLUDE PROPERLY LOCATED TEST COCKS AND TIGHTLY CLOSING SHUT-OFF VALVES AT EACH END OF THE ASSEMBLY. THIS ASSEMBLY IS DESIGNED TO PROTECT AGAINST A HIGH HAZARD.

**SERVICE CONNECTION** - THE TERMINAL END OF A COMPLETE SERVICE CONNECTION, OR, IN THE ABSENCE OF A COMPLETE SERVICE CONNECTION, THE POINT AT WHICH WATER LEAVES THE PUBLIC WATER SYSTEM AND ENTERS A PRIVATE WATER SYSTEM.

**UNAPPROVED WATER SUPPLY** - A WATER SUPPLY WHICH HAS NOT BEEN APPROVED FOR HUMAN CONSUMPTION BY THE APPROPRIATE AGENCY OF THE STATE OF NORTH CAROLINA AND/OR MECKLENBURG COUNTY.

**UNPROTECTED CROSS-CONNECTION** - ANY PHYSICAL CONNECTION OR OTHER CONDITION WHICH COULD PERMIT BACKFLOW TO OCCUR BY ANY MEANS INCLUDING, BUT NOT LIMITED TO, MANIPULATION OF VALVES, IMPROPER FUNCTIONING OF VALVES, OR DIRECT DISCHARGE. UNPROTECTED CROSS-CONNECTION INCLUDES ANY CONDITION IN WHICH BACKFLOW COULD OCCUR AS A RESULT OF THE IMPROPER FUNCTIONING OF A BACKFLOW PREVENTION ASSEMBLY.

### **III. INSTALLATION SPECIFICATIONS**

The installation location of all backflow prevention assemblies shall be in an area that provides a safe working environment for testing and maintenance. This area shall be readily accessible, away from electrical hazards and free from dirt. The location must meet requirements of all other local authorities i.e. Fire, Planning, Zoning, City Department of Transportation (CDOT) or North Carolina Department of Transportation (NCDOT).

The installation shall be in accordance with the manufacturers information, North Carolina State Building Code Vol. II and CMUD. Installation of backflow prevention assemblies shall be upstream of the first branch line leading off the service line. If CMUD determines that it is impossible or impractical for the backflow prevention assembly to be installed outside it may be installed just inside the building. All backflow assemblies shall be installed in a horizontal direction. The backflow prevention assembly must be installed by a licensed plumbing, or utility contractor. Fire line services require a licensed fire sprinkler contractor.

The type of backflow prevention assembly installed will be determined by CMUD and shall depend upon the degree of hazard as stated in the ordinance. If the hazard cannot be determined then a reduced pressure principle assembly shall be installed. The backflow prevention assemblies installed shall be CMUD approved backflow prevention assemblies which include the shut-off valves on each end of the unit and are considered part of the unit. These shut-off valves shall be those approved with each specific unit and there shall not be any substitutions. There shall be four test cocks provided as specified in the section titled "Approved Assemblies and Materials."

1. On the upstream side of the first shut off valve (upstream being the side closest to the property line)
2. Between the first shut off valve and the first check valve.
3. Between the first and second check valve.
4. Between the second check valve and the second shut off valve.

All installations should be installed where easily accessible for testing and maintenance.

Reduced pressure principle backflow prevention assemblies (RP) shall be installed above ground outside zoning setback areas and according to CMUD standard details.

The minimum height from the relief port to the ground shall be 12" and the maximum height shall be 30". A floor drain or an air-gap drain shall be provided for RP's installed inside of buildings (minimum drain sizes are listed in these specifications). For 3/4" - 2", the clearance for an RP installed inside a building shall be 4" minimum from the wall to shut off valve, 30" minimum from the wall or any obstruction on the side utilized for testing and 6" minimum on the other to the assembly . For 3" - 10" RP, the clearance shall be 30" minimum from the wall or any obstruction on the side utilized for testing and 12" minimum on the other. RP's must be installed in an upright horizontal direction.

Double check valve assemblies (DCVA) may be installed above ground or below ground and shall be according to CMUD standard details. DCVA's must be installed in an upright horizontal direction. If the DCVA is installed below ground, it must be installed in a vault. The vault must have positive drainage, by gravity to surface of ground, or to a catch basin in a private storm drain system. If positive drainage cannot be accomplished, the DCVA shall be installed above ground outside zoning setback areas. All drainage systems shall be approved by Building Standards Plumbing Inspection.

If drainage is provided to a catch basin in a private storm drain system, the invert elevation of the drain pipe must be at or above the (top) crown level of the main storm drain line pipe flowing out of the catch basin. All work shall only be performed on the customers property and not in the public road right-of-way. Minimum drain sizes are listed in these specifications. Vault installations shall conform to CMUD Standard Details for DCVA vault installations.

If the DCVA is installed in a vault, it must be easily accessible for testing and maintenance. The length and width shall be such that the entire assembly may be removed. For 3/4" and 1" DCVA there shall be a minimum of 8" clearance on the side of the DCVA used for testing and 4" minimum on the other. For 1 1/2" and 2" DCVA there shall be a minimum of 12" clearance on the side of the DCVA used for testing and 6" minimum on the other. There shall be a minimum of 4" clearance on each end. For 3" - 10" DCVA there shall be a minimum of 30" clearance on the side of the assembly used for testing and maintenance, 12" clearance on the other, and 8" clearance on each end. DCVA's shall be installed with a minimum of 12" and a maximum of 30" clearance between the bottom surface of the body and the ground or floor. If the DCVA is installed inside a building the maximum height shall be 60". The clearance for 3/4"-2" DCVA installed inside a building shall be 4" minimum from the wall to shut off valve, 30" minimum from the wall to the assembly or obstruction on the side utilized for testing and 6" minimum on the other. For 3" - 10" DCVA, the clearance shall be 30" minimum from the wall or obstruction on the side utilized for testing and 12" minimum on the other.

The backflow prevention assembly is the responsibility of the customer to install and maintain. If damage occurs to the assembly for any reason it is the customers responsibility to repair or replace it.

It is recommended that protective structures be used to prevent freezing or vandalism for backflow prevention assemblies installed outside above ground. The backflow prevention assembly shall be protected from freezing in accordance with current State Plumbing Code. The backflow prevention assembly must be readily accessible for maintenance and testing including removing the entire assembly. Adequate drainage shall be provided by hinged door or drain ports along the bottom of the walls of the protective structure. The minimum drain size shall be provided according to current state plumbing code. Insulation shall not be wrapped around the assembly.

If the structure is non-removable and must be entered in order to test or repair the assembly, the same minimum and maximum clearance that is specified for vault installations shall apply.

Covers or doors placed above a protective structure or vault shall be lightweight and shall have adequate width and length to remove the entire assembly. Doors or covers for 3" - 10" vault installations shall be double hinged.

Fire line installations shall be as follows: High hazard fire line installations require a reduced pressure principle assembly (RP) as stated in the ordinance. Moderate hazard fire line installations require a double check valve assembly. It is recommended, if possible, if a booster pump exists, that it be approximately 100-feet downstream of the backflow prevention assembly. **Strainers shall not be installed on fire lines. All fire line installations shall be protected to a min. of 40 degrees or as required by current building code.**

Fire line services with only one fire hydrant with a maximum of distance of 100-feet from the property line shall not require backflow prevention. All assemblies on a fire line, or combination domestic and fire, shall be fire line approved installations with OS & Y type shut-off valves. These valves shall be provided with supervisory tamper switches as required by current Building Code enforced by the Fire Marshal.

Residential lawn irrigation service installations shall be as follows:

The backflow prevention assembly must be installed on the irrigation service line before any branching of the private system and in accordance with all other CMUD Installation Guidelines and Standard Details for Backflow Prevention Assemblies. The assembly may be installed adjacent to the house and shall be outside the footprint of the house.

All residential lawn irrigation system services tapped from the residential domestic service shall require a backflow prevention assembly on the irrigation service line before any branching of the irrigation system and in accordance with CMUD Installation Guidelines and Standard Details for Backflow Assemblies.

Once installation is completed, the customer shall have the backflow prevention assembly inspected by Building Standards Plumbing Inspection or a CMUD representative and tested by a CMUD approved certified tester. The test results shall be submitted to CMUD for the initial test and annual tests thereafter. All rubber parts shall be replaced every five (5) years.



## INSTALLATION REFERENCE TABLES

### MIN. DRAIN SIZES FOR VAULT INSTALLATIONS (DOUBLE CHECK VALVE ONLY)

<u>Size of Assembly</u>	<u>Drain Size</u>
3/4" - 2"	2"
2 1/2" - 10"	4"

### MINIMUM DRAIN SIZES REQUIRED FOR RP INDOOR INSTALLATION

<u>Size of Assembly</u>	<u>Drain Size</u>
3/4" - 1"	4"
1 1/2" - 2"	5"
2 1/2" - 3"	6"
4" - 6"	8"
8" - 10"	2 - 8"

### OVERALL DIMENSIONS OF ASSEMBLIES INCLUDING CMUD CLEARANCES FOR VAULT INSTALLATIONS (INSIDE DIMENSIONS)

<u>SIZE</u>	<u>LENGTH</u>	<u>DOMESTIC INSTALLATIONS</u>		<u>FIRE LINE INSTALLATIONS</u>		<u>HEIGHT</u>
		<u>WIDTH</u>	<u>HEIGHT</u>	<u>LENGTH</u>	<u>WIDTH</u>	
3/4"	23 3/4"	20 1/4"	34 1/2"			
1"	26"	20 1/4"	34 3/4"			
1 1/2"	36 5/8"	30 1/2"	37"			
2"	39 1/2"	30 1/2"	37"			
2 1/2"	55"	52 1/2"	35"			
3"	57"	54"	36"			
4"	68"	55 1/2"	41"	68"	55 1/2"	47 11/16"
6"	79"	60 1/2"	49 3/4"	79"	60 1/2"	56 1/2"
8"	91 1/2"	62 1/4"	63 1/4"	91 1/2"	62 1/2"	66 1/2"
10"	106"	64 3/4"	56 1/4"	106"	64 3/4"	75 3/4"

\*\* LENGTHS DO NOT INCLUDE STRAINER \*\*

\*\* NO STRAINERS ALLOWED ON FIRE LINES \*\*

<u>SIZE</u>	<u>LENGTH</u>
2 1/2"	9 3/4"
3"	10"
4"	12"
6"	18 7/8"
8"	21 3/8"
10"	26"

DIMENSIONS LISTED ON THIS SHEET ARE APPROXIMATE DIMENSIONS OF ASSEMBLIES THAT ARE LISTED ON CMUD APPROVED LIST ! REFER TO MANUFACTURER INFORMATION FOR SPECIFIC ASSEMBLY DIMENSIONS.

#### IV. CONSTRUCTION GUIDELINES

##### EXISTING RESIDENTIAL SERVICE WITH NEW LAWN IRRIGATION SYSTEM TIED TO EXISTING SERVICE LINE:

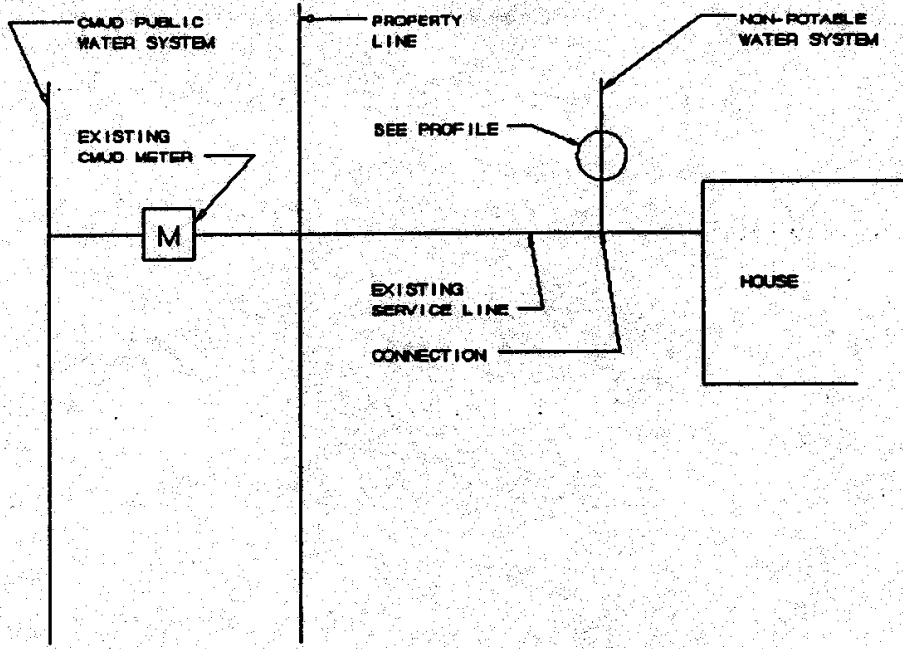
##### I-REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION

- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW IRRIGATION SYSTEM OUTSIDE ZONING SETBACK AREAS, PER CMUD STANDARD DETAILS.
- B. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- C. USE TYPE "L", or "K" COPPER OR GALVANIZED STEEL PIPE (1" DIA. MIN.), FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- D. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY.
- E. LOCATION OF CONNECTION AND BACKFLOW PREVENTION ASSEMBLY WILL BE LOCATED OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES.
- F. IF UNIONS ARE USED, CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED. IT IS REQUIRED TO CAP REMAINING PIPING TO SERVICE LINE AND IS SUBJECT TO CMUD INSPECTION AT ANY TIME ASSEMBLY IS REMOVED.
- G. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER OR NC STATE LICENSED UTILITY CONTRACTOR.

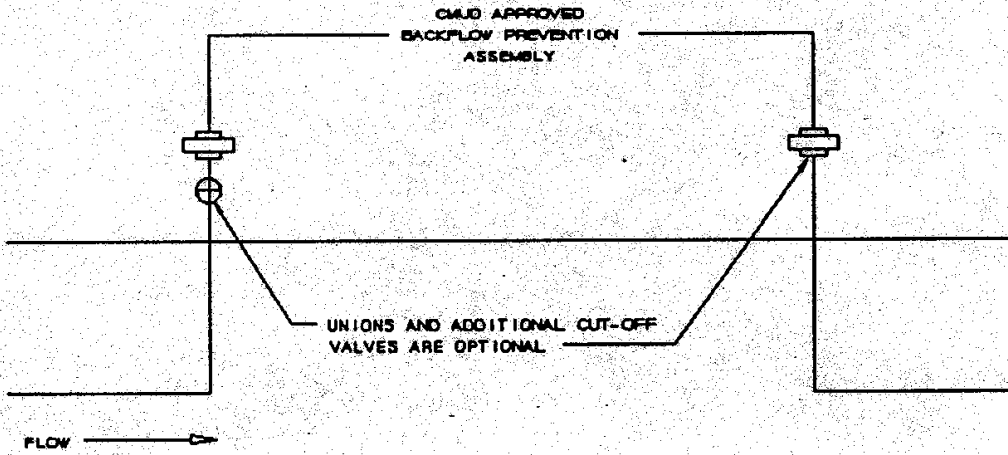
##### II-PROCEDURES FOR APPROVAL OF INSTALLATION

- A. APPLY FOR PLUMBING PERMIT AT BUILDING STANDARDS.
  - 1) APPLY FOR PLUMBING PERMIT AT BLDG. STD.. TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH PLUMBING PERMIT APPLICATION TO BUILDING STANDARDS. BUILDING STANDARDS WILL FORWARD QUESTIONNAIRE TO CMUD SYSTEMS AND RECORDS.
  - 2) FOR QUICK DETERMINATION OF ASSEMBLY REQUIREMENTS DELIVER QUESTIONNAIRE TO CMUD SYSTEMS AND RECORDS.
  - 3) WITH QUESTIONNAIRE CMUD WILL SPECIFY ASSEMBLY REQUIRED (R.P. OR D.C.V.A.). CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE AND BLDG. STD. OF REQUIREMENTS.

- B. INSTALL IRRIGATION SYSTEM
- C. CONTACT BLDG. STD. TO INSPECT INSTALLATION.
- D. WITH APPROVED INSTALLATION CMUD REQUIRES OWNER TO SUBMIT A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD. SEE TESTING REQUIREMENTS.



PLAN VIEW



PROFILE VIEW

EXISTING RESIDENTIAL SERVICE  
 W/ NEW LAWN IRRIGATION SYSTEM  
 TIED TO EXISTING SERVICE LINE

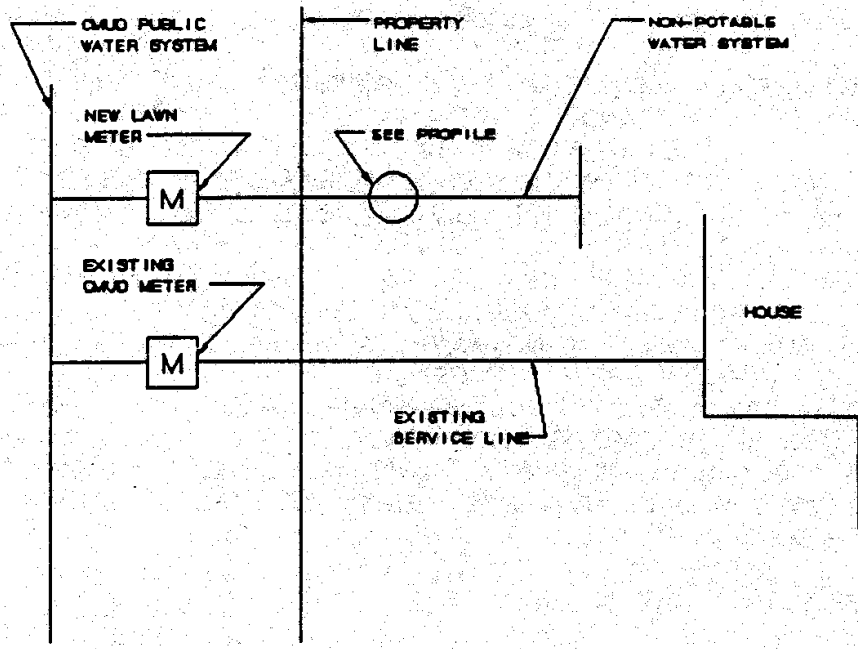
NEW RESIDENTIAL LAWN IRRIGATION SERVICE  
WITH NEW LAWN IRRIGATION SYSTEM TIED TO NEW LAWN METER:

I-REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION

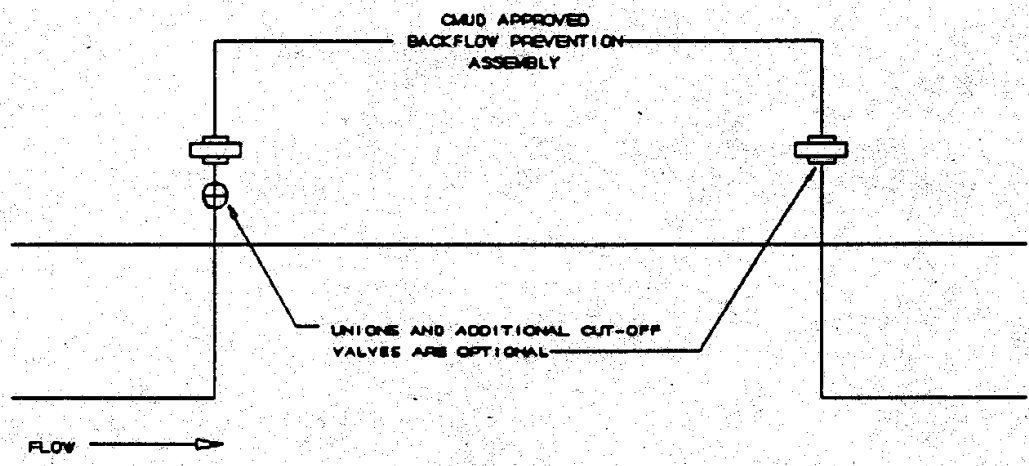
- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW IRRIGATION SYSTEM OUTSIDE ZONING SET BACK AREAS, PER CMUD STANDARD DETAILS.
- B. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- C. USE TYPE "L", or "K" COPPER OR GALVANIZED STEEL PIPE (1" DIA. MIN.), FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- D. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY.
- E. LOCATION OF CONNECTION AND BACKFLOW PREVENTION ASSEMBLY WILL BE LOCATED OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES.
- F. IF UNIONS ARE USED, CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED. IT IS REQUIRED TO CAP REMAINING PIPING TO SERVICE LINE AND IS SUBJECT TO CMUD INSPECTION AT ANY TIME ASSEMBLY IS REMOVED.
- G. ASSEMBLY IS REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER OR NC STATE LICENSED UTILITY CONTRACTOR.

II-PROCEDURES FOR APPROVAL OF INSTALLATION

- A. APPLY FOR NEW LAWN METER AT CMUD.
  - 1) COMPLETE BACKFLOW QUESTIONNAIRE.
  - 2) TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH MONEY FOR SERVICE CONNECTION FEES, TO CMUD.
  - 3) WITH QUESTIONNAIRE CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED (R.P. OR D.C.V.A.). CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE AND BLDG. STD. OF REQUIREMENTS.
- B. APPLY FOR PLUMBING PERMIT AT BLDG. STD.
- C. FLAG LOCATION FOR CMUD CREW TO INSTALL NEW METER.
- D. INSTALL IRRIGATION SYSTEM.
- E. CONTACT BLDG. STD. TO INSPECT INSTALLATION.
- F. WITH APPROVED INSTALLATION CMUD REQUIRES OWNER TO SUBMIT A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD. SEE TESTING REQUIREMENTS.



PLAN VIEW



PROFILE VIEW

**NEW RESIDENTIAL LAWN IRRIGATION SYSTEM**

EXISTING COMMERCIAL SERVICE

WITH LAWN IRRIGATION OR FIRE SYSTEM TIED TO EXISTING SERVICE LINE:

I-1. CMUD REQUIREMENTS AT EXISTING METER

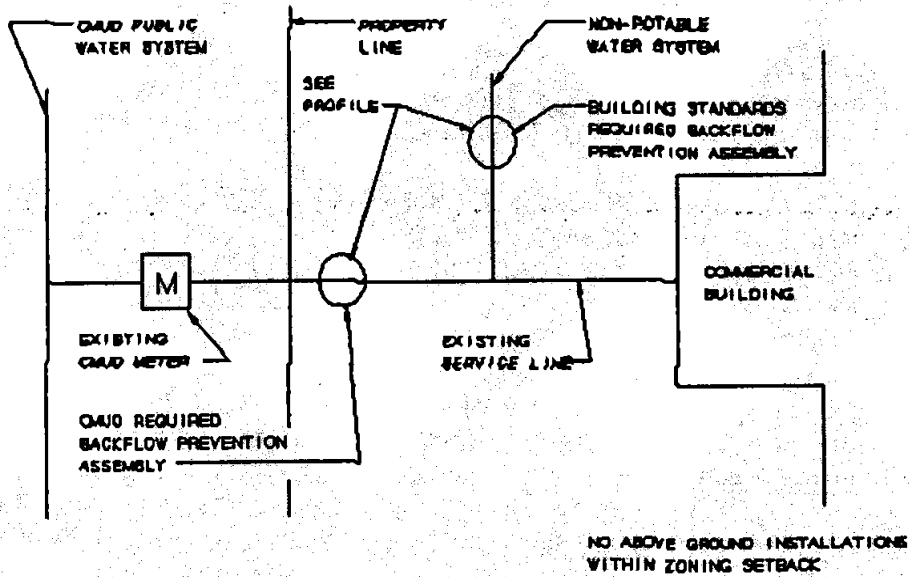
- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW SYSTEM OUTSIDE ZONING SETBACK AREAS, PER CMUD STANDARD DETAILS OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES. **ON FIRE LINES SHUT-OFF VALVES MUST BE OS&Y TYPE, AND BE PROVIDED WITH SUPERVISORY TAMPER SWITCHES WITH TROUBLE SIGNAL TO GO TO THE EMERGENCY CONTROL STATION AS REQUIRED BY CURRENT BUILDING CODE.**
- B. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. **STRAINERS SHALL NOT BE INSTALLED ON FIRE SYSTEMS.** SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- C. USE TYPE "L", or "K" COPPER, D.I.P. (3"-10"), OR GALVANIZED STEEL PIPE (1" DIA. MIN.), FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- D. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY. **ALL ASSEMBLIES USED ON FIRE LINE SERVICES SHALL BE PROTECTED TO MIN. 40 DEGREES OR AS REQUIRED BY CURRENT BUILDING CODE.**
- E. IF UNIONS ARE USED (3/4"-2"), CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED. IT IS REQUIRED TO CAP REMAINING PIPING TO SERVICE LINE AND IS SUBJECT TO CMUD INSPECTION AT ANY TIME ASSEMBLY IS REMOVED.
- F. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER, UTILITY CONTRACTOR, OR NC STATE LICENSED FIRE SPRINKLER CONTRACTOR.

2. BUILDING STANDARDS REQUIREMENTS FOR BACKFLOW ASSEMBLY AT CONNECTION OF NEW LAWN IRRIGATION OR FIRE SYSTEM

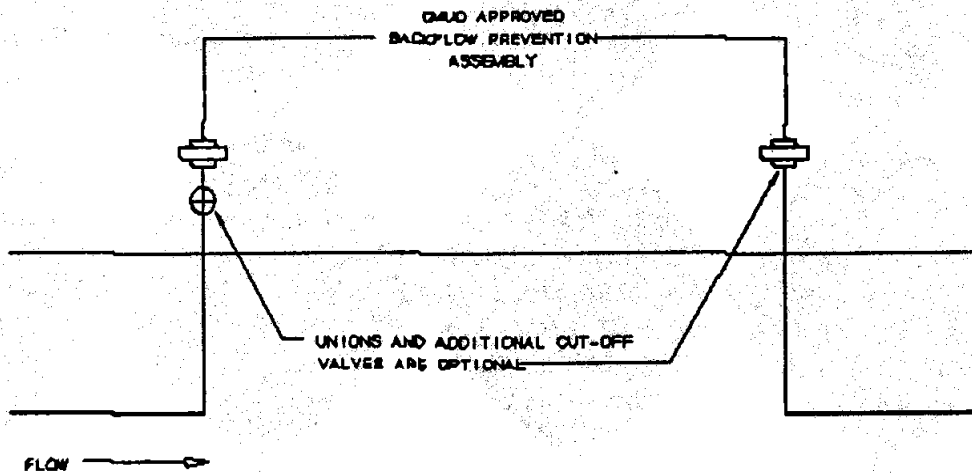
- A. LOCATE 12" ABOVE GROUND MIN. 30" MAX. BEFORE ANY BRANCHES IN NEW SYSTEM, IN HORIZONTAL DIRECTION. 30" MIN. FROM ANY OBSTRUCTION.
- B. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY. **ALL ASSEMBLIES USED ON FIRE LINE SERVICES SHALL BE PROTECTED TO MIN. 40 DEGREES OR AS REQUIRED BY CURRENT BUILDING CODE.**
- C. IF UNIONS ARE USED (3/4"-2"), CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED.
- D. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER, UTILITY CONTRACTOR, OR NC STATE LICENSED FIRE SPRINKLER CONTRACTOR.

II-PROCEDURES FOR APPROVAL OF INSTALLATION AT EXISTING METER

- A. APPLY FOR PLUMBING PERMIT AT BUILDING STANDARDS.
  - 1) COMPLETE APPLICATION FOR PLUMBING PERMIT AND PAY FEE.
  - 2) TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH PLUMBING PERMIT APPLICATION TO BUILDING STANDARDS. BUILDING STANDARDS WILL FORWARD QUESTIONNAIRE TO CMUD.
  - 3) FOR QUICK DETERMINATION OF HAZARD AND ASSEMBLY REQUIREMENTS DELIVER QUESTIONNAIRE TO CMUD SYSTEMS AND RECORDS.
  - 4) CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED. CMUD WILL NOTIFY OWNER AND BLDG. STD. OF REQUIREMENTS.
- B. INSTALLATION OF ASSEMBLY MAY BE SUBJECT TO OTHER LOCAL AUTHORITY REQUIREMENTS AND APPROVAL (i.e. FIRE, PLANNING, ZONING, OR DOT).
- C. INSTALL IRRIGATION OR FIRE SYSTEM AND BACKFLOW PREVENTION ASSEMBLIES AT METER AND AT CONNECTION OF NEW SYSTEM.
- D. CONTACT BUILDING STANDARDS TO INSPECT INSTALLATIONS.
- E. WITH APPROVED INSTALLATION CMUD REQUIRES OWNER TO SUBMIT A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD AT EXISTING METER. SEE TESTING REQUIREMENTS.



PLAN VIEW



PROFILE VIEW

EXISTING COMMERCIAL SERVICE  
W/ NEW IRRIGATION OR FIRE  
SYSTEM CONNECTION



NEW COMMERCIAL, LAWN IRRIGATION, OR FIRE LINE SERVICE  
WITH NEW SERVICE, LAWN, OR FIRE SYSTEM TIED TO NEW METER:

I-1. REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION

- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW SYSTEM OUTSIDE ZONING SETBACK AREAS, PER CMUD STANDARD DETAILS. **ON FIRE LINES SHUT-OFF VALVES SHALL BE OS&Y TYPE, AND BE PROVIDED WITH SUPERVISORY TAMPER SWITCHES WITH TROUBLE SIGNAL TO GO TO THE EMERGENCY CONTROL STATION AS REQUIRED BY CURRENT BUILDING CODE.**
- B. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. **NO STRAINERS SHALL BE INSTALLED ON FIRE SYSTEMS.** SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- C. USE TYPE "L", or "K" COPPER, D.I.P. (3"-10") OR GALVANIZED STEEL PIPE (1" DIA. MIN.), FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- D. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY. **ALL ASSEMBLIES USED ON FIRE LINE SERVICES SHALL BE PROTECTED TO MIN. 40 DEGREES OR AS REQUIRED BY CURRENT BUILDING CODE.**
- E. LOCATION OF CONNECTION AND BACKFLOW PREVENTION ASSEMBLY WILL BE LOCATED OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES.
- F. IF UNIONS ARE USED (3/4"-2"), CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED. IT IS REQUIRED TO CAP REMAINING PIPING TO SERVICE LINE AND IS SUBJECT TO CMUD INSPECTION AT ANY TIME ASSEMBLY IS REMOVED.
- G. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER, UTILITY CONTRACTOR, OR NC STATE LICENSED FIRE SPRINKLER CONTRACTOR.

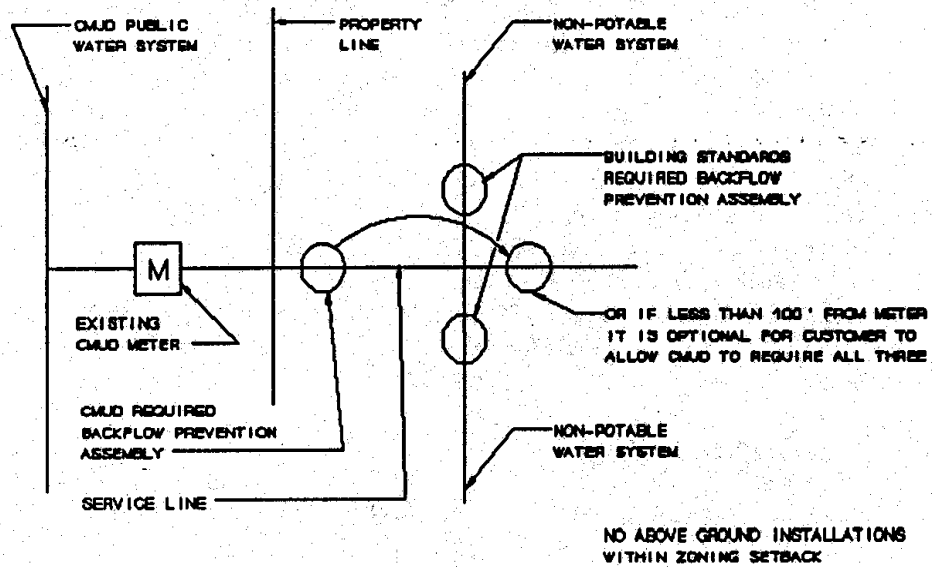
2. BUILDING STANDARDS REQUIREMENTS FOR BACKFLOW ASSEMBLY AT CONNECTION OF NEW LAWN IRRIGATION OR FIRE SYSTEM

- A. LOCATE 12" ABOVE GROUND MIN. 30" MAX. BEFORE ANY BRANCHES IN NEW SYSTEM, IN HORIZONTAL DIRECTION. 30" MIN. FROM ANY OBSTRUCTION.
- B. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY. **ALL ASSEMBLIES USED ON FIRE LINE SERVICES SHALL BE PROTECTED TO MIN. 40 DEGREES OR AS REQUIRED BY CURRENT BUILDING CODE.**
- C. IF UNIONS ARE USED (3/4"-2"), CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED.
- D. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER, UTILITY CONTRACTOR, OR NC STATE LICENSED FIRE SPRINKLER CONTRACTOR.

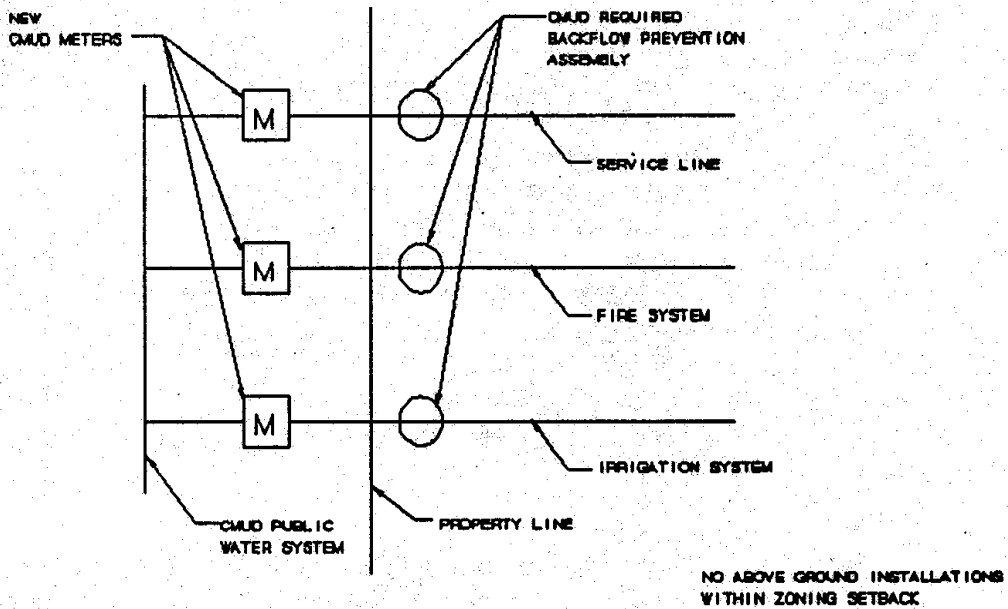
II-PROCEDURES FOR APPROVAL OF INSTALLATION

- A. APPLY FOR PLUMBING PERMIT AT BUILDING STANDARDS.
  - 1) COMPLETE APPLICATION FOR PLUMBING PERMIT AND PAY FEE.
  - 2) TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH PLUMBING PERMIT APPLICATION TO BUILDING STANDARDS. BUILDING STANDARDS WILL FORWARD QUESTIONNAIRE TO CMUD.
  - 3) FOR QUICK DETERMINATION OF HAZARD AND ASSEMBLY REQUIREMENTS DELIVER QUESTIONNAIRE TO CMUD SYSTEMS AND RECORDS.
  - 4) CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED.
- B. INSTALLATION OF ASSEMBLY MAY BE SUBJECT TO OTHER LOCAL AUTHORITY REQUIREMENTS AND APPROVAL (i. e. FIRE, ZONING, PLANNING, OR DOT).
- C. APPLY FOR NEW METER AT CMUD.
  - 1) TURN IN COPY OF COMPLETED BACKFLOW QUESTIONNAIRE WITH MONEY FOR SERVICE CONNECTION FEES.
  - 2) WITH QUESTIONNAIRE CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED (R.P. OR D.C.V.A.). CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE AND BLDG. STD. OF REQUIREMENTS.
- D. FLAG LOCATION FOR CMUD CREW TO INSTALL NEW METER.
- E. INSTALL IRRIGATION OR FIRE SYSTEM.
- F. CONTACT BLDG. STD. TO INSPECT INSTALLATION.
- G. WITH APPROVED INSTALLATION CMUD REQUIRES OWNER TO SUBMIT A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD. SEE TESTING REQUIREMENTS.

COMBINATION METER



SEPARATE METERS



NEW COMMERCIAL SERVICE  
W/ NEW IRRIGATION OR FIRE  
SYSTEM CONNECTION

DEVELOPER INSTALLED SERVICE  
TIED TO NEW DEVELOPER INSTALLED METER

I-1. REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION ON CUSTOMER PROPERTY FOR PRIVATE SYSTEM

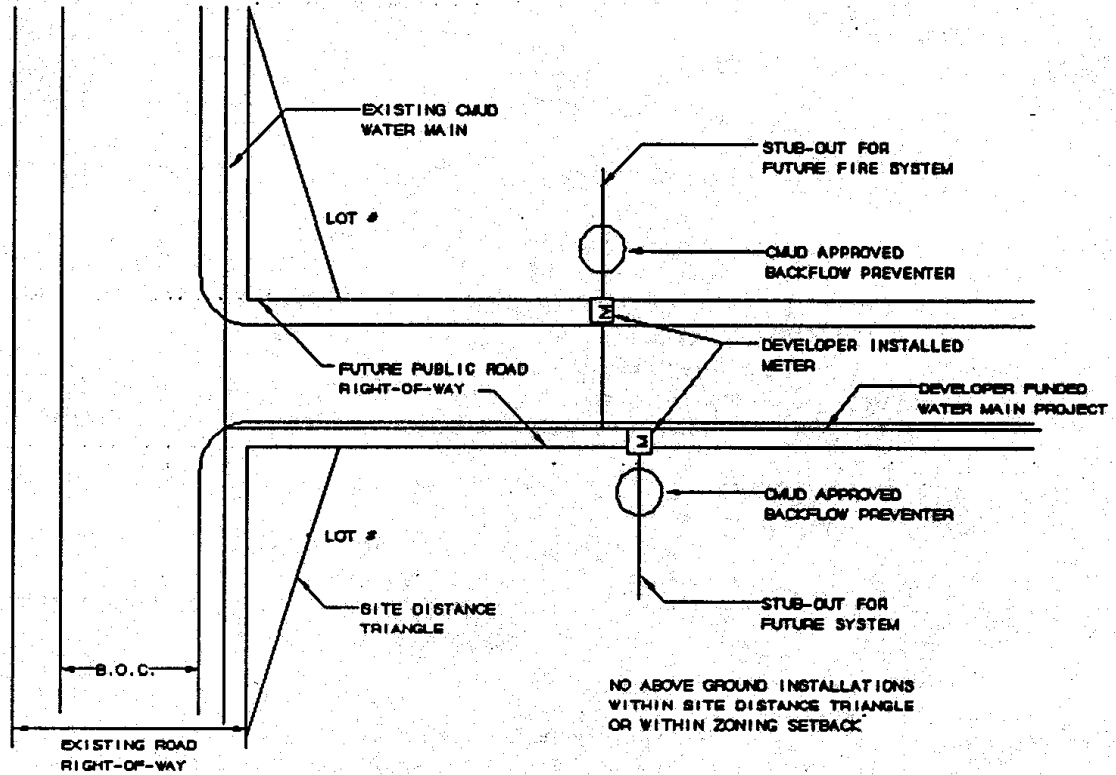
- A. INSTALLATIONS MUST BE INSTALLED OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON CUSTOMER PROPERTY.
- B. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW SERVICE, PER CMUD STANDARD DETAILS. **ON FIRE LINES SHUT-OFF VALVES SHALL BE OS & Y TYPE, AND BE PROVIDED WITH SUPERVISORY TAMPER SWITCHES WITH TROUBLE SIGNAL TO GO TO THE EMERGENCY CONTROL STATION AS REQUIRED BY CURRENT BUILDING CODE.**
- C. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. NO MORE THAN 100' UPSTREAM OF NEW METER. **NO STRAINERS SHALL BE INSTALLED ON FIRE SYSTEMS.** SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- D. USE TYPE "K" COPPER, D.I.P.(3"-10") OR GALVANIZED STEEL (1" DIA. MIN.) PIPE FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- E. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY.
- F. ALL INSTALLATIONS ARE REQUIRED TO BE OUTSIDE OF SITE DISTANCE TRIANGLE.
- G. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER OR NC STATE LICENSED UTILITY CONTRACTOR.

2. REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION WITHIN PUBLIC ROAD RIGHT-OF-WAY (EXISTING OR FUTURE) FOR ROADWAY IRRIGATION SYSTEMS

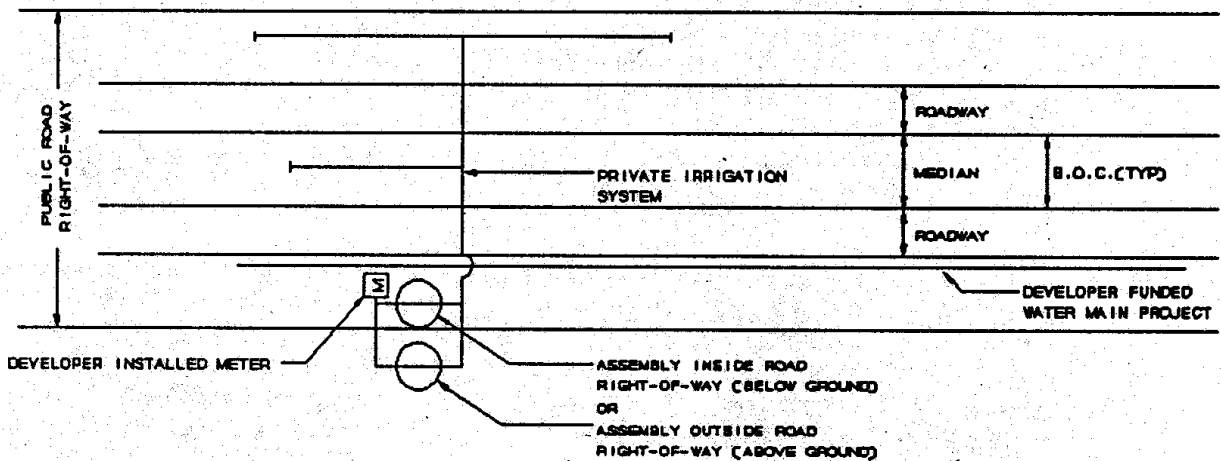
- A. ALL CONSTRUCTION ACTIVITIES, AND MATERIALS IN AN EXISTING OR FUTURE PUBLIC ROAD RIGHT-OF-WAY SHALL COMPLY WITH THE CURRENT NCDOT POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS OF WAY, OR CDOT POLICIES AND PROCEDURES AND ANY ADDITIONAL REQUIREMENTS OF ACTIVE ENCROACHMENT AGREEMENTS.
- B. NO BACKFLOW PREVENTION ASSEMBLY SHALL BE INSTALLED IN ANY FULLY CONTROLLED OR LIMITED CONTROLLED ACCESS ROADS.
- C. NO BACKFLOW PREVENTION ASSEMBLY SHALL BE INSTALLED ABOVE GROUND IN A PUBLIC ROAD RIGHT-OF-WAY. NOTE ALL REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY ARE REQUIRED TO BE INSTALLED ABOVE GROUND OUTSIDE OF THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON CUSTOMER PROPERTY.
- D. A DOUBLE CHECK VALVE ASSEMBLY SHALL BE ALLOWED TO BE INSTALLED BELOW GROUND IN A NCDOT APPROVED VAULT. ANY BELOW GROUND INSTALLATION CONFINE WITHIN THE PUBLIC ROAD RIGHT-OF-WAY SHALL BE LOCATED AS NEAR TO RIGHT-OF-WAY LINE AS POSSIBLE. OUTSIDE FACE OF VAULT MUST BE LOCATED NO MORE THAN ONE FOOT INSIDE PUBLIC RIGHT-OF-WAY. VAULT INSTALLATION ARE REQUIRED TO DRAIN TO FREE ATMOSPHERE. NOTE IF DRAINAGE CANNOT BE ACHIEVED, THE DOUBLE CHECK VALVE MUST BE PLACED ABOVE GROUND OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, OUTSIDE ZONING SETBACK AREAS ON CUSTOMERS PROPERTY.
- E. ALL CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS FOR WATER MAIN CONSTRUCTION WITHIN THE JURISDICTION OF THE CHARLOTTE MECKLENBURG UTILITY DEPARTMENT, FROM THE METER TO AND 5 FEET BEYOND THE BACKFLOW PREVENTION ASSEMBLY INSTALLATION.
- F. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER OR NC STATE LICENSED UTILITY CONTRACTOR.

II-PROCEDURES FOR APPROVAL OF INSTALLATION

- A. APPLY FOR NEW LAWN METER AT CMUD.
  - 1) COMPLETE BACKFLOW QUESTIONNAIRE.
  - 2) TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH MONEY FOR SERVICE CONNECTION FEES.
  - 3) WITH QUESTIONNAIRE CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED (R.P. OR D.C.V.A.). CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE AND SUBDIVISION INSPECTION OF REQUIREMENTS.
- B. ANY INSTALLATION INSTALLED IN (EXISTING, OR FUTURE) PUBLIC ROAD RIGHT-OF-WAY, OR SET-BACK AREAS CONTROLLED BY LOCAL AUTHORITIES ARE SUBJECT TO ALL STATE AND LOCAL APPROVALS.
- C. METER WILL NOT BE ACTIVATED UNTIL ALL REQUIREMENTS OF CMUD HAVE BEEN MET SATISFACTORILY.
- D. WITH APPROVED INSTALLATION CMUD REQUIRES OWNER TO SUBMIT A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD. SEE TESTING REQUIREMENTS.



SERVICE CONNECTION  
FOR FUTURE USE



NO ABOVE GROUND INSTALLATIONS WITHIN SITE DISTANCE TRIANGLE OR WITHIN ZONING SETBACK

IRRIGATION SYSTEM IN  
PUBLIC ROAD RIGHT-OF-WAY

DEVELOPER INSTALLED  
SERVICE CONNECTION

## NEW OR EXISTING IRRIGATION SERVICE FOR A PUBLIC ROADWAY

### I-1. REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION OUTSIDE OF PUBLIC ROAD RIGHT-OF-WAY

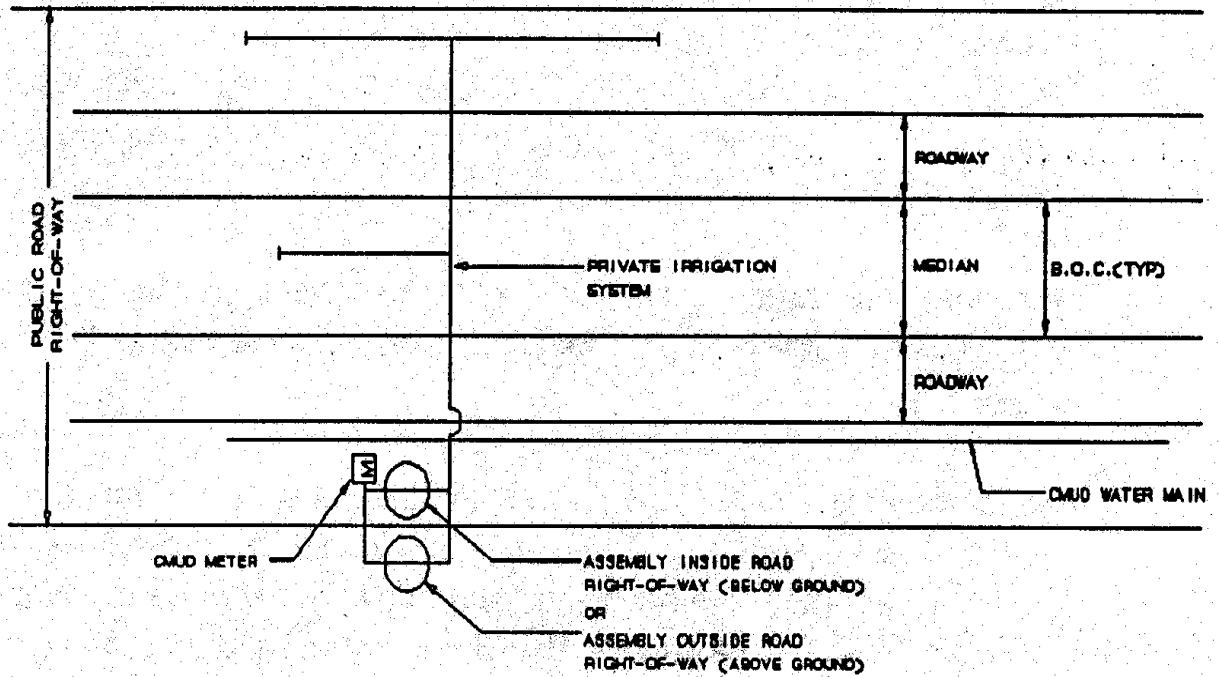
- A. ANY ABOVE GROUND INSTALLATIONS MUST BE INSTALLED OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON PRIVATE PROPERTY. ALL INSTALLATIONS ARE REQUIRED TO BE LOCATED OUTSIDE AREA OF SITE DISTANCE TRIANGLE. ANY WORK IN AN EXISTING PUBLIC ROAD RIGHT-OF-WAY(R/W) REQUIRES AN ENCROACHMENT AGREEMENT WITH OWNER OF R/W.
- B. THE ASSEMBLY MUST BE INSTALLED BEFORE ANY BRANCHES IN NEW SYSTEM, PER CMUD STANDARD DETAILS. SEE INSTALLATION SPECIFICATIONS.
- C. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. NO MORE THAN 100' UPSTREAM OF NEW METER.
- D. USE TYPE "K" COPPER, D.I.P. (3"-10") OR GALVANIZED STEEL PIPE (1"DIA. MIN.) FROM 5' BEFORE TO 5' PAST ASSEMBLY.
- E. REQUIRED INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY.
- F. LOCATION OF CONNECTION AND BACKFLOW PREVENTION ASSEMBLY WILL BE LOCATED OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES.
- G. IF UNIONS ARE USED (3/4"-2"), CAPS MUST BE PROVIDED AND STORED WITH ASSEMBLY, FOR USE ANY TIME THE ASSEMBLY IS REMOVED. IT IS REQUIRED TO CAP REMAINING PIPING TO SERVICE LINE AND IS SUBJECT TO CMUD INSPECTION AT ANY TIME ASSEMBLY IS REMOVED.
- H. ASSEMBLY REQUIRED TO BE INSTALLED BY A LICENSED PLUMBER OR LICENSED UTILITY CONTRACTOR.

### 2. REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION WITHIN (EXISTING OR FUTURE) PUBLIC ROAD RIGHT-OF-WAY

- A. ALL CONSTRUCTION ACTIVITIES, AND MATERIALS IN AN EXISTING OR FUTURE PUBLIC ROAD RIGHT-OF-WAY SHALL COMPLY WITH THE CURRENT NC D.O.T. POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS OF WAY, OR CDOT POLICIES AND PROCEDURES AND ANY ADDITIONAL REQUIREMENTS OF ACTIVE ENCROACHMENT AGREEMENTS.
- B. NO ASSEMBLIES SHALL BE INSTALLED IN ANY FULLY CONTROLLED OR LIMITED CONTROLLED ACCESS ROADS.
- C. NO BACKFLOW PREVENTION ASSEMBLY SHALL BE INSTALLED ABOVE GROUND IN A PUBLIC ROAD RIGHT-OF-WAY. NOTE ALL REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY ARE REQUIRED TO BE INSTALLED ABOVE GROUND OUTSIDE OF THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON PRIVATE PROPERTY.
- D. A DOUBLE CHECK VALVE ASSEMBLY SHALL BE ALLOWED TO BE INSTALLED BELOW GROUND IN A NCDOT APPROVED VAULT. ANY BELOW GROUND INSTALLATION CONFINE WITHIN THE PUBLIC ROAD RIGHT-OF-WAY SHALL BE LOCATED AS NEAR TO RIGHT-OF-WAY LINE AS POSSIBLE. OUTSIDE FACE OF VAULT MUST BE LOCATED NO MORE THAN ONE FOOT INSIDE PUBLIC RIGHT-OF-WAY. VAULT INSTALLATION ARE REQUIRED TO DRAIN TO FREE ATMOSPHERE. NOTE IF DRAINAGE CANNOT BE ACHIEVED, THE DOUBLE CHECK VALVE MUST BE PLACED ABOVE GROUND OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, OUTSIDE ZONING SETBACK AREAS ON CUSTOMERS PROPERTY.
- E. ALL CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS FOR WATER MAIN CONSTRUCTION WITHIN THE JURISDICTION OF THE CHARLOTTE MECKLENBURG UTILITY DEPARTMENT, FROM THE METER TO AND 5 FEET BEYOND THE BACKFLOW PREVENTION ASSEMBLY INSTALLATION.
- F. ASSEMBLY REQUIRED TO BE INSTALLED BY A NC STATE LICENSED PLUMBER OR NC STATE LICENSED UTILITY CONTRACTOR.

## II-PROCEDURES FOR APPROVAL OF INSTALLATION

- A. APPLY FOR NEW LAWN METER AT CMUD.
  - 1) COMPLETE BACKFLOW QUESTIONNAIRE.
  - 2) TURN IN COMPLETED BACKFLOW QUESTIONNAIRE WITH MONEY FOR SERVICE CONNECTION FEES.
  - 3) WITH QUESTIONNAIRE CMUD WILL DETERMINE HAZARD AND SPECIFY ASSEMBLY REQUIRED (R.P. OR D.C.V.A.). CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE AND BUILDING STANDARDS PLUMBING INSPECTION OF REQUIREMENTS.
- B. ANY INSTALLATION INSTALLED IN (EXISTING OR FUTURE) PUBLIC ROAD RIGHT-OF-WAY, OR SET-BACK AREAS CONTROLLED BY LOCAL AUTHORITIES ARE SUBJECT TO ALL STATE AND LOCAL APPROVALS.
- C. APPLY FOR PLUMBING PERMIT AT BUILDING STANDARDS PLUMBING INSPECTION, AND D.O.T. ENCROACHMENT IF REQUIRED.
- D. FLAG LOCATION FOR CMUD METER.
- E. INSTALL IRRIGATION SYSTEM.
- F. CONTACT BUILDING STANDARDS PLUMBING INSPECTION TO INSPECT INSTALLATION.
- G. WITH APPROVED INSTALLATION CMUD WILL NOTIFY OWNER LISTED ON QUESTIONNAIRE TO SEND A COPY OF THE BACKFLOW PREVENTION ASSEMBLY TEST RECORD. SEE TESTING REQUIREMENTS.



NO ABOVE GROUND INSTALLATIONS  
WITHIN SITE DISTANCE TRIANGLE  
OR WITHIN ZONING SETBACK

### IRRIGATION SYSTEM IN PUBLIC ROAD RIGHT-OF-WAY

## V. APPROVED ASSEMBLIES AND MATERIAL SPECIFICATIONS

All backflow prevention assemblies shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCHR), The American Society of Sanitary Engineering (A.S.S.E.), conform to AWWA C506, and adhere to applicable ANSI and ASTM standards. All assemblies installed on fire lines shall have approval by Factory Mutual System (FM).

Backflow prevention assemblies must also be approved by the Charlotte Mecklenburg Utility Department. CMUD will provide a list of approved assemblies.

All internal parts shall be replaceable in line. All internal metal parts shall be bronze or stainless steel. There shall be a minimum of dissimilar metals in an assembly in order to prevent corrosion due to electrolysis. When there are dissimilar metals, the metals shall be electronically similar as possible and insulated if possible.

All assemblies shall have bronze 1/4 turn ball valve test cocks with raised slotted operators or lever type operators. All assemblies shall have four resilient seated test cocks located in the following manner:

1. On the upstream side of the first shut off valve (upstream being the side closest to the property line)
2. Between the first shut off valve and the first check valve.
3. Between the first and second check valve.
4. Between the second check valve and the second shut off valve.

All exterior control piping shall be flexible hose or standard size copper tubing with standard end connections.

All interior control piping or passage ways shall be corrosion resistant. All sensing tubes or passages shall be placed in a manner that prevents clogging or trapping of foreign materials or air.

3/4" - 2" Assemblies shall have bronze or stainless steel bodies and bonnets.

3/4" - 2" Assemblies shall be equipped with shut-off valves that are full port, line size, 1/4 turn, lever type bronze or stainless steel ball valves.



2 1/2 - 10" Assemblies shall have contained check valve modules.

2 1/2 - 10" Assemblies shall be one of the following:  
Fusion bonded epoxy coated cast iron, ductile iron, or steel.  
Bronze bodies and bonnets.  
Stainless steel.

2 1/2" - 10" Assemblies shall be equipped with resilient seated gate, wedge or ball valves with non-rising stem and manual handwheel operators. For fire line installations, the shut-off valves shall be OS & Y gate valves with manual handwheel operators\*

- \* CMUD approved backflow prevention assemblies include shut off valves on each end of the unit.

If special tools or devices are required to repair or maintain an assembly they shall be supplied to the customer by the manufacturer at no extra cost.

An assembly will be removed from the CMUD approved list if it no longer meets CMUD specifications or fails to operate satisfactorily in the field.

CMUD shall be notified in writing of any changes to the design, components, materials, or operation of an assembly. CMUD shall also be notified of any failures, defects or defective material. Failure to do so will result in removal from the CMUD approval list.

Any backflow prevention assembly not on the approved list may be submitted for review and approval by CMUD. If an assembly was previously rejected, it shall not be submitted or resubmitted unless the design has been revised to meet CMUD specifications. Two assemblies shall be submitted for a one-year field evaluation prior to being approved. Shop drawings and specifications of all materials must be furnished as well.

CHARLOTTE MECKLENBURG UTILITY DEPARTMENT  
APPROVED LIST OF BACKFLOW PREVENTION ASSEMBLIES

Double Check Valve Assemblies: 3/4" - 2"

<u>Manufacturer</u>	<u>Size</u>	<u>Model Number</u>
Conbraco	3/4"	40-104-02, 40-104-AZT
	1"	40-105-02, 40-105-AZT
	1 1/2"	40-107-02
	2"	40-108-02
Febco	3/4"	805Y - BV
	1"	805Y - BV
	1 1/2"	805Y - BV
	2"	805Y - BV
Hersey	3/4"	HDC, FDC
	1"	HDC, FDC
	1 1/2"	HDC, FDC
	2"	HDC, FDC
Rainbird	3/4"	DC-QT-075
	1"	DC-QT-100
	1 1/2"	DC-QT-150
	2"	DC-QT-200
Watts	3/4"	709 QT, 007 M1QT
	1"	709 QT, 007 M1QT
	1 1/2"	709 QT, 007 QT
	2"	709 QT, 007 QT
Wilkins	3/4"	550 AB, 950 AB
	1"	550 AB, 950 AB
	1 1/2"	550 AB, 950 AB
	2"	550 AB, 950 AB

Double Check Valve Assemblies: 2 1/2" - 10"

<u>Manufacturer</u>	<u>Size</u>	<u>Model Number</u>
Ames	2 1/2"	2000SS DCA
	3"	2000SS DCA
	4"	2000 DCA OS&Y, 2000SS OS&Y
	6"	2000 DCA OS&Y, 2000SS OS&Y
	8"	2000 DCA OS&Y, 2000SE OS&Y
	10"	2000 DC OS&Y
Conbraco	2 1/2"	40-109-02
	3"	40-100-02
	4"	40-10A-02
	6"	40-10C-02
	8"	40-10E-02
	10"	40-10G-02
Febco	2 1/2"	805YD-RW
	3"	805YD-RW
	4"	805YD-RW
	6"	805YD-RW
	8"	805YD-RW
	10"	805YD-RW
Hersey	3"	No. 2
	4"	No. 2
	6"	No. 2
	8"	No. 2
	10"	No. 2
Watts	2 1/2"	709 RW, 007 RW
	3"	709 RW, 007 RW
	4"	709 RW, 770 RW, 772 RW
	6"	709 RW
	8"	709 RW, 770 RW
	10"	709 RW, 772 RW
Wilkins	2 1/2"	550 R , 950R
	3"	550 R , 950R
	4"	550 R , 950R
	6"	550 R , 950R
	8"	950R

Reduced Pressure Principle Assemblies: 3/4" - 2"

<u>Manufacturer</u>	<u>Size</u>	<u>Model Number</u>
Conbraco	3/4"	40-204-02
	1"	40-205-02
	1 1/2"	40-207-02
	2"	40-208-02
Febco	3/4"	825Y-BV, 825YA-BV
	1"	825Y-BV, 825YA-BV
	1 1/2"	825Y-BV, 825YA-BV
	2"	825Y-BV, 825YA-BV
Hersey	3/4"	FRP II
	1"	FRP II
	1 1/2"	FRP II
	2"	FRP II
Rainbird	3/4"	RP-QT-075
	1"	RP-QT-100
	1 1/2"	RP-QT-150
	2"	RP-QT-200
Watts	3/4"	909 QT, 009M1 QT, 009M2 QT
	1"	909 QT, 009 QT
	1 1/2"	909 M1QT, 009 M1QT
	2"	909 M1QT, 009 M1QT
Wilkins	3/4"	575 AB, 975 AB
	1"	575 AB, 975 AB
	1 1/2"	575 AB, 975 AB
	2"	575 AB, 975 AB

Reduced Pressure Principle Assemblies: 2 1/2" - 10"

<u>Manufacturer</u>	<u>Size</u>	<u>Model Number</u>
Ames	4"	4000 RP OS&Y
	6"	4000 RP OS&Y
	8"	4000 RP OS&Y
	10"	4000 RP OS&Y
Conbraco	2 1/2"	40-209-02
	3"	40-200-02
	4"	40-20A-02
	6"	40-20C-02
	8"	40-20E-02
	10"	40-20G-02
Hersey	2 1/2"	6 CM
	3"	6 CM
	4"	6 CM
	6"	6 CM
Febco	2 1/2"	825D-RW
	3"	825D-RW
	4"	825D-RW
	6"	825D-RW
	8"	825D-RW
	10"	825D-RW
Watts	2 1/2"	909-RW, 009-RW
	3"	909-RW, 009-RW
	4"	909-RW, 990 RW
	6"	909-RW
	8"	909-RW, 990 RW
	10"	909-RW
Wilkins	2 1/2"	575 R, 975R
	3"	575 R, 975R
	4"	575 R, 975R
	6"	575 R, 975R
	8"	975R

## Fire Line Installations

	<u>Sizes</u>	<u>Double Check Valve Assemblies</u>	<u>Reduced Pressure Principle Assemblies</u>
Ames	4", 6" 8" 4"-10"	2000SS OS&Y 2000SE OS&Y 2000 DCA OS&Y	4000 RP OS&Y
Conbraco	4" 6" 8" 10"	40-10A-03 40-10C-03 40-10E-03 40-10G-03	40-20A-03 40-20C-03 40-20E-03 40-20G-03
Febco	4"-10"	805 OS&Y-RW	825 OS&Y
Hersey	4"-10"	No: 2 OS&Y	6 CM OS&Y
Watts	4"-10" 4", 8"	709 OSY-RW 770 OS&Y-RW	909 OSY-RW 990 OS&Y-RW
Wilkins	4"-8"	950R OS&Y	975R OS&Y

## **VI. TESTING REQUIREMENTS**

When assemblies have been installed and approved it is a requirement of the customer to have assemblies tested. Each customer must maintain a complete, written record of every repair and test of all assemblies for a period of at least (7) years. A copy of the record for each test or repair must be sent to CMUD by the customer within (30) days after the completion of each test or repair. Such records must be maintained on forms approved by CMUD. All testing of CMUD regulated backflow prevention assemblies shall be performed by only CMUD approved certified testers using CMUD approved test kits. Refer to requirements of CMUD approved testers and test kits. CMUD will maintain a current list of CMUD approved certified testers and provide this list to the customer.

### **1) NEW SERVICE CONNECTION**

The customer is required to test the backflow prevention assembly upon installation. The customer is required to submit satisfactory test results to CMUD within 30 days upon notification from CMUD. The customer is required to test the backflow prevention assembly and submit to CMUD satisfactory test results annually thereafter. The test results shall be submitted on CMUD approved test forms.

### **2) EXISTING SERVICE CONNECTION**

The customer is required to test the backflow prevention assembly upon installation as outlined in the Backflow Prevention and Cross Connection Control Ordinance. The customer is required to submit satisfactory test results to CMUD within 30 days upon notification from CMUD. The customer is required to test the backflow prevention assembly and submit to CMUD satisfactory test results annually thereafter. The test results shall be submitted on CMUD approved test forms.

In the event an assembly requires repairs before an annual test period, the customer is required to have repairs made immediately. As soon as repairs have been completed the customer must have a CMUD approved certified tester conduct a test showing the assembly is in good working order. Any repairs made shall be with manufacturer approved parts. All work shall be documented with a copy of the satisfactory test and repair records sent to CMUD.

Testing for assemblies on fire protection systems must include standard operating procedures during the testing process. The customer is responsible for notifying any affected parties that the fire system will be shut down (i.e. alarm company, insurance carrier, fire official).

The customer may be required to have an approved plan to protect life and property during any period of time a fire system is out of service. Standard Operating Procedures should be written by the customer and should be approved by the fire official for use in the event of an emergency. No customer shall allow any testing to begin until such procedures are in place

and effective. It is the responsibility of the customer to provide safety for life and property during the entire test or repair. **The customer is required to meet all code and regulations as imposed by the governing fire official.**

## **VII. REQUIREMENTS FOR CERTIFIED TESTER**

Any person interested in becoming an approved certified tester must request to CMUD in writing to become a CMUD approved certified tester. The letter shall include full name, mailing address, phone number they can be reached between 8am and 5pm, and the name of school certification was obtained from. The tester must attend an orientation conducted by CMUD. CMUD will conduct an orientation periodically where the tester will be required to provide evidence of a valid certificate of training in backflow prevention assembly testing and maintenance from one of the schools listed on the current list of CMUD approved schools. During the orientation CMUD will provide the tester with information on the current testing program. The tester will have the following requirements:

1. The tester must have knowledge and understanding of the City of Charlotte Backflow Prevention ordinance Article V of Chapter 23 of the city code. The tester is required to keep abreast of the current CMUD requirements and specifications in the current Backflow Prevention Program Manual. Any violation of the ordinance may result in civil penalties as outlined in the ordinance.
2. The tester must understand and strictly adhere to testing procedures ASSE-5010-1015-1 for double check valve assembly and ASSE-5010-1013-1 for reduced pressure principle backflow prevention assemblies as listed in the American Society of Sanitary Engineering Professional Qualification Standard or the current procedures listed in the most current edition of the Manual Of Cross-Connection Control by the University of Southern California Foundation For Cross-Connection Control And Hydraulic Research.
3. No tester is allowed to conduct any test without the customers full consent and cooperation. Any tester conducting a test on fire protection systems must consult the owner on standard operating procedures during the testing process. No tester shall allow any testing to begin until such procedures are in place and effective. It is the responsibility of the tester to make sure the customer can provide safety for life and property during the entire test or repair. If the customer cannot provide this measure of safety the test is not to be completed until these safety requirements are met. **The tester is required to meet all code and regulations as imposed by the governing fire official. See Bulletin #8 GUIDELINES FOR TESTING BACKFLOW PREVENTION ASSEMBLIES ON FIRELINES.**



4. The tester shall agree to keep their certification current by completing recertification on or before the date their current certificate expires. Any laps in certification shall be reported to CMUD. Failure to report laps or loss of certification may result in penalties as outlined in the ordinance.
5. The tester is required to use only CMUD approved test kits which have been registered with CMUD. (Refer to requirements for CMUD approved test kits). The tester must agree to abide by requirements for test kits.
6. Any work completed by the tester to achieve satisfactory test results for the customer must be documented on CMUD approved test forms. All parts used to repair or overhaul a backflow prevention assembly must be recommended for use by that approved manufacturer for that particular application only. No tester shall be allowed to substitute any other manufacturer's products for the use in another manufacturer's product.
7. A tester is required to report any nonstandard installation not conforming with CMUD standard details and specifications. This can be done in the comments portion of test the form.
8. It is required that the tester provide the customer with accurate and complete test records. The customer will be responsible for submitting the completed CMUD approved test form with satisfactory test results including information of any necessary repairs.
9. It will be the responsibility of the tester to make safe or require the customer to provide a safe working environment. Precautions must be taken with hazards related but not limited to:
  - Confined space
  - Vehicle traffic
  - Insect and animals
  - Tool utilized, etc.
10. The tester shall never place any person or property in any danger such as fire or water contamination during the testing of any assembly. Tester must sign the certified tester agreement and comply with exhibit A therewith. If the tester fails to comply with the agreement, CMUD certification may be revoked.
11. Falsification of records, or failure to meet any of the requirements as outlined will result in removal from approved certified tester list and/or penalties as outlined in ordinance.

12. The tester will be required to sign an agreement with CMUD stating his/her responsibilities as a CMUD certified tester.

### **VIII. REQUIREMENTS FOR TEST KITS**

Any person approved as a certified tester by CMUD is required to use a CMUD approved test kit. An approved test kit will meet and be approved by the current requirements of the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research standards for differential pressure gauges or duplex gauges. Each kit will have the following requirements:

1. The test kit is required to be an approved test kit listed on the current list of CMUD approved backflow prevention assembly test kits.
2. Each kit must be registered with CMUD with a current calibration certificate (less than 1 yr. old). All test kits approved to test CMUD regulated backflow prevention assemblies will be registered with the following:

Manufacturer of kit  
Type of kit ( Duplex / Differential )  
Serial number  
Owner - name, address, and phone  
Calibration Date

3. All registered test kits are required to be recalibrated annually. CMUD will notify owner in writing when recalibration certificate is due. The Recalibration certificate signed by a technician shall be submitted to CMUD by the owner within 30 days. The technician calibrating the test kit shall use the most current edition of the Manual Of Cross-Connection Control from the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research Section 9.5.1, 9.5.2, and 9.5.3 to do a differential pressure gage calibration check and duplex pressure gage calibration check as well as section 6 of the ANSI/ASME Standard B40.1-1985 for pressure gage testing.
4. All registered test kits shall be kept in accurate working order. All repairs shall be made immediately and recalibration is required with a current certificate to be submitted to CMUD upon completion of the repair. Failure to notify CMUD of a malfunctioning tests kit will cause it to be removed from the approved list.

5. Upon request any CMUD approved test kit shall be operated in the presence of a CMUD representative. If repairs are required, a certification of calibration shall be submitted to CMUD showing repairs have been completed and the test kit is in good operating order.
6. CMUD will remove or disapprove any test kit which does not comply with the current requirements of this policy.

**IX. CHARLOTTE MECKLENBURG UTILITY DEPARTMENT APPROVED  
BACKFLOW PREVENTION ASSEMBLY TESTING EQUIPMENT**

<u>Manufacturer</u>	<u>Model</u>
Duke	75
Duke	100
ITT Barton	100 BFT
ITT Barton	100 BFT
Midwest Instrument	830
Midwest Instrument	890
Watts	TK-DP
Watts	TK-DR
Conbraco	40-100-TK
Conbraco	40-200-TK

**X. CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT APPROVED  
TESTERS SCHOOLS**

Fayetteville Public Works Commission P. O. Box 1089 Fayetteville, NC 28302 Mr. Ronnie West - Coordinator (919) 483-1401 Ext. 439	City of Raleigh Department of Public Utilities P. O. Box 590 Raleigh, NC 27602 Mr. Ben Yarborough - Coordinator (919) 831-6527
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University of Southern California Foundation For Cross-connection Control and Hydraulic Research School of Engineering BHE - 315 University park MC-0231 Los Angeles, California 90089-0231 Mr. Paul H. Schwartz, P. E. - Coordinator (213) 743-2032	Charlotte Mecklenburg Utilities System Protection Division Backflow Prevention 5100 Brookshire Blvd. Charlotte, NC 28216 Mr. Mark A. Krouse-COordinator (704) 391-5159
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University of Florida  
Center For Training Research and Education  
For Environmental Occupations (TREEO)  
3900 SW 63rd Boulevard  
Gainesville, Florida 32608 (904) 392-9570

**CHARLOTTE MECKLENBURG BUILDING STANDARDS DEPARTMENT  
PHONE LIST:**

ASSISTANT PLUMBING CODE ADMINISTRATOR

DONNIE TAYLOR 336-3556

PLANS REVIEW FACILITATOR

MICHAEL BURKHARD 336-3836  
PATRICK GRANDSON 336-

CO. FIRE PLAN REVIEW

BEN AYCOCK 336-3808

CITY FIRE PLAN REVIEW

RANDY TURNER 336-3814  
CLEVELAND HUNTLEY 336-3812

PLUMBING PLAN REVIEW

WILLIS HORTON 336-4301  
CHARLIE SUTTON 336-3838

STRUCTURAL PLAN REVIEW

WILLIAM RAKATANSKY 336-4302

ZONING PLAN REVIEW

KAM MERRELL 336-3813  
SAM McCOY 336-

\*\*\*\*\* CHAR.-MECK. BLDG. STD. FAX # 336-3839 \*\*\*\*\*

CMUD 399-2551  
MARK A. KROUSE FAX # 393-2219  
391-5100

BULLETIN #8  
GUIDELINES FOR TESTING OF  
BACKFLOW PREVENTION ASSEMBLIES ON FIRE LINES  
**(Requirements of fire official)**

1. TESTERS WILL BE ALLOWED TO SHUT DOWN WATER SUPPLY TO FIRE LINES FOR NO MORE THAN ONE HOUR PER ASSEMBLY. FIRE LINES SHUT DOWN FOR MORE THAN ONE HOUR FOR BFPA TESTING OR REPAIR PURPOSES, WILL RESULT IN THE TESTER BEING SUBJECT TO ALL FINES, PENALTIES OR ARREST.
2. TESTS OR REPAIRS REQUIRING LONGER SHUT DOWN TIME, WILL REQUIRE A REPLACEMENT BFPA TO BE INSTALLED.
3. TESTING OR REPAIRS WILL BE DONE AT TIMES DURING LOWEST PEDESTRIAN OCCUPANCY. (SEE BELOW)
4. ADDITIONAL PERMITTING FOR THE TESTING OF FIRE LINES WILL BE REQUIRED FOR TESTERS.
5. A 15 DAY ITINERARY WILL BE SUBMITTED BY ALL FIRE PREVENTION BUREAU PERMITTED TESTERS.
6. IN THE EVENT OF LONG TERM IMPAIRMENT OF THE FIRE LINE SYSTEM, ADDITIONAL CHARGES MAY BE LEVIED AGAINST THE PROPERTY OWNER.

TEST TIMES FOR BACKFLOW PREVENTION DEVICES PER OCCUPANCY

1. HIGH RISE - AFTER 6:00 PM, WEEKENDS, HOLIDAYS
2. MALLS - AFTER CLOSING HOURS
3. SCHOOLS - AFTER CLASSES OR SUMMERTIME
4. HOSPITALS & JAILS - BEFORE OR AFTER VISITING HOURS
5. INDUSTRIAL & WAREHOUSE - PREFERABLY AFTER NORMAL OPERATING HOURS OR DURING LOWEST OCCUPANCY (2ND OR 3RD SHIFT)

FIRE PREVENTION BUREAU - 336-2101

ALARM (AFTER HOURS) - 336-2578

## APPROVED FIELD TEST PROCEDURES FOR BACKFLOW PREVENTION ASSEMBLIES

### PREPARATION

1. OBTAIN PERMISSION FROM THE OWNER OR REPRESENTATIVE TO SHUT DOWN THE WATER SUPPLY. JUST PRIOR TO TESTING, THE CUSTOMER SHOULD BE NOTIFIED THAT THE WATER SERVICE WILL BE DISCONTINUED TEMPORARILY

**\*\*\* IF A FIRE LINE IS SUPPLIED BY THE SERVICE WITH BACKFLOW ASSEMBLY BEING TESTED THE APPROPRIATE OFFICIALS MUST BE NOTIFIED OF THE SHUT DOWN. THE TESTER IS REQUIRED TO MEET ALL CODE AND REGULATIONS AS IMPOSED BY THE GOVERNING FIRE OFFICIAL. SEE BULLETIN #8 GUIDELINES FOR TESTING BACKFLOW PREVENTION DEVICES ON FIRE LINES.**

2. OBSERVE AND RECORD THE PHYSICAL CONDITIONS OF THE ASSEMBLY AND SURROUNDING AREA. OBSERVE THE DIRECTION OF FLOW. **IS THIS THE CORRECT ASSEMBLY FOR ITS APPLICATION ?**

3. RECORD OR VERIFY THE FOLLOWING INFORMATION ON EACH ASSEMBLY:

MANUFACTURER  
MODEL  
SERIAL #  
SIZE OF ASSEMBLY  
LOCATION OF ASSEMBLY

4. DETERMINE WHICH TEST KIT IS REQUIRED FOR ASSEMBLY BEING TESTED  
REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRES A DIFFERENTIAL GAUGE  
DOUBLE CHECK VALVE ASSEMBLY REQUIRES A DUPLEX GAUGE
5. REMOVE ANY LODGED FOREIGN MATERIAL THAT MIGHT INTERFERE WITH TEST. FLUSH TEST COCKS BY OPENING #4 TEST COCK TO MAINTAIN FLOW THROUGH ASSEMBLY, THEN OPEN AND CLOSE TEST COCK #1, #2, #3, THEN CLOSE #4 TEST COCK. ATTACH APPROPRIATE FITTINGS TO TEST COCKS THEN FOLLOW TEST STEPS OUTLINED FOR PARTICULAR ASSEMBLY.

STEP-BY-STEP TESTING PROCEDURES FOR  
REDUCED PRESSURE PRINCIPLE ASSEMBLY

PURPOSE 1 TO VERIFY THAT A MINIMUM OF 5.0 psi IS MAINTAINED ACROSS CHECK VALVE #1.  
2 TO CHECK THAT THE RELIEF VALVE OPENING IS AT OR ABOVE 2.0 psi.  
3 TO VERIFY THAT THE CHECK VALVE #2 WILL HOLD TIGHT AGAINST BACKPRESSURE.  
4 TO VERIFY THAT A MINIMUM OF 1.0 psi IS MAINTAINED ACROSS CHECK VALVE #2.

- 1) FOLLOW PREPARATION STEPS, OPERATING TEST COCK #2 **VERY** SLOWLY. ATTACH THE HIGH PRESSURE HOSE TO TEST COCK #2 AND THE LOW PRESSURE HOSE TO TEST COCK #3. THE HIGH CONTROL VALVE SHOULD BE OPEN ON TEST KIT. **IT CAN REMAIN OPEN THROUGHOUT ALL FOUR TESTS.** THE LOW CONTROL VALVE AND THE BYPASS CONTROL VALVE SHOULD BE CLOSED.
- 2) OPEN THE HIGH AND LOW BLEED VALVES, THEN SLOWLY OPEN TEST COCK #3 AND #2, THIS WILL BLEED AIR FROM TEST KIT AND ASSEMBLY. IT IS IMPORTANT THAT THE TEST COCKS BE OPENED IN THIS ORDER TO PREVENT THE RELIEF VALVE FROM OPENING.
- 3) CLOSE HIGH BLEED VALVE, THEN CLOSE THE LOW BLEED VALVE. **CLOSE LOW LAST.** CLOSE #2 SHUT-OFF, OBSERVE DIFFERENTIAL PRESSURE ACROSS CHECK VALVE #1. **THIS READING SHOULD BE GREATER THAN 5.0 psi.**
- 4) OPEN LOW CONTROL VALVE **ONE QUARTER TURN ONLY.** RECORD THE OPENING POINT OF THE RELIEF VALVE WHEN WATER BEGINS TO DRIP FROM THE ASSEMBLY. **THIS READING SHOULD BE GREATER THAN 2.0 psi.** CLOSE THE LOW CONTROL VALE.
- 5) OPEN THE BY PASS CONTROL VALVE AND BLEED AIR FROM HOSE. LOOSELY ATTACH BYPASS HOSE TO TEST COCK #4. CLOSE BYPASS CONTROL VALVE AND TIGHTEN BYPASS LINE. OPEN TEST COCK #4.
- 6) OPEN LOW BLEED VALVE, AND THEN CLOSE LOW BLEED VALVE. OPEN BYPASS CONTROL VALVE, THE DIFFERENTIAL SHOULD REMAIN AT OR ABOVE 5.0 psi. RECORD STATUS OF CHECK VALVE #2 (LEAKED, OR HELD TIGHT). CLOSE BY-PASS CONTROL VALVE, OPEN LOW BLEED TO REESTABLISH ACCURATE PRESSURE READING ACROSS CHECK VALVE #1, CLOSE LOW BLEED.
- 7) RECORD GAUGE READING. THIS IS THE DIFFERENTIAL PRESSURE ACROSS CHECK VALVE #1. CLOSE TEST COCK #2, #3, THEN TEST COCK #4. BLEED TEST KIT, CLOSE BY-PASS CONTROL VALVE ON TEST KIT. REMOVE HOSES.
- 8) ATTACH HIGH HOSE TO TEST COCK #3, AND LOW TO TEST COCK #4. OPEN HIGH AND LOW BLEED VALVES. OPEN TEST COCK #4 THEN TEST COCK #3. BLEED TEST KIT, CLOSE HIGH BLEED VALVE, THEN CLOSE LOW BLEED VALVE LAST.
- 9) RECORD GAUGE READING. THIS IS THE DIFFERENTIAL PRESSURE AT CHECK VALVE # 2. **THIS READING SHOULD BE GREATER THAN 1.0 psi.** CLOSE TEST COCK #4 AND TEST COCK #3.
- 10) **OPEN SHUT OFF VALVE #2.** OPEN ALL CLOSED BLEED, AND CONTROL VALVES AND DRAIN TEST KIT. REMOVE HOSES. NOTIFY CUSTOMER WATER SERVICE IS BACK ON.



BACKFLOW PREVENTER TESTING AND MAINTENANCE  
TROUBLE SHOOTING GUIDE  
**REDUCED PRESSURE PRINCIPLE ASSEMBLY**

**NOTE: MANY PROBLEMS CAN BE CORRECTED BY CLEANING THE INTERNAL COMPONENTS. CAREFULLY OBSERVE CONDITION OF ALL COMPONENTS.**

PROBLEM	MAY BE CAUSED BY
RELIEF VALVE DISCHARGES CONTINUOUSLY.	<ol style="list-style-type: none"> <li>1. FAULTY CHECK VALVE #1.</li> <li>2. FAULTY CHECK VALVE #2 WITH BACK-PRESSURE CONDITION.</li> <li>3. FAULTY RELIEF VALVE.</li> </ol>
RELIEF VALVE DISCHARGES INTERMITTENTLY.	<ol style="list-style-type: none"> <li>1. PROPERLY WORKING ASSEMBLY WITH BACK SIPHONAGE CONDITION.</li> <li>2. CHECK VALVE #1 "BUFFER" IS TOO SMALL (i.e. LESS THAN 3.0 psi), WITH LINE PRESSURE FLUCTUATION.</li> <li>3. WATER HAMMER.</li> </ol>
RELIEF VALVE DISCHARGES AFTER #2 SHUT-OFF VALVE IS CLOSED. (STEP 3)	<ol style="list-style-type: none"> <li>1. NORMALLY INDICATES FAULTY CHECK VALVE #1.               <ol style="list-style-type: none"> <li>a. DIRTY OR DAMAGED DISC.</li> <li>b. DIRTY OR DAMAGED SEAT.</li> </ol> </li> </ol>
RELIEF VALVE WOULD NOT OPEN, DIFFERENTIAL ON THE GAUGE WOULD NOT DROP. (STEP 4)	<ol style="list-style-type: none"> <li>1. LEAKY #2 SHUT-OFF VALVE WITH FLOW THROUGH THE ASSEMBLY.</li> </ol>
RELIEF VALVE WOULD NOT OPEN, DIFFERENTIAL DROPS TO ZERO. (STEP 4)	<ol style="list-style-type: none"> <li>1. RELIEF VALVE STUCK CLOSED DUE TO CORROSION OR SCALE.</li> <li>2. RELIEF VALVE SENSING LINE PLUGGED.</li> </ol>
RELIEF VALVE OPENS TOO HIGH. (WITH SUFFICIENTLY HIGH CHECK VALVE #1 READING OBSERVED) (STEP 4)	<ol style="list-style-type: none"> <li>1. FAULTY RELIEF VALVE.               <ol style="list-style-type: none"> <li>a. DIRTY OR DAMAGED DISC.</li> <li>b. DIRTY OR DAMAGED SEAT.</li> </ol> </li> </ol>
CHECK VALVE #1 READING TOO LOW. (LESS THAN 3.0 psi "BUFFER") (STEP 7)	<ol style="list-style-type: none"> <li>1. DIRTY OR DAMAGED DISC.</li> <li>2. DIRTY OR DAMAGED SEAT.</li> <li>3. GUIDE MEMBERS HANGING UP.</li> <li>4. WEAK OR BROKEN SPRING.</li> </ol>
LEAKY #2 CHECK VALVE.	<ol style="list-style-type: none"> <li>1. DIRTY OR DAMAGED DISC.</li> <li>2. DIRTY OR DAMAGED SEAT.</li> <li>3. GUIDE MEMBERS HANGING UP.</li> <li>4. WEAK OR BROKEN SPRING.</li> </ol>

**REPAIR NOTE: LUBRICANTS SHALL ONLY BE USED TO ASSIST WITH THE REASSEMBLY OF COMPONENTS, AND SHALL NOT BE TOXIC. USE ONLY FOOD-GRADE LUBRICANTS.**

## STEP-BY-STEP TESTING PROCEDURES FOR DOUBLE CHECK VALVE ASSEMBLY

PURPOSE 1 TO VERIFY THAT #1 AND (#2) CHECK VALVE WILL HOLD TIGHT AGAINST BACK PRESSURE.

2 CONFIRMATION TEST WILL VERIFY WHETHER CHECK VALVE WILL HOLD TIGHT AGAINST BACK PRESSURE AND TO DETERMINE WHETHER EITHER SHUT-OFF VALVES LEAKS.

### **INSTRUCTIONS FOR TESTING CHECK VALVE #2 ARE IN PARENTHESES ( )**

- 1) FOLLOW PREPARATION STEPS. ATTACH THE HIGH PRESSURE HOSE TO TEST COCK #2 (#3) AND THE LOW PRESSURE HOSE TO TEST COCK #3 (#4).
- 2) OPEN THE HIGH BLEED AND LOW CONTROL VALVES, THEN CLOSE THE VALVES. CLOSE #2 SHUT-OFF VALVE. CLOSE THE #1 SHUT-OFF VALVE.
- 3) OPEN THE HIGH BLEED VALVE AND REDUCE THE PRESSURE ON THE SUPPLY SIDE TO 2 psi LESS THAN THE PRESSURE ON THE CUSTOMER SIDE.
- 4) OBSERVE WHETHER THE 2 psi SPLIT BETWEEN THE NEEDLES IS MAINTAINED AND RECORD. IF NEEDLES HOLD 2 psi SPLIT CHECK VALVE #1 (#2) IS HOLDING TIGHT. CLOSE ALL TEST COCKS. **OPEN #1 SHUT-OFF VALVE**. REPEAT STEPS FOR CHECK VALVE #2. **OPEN #1 AND #2 SHUT-OFF VALVE**. REMOVE HOSES.
- 5) IF SPILT ISN'T MAINTAINED OR IF THERE IS ANY QUESTION ON THE RESULTS OF THIS TEST, DO CONFIRMATION TEST.

### CONFIRMATION TEST

- 6) OPEN #1 SHUT-OFF VALVE. OPEN LOW CONTROL VALVE TO REMOVE AIR FROM BYPASS HOSE. CONNECT BYPASS HOSE TO THE TEST COCK #1 AND CLOSE LOW CONTROL VALVE OPEN TEST COCK #1.
- 7) CLOSE #1 SHUT-OFF VALVE. LOOSEN THE HOSE CONNECTION AT TEST COCK #3 (#4) TO LOWER PRESSURE IN ASSEMBLY AT LEAST 10 psi. OPEN BOTH HIGH AND LOW CONTROL VALVES SIMULTANEOUSLY AND REDUCE SUPPLY SIDE BY 2.5 psi AND INCREASE CUSTOMER SIDE BY 2.5 psi.
- 8) OBSERVE WHETHER THE 5.0 psi SPLIT IS MAINTAINED, RECORD RESULTS. IF SPLIT CAN BE MAINTAINED WITH CONTROL VALVES CLOSED, CHECK HOLDS TIGHT IF NOT SEE TROUBLE SHOOTING GUIDE.
- 9) CLOSE ALL TEST COCKS. **OPEN #1 AND #2 SHUT-OFF VALVE**. REMOVE HOSES, AND NOTIFY CUSTOMER WATER SERVICE IS BACK ON.

BACKFLOW PREVENTER TESTING AND MAINTENANCE  
TROUBLE SHOOTING GUIDE  
**DOUBLE CHECK VALVE ASSEMBLY**

**NOTE: MANY PROBLEMS CAN BE CORRECTED BY CLEANING THE INTERNAL COMPONENTS. CAREFULLY OBSERVE CONDITION OF ALL COMPONENTS.**

PROBLEM	MAY BE CAUSED BY
DURING CONFORMATION TEST NEEDLES ON TEST KIT BOTH INCREASE IN PRESSURE.	#1 SHUT-OFF VALVE LEAKS.
DURING CONFORMATION TEST NEEDLES BOTH FALL TO ZERO.	#2 SHUT-OFF VALVE LEAKS. (NO BACK PRESSURE EXISTS)
DURING CONFORMATION TEST NEEDLES CONVERGE.	CHECK VALVE LEAKS.
LEAKY CHECK VALVE	1. DIRTY OR DAMAGED DISC. 2. DIRTY OR DAMAGED SEAT. 3. GUIDE MEMBERS HANGING UP. 4. WEAK OR BROKEN SPRING.

**REPAIR NOTE: LUBRICANTS SHALL ONLY BE USED TO ASSIST WITH THE REASSEMBLY OF COMPONENTS, AND SHALL NOT BE TOXIC. USE ONLY FOOD-GRADE LUBRICANTS.**

RESULTS OF THE CONFIRMATION TEST ON THE DOUBLE CHECK VALVE ASSEMBLY. THE MOVEMENT OF THE TWO DUPLEX GAUGE NEEDLES WILL INDICATE WHETHER THE CHECK VALVE IS HOLDING TIGHT AGAINST BACK PRESSURE AND, WHETHER ONE OF THE SHUT-OFF VALVES IS LEAKING.

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**CITY OF CHARLOTTE  
CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT  
CROSS CONNECTION CONTROL AND BACKFLOW  
PREVENTION PROGRAM QUESTIONNAIRE**

PROPERTY OWNER:  
 FIRST NAME: \_\_\_\_\_ LAST NAME: \_\_\_\_\_  
 COMPANY NAME: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_  
 CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP CODE: \_\_\_\_\_

TENANT NAME (if different): \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_  
 CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP CODE: \_\_\_\_\_

CONTACT COMPANY NAME: \_\_\_\_\_  
 CONTACT NAME: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_  
 CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP CODE: \_\_\_\_\_

ADDRESS OF PROPERTY: \_\_\_\_\_  
 CITY: \_\_\_\_\_ ZIP CODE: \_\_\_\_\_

1. Type of facility (i.e., commercial, industrial, medical, institutional): \_\_\_\_\_
2. Type of operation (i.e., retail container co., warehouse, mfg plant): \_\_\_\_\_

Please list Standard Industrial Code (S.I.C. #): \_\_\_\_\_

3. List type(s) equipment used in your facility (i.e., chemical feed tanks, mixing vats, dishwashers, booster pumps, cooling towers): \_\_\_\_\_

- |  |     |    |
|--|-----|----|
| 4. Is there any mixing of water and other substances in your operation?  | YES | NO |
| 5. Are there any toxic chemicals used in your operation?   | YES | NO |
| 6. Does your cooling system utilize recycled water?  | YES | NO |
| 7. Are there any other sources of water to your property for fire protection or additional storage (i.e., private well, elevated storage fed from a well)? | YES | NO |
| 8. Is this service for lawn irrigation only?   | YES | NO |
| WILL SYSTEM USE CHEMICALS?   | YES | NO |

This questionnaire must be submitted with payment of water service connection fee. The information on this questionnaire will assist in determining the hazard classification of your facility. In the event that the information provided is inaccurate or changes, the hazard classification and the type of backflow prevention assembly required may be revised. If no information can be provided, the location will be classified as a high hazard. If you have any questions, please contact the Cross Connection Control Section at (704) 399-2551. Keep a copy for your records.

COMPLETED BY PUBLIC SERVICE: \_\_\_\_\_

COMPLETED BY SYSTEMS & RECORDS: \_\_\_\_\_

DEVELOPER INSTALLED METER ( Y/N ) ? \_\_\_\_\_  
 CMUD PROJECT NAME: \_\_\_\_\_  
 CMUD JOB NUMBER: \_\_\_\_\_  
 DATE: \_\_\_\_\_  
 SERVICE # \_\_\_\_\_  
 METER SIZE: \_\_\_\_\_  
 TOPO NUMBER: \_\_\_\_\_  
 NUMBER OF SERVICES @ ADDRESS: \_\_\_\_\_  
 DOMESTIC, FIRE LINE, COMBINATION  
 OR IRRIGATION: \_\_\_\_\_

\_\_\_\_\_ HIGH OR MODERATE HAZARD  
 \_\_\_\_\_ DCVA OR RBPBA  
 \_\_\_\_\_ ASSESSMENT DATE  
 \_\_\_\_\_ NEW OR EXISTING SERVICE

**CITY OF CHARLOTTE**  
**CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT**  
**BACKFLOW PREVENTER**  
**TEST AND MAINTENANCE REPORT**

CUSTOMER: \_\_\_\_\_  
 ADDRESS OF PROPERTY: \_\_\_\_\_  
 MAILING ADDRESS: \_\_\_\_\_  
 LOCATION OF ASSEMBLY: \_\_\_\_\_

TYPE OF ASSEMBLY: RP- DC- PVB  SIZE: \_\_\_\_\_

MANUFACTURER: \_\_\_\_\_ MODEL: \_\_\_\_\_ SERIAL NO. \_\_\_\_\_  
 TIME OF TEST: \_\_\_\_\_

TYPE OF SERVICE: \_\_\_\_\_  
 DOM.  IRRIG.  F.L.  COMBINATION (DOM. & F.L.)

CHECK VALVE #1	RELIEF VALVE	CHECK VALVE #2	PRESSURE VACUUM BREAKER
<input type="checkbox"/> LEAKED <input type="checkbox"/> CLOSED TIGHT  DIFF. PRESSURE ACROSS CHECK VALVE _____ PSID	OPENED AT _____ PSID  DID NOT OPEN <input type="checkbox"/>	<input type="checkbox"/> LEAKED <input type="checkbox"/> CLOSED TIGHT DIFF. PRESSURE ACROSS CHECK VALVE _____ PSID	AIR INLET OPENED AT _____ PSID DIDN'T OPEN <input type="checkbox"/> CHECK VALVE: LEAKED <input type="checkbox"/> HELD AT _____ PSID
<input type="checkbox"/> CLEANED ONLY  REPLACED: RUBBER KIT <input type="checkbox"/> CV ASSEMBLY <input type="checkbox"/> OR DISC <input type="checkbox"/> O-RINGS <input type="checkbox"/> SEAT <input type="checkbox"/> SPRING <input type="checkbox"/> STEM/GUIDE <input type="checkbox"/> RETAINER <input type="checkbox"/> LOCK NUTS <input type="checkbox"/> OTHER <input type="checkbox"/>	<input type="checkbox"/> CLEANED ONLY  REPLACED: RUBBER KIT <input type="checkbox"/> RV ASSEMBLY <input type="checkbox"/> OR DISC <input type="checkbox"/> O-RINGS <input type="checkbox"/> SEAT <input type="checkbox"/> SPRING <input type="checkbox"/> GUIDE <input type="checkbox"/> DIAPHRAGM <input type="checkbox"/> OTHER <input type="checkbox"/>	<input type="checkbox"/> CLEANED ONLY  REPLACED: RUBBER KIT <input type="checkbox"/> CV ASSEMBLY <input type="checkbox"/> OR DISC <input type="checkbox"/> O-RINGS <input type="checkbox"/> SEAT <input type="checkbox"/> SPRING <input type="checkbox"/> STEM/GUIDE <input type="checkbox"/> RETAINER <input type="checkbox"/> LOCK NUTS <input type="checkbox"/> OTHER <input type="checkbox"/>	<input type="checkbox"/> CLEANED ONLY  REPLACED: RUBBER KIT <input type="checkbox"/> CV ASSEMBLY <input type="checkbox"/> DISC, AIR <input type="checkbox"/> DISC, CV <input type="checkbox"/> SPRING, AIR <input type="checkbox"/> SPRING, CV <input type="checkbox"/> RETAINER <input type="checkbox"/> GUIDE <input type="checkbox"/> O-RING <input type="checkbox"/> OTHER <input type="checkbox"/>
<input type="checkbox"/> CLOSED TIGHT  DIFF. PRESSURE ACROSS CHECK VALVE _____ PSID	OPENED AT _____ PSID	<input type="checkbox"/> CLOSED TIGHT  DIFF. PRESSURE ACROSS CHECK VALVE _____ PSID	AIR INLET _____ PSID  CHECK VALVE _____ PSID

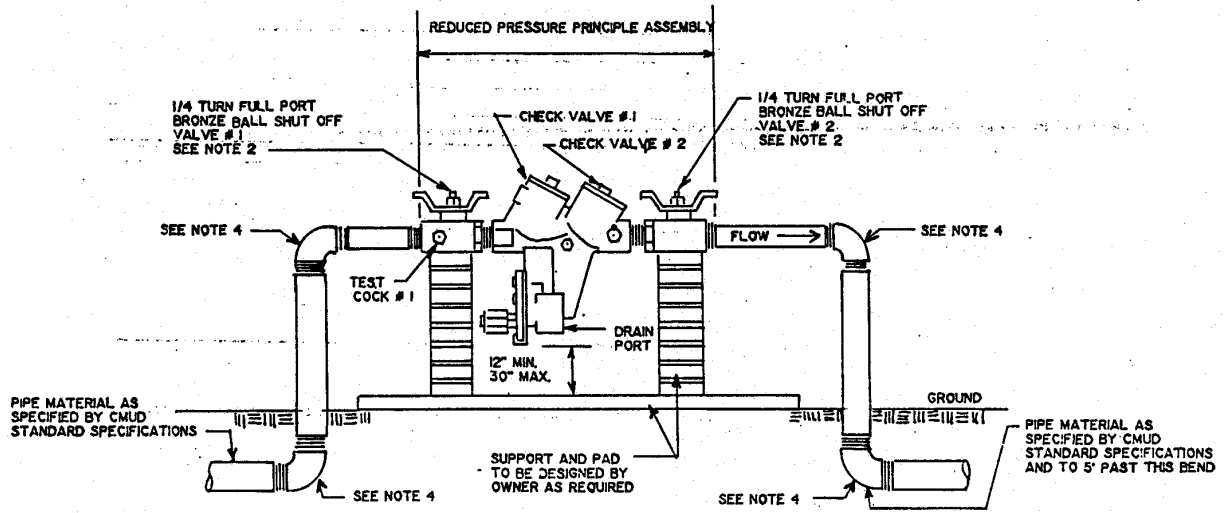
**NOTE: ALL REPAIRS MUST BE COMPLETED WITHIN (10) DAYS.**

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

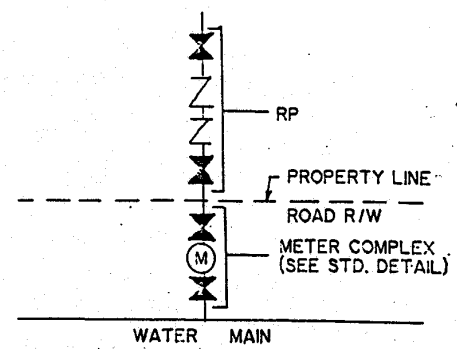
I HEREBY CERTIFY THAT THIS DATA IS ACCURATE AND REFLECTS THE PROPER OPERATION AND MAINTENANCE OF THE ASSEMBLY.

TESTER: \_\_\_\_\_ CERT. NO.: \_\_\_\_\_ DATE: \_\_\_\_\_  
 TEST KIT: DIFFERENTIAL  DUPLEX  ELECTRONIC

CERT. NO.: \_\_\_\_\_ MANUFACTURER: \_\_\_\_\_



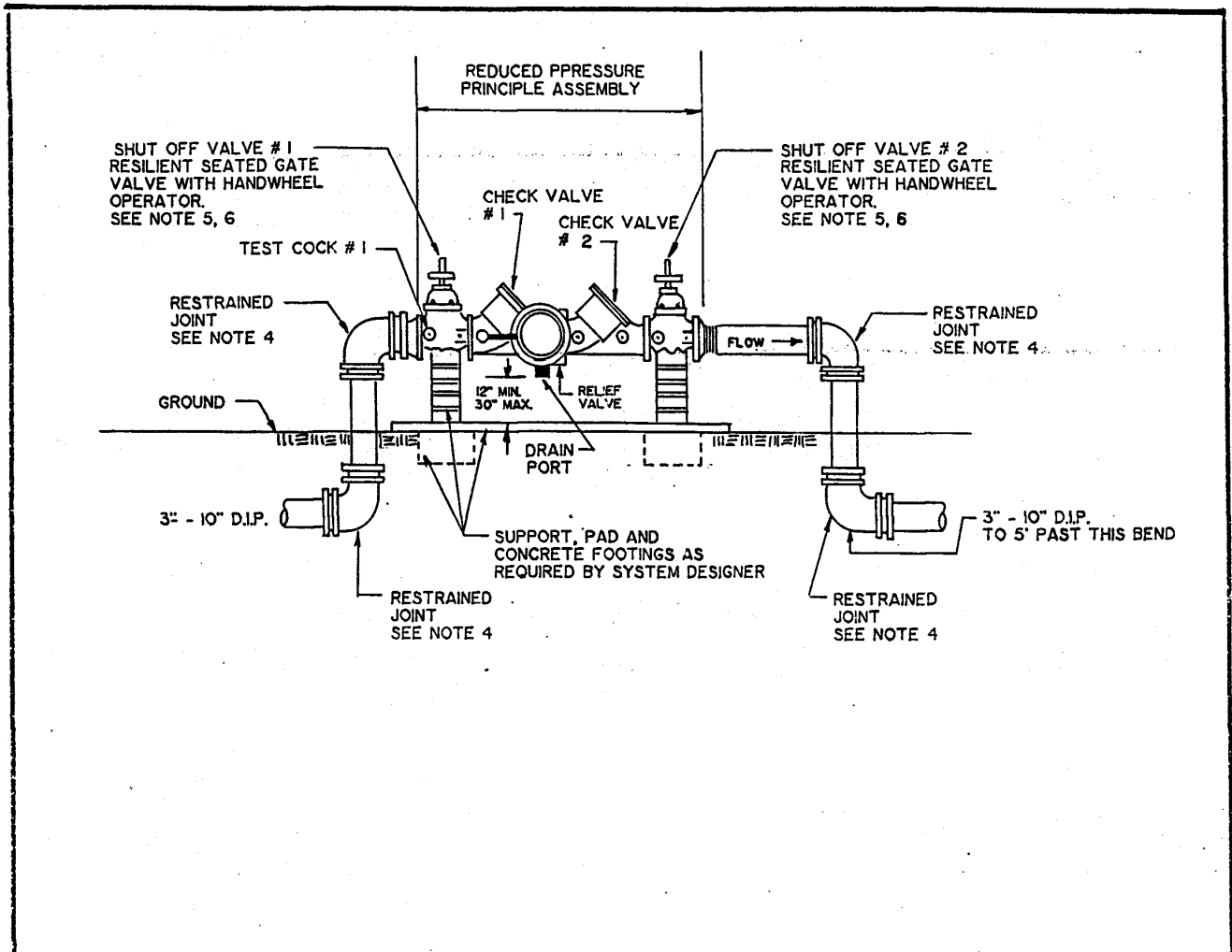
- NOTES**
1. REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RP) MUST CONFORM TO CMUD SPECIFICATIONS.
  2. THE CMUD APPROVED 3/4" - 2" RP INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
  3. IF OUTDOOR INSTALLATION HAS PROTECTIVE COVERING, IT SHALL BE AS SPECIFIED IN CMUD SPECIFICATIONS FOR INSTALLATION OF BACKFLOW PREVENTION ASSEMBLIES.
  4. FITTINGS SHALL BE AS SPECIFIED IN CMUD STANDARD SPECIFICATIONS.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY.
  6. ABOVE GROUND INSTALLATIONS MUST BE LOCATED OUTSIDE ZONING SETBACK AREAS.



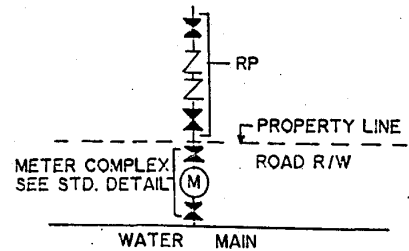
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL BACKFLOW PREVENTION</b>	
PLAN	Scale: NTS	<b>REDUCE PRESSURE PRINCIPLE ASSEMBLY (RP) 3/4" - 2"</b>	
PROFILE	Hor. _____ Vert. _____		
As Built	Date	J.S.	JAT
Surveyed By	Designed By	Drawn By	Project-Eng
		Approved By	JAT
		Date	6-3-94
		Sheet	1
		Of	12

No	Date	By	Reason
2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY MBM COMMITTEE

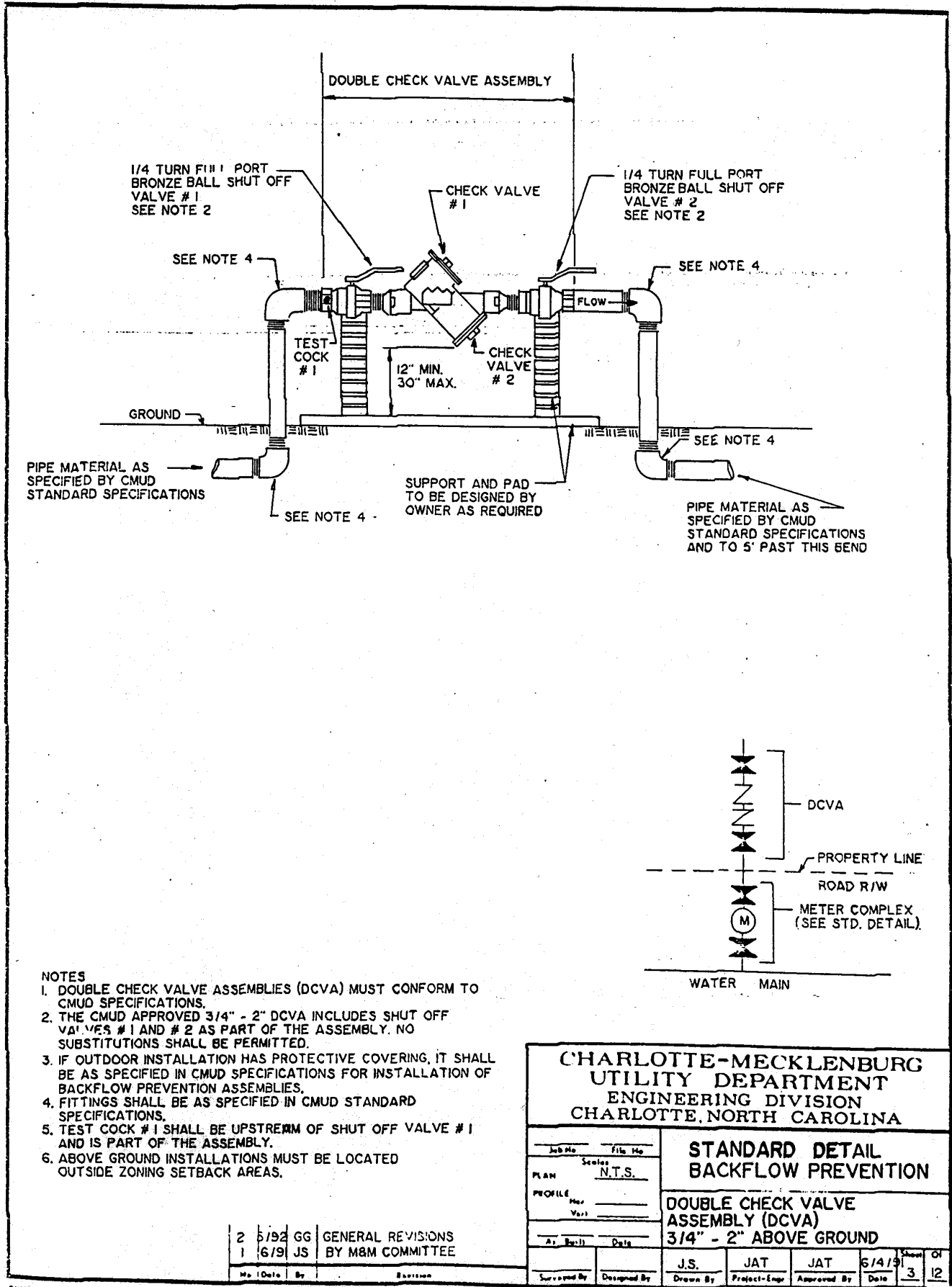


- NOTES:
1. REDUCED PRESSURE ASSEMBLIES (RP) MUST CONFORM TO CMUD SPECIFICATIONS.
  2. 8" - 10" RP SHALL BE SUPPORTED AT CENTER WITH BRICK PEDESTAL AND SHALL NOT BLOCK RELIEF VALVE ON DRAIN PORT.
  3. IF OUTDOOR INSTALLATION HAS PROTECTIVE COVERING IT SHALL BE AS SPECIFIED IN CMUD SPECIFICATIONS FOR INSTALLATION OF BACKFLOW PREVENTION ASSEMBLIES.
  4. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS, OR APPROVED EQUAL.
  5. THE CMUD APPROVED 3" - 10" RP INCLUDES SHUT OFF VALVES #1 AND #2, AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
  6. FIRE LINE SERVICES SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HANDWHEEL OPERATORS.
  7. TEST COCK #1 SHALL BE UPSTREAM OF SHUT OFF VALVE #1 AND IS PART OF THE APPROVED ASSEMBLY.
  8. ABOVE GROUND INSTALLATIONS MUST BE LOCATED OUTSIDE ZONING SETBACK AREAS.



<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>					
Job No. _____ File No. _____			<b>STANDARD DETAIL BACKFLOW PREVENTION</b>		
Scale: _____					
PLAN _____			<b>REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP) 2-1/2" - 10"</b>		
PROFILE _____					
As Built _____ Date _____			J.S. JAT JAT 5/30/81		
Drawn By _____			Project-Engr _____		
Designed By _____			Approved By _____		
No. _____ Date _____ By _____ Revision _____			Date _____ Sheet 2 of 12		





DOUBLE CHECK VALVE ASSEMBLY

1/4 TURN FULL PORT BRONZE BALL SHUT OFF VALVE # 1 SEE NOTE 2

CHECK VALVE # 1

1/4 TURN FULL PORT BRONZE BALL SHUT OFF VALVE # 2 SEE NOTE 2

SEE NOTE 4

TEST COCK # 1

12" MIN. 30" MAX.

CHECK VALVE # 2

FLOW

SEE NOTE 4

GROUND

SEE NOTE 4

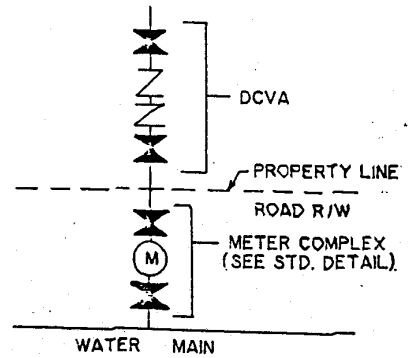
PIPE MATERIAL AS SPECIFIED BY CMUD STANDARD SPECIFICATIONS

SUPPORT AND PAD TO BE DESIGNED BY OWNER AS REQUIRED

SEE NOTE 4

PIPE MATERIAL AS SPECIFIED BY CMUD STANDARD SPECIFICATIONS AND TO 5' PAST THIS BEND

- NOTES
1. DOUBLE CHECK VALVE ASSEMBLIES (DCVA) MUST CONFORM TO CMUD SPECIFICATIONS.
  2. THE CMUD APPROVED 3/4" - 2" DCVA INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
  3. IF OUTDOOR INSTALLATION HAS PROTECTIVE COVERING, IT SHALL BE AS SPECIFIED IN CMUD SPECIFICATIONS FOR INSTALLATION OF BACKFLOW PREVENTION ASSEMBLIES.
  4. FITTINGS SHALL BE AS SPECIFIED IN CMUD STANDARD SPECIFICATIONS.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE ASSEMBLY.
  6. ABOVE GROUND INSTALLATIONS MUST BE LOCATED OUTSIDE ZONING SETBACK AREAS.



CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

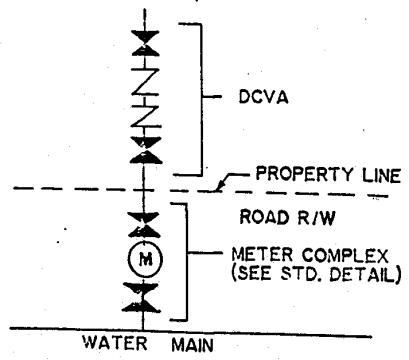
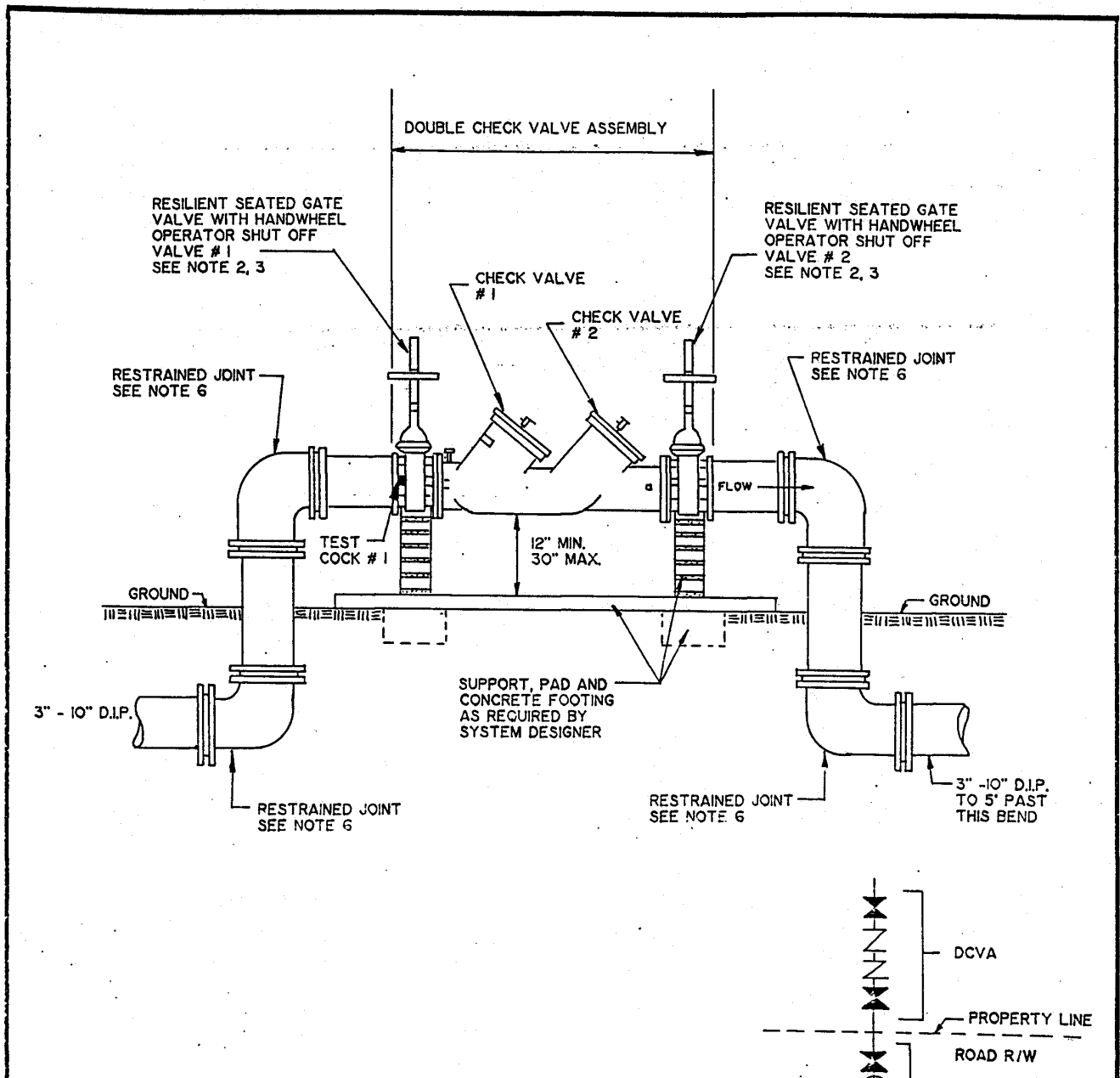
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PLAN _____		Scale N.T.S.	
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By _____		Date _____	
Checked By _____		Designed By _____	
Drawn By _____		Project-Engr _____	
Approved By _____		Approved By _____	
Date 6/4/91		Date _____	
Sheet 3		Of 12	

STANDARD DETAIL  
BACKFLOW PREVENTION

DOUBLE CHECK VALVE  
ASSEMBLY (DCVA)  
3/4" - 2" ABOVE GROUND

2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY M&M COMMITTEE
No.	Date	By	Revision

CUNGAN-PARNELL, INC., CHARLOTTE 487 704-372-7786



- NOTE
1. DOUBLE CHECK VALVE ASSEMBLIES (DCVA) MUST CONFORM TO CMUD SPECIFICATIONS.
  2. THE CMUD APPROVED DCVA INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
  3. FIRE LINE SERVICES SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HANDWHEEL OPERATORS.
  4. 8" - 10" DCVA SHALL BE SUPPORTED AT CENTER WITH BRICK PEDESTAL.
  5. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS OR APPROVED EQUAL.
  6. TEST COCK # 1 SHALL BE UPST REAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY.
  7. IF OUTDOOR INSTALLATION HAS PROTECTIVE COVERING, IT SHALL BE AS SPECIFIED IN CMUD SPECIFICATIONS FOR INSTALLATION OF BACKFLOW PREVENTION ASSEMBLIES.
  8. ABOVE GROUND INSTALLATIONS MUST BE LOCATED OUTSIDE ZONING SETBACK AREAS.

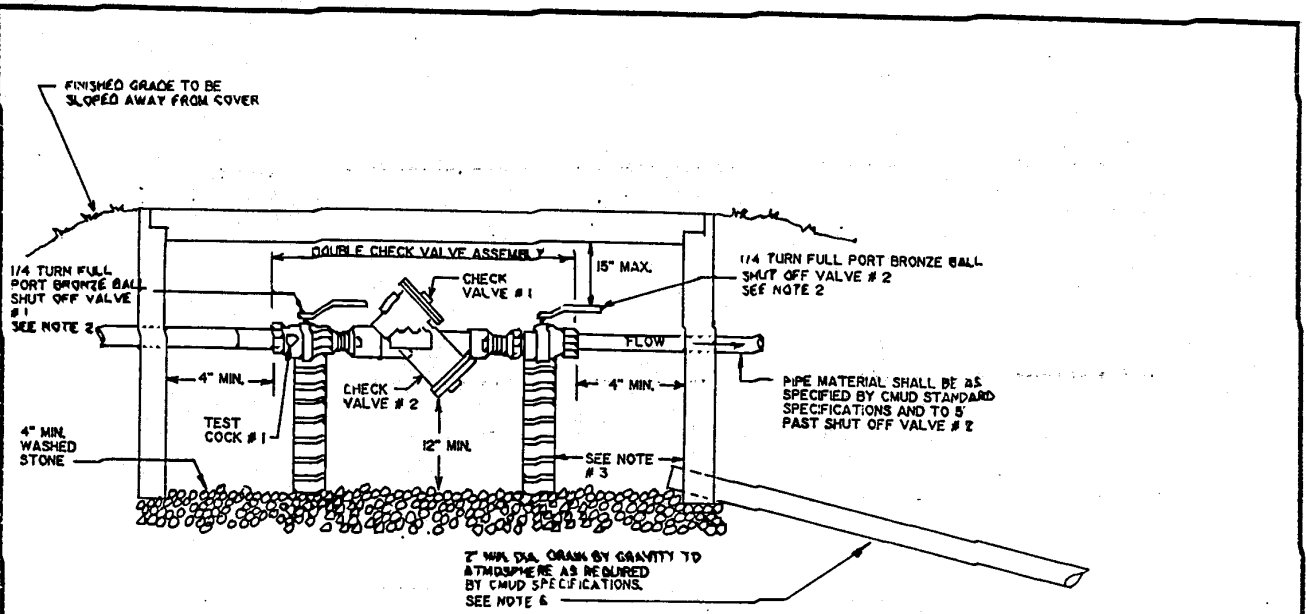
2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY M&M COMMITTEE
No	Date	By	Revision

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UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

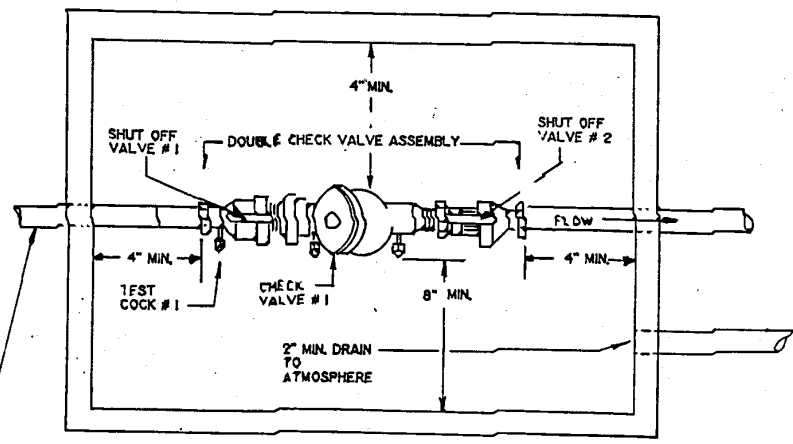
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 2-1/2" - 10" ABOVE GROUND**

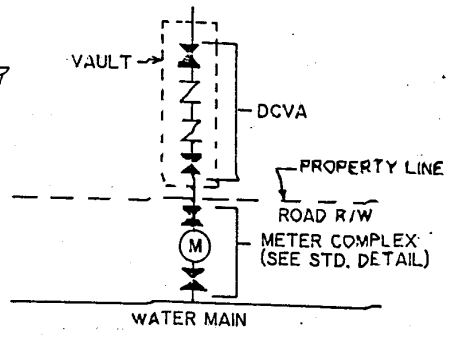
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PLAN	N.T.S.		
PROFILE	Hor	Vert	
As	By	Date	
Surveyed By	Designed By	Drawn By	Project-Engr
JS	JAT	JAT	6/4/91
Approved By		Date	Sheet
		4	12



**ELEVATION VIEW**



**PLAN VIEW**



- NOTES:**
1. DCVA MUST CONFORM TO CMUD SPECIFICATIONS FOR BACKFLOW PREVENTION ASSEMBLIES 3/4" & 1".
  2. CMUD APPROVED DCVA'S INCLUDE SHUT OFF VALVE # 1 AND # 2. NO SUBSTITUTIONS SHALL BE PERMITTED.
  3. VAULT, DOORS OR COVERS AND SUPPORT OF ASSEMBLY SHALL BE DESIGNED BY OWNER AND AS REQUIRED.
  4. IF DRAINAGE CANNOT BE PROVIDED TO FREE ATMOSPHERE OR STORM DRAINAGE, THE DCVA'S SHALL BE INSTALLED ABOVE GROUND.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY. ALL TEST COCKS MUST BE ON ONE SIDE OR TOP. ASSEMBLIES SHALL BE INSTALLED UPRIGHT AND IN THE HORIZONTAL POSITION.
  6. DRAIN MAY BE PROVIDED AS SHOWN OR AS FLOOR DRAIN.

2	6/92	GG	GENERAL REVISIONS
1	6/91	JS	BY MBM COMMITTEE

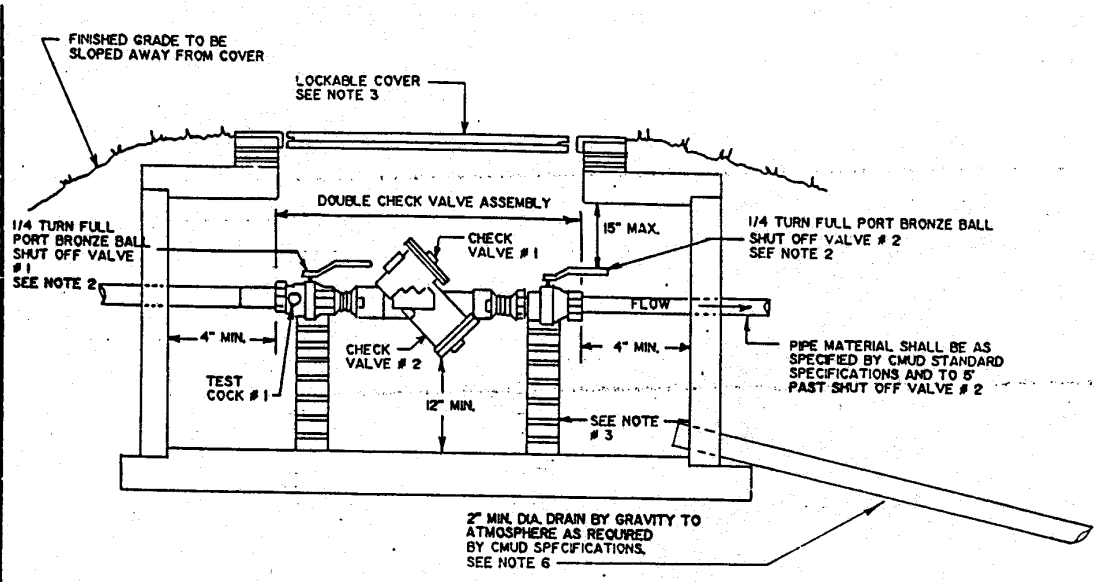
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UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

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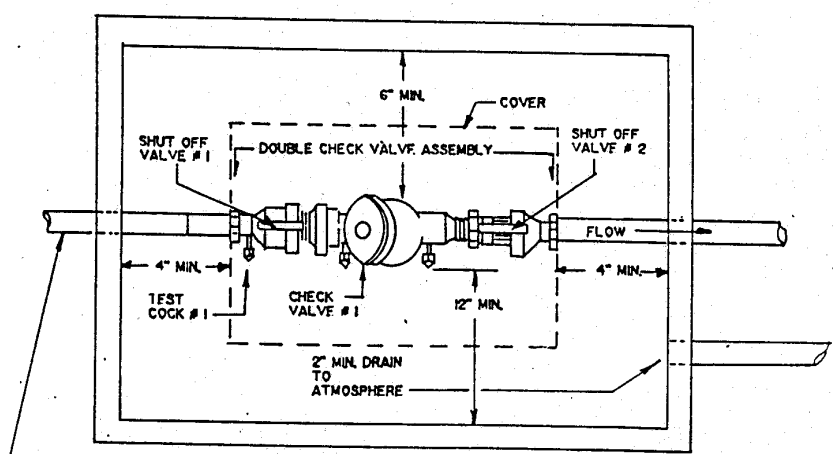
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 3/4" & 1" VAULT**

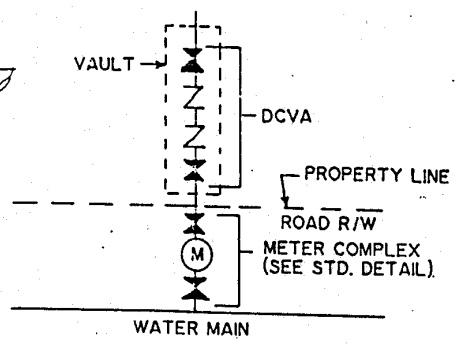
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PLAN		N.T.S.		
PROJECT	No.	DATE		
BY	DATE			
Checked By	Designed By	Drawn By	Project-Eng.	Approved By
		J.S.	JAT	JAT
			5/20/94	5
				12



**ELEVATION VIEW**



**PLAN VIEW**



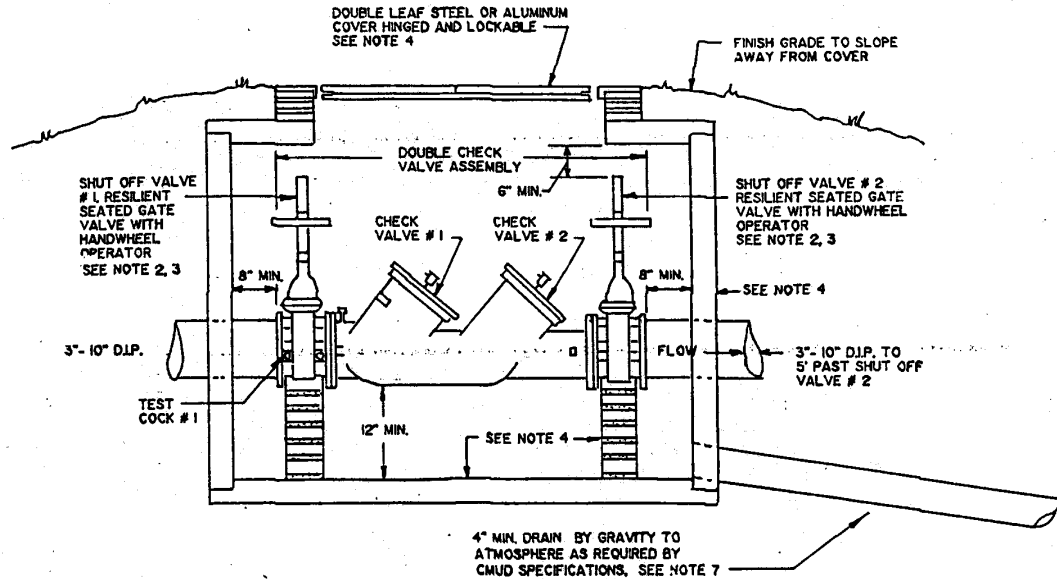
- NOTES:
1. DCVA MUST CONFORM TO CMUD SPECIFICATIONS FOR BACKFLOW PREVENTION ASSEMBLIES 1-1/2" & 2"
  2. CMUD APPROVED DCVA'S INCLUDE SHUT OFF VALVE # 1 AND # 2. NO SUBSTITUTIONS SHALL BE PERMITTED.
  3. VAULT, DOORS OR COVERS AND SUPPORT OF ASSEMBLY SHALL BE DESIGNED BY OWNER AND AS REQUIRED.
  4. IF DRAINAGE CANNOT BE PROVIDED TO FREE ATMOSPHERE OR STORM DRAINAGE, THE DCVA'S SHALL BE INSTALLED ABOVE GROUND.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY. ALL TEST COCKS MUST BE ON ONE SIDE OR TOP. ASSEMBLIES SHALL BE INSTALLED UPRIGHT AND IN THE HORIZONTAL POSITION.
  6. DRAIN MAY BE PROVIDED AS SHOWN OR AS FLOOR DRAIN.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

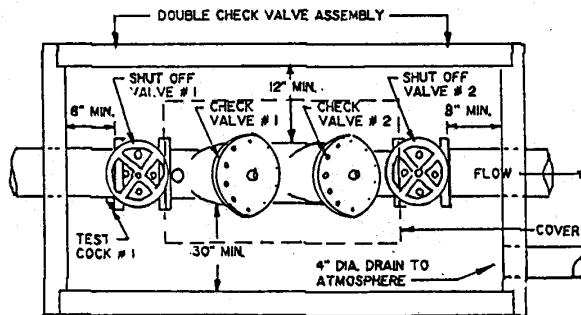
STANDARD DETAIL BACKFLOW PREVENTION	
DOUBLE CHECK VALVE ASSEMBLY (DCVA) 1-1/2" & 2" VAULT	
Job No. _____ File No. _____	Scale: <u>N.T.S.</u>
PLAN _____	PROFILE _____
As Built _____	Date _____
Survived By _____	Designed By _____
Drawn By <u>J.S.</u>	Project-Eng. <u>JAT</u>
Approved By <u>JAT</u>	Date <u>5/30/94</u>
Sheet <u>6</u>	Of <u>12</u>

No.	Date	By	Revision
2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY MBM COMMITTEE

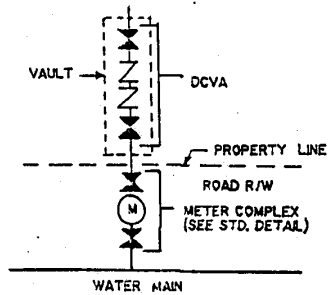
CUNGAN-PARNELL, INC., CHARLOTTE 487 704-373-7788



**ELEVATION**



**PLAN**

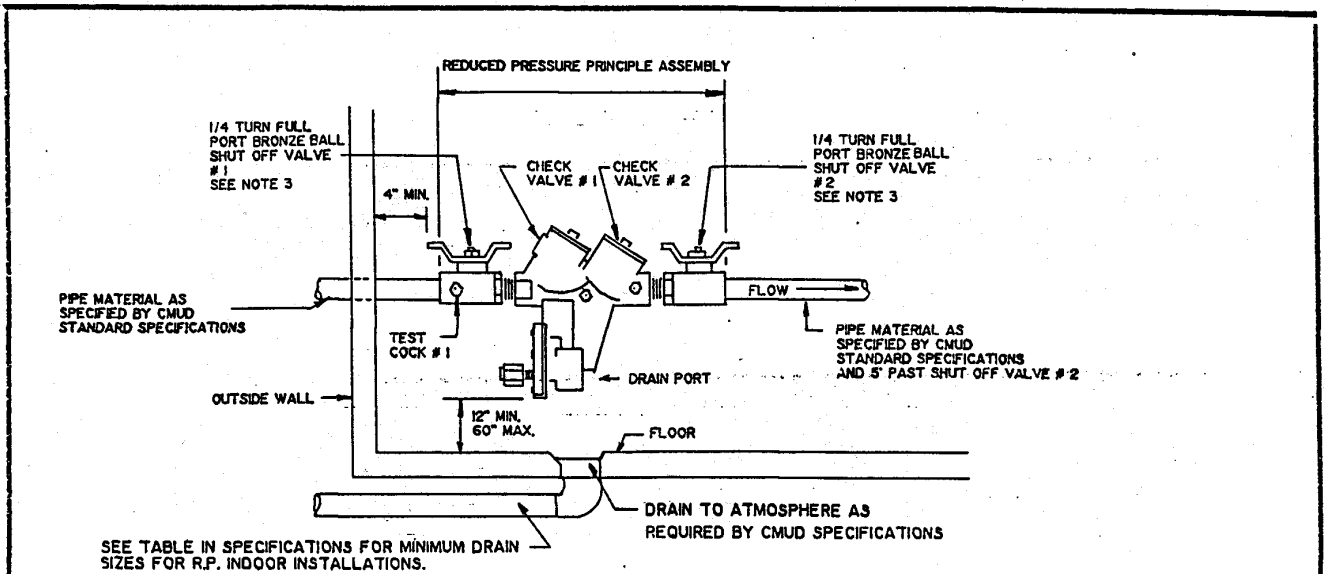


- NOTES:
1. DCVA'S MUST CONFORM TO CMUD SPECIFICATIONS.
  2. CMUD APPROVED DCVA INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE UNIT. NO SUBSTITUTIONS SHALL BE PERMITTED. 6" CLEARANCE SHALL BE WITH VALVE OPEN.
  3. FIRE LINE INSTALLATIONS SHALL HAVE OUTSIDE STEM AND YOKE (OS&Y) HANDWHEEL OPERATORS.
  4. VAULT, DOORS OR COVERS AND SUPPORT OF ASSEMBLY... SHALL BE DESIGNED BY OWNER AS REQUIRED.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF ASSEMBLY.
  6. IF DRAINAGE CANNOT BE PROVIDED TO FREE ATMOSPHERE OR STORM DRAINAGE, THE DCVA SHALL BE INSTALLED ABOVE GROUND.
  7. DRAINAGE MAY BE PROVIDED AS SHOWN OR AS FLOOR DRAIN.

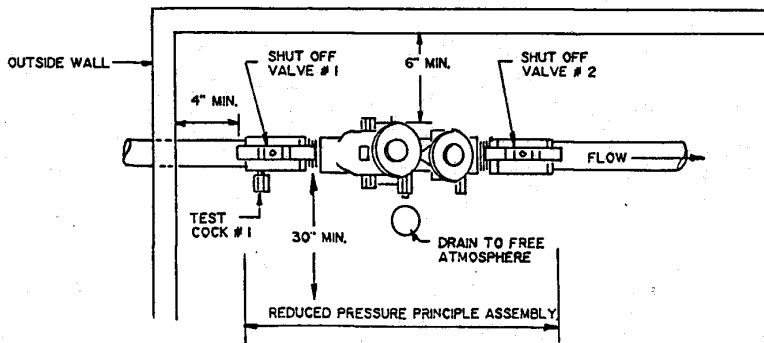
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____		File No. _____		<b>STANDARD DETAIL BACKFLOW PREVENTION</b>	
PLAN		Scale: N.T.S.			
PROFILE		Vert. _____		<b>DOUBLE CHECK VALVE ASSEMBLY (DCVA) 2-1/2" - 10" VAULT</b>	
As Built		Date			
Surveyed By	Designed By	Drawn By	Project-Eng.	Approved By	Date
		JS	JAT	JAT	5/30/97
					Sheet <b>7</b> of <b>12</b>

No.	Date	By	Revision
2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY M&M COMMITTEE



ELEVATION VIEW



PLAN VIEW

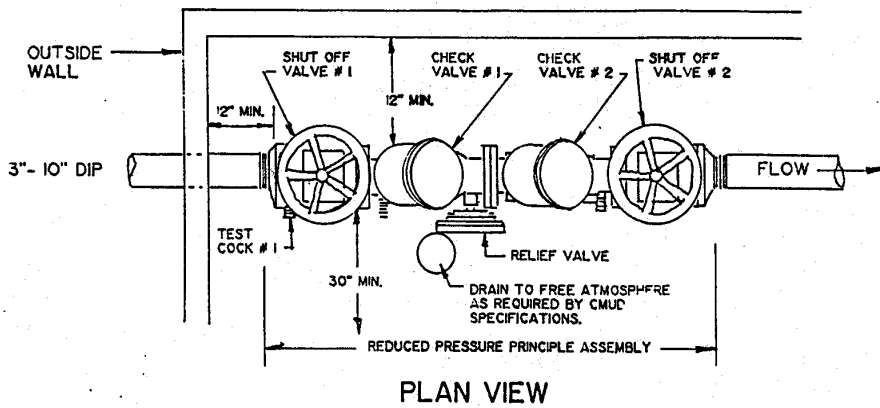
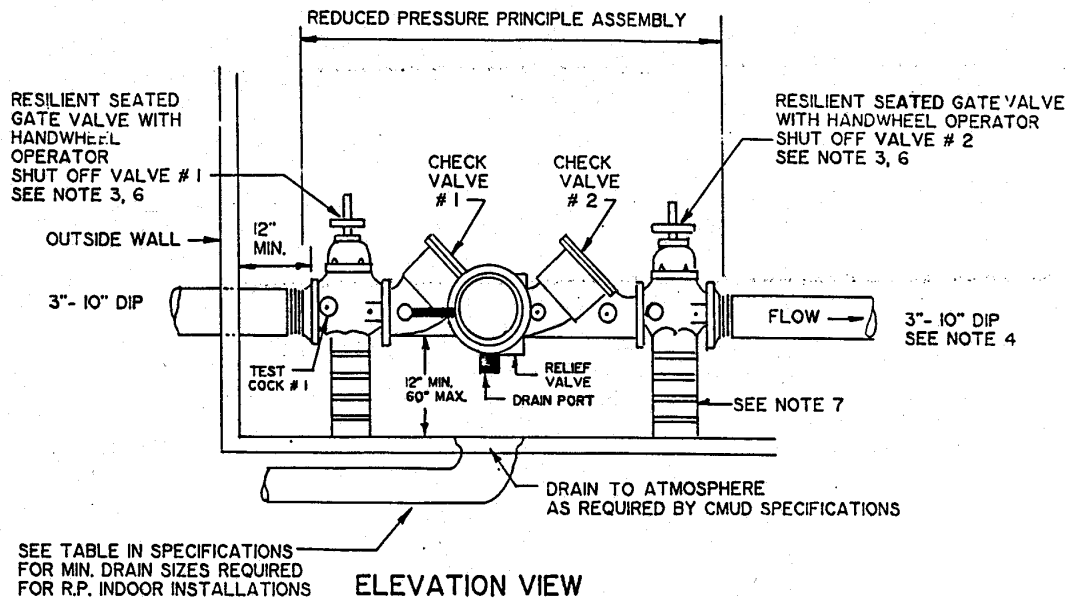
NOTES:

1. INDOOR INSTALLATION SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. CMUD SHALL REVIEW ON A CASE BY CASE BASIS.
2. THE 3/4" - 2" RP MUST CONFORM TO CMUD STANDARDS FOR BACKFLOW PREVENTION ASSEMBLIES.
3. CMUD APPROVED 3/4" - 2" RP INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
4. SUPPORT FOR ASSEMBLY SHALL BE DESIGNED BY OWNER AS REQUIRED.
5. AN AIR-GAP DRAIN IS RECOMMENDED TO REDUCE SPLASHING OF MINOR DISCHARGES FROM THE RELIEF VALVE DRAIN PORT.
6. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY ALL TEST COCKS MUST BE ON ONESIDE OR TOP. ASSEMBLIES SHALL BE INSTALLED UPRIGHT AND IN THE HORIZONTAL POSITION.

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CHARLOTTE, NORTH CAROLINA

Job No. _____ File No. _____		STANDARD DETAIL BACKFLOW PREVENTION	
Scale: N.T.S.			
PLAN	Sheet	REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP) 3/4" - 2" INDOOR	
PROFILE	Hor. Vert.		
As Built Date		Drawn By: J.S.	Project-Eng: JAT
Approved By: _____		Approved By: JAT	Date: 6-3-91
Sheet	Of		
8	12		

2	5/92	TR	GENERAL REVISION
1	6/91	J.S.	BY M&M COMMITTEE
No.	Date	By	Revision

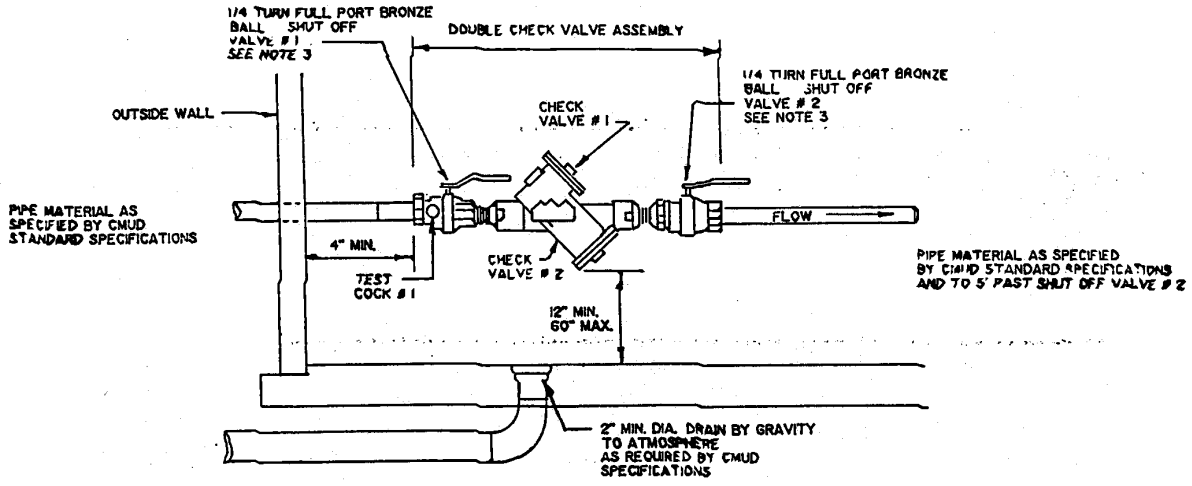


**NOTES:**

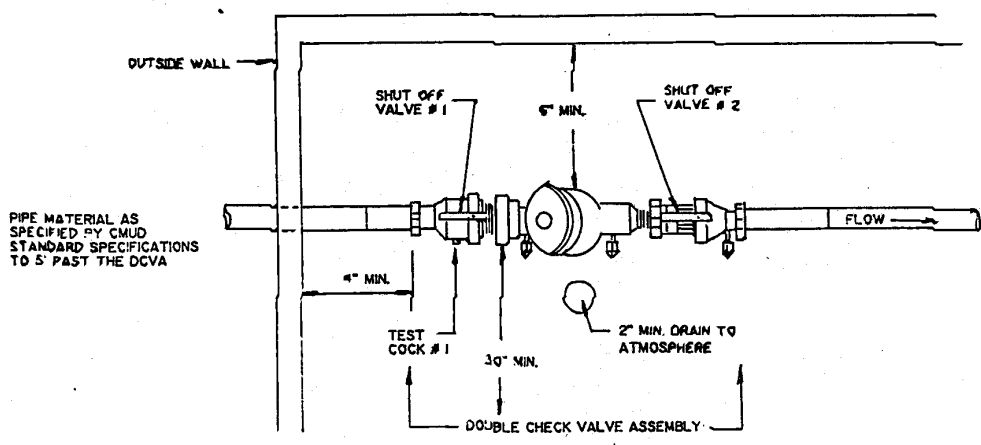
1. INDOOR INSTALLATIONS SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. CMUD SHALL REVIEW ON A CASE BY CASE BASIS.
2. REDUCED PRESSURE ASSEMBLIES (RP) MUST CONFORM TO CMUD SPECIFICATIONS.
3. THE CMUD APPROVED 3"- 10" RP INCLUDES SHUT OFF VALVE # 1 AND # 2. NO SUBSTITUTIONS SHALL BE PERMITTED.
4. ALL PIPE 3"- 10" SHALL BE DIP FROM THE TAP AT THE MAIN TO 5' PAST SHUT OFF VALVE # 2.
5. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS, OR APPROVED EQUAL.
6. FIRE LINE INSTALLATIONS SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HANDWHEEL OPERATOR.
7. SUPPORT OF 3"- 10" RP SHALL BE DESIGNED BY OWNER. IT IS RECOMMENDED 8"- 10" RP BE SUPPORTED AT CENTER. THE SUPPORT SHALL NOT BLOCK RELIEF VALVE OR DRAIN PORT.
8. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY.
9. AN AIR-GAP DRAIN IS RECOMMENDED TO REDUCE SPLASHING OF MINOR DISCHARGE FROM THE RELIEF VALVE DRAIN PORT.

2	5/92	GG	GENERAL REVISIONS
1	7/91	J.S.	BY M&M COMMITTEE

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>					
Job No. _____ Scale: <b>N.T.S.</b>			<b>STANDARD DETAIL BACKFLOW PREVENTION</b>		
PLAN PROFILE			<b>REDUCE PRESSURE PRINCIPLE ASSEMBLY (RP) 2-1/2" - 10" INDOOR</b>		
At Exit _____ Date _____					
Surveyed By	Designed By	Drawn By	Project-Eng.	Approved By	Sheet Of
JS	JAT	JAT	6-3-91	9	12



ELEVATION VIEW



PLAN VIEW

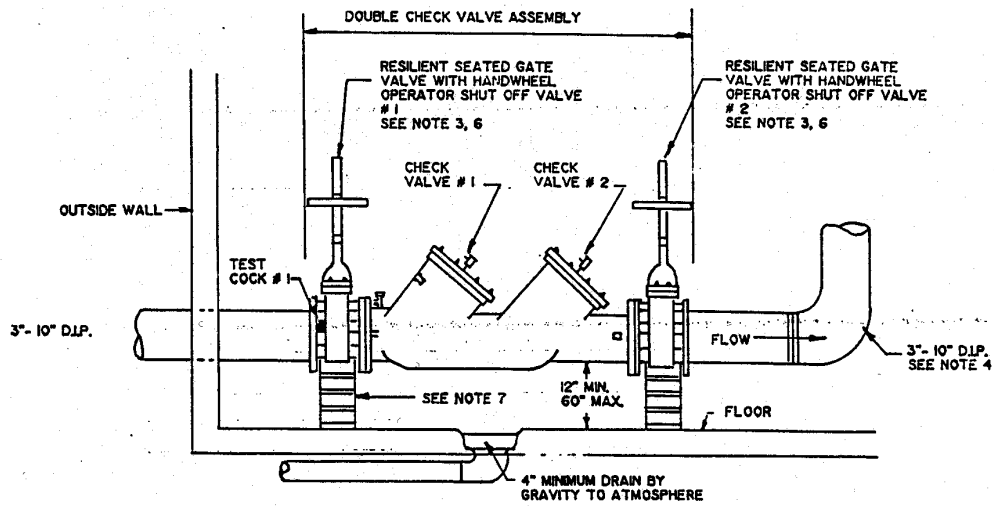
- NOTES:
1. INDOOR INSTALLATION SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. CMUD WILL REVIEW ON A CASE BY CASE BASIS.
  2. DCVA MUST CONFORM TO CMUD SPECIFICATIONS FOR BACKFLOW PREVENTION ASSEMBLIES 3/4"- 2".
  3. CMUD APPROVED DCVA INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
  4. SUPPORT OF BACKFLOW PREVENTION ASSEMBLY SHALL BE DESIGNED BY OWNER AS REQUIRED.
  5. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE ASSEMBLY.

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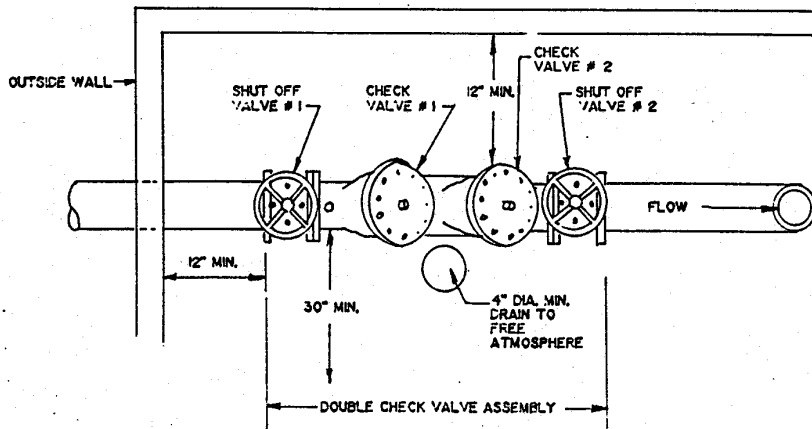
Job No. _____ File No. _____		<b>STANDARD DETAIL BACKFLOW PREVENTION</b>					
Scale: <b>N.T.S.</b>							
PLAN	NO. OF 11	<b>DOUBLE CHECK VALVE ASSEMBLY (DCVA) 3/4"- 2" INDOOR</b>					
DATE	YEAR						
As Built	Date	JS	JAT	JAT	6-4-91	Sheet	Of
Surveyed By	Designed By	Drawn By	Project-Engr	Approved By	Date	10	12

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1	7/91	JS	BY M&M COMMITTEE





ELEVATION VIEW



PLAN VIEW

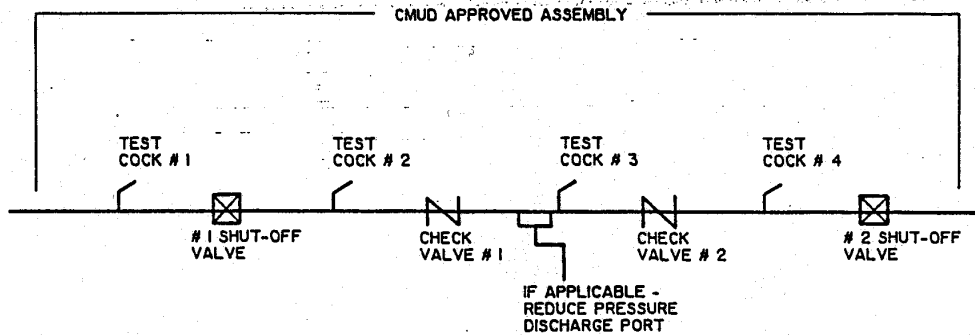
NOTES:

1. INDOOR INSTALLATIONS SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE IS NOT AVAILABLE OUTSIDE. CMUD WILL REVIEW THESE ON A CASE BY CASE BASIS.
2. DCVA MUST CONFORM TO CMUD SPECIFICATIONS.
3. CMUD APPROVED DCVA INCLUDES SHUT OFF VALVES # 1 AND # 2 AS PART OF THE ASSEMBLY. NO SUBSTITUTIONS SHALL BE PERMITTED.
4. ALL PIPE 3"- 10" SHALL BE D.I.P. FROM THE TAP AT THE MAIN TO 5' PAST THE SHUT OFF VALVE # 2
5. RESTRAINED JOINTS SHALL BE WITH MEGA LUG RESTRAINTS OR APPROVED EQUAL.
6. FIRE LINE INSTALLATIONS SHALL HAVE OUTSIDE STEM AND YOKE (OS & Y) HANDWHEEL OPERATORS.
7. SUPPORT OF 3"- 10" DCVA SHALL BE DESIGNED BY OWNER. IT IS RECOMMENDED 8"- 10" DCVA BE SUPPORTED AT CENTER.
8. TEST COCK # 1 SHALL BE UPSTREAM OF SHUT OFF VALVE # 1 AND IS PART OF THE APPROVED ASSEMBLY.

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CHARLOTTE, NORTH CAROLINA

Job No. _____	File No. _____	STANDARD DETAIL BACKFLOW PREVENTION			
PLAN _____	Scale N.T.S.				
PROFILE _____	Hor _____	DOUBLE CHECK VALVE ASSEMBLY (DCVA) 2 1/2" - 10" INDOOR			
As Built _____	Date _____				
Drawn By JS	Project-Eng JAT	JAT	S-SL:91	Sheet 11	Of 12
Designed By _____	Approved By _____	Date _____			

No. 2	Date 5/92	By TR	Revision GENERAL REVISION
1	7/91	JS	BY M&M COMMITTEE



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<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>					
Job No. _____		File No. _____		<b>STANDARD DETAIL BACKFLOW PREVENTION</b>	
Scales _____					
PLAN _____		_____		<b>TEST COCK LOCATION</b>	
PROFILE _____		_____			
_____		_____		_____	
As Built _____		Date _____		_____	
Surveyed By	Designed By	Drawn By	Project-Engr	Approved By	Date
TAR	JAT	JAT	5/92	Sheet	Of
				12	12

No.	Date	By	Revision

## **XIV. STANDARD WATER SPECIFICATIONS AND DETAILS**

**DESCRIPTION:** All materials, equipment, and labor for water main construction shall be furnished in accordance with these specifications and in accordance with the Plans prepared by a Registered Professional Engineer licensed to practice in the state of North Carolina.

### **MATERIAL SPECIFICATIONS**

Unless superseded or modified in the Detailed Specifications, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications contained in this Section. National material standards (ASTM, ANSI, AWWA, etc.) referred to herein shall be considered to be the latest revisions only.

#### **A. PIPE**

1. **Ductile Iron Pipe:** Ductile iron pipe shall conform to the requirements of AWWA Standard C-151 and shall have a cement-mortar lining of standard thickness in accordance with AWWA C-104. Unless otherwise shown on the construction plans, all ductile iron pipe shall be furnished with push on joints in accordance with AWWA C-111.

Sixteen (16) inch and larger diameter pipe shall be minimum Pressure Class 250. Also, the pipe class selection for 16-inch and larger pipe shall be based on the installation conditions. This pipe class shall be as shown on the plans and/or elsewhere in these specifications.

Twelve-inch (12") and smaller diameter pipe shall be Pressure Class 350.

- a. **Mechanical Joint Accessories:** Bolts and gaskets for mechanical joint pipe and fittings shall be furnished by the pipe/fitting manufacturer and shall conform to ANSI Specifications A21.11 (AWWA C-111).
- b. **Push-On Joint Material:** Gaskets for push-on pipe shall be furnished by the pipe manufacturer. Gaskets and gasket lubricant shall meet the requirements of ANSI Specification A21.11 (AWWA C-111).
- c. **Flange Joints And Accessories:** Flange joints shall be in accordance with ANSI A21.10 of either Class 125 or Class 250, as required. Flanges, flange bolts and nuts, and gaskets shall conform to the dimensional requirements of ANSI B16.1 for Class 125 or ANSI B16.2 for Class 250. Bolts shall have standard Hexagonal heads and shall be provided with standard hexagonal cold pressed nuts unless otherwise specified. Bolts and nuts shall be made of the best quality refined iron or mill steel and shall have sound, well fitting threads.
- d. **Restrained Joint Pipe:** Flexible restrained joints shall be supplied by the pipe manufacturer. Gaskets with vulcanized internal stainless steel locking segments may be used for 6-inch through 12-inch Ductile Iron Pipe. The following manufacturers are approved, U. S. Pipe and Field Lok Gasket. Only

designs using a welded retainer ring on the spigot will be allowed for 16-inch and larger diameter pipe. Push-on or mechanical joint designs may be used for the pipe and associated fittings. The following manufacturer's products are approved, American Lok Ring, American Lok Fast, Griffin Snap Lok, Griffin Bolt Lok, and U.S. Pipe TR Flex.

2. Polyvinyl Chloride (PVC) Pipe: Unless amended on the Construction Drawings or elsewhere in these specifications, all six, eight and twelve-inch water main pipe may be PVC 1120, in accordance with AWWA C-900. All 1-1/2" and 2" water main pipe shall be PVC 1120 in accordance with ASTM D-2241. The pipe shall be minimum Pressure Class 200 with a SDR of 14 or less for C-900 pipe and a SDR of 21 or less for ASTM 2241 pipe. PVC Pressure Pipe shall be made from white or blue pigmented virgin materials and shall be furnished in lengths of 20 feet. Lesser lengths will be accepted to allow the proper placement of fittings, valves, etc. All PVC Water Pipe will be shipped, stored, and strung at the project in such a manner as to be protected from total accumulated exposure to sunlight and possible ultraviolet radiation of no more than four (4) weeks.
  - a. Push on Joint: Pipe jointing will be by elastomeric joints only. Joints shall conform to ASTM D-3139 for two inch pipe and to AWWA C-900 for six, eight and twelve inch pipe.

Pipe bells, with gasket seats, shall be formed as the pipe is extruded. Sleeve couplings are not permitted except as specified in the DS Section for connections to existing mains or as necessary for repairs during pressure/leakage tests.
3. Reinforced Concrete Cylinder Pipe: All reinforced concrete water pipe furnished shall be either prestressed concrete cylinder type with rubber and steel joint, or prestressed concrete embedded cylinder type with rubber and steel joints all in compliance with AWWA C-301. The pipe shall be designed and furnished to fit the profile and head conditions shown on the Plans and hydrostatic tests herein specified, plus the standard allowance for water hammer. All connections for main line valves will be mechanical joint unless otherwise shown on the construction plans. Connections for side outlets will be flanged or mechanical joint as indicated on the Construction Plans.
4. Galvanized Steel Pipe: All steel pipe specified shall conform to the requirements of ASTM A-120. The pipe and fittings shall be Schedule 80 (extra strong) galvanized steel, with wall thickness as specified for each size in Table III of ASTM A-120, shall be furnished butt welded, and shall be of the standard length for such materials but not specifically of an exact length. Both ends of the pipe shall be furnished threaded with a coupling on one end. The pipe shall be marked as specified in ASTM A-120. The pipe, couplings, and fittings shall be manufactured in the United States.
5. Copper Tubing: Copper tubing shall be Type K, per ASTM B-88. End connections may be flared or compression. Copper services shall conform to AWWA C-800.

6. Polyethylene Tubing: Polyethylene water service tubing shall be manufactured in accordance with ASTM D-2737, using PE 3408 resin (ASTM D-1248, Type III, Class 5, Grade P34). Polyethylene water service tubing shall be SDR-9, 200 psi pressure rating and shall comply with AWWA C-901 and NSF 14.

## **B. FITTINGS**

1. Cast Fittings: Cast fittings furnished for ductile iron or PVC pipe may be pressure Class 250, cast from ductile iron or gray iron, in accordance with AWWA C-110 or pressure Class 350 compact fittings, cast from ductile iron, in accordance with AWWA C-153. Fittings shall be furnished with mechanical or flanged joints as indicated on the construction plans. All mechanical joint fittings will be Bell and Bell unless otherwise indicated on the plans. All cast fittings shall have a cement mortar lining of standard thickness in accordance with AWWA C-104. All fittings, including glands and bolts, shall be manufactured in domestic foundries.

2. Restrained Mechanical Joint Fittings:

Mechanical joint restraints may be through the use of a follower gland with restraining device that imparts a wedging action against the pipe. The restraining device shall have twist off nuts to ensure proper contact with the pipe. Glands and restraining devices shall be manufactured of Ductile Iron. The restraining devices shall be heat treated to a hardness of 370BHN. Gland dimensions shall be compatible with the MJ fittings hereinbefore specified. The restrained joint shall be rated for a minimum 250 PSI working pressure with a 2:1 safety factor.

Mechanical joint restraints may be through the use of a specially machined ductile iron ring and follower gland that is used with standard mechanical joint gaskets and T-bolts.

Retainer glands will not be permitted. Restrained mechanical joints will not be allowed on C-900 PVC pipe.

Restrained mechanical joints shall be Megalug as manufactured by Ebaa Iron, Inc., GripRing as manufactured by Romac Industries, Inc., or approved equal. Restrained joints may be used where shown on the plan, standard details or as approved by the Engineer.

3. Copper Fittings: Fittings for copper tubing and polyethylene tubing shall be red brass containing 85% copper, 5% lead, 5% tin, and 5% zinc in conformance with ASTM B-62. Fittings may be flared or compression as applicable, in accordance with AWWA C-800. Compression fittings shall utilize a compression nut and/or split clamp with tightening screw. Stab type fittings are not approved.
4. PVC Fittings: All fittings for six, eight and twelve inch PVC pipe shall be cast iron or ductile iron as specified below. Fittings for two inch PVC pipe shall be push on joint PVC or threaded malleable iron. Malleable iron fittings shall be furnished with threaded PVC adapters to connect the fittings to the push on joint pipe. Elastomeric joints for PVC adapters and PVC fittings with push on joints shall conform to ASTM D-

3139. PVC adapters and fittings shall have a minimum pressure rating of 200 PSI and shall, except for threaded areas on adapters, have a SDR of 13.5.

**C. FIRE HYDRANTS**

Fire hydrants shall conform to AWWA C-502, and shall be constructed for 3'-0" minimum depth of trench. All fire hydrants shall be constructed with a bronze main valve seat which screws into a threaded bronze connection at the base of the hydrant. All fire hydrants shall be equipped with two 2½-inch hose nozzles with National Standard Threads, and one 4" (minimum opening) pumper nozzle with Charlotte Fire Department Standard Threads. Charlotte Fire Department Standard

Threads are essentially:

1. 6 Threads Per Inch
2. O.D.: 4.875"
3. Pitch Diameter.: 4.777"
4. Root: 4.653"
5. Gauge: 2C

All hydrants shall open by turning to the right or clockwise, shall have a minimum valve opening size of 4½" and shall be furnished with a 6" mechanical joint inlet. The operating nut shall be 1½" pentagon. Any extensions required shall be as recommended and supplied by the hydrant manufacturer.

All fire hydrants and any portions of the hydrant assembly exposed to view (above adjacent ground elevation) shall be painted with two (2) or more evenly applied coats of yellow hydrant enamel paint. Hydrants will be retouched/repainted as necessary after installation and prior to acceptance.

1. All fire hydrants shall be one of the following models:

MANUFACTURER	MODEL
Mueller Company	Super Centurion 200 No. 421
Kennedy Valve Manufacturing Company	Guardian No. K81-A
American Darling Company	Mark 73-1
Waterous Company	Trend WB-77

2. Fire hydrant tees will be Griffin Swivel Hydrant tee, Tyler 5-125 swivel hydrant tee or approved equal. Swivel 90° bends will be Tyler 5-197 or approved equal.
3. Piping extensions for hydrant installations may be made with 6-inch ductile iron nipples with Tyler long swivel hydrant adapters, Megalug MJ Restraint, U. S. Pipe Field Lok Gaskets, Romac GripRing, or other approved method.

**D. VALVES**

1. Gate valves on water mains smaller than 16-inch in diameter shall be direct bury gate valves and shall be furnished with Charlotte Standard Valve boxes set in concrete pads as specified. Gate valves shall be furnished with non rising stems only, and stem seals shall be of the "O" ring type only. Valves six (6") inches and larger shall be furnished with two inch square operating nuts and shall open by turning to the right or clockwise. Gate valves three (3") inches and smaller shall be furnished with T-Head operating nuts. Valve ends shall normally be mechanical joint with necessary glands, gaskets and bolts furnished with the valve. Flange ends shall be furnished for special installations as shown on the construction plans. Flange by mechanical joint ends shall be furnished for tapping sleeve & valve installations.

Gate valves may be of the double disc parallel seat type in accordance with AWWA C-500 or of the resilient seat type in accordance with AWWA C-509 with a working pressure of 200 PSI. Resilient seated gate valves must be furnished with durable opaque end shields to prevent ultra violet damage to the rubber discs.

Only valves which have been specifically approved by CMUD may be furnished. At the present time, the gate valves listed in the following chart have been approved:

<b>6", 8", 12" MJ GATE VALVES</b>		
<b>Manufacturer</b>	<b>Double Disc Valve</b>	<b>Resilient Seat Valve</b>
Mueller	A-2380-20	A-2370-20
American Darling	55	CRS 80 - No. 85
Kennedy	571 X	4571 X
Waterous	300 Series	500 Series
Clow	5065	F6100

Gate valves smaller than three inches may also be of all bronze construction with iron pipe thread, screw ends, wedge gates and non-rising stems, shall open by turning to the right or clockwise, shall be furnished with a T-head unless a handwheel is specified and shall have a working pressure of 200 PSI. Materials for such gate valves shall be in accordance with the most recent edition of AWWA C-500 and such ASTM designations as apply with reference to chemical requirements as set forth in Table I of ASTM B-62.

The following 2-inch valves are approved:

MANUFACTURER	RESILIENT SEAT	BRONZE DISC
Clow	Fig. 6103	----
Waterous	500 Series	----
Hammond	----	IB 645
Jenkins	----	No. 370
Kennedy	Kenseal II	----
Stockham	----	B 128

2. Butterfly Valves: All valves on water mains 16-inches in diameter and larger, except tapping valves, shall be direct bury butterfly valves with mechanical joint ends conforming to all requirements of AWWA C-504. Unless otherwise shown on the construction plans, all butterfly valves shall be Class 150B.

Each butterfly valve shall be furnished with a manual operator equipped with a two inch square operating nut. The operator shall open the valve when the operating nut is turned to the right or clockwise. The valve and operator shall be assembled for installation in a horizontal line with the main valve shaft horizontal and the operator shaft and operating nut aligned vertically to accept a valve key operated from the surface.

Butterfly valves shall be shop painted for buried service in accordance with AWWA C-504.

Prior to shipping butterfly valves, the manufacturer shall submit shop drawings showing the principal dimensions, general construction, and materials used for all parts of the valves and operators. The manufacturer shall include in the submittal the dates the valves are to be tested. The testing shall be scheduled to allow a representative of the Engineer to be present at the discretion of the Engineer. The valves shall be furnished in accordance with these drawings after they have been approved by the Engineer. The manufacturer must submit written certification that the valves furnished comply with all applicable provisions of AWWA C-504. Each valve must be identifiable through a separate serial number attached to the valve. Butterfly valves shall be manufactured by American Darling, Clow, Kennedy, Mueller, Pratt, or approved equal.

3. Detector Check Valve: Four-inch through ten-inch detector check valves shall be rated for 175 PSI working pressure with flanged ends per ANSI B16.1, Class 125. The valve body may be steel, cast iron, or ductile iron. Steel body valves shall be hot dip zinc galvanized or fusion bonded epoxy coated. Cast/ductile iron body valves shall be fusion bonded epoxy coated. Operating mechanism shall be by internal weight or linkage and spring and shall be all bronze or stainless steel. Valve shall have rubber faced clapper and bronze seat. Valves shall have two tapped bosses on each side to permit installation of a metered bypass. Valve shall be UL listed/FM approved.



The following valves are approved:

<b>MANUFACTURER</b>	<b>MODEL</b>
Ames Company	1000 DCV
Hersey Products	Model EDC III
Watts Regulator	07F Series

E. **WATER MAIN TAPS**

1. Tapping Sleeves

Tapping sleeves may be ductile/cast iron mechanical joint, stainless steel full gasket, or fabricated steel with wedge gasket around tap opening. Twelve-inch (12") and smaller sleeves shall be rated for 200 PSI working pressure. Sixteen-inch (16") and larger sleeves shall be rated for 150 PSI working pressure.

Mechanical joint tapping sleeves shall be furnished complete with joint accessories including split glands, split end gaskets, bolts, etc., and shall be compatible with the type and class of pipe being tapped. The outlet flange shall be Class 125 per ANSI B16.1 compatible with approved tapping valves.

Stainless steel tapping sleeves shall be manufactured from 18-8, type 304 stainless steel. The outlet flange may be ductile iron or stainless steel. The gasket shall be a grid pattern design and shall provide full circumferential sealing around the pipe to be tapped. The sleeve shall include a test plug for pressure testing the installed sleeve prior to making the tap. All welds shall be passivated. The outlet flange shall be Class D per AWWA C-207-ANSI 150 lb. drilling compatible with approved tapping valves.

Fabricated steel tapping sleeves shall be fusion bonded epoxy coated to a 12 mil thickness. The sleeve shall include a test plug for pressure testing the installed sleeve prior to making the tap. The steel outlet flange shall be Class D per AWWA C-207-ANSI 150 lb. drilling compatible with approved tapping sleeve.

The following table lists approved tapping sleeves:

<b>DI/CI MECHANICAL JOINT</b>	<b>STAINLESS STEEL</b>	<b>STEEL</b>
Clow - F5205	Ford - FAST	Ford - STSC
M&H- Style 974/1174/1274	Rockwell - 663	Mueller - H-621
Mueller - H615	Romac - SST	Rockwell - 622
American	Smith Blair - 663	Romac FTS 420
Waterous - Series 800	JCM Industries - 432	Smith Blair - 622
Kennedy Square Seal Style No. 921	PowerSeal - 3490AS - 3480	JCM Industries - 412
-----	-----	PowerSeal - 3460

2. Service Saddles: All corporation stops for services or air releases on PVC pipe as well as 1-inch and larger corporations installed on DIP shall be installed with service saddles having threads to accept standard AWWA Corporation valve inlet thread. Service saddles for 2-inch PVC shall be brass. Service saddles for 6, 8, & 12-inch PVC or 6-inch and larger DIP may be brass, ductile iron or stainless steel. Steel straps must be preformed at the factory to the specified outside diameters of PVC pipe.

The following manufacturers and models are approved:

**BRASS SERVICE SADDLES**

<b>Manufacturer</b>	<b>2" PVC</b>	<b>6" PVC</b>	<b>8" PVC</b>	<b>12" PVC</b>
Ford	S-70	101B	101B	101B
Jones	-----	J996	J996	J996
McDonald	3801	3805	3805	3805
Mueller	13420	16084	16088	16093
Rockwell	-----	321	321	321
Romac	-----	101B	101B	101B
Power Seal	3401	3401	3401	3401

**DUCTILE IRON SERVICE SADDLES**

<b>Manufacturer</b>	<b>Single Strap</b>	<b>Double Strap</b>	<b>Stainless Steel Strap</b>
Ford	F101	F202	FS101
Rockwell	311	313	315
Smith/Blair	311	313	315
JCM Industries	401	402	403
Romac	101	202	101S
PowerSeal	3416	3418	3415

**STAINLESS STEEL SERVICE SADDLES**

<b>Manufacturer</b>	<b>Saddle No.</b>
Ford	F304
Romac	304
Rockwell	371-372

3. Corporation Stops: Corporation stops shall comply with AWWA C-800 and shall be high pressure rated at 150 PSI in accordance with Section 3.3 of the standard. Inlet threads shall be standard AWWA Corporation valve inlet thread. Outlet threads shall be according to the indicated connection. All corporations installed on C-900 PVC pipe as well as 1-inch and larger corporations installed on DIP shall require a tapping saddle/service clamp as hereinafter specified.

The following manufacturers and models are currently approved:

Manufacturer	3/4" and 1" Services		1 1/2" and 2" Services			
			Ball Type		Plug Type	
	Flare	Compress	FIP	Increasing IP	FIP	Increasing IP
Ford	F600	F1000	FB1600	FB800	---	F800
Hays	5200	5200 CJ,CF	4484	4440	---	---
Jones	J1500	J3401	J1932	----	---	J89
McDonald	4701	4701T	3148B	----	---	3121
Mueller	H15000	H15008	---	----	H10045	H10003

Manufacturer	1" Air Release	2" Air Release			
		Ball Type		Plug Type	
		FIP	Increasing IP	FIP	Increasing IP
Ford	F200	FB1600	FB800	---	F800
Hays	5230	4484	4400	---	----
Jones	----	J1932	----	---	J89
McDonald	3120	3148B	----	---	3121
Mueller	H9971	---	----	H10045	H10003

**F. REPAIR/TIE-IN SLEEVES/CLAMPS**

1. Sleeves: Solid cast iron mechanical joint sleeves (long pattern) shall be used where indicated for tie-ins between new mains and existing mains and when replacing defective sections of pipe with new pipe.
2. Repair clamps or split sleeves will not be allowed on new construction. These may be used to repair existing mains if specifically directed by the Engineer.

**G. 3/4-1-INCH WATER SERVICES**

1. Meter Yoke Assembly: Meter yokes shall be the angle type, with vertical inlet and horizontal outlet, with flared or compression connections for water service tubing. Yokes shall be equipped with brass angle stop cutoff valve and coupling. The angle stop for 5/8" meters (3/4" services) shall be 5/8"x3/4" with a 5/8"x3/4" coupling for the tailpiece. The yoke piece shall be of Cast or Ductile Iron. Horizontal type meter yokes may be used for special situations, as approved. Meter yoke assemblies shall be provided for all 5/8" and 1" meters. Expansion connection between meter and yoke shall be 3 piece units by McDonald, Mueller or Jones.

The following meter yoke assemblies are approved:

<b>Manufacturer</b>	<b>5/8" Meter</b>	<b>1" Meter</b>
Ford	501	504
Jones	6200	6202
McDonald	14-1	----
Mueller	H-5010	----

2. Meter Boxes And Lids: Concrete boxes for 5/8-inch meters (3/4-inch services) shall conform to the Standard Details, and shall be as manufactured by Brooks Products Company (36 Series) or approved equal. Concrete boxes for 1-inch meters shall conform to the Standard Details, and shall be Brooks Products #37H or approved equal.

Concrete meter boxes shall be made of concrete mix, 1-2-1, one part cement, two parts granite screenings, and one part 3/8" granite stone. The meter boxes shall be concrete machine made and tamped with pneumatic tamps to insure the proper density. All concrete items shall be steam cured 24 hours and yard cured for two weeks.

Meter box lids may be concrete, plastic, or cast iron, with dimensions as shown on the Standard Details, structured in such a manner as to accept a hinged cast iron reading lid. All reading lids shall be of grey iron conforming to ASTM A-48, Class 35 iron, fully bituminous coated in accordance with standard practice.

3. Backflow Prevention Devices shall be in accordance with CMUD's Backflow Prevention Manual.

#### **H. 1-1/2-INCH AND LARGER WATER SERVICES**

All meters 1½-inch and larger shall be installed in precast concrete vaults conforming to the Standard Details. Vaults shall be approved for use within North Carolina Department of Transportation right-of-way and shall be designed for H-20 loading. Vaults may be adjusted as shown on the standard details using standard size clay or concrete brick. Vaults shall have double leaf steel covers conforming to the Standard Details. Service numbers supplied by Charlotte-Mecklenburg Utility Department shall be bead welded on the cover. All meters shall conform to American Water Works Association (AWWA) standards as specified below. The manufacturers meter serial number shall be imprinted on the outer case of the meter and on the register lid.

All registers for the various types and sizes of meter specified shall be magnetic drive, straight reading, recording in cubic feet, equipped with a center-sweep test hand, dehumidified, air tight, and hermetically sealed.

All meters where the register is separate or removable from the main case, and held in place by screws must have the head of each screw drilled two ways, and sealed with a copper wire and lead seal before delivery. The security of such registers must be guaranteed non-removable except by destruction of seal wire, or seal.

The manufacturer must furnish with each meter a certificate of accuracy which references the particular meter serial number. The certificate of accuracy must be furnished to the Engineer before the meter is activated. The certificate must reference the job name or number. The number can be added by the supplier or contractor.

The manufacturer shall guarantee that all meters furnished under this specification will meet the required new meter accuracy standards in accordance with AWWA standards.

1. Displacement Meters - Sizes 1" and 2":

- a. Meters in these sizes shall be positive displacement type conforming to AWWA C-700.
- b. All 1" and 2" meters shall be furnished with spuds and brass end connections.
- c. Meters may be furnished with either nutating or oscillating type of piston or disc.
- d. Main casings and bottom plate shall be of a copper alloy containing not less than 75% copper.
- e. Measuring chambers for 1" and 2" meters shall be of a copper alloy containing not less than 85% copper.
- f. All meters are to have strainers.
- g. Registers shall be permanently hermetically sealed and shall have standard trial gear combinations. The manufacturer shall furnish the City with a certificate which unconditionally guarantees the registers for a minimum period of 25 years against defects in material or workmanship.
- h. In the interest of standardization, only the following makes and models will be acceptable:  
  
Rockwell Model SR  
Neptune Model 8  
Hersey Model 562-1", 572-2"  
Badger Recordall Bronze 25
- i. Check valves shall be located as shown on the Standard Details. Check valves shall be Grinnell #3310 or approved equal.

2. Turbine Meters - Sizes 1" 2", 3", 4":

- a. These meters shall conform to AWWA C-701.
- b. Main casings shall be of a copper alloy containing not less than 75% copper.
- c. Measuring cages or chambers shall be made of a copper alloy containing not less than 85% copper or of a suitable synthetic polymer.
- d. Meters are to have strainers.
- e. All 1" and 2" meters shall be furnished with spuds and brass end connections. Laying length shall be same as standards for displacement meter.
- f. Meters size 1" and 2" shall meet the performance specifications of AWWA C-700 for displacement meters.
- g. Meters 3" and 4" shall test 100% + 1.5% at the following flow in GPM and size:
  - 3" - 5 to 350
  - 4" - 5 to 650
- h. The following turbine meters are presently approved as meeting the above performance specifications:

- 1" Hersey MVR100
- 2" Hersey MVR160
- 3" Hersey MVR350
- 4" Hersey MVR650

Other makes and models may be added to this approved list when they are certified as meeting the above performance standard and when appropriate test data are submitted.

- i. Checks valves shall be located as shown on the Standard Details. 1" and 2" check valves shall be Grinnell #3310 or approved equal. 3" and 4" check valves shall be Mueller A-2600-6, Kennedy 106, or approved equal. The blank flange on the 3" and 4" check valve shall be replaced with a flange tapped 2-inch as shown on the Standard Details.

3. Combined Fire And Domestic Service Meters - Sizes 6", 8", 10", and 12":

- a. Meters shall comply with AWWA C-703.
- b. Meters must be approved for use for fireline service by Underwriters Laboratories or National Fire Protection Association.
- c. Companion flanges, gaskets, bolts and nuts shall not be provided.
- d. Meters must have stop and check valves on bypass meter.

- e. Measuring cages or chambers shall be made of a copper alloy containing not less than 85% copper.
  - f. Main casing for bypass meters shall be of a copper alloy containing not less than 75% copper.
  - g. Casing for main line meters shall be of copper alloy containing not less than 75% copper or galvanized zinc treated cast iron.
  - h. Only Hersey Model MFM #2 - MVR as manufactured by Hersey Products, Inc., or approved equal combined Fire and Domestic service type meter will be accepted.
4. Backflow Prevention devices shall be in accordance with CMUD's Backflow Prevention Manual.

**I. FERROUS CASTINGS**

- 1. Valve Boxes: All valve boxes shall conform to the dimensions shown on the Standard Details. Valve boxes shall be of cast iron conforming to ASTM A-48, Class 30 and shall be manufactured in domestic foundries.
- 2. Manhole Frames and Covers: All manhole frames and covers shall conform to the dimensions shown on the Standard Details. Manhole frames and covers shall be of cast iron conforming to ASTM-A-48, Class 30 and shall be manufactured in domestic foundries.

**J. MISCELLANEOUS STEEL**

- 1. Steel Encasement Pipe: Steel pipe shall be welded or seamless, consisting of Grade "B" steel as specified in ASTM A-139.

Minimum yield strength shall be 35,000 PSI; and pipe thickness shall be as specified for each individual job.

All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. All burrs at pipe ends shall be removed.

Encasement pipe must be approved by the appropriate controlling agency (D.O.T., R.R., etc.) and the Engineer prior to ordering.

- 2. Structural Steel Tunnel Liner Plates: The tunnel liner plates shall be either the four (4) flange type (as approved for use within D.O.T. right-of-way) or the lap seam type (as approved for use within railroad right-of-way) fabricated to permit assembly of a continuous steel support system as the tunnel is excavated. Tunnel liner plates shall be fabricated from hot rolled, carbon steel sheets or plates conforming to the specifications of ASTM A-569.



The tunnel liner shall be designed in accordance with the requirements of Section 16-Division I and constructed to conform to Section 25-Division II or the current or interim AASHTO Standard Specifications For Highway Bridges.

Liner plates shall be galvanized in accordance with AASHTO M167 and fully bituminously coated in accordance with AASHTO M190. All hardware necessary to the tunneling operation shall be hot-dip galvanized in accordance with ASTM A-153 prior to bituminous coating application. Hardware shall conform to ASTM Specification A-307, Grade A.

The minimum mechanical properties of the flat steel plate before cold forming used for the design of the tunnel liner shall be:

- A. Minimum Tensile Strength of Liner Plates: 42,000 P.S.I.
  - B. Minimum Yield Strength of Liner Plates: 28,000 P.S.I.
  - C. Steel Liner Plates must be approved by the appropriate controlling agency (DOT, Railroad, etc.) and the Engineer prior to ordering. Gauge or thickness of liner plates will be as noted on the plans or elsewhere in these specifications.
  - D. Elongation in 2-inches: 30 percent
  - E. The moment of inertia shall be .042 inches to the 4th power per inch of width for four flange 12 gage liner plate.
3. Steel Reinforcing For Concrete:
- a. Bars: All reinforcement bars shall conform to the Standard Specifications for BILLET-STEEL BARS FOR CONCRETE, REINFORCEMENT, ASTM A-615. All bars shall be deformed and of structural Grade 60.
  - b. Wire: All reinforcement wire fabric shall conform to the Standard Specifications for WELDED STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT, ASTM A-185.

## **K. CONCRETE**

1. Portland Cement: All concrete shall conform to the Standard Specifications for READY MIXED CONCRETE, ASTM C-94. An air-entraining admixture, conforming to ASTM C-260, shall be added to either Type I, Type II, or Type III Portland Cement.

Fly Ash conforming to ASTM C-618 for Class C Fly Ash may be added to the concrete mix but shall not be considered as replacement for more than 10% of the cement therein (strengths shall not be less than hereinafter required).

Types I, IA, III and IIIA Portland Cement shall only be used for manhole inverts, concrete encasement, concrete blocking, and/or as directed by the Engineer, and shall conform to ASTM C-150.

Types II and IIA Portland Cement shall be used in precast manholes, reinforced concrete pipe, reinforced concrete piers and concrete or reinforced concrete rip-rap as directed by the Engineer, and shall conform to ASTM C-150 except that Tricalcium Aluminate ( $3\text{CaOAl}_2\text{O}_3$ ) content shall not exceed 8%.

2. Aggregates: All aggregates used for concreting shall conform to ASTM C-33 and shall be checked daily for any variances in moisture content. Said variances shall be corrected and/or taken into consideration for each batch.
  - a. Coarse Aggregates: Shall be uniformly and evenly graded for each application in accordance with A.C.I. Standard 318. Unless otherwise approved, aggregate shall be sound, crushed, angular granitic stone. Smooth or rounded stone (river rock) shall not be acceptable.
  - b. Fine Aggregates: Shall consist of natural sand, manufactured sand or a combination thereof. Fine aggregates shall conform to the sieve analysis as specified in paragraph 4.1 of the standard except that the percent passing a No. 50 sieve shall not exceed 5% and the percent passing a No. 100 sieve shall be 0% as provided for in paragraph 4.2 of the standard.
3. Mix Design: Concrete shall be watertight, resistant to freeze-thaw cycles and moderate sulfate attack, abrasion resistant, workable, and/or finishable. These qualities may be met through the use of admixtures (if and only if approved in the mix design as hereinafter specified) conforming to the appropriate ASTM with the exception of the use of calcium chloride, which shall be limited to no more than 1% by cement weight - thoroughly mixed to insure uniform distribution within the mix. If the concrete is used with reinforcing steel, no calcium chloride will be allowed.

The Contractor shall assume responsibility for concrete mixture. The concrete shall be proportioned to meet the following requirements: (Note: This mix does not apply "in total" to precast manhole or reinforced concrete pipe).

A.	Compressive Strength	Minimum 3600 PSI
B.	Water-Cement Ratio By Weight	Maximum-0.50
C.	Slump	Min. 3" Max. 5"
D.	Air Content (Entrained & Entrapped)	Min. 4% Max. 6%
E.	Coarse Aggregate	3/4"-1/2" (as required by the application)

When required by the Engineer, and prior to beginning construction, the Contractor, at his expense, shall obtain from an approved commercial testing laboratory a design for a suitable concrete mix and submit same with his list of materials and material suppliers for approval.

4. Curing Compound: All concrete curing compounds shall conform to the standard specifications for LIQUID MEMBRANE - FORMING COMPOUNDS FOR CURING CONCRETE, ASTM C-309, Type 2.

Curing compounds shall be applied as forms are stripped.

5. Grouts: All grouts shall be of a non-shrink nature (as may be achieved through additives or proportioning) and depending upon application range from plastic to flowable cement water paste. Testing as specified above for concrete may be required for acceptance of grouts to include frequent checks for consistency by a time-of-flow measurement.

Expansion grouts shall be either Gilco pre-mixed or Supreme non-metallic grout as manufactured by Gifford-Hill and Company, Incorporated, or Embecco 636 grout as manufactured by Master Builders or equal.

Acceptable range of testing requirements:

Compressive Strength..... 10,500 to 12,500 PSI  
Bond Strength ..... 1,350 to 1,700 PSI  
% Expansion. .... +.025% to +0.75%

Expansion grouts shall be used only as directed by the Engineer.

Grouts shall be mixed (if applicable) and placed in accordance with the manufacturer's current recommendations, for each specific application.

6. Mortar: Mortar used in sanitary sewer manholes shall be hydraulic cement mortar in accordance with ASTM C-398. Mortar used in water meter vaults and water valve vaults shall be Type M mortar in accordance with ASTM C-270.

**L. STONE AND BRICK**

1. Granular Bedding Material: All bedding material shall be angular, clean washed crushed stone graded in accordance with Size #67 in ASTM D-448 for "Standard Sizes of Coarse Aggregate" (NCDOT Standard Size #67).

Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the Engineer.

2. Stone Stabilization Material: All stone stabilization material shall be angular, clean washed crushed stone graded in accordance with standard sizes #467 in ASTM D-448 (NCDOT Standard Size #467M).

Stabilization material will be used only as instructed in the specifications and/or as specifically directed by the Engineer.

3. Silt Check Dam Material: Shall be coarse angular, clean washed crushed stone, gravel, or rock, well graded, and ranging in size from 2-inch through 6-inch, (NCDOT stone for erosion control Class A).

4. Rip Rap: All rip rap shall consist of clean field stone or rough unhewn quarry stone, resistant to the action of air and water, varying in weight from 25 to 250 pounds with 60% weighing a minimum of 100 pounds each and no more than 5% weighing less than 50 pounds each, (NCDOT Class 2 Rip Rap). Rip Rap will be placed from a minimum of 4.0 feet below the toe of the bank to top of the bank in areas determined by field conditions. Rip rap thickness shall be 1 □ times the diameter of the largest stones used, or 2.0 feet, whichever is greater.
5. Brick: Brick shall be clay or shale brick meeting the requirements of ASTM C-62 for Grade SW, except as otherwise provided below.

Brick shall be of uniform standard commercial size, with straight and parallel edges and square corners. They shall be burned hard and entirely true, free from injurious cracks and flaws, tough, strong, and shall have a clear ring when struck together. The sides, ends and faces of all brick shall be plane surfaces at right angles and parallel one to the other.

Concrete brick may be used in lieu of clay or shale brick for adjustment of water meter vaults and/or water valve vaults. Concrete brick shall meet the requirements of ASTM C-55 for Grade S-II except that the absorption of brick used in minor drainage structures shall not exceed 10 lbs./ft.<sup>3</sup>

#### **M. TRAFFIC CONTROL DEVICES**

All traffic control signs, barrels, barricades, pavement markings, etc., shall conform to the "Manual on Uniform Traffic Control Devices" (MUTCD) published by the U.S.D.O.T. and any supplements to the MUTCD adopted by N.C.D.O.T.

#### **N. EROSION CONTROL**

1. Seed: All seed shall be labeled to show that it meets the current requirements of the North Carolina Seed Law. Seed shall have been tested within the six (6) months immediately preceding its use.

Further specifications for each seed item are given below:

- a. Kentucky Fescue #31: Minimum 98% pure live seed; maximum 1% weed seed; minimum 90% germination.
- b. Sericea Lespedeza (Scarified and Unscarified): Minimum 98% pure live seed; maximum .50% weed seed; minimum 85% germination. Scarified may include 20% hard seed.
- c. Rye Grass (Annual): Minimum 98% pure live seed; maximum .10% weed seed; minimum 85% germination.
- d. Sudangrass: Minimum 98% pure live seed; maximum .25% weed seed; minimum 85% germination.

- e. Certification/Supplier: The contractor shall furnish the State's Landscape Supervisor in Albemarle, North Carolina (for work in Department of Transportation rights-of-ways) and the City's Construction Engineer (for all work) the name of the supplier of seed, the seed type and the total amount (not seed rate) to be used in restoring disturbed groundcover. This information shall be furnished at least four (4) weeks prior to reseeding operations so that quality tests can be made by the appropriate controlling agency.

Seed containing prohibited noxious weed seed shall not be accepted. Seed shall conform to the state law restrictions for restricted noxious weeds.

2. Fertilizer: All fertilizer for undeveloped areas shall have minimum 5-10-10 analysis or a comparable 1-2-2 ratio. All fertilizer for established lawn areas shall have a minimum 10-10-10 analysis or a comparable 1-1-1 ratio.

All fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the job site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.

Any fertilizer which becomes caked or otherwise damaged will not be accepted. The quality of all fertilizer and all operations in connection with furnishing same, shall comply with the current requirements of the North Carolina Fertilizer Law and with the current applicable Rules and Regulations adopted by the North Carolina Board of Agriculture.

3. Lime: All lime shall be finely ground limestone (Dolomite) containing not less than 85% total carbonates. Lime shall conform to the specifications of the North Carolina Department of Agriculture for Agricultural Grade.
4. Superphosphate: All superphosphates shall be composed of finely ground phosphate rock, as commonly used for agricultural purposes, containing not less than 20% available phosphoric acid.
5. Mulch: All mulch shall be small grain or tame hay. Small grain or tame hay shall be furnished undamaged, air dried, threshed and free of undesirable weed seed.
6. Erosion Control Fabric: Material shall be as specified in the Environmental Protection Section of these specifications per Erosion Control Standard Detail 16.62.
7. Jute Netting Or Thatching: All jute shall be of a uniform open plain weave of single jute yarn, 18-inches in width (1"). The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half (□) its normal diameter. There shall be 78 warp ends (2), per width of netting; 41 weft ends (1), per linear yard; and the weight shall average 1.22 pounds (5%) per linear yard of netting. Jute shall be anchored into place in accordance with the manufacturer's requirements. Installation shall only be at the direction of the Engineer.

8. Erosion Control Blanket: Erosion control blankets shall be manufactured from wood fiber, straw, coconut fiber or other degradable material woven into a mat and secured with photodegradable plastic mesh or biodegradable thread.

Blankets shall be installed according to manufacturers recommendations where directed by the Engineer. The following manufacturers are approved, AMXCO-Curlex Blanket, North American Green-SC150, HV Excelsior or approved equal.

9. Gabions: Gabions shall be manufactured from zinc coated steel wire mesh (minimum gauge) to form rectangular units. The front, base, back and lid shall be woven into a single unit and the ends and diaphragms shall be factory connected to the base. The individual units shall be installed per the manufacturers instructions and filled with hard durable, clean stone from 4-8 inches inside, or as approved by the Engineer.

## DETAILED SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

### **A. HANDLING AND STORAGE OF MATERIALS**

The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign materials at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

1. Transportation of Materials and Equipment: The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which are to be used for hauling equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads which may be attributed to this project.

All materials required to construct this project shall be furnished by the contractor and shall be delivered and distributed at the site by the Contractor or his material supplier.

2. Loading/Unloading Materials: All pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
3. Responsibility for Materials on Site: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced by material placed along the street right-of-way.

The Contractor will string in advance no more than the amount of pipe and material that can be installed within two (2) weeks unless approved by the Engineer. Other material may be placed in storage yards as specified below. All materials shall be placed in such a manner as not to impede any traffic. Materials strung through residential areas (or any area with maintained lawns) shall be placed in such a manner that normal lawn maintenance is not restricted and must either be installed within two (2) weeks or removed to an approved storage yard, as required by the Engineer.

4. Material and Equipment Storage: The Contractor will be responsible for locating and providing any required offsite storage areas for construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is received by this Department, the Contractor will be required to store all equipment and materials within the project site or the limits of the right-of-way provided. The materials and equipment storage shall comply with all state and local ordinances throughout the construction period. Material and equipment may only be stored within road right-of-way if approved by the controlling agency.

The Contractor shall be responsible for safeguarding materials and equipment against fire, theft, and vandalism and shall not hold the City responsible in any way for the occurrence of the same.

5. Care of Coatings and Linings: Pipe and fittings, including hydrants, shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

## **B. CONNECTION TO EXISTING MAINS**

Connections to the existing system shall be made in the presence of CMUD Inspection personnel. Valves, hydrants, blow offs, etc. will be operated by CMUD personnel and/or the Contractor if specifically directed by CMUD to do so. The Contractor shall provide all labor, materials, and equipment required for connection to the existing system. Only one (1) connection between the existing system and the new extension will be allowed until testing, chlorination, and successful sampling of the new extension is complete.

If connection to existing mains will necessitate an interruption of service, the Contractor will schedule the connection for a time that is most convenient to the affected customers as determined by the Engineer. Adequate notice will be provided to those customers who will be put out of service by the connection. When such interruption of service is approved, the Contractor will have all required labor, material and equipment at the site before beginning any work and the service interruption will be kept to an absolute minimum.

The Contractor shall verify blocking at existing valves prior to making connections and will be required to block, rod, or restrain existing and new pipe, fittings and valves as necessary.

## **C. EXISTING UTILITIES**

The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction or as noted in the Special Provision Section of this document.

All utility owners will be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Owners who are members of ULOCO may be notified in accordance with current ULOCO procedures. The Charlotte-Mecklenburg Utility Department is not a ULOCO member. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act.

Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.



When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved by the Engineer.

When a PVC water main crosses other buried pipeline utilities (storm drain, gas, encased or capped telephone conduit, etc.) 12-inches clearance must be maintained between the water line and utility and the water main shall receive Type III stone bedding. If this clearance requires the water main to be deeper than 5 feet, the Contractor may install a DIP (galvanized steel pipe for 2-inch mains) water main over the utility with less than 12-inches clearance provided there is 3 feet cover over the water main.

#### **D. WATER LINE/SEWER LINE CLEARANCE**

When a water main crosses or is parallel to an existing sewer main, the Contractor shall install ductile iron pipe for the water main and sewer main as described below.

1. Vertical Separation Of Water Lines & Sewer Lines: Whenever it is necessary for a water main to cross over a sewer main with less than 18-inches of vertical separation, the water main and sewer main shall be constructed of ductile iron pipe, for a distance of 10 feet on each side of the point of crossing.

Whenever it is necessary for a water main to cross under a sewer main, the water main and sewer main shall be constructed of ductile iron pipe, for a distance of 10 feet on each side of the point of crossing.

2. Horizontal Separation Of Water Lines And Sewer Lines: Water mains shall be laid at least 10 feet horizontally from existing or proposed sewer mains unless local conditions or barriers prevent a 10-foot horizontal separation. In that case, the water main will be laid in a separate trench, with the elevation of the bottom of the water main at least 18-inches above the top of the sewer. When these conditions are not met, the water main and sewer main shall be constructed of Ductile Iron Pipe.

#### **E. EXCAVATION**

All excavations shall be as specified below. Excavation within street rights-of-way shall be backfilled when left unattended for more than 1 hour unless otherwise approved by the controlling agency.

1. Trench Excavation: No more than 100 LF of trench shall be opened in advance of the pipe laying unless prior approval is given by the Engineer. Ground conditions and/or location will be considered by the Engineer in making this determination.

- (a) Trench Width: Maximum trench width for pipe shall be equal to the outside diameter (as measured at the pipe barrel) of the pipe plus sixteen (16) inches.

Trench width shall be measured between faces of cut at the top of the pipe bell. If the Contractor varies from this requirement without approval of the Inspector, he shall at his own expense install Type II or Type III bedding defined in this specification.

- (b) Trench Bottom Conformation: The excavation shall be made to the elevations, grades, and lines shown on the Construction Plans. The trench bottom shall be excavated slightly above grade and cut down to the pipe grade by hand in the fine grading operation. The trench bottom shall be true and even with bell holes at each joint to provide the barrel of the pipe with soil or granular bedding support for its full length.

This should prevent point loading at the bells. If the trench bottom is inadvertently cut below grade, the Contractor shall (at his own expense) fill it to grade with approved material thoroughly tamped, or with #67 bedding stone. Pipe depth and/or soil conditions may require Type II or Type III granular embedment. This bedding shall also be shaped to allow adequate support of the pipe.

If the trench passes either under or over another pipeline or previous excavation, the trench bottom in this area shall be tamped, if necessary, so the disturbed soil has approximately the same supportive strength as the native soil.

2. Excavation For Structures: The excavation shall be made to the lines, grades and elevations shown on the Plans and the Standard Details. The area excavated shall be limited to no more than is necessary to allow the proper installation of the structure as determined by the Engineer. The excavation shall remain open no longer than is necessary to allow the proper and complete installation of the structure.

- a. Structure Pit Bottom Conformation: The pit bottom shall be true and even, and capable of supporting the structure as determined by the Engineer. If the pit bottom is inadvertently cut below grade, the Contractor shall fill it to the proper elevation with approved material capable of continually maintaining adequate supportive strength.

3. Excavation for Bore Pits: The excavation shall be controlled by the limits of the existing rights-of-way and shall not exceed these without prior written approval of the current property owner. The excavation shall be made to the proper elevation, line and grade to install the casing pipe as shown on the construction plans.

The pit bottom shall be true and even with adequate stabilization to maintain proper elevation and grade on the boring rig for the duration of the bore. The walls of the pit shall be shored or sloped to comply with OSHA requirements.

The bore pit shall not be left open overnight on NCDOT maintained roadways without specific approval from the NCDOT. If approval is obtained, concrete median barriers are required to be placed around the bore pit within the road right-of-way.

4. Rock Excavation: Rock excavation shall be defined as solid ledge rock that requires drilling and blasting, sledging, or barring for its removal. Soft, disintegrated rock that can be removed with a pick shall not be classified as solid rock.

Boulders greater than one cubic yard in volume will also be considered rock excavation. Smaller boulders and soft rock which in the opinion of the Engineer can be excavated by the use of a power shovel, without undue delay, shall not be classified as rock.

Rock shall be removed to the following limits as measured between vertical planes - twelve-inches (12") outside the pipe bell - parallel to the water line and for a depth of six (6) inches below the pipe bell. Rock around structures shall be removed to the same 12-inch limit as measured between vertical planes around the structure to a depth necessary to allow proper installation of the structure. Over excavation of rock due to removal methods, or for safety considerations, shall be the Contractors responsibility.

When rock removal is necessary for pipeline installation, either Type II or Type III bedding shall be installed as specified and directed by the Engineer.

All blasting shall be conducted in the manner as described elsewhere in these Specifications.

5. Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the work. Excavated material will be piled a safe distance away from the edge of the excavation allowing room for an adequate angle of repose and if shoring, sheeting, and bracing is used to protect the excavation, no material will be piled within three (3) feet of the nearest edge.

Sidewalks, driveways, hydrants, valve pit covers, valve boxes, curb stop boxes, existing manholes, fire and police call boxes, or other utility controls shall be unobstructed and accessible until the work is completed. Gutters, catch basins, and natural watercourses shall not be obstructed or silted.

6. Dewatering: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of water entering the excavation or other parts of the work and shall keep all excavations dry until such time as pipe laying and grading is completed.

Water shall not be allowed to rise around the pipe in unbackfilled trenches nor shall it be allowed to rise over masonry until the concrete or mortar has set (minimum 24 hours). All water pumped or drained from the work shall be disposed of in such a manner as to minimize siltation and erosion on adjacent property or other construction.

7. Shoring And Shielding: The Contractor shall comply with OSHA trenching and excavation regulations as revised in Subpart P of Part 1926 in the Federal Register. Shoring and/or shielding systems shall be used as specified in Subpart P to prevent caving of trench banks and to provide a safe excavation.

The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.

If, in the opinion of the Engineer, the trench/excavation is not in compliance with OSHA regulations, the Contractor may be directed to stop work. Continued unsafe conditions will be reported to the appropriate regulatory agency. The Contractor will be responsible for paying all fines resulting from safety violations.

## F. PIPE LAYING

In all instances, pipe shall be installed in a workmanlike manner and true to line and grade. The various pipes specified shall be handled and installed in accordance with the manufacturer's recommendations and good engineering practices. The following requirements and/or standards of the Charlotte-Mecklenburg Utility Department shall govern this construction.

1. Pipe Bedding: Unless otherwise specified or noted on the Plans the following bedding classes are as commonly required by this Department.

When granular material embedment is required, the Contractor will backfill above the granular bedding as specified for Type I bedding to an elevation one (1) foot above the top of the pipe bell.

- (a) Type I - Shaped Bottom Bedding: Shaped bottom bedding shall be such that the pipe bears uniformly upon undisturbed native earth. Soil is then backfilled by hand around the pipe and completely under the pipe haunches in uniform layers not exceeding six (6) inches in depth to an elevation one (1) foot above the top of the pipe bell.

Each layer shall be placed; then carefully and uniformly tamped so that the pipe is not damaged nor the alignment disturbed.

- (b) Type II - Granular Material Embedment: For Type II bedding, the trench bottom shall be undercut a minimum of six (6) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to a vertical height of one-third the outside diameter of the pipe for the pipe's entire length and the entire width of the ditch. Type II embedment shall be used as directed by the Engineer.
- (c) Type III - Granular Material Embedment: For Type III bedding, the trench bottom shall be undercut a minimum of six (6) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to vertical height of one-half the outside diameter of the pipe for the pipe's entire length and width of the ditch. Type III Granular material embedment shall be used as directed by the Engineer.
- (d) Concrete Encasement and Cradles: Concrete encasement or cradles will be used only as designed for individual cases or as directed by the Engineer and will be noted on the plans and in the Special Provisions when applicable.

- (e) Stone Stabilization: Stabilization stone shall be used when the trench must be undercut in excess of the six (6) inches required for Type II or Type III bedding, either due to excessive ground water or the existence of unsuitable material incapable of adequately supporting the pipe.

The Contractor shall undercut the trench as necessary and shall place and compact the stone stabilization material required to establish a stable bottom to receive either the Type II or Type III granular bedding and pipe.

- 2. Depth of Pipe Installation: Unless otherwise indicated on Plans, or required by existing utility location, all pipe will be installed with the top of the pipe at least 3.0' below the edge of adjacent roadway pavement or 3.0' below the ground at the pipe, whichever is greatest. The Contractor is instructed to check the construction plans and blow-up views for additional requirements.

The maximum depth of cover for the previously specified pressure classifications shall be as follows:

Type I Bedding.....	10 feet
Type II Bedding.....	15 feet
Type III Bedding.....	20 feet

The Contractor may be required to vary the depth of pipe to achieve minimum clearance from existing utilities while maintaining the minimum cover specified whether or not the existing pipelines, conduits, cables, mains, etc. are shown on the Plans.

- 3. Alignment and Grade:

- a. New Subdivision Streets: The water main shall be laid and maintained to the required lines and grades with fittings, valves and hydrants at the required locations; spigots centered in bells; and all valves and hydrant stems plumb. The curb must be in place and backfilled, and the area between the curb and the street right-of-way line graded smooth and to finished grade before water mains are installed. The water main shall be installed behind the curb as shown on approved plans or directed by the Engineer.

In special circumstances, the Engineer may approve installation of water mains before the curb is installed. In such cases, the street must be graded according to approved grading plans for the entire width of the street right-of-way, the water main staked five feet behind the proposed curb line with 90° offset stakes every 50 feet, and "cut sheets" provided showing the vertical distance between each offset stake and the trench bottom at that point. Such staking will be done only by a surveyor registered in the State of North Carolina.

After the curb and gutter has been installed, the location and depth of the main, valves, fire hydrants, etc., will be checked for conformance with CMUD standards. Any deficiencies will be corrected to the satisfaction of the Engineer prior to testing, disinfection and activation of the mains.

- b. Existing Streets: The water mains shall be installed as shown on the plans unless an obstruction prevents such alignment or grade. The Contractor will be required to adjust the location of the water main where possible to avoid such conflicts as specified and as directed by the Engineer.

All construction layout and surveying which may be required for construction shall be provided by the Contractor and any costs associated shall be included in the various pay items of the proposal. The Contractor is responsible for determining the amount of construction layout and surveying that may be required to complete construction.

## **G. INSTALLATION AND ASSEMBLY**

Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a backhoe or other suitable means, in such a manner as to prevent damage to protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

1. Inspection of Material: The pipe and fittings shall be inspected for defects.
2. Cleaning Pipe and Fittings: All lumps, blisters and excess coatings shall be removed from the bell and spigot ends of each pipe, and the outside of the spigot and the inside of the bell shall be wire- brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
3. Laying Pipe: Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise approved by the Engineer. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed.

If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hours as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

4. Permissible Deflection of Joints: Wherever it is necessary to deflect pressure pipe from a straight line, either in the vertical or horizontal plane, to avoid obstruction or plumb valve stems, or where long radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory sealing of the joint as recommended by the manufacturer, and shall be approved by the Engineer.
  
5. Installation of Push-On Joint Pipe: The gasket groove and bell socket shall be cleaned and lubricated, and the gasket inserted as specified by the pipe manufacturer. Sterile lubricant, as furnished or specified by the manufacturer shall be applied to the gasket and beveled spigot end of the pipe. The beveled spigot end of pipe shall be pushed straight into bell using either a bar, jack, lever puller, or backhoe. A timber header will be placed between the jack or backhoe bucket and the pipe to prevent damage to the pipe. At no time will the joint be made by swinging the pipe. The pipe will be deflected, if required, after the joint is made.
  
6. Installing Mechanical Joint Pipe and Fittings: All spigots shall be centrally located in the bell and adequate anchorage shall be provided where abrupt change in direction and dead ends occur. All pipe surfaces with which the rubber gasket seals come into contact will be brushed with a wire brush just prior to assembly in order to remove all loose rust or foreign material and to provide a clean surface for the installation of the gasket. The pipe surface with which the gasket comes into contact and the gasket will be brushed with soapy water just prior to the installation of the gasket and the making up of the joint. Torque loads shall be applied to the standard cast iron bolts used in making the joint as follows:

BOLT SIZE, INCHES    RANGE OF TORQUE, FT. POUNDS

5/8	40-60
3/4	60-90
1	70-100
1-1/4	90-120

The above torque loads may be applied with torque measuring or indicating wrenches. Torque wrenches may be used to check the application of approximate torque loads applied by men trained to give an average pull on a definite length of regular socket wrench. The following lengths of wrenches should satisfactorily produce the above ranges of torques when used by the average man:

BOLT SIZE, INCHES    LENGTH OF WRENCH, INCHES

5/8	8
3/4	10
1	12
1-1/4	14

When tightening bolts, the gland will be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket.

7. Bend and Fitting Location: The Contractor is advised that the bends and fittings indicated on the plans are for a guide only. The Contractor will be required to furnish additional bends and fittings as needed to complete all installations.
8. Cutting Pipe: The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. Cut ends of a pipe shall be beveled before installation in a push-on joint bell.

When making connections to existing mains which require water mains to be removed from service, automatic traveling pipe cutting machines will be required on pipe 16-inch and larger. At other times, hand-held pipe saws may be used provided the pipe is marked, prior to cutting, such as to provide a cut at right angles to the axis of the pipe. Handheld pipe saws may be used in all applications for cutting pipe smaller than 16-inch.

Flame cutting of pipe with an acetylene torch will not be allowed.

9. PVC Pipe Installation: PVC water main shall be installed in accordance with the Recommended Practice for the Installation of PVC Pressure Pipe UNI-B-3 and AWWA C-900. Backfill shall be as specified elsewhere in these specifications. Tracer wire or locator tape shall be installed as outlined below:
  - a. Tracer Wire: A 14-gauge solid copper wire shall be laid on top of the PVC pipe to aid in locating the pipe for maintenance purposes. This wire shall be secured to the pipe with duct tape near every bell and at the center of each pipe joint. The wire shall be fastened securely to a cast iron fitting at each main line valve and fire hydrant and/or to copper service lines as directed by the Engineer.
  - b. Locator Tape: in lieu of copper tracer wire specified above, PVC water mains may be installed with blue plastic detachable locator tape made specifically for this purpose. The tape shall be marked with black lettering clearly identifying the pipeline as water. The tape shall be Type III Detachable Marking Tape as manufactured by Lineguard Inc., Terra Tape Sentry Line as manufactured by Reef Industries, or approved equal.

Unless otherwise indicated on the Plans, or required by existing utility locations, all PVC water pipe will be installed with a minimum cover of 3.0 feet. The maximum cover shall be as previously specified. Ductile Iron Pipe shall be installed when the minimum cover is less than 3.0 feet and in all crossings of other pipelines (storm drainage, gas, etc.) when the vertical distance between the water main and the other pipeline is less than 12-inches.

## **H. INSTALLING VALVES, HYDRANTS, AND FITTINGS**

Valves, hydrants and fittings shall be installed in the manner specified for installation and assembly of pipe. Valves and hydrants shall be installed at locations shown on the plans and/or as directed by the Engineer.



1. Valve Boxes: A valve box conforming to the Standard Details shall be installed for every gate valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the box cover flush with the surface of the pavement or other existing surface.

Where the box is not set in pavement, the top section shall be anchored by an 18" x 18" x 6" concrete pad, or an approved pre-cast concrete pad, set flush with the existing terrain. The top section will be grouted into the pre-cast concrete pad. The location of valves will be identified by the letter "V" imprinted into the curb adjacent to mainline or hydrant valve.

All butterfly valves shall be installed with operating nuts plumb and centered beneath a manhole frame and cover, valve box top section and riser pipe as shown in the Standard Details. Extension stems as shown on the standard detail will be required on valves where the operating nut is more than 4.0 feet below the top of the frame and cover.

2. Valve Blocking: All end of line valves 12-inch and smaller installed on PVC or DIP water mains and all 12-inch valves installed along PVC water mains shall be securely wedge blocked with concrete bearing against, and cut into the excavated sides of the trench. Care shall be taken in forming and pouring the "wedge" blocking so the fitting joints will be accessible for repair and/or valve extraction.
3. Fire Hydrants: Hydrants shall be set with no less than three (3) foot bury on water mains 12" and smaller and with four (4) foot or more for water mains 16" and larger. Because of varying topography, extensions, and/or hydrants with greater bury may be required. Extensions will be made by the hydrant manufacturer.

All hydrants and hydrant guard valves will be installed plumb and in accordance with the Standard Details. The appropriate plan view will be noted on the Plans or in the Special Provisions. Each hydrant installation will include a drainage bed of clean washed stone approximately 1 cubic foot in size at the "weep hole". Piping from the main to the hydrant shall be 6-inch DIP.

4. Blocking Fittings: All plugs, caps, tees, and bends deflecting 11-1/4 degree or more on pressure mains 6" in diameter or larger shall be provided with thrust blocking, placed as shown on the Plans and/or as directed by the Engineer, and consisting of ready mix concrete having a compressive strength of not less than 3,600 lbs per square inch at 28 days.

Bagged mix concrete may be used for blocking, anchorage, concrete valve pads, etc. on water mains and valves 12-inches and smaller, when less than 1/2 yard is required. Blocking shall be placed between solid ground and the fittings to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The blocking shall be so placed that the pipe and fittings will be accessible for repair.

5. Restrained joints shall be installed where shown on the plans, standard details or when approved by the Engineer, and may be installed in lieu of blocking. Installation shall be per manufacturer's recommendations, as shown on the plans, special provisions, and/or as directed by the Engineer. Restrained joints will not be allowed on PVC pipe.

## I. WATER MAIN TAPS

1. Installation Of Tapping Sleeves And Valves: Tapping sleeves and valves will be installed only under inspection by the Engineering Division of the Charlotte-Mecklenburg Utility Department and as recommended by the Manufacturer. No work will be done (including excavation of the existing main) except when Charlotte-Mecklenburg Utility Department Engineering personnel are present.

Tapping valves shall be supported at all times to prevent the tapping sleeve from slipping on the main. Tapping sleeves and valves will be field pressure tested after installation on the pipe but before the tap is made.

First, the tapping valve will be opened and the sleeve and valve filled with water and placed under the rated pressure of the sleeve (200 PSI for 12-inch and smaller, 150 PSI for 16-inch and larger). The pressure gauge shall be observed for five minutes with no loss of pressure. Then the pressure shall be released, the valve closed and procedure repeated with test pressure against the outside of the valve gate or wedge.

When tapping sleeves are furnished with test plugs, the test may be made in a single step with the valve closed and pressure applied through the test plug.

2. 3/4" And 1" Water Service Connections: Applications shall be made to the Public Service Section of the Charlotte-Mecklenburg Utility Department and will pay current fees for 3/4-inch and 1-inch meters prior to construction and installation of water service connections. Only those connections which have been applied for and approved will be made.

Service lines will be made perpendicular to the water main and shall, unless otherwise approved, terminate in the middle of the lot served. All taps will be made substantially as shown on the Standard Details. Services lines will be installed with a minimum depth of cover of 20-inches and a maximum depth of cover of 30-inches. Service connections must be installed prior to pressure testing and sterilization. Allowance for the joints in service connections will be included when computing the allowable leakage. The Contractor shall flush each connection after testing and sterilization is complete.

Meter box locations shall be as shown on the standard details. Meter boxes shall be concrete as previously specified. In areas with sidewalks or proposed sidewalks, the meter boxes are to be set either totally in or totally out of the sidewalk. Meter boxes set in sidewalks shall have concrete lids. Meter boxes will not be set in driveway locations.

Meters will be obtained through the Utility Department and will be installed by the Utility Department personnel after the lines are approved by the Engineer, subject to receipt of turn-on order. The location of services will be identified by the letter "W" imprinted into the curb adjacent to the service. Where a service is moved or removed, the "W" will be removed from the curb or grouted over.

On projects without curb, the Contractor will paint a "W" on the edge of pavement adjacent to the service. Markings will be made with blue paint conforming to the uniform color code established by the Utility Location And Coordination Council of the American Public Works Association.

3/4-inch service connections to Ductile Iron Pipe shall be made by tapping the main directly with a corporation stop. Service connections to PVC pipe as well as 1-inch and larger service connections to DIP shall be made by using tapping saddles threaded to accept corporation stops.

In new streets, piping beneath pavement on "long side" taps will be installed prior to paving. Backfill shall be compacted as specified with extreme care taken to prevent damage to the copper piping. Piping beneath paved areas will be one continuous piece.

3. 1-1/2 Inch And Larger Services: Master meters 1□-inch and larger and fire lines with detector checks may be installed by the Contractor. Such installation shall conform to the Standard Details, as applicable for the meter installations and to the applicable MS and DS sections for service line piping. All portions of the installation, including property line valves, shall be contained within the street right-of-way. Where this is not feasible because of vault size or limited right-of-way width, the required additional right-of-way shall be transferred to the City in accordance with the General Conditions section of this document. The Contractor shall consult with the project inspector to determine location of meter vaults before installation begins.
4. Backflow Prevention devices shall be installed in accordance with CMUD's Backflow Prevention Manual.

## **J. BACKFILL**

All backfill shall be of a non-plastic nature free from roots, vegetative matter, waste, construction material, or other objectionable material, including but not limited to rock larger than 2/3 cubic foot. Rock shall not exceed 10% of the fill material, and shall not be placed within 2-feet of the pipeline or within 2-feet of finish grade. Backfill material shall be capable of being tamped by mechanical tamps using relatively low velocity and heavy blows. The material shall have no tendency to flow or behave in a plastic manner under the tamping blows. Material deemed by the Engineer as unsuitable for backfill shall be removed from the job site before backfilling operations begin.

1. Replacement of Wet Or Unsuitable Material: When the Engineer determines that the material excavated from the trench is unsuitable for backfill because of the material type or because it contains excessive debris, rock or organics, it shall be removed from the project and replaced with a backfill material approved by the Engineer. When the moisture content of an otherwise suitable material is too high to achieve specified

compaction, as determined by a moisture content and density test, the Contractor shall replace the material as necessary to meet backfill requirements. The wet material may be dried to optimum moisture content and used for backfill in subsequent phases of the project. Should an otherwise suitable material be found too dry to achieve compaction requirements, water may be added to the material to raise the moisture content to optimum. Borrow material placed at the direction of the Engineer shall be clean earth at optimum moisture content, concord (pit) gravel or ABC stone.

2. Backfilling of Trenches: Trenches shall be backfilled immediately after the pipe is laid. Backfill around pipe and to an elevation of one (1) foot above the pipe bell shall be done only by hand and in layers not exceeding six (6) inches with every layer thoroughly tamped. Successive layers of backfill shall be compacted in place as specified below.

Should water rise in an unbackfilled ditch after the pipe has been placed, the Engineer may require the Contractor to remove the pipe, muck the trench and relay the pipe using Type II or Type III granular bedding.

- a. Backfill of trenches within water main rights-of-way: Trenches excavated outside existing roadway and railway right-of-way may be backfilled, above the initial one (1) foot, by mechanical means in layers up to twelve (12) inches thick, unless otherwise approved by the Engineer.
- b. Backfill of trenches within road and railway rights-of-way: Trenches excavated within existing road and railway rights-of-way shall be backfilled in layers not to exceed six (6) inches and each layer shall be thoroughly tamped.

## **K. COMPACTION REQUIREMENTS**

Compaction for pipeline and structure excavations shall be attained by the use of mechanical tamps. Each layer of backfill shall be placed loose and thoroughly compacted in place. Heavy rollers, vehicles or other equipment shall not be used for compacting backfill nor allowed to cross over completed work except at points adjudged capable of adequately protecting the pipeline. Pneumatic tamps, ram type tamps or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of "Mechanical Tamp".

1. Pipeline Compaction: Trenches excavated outside existing road and railway rights-of-way shall be backfilled as specified above and tamped thoroughly:
  - a. All material shall have an in-place density of at least 95% of maximum density or as directed by the Engineer.
  - b. Should any public or private roadways, service road, drive, etc. be encountered during this construction, the Contractor shall at the Engineer's direction comply with the compaction requirements specified below for work within road and railway rights-of- way.

2. Compaction Within Road and Railway Rights-of-Way: Trenches excavated within existing road and railway rights-of-way, and all structure excavation regardless of location, shall be backfilled as previously specified and thoroughly tamped:
  - a. Unless otherwise required by the controlling agency, all material from the bottom of trench to within six (6) inches of the subgrade shall have an in-place density of 95% of the maximum dry density as defined by a standard proctor curve for the material.
  - b. All material within six (6) inches of the subgrade level shall have an in place density of 100% of the maximum dry density.
  - c. On roadway shoulders, all material shall have an in place density of 95% of maximum dry density.
3. Compaction Testing: Moisture content and density testing of backfill will be performed by CMUD soils technicians. Tests will be performed within all street, highway and railway rights-of-way to insure that the specified compaction requirements are met. The Contractor will cooperate fully with the soils technicians in providing access to backfill at any requested depth for the purpose of performing moisture content/density testing. When requested, the Contractor shall excavate a backfilled ditch to any specified depth for a compaction test and shall insure that the ditch meets all OSHA safety standards before the technician enters to perform the test.

A "standard proctor curve" which establishes the relationship between moisture content and dry density for soil will be determined by the method described in ASTM D-698 or by AASHTO Method T-99. Field density tests will be performed using either the sand cone method or a nuclear moisture/density gauge. Any backfill which does not meet the specified compaction will be re-tamped, or removed and replaced as approved by the Engineer.

#### **L. REMOVAL AND RESTORATION OF PAVEMENT AND ROAD SURFACES**

All removal and restoration of pavement and road surfaces will be in accordance with the specifications approved by the Superintendent of Streets of the City of Charlotte or of the North Carolina Department of Transportation and Safety, Division of Highways, whichever applies.

All restored bituminous and concrete pavements shall be placed to existing cross-section and ride quality. Restored pavement will in all instances be flush and level with existing pavement at the sawed edges, and at existing gutter lines where applicable unless otherwise approved by the Engineer. When pavement repairs do not meet the above criteria or are not performed in a workmanship manner as determined by the Engineer, Superintendent of Streets of the City of Charlotte, or North Carolina Department of Transportation, whichever applies, the contractor will remove and re-perform the restoration as specified.

When cuts are to be made in street rights-of-way under maintenance by the City of Charlotte, the Contractor shall contact the Superintendent of Streets or his designated representative before each separate pavement cut is made and secure a permit.

Pavement will be replaced as follows. In all pavement cuts either the permanent pavement or a temporary pavement consisting of 1"-1□" of black asphaltic concrete (later to be replaced permanently) will be placed immediately upon completion of the subgrade unless otherwise approved by the Engineer.

1. Specifications for Cutting Pavement: Unless otherwise approved or required, concrete pavement shall be removed to the nearest expansion or contraction joint. The Contractor will contact the Superintendent of Streets and/or D.O.T.'s District Engineer for a determination of the limits of concrete replacement and location of joints. Where sawed joints are allowed, the depth of the sawed cut shall be at least one (1) inch and shall extend at least 1/5 of the depth of the concrete. More depth may be required if necessary to prevent damage to surrounding pavement.

Bituminous pavement shall be cut in a smooth and straight line. Sawing is required on asphaltic concrete. The width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. Existing pavement shall be removed on each side of the trench for at least 12 inches beyond top of trench.

The Contractor shall remove and replace pavement which, in the opinion of the Engineer, has been cracked or displaced by the operation of the Contractor.

2. Specification For Restoring Concrete Pavement: The concrete used to restore pavement shall have a minimum 28 day compressive strength of 3600 P.S.I. The concrete as placed shall conform to the shape, grade, and finish of the existing pavement and will be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches.
3. Specification For Restoring Asphalt Pavement: All material above the sub-base level shall be hot-mix bituminous concrete conforming to North Carolina Department of Transportation Standard Specifications for Roads and Structures for both mix design and placement.

The asphalt pavement as placed shall be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches within City maintained roadways or eight (8) inches within state maintained roadways. The asphalt shall be placed in lifts not greater than 4 inches and shall be hot mix bituminous concrete binder Type H. The last two (2) inches in either instance shall be bituminous plant mix (I-2) suitable to the appropriate controlling agency. I-2 asphalt pavement resurfacing will be placed with paving machines and/or rollers of a size and type currently approved by the North Carolina Department of Transportation for use on resurfacing contracts.

If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Engineer, shall replace the concrete to its original thickness, or to a level 2 inches below the finished surface. The Engineer may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials.

Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters).

Under normal conditions, asphalt binder will be placed in pavement cuts at the end of each work day. I-2 shall be replaced weekly or within five days following completion of pipeline construction along a continuous section of pavement. During inclement weather, the Engineer may permit the use of temporary asphalt (cold mix) to seal the trench until permanent asphalt can be placed.

## **M. CONCRETE CONSTRUCTION**

1. Acceptance of Concrete: Concrete shall be accepted on the basis of its meeting the requirements listed under the Material Specifications and Detail Specifications Section of this contract. The Inspector will accept no ready mix concrete without the plant dispatch ticket.

The Engineer shall make or require any tests as he deems necessary to insure that the concrete meets specifications. Such tests may be performed by CMUD materials technicians or the Engineer may require the test to be performed by an independent testing laboratory at the Contractor's expense.

2. Placement: Concrete will not be accepted if it cannot be placed within ninety (90) minutes of the dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete containing foreign material will not be accepted. Depositing will not be permitted when temperature has not exceeded 35° and rising by 10:00 A.M. Depositing shall cease when the descending air temperature in the shade falls below 40° F. It shall not resume until the ascending air temperature rises to 35° F. All concrete shall be kept from freezing by the Contractor. Frozen concrete shall be replaced at the Contractor's expense. Free fall shall not exceed 3 feet in any case.
3. Forms: Forms may be made of wood, plywood, metal, or any other material approved by the Engineer. Forms shall be mortar tight, of material strong enough to resist noticeable deflection or bulging between supports, and the interior dimensions of the forms shall be such that the finished concrete shall be of the form and dimensions shown on the Plans. The design of the forms shall take into account the effect of vibration of concrete as it is placed and also the rate of speed at which the forms will be filled. Forms shall be coated with a lubricant as approved by the Engineer.

Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

4. Curing: All concrete will be cured for a seven (7) day period after placement according to the following procedure.

- a. Forms will normally be left in place for the entire seven (7) day period. Exposed surfaces not covered by forms will be kept moist continuously for the entire seven day period or will be cured through use of an approved curing compound which will be applied after all surface water has disappeared.
  - b. At the discretion of the Engineer, forms may be removed after the initial set and before the end of the seven day period. In such cases, the areas previously covered by forms shall be cured as described above.
  - c. The Engineer may permit backfill of certain structures (e.g. concrete piers) before the end of the curing period. In such cases, the forms shall be stripped and the surfaces that remain exposed after backfill shall be cured as described in (a) above. Curing compound shall not be required for backfilled surfaces except where specified by the plans or Special Provisions.
5. Finishing: The structure shall have a uniform and textured surface. All form marks exposed to view shall be rubbed off with a stone.
6. Testing: The following tests will be performed by CMUD technicians to ensure the concrete quality:
- a. Compressive strength in accordance with ASTM C-31 and ASTM C-39. Test cylinders which are formed in the field will be left in the field until compression testing (7 day, 14 day, 28 day) is completed thereby more closely approximately the curing conditions of the field placed concrete.
  - b. Slump Test in accordance with ASTM C-143.
  - c. Air Content Test in accordance with either ASTM C-173 or ASTM C-231.

#### **N. DRY BORE WITH STEEL ENCASEMENT**

Unless otherwise shown on the construction plans, casing pipe installed under State and/or City maintained roadways shall not require a protective coating. Casing pipe installed within Railroad rights-of-way may require a coal-tar primer coat, followed by a single application of hot coal-tar enamel 3/32 inches thick 1/32 inch plus a bonded 15 lb. asbestos felt wrap or an approved equal coating.

Unless prohibited by the railroad, uncoated pipe may be used if and only if the wall thickness specified is increased to the next thicker standard size, or a minimum of .0063 inches thicker than standard.

1. Bore Pits (or Tunnel Pits): Bore or tunnel pits shall be safed-up, shored, well marked, lighted, and not left unattended except as approved by the Engineer. Requirements for stabilization and dewatering of bore pits shall be as hereinbefore specified. The angle of repose method (sloping pit walls) for creating a safe working area shall not be used unless specifically allowed or approved by the Engineer.



2. Installation: Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe, bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of encasement pipe shall be butt-welded to the section previously jacked into place. Continuous checks shall be made as to the elevation, grade and alignment of each successive section of encasement as well as the tracks (rails) upon which the boring rig travels.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement grout at sufficient pressure to prevent settlement in the roadway/railway.

Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed.

In the event an obstruction is encountered during the boring and jacking operations, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before reapplying to the Controlling Agency for permission to open cut, bore at an alternate location, or install a tunnel.

Installation shall be to the limits specified by the Controlling Agency and/or as delineated in their encroachment issued to the City. (Copy of the encroachment agreement must be kept at the site throughout boring operations).

The completed casing installation shall be such as to prevent the formation of a waterway under the road or railbed.

The Controlling Agency shall have full authority to require remedial measures and/or to stop all work if, in its opinion, said work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test, and approve all materials and methods used.

The Contractor shall notify the Controlling Agency through the Construction Engineer and acknowledgement shall be received a minimum of five (5) working days prior to beginning any work within roadway or railway rights-of-way. If required, 24-hours notice will be given prior to completion.

## **O. GUARANTEED CASING INSTALLATION**

The casing shall be installed by jacking, with simultaneous removal of spoil. The spoil removal shall not proceed more than 18-inches ahead of the casing. The diameter of the excavated hole shall be no larger than necessary to keep the casing moving freely and lubricant may be used to reduce the jacking forces. Casing sections shall be joined by butt weld.

After the casing is jacked in place, 2-inch grout holes shall be used to pump a 1:3 portland cement grout to fill the void outside the casing. Sufficient pressure should be applied to force grout out of the adjacent grout hole. Grout holes shall be a maximum of ten feet apart at the top of the casing.

The casing size and thickness shall be as shown on the Plans or Special Provisions.

**P. TUNNELLING OPERATIONS USING STRUCTURAL STEEL LINER PLATES**

All plates shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seam or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be multiples of the plate length so that plates having the same curvature shall be interchangeable to permit staggering of the longitudinal seam. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of the design specifications. All liner plates for the full length of a specified tunnel shall be either the flanged or the lapped seam type. The two types shall not be mixed in the same tunnel.

Liner plates shall be assembled in accordance with the manufacturer's instructions. Galvanized and coated plates shall be handled in such a manner as to prevent bruising, scaling, or breaking of the coating. Any plates that are damaged during handling or placing shall be replaced, except that small areas with minor damage may be repaired to the satisfaction of the Construction Engineer or his representative.

Galvanized surfaces shall be repaired by thoroughly wire brushing the damaged areas and removing all loose cracked coating, after which the cleaned areas shall be painted with two (2) coats of zinc rich paint as approved, and an acceptable bituminous coating restored.

When tunnelling has proceeded a distance sufficient for placing one section of the tunnel liner, that section of liner will be placed before excavating further. Excavation shall be controlled so that the space outside the liner plate shall be held to a minimum. All voids between the liner plate and the tunnel wall shall be filled with 1:3 portland cement grout, containing no more water than necessary, placed under sufficient pressure to fill all voids.

Grout shall be placed through the grout holes provided in the top of the tunnel liner plates. Grout holes 2" in diameter shall be provided at not more than 4.5 foot centers or every third ring of plates to permit grouting as the erection of the tunnel liner progresses. At no time will the grouting operations be further than 10' from the front end or head of the tunnel construction. At the end of each day's operations, the voids outside installed liner plates shall be grouted whether 10' or less. Grout will be forced into each grout hole. If the grout from one hole should flow along the liner plates so as to plug the next hole, the plug shall be opened by punching through the grout so that each hole may be used for grouting. The grouting operation will be continued at each hole until all spaces outside the liner plates are filled and no grout will flow.

The tunnel shall be constructed to the limits, grade and alignment shown on the Construction Plans. Excavation, without the use of jetting, shall be done in such a manner as to protect public and/or private property from damage. Prior to beginning any construction, the Contractor shall submit pit shoring and tunnel liner details for approval, and no tunneling may begin prior to approval of these details by the appropriate Controlling Agency. After approval of tunnel liner and pit shoring details, a five (5) day notice to the Controlling Agency, through the Construction Engineer, shall be provided as previously specified.

No blasting will be done without prior written approval of the controlling agency and then only in strict accordance with all Federal, State, and Local laws, ordinances, rules, or regulations governing the storage and use of explosives. Where blasting is required, only small controlled charges of 40% dynamite or plastic explosives shall be used. The depths of the holes for these charges shall not exceed the depth necessary to clear an area sufficient to place one section of tunnel liner.

The charges for the initial series of blasts should be placed in the triangle method. The second series should be placed in the radial method a minimum distance from the desired diameter of the tunnel. The triangular charges shall be set to go off first, with the radial charges to go off following a short interval or using the time-lag method.

Where rock is encountered before approaching the shoulder or pavement, the first four series of charges will be used in determining the amount of controlled blasting to be used before beginning any blasting beneath the railway or shoulders or pavement of the highway as applicable. If rock is encountered after tunneling progresses beneath the pavement or railway, the charges will initially be set at very low levels and increased in small increments until the proper amount of charge is determined. In no case will an overshoot be permitted. If a boulder is encountered and removed by blasting or by other methods, a bulkhead will be formed immediately after removal of the boulder and the area filled with grout before proceeding with the tunneling operations.

If there is any indication of a vertical split in the rock formation, or any indication of settlement of the roadway or railway fill, all operations shall be stopped and the Controlling Agency notified immediately. If the vertical split is not determined to be of too great a magnitude or too close to the rails/pavement, the split shall be filled with grout at a pressure specified by the Controlling Agency, allowed to set and tunneling operations may be continued. If it is determined that the vertical split is too great of a magnitude or too close to the pavement or railway, the Controlling Agency shall determine the method to be used to correct the split. If settlement of the roadway or railway occurs, the Controlling Agency will determine the proper steps to be taken to correct the settlement. If deemed necessary by the Controlling Agency, adequate warning devices (signs, flashers, etc.) accompanied by responsible flagmen shall be placed at a distance allowing any and all traffic time to stop safely before reaching the questionable area. At the option of the Controlling Agency, it may provide the necessary flagmen, warning devices, etc., at the Contractor's expense. Traffic shall be allowed over the questionable area only as directed by the Controlling Agency.

The Controlling Agency shall have full authority to inspect entire tunnel operation, require disposition of remedial measures, and to stop all work if, in its opinion, the work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test, and approve all materials used.

The completed liner shall consist of a series of structural steel liner plates assembled with staggered longitudinal joints. Liner plates shall have been fabricated to fit the cross section of the tunnel. All plates shall be connected by bolts on both longitudinal and circumferential seams or joints.

After tunnelling operations have been completed the Contractor will install the carrier pipe in a manner approved by the Engineer. Concrete fill (1:3 portland cement grout) will then be placed after completing installation of the water pipe within the tunnel liner as directed by the Engineer and end enclosure walls installed as shown on the Construction Plans or Standard Details. Ends of the tunnel liner will be sealed with an eight-inch (8") masonry wall on the lower end and a twelve-inch (12") masonry wall on the higher end. Weep holes will be provided on the downstream end for drainage - see Standard Detail #16. The Contractor shall then remove the vertical shoring for pits (if ground conditions allow), surplus spoils, and material from the site.

The site shall then be returned to its original condition, seeded, mulched, or restored as specified and left in a neat and satisfactory condition. Shoring material shall be removed in such a manner so as to avoid collapse and to allow proper backfill. The backfill shall be placed in accordance with these Specifications or the requirements of the Controlling Agency.

The Contractor will notify the Utility Department, in writing, upon completion of the tunnel liner installation. Notification of completion of the tunnel operation will then be forwarded to the Division Engineer, in writing, by letter with a copy to the attention of the State Design Services Engineer, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina 27611 by the Utility Department.

The Contractor shall reimburse the Utility Department (Owner) and the Utility Department (Owner) shall reimburse the Division of Highways should any settlement or damage result to the roadway within a period of one (1) year after completion of the tunneling operations.

The Contractor and any of his subcontractors performing work on the State's (NCDOT) right-of-way in connection with tunneling operations shall furnish for approval, through the Construction Engineer, to the Department of Transportation, attention State Design Services Engineer, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina, 27611, a certificate of insurance. An original and one copy of the certificate in the minimum amounts of \$500,000 Bodily Injury and \$250,000/\$500,000 Property Damage shall be submitted for approval as evidence of proper coverage before beginning any work at the site. The Certificate is to show explosion, collapse, and underground insurance coverage is provided. The Certificate will also reference the project, county and the Design Services Unit's file number.

Insurance requirements for work performed on Railroad (CSX, Norfolk-Southern, etc.) property will be as outlined in the Special Provision Section of this contract. The Contractor shall furnish for approval a certificate of Insurance to this office. All required submittals will be sent to the Utility Department for review and this office will then forward the documentation on to the railroad.

Insurance will remain in full force and effect for one (1) year after acceptance by the owner and the Controlling Agency. The Certificate is to be countersigned by an authorized North Carolina Resident Agent with the name and address of the agent denoted thereon.

**Q. BLASTING**

Prior to commencing any blasting operations the Contractor shall notify either the City Fire Department - Fire Prevention Section or the County Fire Administrator as applicable, and obtain blasting permits as required. The Contractor must furnish certification of Insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

All blasting operations shall be conducted in strict accordance with any and all decrees, rules, regulations, ordinances, and laws as may be imposed by any regulatory body and/or agency having jurisdiction over the work relative to handling, transporting, use and storage of explosives. Blasting shall be done only by competent, sober and experienced personnel whose activities shall be conducted in a workmanlike manner. Satisfactory information must be provided to the Engineer that the blaster meets or exceeds the qualifications enumerated in OSHA Regulations Part 1926, Subpart U, Section 1926.901 - Blaster Qualifications.

All rock, dirt and debris from blasting shall be contained within the excavation by use of weighted mats or undisturbed overburden. The Contractor's blaster shall be fully responsible for determining the method of containment and the weight, size and placement of material required to contain the charge he is using.

Charges shall be sized such that no damage to houses, structures, roadways etc., outside the limits of the excavation will occur. Where there is a possibility of such damage, the charge will initially be set at a very low level and increased in small increments until the proper charge is determined. The Contractor shall be held responsible for any and all injury to persons or damage to public or private property.

1. Permission to Blast: The Contractor shall not be allowed to blast within any rights-of-way maintained by any agency (D.O.T., R.R., Gas, etc.) other than the City without specific approval of the controlling agency and only in accordance with their respective requirements.

**R. TESTING AND INSPECTION**

Required testing of pipelines and valves shall be done under the direct supervision of the Project Inspector. Field testing shall not negate the requirements for material certifications as contained in the material specification section of this contract. Unless otherwise directed by the Engineer, all testing and disinfection will be completed prior to connection to any existing line. The Contractor shall provide open ventilation of confined spaces. The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

1. Hydrostatic and Leakage Tests: On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. The water for this purpose can be taken from existing lines under the supervision of the Engineer's Inspector and leakage will be measured by the Inspector with a meter furnished by the Charlotte-Mecklenburg Utility Department. All leaks and any defective

material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification are met. Any special equipment, pumps, etc. required to make the test shall be furnished and operated by the contractor as directed by the Inspector.

The Contractor shall use great care to be sure that all air is expelled from each section under test. If fire hydrants or other openings are not available for the purpose of expelling air, the Contractor shall provide air releases of sufficient size (as determined by the Engineer) in accordance with City Standard Drawings, at his expense. Specific procedures for testing mains are as follows:

- a. Test pressure will be 200 PSI at the low point of the section under test. When testing against butterfly valves, the differential pressure at the valve must not exceed 150 PSI for valves rated at 150 PSI.

If the test cannot be made with differential pressure of 150 PSI, 250 PSI valves will be specified. Differential pressures across gate valves may be up to 200 PSI.

- b. Allowable leakage will be determined by Table 6, AWWA C-600 (see below) or by the formula  $L = .000106SD$  where S is the length of pipe under test and D is the pipe diameter. Add .0043 gal/hr. for each 3/4-inch service and .0057 gal/hr. for each 1-inch service.

TABLE 6

Allowable Leakage per 1000 ft. (305m) of Pipeline\* - gph‡

Avg. Test Pressure <i>psi (Bar)</i>	Nominal Pipe Diameter - <i>in.</i>															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.45	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.47	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.91	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.64
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

\* If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

‡ To obtain leakage in liters/hour, multiply the values in the table by 3.785.

- c. Pressure and leakage tests will be run concurrently and for a duration of four hours except as modified below.
- d. The Contractor will pressurize the line and verify that it is within allowable leakage before the official test is started.
- e. The Inspector will begin the test and remain at the job for the first hour, making sure that the test pressure is maintained within 5 PSI. The Contractor is to maintain the pressure within 5 PSI for the duration of the test period. At the end of the first hour, with the line pumped to full test pressure, he will read the meter and record the first hour leakage. If the first hour leakage is within allowable, he will return at the end of the fourth hour and again read the meter. If the total leakage for the four hour period does not exceed four times the first hour leakage, the test will be terminated. If the total leakage exceeds four times the first hour leakage, but is still within allowable, the test will be held an additional hour. If the fifth hour leakage does not exceed the average hourly leakage for the first four hours, the test will be terminated at the end of the fifth hour. Otherwise, the test will be held until the leakage is non-increasing and within allowable for two consecutive hours.
- f. If leakage exceeds allowable for the four hour test, the test will be terminated and re-scheduled after the Contractor has verified that actual leakage is within the allowable leakage, but no earlier than the next work day.
- g. If the first hour leakage does not exceed 10% of the allowable, or if the allowable leakage rate does not exceed .4 gal/hr., the test may be terminated at the end of two hours provided the second hour leakage does not exceed the first hour leakage. If the second hour leakage exceeds the first hour leakage, the test will be held for an additional period as described in Paragraph (e) above.
- h. The maximum length of pipe tested in one test shall be 5,000 feet or as close to 5,000 feet as possible depending on valve spacing.
- i. During the last stages of the test and without any reduction in pressure, first the hydrant guard valves will be closed, then progressing in an orderly manner from the end opposite the test pump, each main line valve will be closed and pressure released to determine if it is holding pressure (minimum 10 minutes per valve closing).
- j. Unless otherwise directed by the Engineer, each Butterfly Valve will be tested to 150 PSI for a minimum of 10 minutes after the pipeline has been successfully tested.

- k. When testing mains with Contractor installed water services, the Engineer may on a random basis require jumpers in selected meter yokes with full test pressure applied to the property line valve. Such jumpers will be furnished by the Engineer and installed by the Contractor.
2. Disinfection of Mains: All of the water mains installed shall be thoroughly flushed and disinfected before being placed in service. This work shall be done under the direct supervision of the Engineer's Inspector. The Contractor shall supply all labor, equipment and materials necessary for carrying out this work. After a thorough flushing and cleaning out, sufficient chlorine compounds shall be introduced in the lines to produce a chlorine concentration of at least 50 parts per million. The chlorine solution shall be retained in the lines for at least twenty-four (24) hours. At the end of this period, the chlorine residual shall be at least 20 parts per million. The lines will then be flushed sufficiently to clear them of chlorine exceeding one part per million. Samples of water from the mains will then be taken and analyzed for bacteriological purity. If the mains fail to meet the bacteriological standard for purity, disinfecting and flushing will be repeated until such standards have been met. All analysis for chlorine and bacteriological purity will be by City Personnel.
3. Drainage of Mains: Drainage of mains and disposal of chlorinated water shall be in accordance with all Federal, State and local laws, ordinances and regulations. Mains shall be drained to sanitary sewers, where available. Drainage directly to surface waters (creeks, rivers, streams, lakes, ponds, etc.) will not be allowed. Drainage branches, blowoffs, air vents and appurtenances shall be provided with valves and shall be located and installed as shown on the Plans and Standard Details. Drainage of mains will be accomplished in such a manner as to minimize erosion and siltation to adjoining properties. Water velocity from drainage and/or blow-off will be dissipated as necessary to prevent erosion.

Drainage branches or blowoffs shall not be connected to any sewer, submerged in any streams, or installed in any other manner that will permit back siphonage into the distribution system.

## **S. REPAIRS**

The Contractor shall make any needed repairs to newly installed unactivated mains. Repairs to existing and/or activated mains will be made by the Charlotte-Mecklenburg Utility Department unless the Contractor is otherwise directed by the Engineer.

1. Repairs to New mains: Repairs shall be made by cutting out and removing the damaged/defective section and replacing those with new pipe using long pattern solid sleeves to connect plain ends. Bell clamps will not be allowed to repair newly installed
2. Repairs to Existing Mains: The Contractor will not be required to repair existing mains unless specifically directed by the Engineer, or specified elsewhere in these specifications. Repair methods will be considered on a case by case basis.



## T. RESTORATION

All surfaces and structures (both public and private) within and adjacent to the construction operations shall be restored to a condition comparable to that existing prior to construction or as specified in the special provisions.

All surplus materials shall be disposed of in a manner acceptable to the Engineer, and the construction area shall be left in a neat condition, with special attention called to proper drainage, smoothness of surface, and general clean up. No machinery or equipment shall be left or stored on the job site after the project is completed.

Unless otherwise specified, complete restoration to include fertilizing, seeding, and mulching of any and all areas disturbed during construction shall be completed within thirty (30) working days following the initial ground disturbing activity.

1. Water meters, valve boxes, drain pipes, and other structures encountered shall be reset or relaid to match or clear surface grade and/or water main pipe grade as applicable.
2. All shoulder areas shall be restored, stabilized, and maintained to their original condition. Concrete, asphalt, gravel, and dirt walks, drives and roadways are to be replaced to their original shape and serviceability. Unless otherwise approved by the Engineer all areas (shoulders, side streets, drive, parking areas, etc.) which exhibit a gravel surface at the time of construction will be re-graveled with a minimum depth of six (6) inches of C.A.B.C stone compacted-in-place for the width and length of the disturbed area and then feathered gradually into the existing cross section. When a driveway is finished with other than C.A.B.C stone, a one inch finish coating to match existing gravel gradation and appearance shall be placed.

The Contractor should note that all existing side streets and drives which are either dirt or gravel will be restored as specified for graveled areas.

3. Refuse Burial: The Contractor shall not bury rock, broken concrete/asphalt, construction material, timber, etc. within the street or water main right-of-way.
4. Rip-Rap: The Contractor shall place stone rip-rap as specified in those areas subject to severe water action where directed by the Engineer.

Placement of rip-rap as shown on the Construction Plans shall be considered a guide only, with final determination made at the time of construction by the Engineer. Either the addition or deletion of quantities may be required.

Stone rip-rap will be placed as indicated on the Standard Details immediately following pipe installation and will be installed no steeper than a 2:1 slope except when specifically approved by the Engineer. Grading will be required as necessary to insure continuous even flow.

The rip-rap installation shall include all earthwork necessary to stabilize the creek bank and to provide cover for the water line.

5. Jute Netting/Erosion Blanket: The Contractor shall install jute netting or Erosion Control Blanket in areas subject to high runoff velocities, areas subject to concentrated runoff and on steep slopes as shown on the plans and/or as directed by the Engineer.
6. Fertilizing, Seeding, and Mulching: Established lawns and landscaped areas damaged by construction shall be restored to their former condition by seeding, unless the type and condition of the existing sod warrants it being cut, removed, preserved, and replaced. All areas, regardless of previous condition, damaged by construction shall be fertilized, seeded, and mulched as outlined below:
  - a. Seed Bed Preparation: The seed bed shall be prepared by pulverizing the soil in an approved manner to a depth of three (3) inches for field conditions or slopes that are 3:1 or flatter and to a depth of one (1) to three (3) inches, as determined on site for slopes steeper than 3:1. The soil shall be tilled until a well pulverized, firm, reasonably uniform seed bed is prepared conforming substantially to ground elevations as shown on the Plans and/or as existed prior to construction. The disturbed area shall blend uniformly into adjacent topography. Good surface drainage must be provided, allowances for settlement made and ground elevations adjusted accordingly. Visible ponding will not be allowed. All stones, roots, sticks, rubbish, and other objectionable material shall be removed.
  - b. Soil Improvements: Soil additives shall be incorporated in an approved manner into the top soil at the following rates:
    - (1)..... Fertilizer - 20 pounds per 1000 square feet of 5-10-10 fertilizer generally and 30 pounds per 1000 square feet of 10-10-10 fertilizer for established lawn areas.
    - (2)..... Lime - 100 pounds per 1000 square feet.
    - (3)..... Superphosphate (0-20-0) - 12 pounds per 1000 square feet.
  - c. Seeding: Seeding must be done within thirty (30) calendar days after the initial ground disturbing activity.
    - (1)..... The seed bed must be in good, friable condition and not muddy or hard at the time seeding is performed.
    - (2)..... Seed shall be applied at the rate specified and raked or tilled into the topsoil with the resulting furrows running across the natural slope of the ground. Under no circumstances will any tilling activity be allowed parallel with said slope. Slopes steeper than 3:1 shall require the use of hydraulic seeding unless otherwise specifically approved by the Engineer.
  - d. Mulching: After fertilizing, seeding and raking, dried straw shall be spread uniformly over the area at a rate of 90 pounds per 1000 square feet. Approximately 1/4 of the ground should remain visible to avoid smothering seedlings. The straw shall be sprayed with liquid asphalt to bond it together and anchor it in place within road right-of-way and areas subject to erosion.

- (1)..... Liquid asphalt, thinned with kerosene, shall be used during freezing weather and shall be either rapid or medium curing. It shall be applied at a rate of 200 gallons per ton of straw or approximately 9 gallons per 1000 square feet.
  - (2)..... Emulsified asphalt, thinned with water shall be used when temperatures are less severe, shall be rapid curing only, and shall be applied at a rate of 150 gallons per ton of straw or approximately 7 gallons per 1000 square feet.
- e. Maintenance: The Contractor shall maintain the seeded areas until there is a uniform growth three (3) inches high. Maintenance shall consist of watering, weed and pest control within established lawns, fertilization, erosion repair, reseeding and all else necessary to establish a vigorous healthy and uniform stand of grass. All areas and spots which do not show a uniform stand of grass, for any reason, shall be treated repeatedly until a uniform stand is attained.

Seasonal seeding mixtures and rates of application shall be as follows. All rates are in pounds per 1000 square feet and any rates listed below may be cut by 1/2 for temporary erosion control measures only.

**SEPTEMBER 15 - MARCH 1**

Maintained/Established Lawns or road rights-of-way

- ..... 6# Kentucky Fescue No. 31
- ..... 2# Rye Grain
- ..... 30# Fertilizer (10-10-10)
- ..... 100# Lime
- ..... 12# Superphosphate

Open-Field (Anything other than an established lawn)

- ..... 4# Kentucky Fescue No. 31
- ..... 2# Rye Grain
- ..... 20# Fertilizer (5-10-10)
- ..... 100# Lime
- ..... 12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

- 2# Kentucky Fescue No. 31
- 4# Sericea Lespedeza (Unscarified)
- 2# Rye Grain
- 30# Fertilizer (5-10-10)
- 100# Lime
- 12# Superphosphate

## **FEBRUARY 1 - OCTOBER 15**

Maintained/Established Lawns or road rights-of-way

8# Kentucky Fescue No. 31  
30# Fertilizer (10-10-10)  
100# Lime  
12# Superphosphate

Open-Field (Anything other than an established lawn)

6# Kentucky Fescue No. 31  
2# Sudangrass (May, June, and July only)  
20# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

2# Kentucky Fescue No. 31  
4# Sericea Lespedeza (Scarified)  
2# Sudangrass (May, June, and July only)  
20# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

The Engineer will be consulted prior to seeding for a determination of appropriate seed mixture.

Unless otherwise required by the North Carolina Department of Transportation or the Engineer seeding within road rights-of-way will be as specified for established lawns.

### **U. WORK WITHIN NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RIGHTS-OF-WAY**

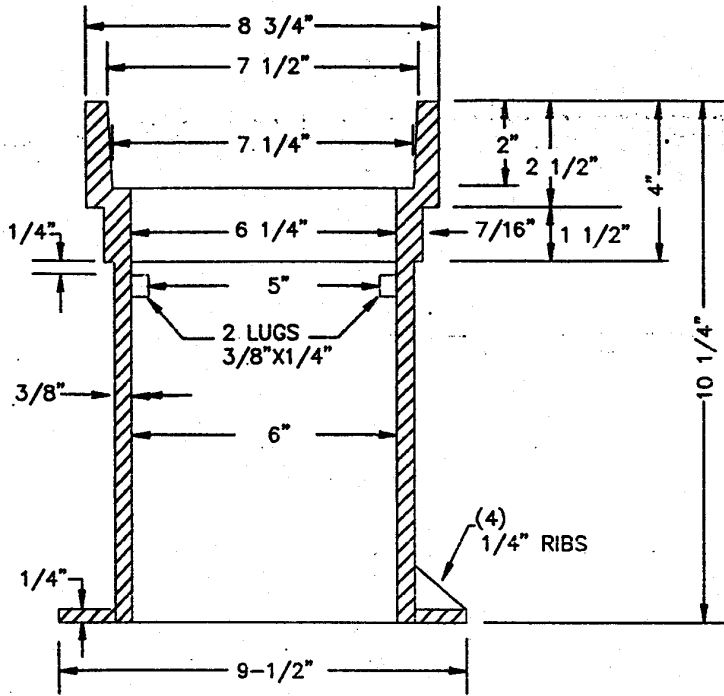
Construction is permitted within the rights-of-way of the North Carolina Department of Transportation (DOT), Division of Highways in accordance with their Policies And Procedures For Accommodating Utilities On Highway Rights-Of-Way as amended. The Charlotte-Mecklenburg Utility Department (CMUD) is required to enforce this entire document as it relates to this work. All bidders are required to become familiar with the document and any amendments which are available from the Manager of Right-of-Way, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina.

1. Charlotte-Mecklenburg Utility Department has entered into an encroachment agreement with the North Carolina Department of Transportation (DOT) which grants the right for any work within the Department of Transportation's rights-of-way. The encroachment agreement for any work within DOT rights-of-way under this project is included as a special provision in this contract. A copy of the approved encroachment has been attached to this contract or will be supplied to the Contractor prior to

construction. A copy of the encroachment agreement must be kept at the construction site at all times.

2. Certain notices are required in writing before any work can proceed within the Department of Transportation's rights-of-way. Upon ample notice by the Contractor, the Engineer will make this notification.
3. Proper signing before, during, and after construction in conformance with the manual on Uniform Traffic Control Devices for Streets and Highways will be required. In addition, warning signs as related to soft and/or low shoulders and broken pavement may be required by the Engineer.
4. Piling and/or storage of excavated material upon the pavement and on some types of shoulders is prohibited unless special permission is granted by the Department of Transportation's Division Engineer. Any material spilled, tracked or placed on the pavement is to be cleaned and damaged pavement repaired subject to stoppage of all work by Charlotte-Mecklenburg Utility Department. Drainage ditches are to be protected from siltation as specified in the EP Section and must be opened at the end of each work day or as weather conditions require.
5. Open trenches are prohibited between dusk and dawn and at designated peak traffic hours unless special permission is received from the Department of Transportation's Division Engineer.
6. When cutting of pavement is permitted, only one-half of the road width shall be opened at any time. Full traffic flow is to be maintained between dusk and dawn and at other peak hours of traffic as required by the encroachment agreement or other Special Provision.
7. The Contractor and his suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads and bridges which will be used for hauling of equipment or materials for this project. The Contractor and his suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads and bridges resulting from this project.

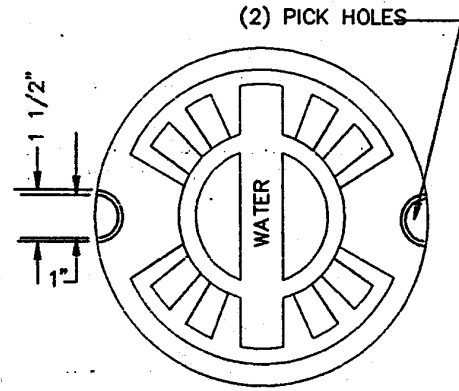
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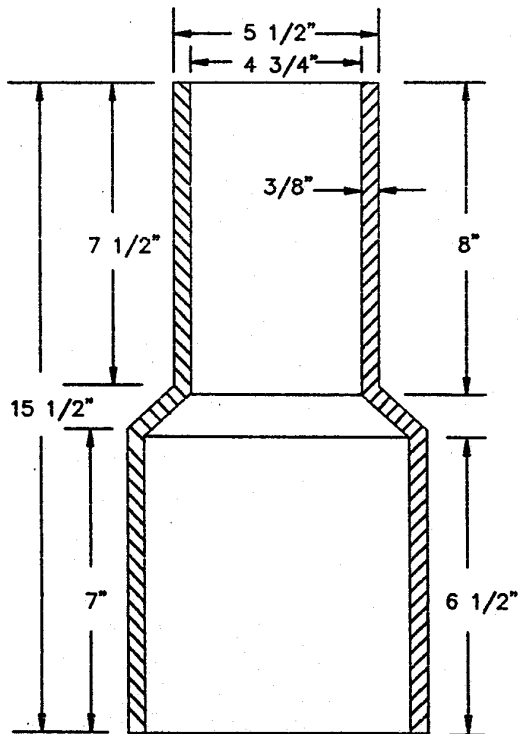
**VALVE BOX - TOP SECTION**  
(SECTION VIEW)

NOTE:

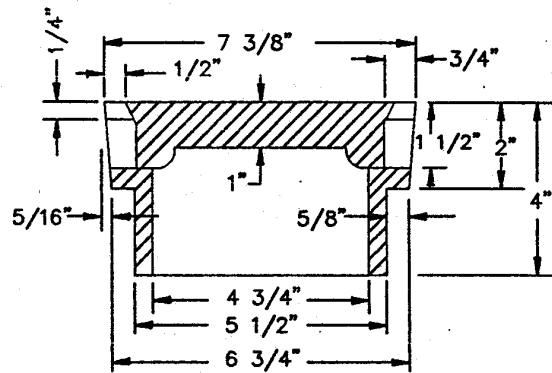
1. FERROUS CASTINGS SHALL BE PER ASTM A-48, CLASS 30.



**COVER - TOP VIEW**



**VALVE BOX - BOTTOM SECTION**  
(SECTION VIEW)



**COVER - SECTION VIEW**

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

**STANDARD DETAIL**  
**WATER**

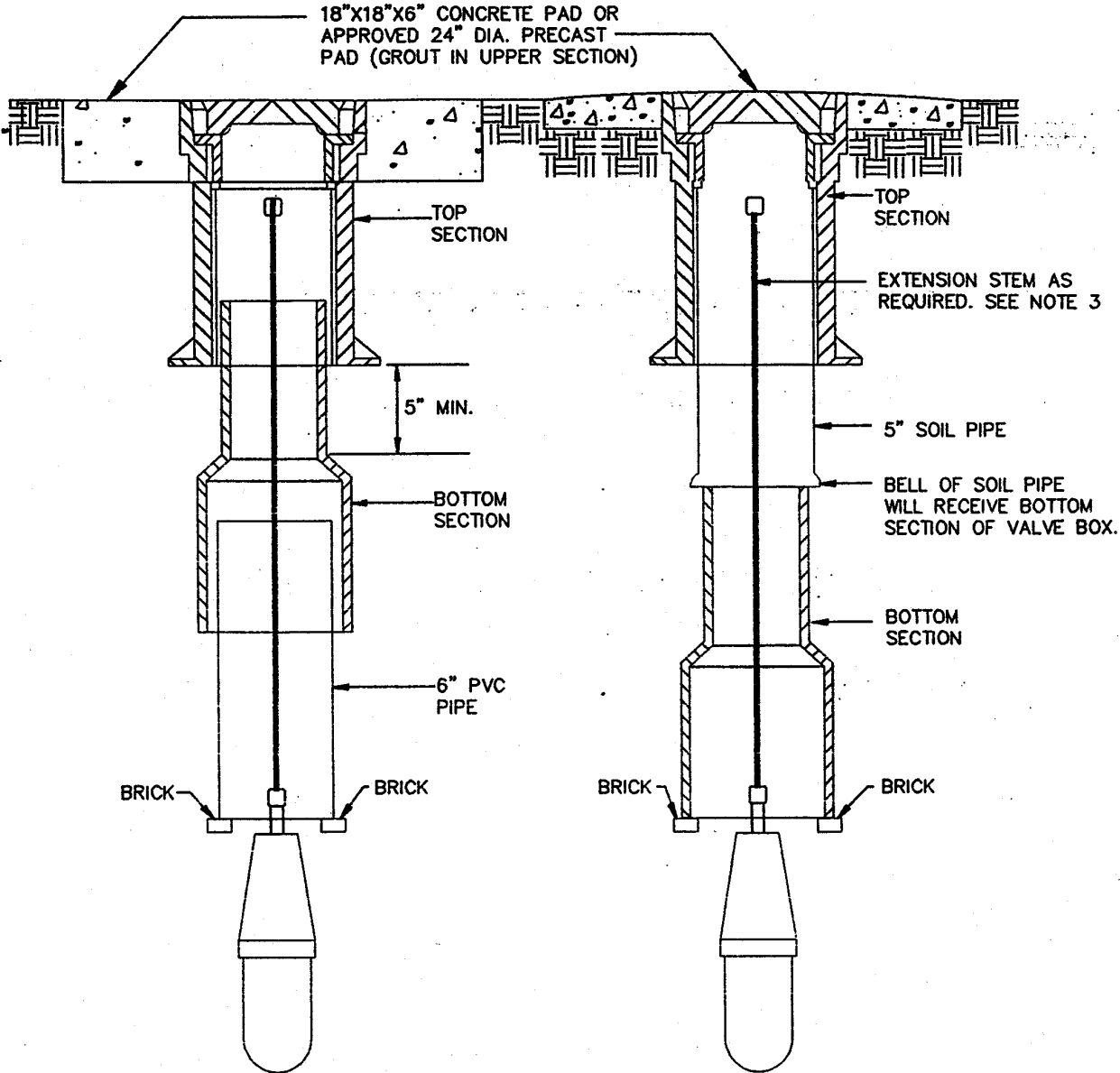
**WATER VALVE BOX**

Job No.	File No.
PLAN	Scales <b>NTS</b>
PROFILE	Hor. _____
	Vert. _____
As Built	Date _____
Surveyed By	Designed By

S.C.	Project-Engr	Approved By	Date	Sheet 1 Of 1
		<i>K. Blaylock</i>	4/14	

No.	Date	By	Revision

SDW  
07/19/04



**EXTENSION USING  
PVC(C-900) PIPE**

**EXTENSION USING  
SOIL PIPE**

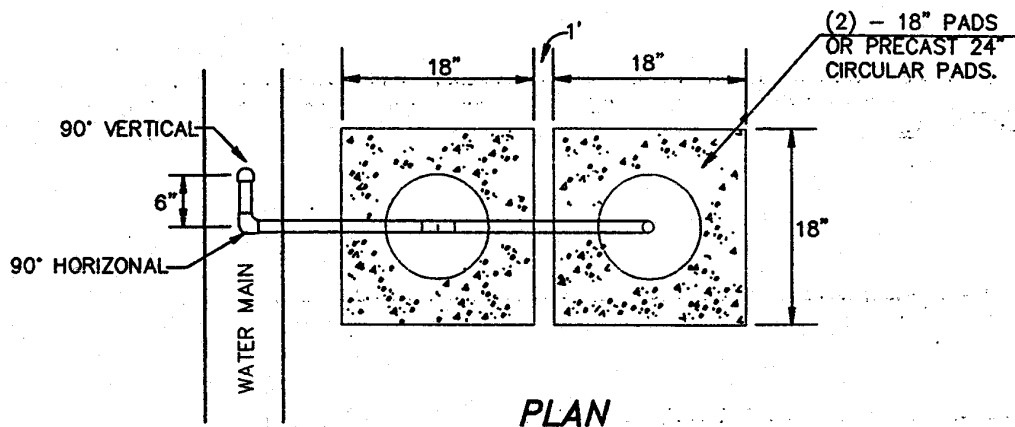
**NOTES:**

1. BOTTOM SECTION TO BE CENTERED OVER NUT, NOT TO BEAR ON VALVE BODY.
2. PROVIDE CLEARANCE BETWEEN VALVE BOX/BRICK AND THE VALVE.
3. WHEN OPERATING NUT DEPTH EXCEEDS 4'-0" BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STD. 2" SQ. OPERATING NUT IN TOP SECTION OF VALVE BOX. EXTENSION STEM SHALL BE SIZED AS RECOMMENDED BY THE VALVE MANUFACTURER.

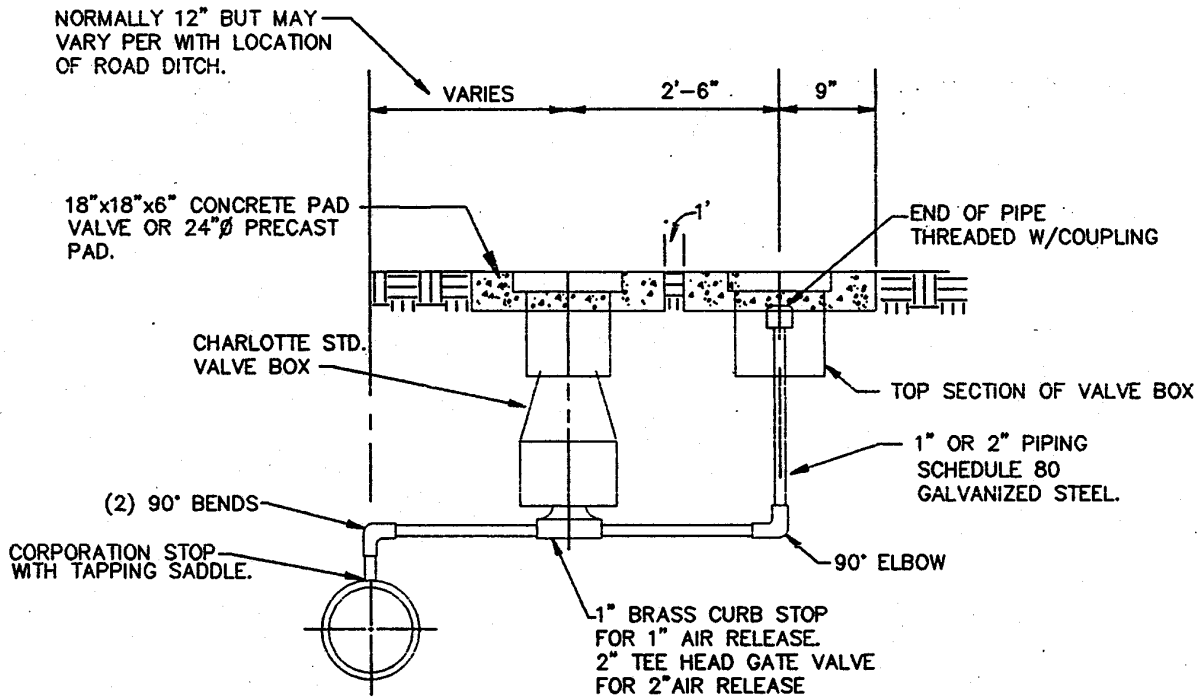
<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>											
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>									
Scales _____		<b>VALVE BOX INSTALLATION</b>									
PLAN _____	PROFILE _____										
Hor. _____		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">As Built</td> <td style="width: 25%;">Date</td> <td style="width: 25%;">SC</td> <td style="width: 25%;">Project-Engr</td> </tr> <tr> <td>Surveyed By</td> <td>Designed By</td> <td>Drawn By</td> <td>Approval By</td> </tr> </table>		As Built	Date	SC	Project-Engr	Surveyed By	Designed By	Drawn By	Approval By
As Built	Date			SC	Project-Engr						
Surveyed By	Designed By	Drawn By	Approval By								
Vert. _____		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">K. Blain</td> <td style="width: 25%;">2/19/84</td> <td style="width: 25%;">Sheet</td> <td style="width: 25%;">Of</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">2</td> <td></td> </tr> </table>		K. Blain	2/19/84	Sheet	Of			2	
K. Blain	2/19/84	Sheet	Of								
		2									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">No.</td> <td style="width: 25%;">Date</td> <td style="width: 25%;">By</td> <td style="width: 25%;">Revision</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>				No.	Date	By	Revision				
No.	Date	By	Revision								

DWG  
2/19/84





**PLAN**



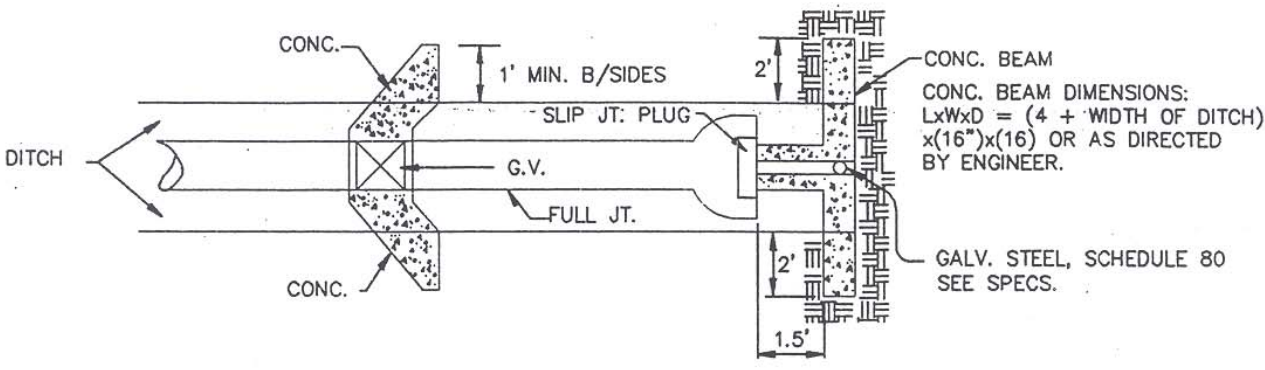
**ELEVATION**

**NOTES:**

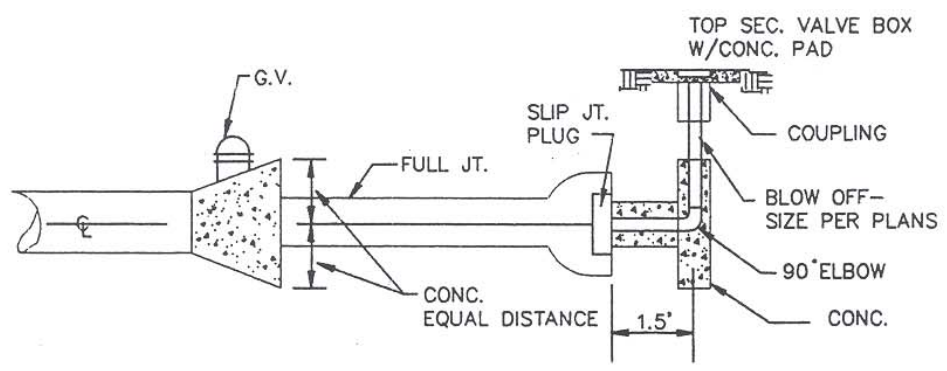
1. AIR VALVES TO BE INSTALLED AT ALL HIGH POINTS AS DIRECTED BY THE ENGINEER.
2. ON 12" PIPE & SMALLER, 1" ASSEMBLY REQUIRED.
3. ON 16" PIPE & LARGER, 2" ASSEMBLY REQUIRED.
4. VALVE & B.O. SHALL NOT BE PLACED IN ROAD DITCH.

<b>CHARLOTTE—MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
Scales <b>N.T.S.</b>		<b>MANUAL AIR RELEASE</b>	
PLAN PROFILE Hor. _____ Vert. _____			
As Built _____ Date _____		S.C. _____	
Surveyed By _____	Designed By _____	Project-Engr _____	Approved By <i>K.B. [Signature]</i> Date <i>2/14/94</i> Sheet <b>3</b> Of _____

No.	Date	By	Revision



PLAN



ELEVATION

- NOTES:  
 1. BLOCKING MUST BE KEYED INTO UNDISTURBED TRENCH WALLS.

**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

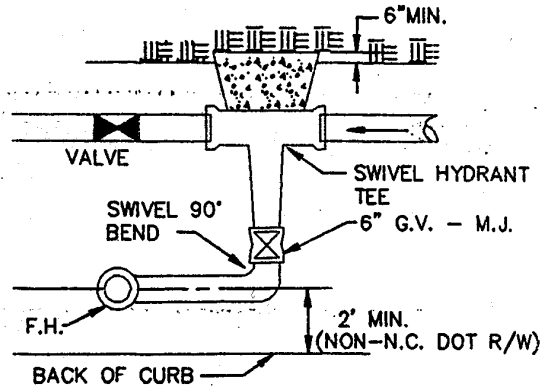
Job No. _____	File No. _____	<b>STANDARD DETAIL WATER</b>
Scales PLAN <b>N.T.S.</b>		
PROFILE Hor. _____ Vert. _____		<b>DEAD END BLOCKING 6", 8", AND 12" MAINS</b>
As Built _____ Date _____		
Surveyed By _____	Designed By _____	S.C. _____ Project-Engr. _____ Approved By <b>K. Blawie</b> <b>2/11/94</b> Date <b>4</b>

No.	Date	By	Revision

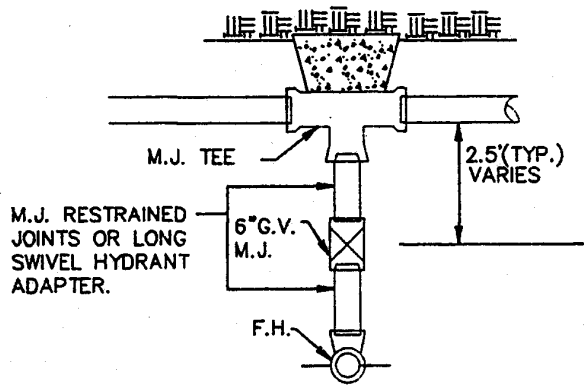
SDWA 01/21/94

**NOTES:**

1. HYDRANT LOCATION:  
ON ROADS WITH CURB & GUTTER, USE DETAIL (1)  
IN ALL CASES UNLESS OTHERWISE NOTED ON MAP.
2. BURIAL TO BE 3.0' UNLESS OTHERWISE DIRECTED BY  
THE ENGINEER.
3. FOR HYDRANTS ON DEAD END LINES, MAIN LINE  
VALVES ARE LOCATED DOWNSTREAM OF HYDRANT.
4. EXTENSIONS REQUIRED AS DETERMINED BY THE  
ENGINEER.
5. 4" OUTLET TO BE TURNED FACING ROADWAY.
6. CONCRETE BLOCKING TO EXTEND TO UNDISTURBED  
EARTH, AMOUNT DETERMINED BY THE ENGINEER.
7. SEE DETAIL 5A FOR PLACEMENT OF F.H. IN N.C. DOT R/W.
8. ALL HYDRANT PIPING SHALL BE D.I.P.

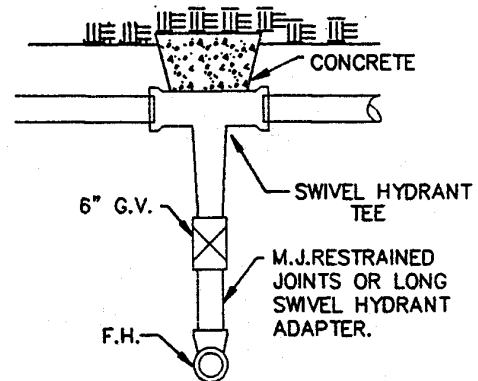


**(1) PLAN VIEW**



**(3) PLAN VIEW**

VALVE SHALL NOT BE PLACED IN ROAD DITCH.

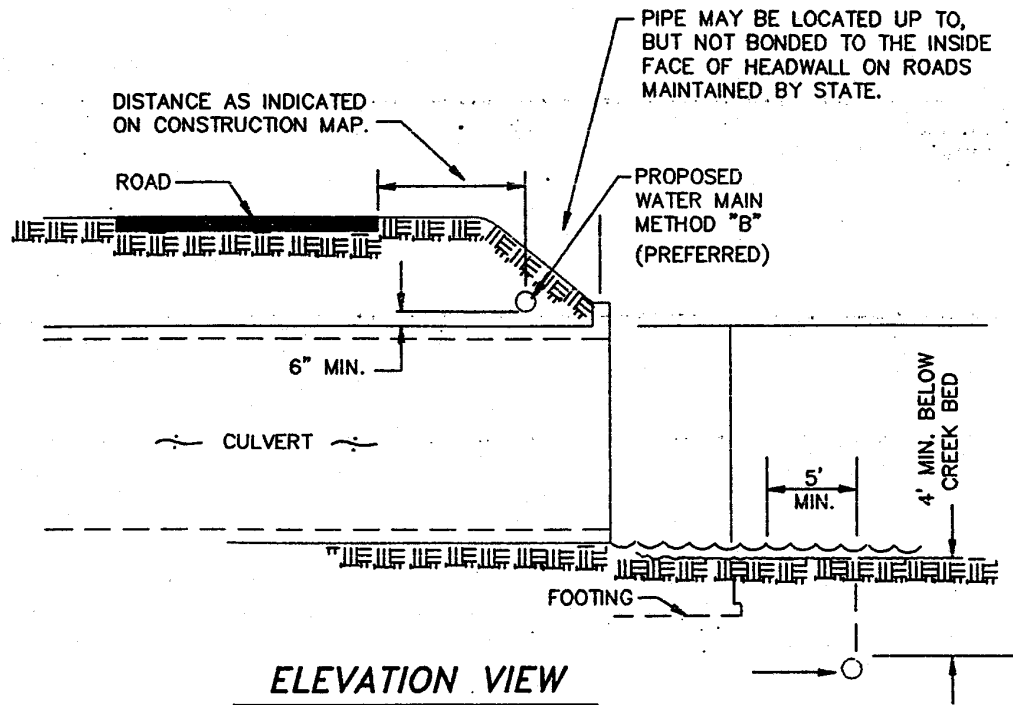


**(4) PLAN VIEW**

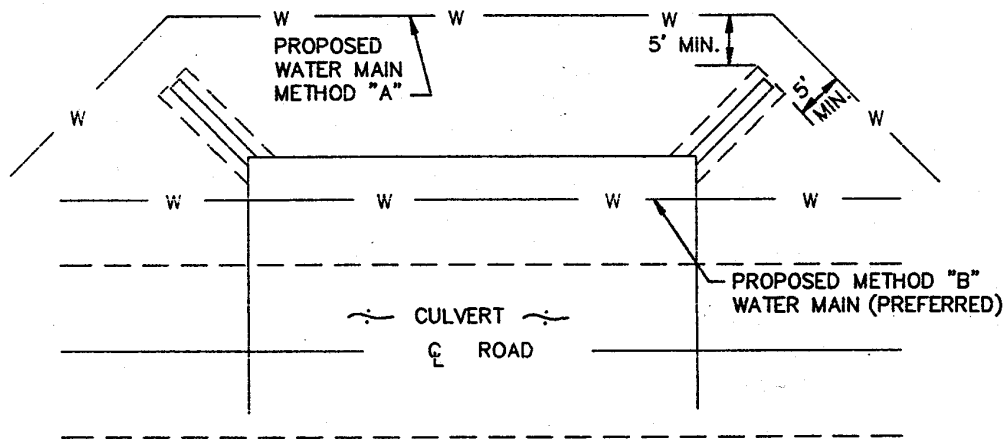
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
Scales _____			
PLAN _____	N.T.S.	<b>FIRE HYDRANT DETAIL</b>	
PROFILE _____	Hor. _____		
	Vert. _____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	Drawn By <b>S.C.</b>	Project-Engr <b>K. D. ...</b>
		Approved By <b>K. D. ...</b>	Date <b>4/14/94</b>
			Sheet <b>5</b> Of _____

No.	Date	By	Revision



**ELEVATION VIEW**



**PLAN VIEW**

**NOTES:**

1. ALL PIPE LARGER THAN 2-INCH SHALL BE D.I.P. UNLESS SHOWN ON CONSTRUCTION PLANS. 2-INCH PIPE SHALL BE PVC.
2. MINIMUM COVER OVER CULVERT IN ANY DIRECTION SHALL BE 30". IF 30" COVER CANNOT BE MAINTAINED, ENCASE PIPE IN CONCRETE PER STANDARD DETAIL. SEPARATE ENCASEMENT FROM CULVERT WITH BURLAP OR PLASTIC FILM TO PREVENT BONDING.

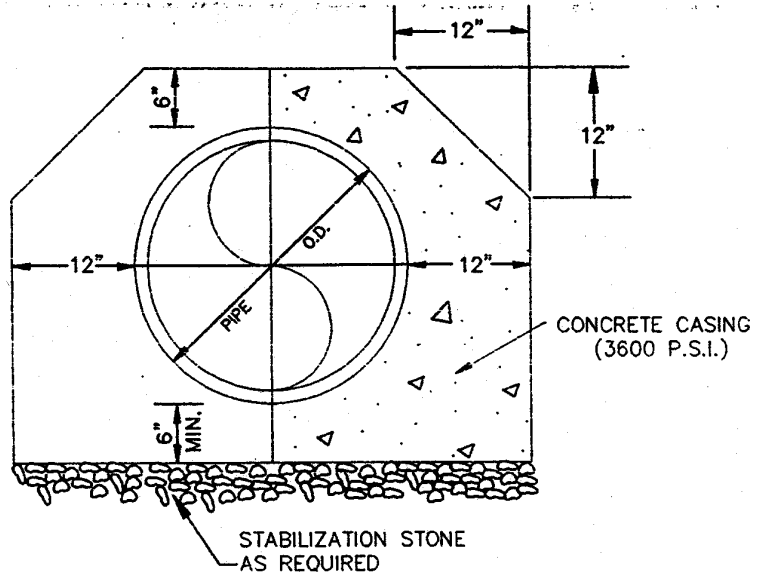
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**WATER MAIN LOCATIONS  
AT CULVERTS**

Job No. _____ File No. _____		Scales PLAN <u>N.T.S.</u>	
PROFILE Hor. _____ Vert. _____		As Built _____ Date _____	
Surveyed By _____	Designed By _____	Drawn By <u>S.C.</u>	Project-Engr <u>K. Blaylock</u>
Approved By _____		Date <u>4/14/94</u>	Sheet <u>6</u> Of _____

No.	Date	By	Revision



ELEVATION SECTION

NOTE:

1. PIPE O.D. SHALL BE OUTSIDE DIAMETER AT BELLS IF BELLS ARE TO BE ENCASED.

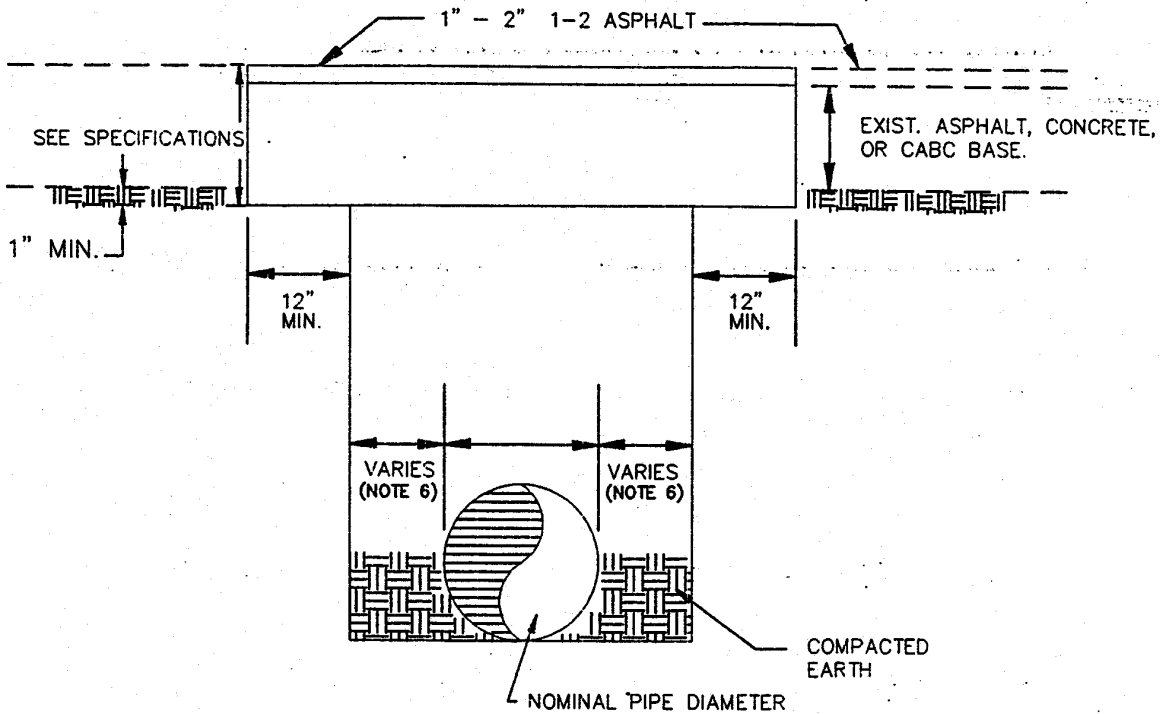
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

**STANDARD DETAIL  
WATER**

**CONCRETE ENCASEMENT.**

Job No. _____	File No. _____	<b>STANDARD DETAIL WATER</b>	
PLAN _____	Scales <u>NTS</u>		
PROFILE _____	Hor. _____	<b>CONCRETE ENCASEMENT.</b>	
	Vert. _____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	Drawn By <u>SC</u>	Project-Engr _____
No. _____	Date _____	By _____	Approved By <u>K. Blaylock</u>
Revision _____		Date _____	Sheet <u>7</u> Of _____

44/15/94



**ELEVATION SECTION**

**NOTES:**

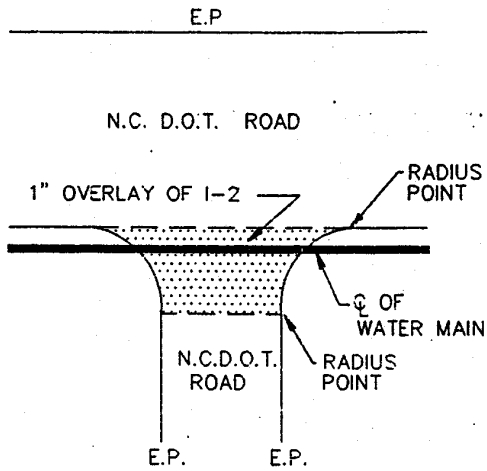
1. ALL CONCRETE AND ASPHALT PAVEMENT, INCLUDING DRIVEWAYS, TO BE CUT WITH A SAW.
2. WHERE CONCRETE PAVEMENT IS OVERLAID WITH ASPHALT H- BINDER MAY BE SUBSTITUTED FOR CONCRETE, AS A BASE MATERIAL, WITH THE APPROVAL OF THE CONTROLLING AGENCY.
3. ALL PAVEMENT REPAIRS ARE SUBJECT TO APPROVAL BY CITY OF CHARLOTTE DOT OR N.C. DOT AS APPLICABLE.
4. 12-INCH MIN. MINIMUM CUT OUTSIDE TRENCH IS ALSO REQUIRED FOR SLOPED TRENCH WALLS.
5. SHORING REQUIRED IN ACCORDANCE WITH OSHA STANDARDS PART 1926, SUBPART P.
6. SEE DETAILED SPECIFICATIONS FOR TRENCH WIDTH.

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

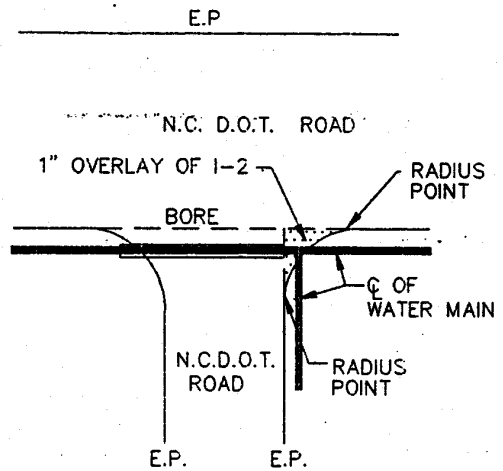
Job No. _____		File No. _____		<b>STANDARD DETAIL WATER</b>	
PLAN Scales _____		PROFILE _____			
Hor. _____		Vert. _____		<b>PAVEMENT REPAIR DETAIL</b>	
As Built _____		Date _____			
Surveyed By	Designed By	Drawn By	Project-Engr	Approved By	Sheet Of
		SC		K. Dwyer	9

No.	Date	By	Revision

01/13/94



**PLAN VIEW**



**PLAN VIEW**

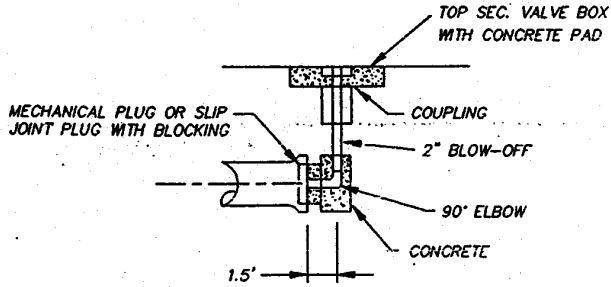
**NOTES:**

1. ALL SHORING WILL BE ACCORDING TO OSHA TRENCHING STANDARDS PART 1926 SUBPART P.
2. PAVEMENT OVERLAY IS IN ADDITION TO PAVEMENT REPAIR PER STANDARD DETAIL 9.
3. FEATHER OVERLAY SMOOTHLY INTO EXISTING PAVEMENT.
4. THIS DETAIL APPLIES TO N.C. DEPARTMENT OF TRANSPORTATION ROADS ONLY, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

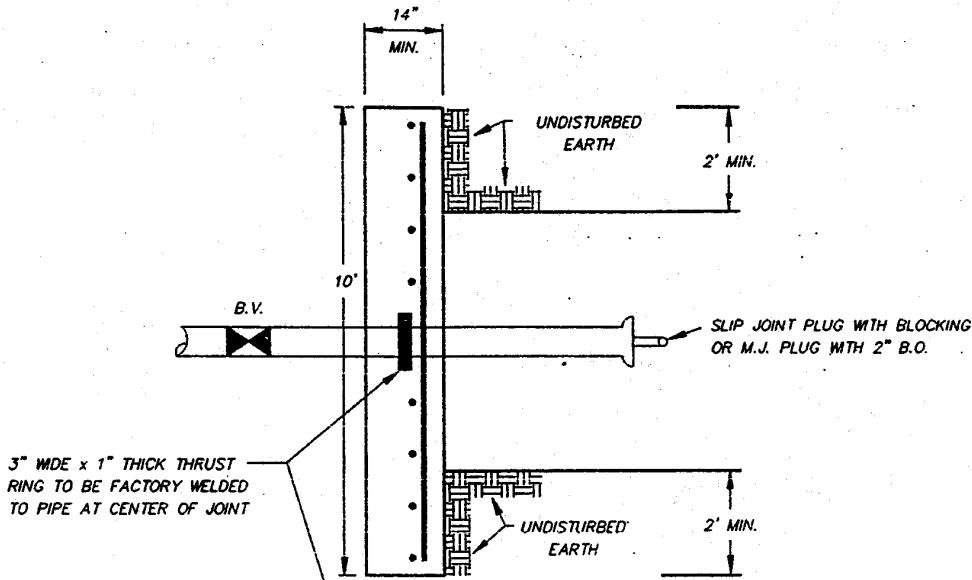
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
Scales _____			
PLAN _____	PROFILE _____	<b>1-2 SURFACE COURSE OVERLAY</b>	
Hor. _____	Vert. _____		
As Built _____ Date _____		Surveyed By _____	
Designed By _____		Drawn By <b>SC</b>	Project-Engr _____
No. _____	Date _____	By _____	Revision _____
Surveyed By _____		Approved By <b>K. Blalock</b>	Sheet <b>14</b> Of <b>9A</b>

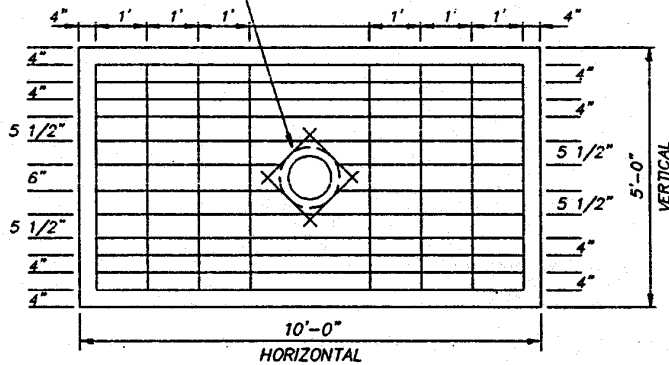
01/13/94



**ELEVATION VIEW**



3" WIDE x 1" THICK THRUST RING TO BE FACTORY WELDED TO PIPE AT CENTER OF JOINT



NOTE:

- VERT. STEEL**
- #10 BARS, 4'-4" LONG, 8 REQ'D
- HORIZ. STEEL**
- #10 BARS 9'-4" LONG, 8 REQ'D
- #10 BARS 3'-11" LONG, 8 REQ'D
- DIAGONAL STEEL**
- #10 BARS, 4'-0" LONG, 4 REQ'D

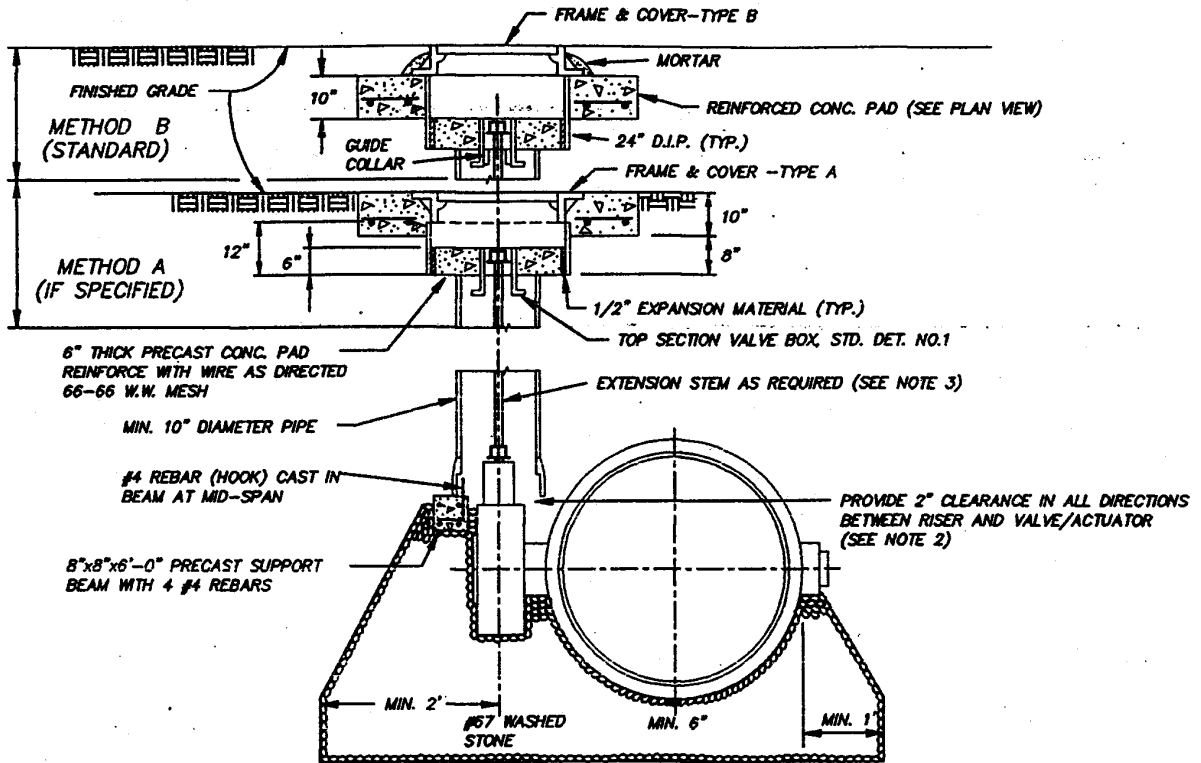
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____	File No. _____	<b>STANDARD DETAIL WATER</b>
Scales <b>N.T.S.</b>		
PLAN _____	Hor. _____	<b>BLOCKING FOR 16" 20" 24" PIPES</b>
PROFILE _____	Vert. _____	
As Built _____	Date _____	
Surveyed By _____	Designed By _____	Drawn By <b>J.F.B.</b>
		Project-Engr <b>K. Blanton</b>
		Approved By <b>[Signature]</b>
		Date <b>10</b>

No.	Date	By	Revision

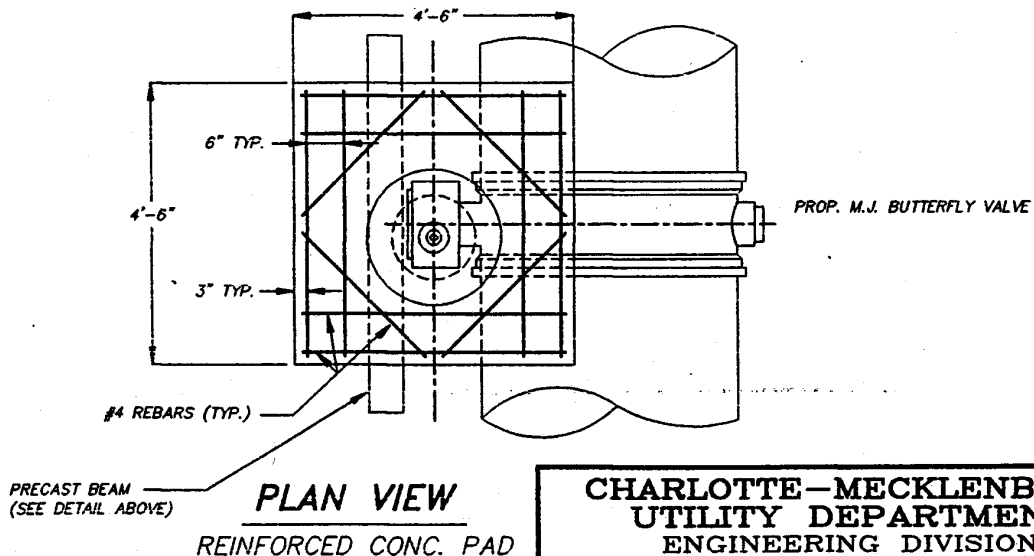
SD/11/2/84





**NOTES:**

1. METHOD B SHALL BE STANDARD, UNLESS METHOD A IS SPECIFIED ON PLANS.
2. DIAMETER OF RISER MAY VARY AS REQUIRED BY VALVE ACTUATOR.
3. WHEN OPERATING NUT DEPTH EXCEEDS 4'-0" BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STD. 2" SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX, EXTENSION STEM SHALL BE SIZED AS RECOMMENDED BY THE VALVE MANUFACTURER.



PRECAST BEAM (SEE DETAIL ABOVE)  
**PLAN VIEW**  
 REINFORCED CONC. PAD

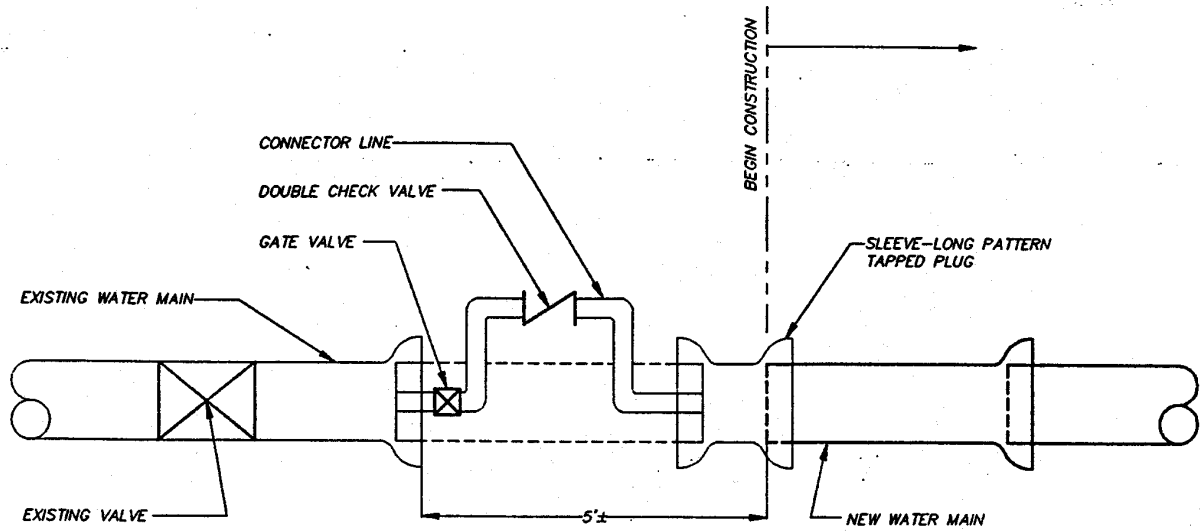
**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
 WATER  
 DIRECT BURY BUTTERFLY  
 VALVE INSTALLATION**

Job No. _____	File No. _____	<b>STANDARD DETAIL</b>	
Scale: _____		<b>WATER</b>	
PLAN	N.T.S.	<b>DIRECT BURY BUTTERFLY</b>	
PROFILE	Hor. _____	<b>VALVE INSTALLATION</b>	
	Vert. _____		
As Built	Date		
Surveyed By	Designed By	J.F.B.	K.D. [Signature]
		Drawn By	Project-Engr
		Approved By	Date 7/11

No.	Date	By	Revision

7/12/84



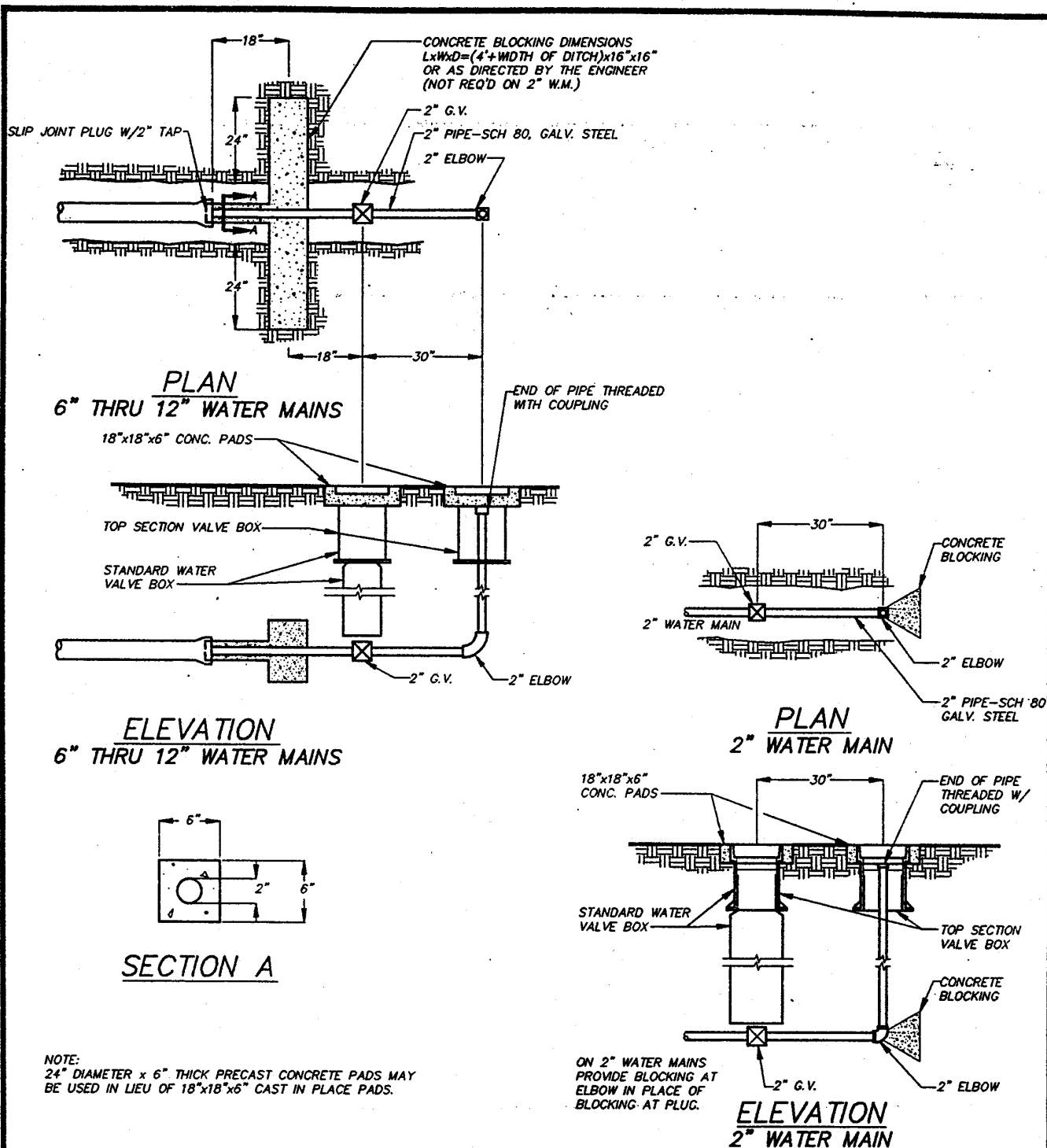
**NOTES:**

1. INSTALL CONNECTOR LINE FROM EXISTING BLOW OFF ASSEMBLY TO NEW MAIN FOR FILLING, TESTING AND STERILIZING NEW MAIN.
2. CONNECTOR LINE TO BE ASSEMBLED WITH CHECK VALVE AND TO BE OPERATED INDEPENDENT OF EXISTING MAIN.
3. BLOCKING ON EXISTING LINE NOT TO BE DISTURBED.
4. FINAL CONNECTION TO EXISTING MAIN TO BE MADE ONLY AFTER TOTAL PROJECT IS ACCEPTED BY THE CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT.
5. VALVES ON EXISTING SYSTEM TO BE OPERATED BY CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT FORCES ONLY.
6. ONLY ONE CONNECTION WILL BE ALLOWED BETWEEN THE EXISTING SYSTEM AND THE NEW CONSTRUCTION UNTIL TESTING AND DISINFECTION IS COMPLETE.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
PLAN Scales <u>NTS</u>		<b>JUMPER CONNECTION</b>	
PROFILE Hor. _____ Vert. _____			
As Built _____ Date _____		KHP _____	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____
K.B. _____		Approved By _____	Date <u>12</u> _____

No.	Date	By	Revision

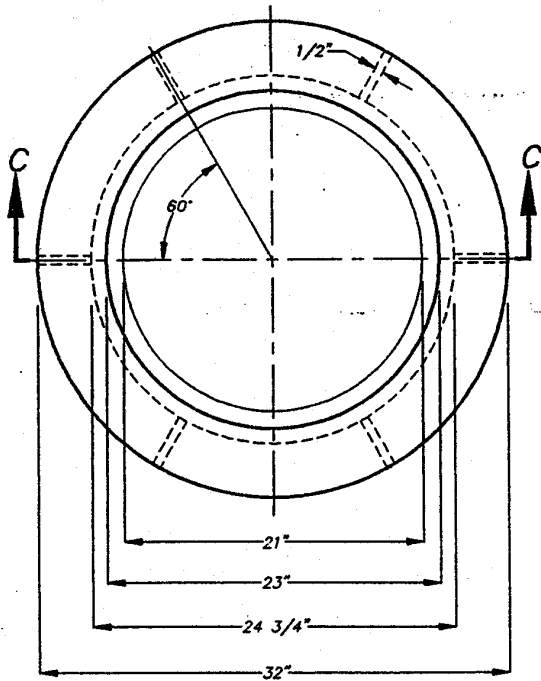
1/11/84



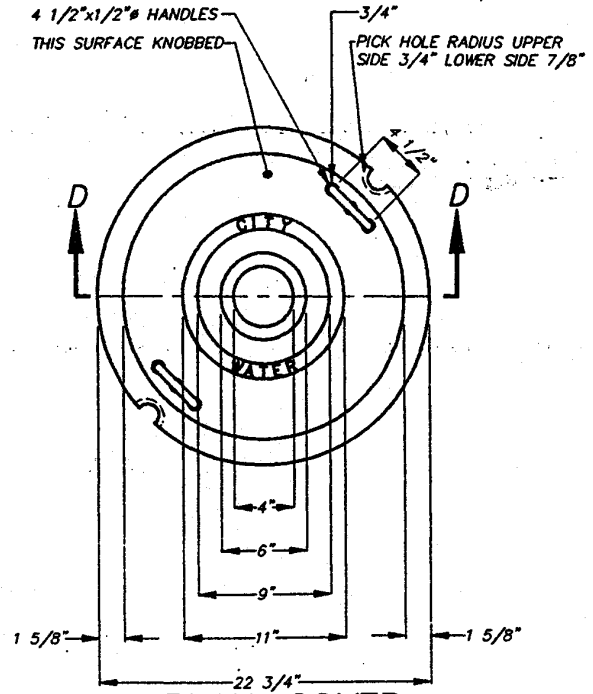
NOTE:  
 24" DIAMETER x 6" THICK PRECAST CONCRETE PADS MAY  
 BE USED IN LIEU OF 18"x18"x6" CAST IN PLACE PADS.

**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

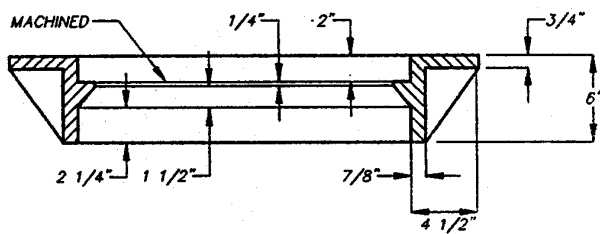
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>									
Scale: <u>NTS</u>											
PLAN		<b>2" VALVE WITH BLOW OFF</b>									
PROFILE											
Hor. _____		Sheet <b>13</b> Of _____									
Vert. _____											
As Built _____ Date _____		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Surveyed By</td> <td style="width: 25%;">Designed By</td> <td style="width: 25%;">Drawn By</td> <td style="width: 25%;">Project-Engr</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">KHP</td> <td style="text-align: center;">K.B. [Signature]</td> </tr> </table>		Surveyed By	Designed By	Drawn By	Project-Engr			KHP	K.B. [Signature]
Surveyed By	Designed By			Drawn By	Project-Engr						
		KHP	K.B. [Signature]								
No. _____	Date _____	By _____	Revision _____								



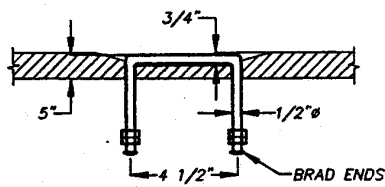
PLAN-RING



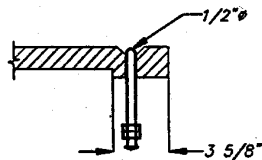
PLAN-COVER



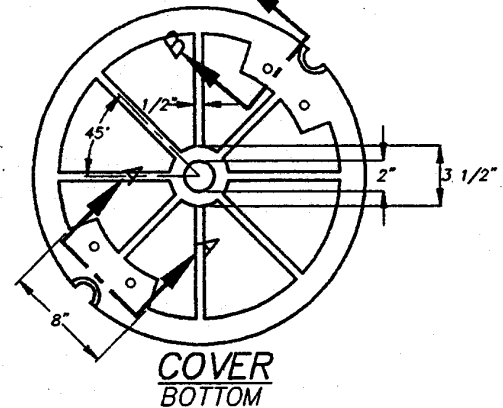
SECTION C-C



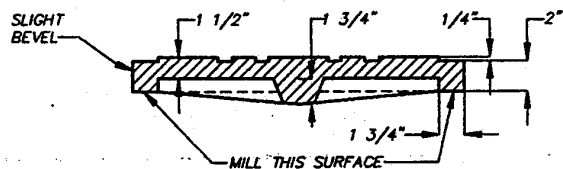
SECTION A-A



SECTION B-B



COVER  
BOTTOM



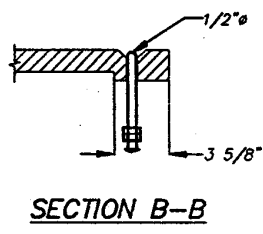
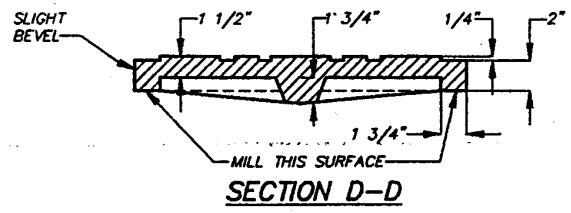
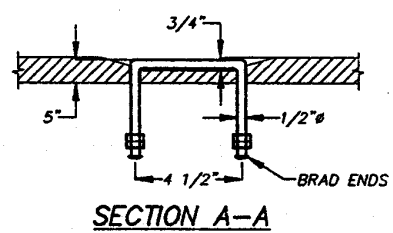
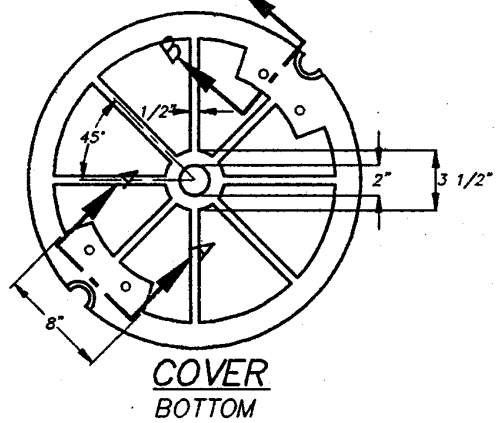
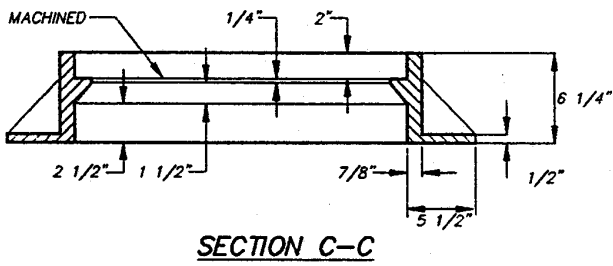
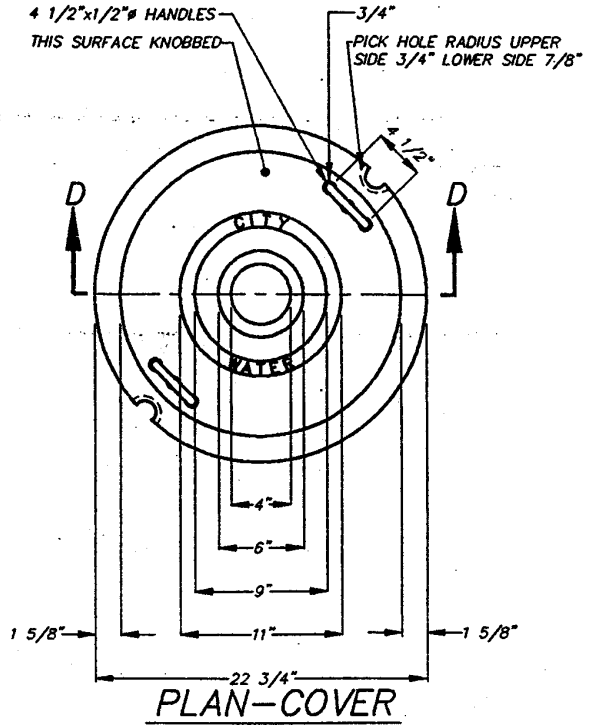
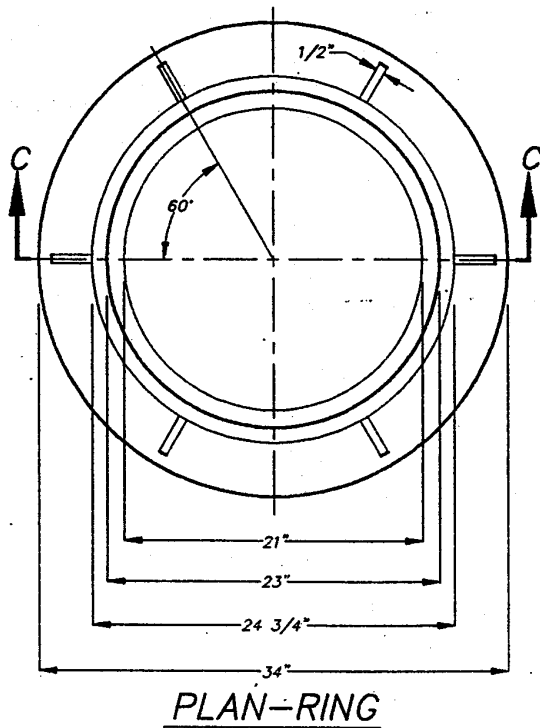
SECTION D-D

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

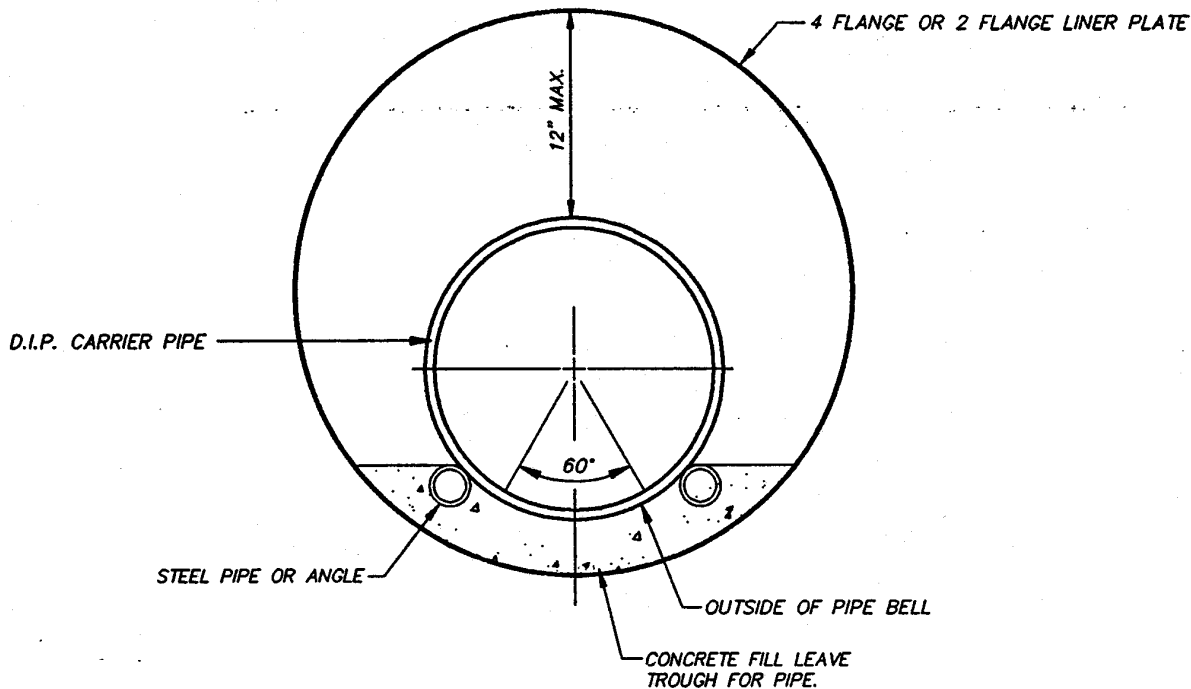
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
PLAN	Scales <b>NTS</b>		
PROFILE	Hor. _____	<b>CAST IRON RING &amp; COVER TYPE A</b>	
	Vert. _____		
As Built _____ Date _____		KHP	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____
		Approved By <b>K.B. [Signature]</b>	Sheet <b>14</b> of _____

No.	Date	By	Revision

SDW:ADG  
1/12/84



<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
PLAN Scale <u>NTS</u>			
PROFILE Hor. _____ Vert. _____		<b>CAST IRON RING &amp; COVER TYPE B</b>	
As Built Date _____			
Surveyed By _____	Designed By _____	Drawn By <u>KHP</u>	Project-Engr. <u>K. Blaylock</u>
No. _____	Date _____	By _____	Approved By <u>Y. Y. 15</u>
Revision _____		Sheet _____	Of _____



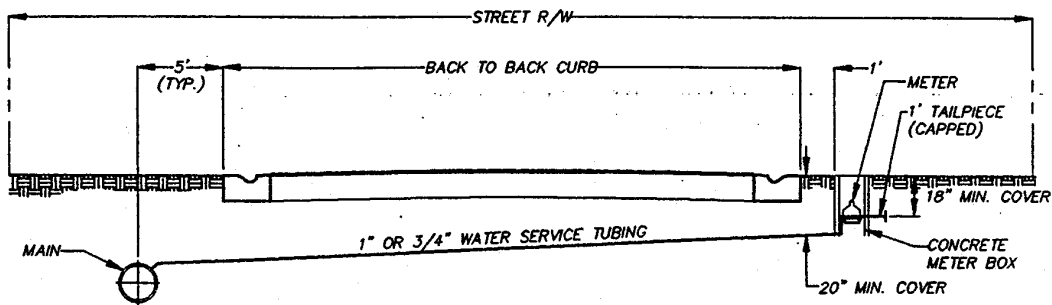
**NOTES:**

1. SEAL ENDS OF TUNNEL PER SPECIFICATIONS.
2. IF CONCRETE FILL IS PLACED LEVEL (NO TROUGH), THE WATER MAIN SHALL BE INSTALLED WITH CASING SPACERS AND THE STEEL PIPE/ANGLES MAY BE DELETED.

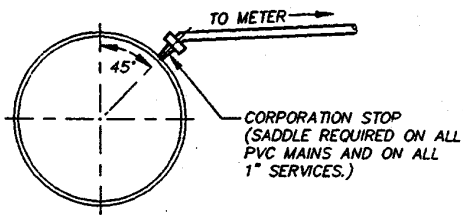
**CHARLOTTE—MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>
Scales _____		
PLAN _____	NTS	<b>TUNNEL LINER SECTION</b>
PROFILE		
Hor. _____		
Vert. _____		
As Built _____	Date _____	
MSW	Project-Engr	Approved By
Surveyed By	Designed By	Date
No.	Date	By
Revision		Sheet 16 of _____

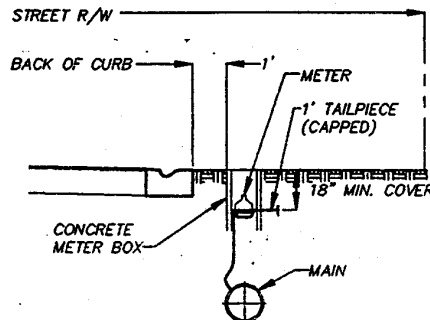
MSW/08/04



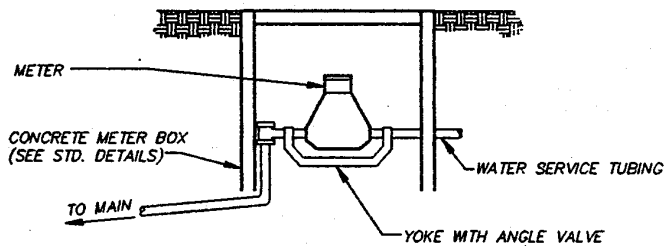
**1" OR 3/4" SERVICE CONNECTION**  
(LONG SIDE)



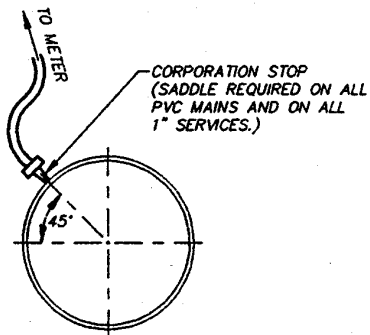
**DETAIL AT MAIN**  
(LONG SIDE)



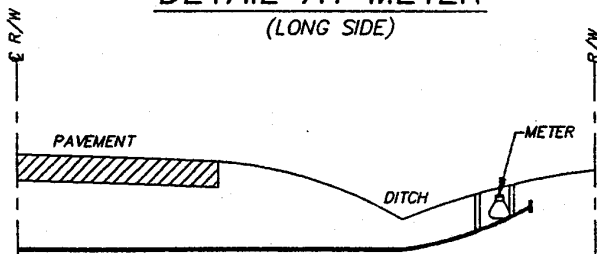
**1" OR 3/4" SERVICE CONNECTION**  
(SHORT SIDE)



**DETAIL AT METER**  
(LONG SIDE)



**DETAIL AT MAIN**  
(SHORT SIDE)



**ROAD WITH SIDE DITCH**

NOTE:  
MIN. DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS  
OR SPIGOTS SHALL BE 3'-0" AS MEASURED ALONG THE MAIN.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

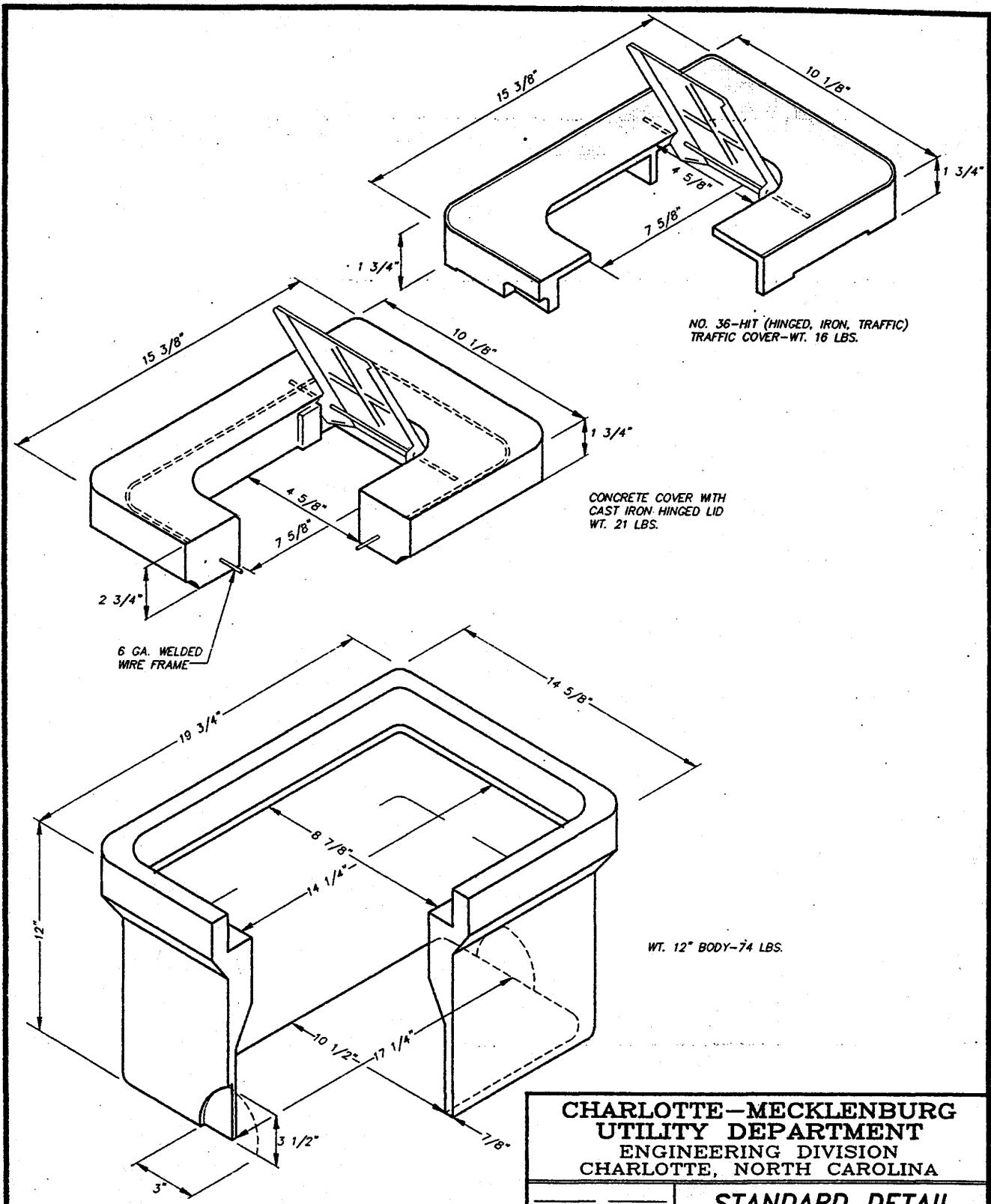
**STANDARD DETAIL  
WATER**

**3/4" AND 1" WATER  
SERVICE CONNECTION**

Job No.	File No.
Scales	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By

Drawn By	Project-Engr	Approved By	Date	Sheet	Of
KHP		KBL	7/17	17	

No.	Date	By	Revision



NO. 36-HIT (HINGED, IRON, TRAFFIC)  
TRAFFIC COVER-WT. 16 LBS.

CONCRETE COVER WITH  
CAST IRON HINGED LID  
WT. 21 LBS.

WT. 12" BODY-74 LBS.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**CONCRETE METER BOX  
FOR 3/4" WATER METER**

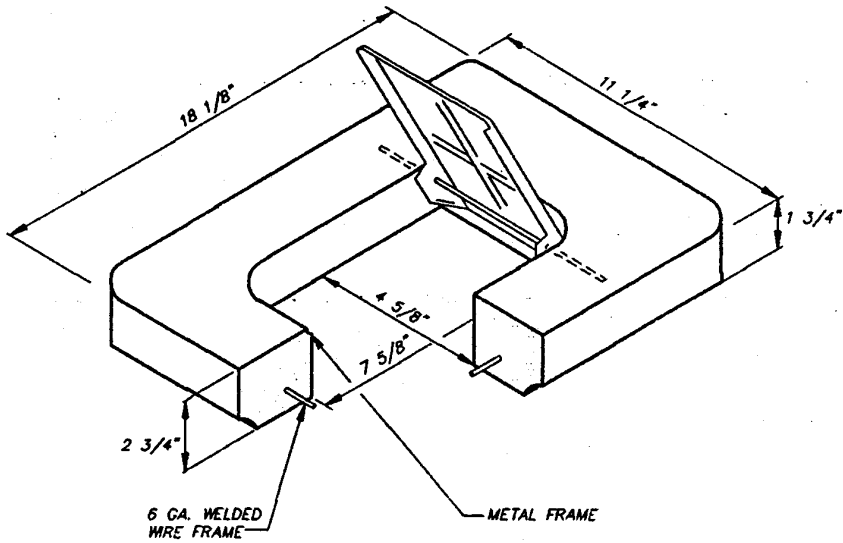
Job No.	File No.
Scales	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By

KHP	K. B. [Signature]	Sheet	Of
Drawn By	Approved By	Date	18

No.	Date	By	Revision

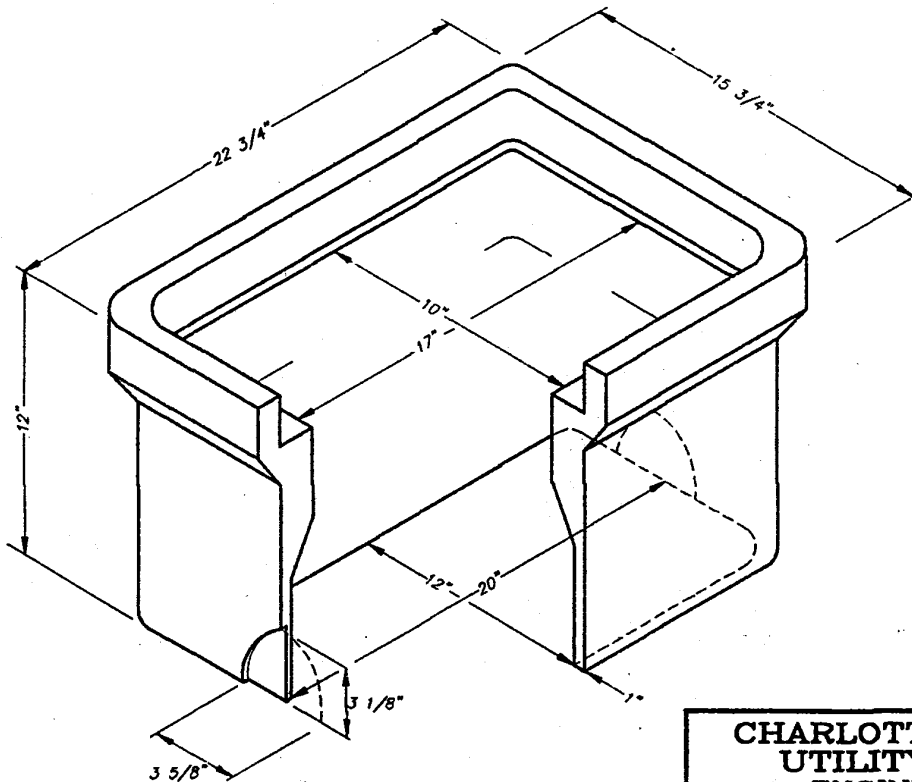
1/13/84





**LID**

NO. 37 H-COVER WITH METAL HINGED LID  
WT. 30 LBS.



**BODY**

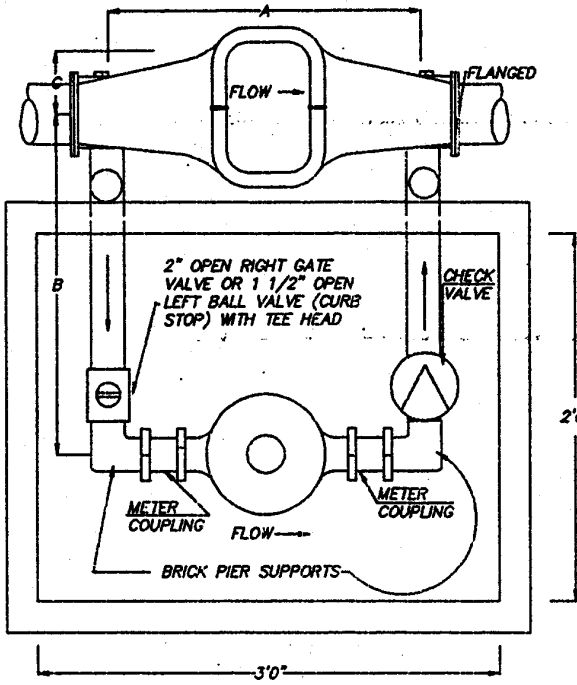
NO. 37 BODY  
WT. -87 LBS.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**CONCRETE METER BOX  
FOR 1" WATER METER**

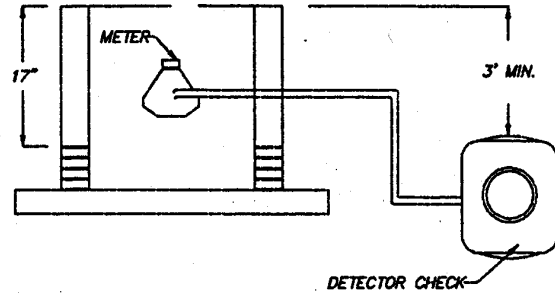
Job No.	File No.	Scales <b>NTS</b>	<b>CONCRETE METER BOX FOR 1" WATER METER</b>
PLAN	PROFILE		
Hor.	Vert.	As Built	Date
Surveyed By	Designed By	Drawn By <b>KHP</b>	Project-Engr <b>K. B. [Signature]</b>
No.	Date	By	Revision



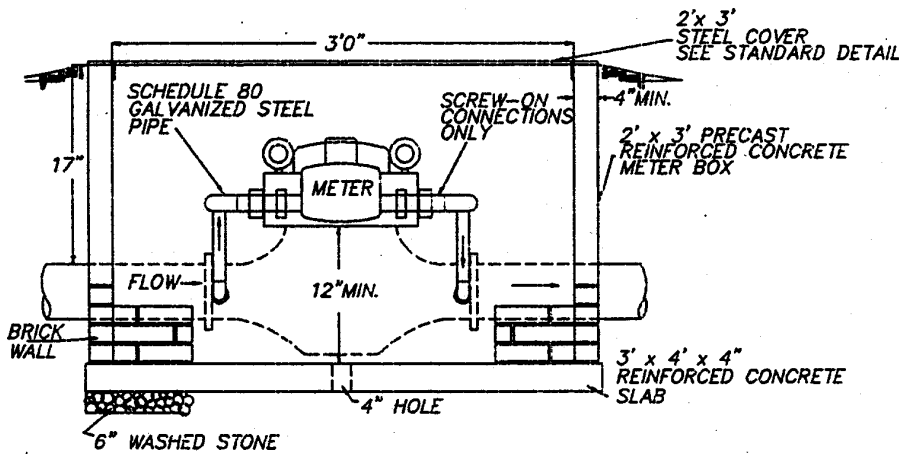
TYPICAL PLAN

SIZE	A	B	C	SIZE METER
4"	12-1/2"	22"	5-1/4"	1"
6"	17"	23-1/2"	6-7/16"	1-1/2"
8"	21"	25"	7-7/8"	2"
10"	28"	25"	9-11/32"	2"

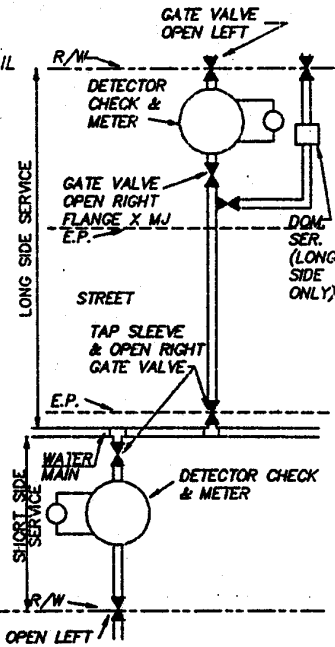
METER COUPLING SHALL BE "GRAND" NO. 2008 FOR 1 1/2" & NO. 2010 FOR 2".



TYPICAL ELEVATION



TYPICAL ELEVATION



NOTES:

ONE INCH METER SHALL BE INSTALLED IN METER BOX PER STD. DETAIL 19.

ALL PIPE SHALL BE RESTRAINED JOINTS FROM TAP TO PROPERTY LINE VALVE.

IN CASE OF NEW MAIN, A TEE MAY BE SUBSTITUTED FOR TAPPING SLEEVE & VALVE, BUT A VALVE MUST BE INSTALLED ON STREET SIDE OF DETECTOR CHECK.

ALL VALVES SHALL HAVE STANDARD VALVE BOX.

CHARLOTTE--MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

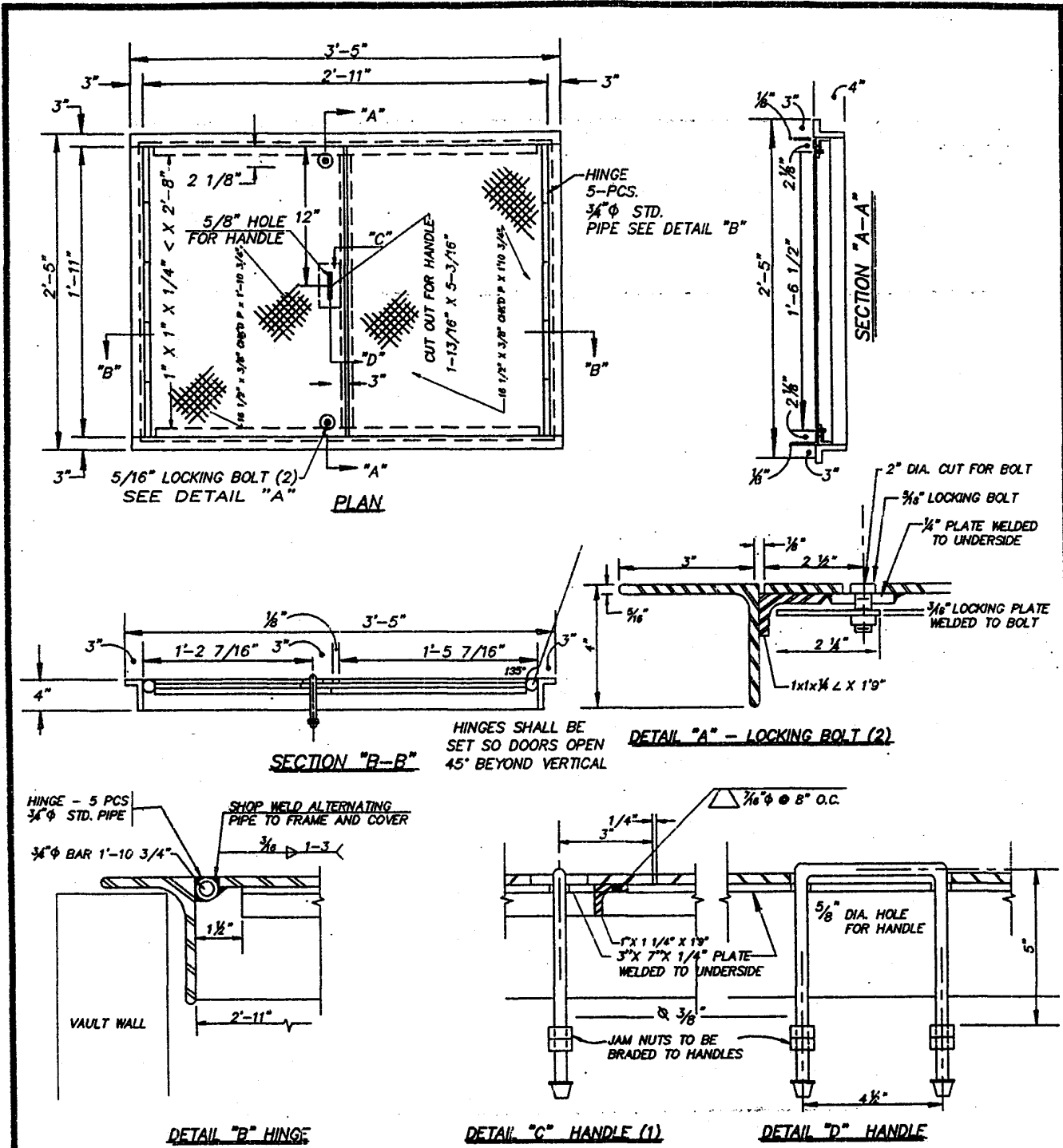
STANDARD DETAIL  
WATER

FIRE LINE  
CONNECTION

Job No.	File No.
Scales	
PLAN NO SCALE	
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Engr

Drawn By	JRM
Project-Engr	K. Clayton
Approved By	
Date	20
Sheet	Of
20	

No.	Date	By	Revision



**NOTES:**

SERVICE NUMBER TO BE BEAD WELDED ON FRAME IN 2 1/2" LETTERS.

FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND FIELD COATED WITH ONE COAT OF COMPATIBLE BLACK ENAMEL.

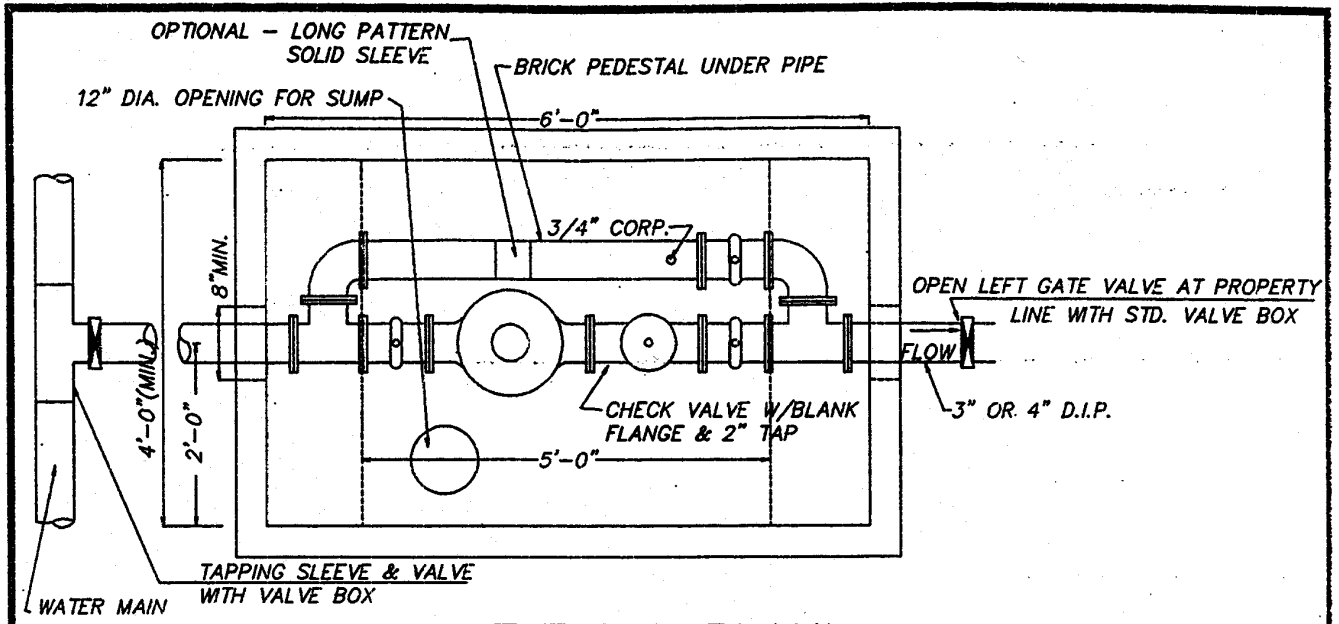
FRAME DIMENSIONS SHALL ALLOW FOR CLOSE FIT INSIDE VAULT AS SHOWN AT TOP OF VAULT WALLS.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

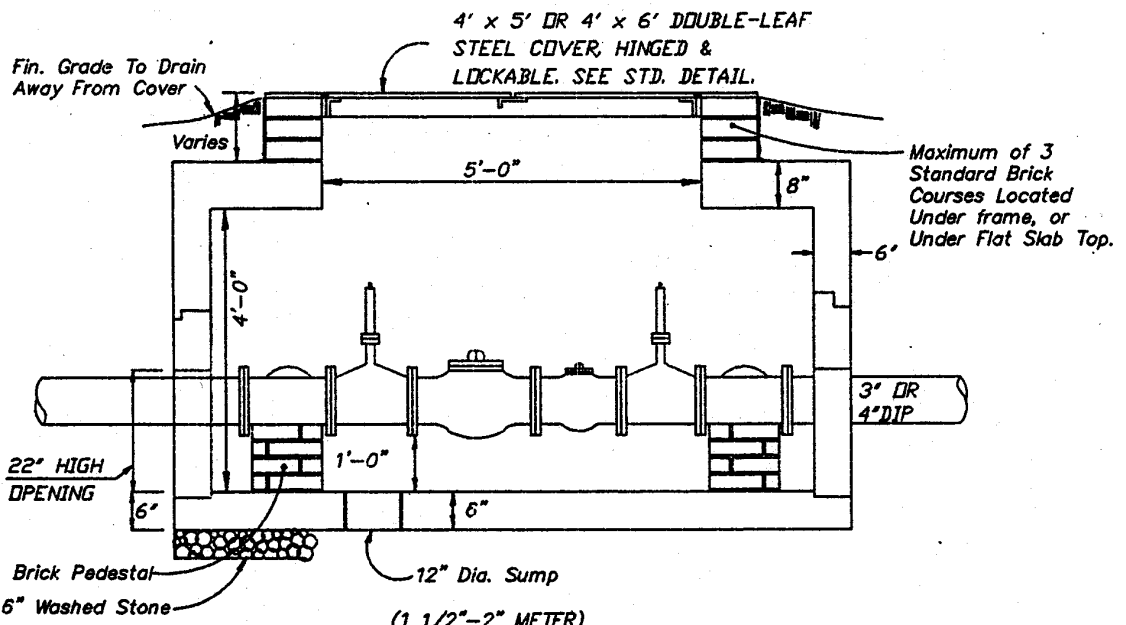
Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>
PLAN _____ Scales <b>NO SCALE</b>		
PROFILE _____		
Hor. _____		<b>2' X 3' METER VAULT FRAME AND COVER</b>
Vert. _____		
As Built _____	Date _____	
Surveyed By _____	Designed By _____	Drawn By <b>JRM</b>
		Project-Engr _____
		Approved By <b>K.B. [Signature]</b>
		Date <b>21</b>

DW21.DWG  
1/05/84

No.	Date	By	Revision



**TYPICAL PLAN**



**TYPICAL ELEVATION**  
(1 1/2"-2" METER)

**NOTES:**  
 VALVES INSIDE METER BOX TO BE OPEN LEFT BALL VALVES AS PER SPECIFICATIONS. ALL VALVES TO BE "T" HEAD  
 VAULT TO BE CONSTRUCTED FROM PRECAST REINFORCED RIBBED CONCRETE WALL PANELS. TOP SLAB TO BE PRECAST REINFORCED CONCRETE.  
 METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.  
 BOTTOM SLAB TO BE SAME AS WALL PANELS WITH FLAT SIDE UP.  
 ALL PIPE SHALL BE RESTRAINED JOINT FROM THE TAP TO THE PROPERTY LINE VALVE.

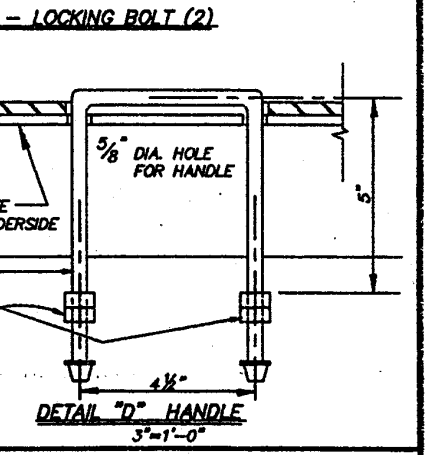
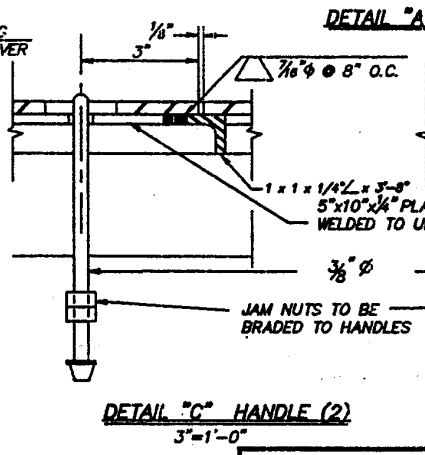
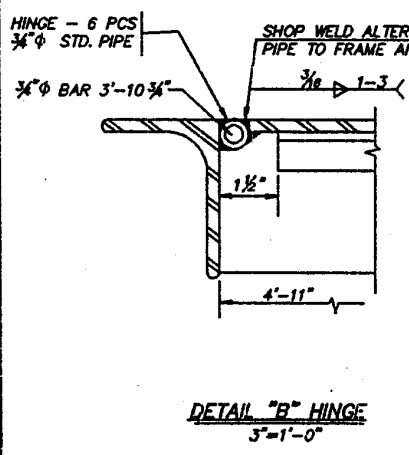
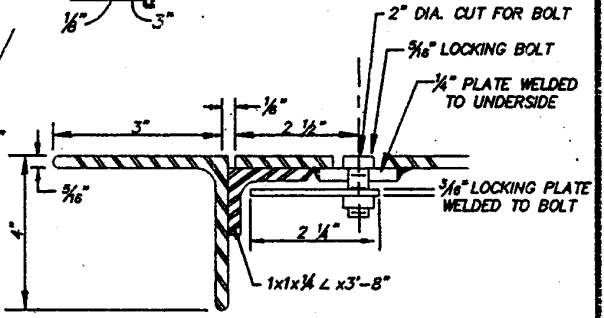
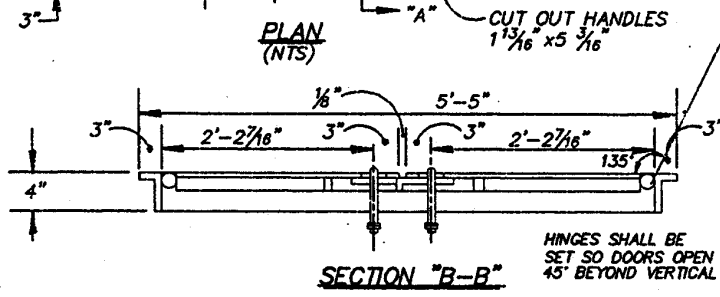
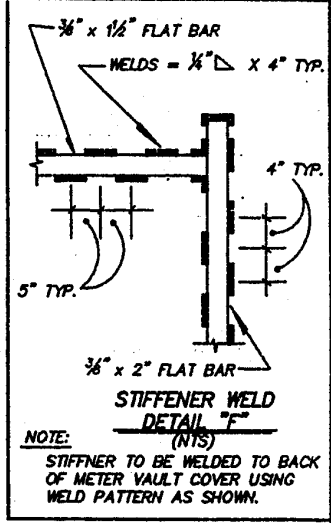
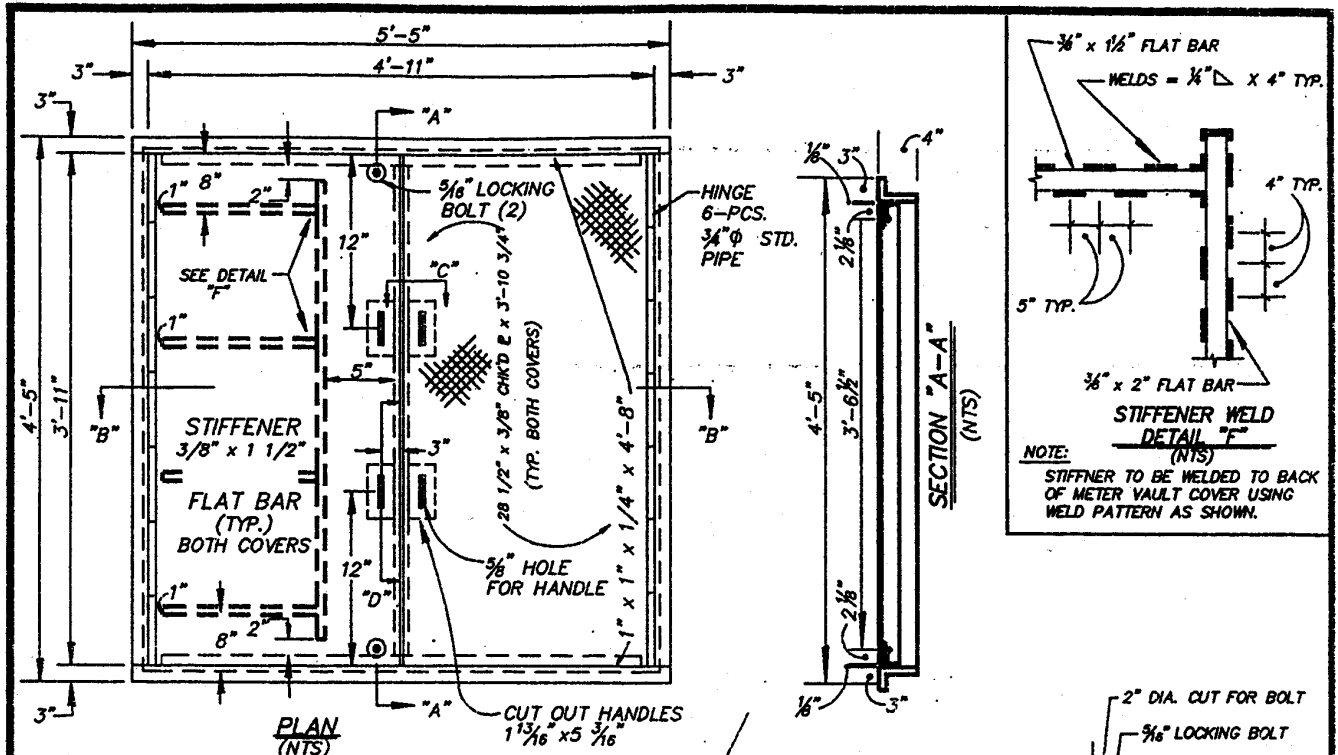
**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
 WATER**

**4" & 3" METER  
 4' x 6' VAULT**

Job No. _____		File No. _____	
PLAN _____		Scale <b>NO SCALE</b>	
PROFILE _____		Hor. _____	
_____		Vert. _____	
As Built _____		Date _____	
Surveyed By _____	Designed By _____	Drawn By <b>JRW</b>	Project-Engr _____
_____		Approved By <b>K. Bl...</b>	Date <b>2/11/22</b>

Sheet **22** Of \_\_\_\_\_

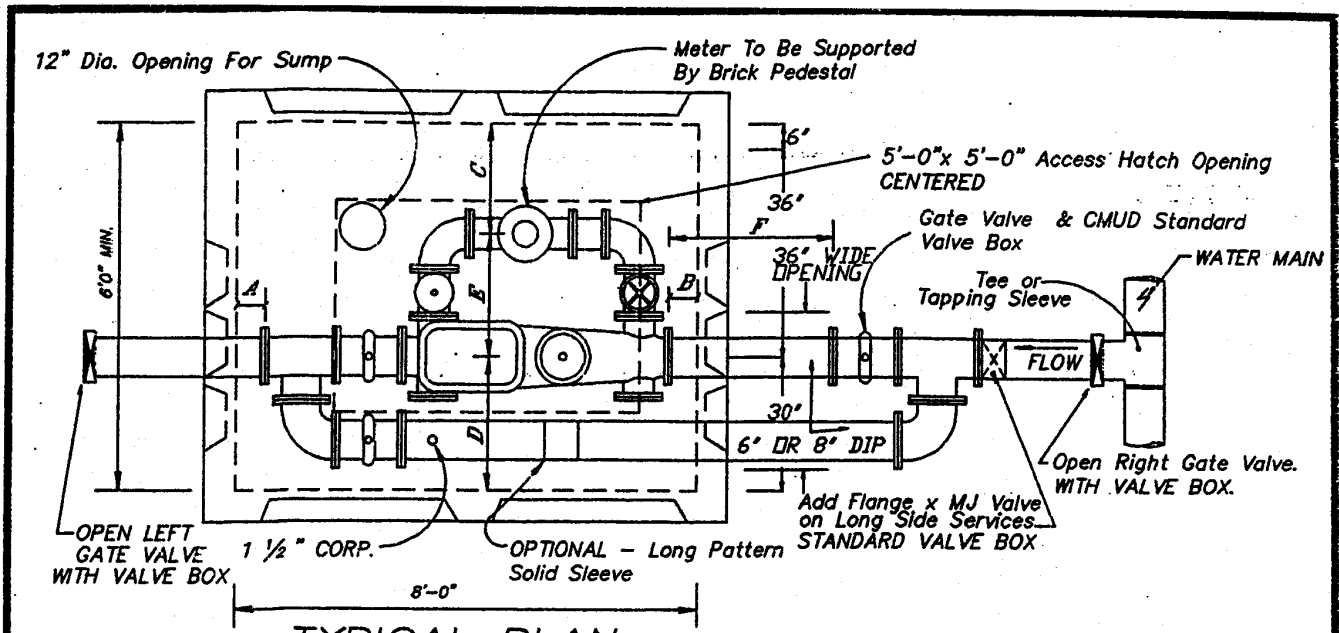


**NOTES:**  
SERVICE NUMBER TO BE BEAD WELDED ON FRAME IN 2 1/2" LETTERS.  
FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND FIELD COATED WITH ONE COAT OF COMPATIBLE BLACK ENAMEL.

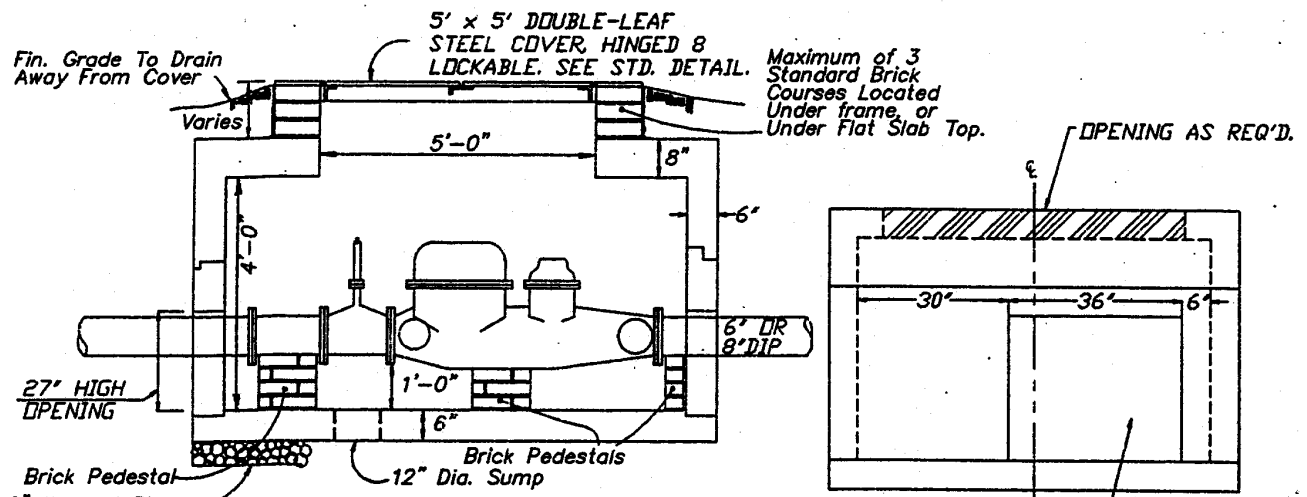
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____		File No. _____	
Scales <b>NO SCALE</b>			
PLAN	NO SCALE		
PROFILE	Hor. _____	Vert. _____	
As Built	Date _____		
Surveyed By	Designed By	Drawn By	Project-Engr
		JRM	K. Blaylock
		2/9/94	2/9/94
		Sheet	Of
		23	

No.	Date	By	Revision



**TYPICAL PLAN**



**TYPICAL ELEVATION**

**END VIEW**

**NOTES:**

ALL PIPE SHALL BE RESTRAINED JOINTS FROM TAP TO PROPERTY LINE VALVE.  
 VAULT TO BE CONSTRUCTED FROM PRECAST REINFORCED RIBBED CONCRETE WALL PANELS. TOP SLAB TO BE PRECAST REINFORCED CONCRETE DR AS APPROVED.

METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.

BOTTOM SLAB TO BE SAME AS WALL PANELS WITH FLAT SIDE UP.

INSTALL OPEN RIGHT GATE VALVES INSIDE METER VAULT, EXCEPT HAND WHEEL VALVE WHICH IS OPENED LEFT.

METER SIZE	A	B	C	D	E	F
6"	12"	12"	20"	29"	23"	30"
8"	5"	9"	20"	25"	27"	30"

**CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT**  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA

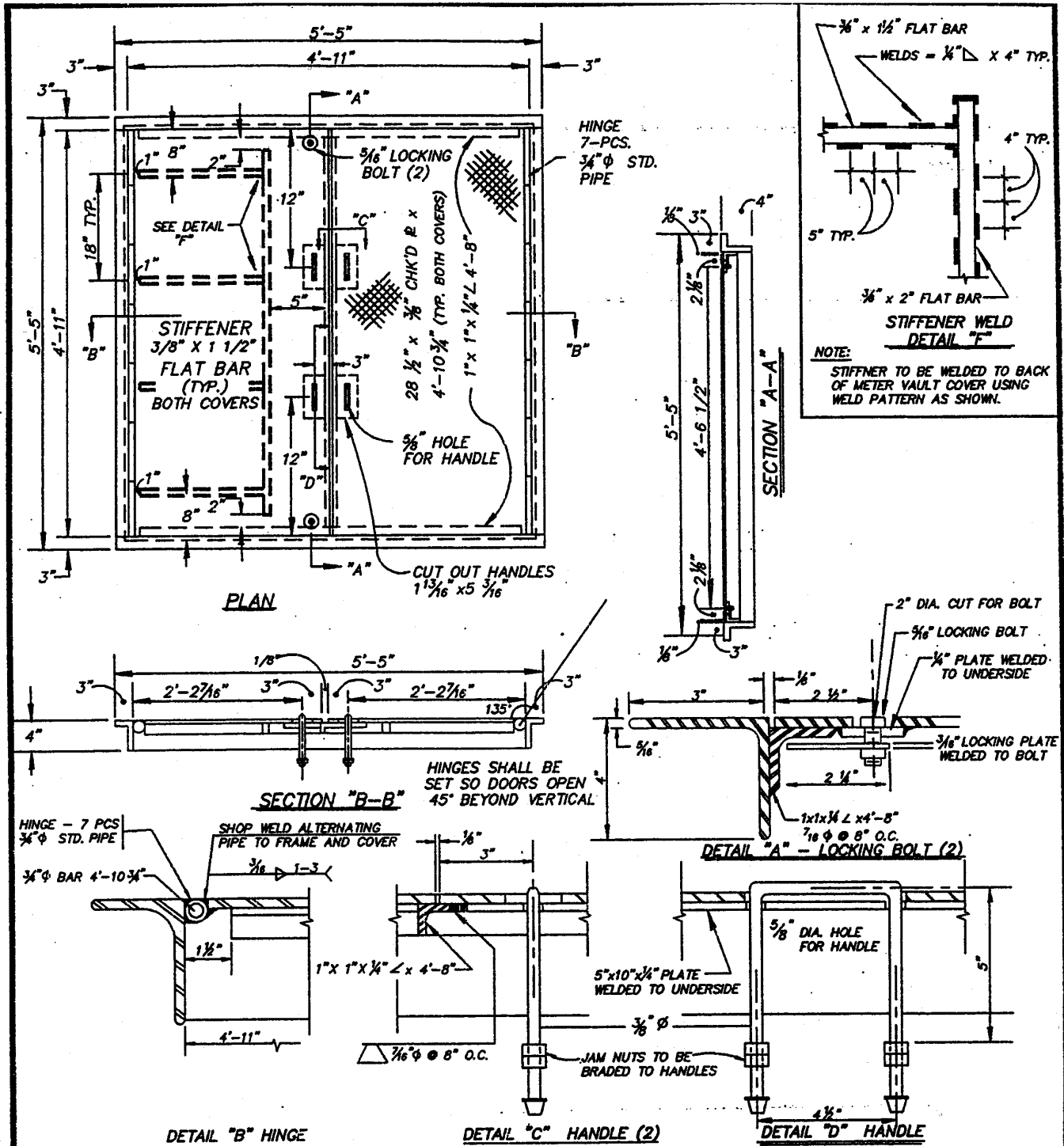
**STANDARD DETAIL WATER**

**6" & 8" METER**  
**6' x 8' VAULT**

Job No. _____	File No. _____
PLAN	Scale <b>NO SCALE</b>
PROFILE	Hor. _____
	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By <b>JRM</b>	Project-Engr _____
Approved By <b>K. DeLeon</b>	Date <b>4/9/94</b>

Sheet **24** Of \_\_\_\_\_

No.	Date	By	Revision

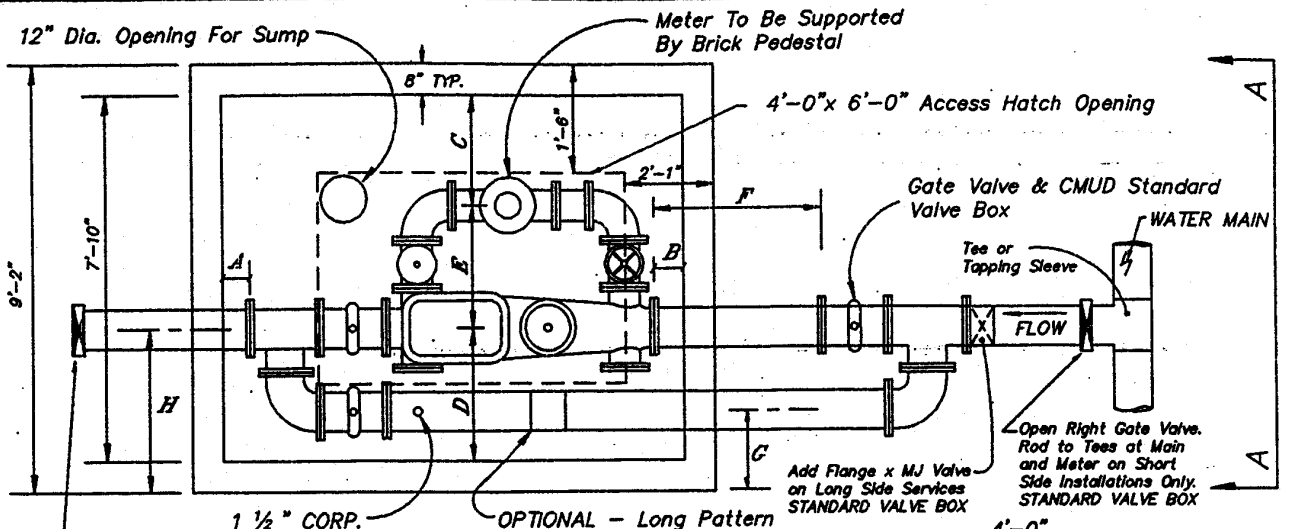


**NOTES:**  
 SERVICE NUMBER TO BE BEAD WELDED ON FRAME IN 2 1/2" LETTERS.  
 FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND FIELD COATED WITH ONE COAT OF COMPATIBLE BLACK ENAMEL.

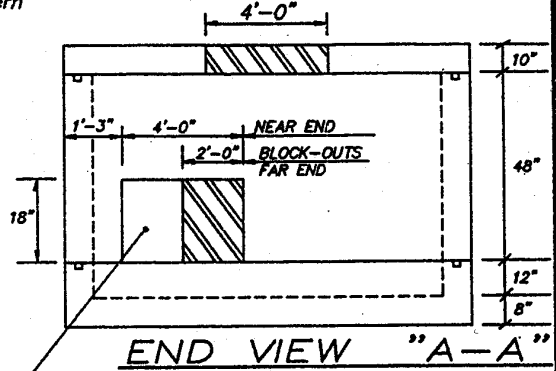
**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

Job No. _____	File No. _____	<b>STANDARD DETAIL WATER</b>
PLAN	Scale <b>NO SCALE</b>	
PROFILE	Hor. _____	<b>5' X 5' METER VAULT FRAME AND COVER</b>
	Vert. _____	
As Built _____	Date _____	
Surveyed By _____	Designed By _____	Drawn By <b>JRM</b>
		Project-Engr _____
		Approved By <b>[Signature]</b>
		Date <b>8/14/94</b>
		Sheet <b>25</b> Of _____

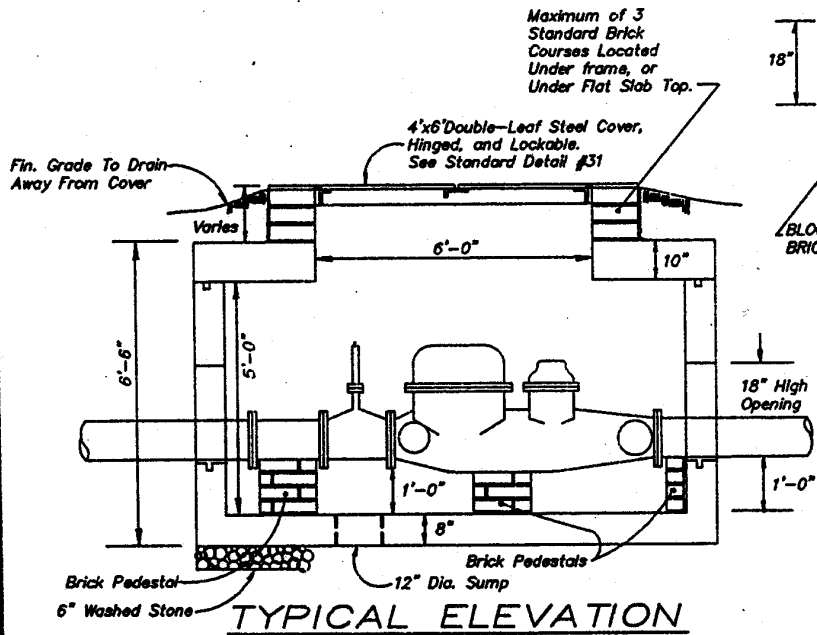
01/08/94



**TYPICAL PLAN**



**END VIEW "A-A"**



**TYPICAL ELEVATION**

METER SIZE	10"x6"	10"x12"x6"
A	8 1/2"	7"
B	8 1/2"	7"
C	19"	17"
D	41"	43"
E	34"	34"
F	30"	30"
G	27"	27"
H	49"	51"

**NOTES:**  
 ALL PIPE FOR 10"x 6" METER SHALL BE 10" D.I.P. ONLY  
 ALL PIPE FOR 10"x 12"x 6" METER SHALL BE 12" D.I.P. ONLY  
 METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.  
 INSTALL OPEN RIGHT GATE VALVES INSIDE METER VAULT, EXCEPT HAND WHEEL VALVE WHICH IS OPEN LEFT.  
 ALL PIPE SHALL BE RESTRAINED JOINT FROM THE TAP TO THE PROPERTY LINE VALVE.

**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

---

**STANDARD DETAIL  
 WATER**

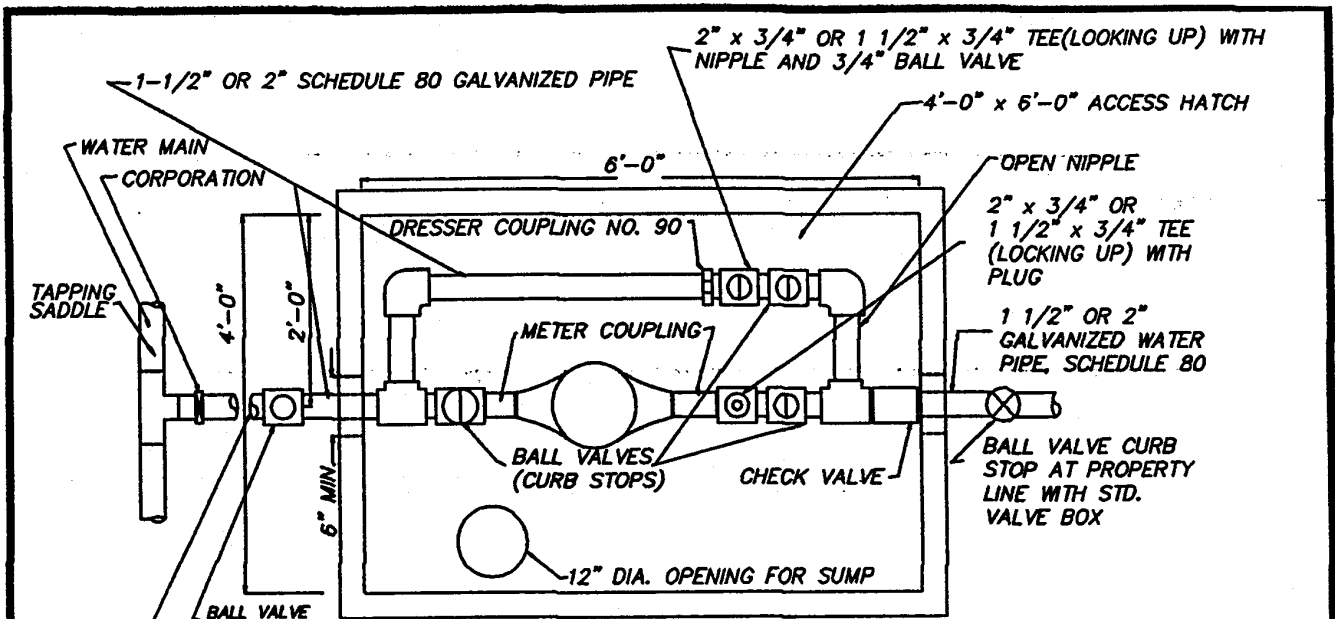
**10"x6" & 10"x12"x6"  
 METER & 8'x10' VAULT**

Job No. _____	File No. _____
Scales <b>NO SCALE</b>	
PLAN _____	
PROFILE _____	
Hor. _____	
Vert. _____	
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By <b>JRM</b>	Project-Engr _____
Approved By <b>K. Blythe</b>	Date <b>26</b>

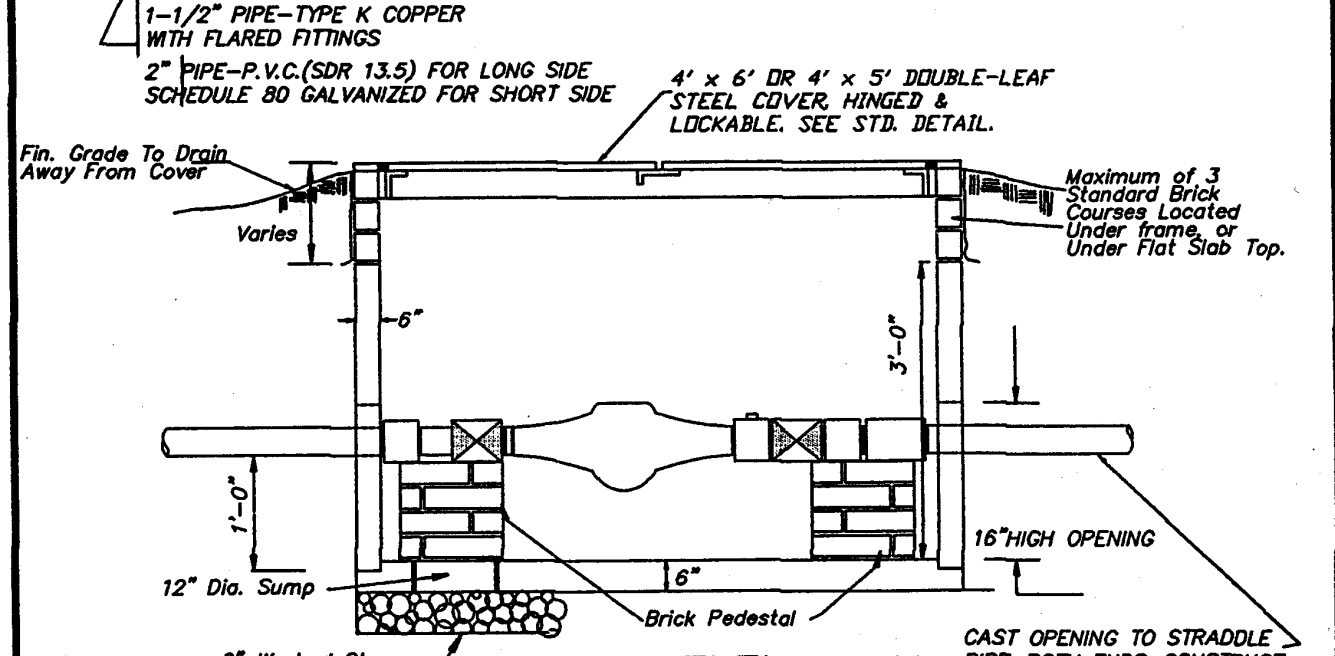
No.	Date	By	Revision

SWEET'S  
D1/05/84





**TYPICAL PLAN**



**TYPICAL ELEVATION**

**NOTES:**

VALVES INSIDE METER BOX TO BE OPEN LEFT BALL VALVES AS PER SPECIFICATIONS. ALL VALVES TO BE "T" HEAD

VAULT TO BE CONSTRUCTED FROM PRECAST REINFORCED RIBBED CONCRETE WALL PANELS. TOP SLAB TO BE PRECAST REINFORCED CONCRETE.

METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.

BOTTOM SLAB TO BE SAME AS WALL PANELS WITH FLAT SIDE UP. ALL METERS TO REGISTER IN CUBIC FEET.

CAST OPENING TO STRADDLE PIPE—BOTH ENDS—CONSTRUCT MASONRY HEADERS PLASTERED ON BOTH SIDES TO SEAL OPENINGS.

**CHARLOTTE—MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**1-1/2" & 2" METER  
4' x 6' VAULT**

Job No.	File No.
PLAN	Scale NO SCALE
PROFILE	Hor. _____ Vert. _____
As Built	Date
Surveyed By	Designed By

Drawn By	Project-Engr	Approved By	Date	Sheet 27 Of
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No.	Date	By	Revision

SOWS/DWG 01/14/84



**MATERIAL SPECIFICATIONS FOR SANITARY SEWER CONSTRUCTION**

Unless superseded or modified by a Special Provision, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specification for same contained in this Section. National material standards (ASTM, ANSI, etc.) referred to herein shall be considered to be the latest revisions only.

**A. SANITARY SEWER PIPE**

1. Vitrified Clay Pipe: Unless amended on the construction drawing or elsewhere in these specifications, all sewer pipe 15-inch in diameter and smaller may be Vitrified Clay Pipe, extra strength only, manufactured in accordance with the standard specification for Extra Strength and Standard Clay Pipe, ASTM C-700. All pipe shall be unglazed.

All joints for Vitrified Clay Pipe shall be factory-fabricated and shall be manufactured in accordance with ASTM C-425 Compression Joints for VCP and fittings.

Vitrified Clay Fittings shall conform to ASTM C-700 extra strength.

2. PVC Pipe:
  - a. Solid Wall PVC: Unless amended on the construction drawings or elsewhere in these specifications, sewer pipe 4-inches through 15-inches in diameter may be Poly Vinyl Chloride (PVC) sewer pipe with a Standard Dimension Ratio (SDR) of 35, and shall meet all requirements of ASTM Specification D-3034. Sewer pipe 18-inches through 27-inches in diameter may be Polyvinyl Chloride Pipe (PVC) large diameter sewer pipe with a minimum pipe stiffness of 46 PSI in accordance with ASTM Specification F-679. Pipe joining shall be push on elastomeric joints only and joints shall be manufactured in accordance with ASTM Specification D-3212. The pipe shall be furnished with integral bells and with gaskets that are permanently installed at the factory. The pipe shall be furnished in nominal lengths of 13 feet. PVC sewer pipe shall be green or white in color.

PVC pipe shall contain the markings required by ASTM D-3034 or F-679 as applicable. The manufacturer shall submit certification that the pipe has been tested in accordance with ASTM D-3034 or F-679 as applicable and has been found to meet all requirements. Test samples shall be as selected by the manufacturer or testing laboratory unless otherwise stipulated in the Special Provision Section of these specifications.

Fittings shall be in accordance with ASTM D-3034, F-679, and/or D-3212 as applicable, with stiffness and wall thickness equal to or greater than the pipe. Adapters shall be provided to join different materials.

- b. PVC Profile Gravity Sewer Pipe: Unless amended on the construction drawings or elsewhere in these specifications, sewer pipe 8-inches through 48-inches may be PVC profile gravity sewer pipe manufactured in accordance with the requirements of ASTM F-794. The minimum pipe stiffness shall be 46 PSI. All seams on the completed pipe shall be thermally fused. Glued seams will not be allowed.

The pipe shall be produced with integral bell and spigot end construction with elastomeric seals and shall conform to all requirements of ASTM D-3212. Joining shall be by rubber gaskets that conform in all respects to the physical requirements specified by ASTM F-477 for low head applications. The lubricant used for assembly shall be as recommended by the manufacturer and shall have no detrimental effect on either the pipe or the rubber gasket.

The average nominal inside diameter and manufacturing tolerance shall be as listed for stiffness Series 46 in Table IA for open profile pipe and Table IB for closed profile pipe of ASTM F-794. The pipe shall be furnished in nominal lengths of 13 feet and shall contain all markings required by ASTM F-794.

One sample of each size pipe specified, from the production runs for this project, shall be tested in accordance with the requirements of ASTM F-794. The manufacturer shall furnish certification that the pipe was manufactured, sampled, tested and inspected in accordance with and has been found to meet the requirements of ASTM F-794 in all respects.

Fittings shall be in accordance with ASTM F-794, D-3212, and/or D-3034 as applicable, with stiffness and wall thickness equal to or greater than the pipe. Adapters shall be provided to join different materials.

- (c) PVC Corrugated Sewer Pipe: Unless amended on the construction drawings or elsewhere in these specifications, sewer pipe 8-inches through 18-inches may be Polyvinyl Chloride Corrugated Sewer Pipe with a smooth interior, manufactured in accordance with ASTM F-949. The pipe shall be produced with integral bell and spigot construction with elastomeric seals and shall conform to all requirements to ASTM D-3212. Joining shall be by rubber gaskets that conform to the requirements of ASTM F-477. The pipe shall be furnished in nominal lengths of 12.5 feet and shall contain all markings required by ASTM F-949. One sample of each pipe size specified, from the production runs of this project, shall be tested in accordance with the requirements of ASTM F-949. The manufacturer shall furnish certification that the pipe was manufactured, sampled, tested, and inspected in accordance with and has been found to meet the requirements of ASTM F-949 in all respects.

Fittings shall be in accordance with ASTM F-949, D-3034, and/or D-3212 as applicable, with stiffness and wall thickness equal to or greater than the pipe. Adapters shall be provided to join different materials.

3. Reinforced Concrete Pipe: Unless amended on the construction drawings or elsewhere in these specifications, all sanitary sewer pipe 18-inch in diameter and larger may be reinforced concrete pipe, Class IV minimum, manufactured with "C" thickness, and conforming to Standard Specification for Reinforced Concrete, Storm Drain, and Sewer Pipe, ASTM C-76 and with the following modifications:

Sacrificial Concrete: This specification is intended to provide sacrificial concrete on the inside of all reinforced concrete sewer pipe. Amendments will be made, as necessary, in the Special Provision Section of this contract to maintain this design and/or specify other acceptable measures when sacrificial concrete is not feasible for large diameter pipe.

In lieu of sacrificial concrete, reinforced concrete pipe may be manufactured with calcareous aggregate. If this option is chosen, all coarse aggregate used in the pipe shall be limestone or dolomite, and the alkalinity of the finished pipe shall be a minimum of 50% when expressed as calcium carbonate equivalent.

Section 9 Design Tables: All Class IV RCP and 48-inch and smaller Class V RCP shall have circular reinforcement (only), equal to the requirements for Wall B reinforcement. The reinforcement shall be placed within C wall (only) the required distance from the outside surface of the pipe for a pipe having Wall B thickness.

All Class V Reinforced Concrete Pipe 54-inch inside diameter and larger shall be furnished with Wall C thickness and Wall C circular reinforcement (only) in accordance with ASTM C-76 Table 5. However 54-inch and larger RCP shall be manufactured with calcareous aggregate as specified above.

Special designs may be submitted by the manufacturer in accordance with Section 7 of ASTM C-76 and will be subject to the review and approval of the Engineer.

Section 5 Cement: The cement shall have a maximum tricalcium aluminate ( $3\text{CaOAl}_2\text{O}_3$ ) content not to exceed eight (8) percent. The Contractor shall submit to the Engineer a certificate from the cement manufacturer stating the guaranteed maximum tricalcium aluminate content.

Pipe Length: The minimum nominal laying length of the pipe shall be not less than 8 feet for 18" and 21" pipe and not less than 12 feet for pipe 24" and larger. Shorter lengths may be provided where required to maintain manhole location and for providing a flexible joint within two (2) feet of the exterior wall of the manhole.

Tests: Acceptability of reinforced concrete pipe in all diameters and classes shall be on the basis of three edge bearing tests for the load required to produce a 0.01 inch crack and ultimate failure of the pipe, absorption tests on selected samples of concrete taken from the pipe wall, by material tests required by Section 6 of ASTM C-76 and by visual inspection of the pipe to determine its conformance to design and its freedom from defects.

All tests shall be performed by an independent testing laboratory and certified test reports submitted to the Engineer. If calcareous aggregate is used, certified test reports shall be submitted stating that the aggregate used is limestone or dolomite and that the alkalinity of the finished pipe is at least 50% when expressed as calcium carbonate equivalent. Test samples shall be selected at random by the testing laboratory except that at least one sample shall be chosen from the production run from which each shipment is made.

Joints for sanitary sewer pipe shall meet the requirements listed in ASTM C-361, Section 8.4 (Subsections 1 through 8, as applicable) and C-443, including Section 10. The manufacturer shall furnish evidence of satisfactory joint design for installation depths greater than 30 feet.

PVC Liners: Where indicated on the plans or elsewhere in these Specifications, RCP shall be provided with a PVC liner as specified below for resistance to corrosive wastewater. PVC Liner shall be designed and installed to protect concrete surfaces from corrosion. All Reinforced Concrete Pipe so specified shall be plastic lined 270-degrees minimum as measured from the pipe crown. Manhole circumferences shall be fully lined from the shelf of the manhole to the top of the cone section. Installation of the plastic liner on all pipes shall be at the point of manufacture, not in the field. The manufacturer of the lining shall furnish an affidavit attesting to the successful use of this material as a lining for concrete structures for a minimum period of ten (10) years in wastewater conditions recognized as corrosive or otherwise detrimental to concrete. The manufacturer shall also document the history and use of its product for such use. The following requirements shall be followed:

a. Composition:

The material used in the liner and in all joint, corner, and welding strips shall be a combination of polyvinyl chloride resin, pigments, and plasticizer, specially compounded to remain flexible. Polyvinyl chloride resin shall constitute not less than ninety-nine percent (99%), by weight, of the formulated compound. Copolymer resins will not be allowed.

b. Physical Properties:

1. Liner plate and weld strip shall have a minimum tensile strength of 2200 PSI.
2. Liner plate placing extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for period of one minute, without rupture to the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70 - 80 degree F inclusive.
3. All plastic liner plate sheets, including lock extensions, all joint, corner, and welding strips shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material. The Engineer may authorize the repair of such defects by approved methods.

4. The lining shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to 1/4-inch settling cracks, which may occur in the pipe or in the joint after installation, without damage to the lining.
5. The lining shall be repairable at any time during the life of the structure.
6. Unless otherwise noted or instructed by the Engineer, the liner shall be white in color.

c. Details and Dimensions:

1. Liner sheets shall be a minimum of 0.065 inches in thickness. Locking extension (T-shaped) of the same material as that of the liner shall be integrally extruded with the sheet. Locking extensions shall be approximately 2.5 inches apart and shall be at least 0.375 inches high.
2. Sheets shall have a nominal width of at least 48-inches and a length of not more than 24 feet, except that longer lengths may be supplied on special order. Lengths specified shall include a tolerance at a ratio of +1/4-inch for each 100 inches.
3. Sheets which will not be used for shop fabrication into larger sheets shall be shop tested for pinholes using an electric spark tester set at 20,000 volts minimum. Any holes shall be repaired and retested.

d. Pipe-Size sheets:

1. Pipe linings shall be supplied as pipe-size sheets, fabricated by shop-welded basic-size sheets together. Shop welds shall be made by lapping sheets a minimum of 1/2-inch and applying heat and pressure to the lap to produce a continuous welded joint. Tensile strength measured across shop-welded joints, measured in accordance with ASTM D-412, shall be at least 2000 PSI.
2. Sheets shall have transverse strap channels cut in the locking extensions so that the strap, used to hold the sheet in the forms during casting of the pipe, can be placed into and perpendicular to the locking extensions.
3. The channels shall not be less than 3/4-inch wide and not more than 1-inch wide, and shall be cut so that a maximum 3/16-inch of the base of the locking extensions remains in the base of the strap channel. Strap channels shall be provided at intervals of not less than 15-inches nor more than 20-inches center-to-center. The strap channels shall not be cut through the final two locking extensions on each edge of the sheet.

4. Transverse flaps shall be provided at the ends of sheets for pipe. Locking extensions shall be removed from flaps so that 1/32 to 1/64-inch of the base of the locking extension is left on the sheet.
5. Weld strips shall be approximately 1-inch wide with a minimum width of 7/8-inch. The edges of weld strips shall be beveled in the manufacturing process. Thickness of weld strip shall be a nominal 1/8-inch.
6. Joint strips for pipe shall be four (4) inches wide plus or minus 1/4. Thickness of joint strips shall be equivalent to that of the liner.
7. Prior to preparing the sheets for shipment, they shall be tested for pinholes using an electrical spark testing set at 20,000 volts minimum. Any holes shall be repaired and retested.

e. Material:

Liner shall be Ameron T-Lock as manufactured by Ameron Protective Coatings Division of Brea, California, equivalent products by Serrot Corporation of Huntington Beach, California or Poly-Tee, Incorporated of Anaheim, California, or other equal.

f. Installation:

1. Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the manufacturer.
2. The intent of this specification is to provide for the complete coverage of all interior concrete surfaces of all manholes and structures constructed under this project.
3. The lining shall be installed with the locking extensions running parallel with the longitudinal axis of the pipe.
4. The lining shall be held snugly in place against inner forms by means of steel banding straps or other means recommended by the manufacturer. Banding straps must be located in the precut strap channels to prevent crushing or tilting of the locking extensions.
5. If banding strips are used, a steel channel, angle, or bar may be inserted along the edge locking extensions of each liner sheet for concrete pipe or cast-in-place structures. The steel channel, angle, or bar shall be of sufficient stiffness to hold the longitudinal edges of the concrete as it is vibrated into place, provided the concrete adequately supports the locking extension.
6. Locking extensions shall terminate not more than 1□-inches from the end of the inside surface of the pipe section. Joint flaps shall extend approximately four (4) inches beyond the end of the inside surface.



7. Concrete poured against lining shall be vibrated, spaded, or compacted in a careful manner so as to protect the lining and produce a dense, homogeneous concrete, securely anchoring the locking extensions into the concrete.
  8. In removing forms, care should be taken to protect the lining from damage. Sharp instruments shall not be used to pry forms from lined surfaces. When forms are removed, any nails that remain in the lining shall be pulled, without tearing the lining, and the resulting holes clearly marked. Form tie holes shall be marked before ties are broken off and all areas of serious abrasion or damage shall be marked.
  9. All nail and tie holes and all cut, torn, and seriously abraded areas in the lining shall be patched. Patches made entirely with welding strip shall be fused to the liner over the entire patch area. Larger patches may consist of smooth liner sheet applied over the damaged area with adhesive. All edges must be covered with welding strip fused to the patch and the surrounding lining adjoining the damaged area.
  10. Hot joint compounds, such as coal tar, shall not be poured or applied to the lining.
  11. The Contractor shall take all necessary measures to prevent damage to installed lining from equipment and materials used in or taken through the work.
- g. Application to Concrete Pipe - Special Requirements:
1. The lining shall be set flush with the inner edge of the bell or spigot end of a pipe section and shall extend to the opposite end or to approximately 4-inches beyond the opposite end depending upon the type of lining joint to be made with the adjoining concrete pipe.
  2. Wherever concrete pipe protected with lining, joint structures not so lined, (such as brick structures, concrete pipe, or cast-in-place structures with clay lining or clay pipe), the lining shall be extended over and around the end of the pipe and back into the structure for not less than 4-inches. This protecting cap may be molded or fabricated from the lining material but need not be locked into the pipe.
  3. Lined concrete pipe may be cured by standard curing methods.
  4. Care shall be exercised in handling, transporting, and placing lined pipe to prevent damage to the lining. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable fork lift.

5. On pipe having 360 degree liner coverage, the longitudinal edges of the sheet shall be butt welded. When pipe tubes are furnished, these shall be shop-welded joints.
6. No pipe with damaged lining will be accepted until the damage has been repaired to the satisfaction of the engineer.

h. Field Joints in Lining for Concrete Pipe:

1. The joint having sections of lined pipe shall be prepared in the following manner:

The inside joint shall be filled and carefully pointed with cement mortar in such a manner that the mortar shall not, at any point, extend into the pipe beyond a straight line connecting the surfaces of the adjacent pipe sections.

No lining joint shall be made until after the trench has been back-filled and consolidated. Pipe joints must be dry before lining joints are made.

2. All mortar and other foreign material shall be removed from lining surfaces adjacent to the pipe joint, leaving them clean and dry.
3. Field joints in the lining at pipe joints may be either of the following described types:

Type P-1: The joint shall be made with a separate 4-inch joint strip and two welding strips. The 4-inch joint strip shall be centered over the joint, heat-sealed to the lining, then welded along each edge to adjacent liner sheets with a 1-inch weld strip. The 4-inch joint strip shall lap over each sheet a minimum of 1/2-inch.

P-2: The joint shall be made with a joint flap with locking extension removed per Paragraph d.4 and extending approximately 4-inches beyond the pipe end. The joint flap shall overlap the lining in the adjacent pipe section a minimum of 1/2-inch and be heat-sealed in place prior to welding. The field joint shall be completed by welding the flap to the lining of the adjacent pipe using 1-inch weld strip.

Care shall be taken to protect the flap from damage. Excessive tension and distortion in bending back the flap to expose the pipe joint during laying and joint mortaring shall be avoided. At temperatures below 50 degree F, heating of the liner may be required to avoid damage.

4. The joint flap or strip on beveled pipe shall be trimmed to a width (measured from the end of the spigot) of approximately 4-inches for the entire circumferential length of the lining.

5. All welding of joints is to be in strict conformance with the specifications and instructions of the lining manufacturer.

Welding shall fuse both sheets and weld strip together to provide a continuous joint equal in corrosion resistance and impermeability to the liner plate.

Hot-air welding tools shall provide effluent air to the sheets to be joined at a temperature between 500 degrees and 600 degrees F. Welding tools shall be held approximately 0.5" from and moved back and forth over the junction of the two materials to be joined. The welding tool shall be moved slowly enough as the weld progresses to cause a small bead of molten material to be visible along both edges and in front of the weld strip.

6. The following special requirement shall apply when the liner coverage is 360 degrees:

When groundwater is encountered the lining joint shall not be made until pumping of groundwater has been discontinued for at least three days and no visible leakage is evident at the joint.

When welding downstream side of joint strip or flap, do not weld 6 to 8 inches at the pipe invert to provide relief of potential future groundwater buildup.

i. Testing and Repairing Damaged Surfaces:

1. After the lining has been installed and welded, all surfaces covered with lining, including welds, shall be tested with an approved electrical hole detector (Tinker & Razor Model No. AP-W with power pack) with the instrument set at 20,000 volts minimum.
2. All welds shall be physically tested by a nondestructive probing method.
3. Holes in the liner revealed by the electrical hole detector shall be repaired in accordance with Paragraph f.9 of this Section.
4. Holes in welded areas revealed by either test method described above shall be repaired by either rewelding or cutting sections of unacceptable weld with small sections of liner plate and covering the resulting hole as described above as instructed by the Engineer.

4. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of AWWA Standard C-151 and shall have a cement-mortar lining of standard thickness in accordance with AWWA C-104. Unless otherwise shown on the construction plans, all ductile iron pipe shall be furnished with push-on joints in accordance with AWWA C-111.

12-inch and smaller diameter pipe shall be pressure class 350. 16-inch and larger diameter pipe shall be minimum pressure class 250. Also, the pipe class selection for 16-inch and larger diameter pipe shall be based on the installation conditions. This pipe class shall be as shown on the plans and/or elsewhere in these specifications.

Fittings shall be in accordance with AWWA C-110 or AWWA C-153 and shall have a cement mortar lining in accordance with AWWA C-104.

5. Steel Pipe - (Aerial Creek Crossings): High Strength Steel Pipe shall be welded or seamless, manufactured in accordance with ASTM A-53 for Welded and Seamless Steel Pipe (1/8-inch to 26-inch inclusive) and/or ASTM A-139 for Welded Straight-Seam Steel Pipe (4-inch to 92-inch inclusive).

All steel shall be Grade "B" only, with minimum yield strength of 35,000 PSI. Thickness shall be 0.250" unless otherwise specified or shown on the plans.

The pipe shall be produced in a single continuous length. Welding of two or more individual pieces together end to end shall not be permitted. Spiral-seam pipe shall not be permitted.

- a. All steel pipe shall receive one (1) of the following shop applied linings on the inside of pipe barrel:

- (1) Coal tar lining 3/32-inch minimum thickness in accordance with AWWA 203.
- (2) Coal tar epoxy lining 24 mils (dry) minimum dry film thickness and shall be Koppers' No. 300M, Amercoat No. 78, Carboline-Carbomastic No. 14 or approved equal.

- b. The outside of steel pipe and complete couplings shall receive one coat of Koppers 300M coal tar epoxy - 16 mils minimum dry film thickness - or approved equal. The coal tar epoxy coat shall be shop applied to the pipe, and field applied to the couplings. Damage to exterior shop applied coatings shall be repaired with the same coating used by the manufacturer and applied as recommended by the manufacturer.

- c. Pipe ends shall have tolerances within the limits required for approved couplings. Pipe shall also be furnished with plain right-angle ends with all burrs removed from the ends. Steel mechanical transition couplings shall be as follows:

Steel Pipe to Steel Pipe:

- (1) 30-inch and smaller pipe sizes shall have a center ring length of seven (7) inches.
- (2) 36-inch and larger pipe sizes shall have a center ring length of ten (10) inches.

- (3) Couplings shall be as manufactured by Dresser Industries - Style 38 Straight Coupling, or approved equal. Center ring, glands, bolts, and nuts shall receive one shop coat of primer.

Steel Pipe to Ductile Iron Pipe:

- (1) 8-inch and smaller pipe sizes shall have a center ring length of five (5) inches.
- (2) 10-inch through 20-inch pipe sizes shall have a center ring length of seven (7) inches.
- (3) 24-inch and larger pipe sizes shall have a center ring length of ten (10) inches.
- (4) Couplings shall be as manufactured by Dresser Industries - Style 62 Transition Coupling, or approved equal. Center ring, glands, bolts, and nuts shall receive one shop coat of primer.

Couplings shall receive field applied protective coatings as specified for steel pipe.

6. 4-Inch Sanitary Sewer Laterals: All 4-inch laterals shall be SDR 35 PVC, Schedule 40 PVC, Ductile Iron, or Cast Iron Soil Pipe. SDR 35 PVC and ductile iron laterals shall be as hereinbefore specified. 4-inch laterals may connect at manholes or tees.
  - a. Schedule 40 PVC: Schedule 40 PVC laterals shall be in accordance with ASTM D-2665, NSF 14, and D-1785. Fittings shall be socket type in accordance with ASTM D-2466. Joining shall be through solvent cement in accordance with ASTM D-2564.
  - b. Cast Iron Soil Pipe: 4-inch soil pipe shall be in accordance with ASTM A-74 Service Weight, with "Charlotte Seal" gasket.
7. 6-Inch Sanitary Sewer Laterals: All 6-inch laterals shall be Ductile Iron Pipe, SDR 35 Polyvinyl Chloride Pipe, or Schedule 40 PVC Pipe as hereinbefore specified. 6-inch laterals may connect at manholes or tees.
8. Couplings/Saddles: Couplings used to join various types of 12-inch and smaller pipe shall be elastomeric PVC sleeve couplings with stainless steel compression bands and stainless steel shear rings as manufactured by Mission Clay Products, Fernco, Logan Clay Products, or approved equal.

Couplings for 12-inch and smaller pipe may also be elastomeric PVC with internally molded rigid fiberglass insert and stainless steel bands as manufactured by DFW Plastics or approved equal. The coupling shall provide a water and/or gas tight connection.

Couplings for 15-inch and larger pipe shall be submitted to the Engineer for approval.

Saddles for lateral connections shall be ABS Plastic, PVC, Elastomeric PVC, or approved equivalent. Saddles shall be connected to VCP using epoxy sealant. Saddles shall be connected to PVC pipe using a flat or profile gasket, as applicable to the type of pipe, and at least two stainless steel bands around the pipe and saddle. The lateral shall be connected to the saddle with a compression gasket, solvent weld adapter, and /or stainless steel band, as applicable.

## **B. MANHOLES**

All sewer manholes shall be constructed of precast concrete sections only in conformance with the following specifications and Charlotte-Mecklenburg Utility Department Standard Detail Drawings. Special cast in place manhole structures shall be as shown on the plans and shall comply with the various other applicable sections in these specifications.

Manholes will be furnished with the following clear inside diameters according to the sewer main diameter unless amended by the Plans or Special Provisions:

8" to 18" pipe	4' Manhole
21" to 36" pipe	5' Manhole
39" to 54" pipe	6' Manhole
54" and larger	8' Manhole

The manhole diameter for a given pipe size may be increased from that shown above for applications where the angle between the influent and effluent pipes precludes proper installation of the pipe connections in the standard size manhole.

Manholes shall be furnished with pre-cast bottom slabs and flexible watertight boots for 15-inch and smaller pipe. The boots shall be cast in as integral parts of the base or installed in cored openings with stainless steel compression bands, and shall conform to ASTM C-923. Manholes for 18-inch and larger pipe may be furnished with precast bottom slabs and flexible boots, flexible seals, or concrete collars. The flexible seals shall be A-Lok or Contour Seal. Flexible connectors shall conform to ASTM C-923. The concrete collars shall be according to the applicable Standard Detail. Manholes to be placed over existing pipelines shall be furnished with "doghouse" openings cast in the bottom section allowing it to be set over the existing pipe. A concrete base and invert shall be poured around the bottom section and the pipe according to the applicable Standard Detail.

Shop drawings which show dimensions, openings for pipe, reinforcing steel dimensions and layout and other essential details shall be submitted for approval.

1. Precast Reinforced Concrete Manhole Sections: All precast reinforced concrete manholes shall conform to CMUD Standard Detail drawings and to ASTM C-478. The following minimum standards shall also apply:
  - a. Wall thickness shall be 1/12th of the inside diameter with a minimum thickness of five (5") inches.
  - b. Base sections shall be cast monolithically or have a waterstop cast in the cold joint between the walls and the base slab.

- c. Cone sections shall normally be eccentric with the inside face of one side vertical and flush with the inside face of the barrel section. Eccentric cones with bolt down frame and cover shall have a minimum vertical height, as measured from the top of the cone to the bottom of the bell, of 32 inches. Eccentric cones without bolt down frame and cover to be installed flush to finish grade may have a minimum vertical height of 24-inches. Concentric cones with a vertical height of 20-inches may be used on manholes less than five (5') feet deep (4' diameter manhole only). Transition cone sections may be provided for an eccentric transition from a 60-inch riser to a 48-inch cone section to be placed directly beneath the 48-inch cone.
- d. Transition slabs may be placed a minimum of five (5) feet above the invert shelf for six (6) feet and larger diameter manholes where the slab will be buried. Flat top slabs may be used for six (6) feet and larger diameter manholes, unless the manhole is located within pavement or maintained lawns.
- e. Joints between sections shall be manufactured in accordance with ASTM C-443. Joints may be sealed with rubber gaskets in accordance with ASTM C-443 or with butyl rubber sealants conforming to Federal Specification SS-S-210A and AASHTO M-198, Type B.
- f. All markings required by ASTM C-478 shall be clearly stamped on the inside of each section.
- g. Aggregate shall be sound, crushed, angular granitic stone only, substantially in accordance with ASTM C-33, except that the requirement for gradation in that standard shall not apply. Smooth or rounded stone (river rock) shall not be acceptable.
- h. The cement shall be Type II with a maximum tricalcium aluminate ( $3\text{CaOAl}_2\text{O}_3$ ) content 8%.

In lieu of Type II cement and granitic aggregate, precast manhole sections may be furnished of Type III cement with calcareous (limestone) aggregate. The manufacturer will submit lab tests certifying the amount of Alkalinity (minimum 78%) present in the complete mix.

- i. Manhole riser sections, transition slabs, flat top slabs, and cone sections shall be designed for H-20 loadings.
- j. The manufacturer shall furnish the Engineer with test results on compression and absorption for one section in every twenty-five sections poured, and certification from cement manufacturer and aggregate supplier certifying chemical content. The Engineer reserves the right to pick random sections for the required testing.

2. Steps: Manhole steps will be furnished in accordance with Standard Detail Drawings ASTM C-478 and current OSHA regulations. In addition to the testing requirements of ASTM C-478 each step installed in pre-cast manholes will be tested to resist a 1000 lb pullout. The manhole manufacturer will furnish certification of each test with each shipment showing manhole location, date of test, and results.
3. PVC Liner: Where indicated on the plans or elsewhere in these specifications, manholes shall be furnished with a PVC Liner for resistance to corrosive sewers. The liner shall be as hereinbefore specified for RCP.

### **C. MISCELLANEOUS STEEL**

1. Steel Pier Material: Steel piles, cross braces, cradles, etc., shall consist of structural steel shapes of the section required on the Plans and Details. The steel shall conform to Specifications For Steel For Bridges And Buildings, ASTM A-36.

All bolts and nuts will conform to ASTM A-325 for 7/8-inch and to ASTM A-490 for 1-inch and larger.

The Contractor shall handle and store steel members above ground on platforms, skids, or other supports. Members shall be free of dirt, grease, and other foreign material and protected against corrosion.

Coal tar epoxy coating Koppers' No. 300M, Amercoat No. 78, Carboline-Carbomastic No. 14 or approved equal shall be applied to all specified surfaces of the steel pier.

Welding Electrodes shall conform to the following:

Shielded Metal-Arc: AWS A5.1 or AWS 5.5, E70XX

Submerged-Arc: AWS A5.17, F70X-EXXX

Gas Metal-Arc: AWS A5.18, E70S-X or E70U-1

Flux Cored-Arc: AWS A5.20, E70T-X (except 2 and 3)

2. Steel Encasement Pipe: Steel pipe shall be welded or seamless, smooth wall or spiral weld, consisting of Grade "B" steel as specified in ASTM A-139.

Minimum yield strength shall be 35,000 PSI; and pipe thickness shall be as specified for each individual job.

All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. All burrs at pipe ends shall be removed.

Encasement pipe must be approved by the appropriate controlling agency (D.O.T., R.R., etc.) and the Engineer prior to ordering.



3. Structural Steel Tunnel Liner Plates: The tunnel liner plates shall be either the four (4) flange type (as approved for use within D.O.T. right-of-way) or the lap seam type (as approved for use within railroad right-of-way) fabricated to permit assembly of a continuous steel support system as the tunnel is excavated. Tunnel liner plates shall be fabricated from hot rolled, carbon steel sheets or plates conforming to the specifications of ASTM A-569.

The tunnel liner shall be designed in accordance with the requirements of Section 16-Division I and constructed to conform to Section 25-Division II of the current or interim AASHTO Standard Specifications for Highway Bridges.

Liner plates shall be galvanized in accordance with AASHTO M167 and fully bituminously coated in accordance with AASHTO M190. All hardware necessary to the tunneling operation shall be hot-dip galvanized in accordance with ASTM A-153 prior to bituminous coating application. Hardware shall conform to ASTM Specification A-307, Grade A.

The minimum mechanical properties of the flat steel plate before cold forming used for the design of the tunnel liner shall be:

- A. Minimum Tensile Strength of Liner Plates: 42,000 P.S.I.
  - B. Minimum Yield Strength of Liner Plates: 28,000 P.S.I.
  - C. Steel Liner Plates must be approved by the appropriate controlling agency (DOT, Railroad, etc.) and the Engineer prior to ordering. Gauge or thickness of liner plates will be as noted on the plans and elsewhere in these specifications.
  - D. Elongation, 2-inches = 30 percent
  - E. The moment of inertia shall be .042 inches to the 4th power per inch of width for four flange 12 gage liner plate.
4. Steel Vent Pipe: Unless otherwise specified, steel vents shall be Schedule 40 five-inch (5") diameter steel pipe, consisting of Grade "B" steel as specified in ASTM A-139.

All steel shall be Grade "B" only, with a minimum yield strength of 35,000 P.S.I.

The steel pipe shall have an inside coal tar lining 3/32 inch minimum thickness in accordance with AWWA C-203 or a coal tar epoxy lining conforming to that required for steel (aerial creek crossing) pipe.

Outside surface of pipe shall be sand or grit blasted to commercial standard and have one (1) coat of zinc chromate primer applied in accordance with Federal Specification TT-86a.

Pipe shall be furnished with two (2) evenly applied coats of rust inhibiting enamel paint, either Koppers Glamortex No. 501 Enamel (Olive Green), Southern Coatings Rustaloy No. 0537 Enamel (Garden Green), or equal.

5. Steel Straps And Anchors: All pipe and/or pier straps shall conform to the requirements of ASTM A-36 with a minimum yield strength of 36,000 P.S.I.

Finished straps and anchors shall be galvanized in accordance with ASTM A-153. The entire strap and all exposed surfaces of anchors and/or bolts (and nuts) shall be fully bituminously coated in accordance with AASHTO M-190. Anchor bolts (non-head) shall conform to ASTM A-36 with tension test to be made (as required) on the bolt body or on the bar stock used for making the anchor bolts. Unless otherwise specified all other fasteners shall conform to ASTM A-307 for carbon steel externally and internally threaded standard fasteners Grade A or B.

6. Steel Reinforcing For Concrete:
  - A. Bars: All reinforcement bars shall conform to the Standard Specifications for BILLET-STEEL BARS FOR CONCRETE, REINFORCEMENT, ASTM A-615. All bars shall be deformed and of structural Grade 60.
  - B. Wire: All reinforcement wire fabric shall conform to the Standard Specifications for WELDED STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT, ASTM A-185.

#### **D. CONCRETE**

1. Portland Cement: All concrete shall conform to the Standard Specifications for READY MIXED CONCRETE, ASTM C-94. An air-entraining admixture, conforming to ASTM C-260, shall be added to either Type I, Type II, or Type III Portland Cement. Fly Ash conforming to ASTM C-618 for Class C Fly Ash may be added to the concrete mix but shall not be considered as replacement for more than 10% of the cement therein (strengths shall not be less than hereinafter required).

Types I, IA, III and IIIA Portland Cement shall only be used for manhole inverts, concrete encasement, concrete blocking, and/or as directed by the Engineer, and shall conform to ASTM C-150.

Types II and IIA Portland Cement shall be used in precast manholes, cast in place manhole structures, reinforced concrete pipe, reinforced concrete piers and concrete or reinforced concrete rip-rap as directed by the Engineer, and shall conform to ASTM C-150 except that Tricalcium Aluminate ( $3\text{CaOAl}_2\text{O}_3$ ) content shall not exceed 8%.

2. Aggregates: All aggregates used for concreting shall conform to ASTM C-33 and shall be checked daily for any variances in moisture content. Said variances shall be corrected and/or taken into consideration for each batch.
  - a. Coarse Aggregates: Shall be uniformly and evenly graded for each application in accordance with A.C.I. Standard 318. Unless otherwise approved, aggregate shall be sound, crushed, angular granitic stone. Smooth or rounded stone (river rock) shall not be acceptable.

- b. Fine Aggregates: Shall consist of natural sand, manufactured sand or a combination thereof. Fine aggregates shall conform to the sieve analysis as specified in paragraph 4.1 of the standard except that the percent passing a No. 50 sieve shall not exceed 5% and the percent passing a No. 100 sieve shall be 0% as provided for in paragraph 4.2 of the standard.
3. Mix Design: Concrete shall be watertight, resistant to freeze-thaw cycles and moderate sulfate attack, abrasion resistant, workable, and/or finishable. These qualities may be met through the use of admixtures (if and only if approved in the mix design as hereinafter specified) conforming to the appropriate ASTM with the exception of the use of calcium chloride, which shall be limited to no more than 1% by cement weight - thoroughly mixed to insure uniform distribution within the mix. If the concrete is used with reinforcing steel, no calcium chloride will be allowed.

The Contractor shall assume responsibility for concrete mixture. The concrete shall be proportioned to meet the following requirements: (Note: This mix does not apply "in total" to precast manhole or reinforced concrete pipe).

A.	Compressive Strength	Minimum 3600 PSI
B.	Water-Cement Ratio By Weight	Maximum-0.50
C.	Slump	Min. 3" Max. 5"
D.	Air Content (Entrained & Entrapped)	Min. 4% Max. 6%
E.	Coarse Aggregate	3/4"-1 1/2 (as required by the application)

When required by the Engineer, and prior to beginning construction, the Contractor, at his expense, shall obtain from an approved commercial testing laboratory a design for a suitable concrete mix and submit same with his list of materials and material suppliers for approval.

4. Curing Compound: All concrete curing compounds shall conform to the standard specifications for LIQUID MEMBRANE - FORMING COMPOUNDS FOR CURING CONCRETE, ASTM C-309, Type 2.

Curing compounds shall be applied as forms are stripped.

5. Grouts: All grouts shall be of a non-shrink nature (as may be achieved through additives or proportioning) and depending upon application range from plastic to flowable cement water paste. Testing as specified above for concrete may be required for acceptance of grouts to include frequent checks for consistency by a time-of-flow measurement.

Expansion grouts shall be either Gilco pre-mixed or Supreme non-metallic grout as manufactured by Gifford-Hill and Company, Incorporated, or Embecco 636 grout as manufactured by Master Builders or equal.

Acceptable range of testing requirements:

Compressive Strength	10,500 to 12,500 PSI
Bond Strength	1,350 to 1,700 PSI
% Expansion	+0.025% to +0.75%

Expansion grouts shall be used only as directed by the Engineer.

Grouts shall be mixed (if applicable) and placed in accordance with the manufacturer's current recommendations, for each specific application.

6. Mortar: Mortar used in sanitary sewer manholes shall be hydraulic cement mortar in accordance with ASTM C-398. Mortar used in water meter vaults and water valve vaults shall be Type M mortar in accordance with ASTM C-270.

## E. STONE AND BRICK

1. Granular Bedding Material: All bedding material shall be angular, clean washed crushed stone graded in accordance with Size #67 in ASTM D-448 for "Standard Sizes of Coarse Aggregate", (NCDOT Standard size #67).

Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the Engineer.

2. Stone Stabilization Material: All stone stabilization material shall be angular, clean washed crushed stone graded in accordance with standard sizes #467 in ASTM D-448, (NCDOT Standard size #467M).

Stabilization material will be used only as instructed in the specifications and/or as specifically directed by the Engineer.

3. Silt Check Dam Material: Shall be coarse angular, clean washed crushed stone, gravel, or rock, well graded, and ranging in size from 2-inches to 6-inches, (NCDOT stone for erosion control-Class A).

4. Rip Rap: All rip rap shall consist of clean field stone or rough unhewn quarry stone, resistant to the action of air and water, varying in weight from 25 to 250 pounds with 60% weighing a minimum of 100 pounds each and no more than 5% weighing less than 50 pounds each, (NCDOT Class 2 Rip Rap). Rip rap will be placed from a minimum of 4.0 feet below the toe of the bank to top of the bank in areas determined by field conditions. Rip rap thickness shall be 1  $\square$  times the diameter of the largest stones used, or 2.0 feet, whichever is greater.

5. Brick: All brick used to construct manhole inverts or adjust frames shall be made from clay or shale, shall be solid only and shall be of standard building size. All brick shall meet or exceed the compressive strength and water absorption properties specified in ASTM C-32 for Grade MS brick or in ASTM C-216 and ASTM C-62 for Grade SW brick.

## F. FERROUS CASTINGS

1. Special Castings: All cast iron pipe fittings and special castings shall be furnished in weight, classes, and/or special thickness as specified elsewhere. The castings shall conform to ASTM A-126 and shall be manufactured in domestic foundries. Coatings and linings (if applicable) shall be the same as specified for Ductile Iron Pipe.
2. Frames, Covers And Grates: All manhole frames and covers shall conform to ASTM A-48, Class 30 and shall be manufactured in domestic foundries. Dimensions shall conform to the Standard Details.

Manhole frames and covers shall be furnished with the common contact surfaces between frame and cover machined. Frames and covers shall be Dewey Brothers RCR 2010, Vulcan VM-83, U.S. Foundry or approved equal.

Where watertight frames and covers are specified, the watertight seal between frame and cover shall be accomplished by means of a rubber gasket. Watertight frames and covers shall be Dewey Brothers RCR 2010W, Vulcan VM 1383, U.S. Foundry or approved equal.

## G. TRAFFIC CONTROL DEVICES

All traffic control signs, barrels, barricades, pavement markings, etc., shall conform to the "Manual on Uniform Traffic Control Devices" (MUTCD) published by the U.S.D.O.T. and any supplements to the MUTCD adopted by N.C.D.O.T.

## H. EROSION CONTROL

1. Seed: All seed shall be labeled to show that it meets the current requirements of the North Carolina Seed Law. Seed shall have been tested within the six (6) months immediately preceding its use. Further specifications for each seed item are given below:
  - a. Kentucky Fescue #31: Minimum 98% pure live seed; maximum 1% weed seed; minimum 90% germination.
  - b. Sericea Lespedeza (Scarified and Unscarified): Minimum 98% pure live seed; maximum .50% weed seed; minimum 85% germination. Scarified may include 20% hard seed.
  - c. Rye Grass (Annual): Minimum 98% pure live seed; maximum .10% weed seed; minimum 85% germination.
  - d. Sudangrass: Minimum 98% pure live seed; maximum .25% weed seed; minimum 85% germination.

- e. Certification/Supplier: The contractor shall furnish the State's Landscape Supervisor in Albemarle, North Carolina (for work in Department of Transportation rights-of-ways) and the City's Construction Engineer (for all work) the name of the supplier of seed, the seed type and the total amount (not seed rate) to be used in restoring disturbed groundcover. This information shall be furnished at least four (4) weeks prior to reseeding operations so that quality tests can be made by the appropriate controlling agency. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall conform to the state law restrictions for restricted noxious weeds.
  
2. Fertilizer: All fertilizer for undeveloped areas shall have minimum 5-10-10 analysis or a comparable 1-2-2 ratio. All fertilizer for established lawn areas shall have a minimum 10-10-10 analysis or a comparable 1-1-1 ratio. All fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the job site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged will not be accepted. The quality of all fertilizer and all operations in connection with furnishing same, shall comply with the current requirements of the North Carolina Fertilizer Law and with the current applicable Rules and Regulations adopted by the North Carolina Board of Agriculture.
  
3. Lime: All lime shall be finely ground limestone (Dolomite) containing not less than 85% total carbonates. Lime shall conform to the specifications of the North Carolina Department of Agriculture for Agricultural Grade.
  
4. Superphosphate: All superphosphates shall be composed of finely ground phosphate rock, as commonly used for agricultural purposes, containing not less than 20% available phosphoric acid.
  
5. Mulch: All mulch shall be small grain or tame hay. Small grain or tame hay shall be furnished undamaged, air dried, threshed and free of undesirable weed seed.
  
6. Erosion Control Fabric: Material shall be as specified in the Environmental Protection Section of these specifications per Erosion Control Standard Detail 6.62.
  
7. Jute Netting Or Thatching: All jute shall be of a uniform open plain weave of single jute yarn, 18-inches in width (1"). The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half (□) its normal diameter.

There shall be 78 warp ends (2), per width of netting; 41 weft ends (1), per linear yard; and the weight shall average 1.22 pounds (5%) per linear yard of netting. Jute shall be anchored into place in accordance with the manufacturer's requirements. Installation shall only be at the direction of the Engineer.

8. Erosion Control Blanket: Erosion control blankets shall be manufactured from wood fiber, straw, coconut fiber or other degradable material woven into a mat and secured with photo degradable plastic mesh or biodegradable thread. Blankets shall be installed according to manufacturers recommendations where directed by the Engineer. The following manufacturers are approved: AMXCO-Curlex Blanket, North American Green-SC 150, and HV Excelsior.
  
9. Gabions: Gabions shall be manufactured from zinc coated steel wire mesh (minimum H-gauge) to form rectangular units. The front, base, back and lid shall be woven into a single unit and the ends and diaphragms shall be factory connected to the base. The individual units shall be installed per the manufacturers instructions and filled with hard durable, clean stone from 4-8 inches inside or as approved by the Engineer.

## **DETAILED SPECIFICATIONS FOR SANITARY SEWER CONSTRUCTION**

The Contractor shall furnish all materials, equipment and labor required to construct the project as outlined in these specifications and accompanying plans.

### **A. HANDLING AND STORAGE OF MATERIALS**

The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of all pipe, manholes and other accessories shall be kept free from dirt and foreign materials at all times.

1. Transportation of Materials and Equipment: The Contractor and his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which would be used for hauling of equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to said roads which may be attributed to this project.

All materials furnished by the contractor shall be delivered and distributed at the site by the Contractor or his material supplier.

2. Loading and Unloading Materials: Ductile iron pipe and cast iron accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Concrete pipe, clay pipe, and precast manholes will be unloaded with hoists and/or as recommended by the respective manufacturers. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
3. Responsibility for Materials on Site: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or right-of-way, as applicable.

The Contractor will string in advance no more than the amount of pipe and material that can be installed within four (4) weeks or less as approved by the Engineer. All the materials shall be placed in such a manner as not to hinder access, endanger or impede traffic, or create a public nuisance. Materials strung through residential areas (or any area with maintained lawns) shall be placed in such a manner as not to restrict normal maintenance of established lawns, and must either be installed within two (2) weeks or removed to an approved storage yard, as required by the Engineer.

4. Material and Equipment Storage: The Contractor will be responsible for locating and providing storage areas for construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is received by this Department, the Contractor will be required to store all equipment and materials within the limits of the sanitary sewer right-of-way and temporary construction easement provided. The materials and equipment storage shall comply with all local and state ordinances throughout the construction period. Material and equipment may only be stored within road right-of-way if approved by the controlling agency.



The Contractor shall be responsible for the safeguarding of materials and equipment against fire, theft, and vandalism and shall not hold the City responsible in any way for the occurrence of same.

5. Care of Coatings and Linings: Pre-cast manholes, pipe and fittings, including rings and covers, steps, straps, etc., shall be so handled that the coating or lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

## **B. CONNECTION TO EXISTING SEWERS**

Tie-ins to existing activated sewer lines will be allowed when proper precautions are taken to protect the existing main. Tie-ins to existing unactivated sewer lines not installed under the same contract will not be allowed without written approval from all parties involved (CMUD, contractors, contract holders, etc.). The Contractor will be required to install watertight masonry plugs in the proposed pipeline at the existing manhole and at the first proposed manhole until all construction is completed and testing begun. If the proposed sewer does not begin at an existing manhole, a straddle type manhole as shown on the Standard Details will be constructed over (and around) the undisturbed existing pipeline and the proposed pipeline plugged as specified. The existing pipeline will not be broken-out and the new invert formed until all testing has been successfully completed. Any connection with 18-inch and smaller pipe at an existing precast or cast-in-place manhole will require the Contractor to core the necessary opening through the manhole wall. Connections to existing manholes with 21-inch and larger pipe may be cored or sawed as approved by the Engineer.

1. Temporary Watertight Plugs: The Contractor shall install temporary watertight plugs in the proposed sewer line at any manhole that is incomplete, at the open end of the pipeline prior to leaving the job site daily and elsewhere as dictated by good engineering and construction practices. All installed pipe shall be backfilled or otherwise securely tied down to prevent flotation in the event water enters or rises in the trench.

The plugs as installed shall prevent infiltration or the introduction of any foreign material into either the existing or proposed systems.

The City will not accept any pipeline or manhole which contains any silt, sedimentation or other foreign material, within. The Contractor shall at his own expense flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

Upon completion of all construction, the Contractor will be responsible for the complete removal of all watertight plugs, in the sequence necessary to allow testing and subsequent activation, all under the direction of the Engineer.

2. Scheduling: When the flow of an existing sewer must be interrupted and/or bypassed, the Contractor shall, before beginning any construction, submit a work schedule which will minimize the interruption and/or bypassing of wastewater flow during construction. This schedule must be approved by the appropriate controlling agencies and Engineer and may require night, holiday, and/or weekend work.
3. Bypass Pumping: If pumping is required, an identical standby pump shall be on site in the event of failure of the primary pump. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work shall be suspended until the problem is resolved to the satisfaction of the Engineer. The Contractor shall be responsible for any fines levied as a result of effluent reaching the creek. The Contractor will be required to verify his method of handling sewer flows during construction by pumping at peak flows for 1 hour as approved by the Engineer.

### C. EXISTING UTILITIES

The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction or as noted in the Special Provision Section of this document.

All utility owners will be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Owners who are members of ULOCO may be notified in accordance with current ULOCO procedures. The Charlotte-Mecklenburg Utility Department is not a ULOCO member. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act.

Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved by the Engineer.

Whenever a sewer main crosses under other utility lines (gas, telephone conduit, storm drain, etc.) there shall be 2 feet clearance between the top of the sewer and the bottom of the affected utility. Stone bedding shall be used from 6-inches below the sewer to 12-inches above the sewer from one foot outside the utility trench. If this clearance is not possible, the sewer line shall be Ductile Iron Pipe from one foot outside the utility trench with a minimum length of 10 feet.

Whenever a sewer main crosses over other utility lines (storm drain, gas, encased or capped telephone conduit, etc.) the following will apply:

For VCP sewer lines - The sewer line shall be DIP from one foot outside the utility trench with a minimum length of 10 feet.

For PVC sewer lines - There shall be one foot clearance from the top of the utility to the bottom of the sewer. If this clearance is not possible the sewer line shall be ductile iron pipe from one foot outside the utility trench with a minimum length of 10 feet.

#### **D. SEWER LINE/WATER LINE CLEARANCE**

When a sewer main or lateral crosses or is parallel to an existing water main, the Contractor shall install ductile iron pipe (including laterals) for the sewer main and water main as described below.

1. Vertical Separation Of Sewer Lines & Water Lines: Whenever it is necessary for a sewer main to cross under a water main with less than 18-inches of vertical separation, the sewer main and water main shall be constructed of ductile iron pipe, with joints meeting water main standards, for a distance of 10 feet on each side of the point of crossing.

Whenever it is necessary for a sewer main to cross over a water main, the sewer main and water main shall be constructed of ductile iron pipe, with joints meeting water main standards, for a distance of 10 feet on each side of the point of crossing.

2. Horizontal Separation of Sewer Lines and Water Lines: Sewer mains shall be laid at least 10 feet horizontally from existing or proposed water mains unless local conditions or barriers prevent a 10-foot horizontal separation. In that case, the sewer main will be laid in a separate trench, with the elevation of the bottom of the water main at least 18-inches above the top of the sewer. When these conditions are not met, the sewer main and water main shall be constructed of Ductile Iron Pipe with joints meeting water main standards.
3. Horizontal Separation Of Sewer Lines and Water Wells: Sewer lines shall be installed at least 100 feet from water wells. Where this separation is not possible the sewer line shall be ductile iron pipe. Sewer lines shall not be installed within 25 feet of any private well or within 50 feet of any community well.

#### **E. CLEARING**

Unless otherwise specified, the entire permanent right-of-way shall be cleared and all stumps, limbs and trash removed and disposed of at an approved location. When the sewer line is installed in undeveloped/non-maintained areas (woods), stumps can be left flush with the ground if they are outside the trench excavation. Stumps must be removed from all maintained areas (yards, lawns, etc.).

Temporary construction easements will be selectively cleared with specimen trees left standing as stipulated in Special Provisions and/or right-of-way agreements. No clearing or grubbing may be performed on rights-of-way except under supervision of the Project Inspector.

Useable timber and/or firewood may be left on adjoining property, off the permanent right-of-way at the request of or with the consent of the property owner. Such requests must be in writing and must release the City from any claims for improper disposal of timber.

The Contractor shall abide by all special conditions contained in the right-of-way agreements for this project. When the right-of-way agreement specifies stacking timber or firewood adjacent to the right-of-way, a written release is not required. The Contractor shall verify cut lengths of timber/firewood for such placement and location with the property owner.

Fences removed during construction shall be replaced of the same material and to the same condition existing prior to the construction. The Contractor may refer to the "Environmental Protection Section" contained herein for further instructions pursuant to right-of-way treatment.

The Contractor shall confine all his operations to the bounds as set forth in all rights-of-way unless prior written approval of the current property owner is obtained and submitted to the Engineer for his approval.

#### **F. EXCAVATION**

All excavations for pipe laying, manholes, piers, drainage ditches, grading and any other excavation required for the proper completion of this contract shall be included herein.

Excavation within street rights-of-way shall be backfilled when left unattended for more than 1 hour unless otherwise approved by the controlling agency. Excavations within sewer/water rights-of-way shall be backfilled, fenced or otherwise protected when left unattended for more than 1 hour. Fencing or other protection methods shall be designed to reasonably prevent people and large animals from entering the excavation.

1. Trench Excavation: No more trench (100 LF) shall be opened in advance of the pipe laying than is necessary to expedite the work unless prior approval is given by the Engineer. Ground conditions and/or location requirements shall govern the amount of trench open at any one time as determined by the Engineer.

a. Trench Width: The maximum trench width shall be as indicated for each type of pipe specified. If the actual trench width exceeds the specified width, due to shoring methods, the contractor must obtain approval from the Engineer.

Trench width shall be measured between faces of cut at the top of the pipe bell. If the Contractor varies from this requirement without prior approval of the Engineer, or if specified trench widths cannot be maintained, improved bedding and/or improved pipe material shall be installed as directed by the Engineer.

- b. Trench Bottom Conformation: The excavation shall be made to the elevations, grades, and lines shown on the Construction Plans unless otherwise approved by the Engineer. The trench bottom shall be excavated slightly above grade and cut down to the pipe grade by hand in the fine grading operation. The trench bottom shall be true and even with bell holes at each joint to provide the barrel of the pipe with soil and/or granular bedding (as applicable) support for its full length. This should prevent point loading at the bells. If the trench bottom is inadvertently cut below grade, the Contractor shall fill it to grade with approved material thoroughly tamped.

Pipe depth and/or soil conditions may dictate a granular embedment as specified below. Such bedding shall also be shaped to allow adequate support of the pipe along the full length of the barrel.

If the trench passes either under or over another pipeline or previous excavation, the trench bottom in this area shall be tamped, if necessary, so the disturbed soil has approximately the same supportive strength as the native soil.

2. Excavation for Structures: The excavation shall be made to the lines, grades and elevations shown on the Plans and Standard Details. The area excavated shall be limited to no more than is necessary to allow the proper installation of the structure as determined by the Engineer. The excavation shall remain open no longer than is necessary to allow the proper and complete installation of the structure.
- a. Structure Pit Bottom Conformation: The pit bottom shall be true and even, and capable of supporting the structure as determined by the Engineer. If the pit bottom is inadvertently cut below grade, the Contractor shall fill it to the proper elevation with approved material capable of continually maintaining adequate supportive strength.
3. Excavation for Bore Pits: The excavation shall be controlled by the limits of the existing rights-of-way and shall not exceed these without prior written approval of the current property owner. The excavation shall be made to the proper elevation, line and grade as required to install the casing pipe as shown on the construction plans.
- a. Bore Pit Conformation: The pit bottom shall be true and even with adequate stabilization to maintain proper elevation and grade on the boring rig for the duration of the bore.
4. Rock Excavation: Rock excavation shall be defined as solid ledge rock that requires drilling and blasting, sledging, or barring for its removal. Soft, disintegrated rock that can be removed with a pick shall not be classified as solid rock.

Boulders greater than one cubic yard in volume will also be considered rock excavation. Smaller boulders and soft rock which in the opinion of the Engineer can be excavated by the use of a power shovel, without undue delay, shall not be classified as rock.

Rock shall be removed to a depth of six (6) inches below the pipe bell and to the trench widths specified for each size and type of pipe installed. Rock around structures shall be removed to the same twelve (12) inch minimum as measured between vertical planes around the structure, but only to a depth necessary to allow proper installation. Over excavation of rock due to removal methods, or for safety considerations, shall be the Contractor's responsibility.

When rock removal is necessary for pipeline installation either Type II or Type III bedding shall be installed as specified and directed by the Engineer.

All blasting shall be conducted in a manner as specified elsewhere in these Specifications.

5. Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the work. Excavated material will be piled a safe distance away from the edge of the excavation allowing room for an adequate angle of repose and if shoring, sheeting, and bracing is used to protect the excavation, no material will be piled within three (3) feet of the nearest edge. Sidewalks, driveways, hydrants, valve pit covers, valve boxes, curb stop boxes, existing manholes, fire and police call boxes, or other utility controls shall be unobstructed and accessible until the work is completed. Gutters, catch basins, and natural watercourses shall not be obstructed or silted.

When working in close proximity with a creek channel or natural watercourse the Contractor shall pile all excavated material on the side of his excavation away from the watercourse.

6. De-watering: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of any and all water entering the excavation or other parts of the work and keep all excavations dry until such time as pipe laying and grading is completed and structures to be built therein are completed.

No water shall be allowed to rise around the pipe in unbackfilled trenches nor shall it be allowed to rise over masonry until the concrete or mortar has set (minimum 24 hours). All water pumped or drained from the work shall be disposed of in such a manner as to prevent siltation and erosion to adjacent property or other construction.

7. Shoring And Shielding: The Contractor shall comply with OSHA trenching and excavation regulations as revised in Subpart P of Part 1926 in the Federal Register. Shoring and/or shielding systems shall be used as specified in Subpart P to prevent caving of trench banks and to provide a safe excavation.

The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.

If, in the opinion of the Engineer, the trench/excavation is not in compliance with OSHA regulations, the Contractor may be directed to stop work. Continued unsafe conditions will be reported to the appropriate regulatory agency. The Contractor will be responsible for paying all fines resulting from safety violations.

## G. PIPE LAYING

In all instances pipe shall be laid in a workmanlike manner, true to line and grade, with bell ends facing up-grade in the direction of laying. The various pipes referred to herein shall be handled, belled up and laid in accordance with the manufacturer's requirements and good engineering practices as defined in the various publications referenced in this document. The following requirements and/or standards of the Charlotte-Mecklenburg Utility Department shall govern this construction unless exceeded by other regulatory bodies.

1. Pipe Bedding: Unless otherwise specified or noted on the Plans the following bedding classes are as commonly required by this Department.

When granular material embedment is required, the Contractor will follow the layered procedure specified in Type I for soil placement, above the granular bedding, to an elevation one (1) foot above the top of the pipe bell.

- a. Type I - Shaped Bottom Bedding: The trench bottom shall be shaped so the pipe bears uniformly upon undisturbed native earth. Soil shall then be placed by hand around the pipe and completely under the pipe haunches in uniform layers not exceeding six (6) inches in depth up to an elevation one (1) foot above the top of the pipe bell.

Each layer shall be placed and then carefully and uniformly tamped, so that the pipe is not damaged nor the alignment disturbed.

- b. Type II - Granular Material Embedment: The trench bottom shall be undercut a minimum of six (6) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to a vertical height of one-third the outside diameter of the pipe bell for the pipe's entire length and for the entire width of the ditch. Depending upon soil and ground water conditions, greater depths (undercut) may be required to create a stable condition. Type II granular material embedment shall be used as directed by the Engineer.
- c. Type III - Granular Material Embedment: The trench bottom shall be undercut a minimum of six (6) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to vertical height of one-half the outside diameter of the pipe bell for the pipe's entire length and for the entire width of the ditch. Depending upon soil and ground water conditions, greater depths (undercut) may be required to create a stable condition. Type III granular material embedment shall be used as directed by the Engineer.
- d. Stone Stabilization: When the bottom of the trench is not sufficiently stable to prevent vertical or lateral displacement of the pipe after installation with Type II or Type III bedding, stone stabilization will be required to develop a non-yielding foundation for the bedding and pipe. When such conditions are encountered, the trench will be excavated to a depth determined by the Engineer, and #467 crushed stone will be placed to an elevation six-inches

below the bottom of the pipe. The pipe will then be laid with Type II or Type III bedding as directed by the Engineer.

- e. Concrete Encasement and Cradles: Shall be as designed for each individual case and will be noted on the Plans and in the Special Provisions when applicable.

2. Installation Depth Limitations: The following are limitations and bedding requirements for supportive strength and shall be adhered to at all times. Granular material embedment may still be required for lesser depths of cover should groundwater and/or soil conditions warrant its use, as determined by the Engineer.

- \* The standard trench width for 8"-15" pipe shall be limited to the nominal pipe size plus 30-inches.
- \* The standard trench width for 18"-30" pipe shall be limited to the nominal pipe size plus 36-inches.
- \* The standard trench width for 36" and larger pipe shall be limited to the nominal pipe size plus 42-inches.

Deviations from the standard trench width shall be as approved by the Engineer.

Trench widths must be maintained constant as measured at the top of the pipe. Deviation from the standard trench width will necessitate an increase in the stone bedding around the pipe and/or a change in the type or class of pipe being installed at the Contractor's expense.

All pipes regardless of bedding or pipe type shall require adequate tamping of backfill as specified for Type I, Shaped Bottom Bedding.

- a. Extra Strength Clay Pipe shall be installed with a minimum of 3.0 feet of cover over the top of the pipe and a maximum depth of cover over the top of the pipe subject to the bedding limitations specified below. When the cover is less than 3.0 feet or greater than the depths shown for Type III Bedding, Ductile Iron Pipe must be used.

<b>MAXIMUM DEPTH OF COVER- VCP</b>			
<b>Size</b>	<b>Type I Bedding</b>	<b>Type II Bedding</b>	<b>Type III Bedding</b>
8"-15"	10'	15'	18'



- b. Reinforced Concrete Pipe shall be Class IV or Class V, subject to the maximum depth of cover over the top of the pipe as specified below, based on the bedding type indicated. Greater depths of cover can be attained if the trench width is restricted.

<b>MAXIMUM DEPTH OF COVER - RCP</b>						
<b>SIZE</b>	<b>TYPE I BEDDING</b>		<b>TYPE II BEDDING</b>		<b>TYPE III BEDDING</b>	
	<b>Class IV</b>	<b>Class V</b>	<b>Class IV</b>	<b>Class V</b>	<b>Class IV</b>	<b>Class V</b>
18"-48"	12'	17'	16'	24'	20'	30'

- c. Ductile Iron Pipe: Installation of Ductile Iron Pipe shall be installed subject to the bedding limitations specified below, based on a deflection limit of three (3) percent for cement lining. Greater depths of cover may be achieved by using a higher pressure classification and/or using pipe with a flexible lining.

<b>MAXIMUM DEPTH OF COVER - DIP</b>				
<b>Pipe Size</b>	<b>Pressure Class</b>	<b>BEDDING</b>		
		<b>Type I</b>	<b>Type II</b>	<b>Type III</b>
8"	350	20'	34'	50'
10"	350	15'	28'	45'
12"	350	15'	28'	44'
14"	250	15'	23'	36'
16"	250	15'	24'	34'
18"	250	14'	22'	31'
20"	250	14'	22'	30'
24"	250	15'	20'	29'
30"	250	15'	19'	27'
36"	250	14'	18'	25'
42"	250	14'	17'	25'
48"	250	13'	17'	24'

- d. Poly Vinyl Chloride (PVC) Pipe: PVC pipe shall be installed with a minimum of 3.0 feet of cover and a maximum of 20 feet of cover. When the cover is less than 3.0 feet or more than 20 feet, Ductile Iron Pipe must be used subject to the specified bedding limits. PVC pipe shall be installed in accordance with ASTM D-2321 with the following modifications:

- (1) All PVC pipe shall be installed using Type III Granular Embedment. The bedding shall extend from the pipe to the trench wall or to two and one half pipe diameters (OD) on each side of the pipe, whichever is less.
3. Grade and Line For Pipe: As a minimum, centerline hubs will be set at each manhole and offset stakes set at each manhole, and if required at 100 foot intervals between manholes. Cut sheets will show the vertical distance from the offset stakes to the inlet and outlet pipe invert at each manhole and to the pipe invert at each offset stake. Grade and line may be transferred to "batter boards" set at intervals not to exceed fifty (50) feet. Unless otherwise approved by the Engineer, three (3) batter boards will be in place at all times while pipe laying is in progress. Each joint shall be checked with a grade rod and plumb line with care being taken to keep the string line taut at all times.

Laser beams may be used to set line and grade when the Contractor provides adequate and accurate equipment for the Engineer to check his line and grade at each cut stake (lock levels shall not be considered adequate). If laser equipment is used, the grade shall be checked at each manhole and at benchmarks every 500 feet. The Contractor shall keep close check of his laser for variations in line and grade. No variations between manholes shall be corrected without relaying that portion of line which has deviated from line or grade unless otherwise approved by the Engineer.

## H. LATERAL INSTALLATION

1. 4-Inch and 6-Inch Laterals: Four inch and six inch laterals shall be connected to the main with tees as previously specified if the lateral is installed during the construction of the main. Four inch and six inch laterals shall be connected to existing mains with saddles placed in holes cored by an approved coring machine. Saddles and tees shall be as previously specified and as shown on the Standard Details.

Laterals shall be completed to the property line using 22" bends at the tee or saddle and pipe as previously specified and as shown in these Standard Details. The lateral shall be laid with a minimum slope of 1/8-inch per foot (1%). The end of the lateral will be plugged water/air tight. All tees, saddles and bends shall be completely encased in #67 washed stone. An "S" shall be cut in the curb at the location where lateral crosses under curb.

In subdivisions constructed without curb, the Contractor will paint an "S" on the edge of pavement at the location where the lateral crosses under the edge of pavement. Markings will be made using green paint.

All laterals except those serving lots adjacent to in line manholes or upstream from dead-end manholes in cul-de-sacs shall be connected to the sewer main. Laterals connected to manholes shall be laid on a line from the center of the lot to the center of the manhole and shall extend not more than six inches inside the manhole wall. Manholes in cul-de-sacs shall have a maximum of three (3) laterals. Any in line manhole shall have a maximum of two (2) laterals. The lateral elevation entering the manhole shall match crown to crown with the main entering the manhole and a trough shall be formed for the lateral invert. Laterals that are connected to outfall lines shall enter the manhole at the shelf and an invert shall be formed to carry the lateral flow to the main invert.

The laterals shall be installed with a minimum of four (4) feet of cover at the property line, unless otherwise approved by Charlotte-Mecklenburg Utility Department. The depth of the lateral at the property line shall not be greater than five (5) feet unless greater depth is required to serve the building. The Contractor will not backfill any portion of the lateral until the installation is approved by a Charlotte-Mecklenburg Utility Department Inspector.

Measurements: The Inspector, assisted by the Contractor, will measure the distance to the tee or tap from the down-stream manhole to obtain the information required for the "As-Built" records.

2. 8-Inch And Larger Laterals: 8-inch and larger diameter laterals shall connect to manholes with the lateral crown level with the crown of the main line pipe, or with outside drops, in accordance with the specifications and standard details for mainline construction. When the lateral is the same diameter as the main line pipe, a drop of 0.2 feet will be provided in the manhole between the invert of the lateral and the invert of the main line pipe. The lateral shall be laid with a minimum slope of 1/8-inch per foot (1%).

## I. BACKFILL

All backfill shall be of a non-plastic nature free from roots, vegetative matter, waste, construction material, rock larger than 3/4 cubic foot, or other objectionable material. Small rock (less than 3/4 cubic foot) shall not exceed 10% of the fill material. Rock shall not be placed within 3-feet of the pipeline or within three feet of the finished grade. Rock larger than 3/4 cubic foot will not be permitted within the trench. No objectionable or unsuitable material will be allowed in the backfill. Backfill material shall be capable of being tamped by mechanical tamps using relatively low velocity and heavy blows. The material shall have no tendency to flow or behave in a plastic manner under the tamping blows. Material deemed by the Engineer as unsuitable for backfill purposes shall be removed from the job site before backfilling operations begin.

When the Engineer determines that the material excavated from the trench is unsuitable for backfill because of the material type or because it contains excessive debris, rock or organics, it shall be removed from the project and replaced with a backfill material approved by the Engineer. When the moisture content of an otherwise suitable material is too high to achieve specified compaction, as determined by a moisture content and density test, the Contractor shall replace the material as necessary to meet backfill requirements. The wet material may be dried to optimum moisture content and used for backfill in subsequent phases of the project. Should an otherwise suitable material be found too dry to achieve compaction requirements, water may be added to the material to raise the moisture content to optimum.

Borrow material placed at the direction of the Engineer shall be clean earth at optimum moisture content, concord (pit) gravel or ABC stone.

Backfill shall be accomplished immediately after the pipe is laid. Backfill around pipe and to an elevation of one (1) foot above the pipe bell shall be done only by hand and in layers not exceeding six (6) inches with each and every layer thoroughly tamped. The first three (3) feet of fill shall be completely free of rocks. Successive layers of backfill shall be compacted in place as specified below.

Under no circumstances shall water be permitted to rise in unbackfilled trenches after the pipe has been placed. Should water rise in an unbackfilled ditch after the pipe has been placed, the Engineer may require the Contractor to remove the pipe, muck the trench and follow the procedure for either Type II or Type III Granular Embedment when relaying the pipe.

1. Backfill of trenches within sewer main rights-of-way: Trenches excavated outside existing roadway and railway right-of-way may be backfilled, above the initial one (1) foot, by mechanical means in layers up to twelve (12) inches thick unless otherwise directed by the Engineer.
2. Backfill of trenches within road and railway rights-of-way: Trenches excavated within existing road and railway rights-of-way shall be backfilled in layers not to exceed six (6) inches and each successive layer shall be thoroughly tamped, as specified.

#### **J. COMPACTION REQUIREMENTS**

Compaction shall be attained by the use of mechanical tamps only. Each layer of backfill shall be placed loose and thoroughly compacted in place. Heavy rollers, vehicles or other equipment shall not be used for compacting pipeline and structure backfill nor allowed to cross over completed work except at points adjudged capable of adequately protecting the pipeline. Pneumatic tamps, gasoline ram type tamps or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of "Mechanical Tamp". Variances shall only be with the explicit approval of the Engineer.

1. Compaction Within Sewer Rights-of-way: Trenches excavated outside existing road and railway rights-of-way shall be backfilled as hereinbefore specified and tamped thoroughly:
  - a. All material shall have an in-place density of at least 85% of maximum dry density or as approved by the Engineer.
  - b. Should any public or private roadways, service roads, drives, etc. be encountered during this construction, the Contractor shall at the Engineer's direction comply with those compaction requirements specified below for work within road and railway rights-of-way.
2. Compaction Within Road and Railway Rights-of-Way: Unless otherwise approved by the controlling agencies, trenches excavated within existing road and railway rights-of-way and all structure excavation regardless of location shall be backfilled as hereinbefore specified and thoroughly tamped:

- a. Unless otherwise directed by the Engineer, all material from the bottom of trench to within six (6) inches of the subgrade shall have an in-place density of 95% of the maximum dry density as defined by a standard proctor curve for the material.
  - b. All material within six (6) inches of the subgrade level shall have an in place density of 100% of the maximum dry density.
  - c. On roadway shoulders, all material shall have an in place density of 95% of the maximum dry density. The Contractor shall remove and replace all material failing to meet these requirements with suitable material. The extent of this removal shall be determined by the Engineer.
3. Compaction Testing: Moisture content and density testing of backfill will be performed by CMUD soils technicians. Tests will be performed within all street, highway and railway rights-of-way to insure that the specified compaction requirements are met. The Contractor will cooperate fully with the soils technicians in providing access to backfill at any requested depth for the purpose of performing moisture content/density testing. When requested, the Contractor shall excavate a backfilled ditch to any specified depth for a compaction test and shall insure that the ditch meets all OSHA safety standards before the technician enters to perform the test.

A "standard proctor curve" which establishes the relationship between moisture content and dry density for soil will be determined by the method described in ASTM D-698 or by AASHTO Method T-99. Field density tests will be performed using either the sand cone method or a nuclear moisture/density gauge. Any backfill which does not meet the specified compaction will be re-tamped, or removed and replaced as approved by the Engineer.

## **K. MANHOLE CONSTRUCTION**

All manholes outside street rights-of-way or landscaped areas shall be constructed to a height of two (2) feet above the adjacent ground unless otherwise indicated on the Plans or by the Special Provisions. Manholes within street rights-of-way or landscaped areas shall have finished rim elevations flush with the pavement or adjacent finished grade.

After final inspection is complete and all deficiencies have been corrected, the Contractor shall seal all manholes (rings to covers) with penetration type asphaltic cement No. AC-20 as manufactured by Exxon Oil Company or equal.

1. Precast Reinforced Concrete Structures: All precast manhole sections shall conform to the Material Specifications and Standard Details.

Precast manholes shall be treated similar to reinforced concrete pipe for installation. That is, if ground water and/or soil conditions require stabilization for pipe installation comparable measures will be required for precast manhole installation. Under no circumstances will a precast base section be placed on unstable soil as solely determined by the Engineer.

Jointing of precast sections will be done in accordance with the manufactures recommendation, with special attention called to the amount of force used.

All backfill around structures shall be thoroughly tamped in layers as specified for placing backfill.

Regardless of the type manhole construction used, the Contractor will do that which is necessary to stabilize the soil intended to support the structure. A stable condition shall only be so adjudged by the Construction Engineer or his authorized representative. Any cost incurred by the Contractor in stabilizing the area to support a manhole shall be considered incidental to the manhole construction.

2. Outside Drops: When design considerations dictate a large elevation change across a manhole, an outside drop shall be constructed in accordance with the Charlotte-Mecklenburg Utility Department Standard Details. Depending on the particular fittings used, elevation differences of 2.0 to 2.5 feet are required to accommodate an outside drop. When there is not sufficient elevation difference to permit construction of an outside drop, the grade of the influent pipe shall be lowered such that the vertical separation of the influent and effluent pipes is 0.2 feet, as measured at the center of the manhole when the grades of both pipes are projected to that point. Outside drops shall not enter the cone section of precast manholes.
3. Inside Drops: When connecting a proposed sewer main to an existing manhole at an elevation significantly higher than the existing invert elevation, and where safety considerations or working space limitations preclude building an outside drop, the connection may be made with an inside drop constructed in conformance with the Standard Details. Inside drops will be used only where shown on the plans or specifically approved by the Engineer. They may not be used in lieu of outside drops shown on the plans. Inside drops shall not enter the manhole in the cone section. Inside drops are not allowed on four (4) feet diameter manholes.
4. Installation Of Frames And Covers: The frame shall be installed on the manhole with anchor bolts on all manholes that are not flush with the ground. 8-inch tall or 4-inch tall frames may be used for manholes with bolt down frames. These frames shall have four (4) holes in the support flange to permit installation on the cone with anchor bolts. Holes shall be equally spaced in the flange. Complete anchor bolt assemblies shall be zinc plated steel and shall consist of a drive in type anchor sleeve, a threaded stud and two nuts. Anchors shall be installed in field drilled holes in the cone. Minimum diameter of the threaded stud shall be 1/2 inch. The Contractor shall seal the frame to the manhole by installing a length of butyl rubber joint sealant to form a gasket between frame and manhole. The butyl rubber joint sealant shall have a one inch cross section, and shall make two full circles when placed on the cone section, and shall be compressed by the frame with the anchor bolts. Butyl rubber joint sealant shall be "Rubber Seal" as manufactured by Ru Van, Inc., or approved equal. Cement mortar grouting of the frame shall be required. Brick may not be used to adjust rim elevations of above grade manholes.

Manholes that are installed flush with pavement or grade shall have frames attached to the manhole with a bed of cement mortar grout. 8-inch tall frames are required for all manholes that are flush with pavement or finished grade unless otherwise approved. Standard size brick or reinforced concrete grade rings may be used to adjust the finished rim elevation of such manholes. This adjustment may not exceed 21-inches in height.

5. Manhole Step Testing: The Contractor will furnish a hydraulic driven system consisting of cylinder, connecting hose and above ground pump with gauge to test manhole steps to exceed 1000 lbs. of resistance of pullout. All field installed steps will be tested. In lieu of field testing steps installed at the plant, certified shop reports by the manufacturer showing that each step passed the required 1000 lb. pullout will be accepted. The certificates will be furnished to the Inspector prior to field installation.

Unless the Contractor can furnish the manufacturer's certification on step tests, the Contractor will be required to test 10% of the plant installed steps. An additional 10% will be tested for each failure.

6. False Walls: False walls shall be constructed in manholes when specified on the Plans. Holes of the appropriate size shall be cored or blocked out in the manhole wall at the elevation and alignment shown on the Plans. A four-inch thick masonry wall shall be constructed in the opening. Inverts shall be constructed to match proposed pipe elevations and alignments and permit installation of the future extension without demolition work other than removal of the false wall.
7. Steel Vent Pipes: Steel vent pipes will be installed in accordance with the Standard Details. Shop drawings of strap on vents, mounting straps, and anchor bolts will be subject to approval of the Engineer. Material shall be as specified in the Materials Specification Section.

## L. PIERS

Pier locations as shown on the Plans shall be considered a guide only, with final determination made at the time of construction by the Engineer. Pier spacing center to center, will be as shown on the Plans, but all pier locations may be adjusted by the Engineer due to field conditions.

Piers will be placed parallel to the flow of the creek unless otherwise directed by the Engineer.

1. Steel Pile Piers: The work covered by this section consists of furnishing and driving piles, as indicated on the plans, the standard details, and as approved by the Engineer, in conformity with the specifications and to the bearing and penetration required.
  - a. Installation: General - The HP8X36 or W8X35 pilings shall be driven to obtain a bearing capacity of 20 tons based on the following formula (the Engineering News Record Pile Driving Equation) and to a minimum depth of 10 feet in undisturbed earth below the bottom of the creek channel or existing ground when not adjacent to the creek.

ENR Formula:  $S = (2E/R) - C$

S = penetration per blow (inches)  
R = specified bearing capacity (pounds)  
E = energy per blow (ft-lbs)  
C = 1.0 for drop hammer; 0.1 for air, steam, or diesel hammer

- b. Piles Lengths: Full length piles shall be used where practicable and not more than 2 pieces (1 splice) of steel pile will be permitted in making up one full length pile unless approved by the Engineer. Splices, where necessary and approved by the Engineer, shall be made as to maintain the true alignment and position of the pile sections. Both pieces of a spliced pile shall be the same shape (HP8x36 or W8x35).

Splices should develop not less than 100 percent of the bending strength of the pile and not less than 100 percent of the axial load strength of the pile. All welded splices will be of butt weld type with back-up plates welded to the flanges and web of the steel piles. All welding of structural steel in the shop or in the field shall meet the requirements of the AWS Code and be done by qualified welders. Certification of welders and welds will be required by the Engineer in accordance with the AWS Code.

- c. Driving: Steel piles shall be driven with a diesel, steam, drop, or air hammer with a rated energy of not less than 15,000 ft. lbs., fixed leads and a ram weight of one (1) to one and a half (1½) times the pile weight. In case the required penetration is not obtained by the use of a hammer complying with the above minimum requirements, the Contractor shall provide a heavier hammer, at his own expense. The piles shall be driven on a batter of 15° to the vertical or as shown on the plans, and shall not be out of position at the top of the pile by more than three inches in any direction after driving.
- d. Cross Bracing: Cross bracing will be required only when the undisturbed ground level is below the intersection of the cross bracing.
- e. Painting Steel Piers: Unless otherwise directed, all steel in the piers shall have a coal tar epoxy coating consisting of two coats of coal tar epoxy as specified. All surfaces of the steel to one foot below the disturbed ground or to one foot below the cross bracing, whichever is greater, shall receive the coating system and shall be thoroughly sand blasted prior to application to remove rust, dirt, grease, and other foreign material and to provide a clean surface to receive the coating. Each coat of paint shall be approved by the Engineer prior to application of the next coat. The total dry film thickness shall be at least 16 mils. Areas with coatings less than 16 mils shall be recoated as required to provide the specified film thickness.
- f. Testing And Inspection: The Charlotte-Mecklenburg Utility Department will provide inspection and will determine bearing capacity of the driven piles. The Contractor will submit certification of rated hammer energy acceptable to the Engineer.



The Inspector will be present during all pile driving operations and the Contractor will provide him evidence that the average penetration for the last 10 blows is less than the S calculated by use of the above formula.

Test piles furnished and driven by the Contractor for his use in determining the lengths of piles to be furnished may be so located that they may be cut off and become a part of the completed structure, provided that such test piles conform to the specifications and are approved by the Engineer.

Test piles shall be driven with equipment of the same type and capacity as that used for driving piles for the structure.

Test piles which are not to be incorporated in the completed structure shall be removed to at least 2 feet below the surface of the ground or the stream bed, and the remaining hole backfilled with earth or other suitable material.

The Contractor shall give written notice before beginning construction on the steel piles in order to coordinate this work with Charlotte-Mecklenburg Utility Department.

2. Concrete Piers: If the required penetration for a pile is not obtained, as determined solely by the Engineer, the Contractor may be directed to construct a reinforced concrete pier. The Contractor will not attempt to drive a second pile at a pier location at which the first pile did not achieve the required penetration unless the Engineer has determined that the first pile will be used.

A pile which will not be incorporated in the completed structure will be removed or cut off so that the top of the pile is below the concrete footing.

#### **M. REMOVAL AND RESTORATION OF PAVEMENT AND ROAD SURFACES**

All removal and restoration of pavement and road surfaces will be in accordance with the specifications approved by the Superintendent of Streets of the City of Charlotte or of the North Carolina Department of Transportation and Safety, Division of Highways, whichever applies.

All restored bituminous and concrete pavements shall be placed to existing cross-section and ride quality. Restored pavement will in all instances be flush and level with existing pavement at the sawed edges, and at existing gutter lines where applicable unless otherwise approved by the Engineer. When pavement repairs do not meet the above criteria or are not performed in a workmanship manner as determined by the Engineer, Superintendent of Streets of the City of Charlotte, or North Carolina Department of Transportation, whichever applies, the contractor will remove and re-perform the restoration as specified.

When cuts are to be made in street rights-of-way under maintenance by the City of Charlotte, the Contractor shall contact the Superintendent of Streets or his designated representative before each separate pavement cut is made and secure a permit.

Pavement will be replaced as follows. In all pavement cuts either the permanent pavement or a temporary pavement consisting of 1"-1□" of black asphaltic concrete (later to be replaced permanently) will be placed immediately upon completion of the subgrade unless otherwise approved by the Engineer.

1. Specifications for Cutting Pavement: Unless otherwise approved or required, concrete pavement shall be removed to the nearest expansion or contraction joint. The Contractor will contact the Superintendent of Streets and/or D.O.T.'s District Engineer for a determination of the limits of concrete replacement and location of joints. Where sawed joints are allowed, the depth of the sawed cut shall be at least one (1) inch and shall extend at least 1/5 of the depth of the concrete. More depth may be required if necessary to prevent damage to surrounding pavement.

Bituminous pavement shall be cut in a smooth and straight line. Sawing is required on asphaltic concrete. The width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. Existing pavement shall be removed on each side of the trench for at least 12 inches beyond top of trench.

The Contractor shall remove and replace pavement which, in the opinion of the Engineer, has been cracked or displaced by the operation of the Contractor.

2. Specification For Restoring Concrete Pavement: The concrete used to restore pavement shall have a minimum 28 day compressive strength of 3600 P.S.I. The concrete as placed shall conform to the shape, grade, and finish of the existing pavement and will be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches.
3. Specification For Restoring Asphalt Pavement: All material above the sub-base level shall be hot-mix bituminous concrete conforming to North Carolina Department of Transportation standard specifications for roads and structures for both mix design and placement. The asphalt pavement as placed shall be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches within City maintained roadways or eight (8) inches within state maintained roadways. The asphalt shall be placed in lifts not greater than 4 inches and shall be hot mix bituminous concrete binder Type H. The last two (2) inches in either instance shall be bituminous plant mix (I-2) suitable to the appropriate controlling agency. I-2 asphalt pavement resurfacing will be placed with paving machines and/or rollers of a size and type currently approved by the North Carolina Department of Transportation for use on resurfacing contracts.

If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Engineer, shall replace the concrete to its original thickness, or to a level 2 inches below the finished surface. The Engineer may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials.

Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters).

Under normal conditions, asphalt binder will be placed in pavement cuts at the end of each work day. I-2 shall be replaced weekly or within five days following completion of pipeline construction along a continuous section of pavement. During inclement weather, the Engineer may permit the use of temporary asphalt (cold mix) to seal the trench until permanent asphalt can be placed.

## **N. CONCRETE CONSTRUCTION**

1. Acceptance of Concrete: Concrete shall be accepted on the basis of its meeting the requirements listed under the Material Specifications and Detail Specifications Section of this contract. The Inspector will accept no ready mix concrete without the plant dispatch ticket.

The Engineer shall make or require any tests as he deems necessary to insure that the concrete meets specifications. Such tests may be performed by CMUD materials technicians or the Engineer may require the test to be performed by an independent testing laboratory at the Contractor's expense.

2. Placement: Concrete will not be accepted if it cannot be placed within ninety (90) minutes of the dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete containing foreign material will not be accepted. Depositing will not be permitted when temperature has not exceeded 35° and rising by 10:00 A.M. Depositing shall cease when the descending air temperature in the shade falls below 40° F. It shall not resume until the ascending air temperature rises to 35° F. All concrete shall be kept from freezing by the Contractor. Frozen concrete shall be replaced at the Contractor's expense. Free fall shall not exceed 3 feet in any case.
3. Forms: Forms may be made of wood, plywood, metal, or any other material approved by the Engineer. Forms shall be mortar tight, of material strong enough to resist noticeable deflection or bulging between supports, and the interior dimensions of the forms shall be such that the finished concrete shall be of the form and dimensions shown on the Plans. The design of the forms shall take into account the effect of vibration of concrete as it is placed and also the rate of speed at which the forms will be filled. Forms shall be coated with a lubricant as approved by the Engineer.

Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

4. Curing: All concrete will be cured for a seven (7) day period after placement according to the following procedure.

- a. Forms will normally be left in place for the entire seven (7) day period. Exposed surfaces not covered by forms will be kept moist continuously for the entire seven day period or will be cured through use of an approved curing compound which will be applied after all surface water has disappeared.
  - b. At the discretion of the Engineer, forms may be removed after the initial set and before the end of the seven day period. In such cases, the areas previously covered by forms shall be cured as described above.
  - c. The Engineer may permit backfill of certain structures (e.g. concrete piers) before the end of the curing period. In such cases, the forms shall be stripped and the surfaces that remain exposed after backfill shall be cured as described in (a) above. Curing compound shall not be required for backfilled surfaces except where specified by the plans or Special Provisions.
5. Finishing: The structure shall have a uniform and textured surface. All form marks exposed to view shall be rubbed off with a stone.
6. Testing: The following tests will be performed by CMUD technicians to ensure the concrete quality:
- a. Compressive strength in accordance with ASTM C-31 and ASTM C-39. Test cylinders which are formed in the field will be left in the field until compression testing (7 day, 14 day, 28 day) is completed thereby more closely approximately the curing conditions of the field placed concrete.
  - b. Slump Test in accordance with ASTM C-143.
  - c. Air Content Test in accordance with either ASTM C-173 or ASTM C-231.

0. **DRY BORE WITH STEEL ENCASEMENT**

1. Bore Pits (or Tunnel Pits): Bore or tunnel pits shall be safed-up, shored, well marked, lighted, and not left unattended except as approved by the controlling agency. Requirements for stabilization and dewatering of bore pits shall be as hereinbefore specified. The angle of repose method (sloping pit walls) for creating a safe working area shall not be used.
2. Installation: Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe, bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of encasement pipe shall be butt-welded to the section previously jacked into place. Continuous checks shall be made as to the elevation, grade and alignment of each successive section of encasement as well as the tracks (rails) upon which the boring rig travels.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement grout at sufficient pressure to prevent settlement in the roadway/railway.

Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed.

In the event an obstruction is encountered during the boring and jacking operations, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before reapplying to the Controlling Agency for permission to open cut, bore at an alternate location, or install a tunnel.

Installation shall be to the limits specified by the Controlling Agency and/or as delineated in their encroachment issued to the City. (Copy of the encroachment agreement must be kept at the site throughout boring operations).

The completed casing installation shall be such as to prevent the formation of a waterway under the road or railbed.

The Controlling Agency shall have full authority to require remedial measures and/or to stop all work if, in its opinion, said work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test, and approve all materials and methods used.

The Contractor shall notify the Controlling Agency through the Construction Engineer and acknowledgement shall be received a minimum of five (5) working days prior to beginning any work within roadway or railway rights-of-way. If required, 24-hours notice will be given prior to completion.

**P. GUARANTEED CASING INSTALLATION**

The casing shall be installed by jacking, with simultaneous removal of spoil. The spoil removal shall not proceed more than 18-inches ahead of the casing. The diameter of the excavated hole shall be no larger than necessary to keep the casing moving freely and lubricant may be used to reduce the jacking forces. Casing sections shall be joined by butt weld.

After the casing is jacked in place, 2-inch grout holes shall be used to pump a 1:3 portland cement grout to fill the void outside the casing. Sufficient pressure should be applied to force grout out of the adjacent grout hole. Grout holes shall be a maximum of ten feet apart at the top of the casing.

The casing size and thickness shall be as shown on the Plans or Special Provisions.

**Q. TUNNELLING OPERATIONS USING STRUCTURAL STEEL LINER PLATES**

All plates shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seam or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be multiples of the plate length so that plates having the same curvature shall be interchangeable to permit staggering of the longitudinal seam. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of the design specifications. All liner plates for the full length of a specified tunnel shall be either the flanged or the lapped seam type. The two types shall not be mixed in the same tunnel.

Liner plates shall be assembled in accordance with the manufacturer's instructions. Galvanized and coated plates shall be handled in such a manner as to prevent bruising, scaling, or breaking of the coating. Any plates that are damaged during handling or placing shall be replaced, except that small areas with minor damage may be repaired to the satisfaction of the Construction Engineer or his representative.

Galvanized surfaces shall be repaired by thoroughly wire brushing the damaged areas and removing all loose cracked coating, after which the cleaned areas shall be painted with two (2) coats of zinc rich paint as approved, and an acceptable bituminous coating restored.

When tunnelling has proceeded a distance sufficient for placing one section of the tunnel liner, that section of liner will be placed before excavating further. Excavation shall be controlled so that the space outside the liner plate shall be held to a minimum. All voids between the liner plate and the tunnel wall shall be filled with 1:3 portland cement grout, containing no more water than necessary, placed under sufficient pressure to fill all voids. Grout shall be placed through the grout holes provided in the top of the tunnel liner plates. Grout holes 2" in diameter shall be provided at not more than 4.5 foot centers or every third ring of plates to permit grouting as the erection of the tunnel liner progresses. At no time will the grouting operations be further than 10' from the front end or head of the tunnel construction.

At the end of each day's operations, the voids outside installed liner plates shall be grouted whether 10' or less. Grout will be forced into each grout hole. If the grout from one hole should flow along the liner plates so as to plug the next hole, the plug shall be opened by punching through the grout so that each hole may be used for grouting. The grouting operation will be continued at each hole until all spaces outside the liner plates are filled and no grout will flow.

The tunnel shall be constructed to the limits, grade and alignment shown on the Construction Plans. Excavation, without the use of jetting, shall be done in such a manner as to protect public and/or private property from damage. Prior to beginning any construction, the Contractor shall submit pit shoring and tunnel liner details for approval, and no tunneling may begin prior to approval of these details by the appropriate Controlling Agency. After approval of tunnel liner and pit shoring details, a five (5) day notice to the Controlling Agency, through the Construction Engineer, shall be provided as previously specified.

No blasting will be done without prior written approval of the controlling agency and then only in strict accordance with all Federal, State, and Local laws, ordinances, rules, or regulations governing the storage and use of explosives. Where blasting is required, only small controlled charges of 40% dynamite or plastic explosives shall be used. The depths of the holes for these charges shall not exceed the depth necessary to clear an area sufficient to place one section of tunnel liner.

The charges for the initial series of blasts should be placed in the triangle method. The second series should be placed in the radial method a minimum distance from the desired diameter of the tunnel. The triangular charges shall be set to go off first, with the radial charges to go off following a short interval or using the time-lag method.

Where rock is encountered before approaching the shoulder or pavement, the first four series of charges will be used in determining the amount of controlled blasting to be used before beginning any blasting beneath the railway or shoulders or pavement of the highway as applicable. If rock is encountered after tunneling progresses beneath the pavement or railway, the charges will initially be set at very low levels and increased in small increments until the proper amount of charge is determined.

In no case will an overshoot be permitted. If a boulder is encountered and removed by blasting or by other methods, a bulkhead will be formed immediately after removal of the boulder and the area filled with grout before proceeding with the tunneling operations.

If there is any indication of a vertical split in the rock formation, or any indication of settlement of the roadway or railway fill, all operations shall be stopped and the Controlling Agency notified immediately. If the vertical split is not determined to be of too great a magnitude or too close to the rails/pavement, the split shall be filled with grout at a pressure specified by the Controlling Agency, allowed to set and tunneling operations may be continued.

If it is determined that the vertical split is too great of a magnitude or too close to the pavement or railway, the Controlling Agency shall determine the method to be used to correct the split. If settlement of the roadway or railway occurs, the Controlling Agency will advise the Owner and his Contractor of the proper steps to be taken to correct the settlement. If deemed necessary by the Controlling Agency, adequate warning devices (signs, flashers, etc.) accompanied by responsible flagmen shall be placed at a distance allowing any and all traffic time to stop safely before reaching the questionable area. At the option of the Controlling Agency, it may provide the necessary flagmen, warning devices, etc., at the Contractor's expense. Traffic shall be allowed over the questionable area only as directed by the Controlling Agency.

The Controlling Agency shall have full authority to inspect entire tunnel operation, require disposition of remedial measures, and to stop all work if, in its opinion, the work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test, and approve all materials used.

The completed liner shall consist of a series of structural steel liner plates assembled with staggered longitudinal joints. Liner plates shall have been fabricated to fit the cross section of the tunnel. All plates shall be connected by bolts on both longitudinal and circumferential seams or joints.

After tunnelling operations have been completed the Contractor will install the carrier pipe in a manner approved by the Engineer. Concrete fill (1:3 portland cement grout) will then be placed after completing installation of the sewer pipe within the tunnel liner as directed by the Engineer and end enclosure walls installed as shown on the Construction Plans or Standard Details. Ends of the tunnel liner will be sealed with an eight-inch (8") masonry wall on the lower end and a twelve-inch (12") masonry wall on the higher end. Weep holes will be provided on the downstream end for drainage - See Standard Detail #16. The Contractor shall then remove the vertical shoring for pits (if ground conditions allow), surplus spoils, and material from the site.

The site shall then be returned to its original condition, seeded, mulched, or restored as specified and left in a neat and satisfactory condition. Shoring material shall be removed in such a manner so as to avoid collapse and to allow proper backfill. The backfill shall be placed in accordance with these Specifications or the requirements of the Controlling Agency.

The Contractor will notify the Utility Department, in writing, upon completion of the tunnel liner installation. Notification of completion of the tunnel operation will then be forwarded to the Division Engineer, in writing, by letter with a copy to the attention of the State Design Services Engineer, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina 27611 by the Utility Department.

The Contractor shall reimburse the Utility Department (Owner) and the Utility Department (Owner) shall reimburse the Division of Highways should any settlement or damage result to the roadway within a period of one (1) year after completion of the tunneling operations.

The Contractor and any of his subcontractors performing work on the State's (N.C. DOT) right-of-way in connection with tunneling operations shall furnish for approval, through the Construction Engineer, to the Department of Transportation, attention State Design Services Engineer, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina, 27611, a certificate of insurance. An original and one copy of the certificate in the minimum amounts of \$500,000 Bodily Injury and \$250,000/\$500,000 Property Damage shall be submitted for approval as evidence of proper coverage before beginning any work at the site. The Certificate is to show explosion, collapse, and underground insurance coverage is provided. The Certificate will also reference the project, county and the Design Services Units file number.

Insurance requirements for work performed on Railroad (CSX, Norfolk-Southern, etc.) property will be as outlined in the Special Provision Section of this contract. The Contractor shall furnish for approval a certificate of Insurance to this office. All required submittals will be sent to the Utility Department for review and this office will then forward the documentation on to the railroad.

Insurance will remain in full force and effect for one (1) year after acceptance by the owner and the Controlling Agency. The Certificate is to be countersigned by an authorized North Carolina Resident Agent with the name and address of the agent denoted thereon.



## R. BLASTING

Prior to commencing any blasting operations the Contractor shall notify either the City Fire Department - Fire Prevention Section or the County Fire Administrator as applicable, and obtain blasting permits as required. The Contractor must furnish certification of Insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

All blasting operations shall be conducted in strict accordance with any and all decrees, rules, regulations, ordinances, and laws as may be imposed by any regulatory body and/or agency having jurisdiction over the work relative to handling, transporting, use and storage of explosives. Blasting shall be done only by competent, sober and experienced personnel whose activities shall be conducted in a workmanlike manner. Satisfactory information must be provided to the Engineer that the blaster meets or exceeds the qualifications enumerated in OSHA Regulations Part 1926, Subpart U, Section 1926.901 -Blaster Qualifications.

All rock, dirt and debris from blasting shall be contained within the excavation by use of weighted mats or undisturbed overburden. The Contractor's blaster shall be fully responsible for determining the method of containment and the weight, size and placement of material required to contain the charge he is using.

Charges shall be sized such that no damage to houses, structures, roadways etc., outside the limits of the excavation will occur. Where there is a possibility of such damage, the charge will initially be set at a very low level and increased in small increments until the proper charge is determined. The Contractor shall be held responsible for any and all injury to persons or damage to public or private property.

1. Permission to Blast: The Contractor shall not be allowed to blast within any rights-of-way maintained by any agency (D.O.T., R.R., Gas, etc.) other than the City without specific approval of the controlling agency and only in accordance with their respective requirements.

## S. TESTING AND INTERNAL INSPECTION

The Contractor shall provide proper ventilation of sewer lines and manholes during any test or inspection procedure. The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

1. Gravity Sewer Pipe Leakage Testing: No sooner than 10 days following completion of backfill, the Contractor along with the project inspector will be required to determine the level of the ground water table. If the level of ground water table is above the top of the pipe, the sewer line shall be tested for infiltration. If there is no ground water above the top of the pipe the sewer line shall be low pressure air tested. Each test shall be performed as follows:
  - a. Infiltration: Weirs are to be furnished by CMUD and installed by the Contractor. The infiltration shall not exceed 100 gallons per day per inch diameter per mile as measured for a reach of pipe the same diameter up to one mile long. However, when excessive infiltration can be isolated to a particular section (manhole-manhole) the limit will be applied to that section. There shall be no visible points of infiltration. Any section (manhole-manhole) must be isolated and tested separately if so directed by the Engineer. The Charlotte-

Mecklenburg Utility Department reserves the right to TV any sewer line to detect sources of infiltration.

- b. Low Pressure Air Test: Tests shall be performed in accordance with ASTM C-828 and C-924 on sewer lines 42-inches in diameter and smaller. Test pressure will be measured by gauges furnished by CMUD and installed by the Contractor above ground at the manhole opposite the air supply. The Contractor shall furnish all other test equipment required including connecting hoses at the CMUD supplied gauge.

Sewer lines larger than 42-inches in diameter shall be tested for infiltration as specified above and each joint shall be visually inspected by a CMUD representative.

2. Manhole Leakage Testing: Manholes shall be tested by plugging the inlet and outlet pipes with airtight plugs and using one of the following procedures:
  - a. Exfiltration: Fill the manhole to the rim with water and allow the level to equalize due to saturation. Refill the manhole and mark the level to begin the test. The test shall last at least 2 hours and allowable leakage shall be 3 gallons per hour. The Engineer will select 25% of the manholes on the project to be tested. If any manhole fails, an additional manhole will be tested. Manholes that fail the test shall be repaired as specified and retested until they pass.
  - b. Vacuum Air: Manhole vacuum air testing shall be performed in accordance with ASTM C-1244. The Engineer will select 25% of the manholes on the project to be tested. Manholes that fail the test shall be repaired as specified and retested until they pass. Manholes that show leaks and are repaired prior to testing shall be tested as specified.
3. Deflection Testing of PVC Pipe: Not less than 30 days following completion of backfill, the pipe shall be tested for deflection with a 5% mandrel sized as defined in ASTM D-3034. Mandrels shall be furnished by the Charlotte-Mecklenburg Utility Department. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced or re-rounded and the bedding shall be properly constructed as specified to prevent excessive deflection. Such sections shall be re-tested for deflection after completion of backfill.

## T. REPAIRS

All leaks shall be repaired by identifying and exposing the defective section of pipe and completing repairs as follows:

1. PVC, VCP or Ductile Iron Pipe: Defective or damaged pipe including leaking joints shall be removed and replaced with sound new pipe. The pipe shall be re-connected with approved couplings as specified in the MS Section of this document.

2. RCP: Defective or damaged pipe shall be removed and replaced with sound new pipe. Pipe re-connections shall be made, and joint leaks repaired, using concrete collars per Standard Details.

Chemical grouting or internal or external wiping of joints with cement grout are specifically not approved as methods for repairing leaks on new pipelines, regardless of the pipe material.

Repair couplings and/or collars shall be limited to one every one hundred feet not to exceed three pipe repairs between manholes. Deficiencies in excess of these limitations shall be corrected by relaying the section of pipe.

3. Manholes: Any damage to the interior wall of the manhole resulting from penetration of the lift holes shall be repaired with non-shrink cement grout.

Leaks through manhole joints or walls or around pipe collars, may be repaired from inside the manhole with non-shrink cement grout. If the size of the leak, or the external water pressure, prevents such repairs, the manhole shall be excavated and repaired from outside.

Leaks around boots or gaskets used to join pipe to manholes shall be repaired by external concrete collars or as approved by the Engineer.

## **U. ABANDONMENT**

The following requirements shall apply for proposed abandonment of existing facilities unless otherwise shown on the plans or approved by the Engineer. All areas disturbed by abandonment will be restored.

1. Abandonment Of Existing Manholes: Manholes which are to be abandoned will first have both influent and effluent lines plugged inside the manhole with watertight masonry. The manhole will then be filled with non-compressible material (#67 stone or as approved), to a point three feet (3'-0") below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be filled to finish grade with suitable soil compacted in place.
2. Abandonment Of Mains At Manholes Which Remain In Service: Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole and then plugging the abandoned main and the manhole wall with watertight masonry. The invert shall then be rebuilt to conform with the standard details.
3. Abandonment Of Exposed Pipe: Exposed sections of abandoned mains shall be removed to a point not less than 5 feet into the adjacent banks. The remaining ends of the pipe shall be plugged with watertight masonry. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point three feet (3'-0") below the finish grade. Steel piers shall be cut off three feet (3'-0") below finish grade.

4. Abandonment Of Existing Pump Stations: Pumps, motors, controls, etc., shall be salvaged and transported by the Contractor to the sewer maintenance yard at 3001 Wilmont Road. All influent and effluent pipes shall be plugged with watertight masonry. The pump chamber and wetwell (if abandoned) will be filled with non-compressible material (#67 stone or as approved), to a point three feet (3'-0") below the finish grade. The remainder of the structure shall be broken down and removed. Then the excavation shall be filled to finish grade with suitable soil compacted in place. All above ground structures associated with the pump station, including fencing and the access road shall be removed and the area restored.

## V. RESTORATION

All surfaces and structures (both public and private) within and adjacent to the construction operations shall be restored to a condition comparable to that existing prior to construction or as specified in the special provisions.

All surplus materials shall be disposed of in a manner acceptable to the Engineer, and the construction area shall be left in a neat condition, with special attention called to proper drainage, smoothness of surface, and general clean up. No machinery or equipment shall be left or stored on the job site after the project is completed.

Unless otherwise specified, complete restoration to include fertilizing, seeding, and mulching of any and all areas disturbed during construction shall be completed within thirty (30) working days following the initial ground disturbing activity.

1. Water meters, valve boxes, drain pipes, and other structures encountered shall be reset or relaid to match or clear surface grade and/or water main pipe grade as applicable.
2. All shoulder areas shall be restored, stabilized, and maintained to their original condition. Concrete, asphalt, gravel, and dirt walks, drives and roadways are to be replaced to their original shape and serviceability. Unless otherwise approved by the Engineer all areas (shoulders, side streets, drive, parking areas, etc.) which exhibit a gravel surface at the time of construction will be re-graveled with a minimum depth of six (6) inches of C.A.B.C stone compacted-in-place for the width and length of the disturbed area and then feathered gradually into the existing cross section. When a driveway is finished with other than C.A.B.C stone, a one inch finish coating to match existing gravel gradation and appearance shall be placed.

The Contractor should note that all existing side streets and drives which are either dirt or gravel will be restored as specified for graveled areas.

3. Refuse Burial: Timber, rock and other refuse may not be buried within the permanent sewer rights-of-way with the exception of rock smaller than 3/4 cubic foot which is allowed as previously specified.
4. Rip-Rap: The Contractor shall place stone rip-rap as specified in those areas subject to severe water action where directed by the Engineer.

Placement of rip-rap as shown on the Construction Plans shall be considered a guide only, with final determination made at the time of construction by the Engineer. Either the addition or deletion of quantities may be required.

Stone rip-rap will be placed as indicated on the Standard Details immediately following pipe installation and will be installed no steeper than a 2:1 slope except when specifically approved by the Engineer. Grading will be required as necessary to insure continuous even flow.

In locations where a creek bank is eroded near the sewer line the Contractor will be required to place compacted fill material along the creek bank in order to maintain 3' of cover over the sewer line in all directions. This is to be done before the rip-rap is placed.

The rip-rap installation shall include all earthwork necessary to stabilize the creek bank and to provide cover for the sewer line.

5. Jute Netting/Erosion Blanket: The contractor shall install jute netting or Erosion Control Blanket in areas subject to high runoff velocities, areas subject to concentrated runoff and on steep slopes as shown on the plans and/or as directed by the Engineer.
6. Fertilizing, Seeding, and Mulching: Established lawns and landscaped areas damaged by construction shall be restored to their former condition by seeding, unless the type and condition of the existing sod warrants it being cut, removed, preserved, and replaced. All areas, regardless of previous condition, damaged by construction shall be fertilized, seeded, and mulched as outlined below:
  - a. Seed Bed Preparation: The seed bed shall be prepared by pulverizing the soil in an approved manner to a depth of three (3) inches for field conditions or slopes that are 3:1 or flatter and to a depth of one (1) to three (3) inches, as determined on site for slopes steeper than 3:1. The soil shall be tilled until a well pulverized, firm, reasonably uniform seed bed is prepared conforming substantially to ground elevations as shown on the Plans and/or as existed prior to construction. The disturbed area shall blend uniformly into adjacent topography. Good surface drainage must be provided, allowances for settlement made and ground elevations adjusted accordingly. Visible ponding will not be allowed. All stones, roots, sticks, rubbish, and other objectionable material shall be removed.
  - b. Soil Improvements: Soil additives shall be incorporated in an approved manner into the top soil at the following rates:
    - (1) Fertilizer - 20 pounds per 1000 square feet of 5-10-10 fertilizer generally and 30 pounds per 1000 square feet of 10-10-10 fertilizer for established lawn areas.
    - (2) Lime - 100 pounds per 1000 square feet.

(3) Superphosphate (0-20-0) - 12 pounds per 1000 square feet.

c. Seeding: Seeding must be done within thirty (30) calendar days after the initial ground disturbing activity.

(1) The seed bed must be in good, friable condition and not muddy or hard at the time seeding is performed.

(2) Seed shall be applied at the rate specified and raked or tilled into the topsoil with the resulting furrows running across the natural slope of the ground. Under no circumstances will any tilling activity be allowed parallel with said slope.

Slopes steeper than 3:1 shall require the use of hydraulic seeding unless otherwise specifically approved by the Engineer.

d. Mulching: After fertilizing, seeding and raking, dried straw shall be spread uniformly over the area at a rate of 90 pounds per 1000 square feet. Approximately 1/4 of the ground should remain visible to avoid smothering seedlings. The straw shall be sprayed with liquid asphalt to bond it together and anchor it in place within road right-of-way and areas subject to erosion.

(1) Liquid asphalt, thinned with kerosene, shall be used during freezing weather and shall be either rapid or medium curing. It shall be applied at a rate of 200 gallons per ton of straw or approximately 9 gallons per 1000 square feet.

(2) Emulsified asphalt, thinned with water shall be used when temperatures are less severe, shall be rapid curing only, and shall be applied at a rate of 150 gallons per ton of straw or approximately 7 gallons per 1000 square feet.

e. Maintenance: The Contractor shall maintain the seeded areas until there is a uniform growth three (3) inches high. Maintenance shall consist of watering, weed and pest control within established lawns, fertilization, erosion repair, reseeding and all else necessary to establish a vigorous healthy and uniform stand of grass. All areas and spots which do not show a uniform stand of grass, for any reason, shall be treated repeatedly until a uniform stand is attained.

Seasonal seeding mixtures and rates of application shall be as follows. All rates are in pounds per 1000 square feet and any rates listed below may be cut by 1/2 for temporary erosion control measures only.

**SEPTEMBER 15 - MARCH 1**

Maintained/Established Lawns or road rights-of-way

6# Kentucky Fescue No. 31  
2# Rye Grain  
30# Fertilizer (10-10-10)  
100# Lime  
12# Superphosphate

Open-Field (Anything other than an established lawn)

4# Kentucky Fescue No. 31  
2# Rye Grain  
20# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

2# Kentucky Fescue No. 31  
4# Sericea Lespedeza (Unscarified)  
2# Rye Grain  
30# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

**FEBRUARY 1 - OCTOBER 15**

Maintained/Established Lawns or road rights-of-way

8# Kentucky Fescue No. 31  
30# Fertilizer (10-10-10)  
100# Lime  
12# Superphosphate

Open-Field (Anything other than an established lawn)

6# Kentucky Fescue No. 31  
2# Sudangrass (May, June, and July only)  
20# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

2# Kentucky Fescue No. 31  
4# Sericea Lespedeza (Scarified)  
2# Sudangrass (May, June, and July only)  
20# Fertilizer (5-10-10)  
100# Lime  
12# Superphosphate

The Engineer will be consulted prior to seeding for a determination of appropriate seed mixture.

Unless otherwise required by the North Carolina Department of Transportation or the Engineer seeding within road rights-of-way will be as specified for established lawns.

**W. WORK WITHIN NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RIGHTS-OF-WAY**

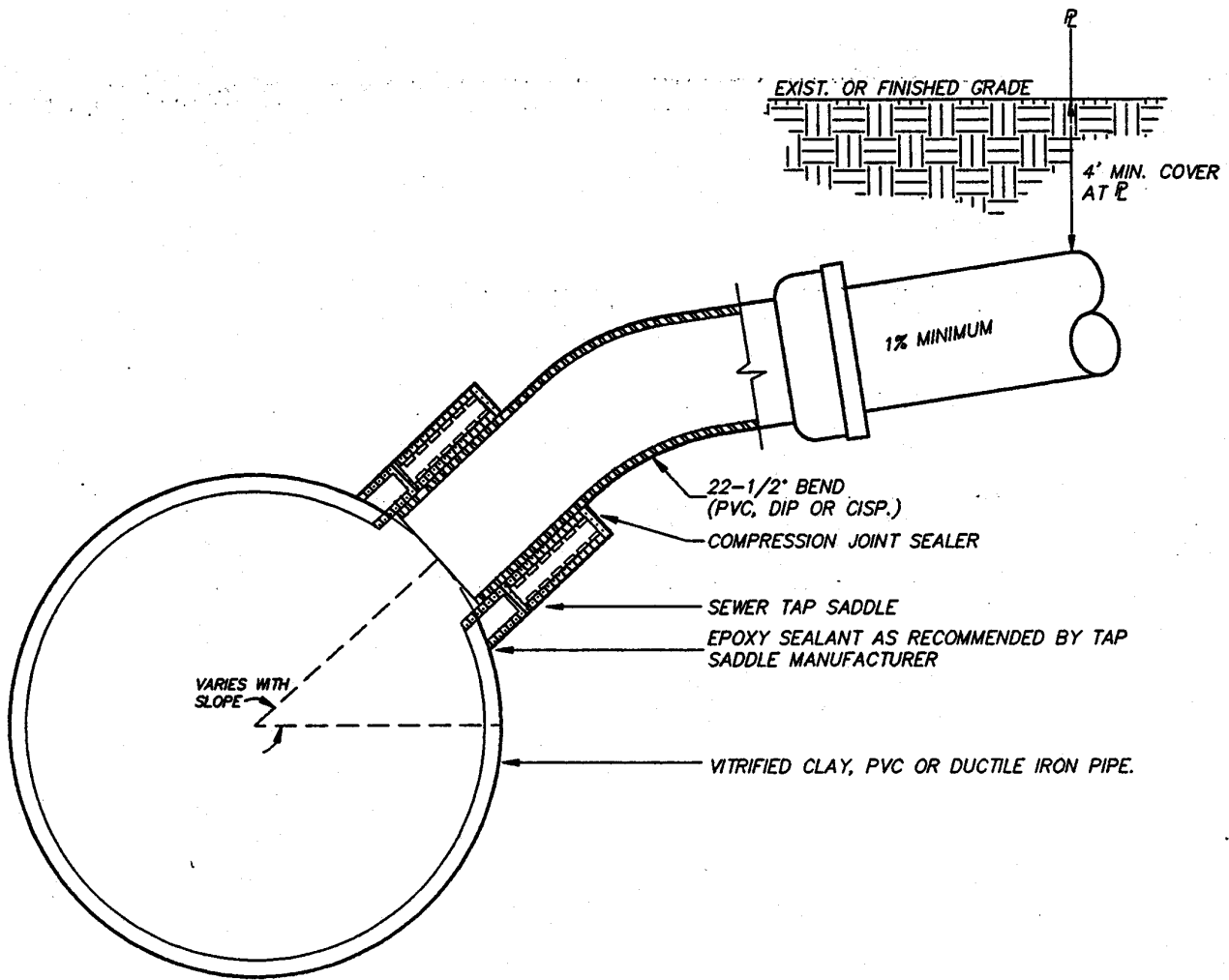
Construction is permitted within the rights-of-way of the North Carolina Department of Transportation (DOT), Division of Highways in accordance with their Policies And Procedures For Accommodating Utilities On Highway Rights-Of-Way as amended. The Charlotte-Mecklenburg Utility Department (CMUD) is required to enforce this entire document as it relates to this work. All bidders are required to become familiar with the document and any amendments which are available from the Manager of Right-of-Way, North Carolina Department of Transportation, Division of Highways, Raleigh, North Carolina.

1. Charlotte-Mecklenburg Utility Department has entered into an encroachment agreement with the North Carolina Department of Transportation (DOT) which grants the right for any work within the Department of Transportation's rights-of-way. The encroachment agreement for any work within DOT rights-of-way under this project is included as a special provision in this contract. A copy of the approved encroachment has been attached to this contract or will be supplied to the Contractor prior to construction. A copy of the encroachment agreement must be kept at the construction site at all times.
2. Certain notices are required in writing before any work can proceed within the Department of Transportation's rights-of-way. Upon ample notice by the Contractor, the Engineer will make this notification.
3. Proper signing before, during, and after construction in conformance with the manual on Uniform Traffic Control Devices for Streets and Highways will be required. In addition, warning signs as related to soft and/or low shoulders and broken pavement may be required by the Engineer.



4. Piling and/or storage of excavated material upon the pavement and on some types of shoulders is prohibited unless special permission is granted by the Department of Transportation's Division Engineer. Any material spilled, tracked or placed on the pavement is to be cleaned and damaged pavement repaired subject to stoppage of all work by Charlotte-Mecklenburg Utility Department. Drainage ditches are to be protected from siltation as specified in the EP Section and must be opened at the end of each work day or as weather conditions require.

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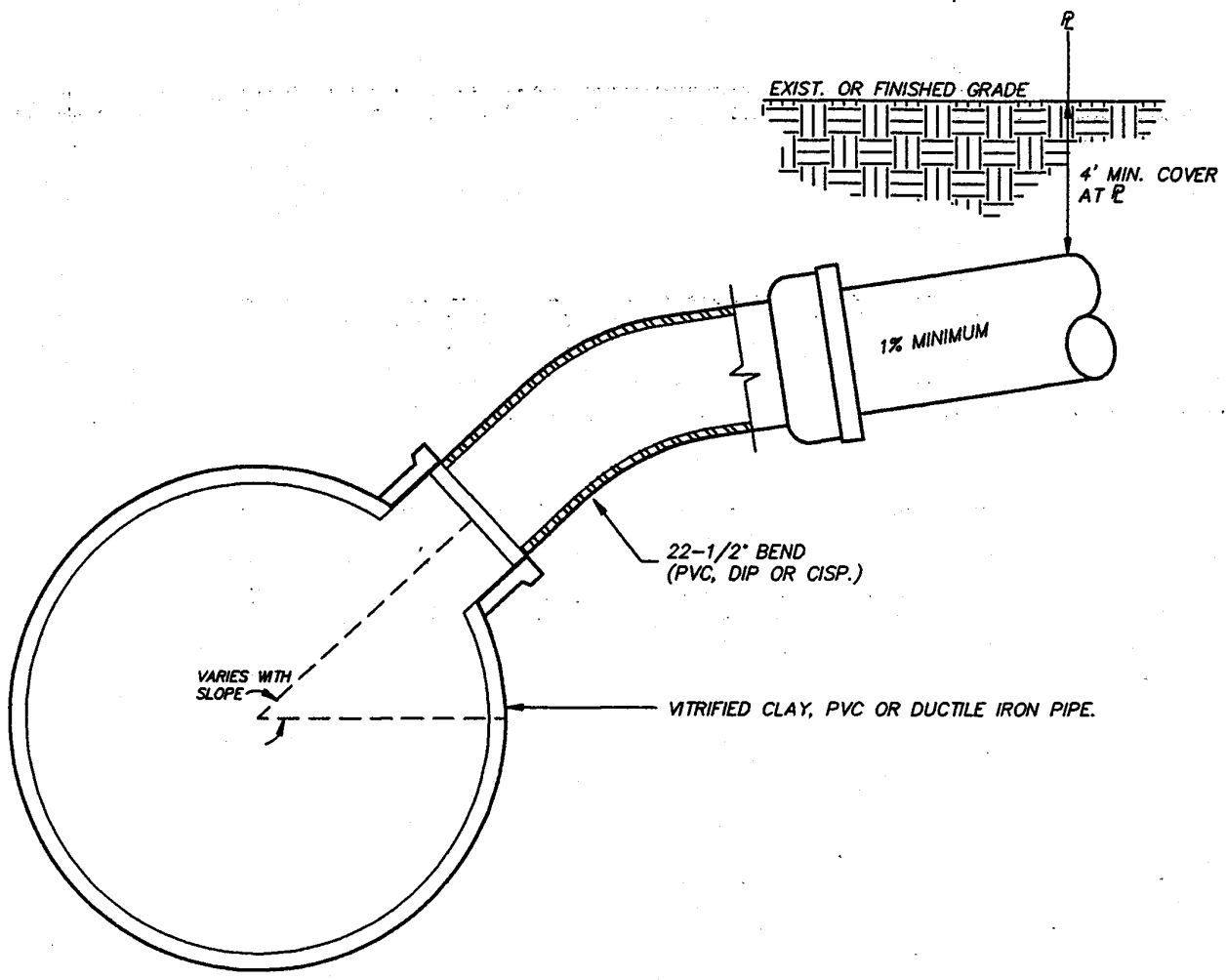


**NOTES:**

1. THE OPENING IN PIPE SHALL BE CUT WITH A TAP MACHINE ONLY.
2. THE TAP SHALL BE MADE IN THE UPPER HALF OF THE PIPE AT 45° FROM THE HORIZONTAL.
3. MAXIMUM SIZE TAP SHALL BE FOUR INCHES.
4. TEE & BEND TO BE FULLY ENCASED WITH #67 CRUSHED STONE.
5. SDR 35 PVC LATERAL PIPE REQUIRE TYPE III GRANULAR BEDDING.
6. MIN. CLEAR TO PIPE JOINT ON MAIN SHALL BE 1'-0".
7. THE LATERAL MUST BE INSTALLED PERPENDICULAR TO THE MAIN.
8. IF THE LATERAL HAS LESS THAN 3' OF COVER, THE LATERAL MUST BE D.I.P.

<b>CHARLOTTE—MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL SEWER</b>	
Scales _____			
PLAN _____ NTS _____		<b>4" LATERAL (TAP)</b>	
PROFILE Hor. _____ Vert. _____			
As Built _____ Date _____			
Surveyed By _____	Designed By _____	Drawn By <b>MSW</b>	Project—Engr. <b>K. Blain</b> 2/99
No. _____	Date _____	By _____	Revision _____
		Approved By _____	Sheet <b>1</b> Of _____

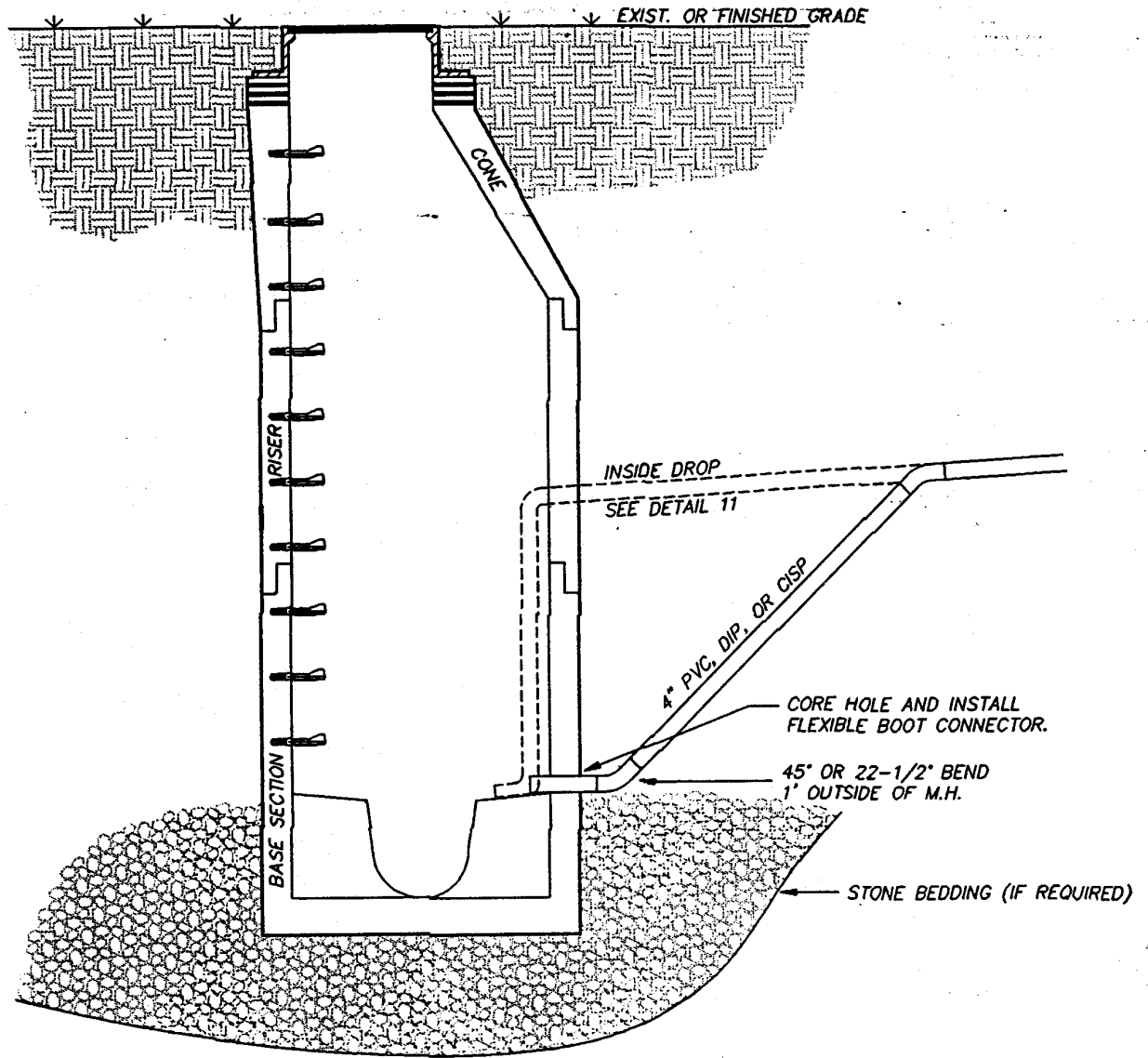
01/07/94



**NOTES:**

1. CLAY TEES REQUIRE COMPRESSION GASKET TO PROVIDE SEAL FOR PLAIN END OF 22-1/2' BEND.
2. IF THE LATERAL HAS LESS THAN 3' OF COVER, THE LATERAL MUST BE D.I.P.
3. TEE AND BEND TO BE FULLY ENCASED IN #67 CRUSHED STONE.
4. SDR 35 PVC PIPING REQUIRES TYPE III GRANULAR BEDDING.
5. MIN. DISTANCE BETWEEN TEES SHALL BE 7' CENTER TO CENTER.
6. THE LATERAL MUST BE INSTALLED PERPENDICULAR TO THE MAIN.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____	File No. _____	<b>STANDARD DETAIL SEWER</b>	
Scales <u>NTS</u>			
PLAN _____	Hor. _____	<b>4" LATERAL (TEE)</b>	
PROFILE _____	Vert. _____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	Drawn By <u>MSW</u>	Project-Engr <u>K. Blaylock</u>
No. _____	Date _____	By _____	Revision _____
		Approved By <u>[Signature]</u>	Sheet <u>2</u> of <u>2</u>



**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

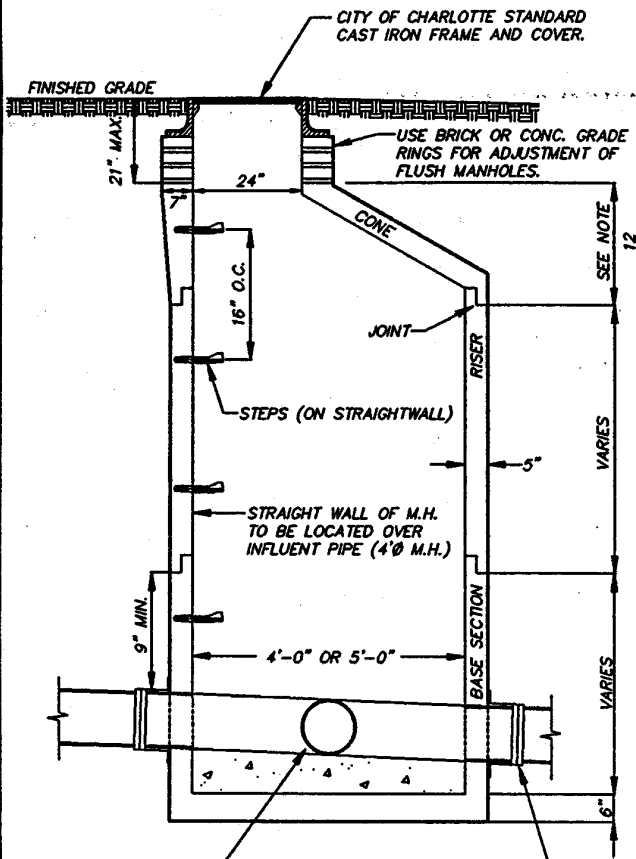
**STANDARD DETAIL  
SEWER**

**LATERAL INSTALLATION  
AT MANHOLE**

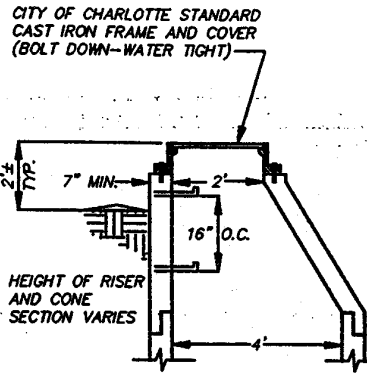
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PLAN Scales _____	NTS
PROFILE Hor. _____	
Vert. _____	
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By <b>MSW</b>	Project-Engr _____
Approved By <b>K. B. [Signature]</b>	Date <b>2/14/95</b>
Sheet <b>3</b>	Of _____

No.	Date	By	Revision

CSL/DWG  
01/11/94

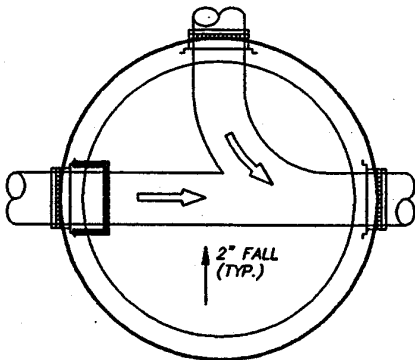


FOR 8" AND 10" PIPE, INVERTS ARE TO BE 3/4" PIPE OD AT TROUGH, FOR 12" AND LARGER PIPE, PROVIDE FULL INVERT AS SHOWN. THE SHELF SHALL SLOPE 2" FROM THE MANHOLE WALL TO THE TROUGH.

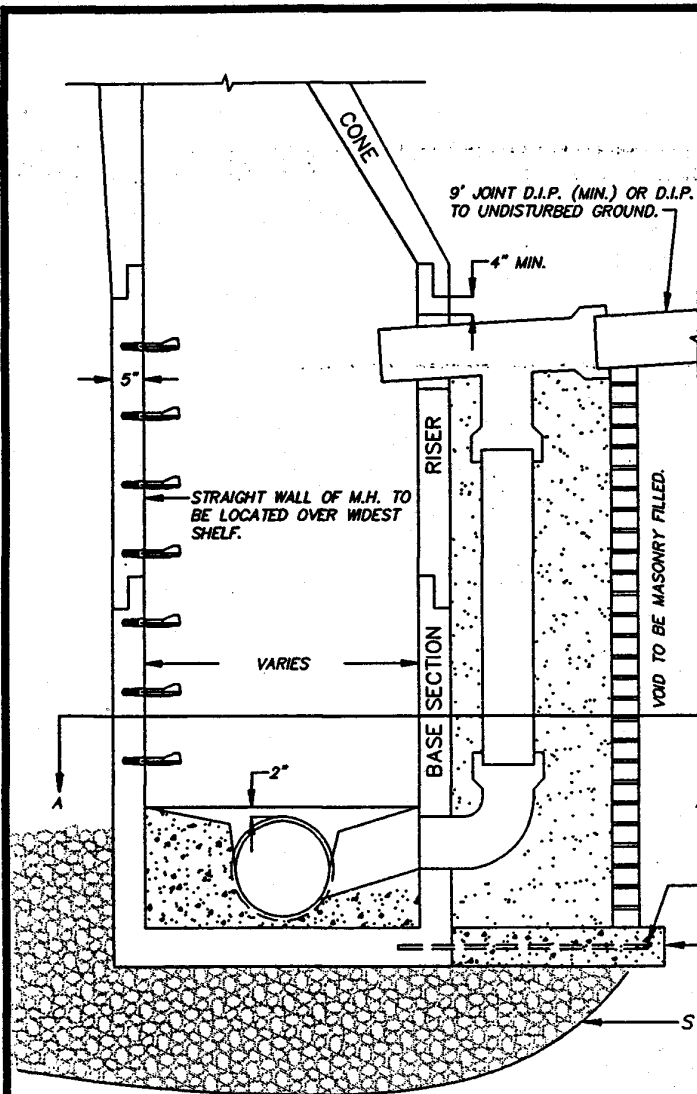


**NOTES:**

1. MANHOLE TO CONFORM WITH ASTM C478 EXCEPT AS MODIFIED BELOW.
2. MANHOLE BASE TO BE REINFORCED WITH A MINIMUM AREA OF 0.20 SQ. IN. PER LINEAL FOOT EACH WAY. WALL REINFORCING TO BE MINIMUM OF 0.12 SQ. IN. PER LINEAL FOOT. EITHER TONGUE OR GROOVE SHALL HAVE REINFORCING EQUAL IN AREA TO MINIMUM OF WALL SECTION.
3. ALL JOINTS SHALL CONFORM WITH ASTM C443.
4. STEPS TO BE PLASTIC PER CITY STANDARDS.
5. ALL PIPE OPENINGS TO BE NO GREATER THAN 3" LARGER THAN OUTSIDE DIAMETER OF PIPE AND ADDITIONALLY REINFORCED WITH A MINIMUM OF 0.20 SQ. IN. OF STEEL AT 90 DEGREES. (ADDITIONAL REINFORCING NOT REQUIRED FOR CORED OPENINGS)
6. ALL SURFACES SHALL BE SMOOTH EVEN TEXTURED WITH A MINIMUM OF HONEYCOMB, FINS AND OTHER IMPERFECTIONS.
7. PENETRATING LIFTING HOLES SHALL BE PLUGGED WITH EXPANSION GROUT.
8. INVERTS MAY BE 3600 PSI READY MIX CONCRETE IN LIEU OF BRICK. PRECAST INVERTS ARE ACCEPTABLE.
9. STEPS IN 5' DIAMETER MANHOLES TO BE OVER WIDEST SHELF.
10. 4'Ø CONE SECTIONS MAY BE USED WITH 5'Ø MANHOLES WITH A 5'-4" TRANSITION SECTION PLACED DIRECTLY BENEATH THE 4'Ø CONE.
11. ALL MANHOLE SECTIONS SHALL BE DESIGNED FOR H-20 LOADING.
12. MINIMUM HEIGHT FOR CONCENTRIC CONES ON MANHOLES WITH BOLT DOWN F&C IS 32".

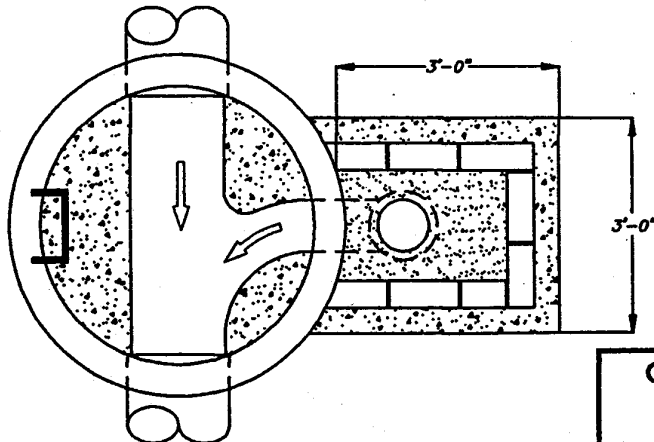
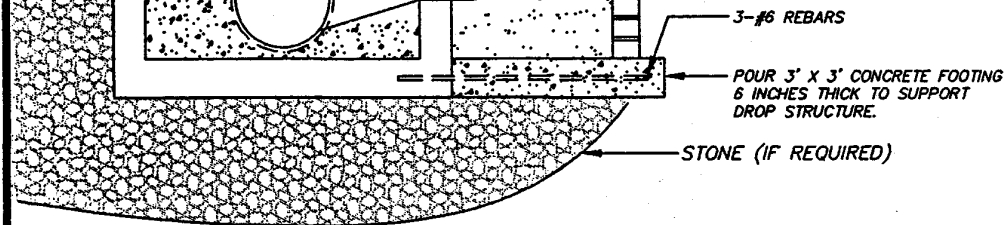


<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>													
Job No. _____ File No. _____		<b>STANDARD DETAIL SEWER</b>											
Scales _____		<b>PRECAST MANHOLES 4' AND 5' DIAMETER</b>											
PLAN _____	NTS _____												
PROFILE _____	Hor. _____	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>As Built _____</td> <td>Date _____</td> </tr> <tr> <td>Surveyed By _____</td> <td>Designed By _____</td> </tr> <tr> <td>Drawn By _____</td> <td>Project-Engr _____</td> </tr> <tr> <td>MSW _____</td> <td>Approved By _____</td> </tr> <tr> <td>Project-Engr _____</td> <td>Date _____</td> </tr> </table>		As Built _____	Date _____	Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____	MSW _____	Approved By _____	Project-Engr _____	Date _____
As Built _____	Date _____												
Surveyed By _____	Designed By _____												
Drawn By _____	Project-Engr _____												
MSW _____	Approved By _____												
Project-Engr _____	Date _____												
No. _____ Date _____ By _____		Sheet 4 of _____ Approved By _____ Date _____											



**NOTES:**

1. ALL MASONRY MORTAR SHALL BE PORTLAND CEMENT 1:3 MIX.
2. CARE MUST BE TAKEN TO FORM A SMOOTH FINISHED TROUGH FROM ENTRANCE PIPES TO EXIT PIPE, AND IN CURVED MANHOLES THE TROUGH MUST BE A SMOOTH CIRCULAR ARC TANGENT TO THE INSIDE WALLS OF THE PIPES AT THEIR ENDS.
3. PROTECTIVE WALL FOR OUTSIDE DROP SHALL BE A MINIMUM OF 4" MASONRY.
4. THE SLOPE OF THE OUTSIDE DROP TROUGH SHALL BE 1/4" PER FOOT.
5. ALL PIPE OPENINGS TO BE NO GREATER THAN 3" LARGER THAN O.D. OF PIPE AND ADDITIONALLY REINFORCED WITH A MINIMUM OF 0.20 SQ. IN. OF STEEL AT 90 DEGREES. PIPE TO BE CENTERED IN OPENINGS. ADDITIONAL REINFORCING NOT REQUIRED FOR CORED OPENINGS.
6. RAMSET MASONRY TIES EVERY 12 INCHES.
7. DROP STRUCTURE MAY BE FORMED AND Poured OF 3600 PSI CONCRETE IN LIEU OF MASONRY.
8. FOOTING FOR DROP MAY BE Poured AS PART OF THE MANHOLE BASE SLAB OR FIELD Poured AND TIED TO MANHOLE BASE WITH THREE EQUALLY SPACED #6 REBARS DOWELED INTO MANHOLE BASE 2" FROM TOP OF SLAB. GROUT INTO 8" DEEP HOLES WITH EXPANSION GROUT.
9. OUTSIDE DROP SHALL NOT ENTER MANHOLE IN CONE SECTION.
10. MATCH DROP INFLUENT CROWN TO CROWN WITH EFFLUENT PIPE.
11. DROP MAY BE PVC, D.I.P. OR V.C.P.



SECTION A-A

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

**OUTSIDE DROP**

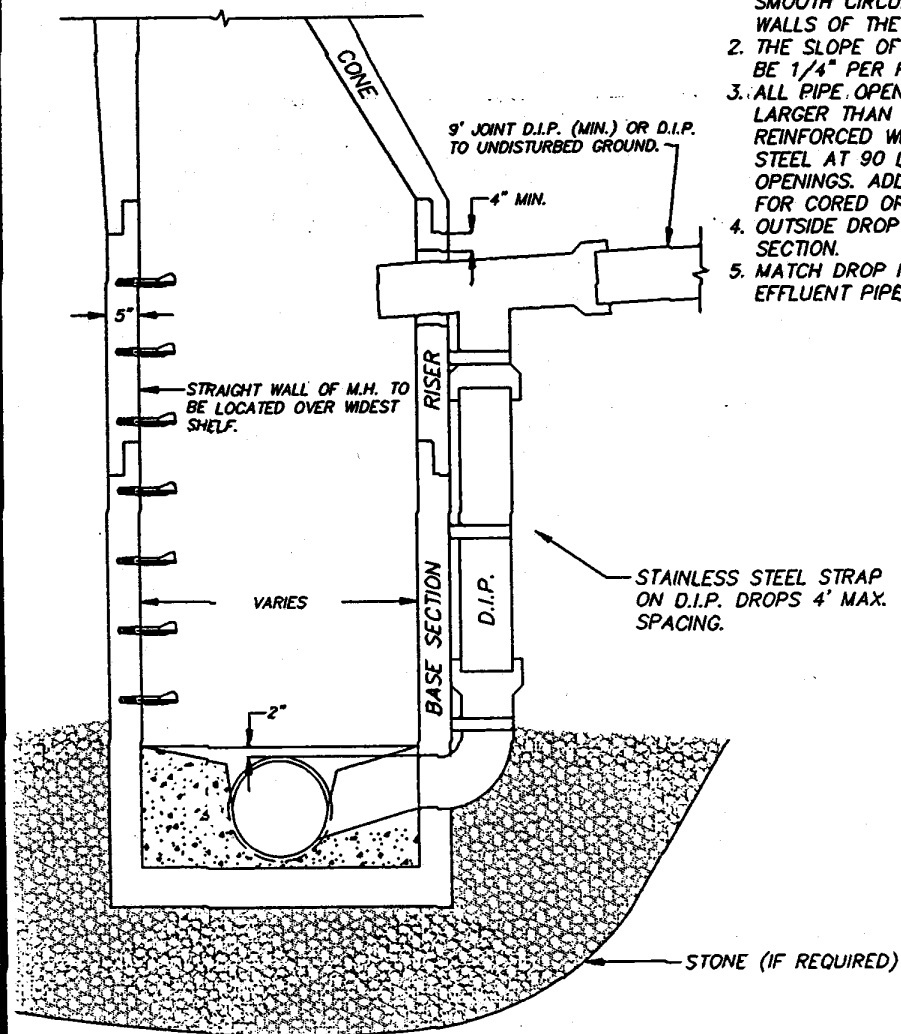
Job No. _____	File No. _____	<b>MSW</b>	<b>K. J. [Signature]</b>	2/95	Sheet 5	Of _____
Scales PLAN <u>NTS</u>						
PROFILE Hor. _____ Vert. _____		Drawn By	Project-Engr	Approved By	Date	
As Built _____ Date _____		Surveyed By	Designed By	Drawn By	Project-Engr	Approved By

No.	Date	By	Revision

MSW  
2/95

**NOTES:**

1. CARE MUST BE TAKEN TO FORM A SMOOTH FINISHED TROUGH FROM ENTRANCE PIPES TO EXIT PIPE, AND IN CURVED MANHOLES THE TROUGH MUST BE A SMOOTH CIRCULAR ARC TANGENT TO THE INSIDE WALLS OF THE PIPES AT THEIR ENDS.
2. THE SLOPE OF THE OUTSIDE DROP TROUGH SHALL BE 1/4" PER FOOT.
3. ALL PIPE OPENINGS TO BE NO GREATER THAN 3" LARGER THAN O.D. OF PIPE AND ADDITIONALLY REINFORCED WITH A MINIMUM OF 0.20 SQ. IN. OF STEEL AT 90 DEGREES. PIPE TO BE CENTERED IN OPENINGS. ADDITIONAL REINFORCING NOT REQUIRED FOR CORED OPENINGS.
4. OUTSIDE DROP SHALL NOT ENTER MANHOLE IN CONE SECTION.
5. MATCH DROP INFLUENT CROWN TO CROWN WITH EFFLUENT PIPE.



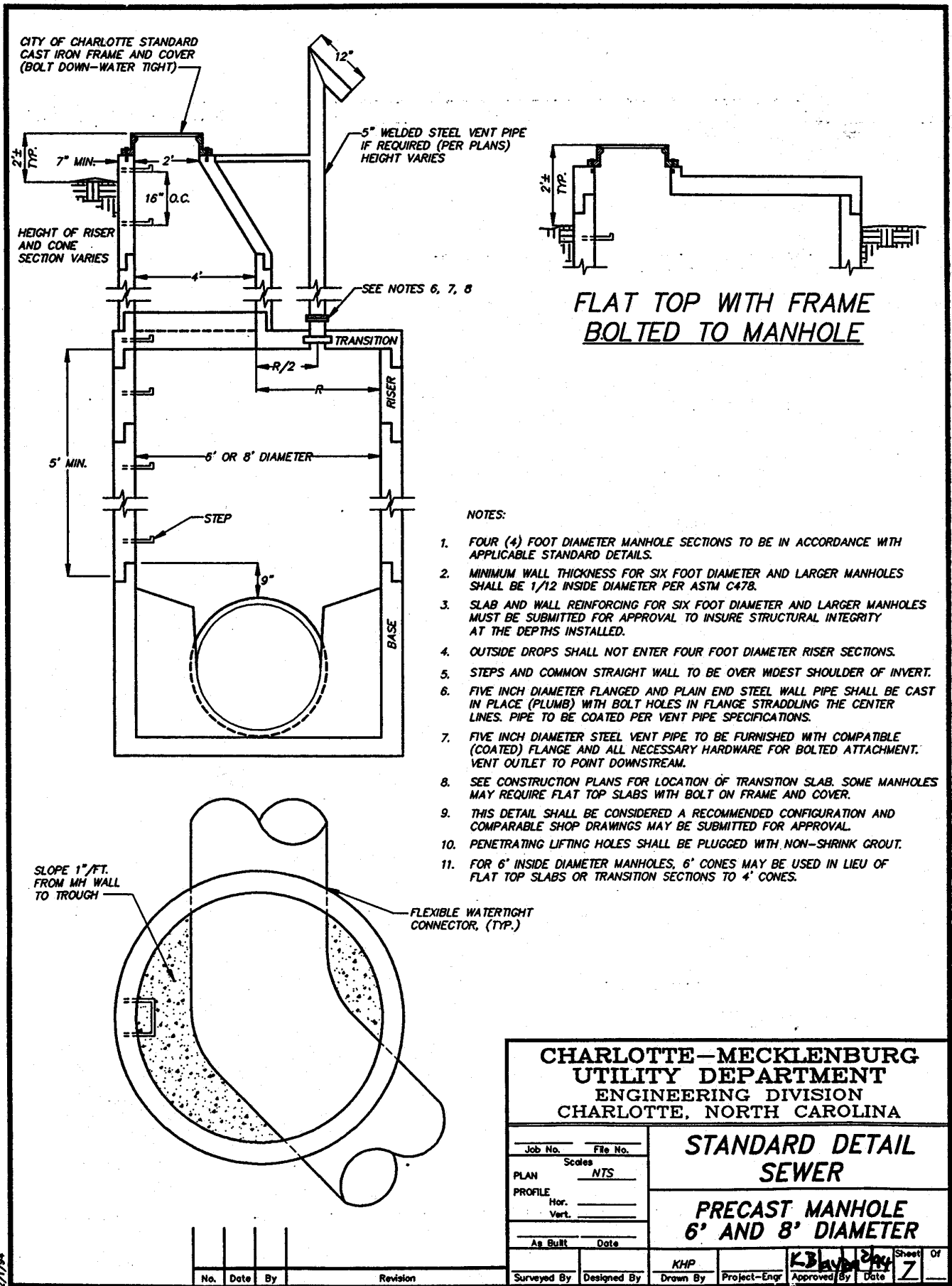
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER  
OUTSIDE DROP  
INSTALLATION (ALTERNATE)**

Job No. _____	File No. _____	<b>MSW</b>	<b>Project-Engr</b>	<b>Approved By</b>	<b>Date</b>	Sheet <b>6</b> Of _____
Scales _____						
PLAN _____	NTS	Drawn By _____	Project-Engr _____	Approved By _____	Date _____	Sheet <b>6</b> Of _____
PROFILE _____	Hor. _____					
Vert. _____	As Built _____	Designed By _____	Drawn By _____	Project-Engr _____	Approved By _____	Date _____

No.	Date	By	Revision



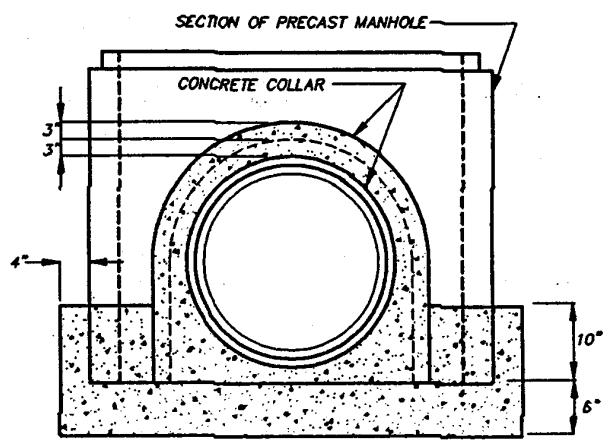
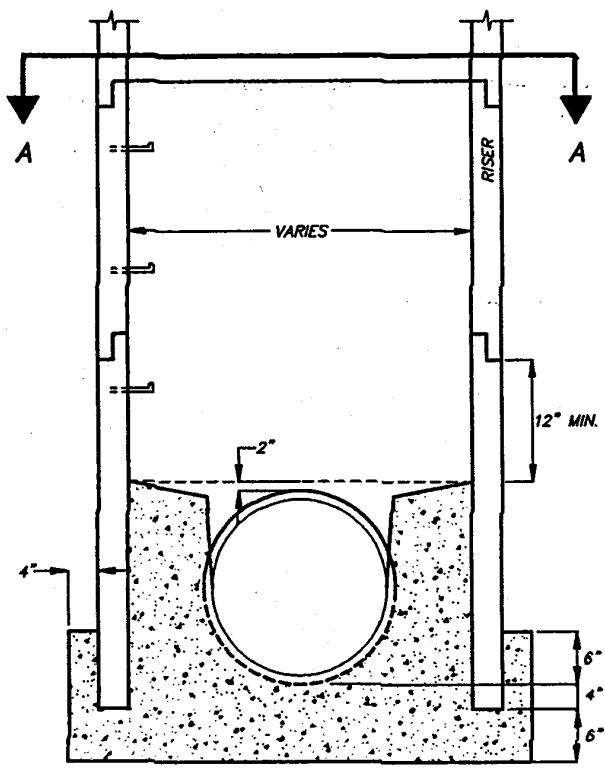


**FLAT TOP WITH FRAME BOLTED TO MANHOLE**

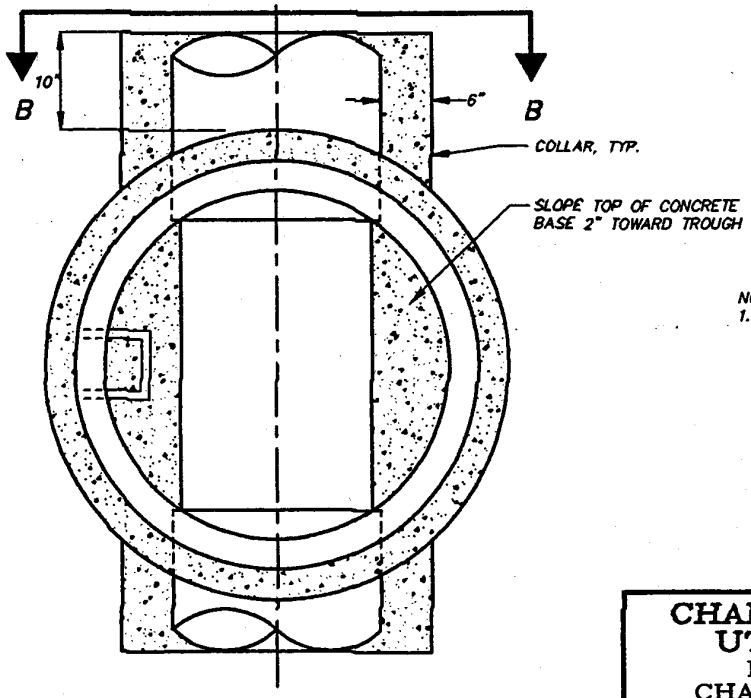
**NOTES:**

1. FOUR (4) FOOT DIAMETER MANHOLE SECTIONS TO BE IN ACCORDANCE WITH APPLICABLE STANDARD DETAILS.
2. MINIMUM WALL THICKNESS FOR SIX FOOT DIAMETER AND LARGER MANHOLES SHALL BE 1/12 INSIDE DIAMETER PER ASTM C478.
3. SLAB AND WALL REINFORCING FOR SIX FOOT DIAMETER AND LARGER MANHOLES MUST BE SUBMITTED FOR APPROVAL TO INSURE STRUCTURAL INTEGRITY AT THE DEPTHS INSTALLED.
4. OUTSIDE DROPS SHALL NOT ENTER FOUR FOOT DIAMETER RISER SECTIONS.
5. STEPS AND COMMON STRAIGHT WALL TO BE OVER WIDEST SHOULDER OF INVERT.
6. FIVE INCH DIAMETER FLANGED AND PLAIN END STEEL WALL PIPE SHALL BE CAST IN PLACE (PLUMB) WITH BOLT HOLES IN FLANGE STRADDLING THE CENTER LINES. PIPE TO BE COATED PER VENT PIPE SPECIFICATIONS.
7. FIVE INCH DIAMETER STEEL VENT PIPE TO BE FURNISHED WITH COMPATIBLE (COATED) FLANGE AND ALL NECESSARY HARDWARE FOR BOLTED ATTACHMENT. VENT OUTLET TO POINT DOWNSTREAM.
8. SEE CONSTRUCTION PLANS FOR LOCATION OF TRANSITION SLAB. SOME MANHOLES MAY REQUIRE FLAT TOP SLABS WITH BOLT ON FRAME AND COVER.
9. THIS DETAIL SHALL BE CONSIDERED A RECOMMENDED CONFIGURATION AND COMPARABLE SHOP DRAWINGS MAY BE SUBMITTED FOR APPROVAL.
10. PENETRATING LIFTING HOLES SHALL BE PLUGGED WITH NON-SHRINK GROUT.
11. FOR 6' INSIDE DIAMETER MANHOLES, 6' CONES MAY BE USED IN LIEU OF FLAT TOP SLABS OR TRANSITION SECTIONS TO 4' CONES.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____		File No. _____	
Scales			
PLAN _____		NTS	
PROFILE			
Hor. _____		Vert. _____	
As Built _____		Date _____	
Surveyed By _____	Designed By _____	Drawn By <b>KHP</b>	Project-Engr _____
		Approved By <b>KJ</b>	Sheet <b>2</b> Of _____



**SECTION B-B**



**SECTION A-A**

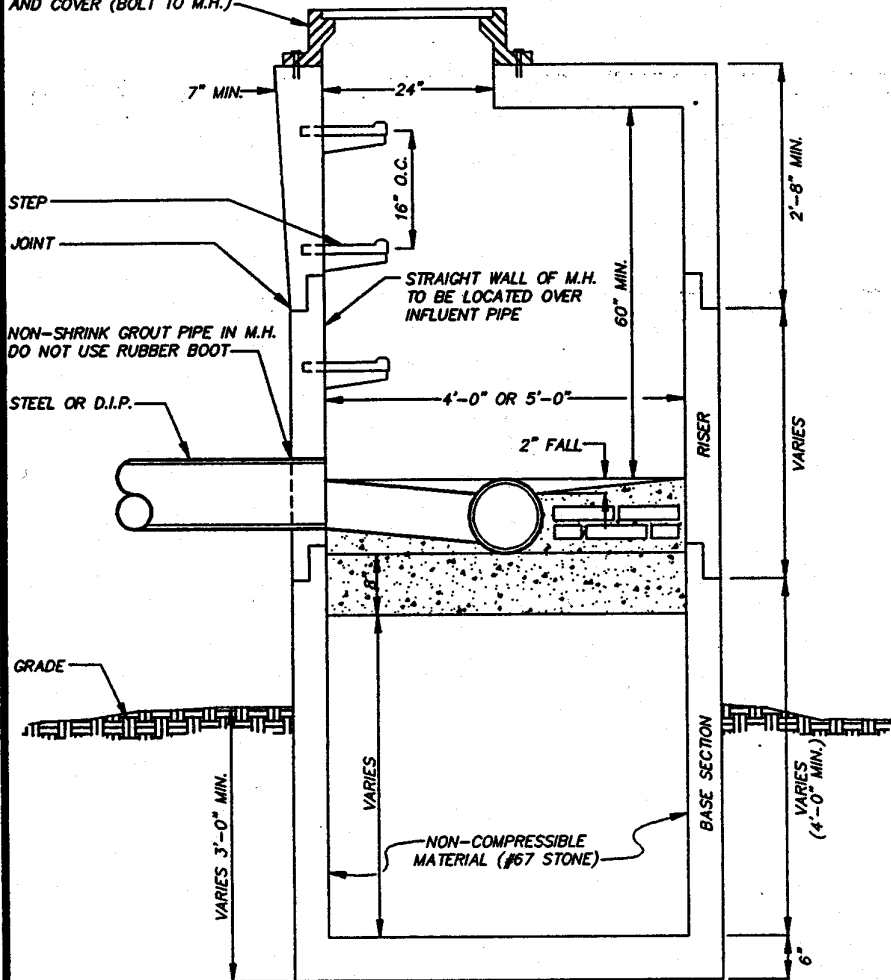
NOTES:  
1. MANHOLES SHALL ALSO COMPLY WITH STANDARD DETAILS 4 AND 7 AS APPLICABLE.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>	
<b>STANDARD DETAIL SEWER</b>	
<b>PRECAST MANHOLES INSTALLED OVER EXISTING PIPE</b>	
Job No. _____	File No. _____
PLAN Scales _____	NTS
PROFILE Hor. _____	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By <b>KHP</b>	Project-Engr _____
Approved By <b>[Signature]</b>	Date <b>2/7/94</b>
Sheet <b>8</b>	Of _____

No.	Date	By	Revision

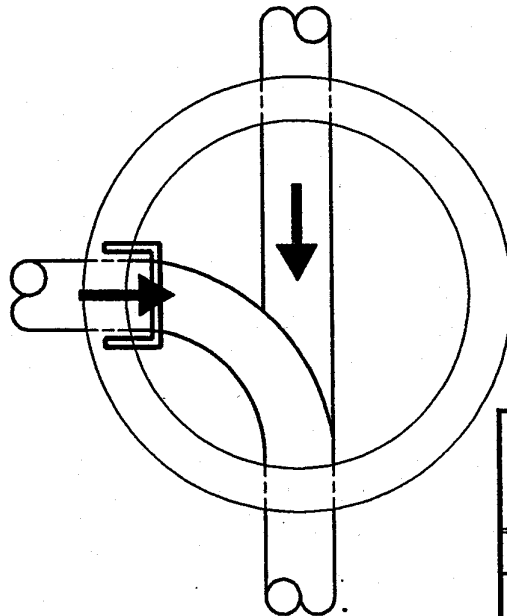
S058.DWG  
2/2/94

CITY OF CHARLOTTE  
STANDARD C.I. FRAME  
AND COVER (BOLT TO M.H.)



NOTES:

1. THIS DETAIL IS TO BE USED WHERE THE INVERT OF THE MANHOLE IS ABOVE THE EXISTING GROUND.
2. FILLING BETWEEN THE BASE AND ELEVATED FLOOR MAY BE CRUSHED STONE, BRICK BATS, OR ANY NON-COMPRESSIBLE MATERIAL. THIS FILLING SHALL BE COVERED WITH IMPERVIOUS MATERIAL BEFORE THE CONCRETE IS PLACED.
3. MANHOLES SHALL ALSO COMPLY WITH STANDARD DETAIL 4 AS APPLICABLE.



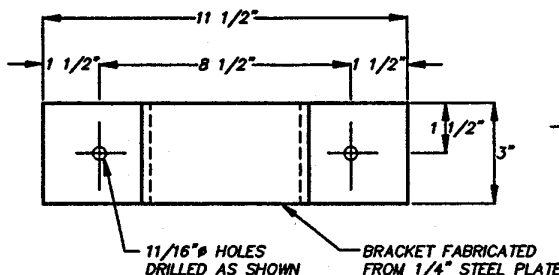
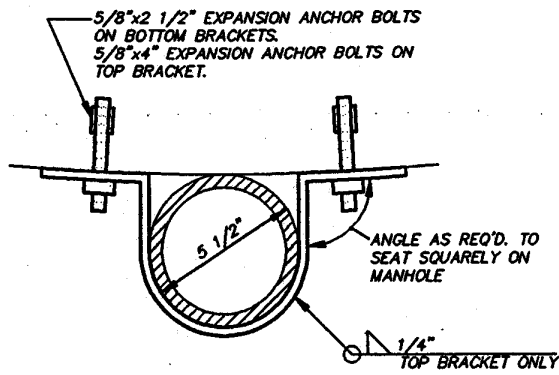
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
SEWER

PRECAST MANHOLE  
INVERT ABOVE GROUND

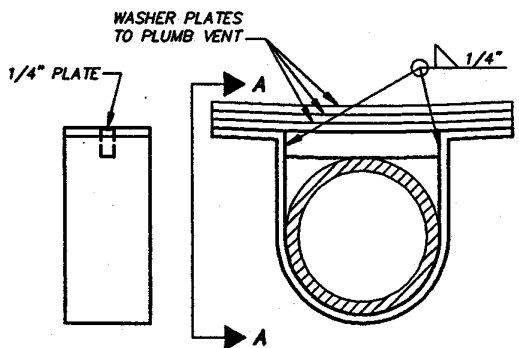
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PLAN _____	NTS									
Profile	Hor. _____	Vert. _____	As Built	Date	KHP	Project-Engr	Approved By	Date	9	Sheet Of
No.	Date	By	Revision		Surveyed By	Designed By	Drawn By	Project-Engr	Approved By	Date

USS:DWG  
7/7784



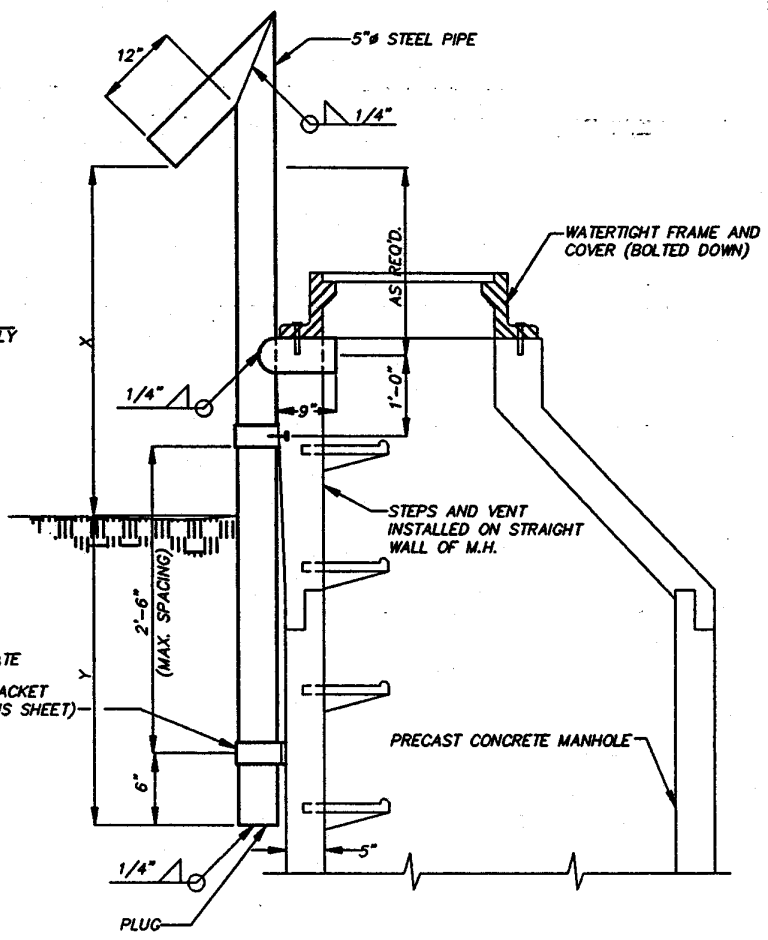
**PIPE BRACKET**

PIPE BRACKET (SEE THIS SHEET)



**SECTION A-A**

ACCORDING TO THE TYPE OF PRECAST MANHOLE, WASHER SPACERS MAY BE REQUIRED ON LOWER BRACKETS.



**NOTES:**

1. VENT SHALL BE ON CREEK SIDE AND POINT DOWNSTREAM.
2. VENT AND BRACKETS SHALL BE PAINTED PER SPECS.
3. AVOID PLACING PIPE BRACKET AT MANHOLE JOINTS OR STEPS.
4. ANCHOR SLEEVE, THREADED STUD AND NUT SHALL BE STAINLESS STEEL OR GALVANIZED STEEL.
5. ROTATE STRAIGHT WALL OF MANHOLE TO CREEKSIDE.

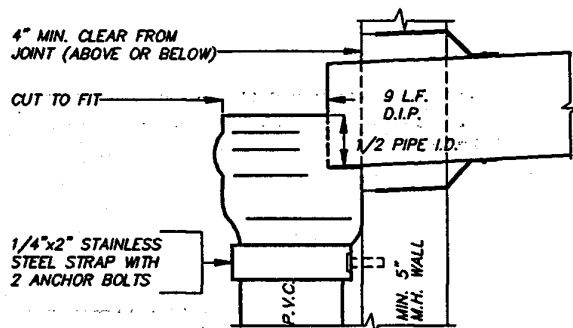
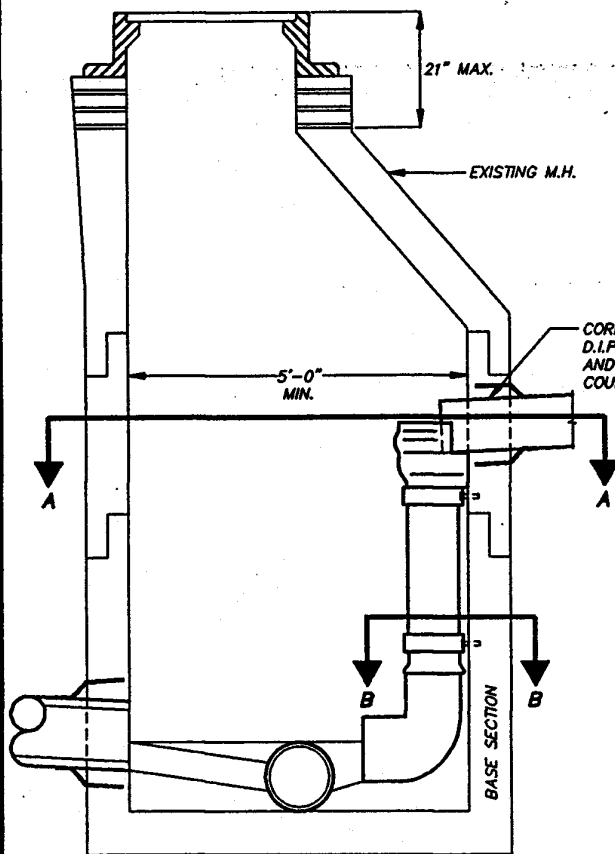
X	Y	MIN. NO. OF PIPE BRACKETS
0"-72"	60"	3
72"-84"	66"	3
OVER 84"	72"	3

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

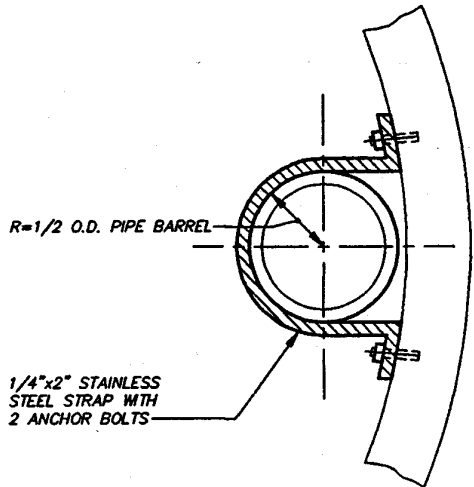
**STANDARD DETAIL  
SEWER**

**MANHOLE VENT**

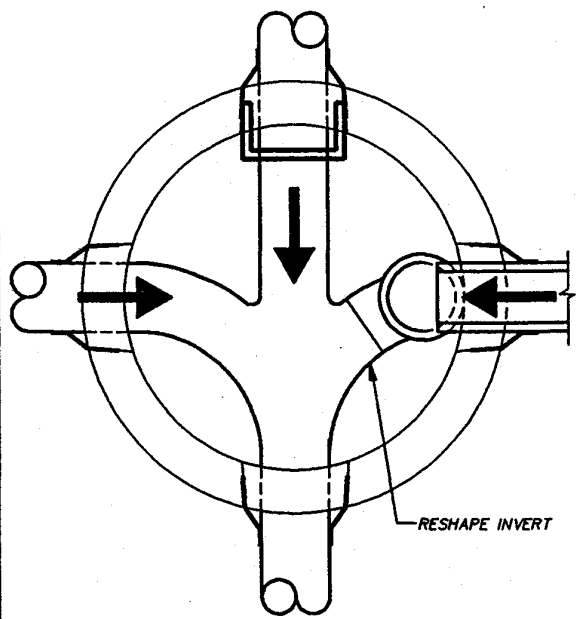
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						NTS											10	



**ENLARGED DETAIL**



**SECTION B-B**



**SECTION A-A**

**NOTES:**

1. PIPE FOR INSIDE DROP SHALL BE SDR 35 PVC CONFORMING TO ASTM SPECIFICATION D3034.
2. BOTTOM BEND TO BE 90° SHORT BEND, BELL SPIGOT, OF SDR 35 PVC. SPIGOT OF BEND TO REST DIRECTLY ON EXISTING SHELF. CONSTRUCT MASONRY TROUGH FROM DROP EFFLUENT TO MAIN CHANNEL.
3. NOTCH BELL OF PVC DROP TO ACCEPT D.I.P. SPIGOT AS SHOWN.
4. LOCATE STRAPS AT PIPE BELL AND ABOVE BELL OF 90° BEND AS SHOWN. ADD EXTRA STRAPS AS NECESSARY TO MAINTAIN MAXIMUM SPACING OF TEN FEET.
5. HOLE IN MANHOLE WALL TO MADE WITH A CORING MACHINE. INSTALL FLEXIBLE RUBBER COUPLING.
6. CORE HOLE SHALL NOT ENTER CONE SECTION.
7. STEPS SHALL BE RELOCATED IF THEY CONFLICT WITH INSIDE DROP.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

**INSIDE DROP**

Job No. _____	File No. _____
Scales	
PLAN	NTS
PROFILE	Hor. _____
	Vert. _____
As Built	Date _____
Surveyed By _____	Designed By _____

KHP	_____	_____	_____	_____	_____
Drawn By	Project-Engr	Approved By	Date	Sheet	Of
_____	_____	_____	_____	11	17

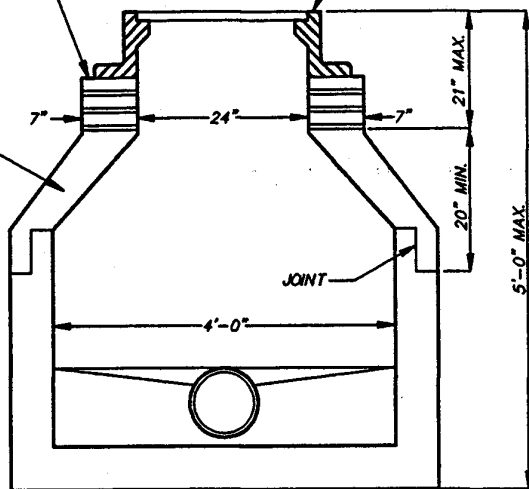
No.	Date	By	Revision

DATE PLOTTED 7/27/95

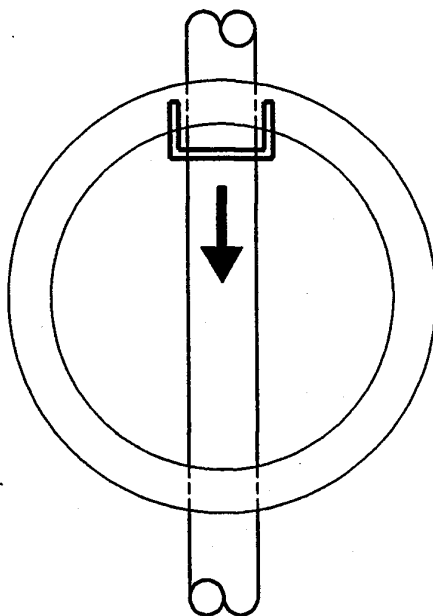
USE BRICK OR CONC. GRADE RINGS FOR ADJUSTMENT

CITY OF CHARLOTTE STANDARD C.I. FRAME AND COVER

CONCENTRIC CONCRETE



SECTION



PLAN

NOTES:

1. MANHOLE TO CONFORM TO ASTM C478 EXCEPT AS MODIFIED BELOW.
2. MANHOLE BASE TO BE REINFORCED WITH A MINIMUM AREA OF 0.20 SQ. IN. PER LINEAL FOOT EACH WAY. WALL REINFORCING TO BE A MINIMUM OF 0.12 SQ. IN. PER LINEAL FOOT. EITHER TONGUE OR GROOVE OF JOINTS SHALL HAVE REINFORCING EQUAL IN AREA TO MINIMUM OF WALL SECTION.
3. ALL JOINTS SHALL CONFORM TO ASTM C443.
4. STEPS TO BE PLASTIC PER CITY STANDARDS.
5. ALL PIPE OPENINGS TO BE NO GREATER THAN 3" LARGER THAN O.D. OF PIPE AND ADDITIONALLY REINFORCED WITH A MINIMUM OF 0.20 SQ. IN. OF STEEL AT 90 DEGREES. ADDITIONAL REINFORCING NOT REQUIRED FOR CORED OPENINGS.
6. ALL SURFACES SHALL BE SMOOTH, EVEN TEXTURED WITH A MINIMUM OF HONEYCOMB, FINS AND IMPERFECTIONS.
7. PENETRATING LIFTING HOLES SHALL BE PLUGGED WITH EXPANSION GROUT.

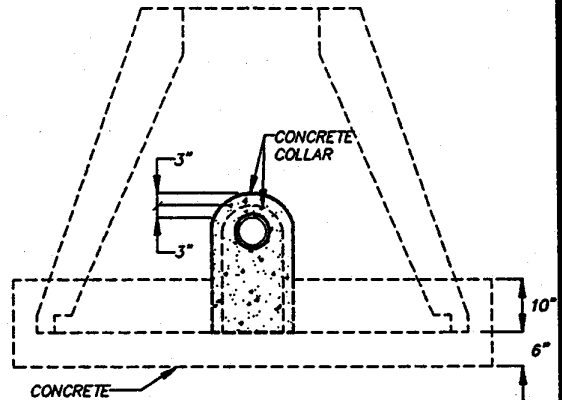
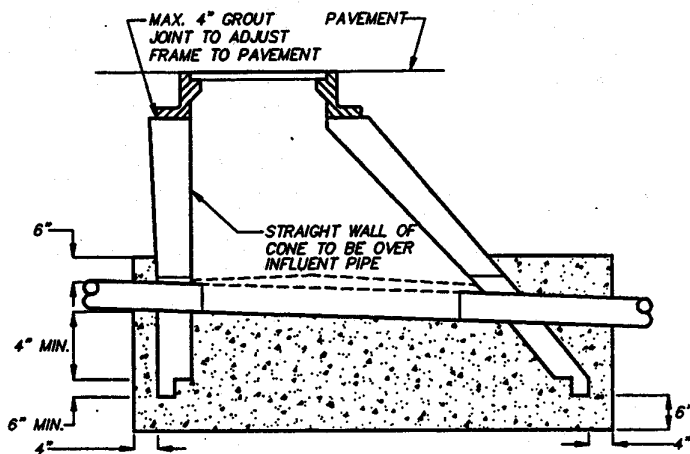
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

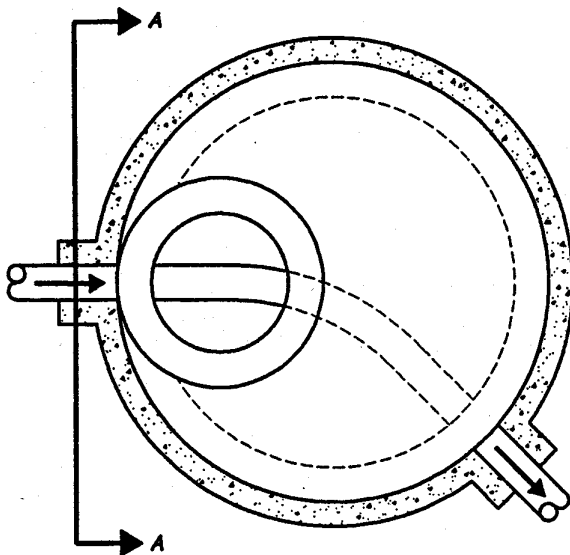
**PRECAST SHORT  
MANHOLE-4' DIAMETER**

Job No.	File No.	Scales	NTS
PLAN	PROFILE		
Hor.	Vert.	As Built	Date
Surveyed By	Designed By	Drawn By	Project-Engr
		KHP	K. B. Brown
		2/14	12
		Sheet	OF

No.	Date	By	Revision



**SECTION A-A**



**NOTES:**

1. MANHOLE TO CONFORM TO ASTM C478 EXCEPT AS MODIFIED BELOW.
2. WALL REINFORCING TO BE A MINIMUM OF 0.12 SQ. IN. PER LINEAL FOOT. EITHER TONGUE OR GROOVE OF JOINTS SHALL HAVE REINFORCING EQUAL IN AREA TO MINIMUM OF WALL SECTION.
3. ALL JOINTS SHALL CONFORM TO ASTM C443.
4. STEP TO BE DELETED FROM CONE.
5. ALL PIPE OPENINGS TO BE NO GREATER THAN 3" LARGER THAN O.D. OF PIPE AND ADDITIONALLY REINFORCED WITH A MINIMUM OF 0.20 SQ. IN. OF STEEL AT 90 DEGREES. PIPE TO BE CENTERED IN OPENINGS.
6. ALL SURFACES SHALL BE SMOOTH, EVEN TEXTURED WITH A MINIMUM OF HONEYCOMB, FINS, AND OTHER IMPERFECTIONS.
7. MANHOLE BASE SHALL BE 3600 P.S.I. CONCRETE PLACED ON UNDISTURBED EARTH AND MAY BE PLACED AGAINST SHAPED BANKS IN LIEU OF FORMS.
8. CARE MUST BE TAKEN TO FORM A SMOOTH FINISHED TROUGH FROM ENTRANCE PIPES TO EXIT PIPE, AND IN CURVED MANHOLES THE TROUGH MUST BE A SMOOTH CIRCULAR ARC TANGENT TO THE INSIDE WALLS OF THE PIPES AT THEIR ENDS.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

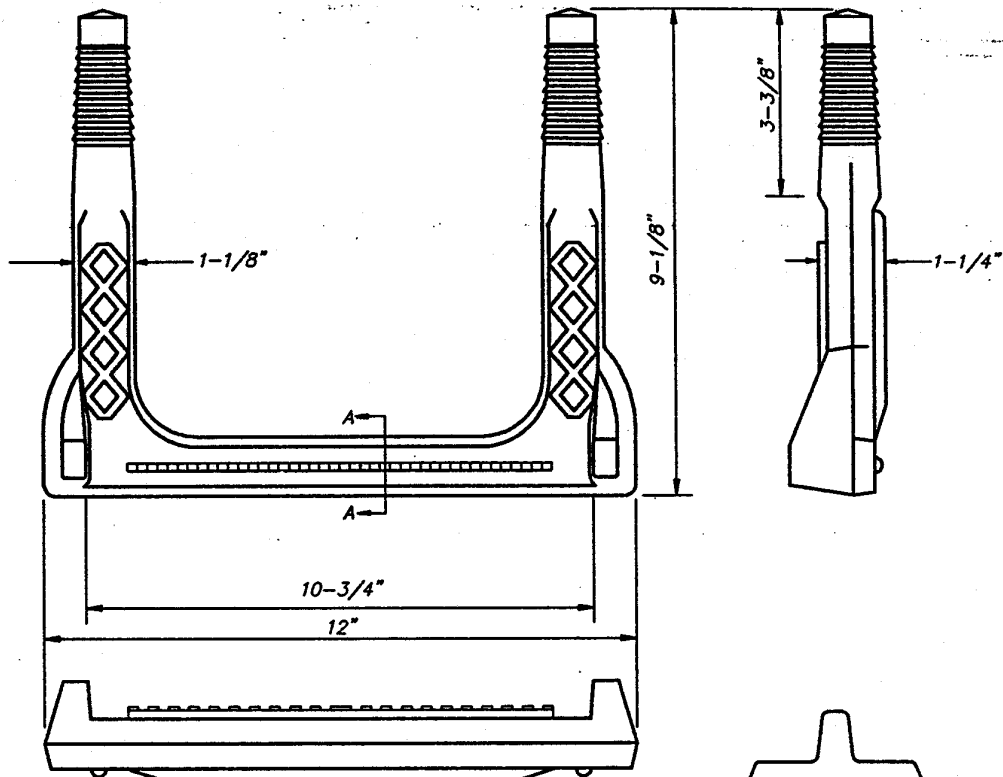
**STANDARD DETAIL  
SEWER**

**ECCENTRIC CONE SHORT  
MANHOLE-4' DIAMETER**

Job No. _____	File No. _____
Scales _____	
PLAN _____	NTS _____
PROFILE _____	Hor. _____
	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By _____	Project-Engr _____

Drawn By	Project-Engr	Approved By	Date	Sheet	Of
KHP		KD	2/4/13	13	

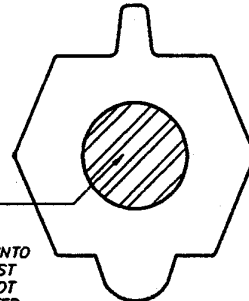
No.	Date	By	Revision



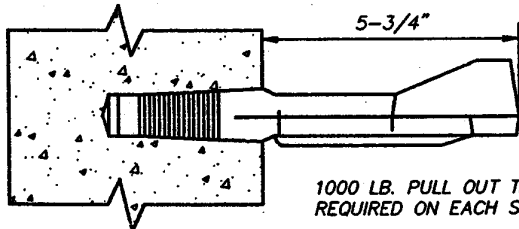
COPOLYMER POLYPROPYLENE PLASTIC

1/2" GRADE 60 STEEL REINFORCEMENT

NOTE:  
THIS STEP TO BE DRIVEN INTO  
TAPERED HOLES IN PRECAST  
MANHOLE SECTIONS. DO NOT  
USE AS A GROUTED-IN STEP.



SECTION A-A



1000 LB. PULL OUT TEST REPORT  
REQUIRED ON EACH STEP.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

**PLASTIC STEP CORED HOLE  
DRIVEN IN PLACE**

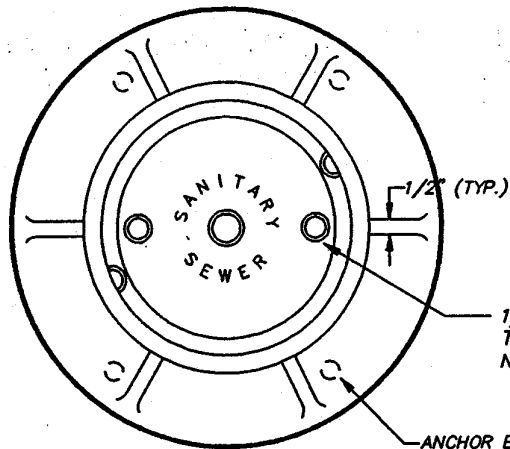
Job No. _____	File No. _____
Scales _____	
PLAN _____	NTS
PROFILE _____	
Hor. _____	
Vert. _____	
As Built _____	Date _____
Surveyed By _____	Designed By _____

MSW _____	Project-Engr _____	Approved By _____	Date _____	Sheet 14	Of _____
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No.	Date	By	Revision

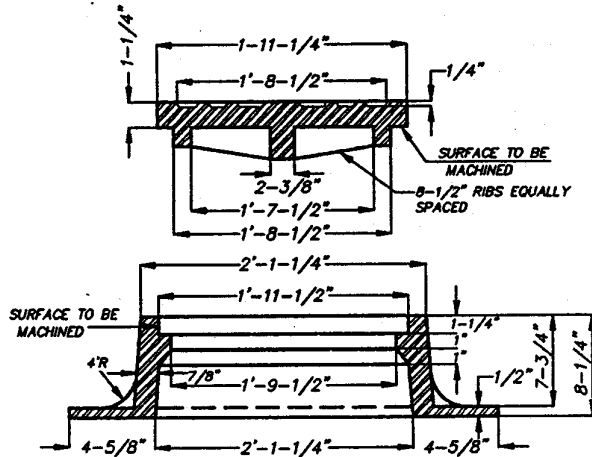
02/08/94



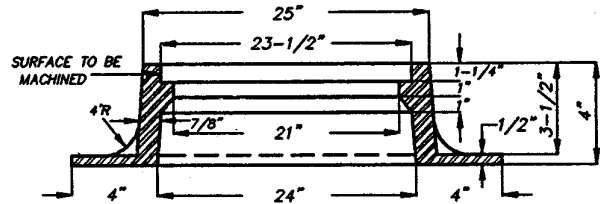


1/4" RIM RAISED 1/4" 1" HOLE AT TOP, TAPER TO 1-1/8" AT BOTTOM. NO HOLE FOR WATERTIGHT F & C.

ANCHOR BOLT HOLE



**STANDARD HEIGHT**



**SHORT - 4 INCH HEIGHT**

**NOTES:**

1. ALL CASTING TO BE FREE FROM SAND HOLES AND NO PLUGGING WILL BE ALLOWED.
2. CAST WITH THE USE OF ALUMINUM PATTERNS.
3. SLIGHT DRAFT ALLOWED ON STRAIGHT FACES.
4. APPROXIMATE WEIGHT OF FRAME 230 LBS.  
APPROXIMATE WEIGHT OF FRAME 143 LBS.  
APPROXIMATE WEIGHT OF FRAME 373 LBS.
5. WHEN THE MANHOLE RIM IS ABOVE FINISH GRADE, THE FRAME WILL BE BOLTED TO THE MANHOLE CONE AS SPECIFIED.
6. WATERTIGHT COVERS WITH GASKETS SHALL BE USED WHERE SHOWN ON CONSTRUCTION PLANS.
7. BOLT HOLE SHALL NOT BE GREATER THAN BOLT DIA. PLUS 1/8".
8. SLIGHT VARIATION IN DIMENSIONS NOT CRITICAL TO INTER-CHANGEABILITY ARE PERMITTED. ENGINEER'S APPROVAL REQUIRED FOR EACH FRAME AND COVER.
9. 4 INCH TALL FRAME WILL ONLY BE ALLOWED WHERE FRAME IS BOLTED TO MANHOLE.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

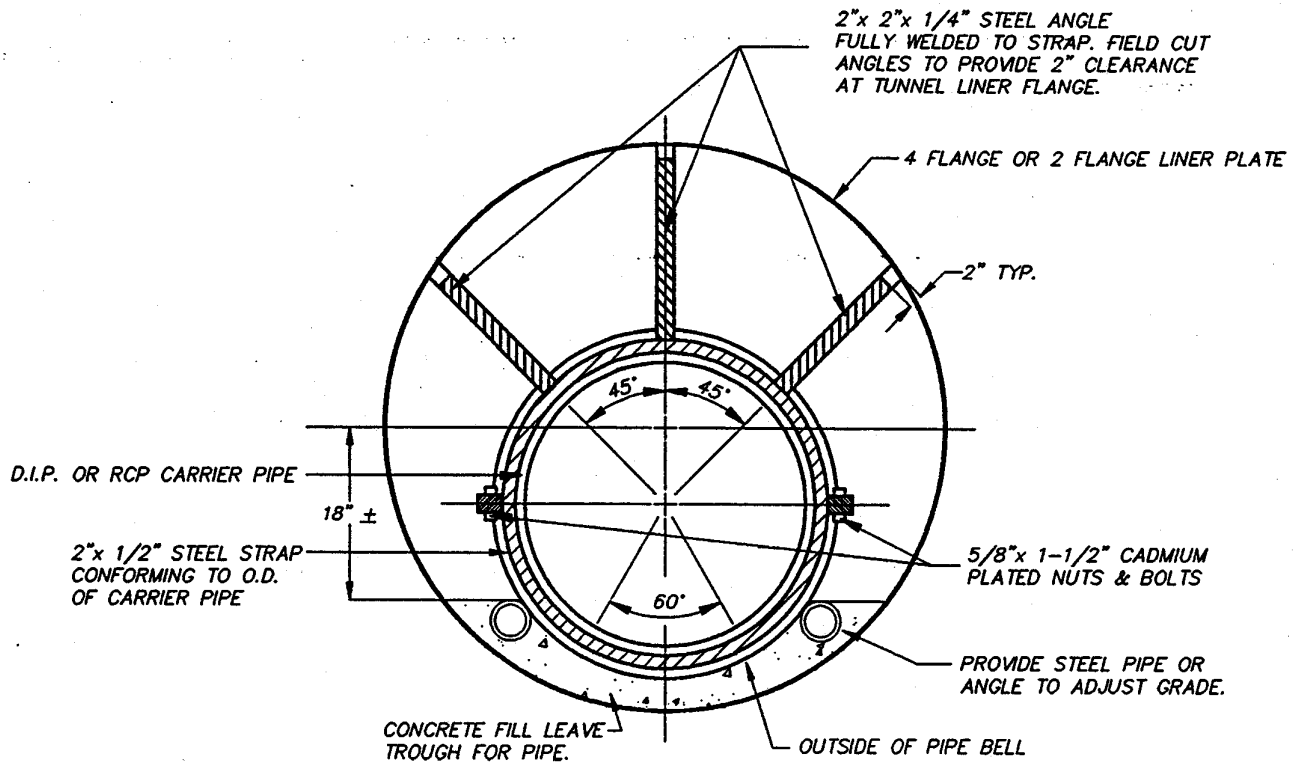
**STANDARD DETAIL  
SEWER**

**CAST IRON FRAME AND COVER  
SANITARY SEWER MANHOLES**

Job No.	File No.
Scales	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Engr

MSW	2. Blaylock	2/24	Sheet 15 of
Drawn By	Project-Engr	Approved By	Date

No.	Date	By	Revision



**NOTES:**

1. COAT ENTIRE SPIDER WITH COAL TAR BEFORE ASSEMBLY ON CARRIER PIPE. TOUCH UP BEFORE JACKING PIPE.
2. ONE SPIDER REQUIRED FOR EACH JOINT OF CARRIER PIPE.
3. SEAL TUNNEL ENDS PER SPECIFICATIONS.
4. PLACE CONCRETE FILL PRIOR TO PIPE INSTALLATION.
5. SPIDER DETAILS OR ALTERNATIVE SHALL BE SUBMITTED FOR APPROVAL.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

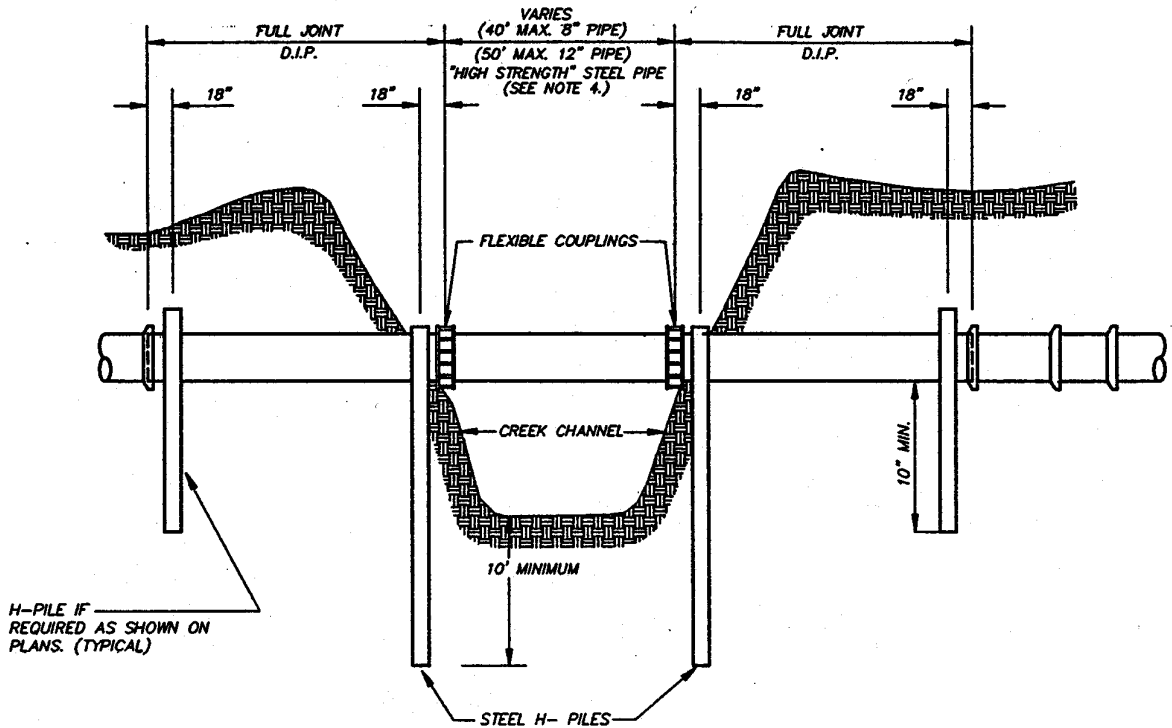
**STANDARD DETAIL  
SEWER**

**TUNNEL LINER SECTION**

Job No.	File No.
Scales	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Engr
Approved By	Date

No.	Date	By	Revision

MSW	K. Blayton	2/16	Sheet 16 of
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**NOTES:**

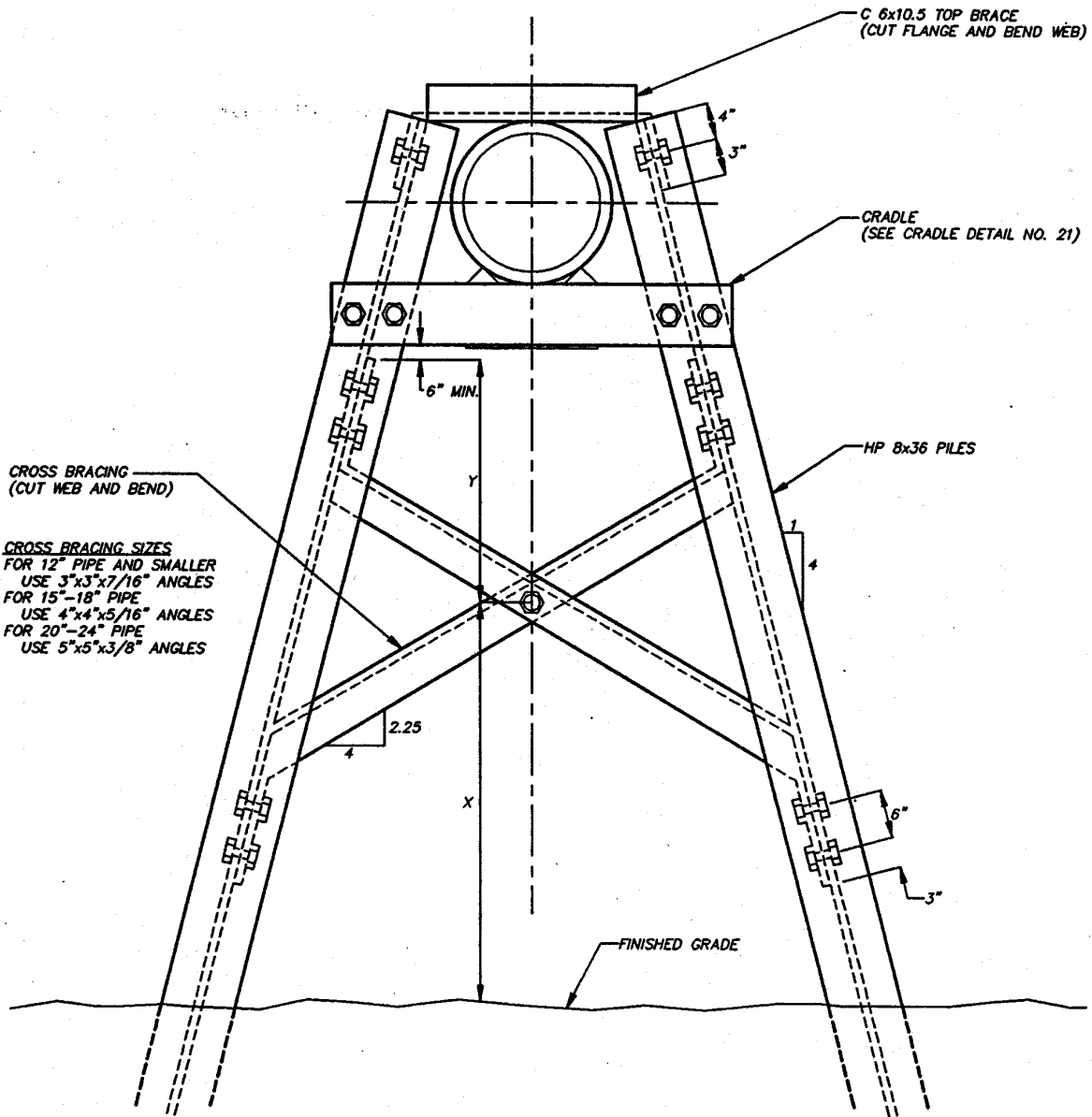
1. FLEXIBLE COUPLING SHALL BE LONG BODY TYPE.
2. MINIMUM DEPTHS SHALL BE IN UNDISTURBED SOIL.
3. MAXIMUM HEIGHT FROM PIPE TO BE UNDISTURBED SOIL IS 20 FEET.
4. STEEL PIPE MUST BE SEAMLESS OR STRAIGHTSEAM. SPIRAL WELD NOT PERMITTED.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

**CREEK CROSSING  
STEEL H-PILES**

Job No. _____		File No. _____		<b>MSW</b>		<b>CRB</b>		Sheet <b>17</b> Of _____	
Scales <b>NTS</b>									
PLAN		Hor. _____		Surveyed By _____		Designed By _____		Project-Engr _____	
PROFILE		Vert. _____		As Built _____		Date _____		Approved By _____	
No.	Date	By	Revision						



CROSS BRACING  
(CUT WEB AND BEND)

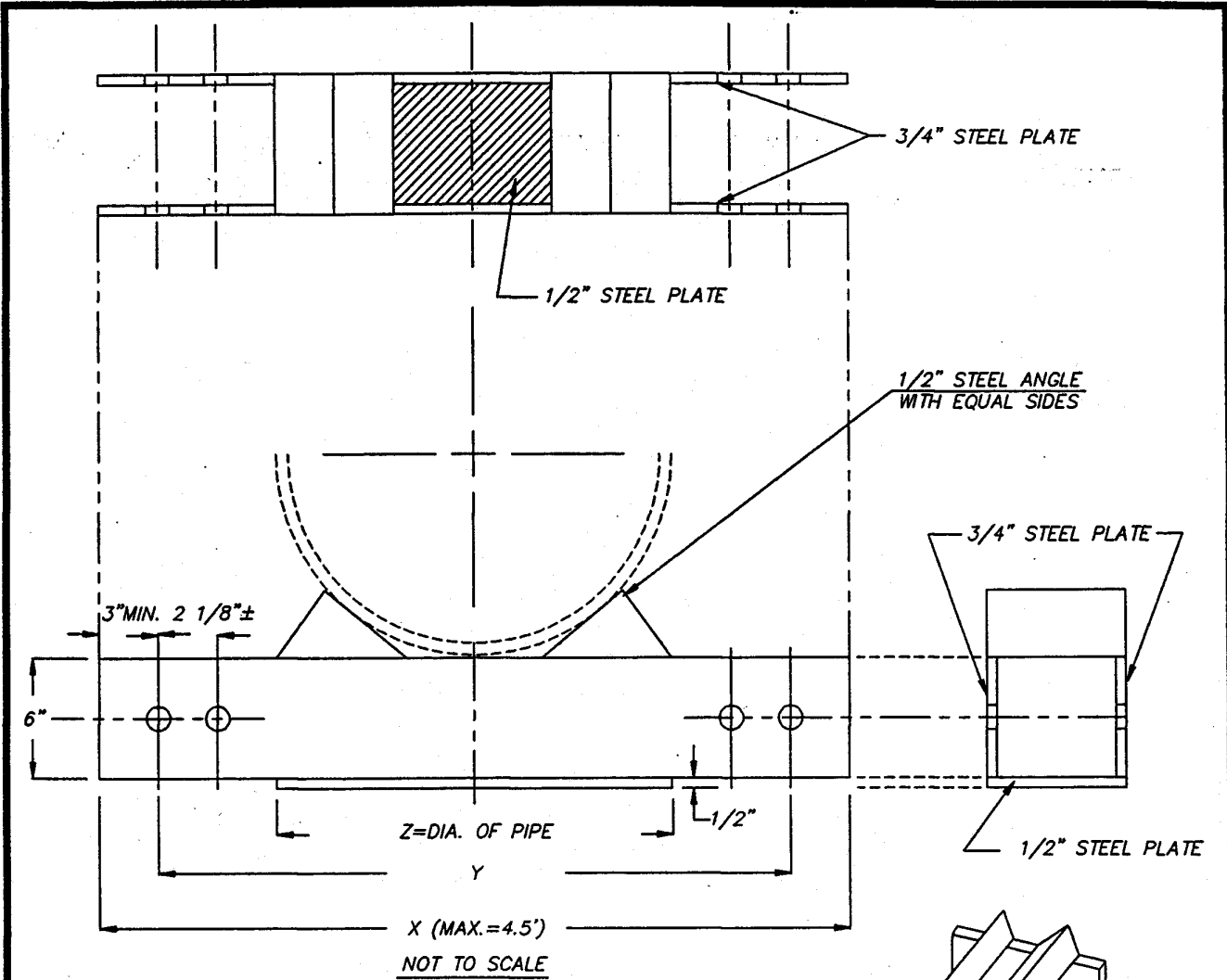
**CROSS BRACING SIZES**  
 FOR 12" PIPE AND SMALLER  
 USE 3"x3"x7/16" ANGLES  
 FOR 15"-18" PIPE  
 USE 4"x4"x5/16" ANGLES  
 FOR 20"-24" PIPE  
 USE 5"x5"x3/8" ANGLES

**NOTES:**

1. MAXIMUM HEIGHT FROM PIPE TO UNDISTURBED SOIL IS 20 FEET.
2. PIPE SHALL FIT SNUGLY.
3. X SHALL EQUAL Y OR AS APPROVED.
4. FOR 8 INCH TO 18 INCH PIPE ALL BOLTS SHALL BE 7/8" IN DIAMETER AND MEET ASTM A325. FOR 24" PIPE, BOLTS ON THE CRADLE SHALL BE 1" IN DIAMETER AND MEET ASTM A490. BOLTS SHALL BE AT LEAST 2 1/2" LONG. PLAIN ROUND WASHERS WILL BE REQUIRED.
5. BOLT HOLES SHALL BE 1/16" LARGER THAN THE DIAMETER OF THE BOLT AND SHALL BE DRILLED.
6. ALL STEEL SHALL BE A36 STEEL.
7. SEE STEEL H-PILE SPECIFICATIONS.
8. PILES SHALL BE DRIVEN TO A MINIMUM DEPTH OF TEN (10) FEET BELOW GROUND OR AS DIRECTED BY THE ENGINEER.
9. PILES SHALL BE DRIVEN TO A DEPTH AT WHICH PILE BEARING CAPACITY IS TWENTY (20) TONS OR AS APPROVED BY THE ENGINEER.
10. THESE PIERS SHALL BE USED FOR DUCTILE IRON PIPE OR HIGH STRENGTH STEEL PIPE ONLY.
11. CONTRACTOR MAY SUBSTITUTE WBx35 FOR HP8x36 FOR THE PILES.

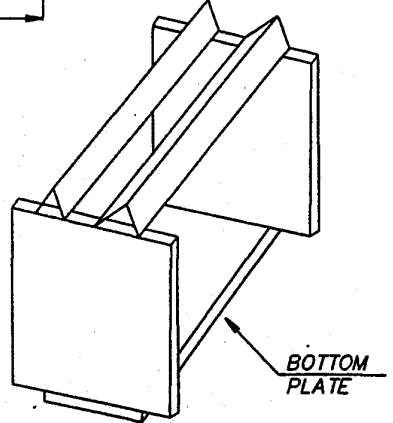
<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>																	
Job No. _____ File No. _____ Scales _____ PLAN _____ NTS _____ PROFILE _____ Hor. _____ Vert. _____ As Built _____ Date _____ Surveyed By _____ Designed By _____	<b>STANDARD DETAIL SEWER</b>  <b>STEEL H-PILES PIERS FOR 24" PIPE AND SMALLER</b>																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">No.</td> <td style="width: 25%;">Date</td> <td style="width: 25%;">By</td> <td style="width: 25%;">Revision</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	No.	Date	By	Revision					<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">KHP</td> <td style="width: 25%;">C. Bayly</td> <td style="width: 25%;">2/24</td> <td style="width: 25%;">18</td> </tr> <tr> <td>Drawn By</td> <td>Project-Engr</td> <td>Approved By</td> <td>Date</td> </tr> </table>	KHP	C. Bayly	2/24	18	Drawn By	Project-Engr	Approved By	Date
No.	Date	By	Revision														
KHP	C. Bayly	2/24	18														
Drawn By	Project-Engr	Approved By	Date														

2/10/74



**NOTES:**

1. DIMENSIONS X AND Y VARY ACCORDING TO PIPE SIZE ELEVATION OF PIPE. THE MAXIMUM LENGTH OF X IS 4.5'.
2. DIMENSION Z IS EQUAL TO THE DIAMETER OF THE PIPE.
3. ALL STEEL PLATES SHALL MEET ASTM A36.
4. FOR 8 INCH - 18 INCH PIPE ALL BOLTS SHALL BE 7/8" IN DIAMETER AND MEET ASTM A325. FOR 24 INCH PIPE, BOLTS ON THE CRADLE SHALL BE 1" DIAMETER AND MEET ASTM A490. BOLTS SHALL BE AT LEAST 2 1/2" LONG. PLAIN ROUND WASHERS WILL BE REQUIRED.
5. BOLT HOLES SHALL BE 1/16" LARGER THAN THE DIAMETER OF THE BOLT AND SHALL BE DRILLED.
6. THIS CRADLE SHALL NOT BE USED FOR PIPE LARGER THAN 24" IN DIAMETER.
7. ATTACH THE CRADLE TO THE PILES WITH FOUR(4) BOLTS ON EACH SIDE [TOTAL OF EIGHT (8) BOLTS].
8. ATTACH BOTTOM PLATE TO CRADLE SIDES WITH A CONTINUOUS 3/8" FILLET WELD.
9. THE 1/2" STEEL ANGLES SHALL BE SPOT WELDED TO THE SIDES OF THE CRADLE.



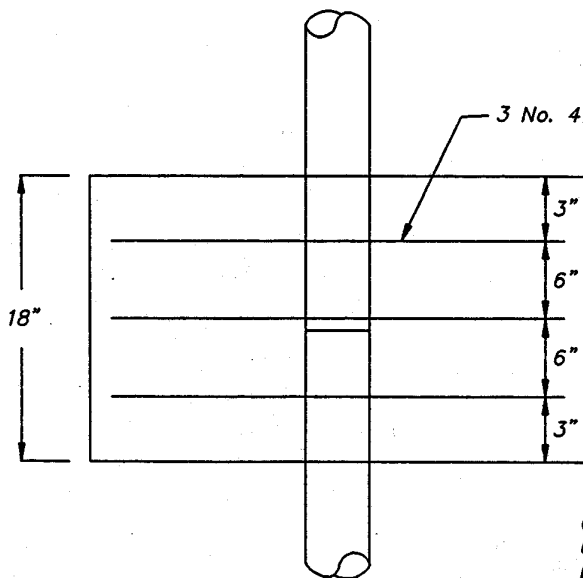
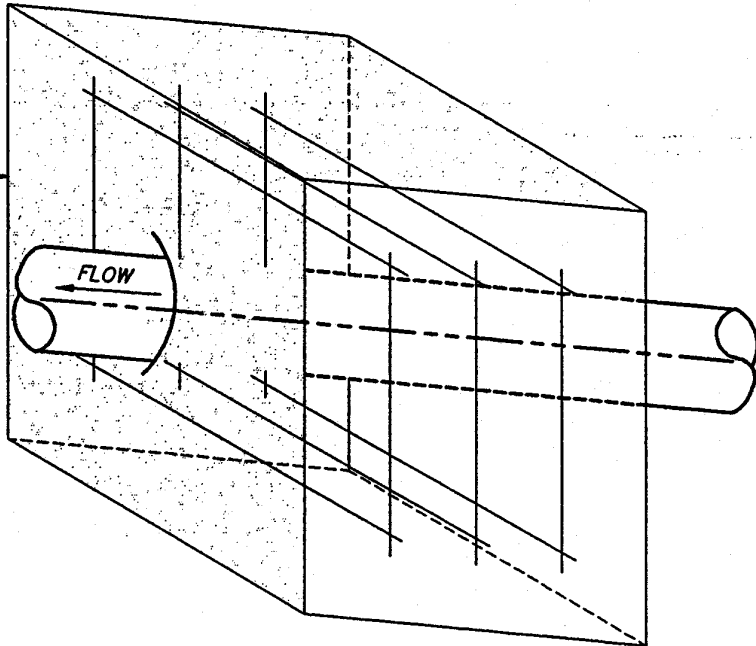
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL SEWER</b>	
Scales _____		<b>PIER CRADLE 24" PIPE &amp; SMALLER</b>	
PLAN _____	PROFILE _____		
Hor. _____		As Built _____ Date _____	
Vert. _____		Surveyed By _____	Designed By _____
Drawn By <i>JRW</i>		Project-Engr _____	Approved By <i>K. Blalock</i> <span style="float: right;">Sheet 19 Of</span>

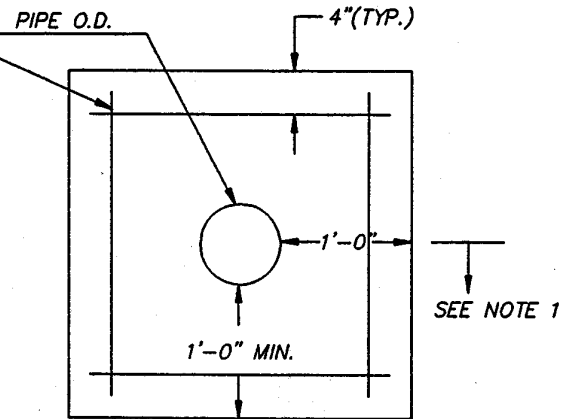
No.	Date	By	Revision

POURED IN PLACE

CONCRETE



PLAN VIEW



CONC. PLACED ON UNDISTURBED SOIL AS DETERMINED BY THE ENGINEER

VERTICAL VIEW

**NOTES:**

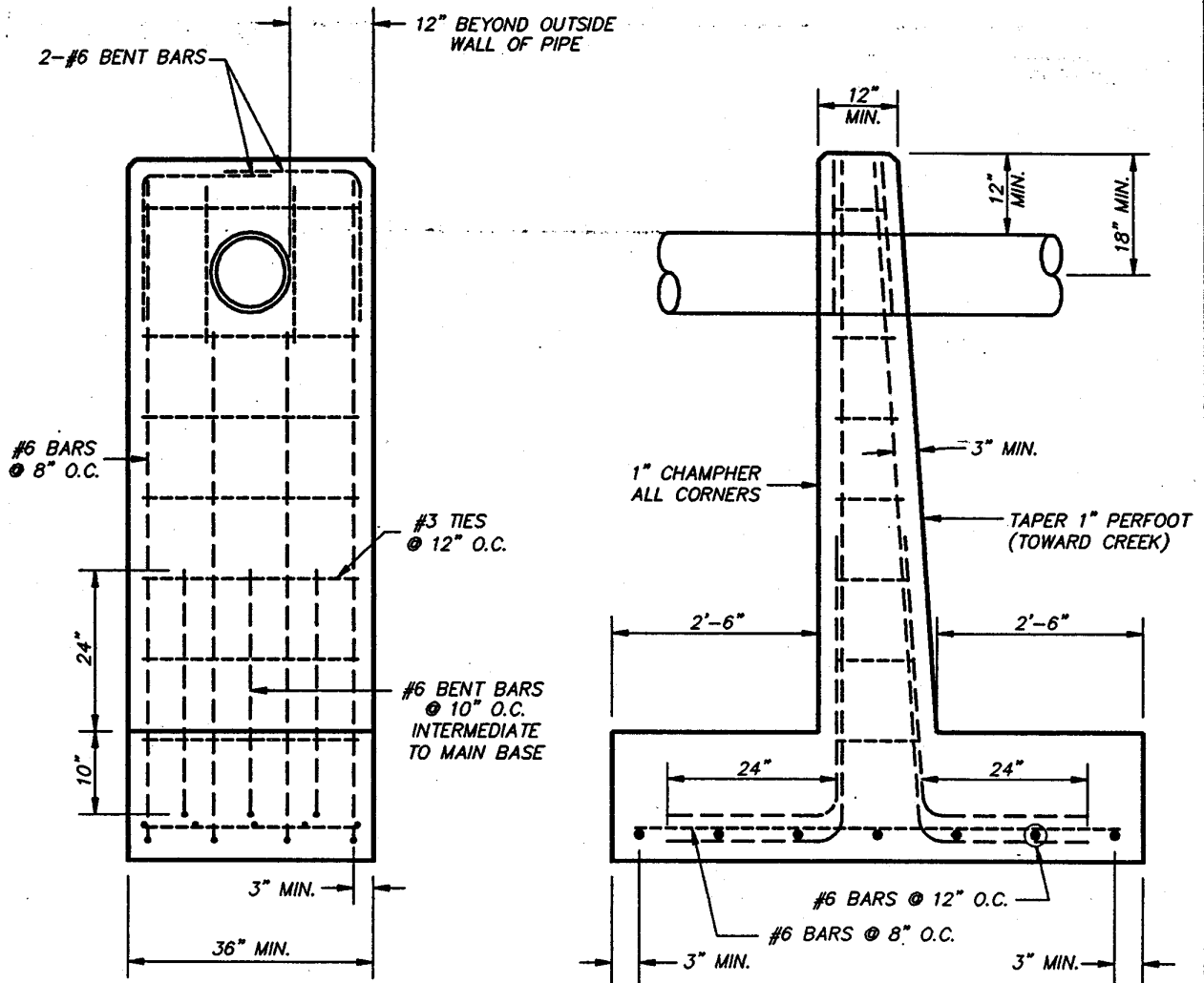
- FORMS NOT REQUIRED BELOW SPRING LINE, CONCRETE MAY BE PLACED AGAINST SHAPED BANKS IN LIEU OF FORMS.

<b>CHARLOTTE—MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL SEWER</b>	
Scales _____		<b>CONCRETE COLLAR</b>	
PLAN PROFILE _____			
Hor. _____		As Built _____ Date _____	
Vert. _____		Surveyed By _____ Designed By _____	
_____		Drawn By <u>JRW</u> Project-Engr _____	
_____		Approved By <u>E. B. [Signature]</u> Date <u>20</u>	
No.	Date	By	Revision





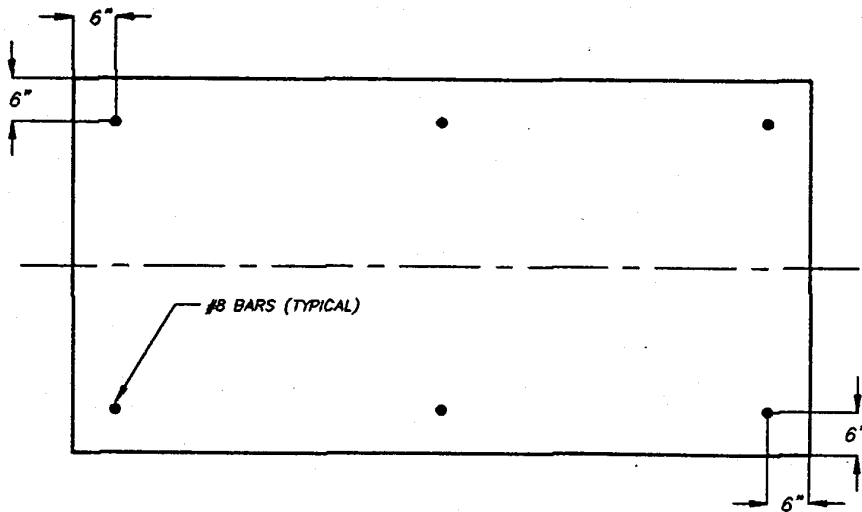
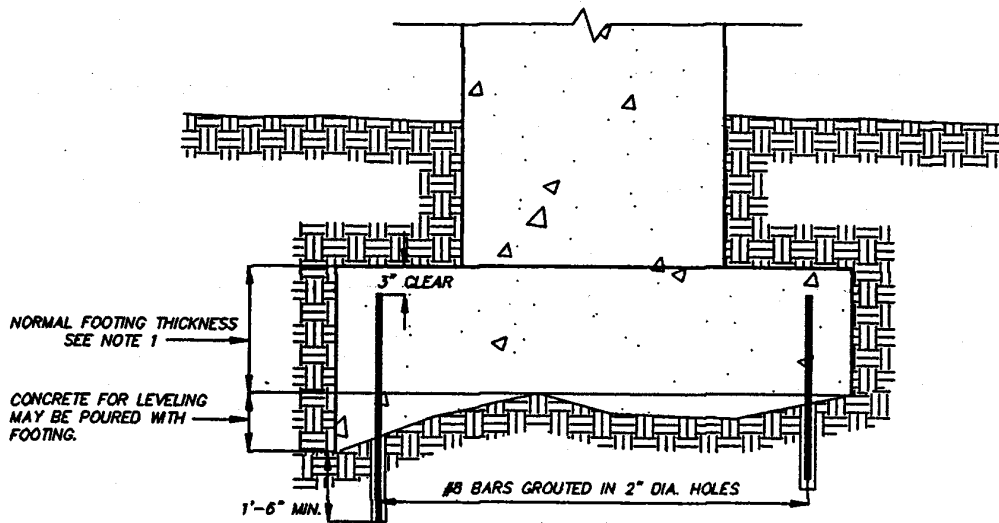




**NOTES:**

1. ALL CONCRETE TO BE 3600 PSI.
2. DEPTH OF PIERS TO BE DETERMINED BY THE ENGINEER.
3. FOOTING THICKNESS SAME AS BASE THICKNESS OF PIER, BUT NOT TO EXCEED 2'-0".
4. PIERS TO BE BUILT WITH LONG SIDE OF FOOTING PERPENDICULAR TO CREEK FLOW.
5. REINFORCING STEEL TO BE PLACED WITH A MINIMUM CLEARANCE OF 3" WITH THE SURFACE OF THE CONCRETE.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
<b>STANDARD DETAIL SEWER</b>			
<b>REINFORCED CONCRETE ANCHOR PIER</b>			
Job No. _____	File No. _____		
Scales			
PLAN _____	NTS		
PROFILE _____	Hor. _____		
	Vert. _____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	MSW	Project-Engr _____
		Drawn By _____	Approved By _____
			Date 23



NOTES:

1. MINIMUM THICKNESS OF FOOTING ABOVE ROCK TO BE SAME AS BASE THICKNESS OF PIER.
2. MAT STEEL FOR FOOTING SHALL BE TIED TO DOWELS.
3. CONCRETE SHALL BE 3600 PSI.

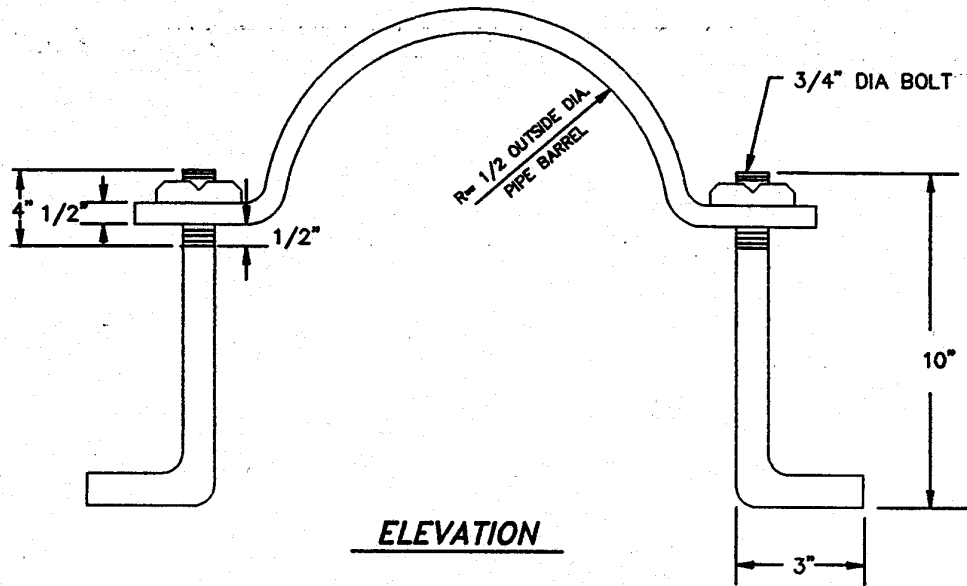
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
SEWER

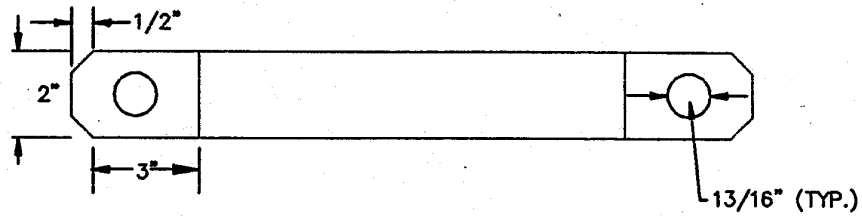
PIER FOOTING ON ROCK

Job No. _____	File No. _____	MSW		K. D. [Signature]	2/24	Sheet 24	Of _____
PLAN _____	Scale _____						
PROFILE _____	NTS						
Hor. _____	Vert. _____	As Built _____		Date _____			
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____	Approved By _____	Date _____		

No.	Date	By	Revision



ELEVATION



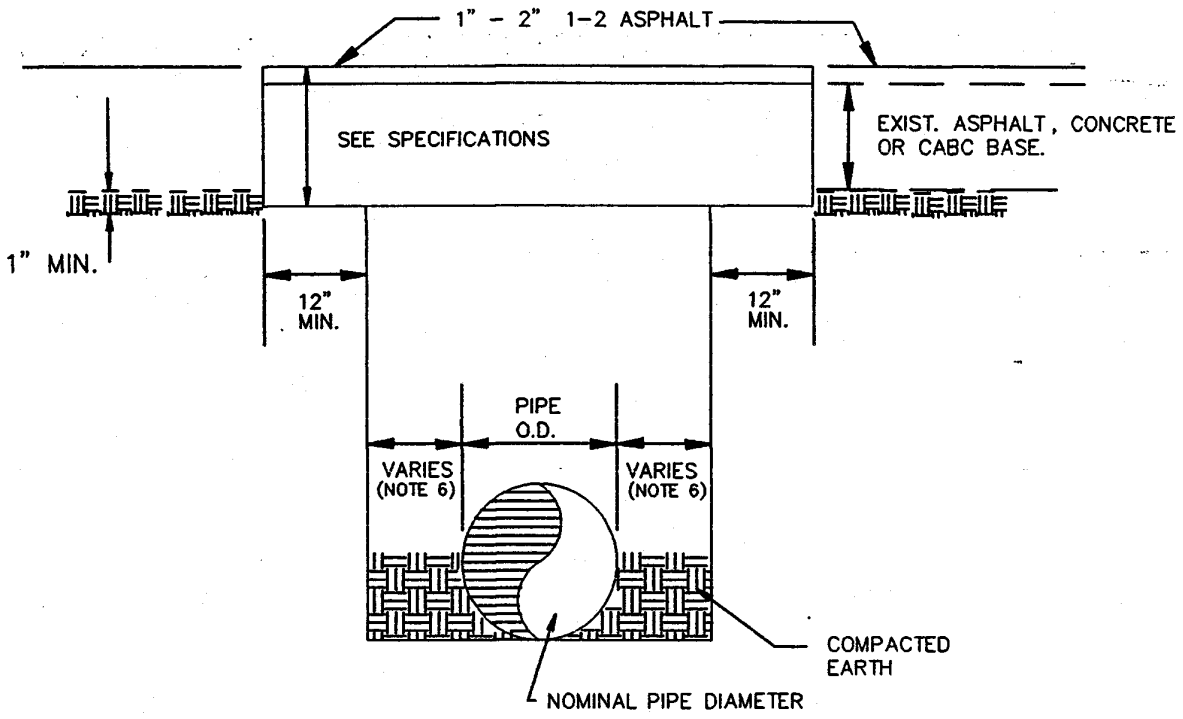
PLAN

NOTES:

1. ANCHOR BOLTS AND STRAPS SHALL BE GALVANIZED AND HOT ASPHALT DIPPED.
2. GALVANIZED STEEL OR IRON CAN BE USED.
3. FOR PIPES 24" AND LARGER USE 1" DIA. BOLTS. AND 1 1/16"  $\phi$  HOLE IN STRAP
4. HOLES TO BE DRILLED IN STRAP.
5. PROVIDE WASHERS UNDER STRAP SUCH THAT STRAP IS PULLED DOWN TIGHT.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____ Scales <b>NTS</b>		<b>STANDARD DETAIL SEWER</b>	
PLAN PROFILE Hor. _____ Vert. _____ As Built _____ Date _____		<b>PIPE STRAPS FOR PIERS</b>	
No. _____ Date _____ By _____ Revision _____	Surveyed By _____ Designed By _____	Drawn By <b>S.C.</b> Project-Engr _____	Approved By <b>L. Blalock</b> Date <b>25</b>

07/23/94



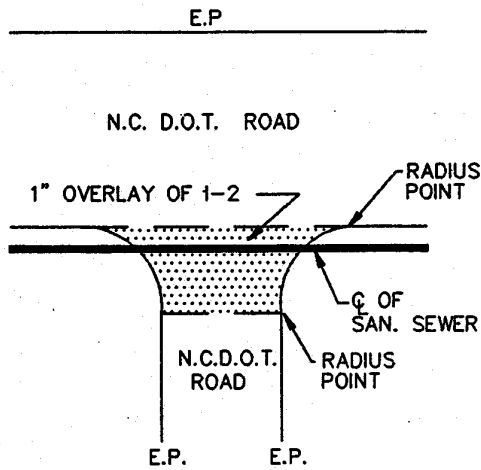
**ELEVATION SECTION**

**NOTES:**

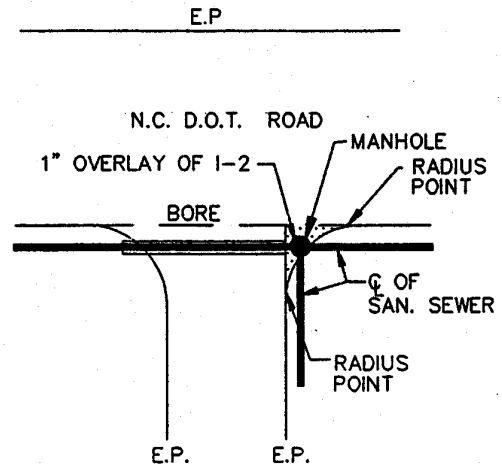
1. ALL CONCRETE AND ASPHALT PAVEMENT, INCLUDING DRIVEWAYS, TO BE CUT WITH A SAW.
2. WHERE CONCRETE PAVEMENT IS OVERLAID WITH ASPHALT H-BINDER MAY BE SUBSTITUTED FOR CONCRETE, AS A BASE MATERIAL, WITH THE APPROVAL OF THE CONTROLLING AGENCY.
3. ALL PAVEMENT REPAIRS ARE SUBJECT TO APPROVAL BY CITY OF CHARLOTTE D.O.T. AS APPLICABLE.
4. 12-INCH MIN. MINIMUM CUT OUTSIDE TRENCH IS ALSO REQUIRED FOR SLOPED TRENCH WALLS.
5. SHORING REQUIRED IN ACCORDANCE WITH OSHA STANDARDS, PART 1926, SUBPART P.
6. SEE DETAILED SPECIFICATIONS FOR TRENCH WIDTH.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____ Scales <b>NTS</b>		<b>STANDARD DETAIL SEWER</b>	
PLAN _____ PROFILE Hor. _____ Vert. _____			
As Built _____ Date _____		<b>PAVEMENT REPAIR DETAIL</b>	
No. _____ Date _____ By _____	Revision _____	SC _____ Drawn By _____	Project-Engr. <b>KBl</b> Approved By <b>Yag</b> Date <b>26</b>
Surveied By _____ Designed By _____		Sheet <b>26</b> Of _____	

01/23/94



**PLAN VIEW**



**PLAN VIEW**

**NOTES:**

1. ALL SHORING WILL BE ACCORDING TO OSHA TRENCHING STANDARDS PART 1926 SUBPART P.
2. PAVEMENT OVERLAY IS IN ADDITION TO PAVEMENT REPAIR PER STANDARD DETAIL 27.
3. FEATHER OVERLAY SMOOTHLY INTO EXISTING PAVEMENT.
4. THIS DETAIL APPLIES TO N.C. DEPARTMENT OF TRANSPORTATION ROADS ONLY, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL SEWER</b>	
Scales _____			
PLAN _____	NTS	<b>1-2. SURFACE COURSE OVERLAY</b>	
PROFILE _____	Hor. _____ Vert. _____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	S.C. _____	Project-Engr _____
		Approved By <i>K. Black</i>	Date <i>7/27</i>
		Sheet <b>27</b>	Of _____

No.	Date	By	Revision

## **XVI. ENVIRONMENTAL PROTECTION**

The purpose of this section is to provide the Contractor with specific guidelines pertaining to protection of the environment during the construction of this project. The intent is to reduce soil erosion, siltation, air pollution, water pollution and noise to their lowest reasonably achievable levels. The Contractor shall fully comply with the provisions of this section, with any provisions pertaining to Environmental Protection contained in the Special Provisions Section of this document and with the specific erosion/siltation control devices and requirements shown on the construction plans. In the event of conflicting specifications, the more restrictive shall apply.

### **A. TREES:**

1. City Ordinance 722, Chapter 22, is quoted as follows:

"Any person desiring for any lawful purpose to remove, destroy, cut, severely prune (including the root system), or treat with a view to its preservation from disease or insects, any tree or shrub in or upon any public street or public property owned (or maintained) by the City of Charlotte, its agencies, boards, authorities, and commissions, shall first obtain a written permit (from the City Arborist) hereinafter provided for, on forms furnished by the City Landscaping Division. Any work performed under such permit must be done in strict accordance with the conditions of the permit and the provisions of this chapter."

The violation of any provision of Chapter 22 shall constitute a misdemeanor as provided by G.S. 14-4 and Section 1-6 of the City Code.

The above ordinance shall cover all trees encountered throughout this project. The requirement for a permit shall not apply to trees located within sanitary sewer or water main rights-of-way or temporary construction easements crossing private properties. The Contractor shall, however, conduct his operations in a manner to prevent limb, bark, or root injuries to trees, shrubs, or other types of vegetation that are to remain growing and also to prevent damage on adjacent property. When any such injuries unavoidably occur, all rough or scarred areas shall first be made reasonably smooth in accordance with generally accepted horticultural practices and the scars then thoroughly covered with an asphaltum base tree paint. Any trees or shrubs that are damaged, by any work pursuant to this contract, to such an extent as to destroy their value for shade or other landscape purposes, shall be reported to the owner (when the tree or shrub is off the right-of-way), the City Arborist, and the Construction Engineer for their cumulative decision as to the action that must be taken.

The Contractor will note that selective clearing operations may be required within public rights-of-way and temporary construction easements. Unless otherwise specified, all trees totally within permanent sewer or water rights-of-way will be

cleared. This may require the Contractor to implement care and caution when working in the vicinity of trees which are to remain and may further necessitate the use of guy wires or tie downs to hold small (less than 6" in diameter) or valuable trees in place during and after construction until such time as the root system re-establishes itself. Badly damaged roots shall be pruned back to healthy tissue, treated and trenches backfilled as soon as possible. Trees should be pruned sufficiently to balance the remaining roots and the wounds treated. If, for example, one-fourth of the feeding roots have been destroyed, the leaf surface shall also be reduced at least one-fourth without topping or improper pruning.

Valuable trees shall be provided with suitable protective devices or barriers placed in such a manner as to prevent mechanical injuries. Figures 1 and 2 below are examples of approved protective devices. The Contractor shall also do all that is reasonably possible to prevent consolidation and puddling of the soil over root systems of trees to be left in place.

2. Trenching Around Trees: When a trench is excavated within the drip area of a tree, the following procedures will be required as a minimum. Additional measures may be required by the property owner or the City Arborist and such requirements will be included as Special Provisions.
  - a. All roots that must be cut shall be cut cleanly.
  - b. Roots more than one inch (1") in diameter shall be treated with an approved wound dressing compound made specifically for that purpose and approved by the Engineer.
  - c. The trench must be backfilled as soon as possible. Roots shall not be exposed to air for extended periods and air pockets shall not be left in the backfill.
  - d. If the trench must be left open (e.g. at manhole locations), the roots shall be kept moist with wet burlap or peat moss.
  - e. The leaf surface of the tree shall be pruned back as directed by the Engineer or City Arborist, an amount proportional to the root loss.
  - f. Designated trees shall be fed with Davey Tree Company "Arboregreen" fertilizer or approved equal. The method of application and amount used shall be as recommended by the fertilizer manufacturer.

## **B. AIR POLLUTION**

1. Open Burning: Open burning of materials resulting from any land clearing associated with this project or of any discarded construction materials or by-products is strictly prohibited. The single exception is that diseased trees may be burned provided that a permit is secured from the Air Quality Section,

Mecklenburg County Environmental Health Department.

2. **Dust Control:** The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction. This includes, but is not specifically limited to, paved and unpaved roads, haul roads, access roads, disposal sites, borrow pits and material and equipment storage sites. Dust control measures may include but are not limited to wetting down disturbed earth surfaces or eliminating traffic across them, removing accumulations of dirt from paved areas by hand or mechanical means and washing streets at the end of the work day. Such dust control measures shall be taken when required by the Engineer or the controlling agency for streets and roadways. When the Contractor is required to wash dust or mud from paved streets, he shall provide adequate silt check barriers at storm drain inlets and/or discharge points emptying into or leading to a natural watercourse. At storm drain inlets or catch basins, excavated drop inlet protection (Erosion Control Detail 6.50) or Fabric Drop Inlet Protection (Erosion Control Detail 6.51) shall be constructed provided such construction does not impede traffic or create a hazard. Temporary Sediment Traps (Erosion Control Detail 6.60) or Check Dams (Erosion Control detail 6.83) shall be placed at storm drain or roadway ditch outlets as required to contain siltation within the roadway limits. Normally, these devices will be kept in place for the duration of the project or until the Engineer directed their removal. Where such devices would impede traffic or create a hazard, temporary protection during street washing operations will be provided by lining storm inlets with burlap bags filled with #67 washed stone. The burlap bags and all accumulated silt shall be removed immediately following street washing.

**C. NOISE CONTROL**

The Contractor shall keep the noise level on this project to the lowest level that is reasonable achievable through the use of proper mufflers on motorized equipment and through conduct of operations in a manner that minimizes noise. Further, work in populated areas may be restricted or prohibited during certain evening, weekend or holiday hours if required in the Special Provisions Section of this document. When working within the Charlotte City Limits, the Contractor is responsible for compliance with the City Noise Ordinance, Charlotte City Ordinance #1401.

**D. WATER POLLUTION**

The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams and water impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, concretes, grouts, raw sewage or any other harmful waste shall not be discharged into or alongside of any watercourse or impoundment or into any channel leading thereto.



## **E. EROSION AND SILTATION CONTROL**

The North Carolina Sedimentation Pollution Control Action of 1973 requires that all visible sediment be contained within the boundaries of a construction site, that cut and fill slopes be vegetated or otherwise stabilized within 30 working days and that all soil surfaces be stabilized and non erosive within 30 working days or 120 calendar days following completion of the ground disturbing activity, whichever period is shorter. For purposes of this specification, the construction site is defined as the permanent rights-of-way and temporary construction easements, access roads and public maintained road rights-of-way, as shown on the construction plans.

The Contractor shall exercise every reasonable precaution, throughout the life of the project, to contain all siltation within these boundaries and to prevent the eroding of soil and the silting of streams, lakes, reservoirs, other water impoundments, roadway surfaces, or other property. The erosion/siltation control measures for this project as stated in these specifications and/or as shown on the construction plans, have been approved by the North Carolina Department of Environment, Health And Natural Resources. The project is subject to periodic inspection by that Department during construction.

The erosion/siltation control measures shown on the construction plans and/or required by field conditions at the time of construction shall be installed concurrently with the clearing and grubbing operation and/or before any land disturbing activity in the drainage area within which they are located. They shall be maintained in proper working order until permanent ground cover is re-established and the Engineer directs their removal. Where cleared rights-of-way will be left more than 30 working days prior to actual construction, temporary ground cover will be established on all disturbed areas except an area along the center line as required for construction traffic. Temporary ground cover will consist of seeding, mulching and fertilizing as specified in the DS Section of these specifications. Particular attention will be given to prompt establishment of temporary ground cover along cut and fill slopes.

Once construction has begun, the Contractor will be required to keep site restoration and permanent seeding, fertilizing and mulching up with the land disturbing activity as closely as practical. No area of any project will be allowed to remain devoid of ground cover longer than 30 working days except as required for actual construction activity. Jute netting or stone rip-rap (Standard Detail #29) shall be placed as shown on the construction plans or as directed by the Engineer to stabilize the soil in areas with steep slopes and/or high velocity runoff. During construction, the Contractor shall make every effort to place excavated material on the side of the trench away from natural watercourses or impoundments and shall maintain erosion/siltation devices as necessary to prevent silt from escaping the site in the event of rainfall prior to backfill and restoration.

Fording of active streams with construction equipment will not be permitted. Temporary crossings shall be constructed using pipe or pipes of sufficient capacity to carry normal flow and placed in such a manner as to disrupt the natural flow as little as possible. Both faces of such crossings shall be covered with rock rip-rap. Spillways will be constructed to carry the flow from a 2-year storm. See Erosion

Control Detail #1 for construction details. Temporary crossings will be left in place only for the period of time they are needed for construction activities. They will be maintained in proper working order while in place and will be removed completely when no longer needed.

When shown on the construction plans or directed by the Engineer, temporary sediment traps conforming to Erosion Control Detail 6.60 shall be placed on each side of a creek before a temporary construction crossing or a pipe line crossing is made. Sediment traps shall be placed so that all runoff crossing the disturbed land area and entering the creek near the crossing is filtered through them. Where necessary, diversion ditches will be cut, or berms constructed, within the assigned right-of-way, to divert runoff to the silt basins. In addition to these basins, sediment fences (Erosion Control Detail 6.62) may be required to filter the runoff.

When the pipeline crosses the watercourse itself, the Contractor shall expedite his construction through the critical area (where potential erosion is obvious), thus limiting exposure time to potential erosion and sedimentation. After the pipeline crossing is completed and the creek banks are restored to the specified slope, the Contractor will either install rock rip-rap, or jute netting and vegetative cover as directed by the Engineer. Sediment fences may be required at the top of both creek banks to prevent surface water from eroding a creek bank face or silting the channel while vegetative cover is being restored.

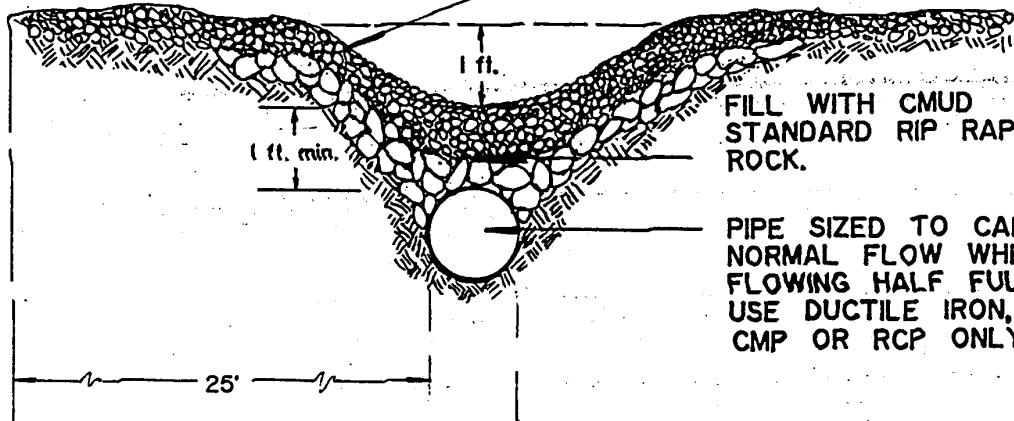
Before crossing wet-weather or drainage ditches, the Contractor shall construct temporary sediment traps conforming to Erosion Control Detail 6.60 or check dams conforming to Erosion Control Detail 6.83. These devices shall be located downstream from the crossing as directed by the Engineer. When working along existing roadways, the Contractor will place check dams conforming to Erosion Control Detail 6.83 in the roadway ditches and at ditch turnouts to prevent erosion of the ditches and the siltation of watercourses and/or adjacent property.

Borrow and/or spoil areas, either at the project site or at any location used by the Contractor (and approved by the Engineer), shall be subject to all erosion control requirements contained herein and to periodic inspection. Excavated soils either at the site or at borrow areas will be piled in such a manner and sufficient precautions taken to prevent erosion and runoff causing sediment to be carried away from the disturbed area.

Failure of the Contractor to comply with any of the preceding requirements will result in the Contractor receiving formal notification to initiate such measures. If compliance is not forthcoming within 48 hours of receipt of same, the Engineer will suspend all work and pursuant to the North Carolina Sedimentation Pollution Control Act of 1983 (GS 113A-54), report the violation to the North Carolina Sedimentation Control Commission for legal disposition.

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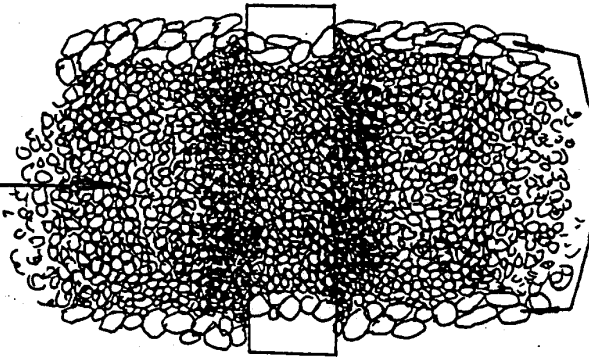
#467 COARSE AGGREGATE 6" DEEP.  
EXTEND 25' EACH SIDE OF BANKS.



FILL WITH CMUD  
STANDARD RIP RAP  
ROCK.

PIPE SIZED TO CARRY  
NORMAL FLOW WHEN  
FLOWING HALF FULL  
USE DUCTILE IRON,  
CMP OR RCP ONLY.

6" #467 STONE



RIP RAP  
STD. DET. #29

NOTES:

1. SLOPE APPROACHES TO CROSSING 2:1 OR FLATTER.
2. SPILLWAY LENGTH = BANK TO BANK WIDTH OF STREAM OR AS SHOWN ON PLANS.
3. PIPE TO EXTEND COMPLETELY ACROSS PERMANENT RIGHT OF WAY AND 1 ft BEYOND LIMITS OF RIP RAP.
4. CROSSING TO BE REMOVED UPON COMPLETION OF CONSTRUCTION. RIP RAP STONE TO BE USED TO RIP RAP BANKS.

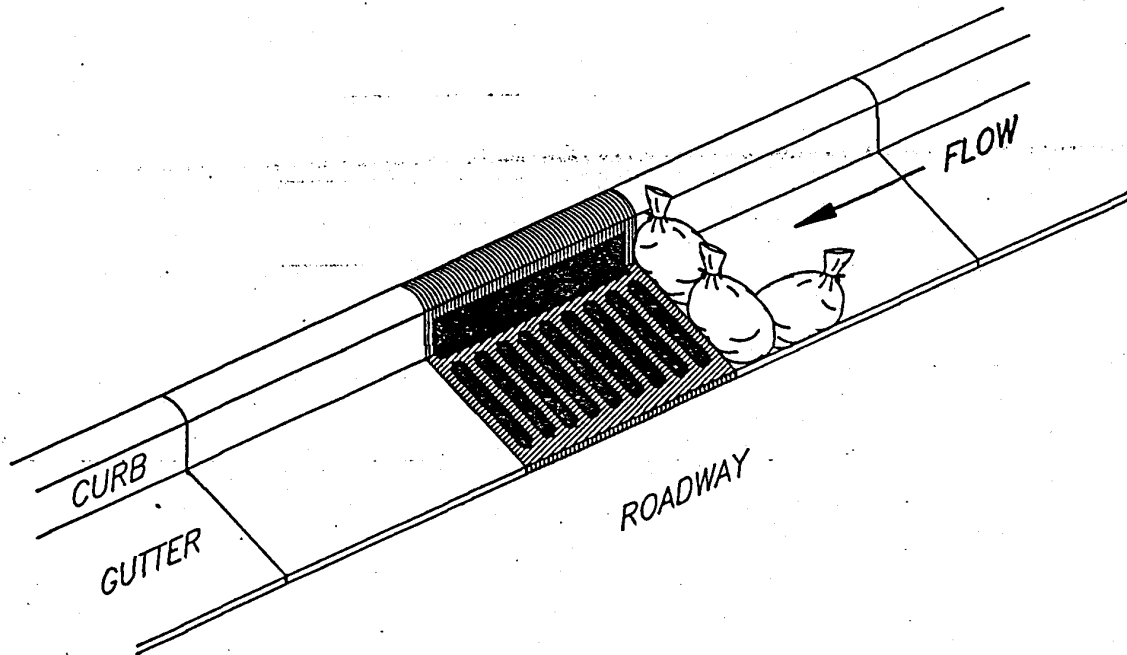
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No.	File No.
Scale	NONE
PLAN	NONE
PROFILE	NONE
As Built	Date
Drawn By	Designed By

STANDARD DETAIL  
EROSION CONTROL

TEMPORARY  
STREAM  
CROSSING

OLD	WOC	Checked	8-18	Sheet	01
Drawn By	Project Eng	Approved By	Date	1	



**STONE FILLED BURLAP BAGS**

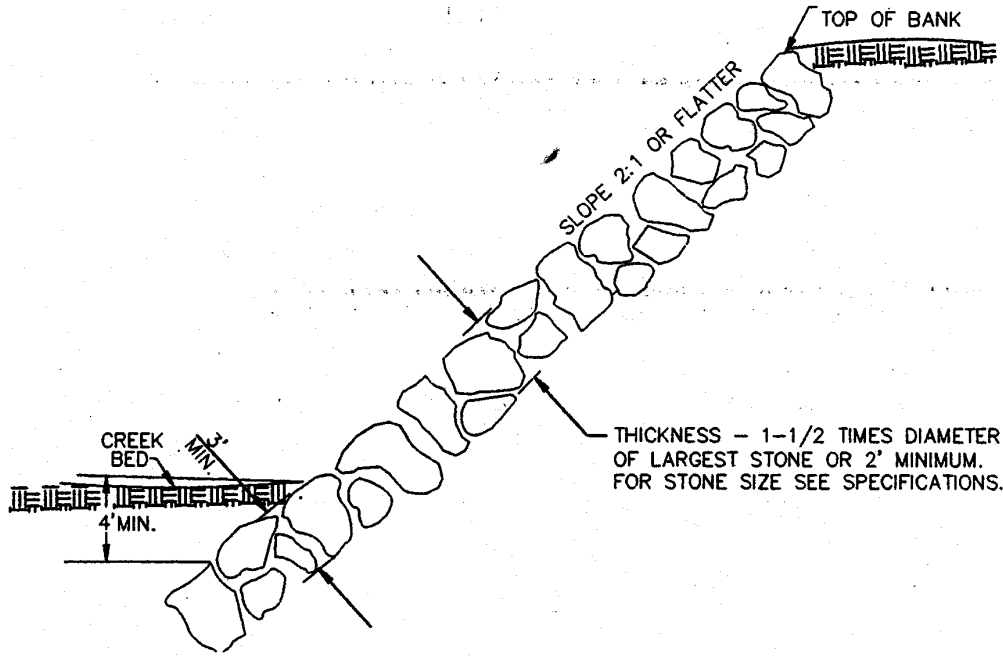
ALL STONE SHALL BE ANGULAR, CLEAN WASHED CRUSHED STONE GRADED IN ACCORDANCE WITH STANDARD SIZES #467 OR #357 IN ASTM D448 FOR "STANDARD SIZES FOR COARSE AGGREGATE".

BAGS SHALL BE MADE OF BURLAP WEIGHING AT LEAST 9 OUNCES PER SQUARE YARD OR NCF-120 FABRIC (MANUFACTURED BY ONSITE SYSTEMS INC.) OR AN APPROVED EQUAL AND SHALL HAVE DIMENSIONS OF 12" Lx6" Wx6" D WHEN FULL.

FOR DUAL DIRECTIONAL FLOW, BAGS SHALL BE PLACED ON BOTH SIDES OF CATCH BASIN IN THE SAME MANNER AS SHOWN ABOVE.

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>					
Job No. _____ File No. _____ Scales: <u>NONE</u>		<b>STANDARD DETAIL EROSION CONTROL</b>			
PLAN _____ PROFILE Max. _____ Vert. _____		<b>STONE FILLED BURLAP BAGS</b>			
As Built _____ Date _____		Drawn By: <u>RMB</u>		Project-Eng: <u>W.D.C.</u>	
No. 1 Date: _____ By: _____		Checked By: <u>KJS</u>		Approved By: <u>RCW</u>	
_____		Date: <u>5/91</u>		Sheet: <u>2</u> of _____	

DUNCAN-PARNELL, INC., CHARLOTTE 482 784-3333 FAX

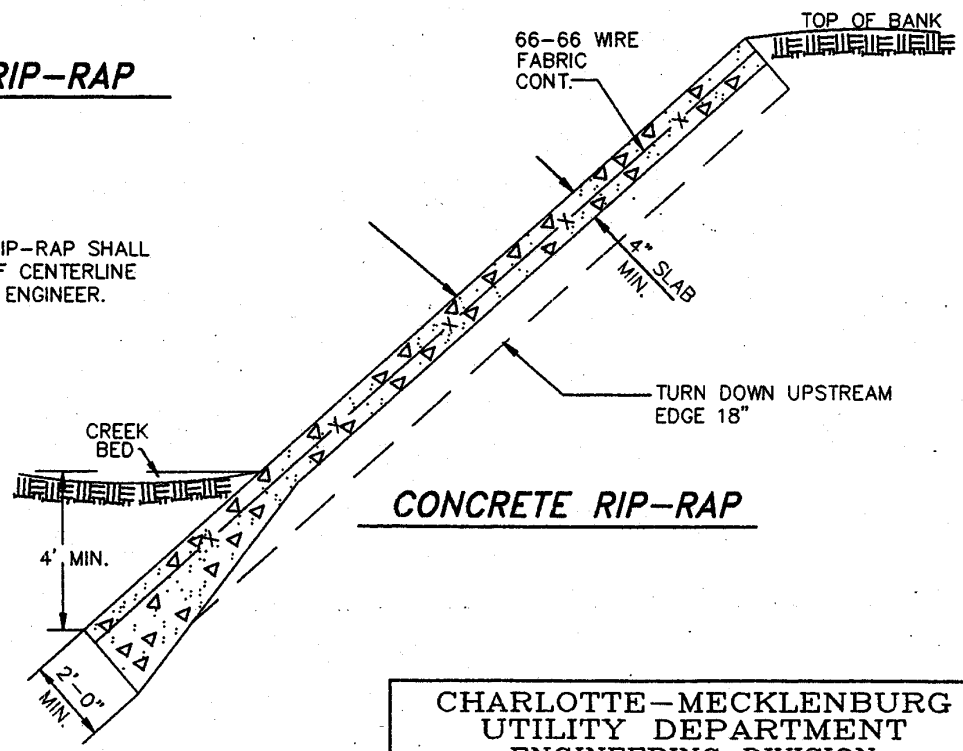


THICKNESS - 1-1/2 TIMES DIAMETER OF LARGEST STONE OR 2' MINIMUM. FOR STONE SIZE SEE SPECIFICATIONS.

**STONE RIP-RAP**

**NOTE:**

MINIMUM WIDTH OF RIP-RAP SHALL BE 10' EACH SIDE OF CENTERLINE OR AS DIRECTED BY ENGINEER.



**CONCRETE RIP-RAP**

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. _____	File No. _____
PLAN Scales _____	NTS
PROFILE Hor. _____	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____

<b>STANDARD DETAIL EROSION CONTROL</b>	
<b>STONE &amp; CONCRETE RIP-RAP</b>	
Drawn By <b>S.C.</b>	Project-Engr _____
Approved By _____	Date _____
Sheet <b>3</b> Of _____	

No.	Date	By	Revision

TREE PROTECTION - BARRIERS

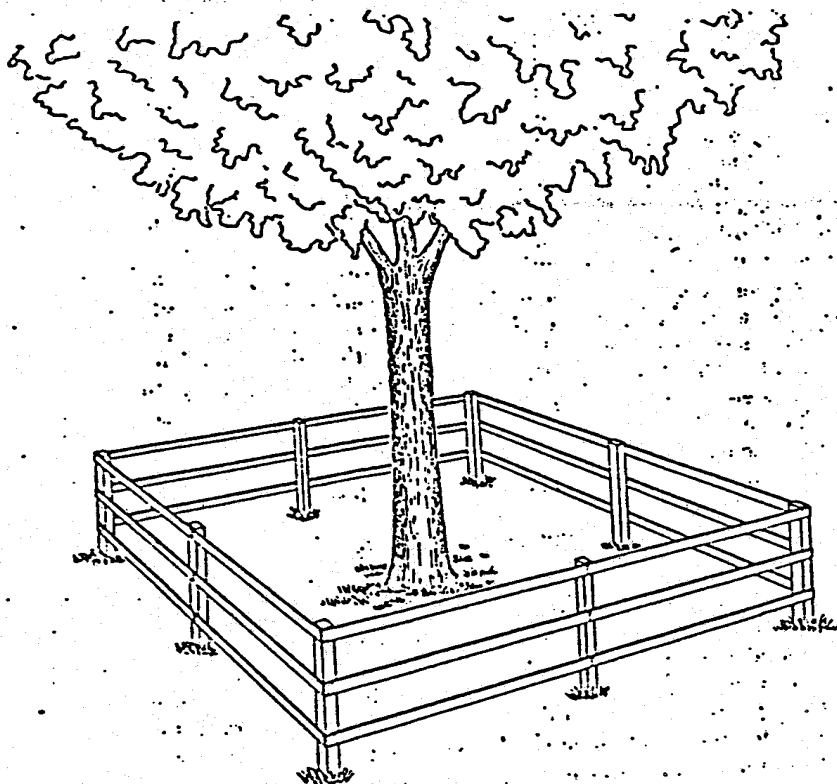
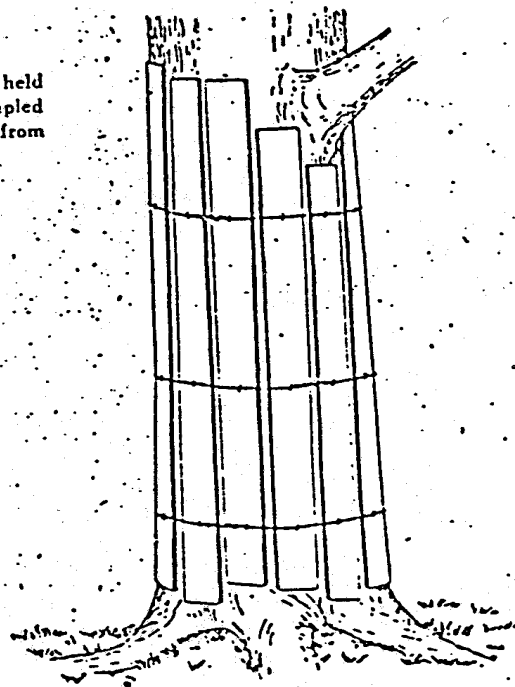


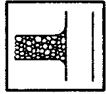
FIGURE 1.—A simple barrier to protect the tree trunk and part of the root system from mechanical injury.

FIGURE 2.—Planks or split poles held firmly against a tree trunk by stapled wires or rope will protect bark from much mechanical injury.



6.06

**TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT**



**Definition** A graveled area or pad located at points where vehicles enter and leave a construction site.

**Purpose** To provide a buffer area where vehicles can drop their mud and sediment to avoid transporting it onto public roads, to control erosion from surface runoff, and to help control dust.

**Conditions Where Practice Applies** Wherever traffic will be leaving a construction site and moving directly onto a public road or other paved off-site area. Construction plans should limit traffic to properly constructed entrances.

**Design Criteria** Aggregate Size—Use 2-3 inch washed stone.

**Dimensions of gravel pad—**

Thickness: 6 inches minimum

Width: 12-ft minimum or full width at all points of the vehicular entrance and exit area, whichever is greater

Length: 50-ft minimum

**Location—**Locate construction entrances and exists to limit sediment from leaving the site and to provide for maximum utility by all construction vehicles (Figure 6.06a). Avoid steep grades and entrances at curves in public roads.

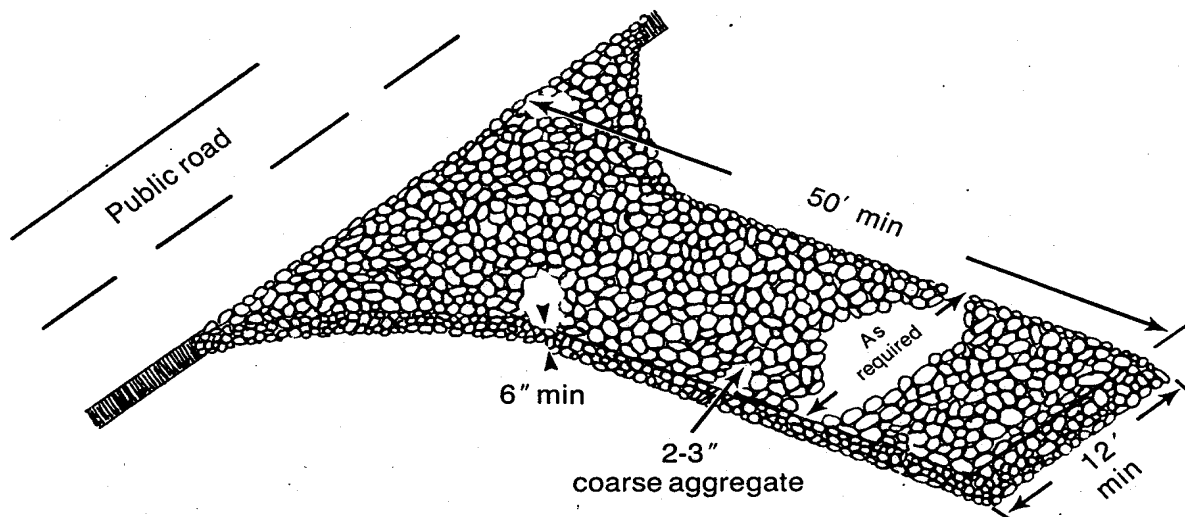


Figure 6.06a Gravel entrance/exit keeps sediment from leaving the construction site (modified from Va SWCC).



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**Washing**—If conditions at the site are such that most of the mud and sediment are not removed by vehicles traveling over the gravel, the tires should be washed. Washing should be done on an area stabilized with crushed stone that drains into a sediment trap or other suitable disposal area. A wash rack may also be used to make washing more convenient and effective.

### Construction Specifications

1. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
2. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
3. Provide drainage to carry water to a sediment trap or other suitable outlet.
4. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water table.

### Maintenance

Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

### References

*Runoff Conveyance Measures*  
6.30, Grass-lined Channels

*Sediment Traps and Barriers*  
6.60, Temporary Sediment Trap

6.20

→ TD →

**TEMPORARY DIVERSIONS**

**Definition** A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade.

**Purpose** To protect work areas from upslope runoff and to divert sediment-laden water to appropriate traps or stable outlets.

**Conditions Where Practice Applies** This practice applies to construction areas where runoff can be diverted and disposed of properly to control erosion, sedimentation, or flood damage. Specific locations and conditions include:

- above disturbed existing slopes, and above cut or fill slopes to prevent runoff over the slope;
- across unprotected slopes, as slope breaks, to reduce slope length;
- below slopes to divert excess runoff to stabilized outlets;
- where needed to divert sediment-laden water to sediment traps;
- at or near the perimeter of the construction area to keep sediment from leaving the site;
- above disturbed areas before stabilization to prevent erosion and maintain acceptable working conditions.
- Temporary diversions may also serve as sediment traps when the site has been overexcavated on a flat grade; they may also be used in conjunction with a sediment fence.

### Planning Considerations

It is important that diversions are properly designed, constructed and maintained since they concentrate water flow and increase erosion potential (Figure 6.20a). Particular care must be taken in planning diversion grades. Too much slope can result in erosive velocity in the diversion channel or at the outlet. A change of slope from steeper grade to flatter may cause deposition to occur. The deposition reduces carrying capacity and may cause overtopping and failure. Frequent inspection and timely maintenance are essential to the proper functioning of diversions.

Sufficient area must be available to construct and properly maintain diversions. It is usually less costly to excavate a channel and form a ridge or dike on the

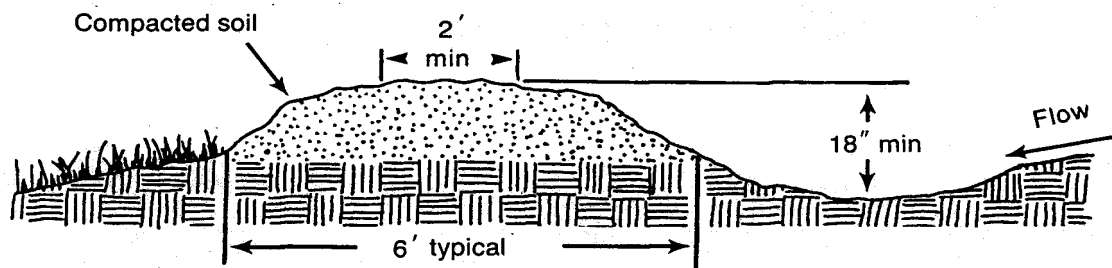


Figure 6.20a Temporary earthen diversion dike.

6.20.1

downhill side with the spoil than to build diversions by other methods. Where space is limited, it may be necessary to build the ridge by hauling in diking material or using a silt fence to divert the flow. Use gravel to form the diversion dike where vehicles must cross frequently (Figure 6.20b).

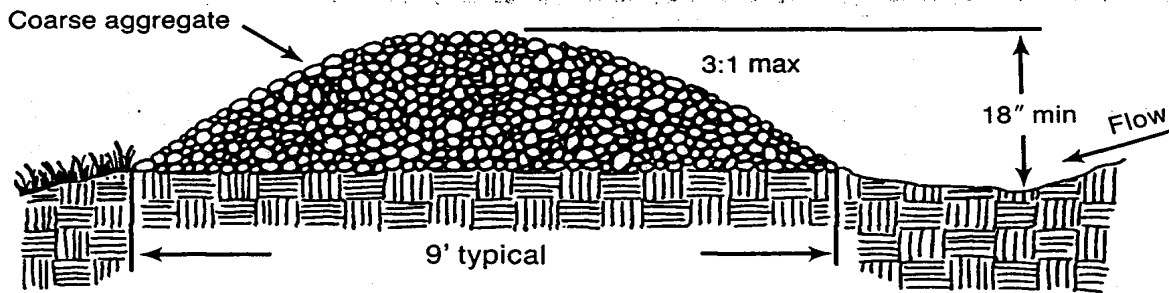


Figure 6.20b Temporary gravel diversion dike for vehicle crossing (modified from Va SWCC).

Plan temporary diversions to function 1 year or more, or they may be constructed anew at the end of each day's grading operation to protect new fill. Diversions that are to serve longer than 30 working days should be seeded and mulched as soon as they are constructed to preserve dike height and reduce maintenance.

Where design velocities exceed 2 ft/sec, a channel liner is usually necessary to prevent erosion (Table 8.05a, Appendix 8.05).

Temporary diversions may serve as in-place sediment traps if overexcavated 1 to 2 ft and placed on a nearly flat grade. The dike serves to divert water as the stage increases. A combination silt fence and channel in which fill from the channel is used to stabilize the fence can trap sediment and divert runoff simultaneously.

Wherever feasible, build and stabilize diversions and outlets before initiating other land-disturbing activities.

## Design Criteria

**Drainage areas**—5 acres or less.

**Capacity**—peak runoff from 10-year storm.

**Velocity**—See Table 8.05a, Permissible Velocities for Erosion Protection, Appendix 8.05.

**Ridge design**—

side slope:	2:1 or flatter
	3:1 or flatter at points where vehicles cross
top width:	2 ft minimum
freeboard:	0.3 ft minimum
settlement:	10% of total fill height minimum

**Channel design**— shape: parabolic, trapezoidal, or V-shaped  
side slope: 2:1 or flatter  
3:1 or flatter where vehicles cross

**Grades**—Either a uniform or a gradually increasing grade is preferred. Sudden decreases in grade accumulate sediment and should be expected to cause overtopping. A large increase in grade may erode.

**Outlet**—Design the outlet to accept flow from the diversion plus any other contributing areas. Divert sediment-laden runoff and release through a sediment-trapping device (Practice 6.60, *Temporary Sediment Trap* and Practice 6.61, *Sediment Basin*). Flow from undisturbed areas can be dispersed by a level spreader (Practice 6.40, *Level Spreader*).

**Small diversions**—Where the diversion channel grade is between 0.2 and 3%, a permanent vegetative cover is required. A parabolic channel and ridge 1.5 ft deep and 12 ft wide may be used for diversions with flows up to 5 cfs. This depth does not include freeboard or settlement. Side slopes should be 3:1 or flatter and the top of the dike must be at least 2 ft wide.

## Construction Specifications

1. Remove and properly dispose of all trees, brush, stumps, and other objectionable material.
2. Ensure that the minimum constructed cross section meets all design requirements.
3. Ensure that the top of the dike is not lower at any point than the design elevation plus the specified settlement.
4. Provide sufficient room around diversions to permit machine regrading and cleanout.
5. Vegetate the ridge immediately after construction, unless it will remain in place less than 30 working days.

## Maintenance

Inspect temporary diversions once a week and after every rainfall. Immediately remove sediment from the flow area and repair the diversion ridge. Carefully check outlets and make timely repairs as needed. When the area protected is permanently stabilized, remove the ridge and the channel to blend with the natural ground level and appropriately stabilize it.

## References

### *Surface Stabilization*

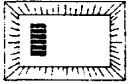
- 6.10, Temporary Seeding
- 6.11, Permanent Seeding
- 6.14, Mulching

### *Outlet Protection*

- 6.40, Level Spreader
- 6.41, Outlet Stabilization Structure

6.50

**EXCAVATED DROP INLET PROTECTION (Temporary)**



**Definition** An excavated area in the approach to a storm drain drop inlet or curb inlet.

**Purpose** To trap sediment at the approach to the storm drainage systems. This practice allows use of permanent stormwater conveyance at an early stage of site development.

**Conditions Where Practice Applies** Where storm drain drop inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is applicable where relatively heavy flows are expected and overflow capability is needed (Figure 6.50a). Frequent maintenance is required and temporary flooding in the excavated area will occur. This practice can be used in combination with other temporary inlet protection devices such as Practice 6.51, *Fabric Drop Inlet Protection* and Practice 6.52, *Block and Gravel Inlet Protection*.

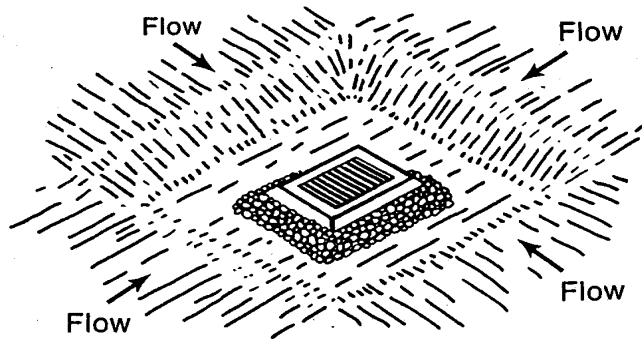
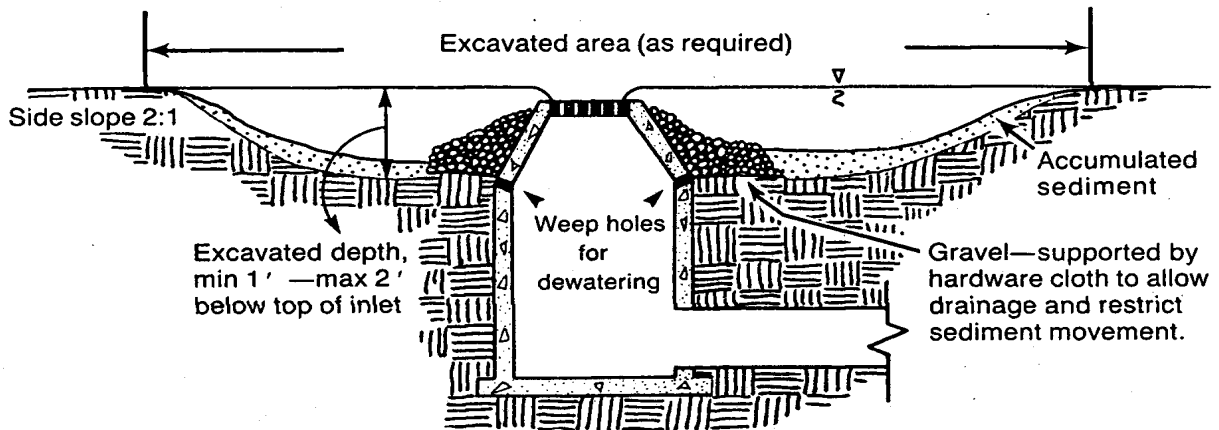


Figure 6.50a Excavated drop inlet protection.

6.50.1

6.51

**FABRIC DROP INLET PROTECTION (Temporary)**



**Definition** A temporary fabric barrier placed around a drop inlet.

**Purpose** To help prevent sediment from entering storm drains during construction operations. This practice allows early use of the storm drain system.

**Conditions Where Practice Applies** Where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. This method of inlet protection is effective where the inlet drains a small, nearly level area with slopes generally less than 5% and where shallow sheet flows are expected. The immediate land area around the inlet should be relatively flat (less than 1%) and located so that accumulated sediment can be easily removed.

**This practice must not be used near the edge of fill material and must not divert water over cut or fill slopes.**

**Design Criteria** Ensure that drainage areas do not exceed 1 acre per inlet.

Keep the maximum height of fabric above the crest of the drop inlet at 1.5 ft. This height allows a shallow temporary desilting pool to form behind the fabric but limits the pressure against the fabric if overtopping occurs. The selected height of the top of the barrier should allow overflow into the drop inlet and not let overflow bypass the inlet to unprotected lower areas.

For fabric barriers, use stakes with a minimum length of 3 ft, and space them a maximum of 3 ft apart, and securely drive them into the ground.

Drive the stakes close to the drop inlet so that overflow will fall directly into the structure and not on unprotected soil.

To attach the fabric, make a frame around the stakes a maximum of 1.5 ft above the top of the drop inlet. This will serve as a stable crest for overflow during rainfall.

Ensure that both fabric and supporting stakes are sufficiently strong to hold a 1.5 ft head of water without failure (Figure 6.51a).

Improved performance and sediment storage volume can be obtained by excavating the area (Practice 6.50, *Excavated Drop Inlet Protection*).

**Construction Specifications**

1. As synthetic fabric, use a pervious sheet of nylon, polyester, or ethylene yarn—extra strength (50 lb/1 inch minimum)—that contains ultraviolet ray inhibitors and stabilizers. Fabric should be sufficiently porous to provide adequate drainage of the temporary sediment pool. Burlap may be used for short-term applications. It must be replaced every 60 days.

2. Cut fabric from a continuous roll to eliminate joints.

6.51.1

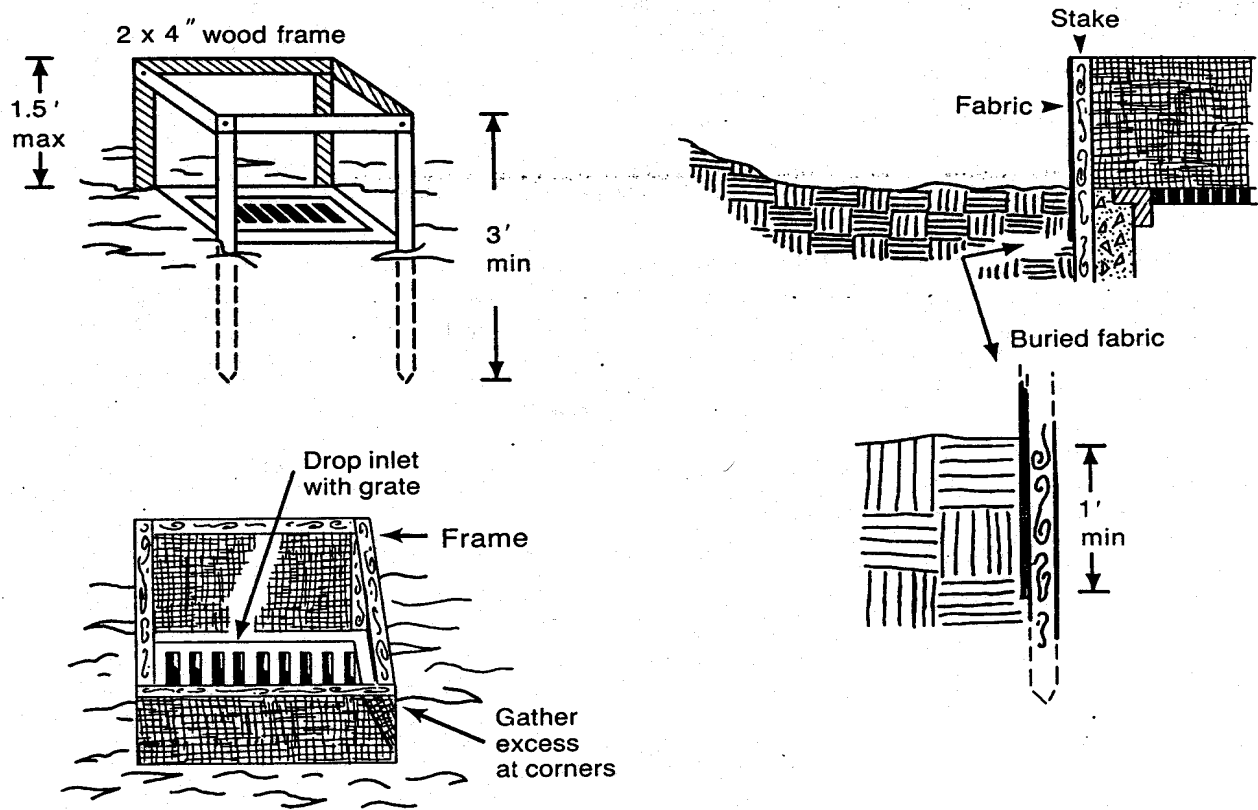


Figure 6.51a Installation of fabric and supporting frame for inlet protection.

3. For stakes, use 2 x 4-inch wood (preferred) or equivalent metal with a minimum length of 3 ft.
4. Space stakes evenly around the perimeter of the inlet a maximum of 3 ft apart, and securely drive them into the ground, approximately 18 inches deep.
5. To provide needed stability to the installation, frame with 2 x 4-inch wood strips around the crest of the overflow area at a maximum of 1.5 ft above the drop inlet crest.
6. Place the bottom 12 inches of the fabric in a trench and backfill the trench with at least 4 inches of crushed stone or 12 inches of compacted soil.
7. Fasten fabric securely to the stakes and frame. Joints must be overlapped to the next stake.
8. The top of the frame and fabric must be well below the ground elevation downslope from the drop inlet to keep runoff from bypassing the inlet. It may be necessary to build a temporary dike on the down slope side of the structure

to prevent bypass flow. Material from within the sediment pool may be used for diking.

**Maintenance** Inspect the fabric barrier after each rain and make repairs as needed.

Remove sediment from the pool area as necessary to provide adequate storage volume for the next rain. Take care not to damage or undercut the fabric during sediment removal.

When the contributing drainage area has been adequately stabilized, remove all materials and any unstable sediment and dispose of them properly. Bring the disturbed area to the grade of the drop inlet and smooth and compact it. Appropriately stabilize all bare areas around the inlet.

**References** *Inlet Protection*  
6.50, Excavated Drop Inlet Protection (Temporary)  
6.52, Block and Gravel Inlet Protection (Temporary)



6.60

**TEMPORARY SEDIMENT TRAP**



**Definition** A small, temporary ponding basin formed by an embankment or excavation to capture sediment.

**Purpose** To detain sediment-laden runoff and trap the sediment to protect receiving streams, lakes, drainage systems, and protect adjacent property.

**Conditions Where Practice Applies** At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment-laden water.

Below areas that are 5 acres or less.

Where access can be maintained for sediment removal and proper disposal.

In the approach to a storm water inlet located below a disturbed area as part of an inlet protection system.

Structure life limited to 2 years.

**Planning Considerations**

Select locations for sediment traps during site evaluation. Note natural drainage divides and select trap sites so that runoff from potential sediment-producing areas can easily be diverted into the traps. Ensure the drainage areas for each trap does not exceed 5 acres.

Make traps readily accessible for periodic sediment removal and other necessary maintenance. Plan locations for sediment disposal as part of trap site selection. Clearly designate all disposal areas on the plans.

In preparing plans for sediment traps, it is important to consider provisions to protect the embankment from failure from storm runoff that exceeds the design capacity. Consider nonerosive emergency bypass areas, particularly if there could be severe consequences from failure. If a bypass is not possible and failure would have severe consequences, consider alternative sites.

Sediment trapping is achieved primarily by settling within a pool formed by an embankment. The sediment pool may also be formed by excavation, or by a combination of excavation and embankment. Sediment-trapping efficiency is a function of surface area and inflow rate (Practice 6.61, *Sediment Basin*). Therefore, maximize the surface area in the design. Installations that provide pools with large length to width ratios reduce short circuiting and allow more of the pool surface area for settling. This optimizes efficiency.

Because well-planned sediment traps are key measures to preventing off-site sedimentation, they should be installed in the first stages of project development.

6.60.1

**Design Criteria** Ensure drainage area for a sedimentation trap does not exceed 5 acres.

**Storage capacity**—Keep the minimum volume of the sediment trap at 1800 ft<sup>3</sup>/acre based on disturbed area draining into the basin. Measure volume below the crest elevation of the outlet. The volume of a natural sediment trap may be satisfactorily approximated by the equation:

$$\text{volume (ft}^3\text{)} = 0.4 \times \text{surface area (ft}^2\text{)} \times \text{maximum pool depth (ft)}$$

**Trap cleanout**—Remove sediment from the trap and restore the capacity to original trap dimensions when sediment has accumulated to one-half the design depth.

**Trap efficiency**—Keep the surface area at peak flow as large as possible. Research by Barfield and Clar (1985) indicates that use of the following equation will give trap efficiency of 75% for most Coastal Plain and Piedmont soils:

$$\text{surface area at design flow (acres)} = (0.01) \text{ peak inflow rate (cfs)}$$

**Embankment**—Ensure that embankments for temporary sediment traps do not exceed 5 ft in height measured at the center line from the original ground surface to the top of the embankment. Additional freeboard may be added to the embankment height to allow flow through a designated bypass location. Construct embankments with a minimum top width of 5 ft and side slopes of 2:1 or flatter. Machine compact embankments.

**Excavation**—Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 or flatter for safety.

**Outlet section**—Construct the sediment trap outlet using a stone section of embankment located at the low point in the basin. The stone section serves two purposes: (1) the top section serves as a nonerosive spillway outlet for flood flows, and (2) the bottom section provides a means of dewatering the basin between runoff events.

**Stone size**—Construct the outlet using well-graded stones with a d<sub>50</sub> size of 9 inches (class B erosion control stone is recommended,) and a maximum stone size of 14 inches. A 1-ft thick layer of 1/2 - 3/4-inch aggregate (N.C. DOT #57 washed stone is recommended) should be placed on the inside face to reduce drainage flow rate.

**Side slopes**—Keep the side slopes of the spillway section at 2:1 or flatter. To protect the embankment, keep the sides of the spillway at least 21 inches thick.

**Depth**—Keep the crest of the spillway outlet a minimum of 1.5 ft below the settled top of the embankment.

**Protection from piping**—Place filter cloth on the foundation below the riprap to prevent piping. An alternative would be to excavate a keyway trench across the riprap foundation and up the sides to the height of the dam.

**Weir length and depth**—Keep the spillway weir at least 4 ft long and sized to pass the peak discharge of the 10-yr storm (Figure 6.60a). A maximum flow depth of 1 ft, a minimum freeboard of 0.5 ft, and maximum side slopes of 2:1 are recommended. Weir length may be selected from Table 6.60a shown for most site locations in North Carolina.

**Table 6.60a  
Design of Spillways**

Drainage Area (acres)	Weir Length <sup>1</sup> (ft)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

<sup>1</sup>Dimensions shown are minimum

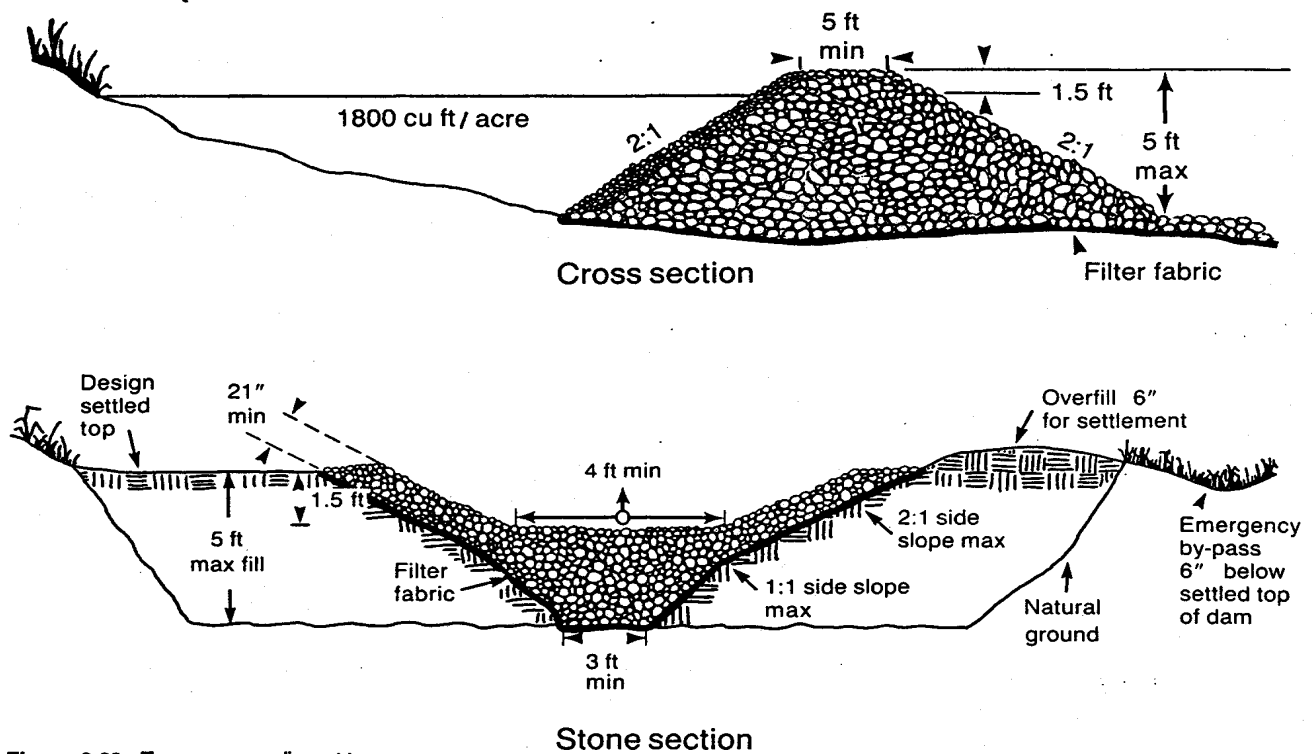


Figure 6.60a Temporary sediment trap.

**Construction Specifications**

1. Clear, grub, and strip the area under the embankment of all vegetation and root mat. Remove all surface soil containing high amounts of organic matter and stockpile or dispose of it properly. Haul all objectionable material to the designated disposal area.

- 
2. Ensure that fill material for the embankment is free of roots, woody vegetation, organic matter, and other objectionable material. Place the fill in lifts not to exceed 9 inches and machine compact it. Over fill the embankment 6 inches to allow for settlement.
  3. Construct the outlet section in the embankment. Protect the connection between the riprap and the soil from piping by using filter fabric or a keyway cutoff trench between the riprap structure and the soil.
    - Place the filter fabric between the riprap and soil. Extend the fabric across the spillway foundation and sides to the top of the dam; or
    - excavate a keyway trench along the centerline of the spillway foundation extending up the sides to the height of the dam. The trench should be at least 2 ft deep and 2 ft wide with 1:1 side slopes.
  4. Clear the pond area below the elevation of the crest of the spillway to facilitate sediment cleanout.
  5. All cut and fill slopes should be 2:1 or flatter.
  6. Ensure that the stone (drainage) section of the embankment has a minimum bottom width of 3 ft and maximum side slopes of 1:1 that extend to the bottom of the spillway section.
  7. Construct the minimum finished stone spillway bottom width, as shown on the plans, with 2:1 side slopes extending to the top of the over filled embankment. Keep the thickness of the sides of the spillway outlet structure at a minimum of 21 inches. The weir must be level and constructed to grade to assure design capacity.
  8. Material used in the stone section should be a well-graded mixture of stone with a  $d_{50}$  size of 9 inches (class B erosion control stone is recommended) and a maximum stone size of 14 inches. The stone may be machine placed and the smaller stones worked into the voids of the larger stones. The stone should be hard, angular, and highly weather-resistant.
  9. Ensure that the stone spillway outlet section extends downstream past the toe of the embankment until stable conditions are reached and outlet velocity is acceptable for the receiving stream. Keep the edges of the stone outlet section flush with the surrounding ground and shape the center to confine the outflow stream (*References: Outlet Protection*).
  10. Direct emergency bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.
  11. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction (*References: Surface Stabilization*).
  12. Show the distance from the top of the spillway to the sediment cleanout level (one-half the design depth) on the plans and mark it in the field.
-

## Maintenance

Inspect temporary sediment traps after each period of significant rainfall. Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment that is removed in the designated disposal area and replace the contaminated part of the gravel facing.

Check the structure for damage from erosion or piping. Periodically check the depth of the spillway to ensure it is a minimum of 1.5 ft below the low point of the embankment. Immediately fill any settlement of the embankment to slightly above design grade. Any riprap displaced from the spillway must be replaced immediately.

After all sediment-producing areas have been permanently stabilized, remove the structure and all unstable sediment. Smooth the area to blend with the adjoining areas and stabilize properly (*References: Surface Stabilization*).

## References

### *Outlet Protection*

6.41, Outlet Stabilization Structure

### *Surface Stabilization*

6.10, Temporary Seeding

6.11, Permanent Seeding

6.15, Riprap

### *North Carolina Department of Transportation*

Standard Specifications for Roads and Structures

6.61

**SEDIMENT BASIN**

**Definition** An earthen embankment suitably located to capture sediment.

**Purpose** To retain sediment on the construction site and prevent sedimentation in off-site streams, lakes, and drainageways.

**Conditions Where Practice Applies**

**Special limitation**—This practice applies only to the design and installation of sediment basins where failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use of public roads or utilities. Regardless of hazard classification, structures larger than 15 ft or higher, and having a maximum storage capacity of 10 acre-ft or more are subject to the N.C. Dam Safety Act.

Sediment basins are needed where erosion control measures are not adequate to prevent off-site sedimentation. Specific criteria for installation of a sediment basin are as follows:

- Keep the drainage area less than 100 acres.
- Ensure that basin location provides a convenient concentration point for sediment-laden flows from the area served.
- Ensure that basin location allows access for sediment removal and proper disposal under all weather conditions.
- Keep the basin life limited to 3 years, unless it is designed as a permanent structure.
- Do not locate sediment basins in perennial streams.

**Planning Considerations**

Select key locations for sediment basins during initial site evaluation. Install basins before any site grading takes place within the drainage area.

Select basin sites to capture sediment from all areas that are not treated adequately by other sediment traps. Always consider access for cleanout and disposal of the trapped sediment. Locations where a pond can be formed by constructing a low dam across a natural swale are generally preferred to sites that require excavation. If practical, divert sediment-free runoff away from the basin.

Sediment trapping efficiency is primarily a function of sediment particle size and the ratio of basin surface area to inflow rate. Therefore, design the basin to have a large surface area for its volume. Figure 6.61a shows the relationship between the ratio of surface area to peak inflow rate and trap efficiency observed by Barfield and Clar (1985).

Sediment basins with an expected life greater than 3 years should be designed as permanent structures. In these cases, the structure should be designed by a qualified professional engineer experienced in the design of dams. Permanent ponds and artificial lakes are beyond the scope of this practice standard. USDA

6.61.1

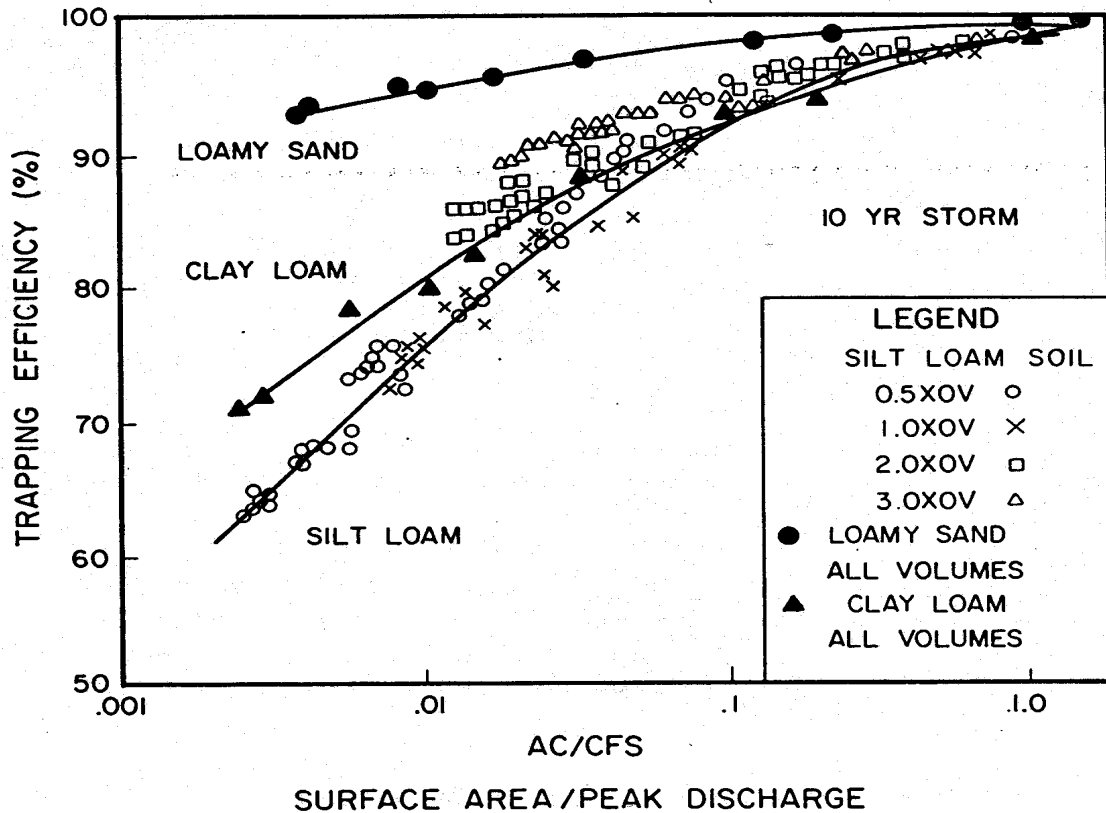


Figure 6.61a Graph showing the relationship between the ratio of surface area to peak inflow rate and trap efficiency.  
(source: Barfield and Clar)

Soil Conservation Service Practice Standard Ponds Code No. 378 provides criteria for design of permanent ponds.

**Design Criteria** Drainage areas—Limit drainage areas to 100 acres.

Design basin life—Ensure a design basin life of 3 years or less.

Dam height—Limit dam height to 15 ft. Dams 15 ft or higher and with storage volume of 10 acre-ft or more are governed by the N.C. Dam Safety Act. Height of a dam is measured from the top of the dam to the lowest point at the downstream toe. Volume is measured to the top of the dam.

Basin locations— Select areas that:

- provide capacity for storage of sediment from as much of the planned disturbed area as practical;
- exclude runoff from undisturbed areas, where practical;
- provide access for sediment removal throughout the life of the project;

- interfere minimally with construction activities.

**Surface area**—Recent studies (Barfield and Clar, 1985) indicate that the following relationship between surface area and peak inflow rate gives a trapping efficiency greater than 75% for most sediment in the Coastal Plain and Piedmont regions:

$$A = 0.01q$$

Where A is basin surface area in acres and q is peak inflow rate in cfs. Area is measured at design capacity of the principal spillway.

**Basin shape**—Ensure that the flow length to basin width ratio is greater than 2:1 to improve trapping efficiency. This basin shape may be attained by site selection, excavation, or installing baffles. Length is measured at the elevation of the principal spillway.

**Storage volume**—Ensure that the sediment storage volume of the basin, as measured to the elevation of the crest of the principal spillway, is at least 1,800 ft<sup>3</sup>/acre for the disturbed area draining into the basin (1800 ft<sup>3</sup> is equivalent to 1/2 inch of sediment per acre of basin drainage area). Where possible, the entire drainage basin is used for this computation, rather than the disturbed area alone, to help ensure adequate trapping efficiency.

Remove sediment from the basin when approximately one-half of the storage volume has been filled.

**Spillway capacity**—The spillway system must carry the peak runoff from the 10-yr storm with a minimum 1 ft freeboard in the emergency spillway. Base runoff computations on the disturbed soil cover conditions expected during the effective life of the structure.

**Principal spillway**—Construct the principal spillway with a vertical riser connected to a horizontal barrel that extends through the embankment and outlets beyond the downstream toe of the dam, or an equivalent design.

- Capacity—Ensure a minimum capacity of 0.2 cfs/acre of drainage area, with the water surface at the emergency spillway crest elevation.

**Sediment cleanout elevation**—Show the distance from the top of the riser to the pool level when the basin is 50% full. This elevation should also be marked in the field with a permanent stake set at this ground elevation (not the top of the stake).

**Crest elevation**—Keep the crest elevation of the riser a minimum of 1 ft below the crest elevation of the emergency spillway.

**Riser and Barrel**—Keep the minimum barrel size at 8 inches for corrugated metal pipe or 6 inches for smooth wall pipe to facilitate installation and reduce potential for failure from blockage. Ensure that the pipe is capable of withstanding the maximum external loading without yielding, buckling, or cracking. To improve the efficiency of the principal spillway system, make the cross-sectional area of the riser at least 1.5 times that of the barrel.



**Pipe Connections**—Ensure that all conduit connections are watertight.

Rod and lug type connector bands with gaskets are preferred for corrugated metal pipe to assure watertightness under maximum loading and internal pressure. Do not use dimple (universal) connectors under any circumstances.

**Basin dewatering**—Many new techniques are available for dewatering sediment basins. A single hole placed just above the sediment cleanout level will dewater the basin slowly and not interfere with trap efficiency.

The size of the dewatering hole may be approximated as follows:

$$A_o = \frac{A_s \times \sqrt{2h}}{T \times C_d \times 20,428}$$

where:

- $A_o$  = surface area of the dewatering hole, ft<sup>2</sup>
- $A_s$  = surface area of the basin, ft<sup>2</sup>
- $h$  = head of water above the hole, ft
- $C_d$  = coefficient of contraction for an orifice, approximately 0.6, and
- $T$  = detention time or time needed to dewater the basin, hours (recommended 10 hours).

**NOTE:** Perforating the riser with multiple holes with a combined surface area equal to  $A_o$  is acceptable. Perforated risers that dewater the basin rapidly may interfere with sediment trapping.

The basin may also be dewatered by perforating the lower half of the riser with 1/2-inch holes with a spacing of approximately 3 inches in each outside valley. Cover the perforated section with 2 ft of 1/2 - 3/4-inch gravel. Use NCDOT Standard #57, or #5 washed stone when it is available.

It is important that a suitable trash guard be installed to prevent the dewatering holes from becoming clogged.

- **Trash guard**—Install a trash guard on the top of the riser to prevent trash and other debris from clogging the conduit. A combination anti-vortex device and trash guard improves the efficiency of the principal spillway and protects against trash intake.
- **Protection against piping**—Install at least one watertight anti-seep collar with a minimum projection of 1.5 ft around the barrel of principal spillway conduits, 8 inches or larger in diameter. Locate the anti-seep collar slightly downstream from the dam center line. A properly designed drainage diaphragm installed around the barrel may be used instead of an anti-seep collar when it is appropriate.
- **Protection against flotation**—Secure the riser by an anchor with buoyant weight greater than 1.1 times the water displaced by the riser.
- **Outlet**—Protect the outlet for the barrel against erosion.

Discharge velocities must be within allowable limits for the receiving stream (*References: Outlet Protection*).

**Emergency spillway**—Construct the entire flow area of the emergency spillway in undisturbed soil (not fill). Make the cross section trapezoidal with side slopes of 3:1 or flatter. Make the control section of the spillway straight and at least 20 ft long. The inlet portion of the spillway may be curved to improve alignment, but ensure that the outlet section is straight due to supercritical flow in this portion.

- **Capacity**—The minimum design capacity of the emergency spillway must be the peak rate of runoff from the 10-yr storm, less any reduction due to flow in the principal spillway. In no case should freeboard of the emergency spillway be less than 1 ft above the design depth of flow.
- **Velocity**—Ensure that the velocity of flow discharged from the basin is nonerosive for the existing conditions. When velocities exceed that allowable for the receiving areas, provide outlet protection (*References: Outlet Protection*).

**Embankment**—

- **Cut-off trench**—Excavate a trench at the centerline of the embankment. Ensure that the trench is in undisturbed soil and extends through the length of the embankment to the elevation of the riser crest at each end. A minimum of 2 ft depth is recommended.
- **Top width**—The minimum top width of the dam is shown in Table 6.61a.
- **Freeboard**—Ensure that the minimum difference between the design water elevation in the emergency spillway and the top of the settled embankment is 1 ft.
- **Side slopes**—Make the side slopes of the impoundment structure 2.5:1 or flatter (Figure 6.61b).
- **Allowance for settlement**—Increase the constructed height of the fill at least 10% above the design height to allow for settlement.
- **Erosion protection**—Stabilize all areas disturbed by construction (except the lower 1/2 of the sediment pool) by suitable means immediately after completing the basin (*References: Surface Stabilization*).

Design information included in the Appendices may be used to develop final plans for sediment basins (*References: Appendices*).

**Trap efficiency**—Improve sediment basin trapping efficiency by employing the following considerations in the basin design:

- **Surface area**—In the design of the settling pond, allow the largest surface area possible. Studies of Barfield and Clar (1985) indicate that surface area (in acres) should be larger than 0.01 times the peak inflow rate in cfs.
- **Length**—Maximize the length-to-width ratio of the basin to prevent short circuiting, and ensure use of the entire design settling area.

**Table 6.61a**  
Acceptable Dimensions for  
Basin Embankment

Fill Height	Minimum Top Width
less than 10 ft	8.0 ft
10 feet to 15 ft	10.0 ft

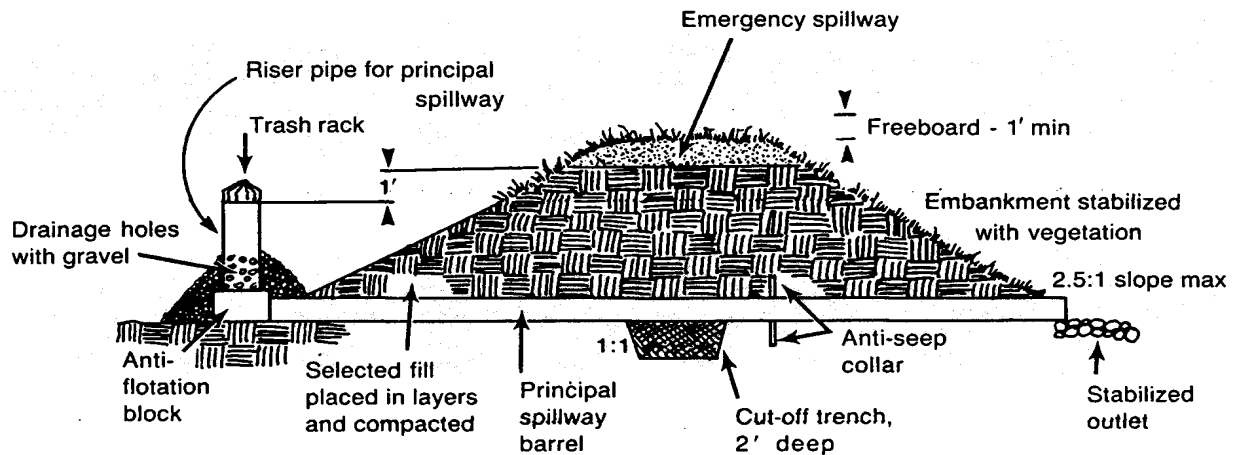


Figure 6.61b Section through embankment and basin controls.

- Inlets—Locate the sediment inlets to the basin the greatest distance from the principal spillway.
- Dewatering—Allow the maximum reasonable detention period before the basin is completely dewatered—at least 10 hours.
- Inflow rate—Reduce the inflow velocity and divert all sediment-free runoff.

## Construction Specifications

1. Site preparations—Clear, grub, and strip topsoil from areas under the embankment to remove trees, vegetation, roots, and other objectionable material. To facilitate sediment cleanout and restoration, clear the pool area of all brush, trees, and other objectionable materials. Stockpile all topsoil or soil containing organic matter for use on the outer shell of the embankment to facilitate vegetative establishment. Place temporary sediment control measures below the basin as needed.

2. Cut-off trench—Excavate a cut-off trench along the centerline of the earth fill embankment. Cut the trench to stable soil material, but in no case make it less than 2 ft deep. The cut-off trench must extend into both abutments to at least the elevation of the riser crest. Make the minimum bottom width wide enough to permit operation of excavation and compaction equipment but in no case less than 2 ft. Make side slopes of the trench no steeper than 1:1. Compaction requirements are the same as those for the embankment. Keep the trench dry during backfilling and compaction operations.

3. Embankment—Take fill material from the approved areas shown on the plans. It should be clean mineral soil, free of roots, woody vegetation, rocks, and other objectionable material. Scarify areas on which fill is to be placed before placing fill. The fill material must contain sufficient moisture so it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Place fill material in 6 to 8-inch continuous layers over the entire length of the fill area and then compact it. Com-

paction may be obtained by routing the construction hauling equipment over the fill so that the entire surface of each layer is traversed by at least one wheel or tread track of the heavy equipment, or a compactor may be used. Construct the embankment to an elevation 10% higher than the design height to allow for settling.

**4. Conduit spillways**—Securely attach the riser to the barrel or barrel stub to make a watertight structural connection. Secure all connections between barrel sections by approved watertight assemblies. Place the barrel and riser on a firm, smooth foundation of impervious soil. Do not use pervious material such as sand, gravel, or crushed stone as backfill around the pipe or anti-seep collars. Place the fill material around the pipe spillway in 4-inch layers and compact it under and around the pipe to at least the same density as the adjacent embankment. Care must be taken not to raise the pipe from firm contact with its foundation when compacting under the pipe haunches.

Place a minimum depth of 2 ft of hand-compacted backfill over the pipe spillway before crossing it with construction equipment. Anchor the riser in place by concrete or other satisfactory means to prevent flotation. In no case should the pipe conduit be installed by cutting a trench through the dam after the embankment is complete.

**5. Emergency spillway**—Install the emergency spillway in undisturbed soil. The achievement of planned elevations, grade, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.

**6. Inlets**—Discharge water into the basin in a manner to prevent erosion. Use diversions with outlet protection to divert sediment-laden water to the upper end of the pool area to improve basin trap efficiency (*References: Runoff Control Measures and Outlet Protection*).

**7. Erosion control**—Construct the structure so that the disturbed area is minimized. Divert surface water away from bare areas. Complete the embankment before the area is cleared. Stabilize the emergency spillway embankment and all other disturbed areas above the crest of the principal spillway immediately after construction (*References: Surface Stabilization*).

**8. Safety**—Sediment basins may attract children and can be dangerous. Avoid steep side slopes, and fence and mark basins with warning signs if trespassing is likely. Follow all state and local requirements.

## Maintenance

Check sediment basins after periods of significant runoff. Remove sediment and restore the basin to its original dimensions when sediment accumulates to one-half the design depth.

Check the embankment, spillways, and outlet for erosion damage, and inspect the embankment for piping and settlement. Make all necessary repairs immediately. Remove all trash and other debris from the riser and pool area.

6.62

**SEDIMENT FENCE (SILT FENCE)**



**Definition** A temporary sediment barrier consisting of filter fabric buried at the bottom, stretched, and supported by posts.

**Purpose** To retain sediment from small disturbed areas by reducing the velocity of sheet flows to allow sediment deposition.

**Conditions Where Practice Applies** Below small disturbed areas less than 1/4 acre per 100 ft of fence.  
Where runoff can be stored behind the sediment fence without damaging the fence or the submerged area behind the fence.

Do not install sediment fences across streams, ditches, or waterways.

**Planning Considerations** A sediment fence is a permeable barrier that should be planned as a system to retain sediment on the construction site. The fence retains sediment primarily by retarding flow and promoting deposition. In operation, generally the fence becomes clogged with fine particles, which reduce flow rate. This causes a pond to develop more quickly behind the fence. The designer should anticipate ponding and provide sufficient storage areas and overflow outlets to prevent flows from overtopping the fence. Since sediment fences are not designed to withstand high heads, locate them so that only shallow pools can form. Tie the ends of a sediment fence into the landscape to prevent flow around the end of the fence before the pool reaches design level. Provide stabilized outlets to protect the fence system and release stormflows that exceed the design storm.

Deposition occurs as the storage pool forms behind the fence. The designer can direct flows to specified deposition areas through appropriate positioning of the fence or by providing an excavated area behind the fence. Plan deposition areas at accessible points to promote routine cleanout and maintenance. Show deposition areas in the erosion and sedimentation control plan. A sediment fence acts as a diversion if placed slightly off the contour. This may be used by the designer to control shallow, uniform flows from small disturbed areas and to deliver sediment-laden water to deposition areas.

Sediment fences serve no function along ridges or near drainage divides where there is little movement of water. Confining or diverting runoff unnecessarily with a sediment fence may create erosion and sedimentation problems that would not otherwise occur.

**Design Criteria** Ensure that the drainage area is no greater than 1/4 acre per 100 ft of fence.

Make the fence stable for the 10-yr peak storm runoff.

Where all runoff is to be stored behind the fence, ensure that the maximum slope length behind a sediment fence does not exceed the specifications shown in Table 6.62a.

Ensure that the depth of impounded water does not exceed 1.5 ft at any point along the fence.

If nonerosive outlets are provided, slope length may be increased beyond that shown in Table 6.62a, but runoff from the area should be determined and bypass capacity and erosion potential along the fence must be checked. The velocity of the flow at the outlet or along the fence should be in keeping with Table 8.05d, *Appendix 8.05*.

**Table 6.62a  
Maximum Slope Length and  
Slope for which Sediment  
Fence is Applicable**

Slope	Slope Length (ft)
< 2%	100
2 to 5%	75
5 to 10%	50
10 to 20%	25
>20%	15

Provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment fence, such as natural depressions or swales. Ensure that the maximum height of the fence at a protected, reinforced outlet does not exceed 1 ft and that support post spacing does not exceed 4 ft.

The design life of a synthetic sediment fence should be 6 months. Burlap is only acceptable for periods up to 60 days.

**Construction  
Specifications**

**MATERIALS**

1. Use a synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the requirements shown in Table 6.62b.

Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120° F.

2. Ensure that posts for sediment fences are either 4-inch diameter pine, 2-inch diameter oak, or 1.33 lb/linear ft steel with a minimum length of 4 ft. Make sure that steel posts have projections to facilitate fastening the fabric.

3. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

**Table 6.62b  
Specifications For  
Sediment Fence Fabric**

Physical Property	Requirements
Filtering Efficiency	85% (min)
Tensile Strength at 20% (max.) Elongation	Standard Strength- 30 lb/lin in (min) Extra Strength- 50 lb/lin in (min)
Slurry Flow Rate	0.3 gal/sq ft/min (min)

### **CONSTRUCTION**

1. Construct the sediment barrier of standard strength or extra strength synthetic filter fabrics.
2. Ensure that the height of the sediment fence does not exceed 18 inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
3. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with overlap to the next post.
4. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, or tie wires. Extend the wire mesh support to the bottom of the trench.
5. When a wire mesh support fence is used, space posts a maximum of 8 ft apart. Support posts should be driven securely into the ground to a minimum of 18 inches.
6. Extra strength filter fabric with 6-ft post spacing does not require wire mesh support fence. Staple or wire the filter fabric directly to posts.
7. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier (Figure 6.62a).
8. Backfill the trench with compacted soil or gravel placed over the filter fabric.
9. Do not attach filter fabric to existing trees.

### **Maintenance**

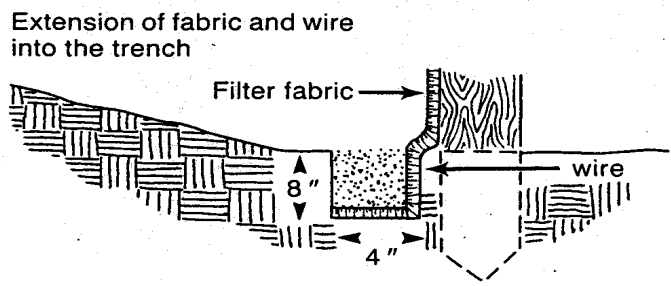
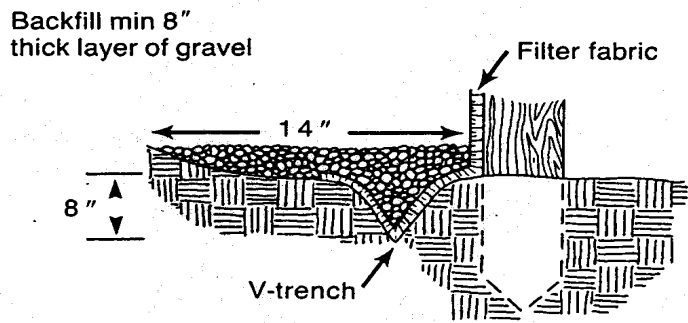
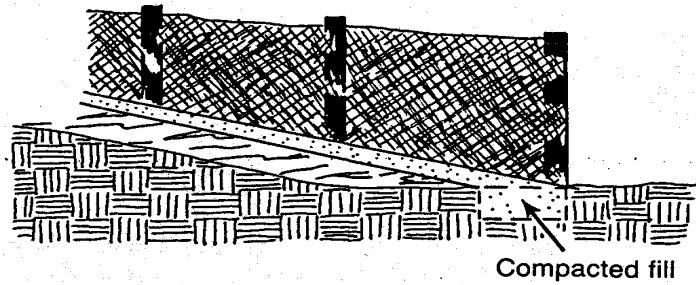
Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

Should the fabric of a sediment fence collapse, tear, decompose or become ineffective, replace it promptly. Replace burlap every 60 days.

*Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.*

Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

Figure 6.62a Installation detail of a sediment fence.



References

*Runoff Control Measures*  
6.20, Temporary Diversions

*Outlet Protection*  
6.41, Outlet Stabilization Structure

*Sediment Traps and Barriers*  
6.60, Temporary Sediment Trap  
6.61, Sediment Basin

*Appendix*  
8.03, Estimating Runoff



6.63

**ROCK DAM**

**Definition** A rock embankment located to capture sediment.

**Purpose** To retain sediment on the construction site and prevent sedimentation in off-site streams, lakes, and drainage ways.

**Conditions Where Practice Applies** The rock dam may be used instead of the standard sediment basin with barrel and riser (Practice 6.61, *Sediment Basin*). The height of the dam is limited to 8 ft, and drainage area should be no larger than 50 acres.

The rock dam is preferred where a stable, earthen embankment would be difficult to construct, and riprap and gravel are readily available. The site must be accessible for periodic sediment removal.

**A rock dam should not be located in a live stream.**

### Planning Considerations

A sediment basin formed by a rock embankment is used primarily where it is desirable to have the top of the structure serve as the overflow outlet and where suitable rock is readily available. A long weir crest is designed to keep flow depth shallow and discharge velocities low. The inside face of the rock dam must be covered with gravel to reduce the rate of seepage through the dam so that a sediment pool will form during runoff events. The pool should drain slowly through the gravel to improve basin trapping efficiency.

The abutments of the rock dam must be higher than the top of the dam to prevent any water from flowing against the soil. A cutoff trench should be installed under the entire length of dam and suitable filter fabric placed between the rock structure and its soil base and abutments. This prevents "piping" or soil movement in the foundation and abutments. Rock should extend downstream from the toe of the dam, on zero grade, a sufficient distance to stabilize flow and prevent erosion.

For other planning considerations see Practice 6.61, *Sediment Basin*.

**Design Criteria** **Drainage area**—limited to 50 acres

**Design basin life**—3 years or less

**Dam height**—limited to 8 ft

**Basin locations**—select areas that:

- provide a large surface area to trap sediment;
- intercept runoff primarily from disturbed areas;
- are accessible for periodic sediment removal;
- interfere minimally with construction activities.

6.63.1

**Basin volume**—The volume of the basin should be at least 1800 ft<sup>3</sup>/acre based on disturbed area draining into the basin, and measured 1 ft below the top of the dam.

**Spillway capacity**—The spillway should carry peak runoff for a 10-year storm with maximum flow depth 1 ft and a minimum freeboard 1 ft. The top of the rock embankment may serve as the spillway.

**Embankment**—

Top width— 5 ft minimum

Side slopes— Maximum: 2:1 upstream slope  
3:1 downstream slope

Rock abutments should extend to an elevation at least 2 ft above the spillway. Abutments should be 2 ft thick with 2:1 side slopes. The rock abutments should extend down the downstream face of the dam to the toe, at least 1 ft higher than the rest of the dam to protect the earth abutments from scour.

**Outlet protection**—A rock apron at least 1.5 ft thick should extend downstream from the toe of the dam, on zero grade, a sufficient distance to prevent channel erosion, or a distance equal to the height of the dam whichever is greater.

**Rock fill**—Rock should be well graded, hard, erosion resistant stone with a minimum d<sub>50</sub> size of 9 inches.

**Protection from "piping"**—A keyway lined with geotextile filter fabric should be on the soil foundation under the rock fill. To prevent soil movement and piping under the dam, the filter fabric must extend from the keyway to the downstream edge of the apron and must run under the dam's abutments.

**Basin dewatering**—The entire upstream face of the rock structure should be covered with fine gravel (NCDOT #57 washed stone or equivalent) a minimum of 1 ft thick to reduce the drainage rate.

**Trap efficiency**—To obtain maximum trapping efficiency, consider the following design principles :

- Allow surface area, 0.01 acres per cfs based on the 10-yr storm.
- Locate sediment inflow to the basin away from the dam to prevent short circuits from inlets to the outlet.
- Design for a long detention period before the basin is completely drained (8 hrs or more).

## Construction Specifications

1. Clear the areas under the embankment and strip it of roots and other objectionable material. Clear the reservoir area to facilitate sediment removal.
2. Excavate a cutoff trench a minimum of 2 ft deep and 2 ft wide with 1:1 side slopes under the total length of the dam at its centerline. Line the trench with extra-strength filter fabric before backfilling with rock. Apply filter fabric under the rockfill embankment, from the upstream edge of the keyway to the

downstream edge of the apron. Overlap filter material a minimum of 1 ft at all joints, with the upstream strip laid over the downstream strip.

3. Construct the embankment with well-graded rock and gravel to the size and dimensions shown on the drawings. It is important that rock abutments be at least 2 ft higher than the spillway crest and at least 1 ft higher than the downstream face of the dam, all the way to the toe, to prevent scour and erosion at the abutments.

4. Sediment-laden water from the construction site should be diverted into the basin reservoir at the furthest area from the dam.

5. Construct the rock dam before the basin area is cleared to minimize sediment yield from construction of the basin. Stabilize immediately all areas disturbed during the construction of the dam except the sediment pool (*References: Surface Stabilization*).

6. **Safety**—Sediment basins should be considered dangerous because they attract children. Steep side slopes should be avoided. Fences with warning signs may be needed if trespassing is likely. All state and local requirements must be followed.

## Maintenance

Check sediment basins after each rainfall. Remove sediment and restore original volume when sediment accumulates to about one-half the design volume.

Check the structure for erosion, piping, and rock displacement after each significant rainstorm and repair immediately.

Remove the structure and any unstable sediment immediately after the construction site has been permanently stabilized. Smooth the basin site to blend with the surrounding area and stabilize. All water and sediment should be removed from the basin prior to dam removal. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainageways during structure removal.

## References

### *Surface Stabilization*

6.10, Temporary Seeding

6.11, Permanent Seeding

6.12, Sodding

6.13, Trees, Shrubs, Vines, and Ground Covers

### *Runoff Control Measures*

6.20, Temporary Diversions

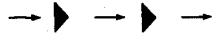
### *Outlet Protection*

6.41, Outlet Stabilization Structure

North Carolina Department of Transportation

*Standard Specifications for Roads and Structures*

6.83

**CHECK DAM**

<b>Definition</b>	Small temporary stone dams constructed across a drainageway.
<b>Purpose</b>	To reduce erosion in a drainage channel by restricting the velocity of flow in the channel.
<b>Conditions Where Practice Applies</b>	<p>This practice may be used as a temporary or emergency measure to limit erosion by reducing flow in small open channels. Limit drainage areas to 2 acres or less. <b>Do not use check dams in live streams.</b></p> <p>Check dams may be used to:</p> <ul style="list-style-type: none"> <li>• reduce flow in small temporary channels that are degrading, but, where permanent stabilization is impractical due to their short period of usefulness;</li> <li>• reduce flow in small eroding channels where construction delays or weather conditions prevent timely installation of nonerosive liners.</li> </ul>
<b>Planning Considerations</b>	<p>Check dams are an expedient way to reduce gulying in the bottom of channels that will be filled or stabilized at a later date. It is usually better to line the channel or divert the flow to stabilize the channel than to install check dams. However, under circumstances where this is not feasible, check dams may be helpful.</p> <p>Check dams installed in grass-lined channels may kill the vegetative lining if submergence after rains is too long and/or silting is excessive. All stone and riprap must be removed if mowing is planned as part of vegetative maintenance.</p> <p>Consider the alternative of protecting the channel bottom with materials such as riprap, concrete, fiberglass mat, or other protective linings in combination with grass before selecting check dams.</p>
<b>Design Criteria</b>	<p>The following criteria should be used when designing a check dam:</p> <ul style="list-style-type: none"> <li>• Ensure that the drainage area above the check dam does not exceed 2 acres.</li> <li>• Keep the maximum height at 2 ft at the center of the dam.</li> <li>• Keep the center of the check dam at least 9 inches lower than the outer edges at natural ground elevation.</li> <li>• Keep the side slopes of the dam at 2:1 or flatter.</li> <li>• Ensure that the maximum spacing between dams places the toe of the upstream dam at the same elevation as the top of the downstream dam (Figure 6.83a).</li> <li>• Stabilize overflow areas along the channel to resist erosion caused by check dams.</li> </ul>

6.83.1

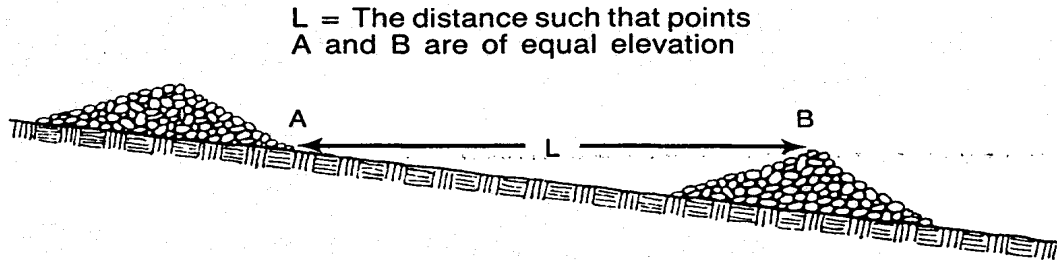


Figure 6.83a Space check dams in a channel so that the crest of downstream dam is at elevation of the toe of upstream dam.

- Use 2 to 15-inch stone (N.C. Department of Transportation class A or class B erosion control stone).
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.

### Construction Specifications

1. Place stone to the lines and dimensions shown in the plan on a filter fabric foundation.
2. Keep the center stone section at least 9 inches below natural ground level where the dam abuts the channel banks.
3. Extend stone at least 1.5 ft beyond the ditch banks (Figure 6.83b) to keep overflow water from undercutting the dam as it re-enters the channel.
4. Set spacing between dams to assure that the elevation at the top of the lower dam is the same as the toe elevation of the upper dam.
5. Protect the channel downstream from the lowest check dam, considering that water will flow over and around the dam (Practice 6.41, *Outlet Stabilization Structure*).
6. Make sure that the channel reach above the most upstream dam is stable.
7. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.

### Maintenance

Inspect check dams and channels for damage after each runoff event.

Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam. Correct all damage immediately. If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel (Practice 6.31, *Riprap-lined and Paved Channels*).

Remove sediment accumulated behind the dams as needed to prevent damage to channel vegetation, allow the channel to drain through the stone check dam, and prevent large flows from carrying sediment over the dam. Add stones to dams as needed to maintain design height and cross section.

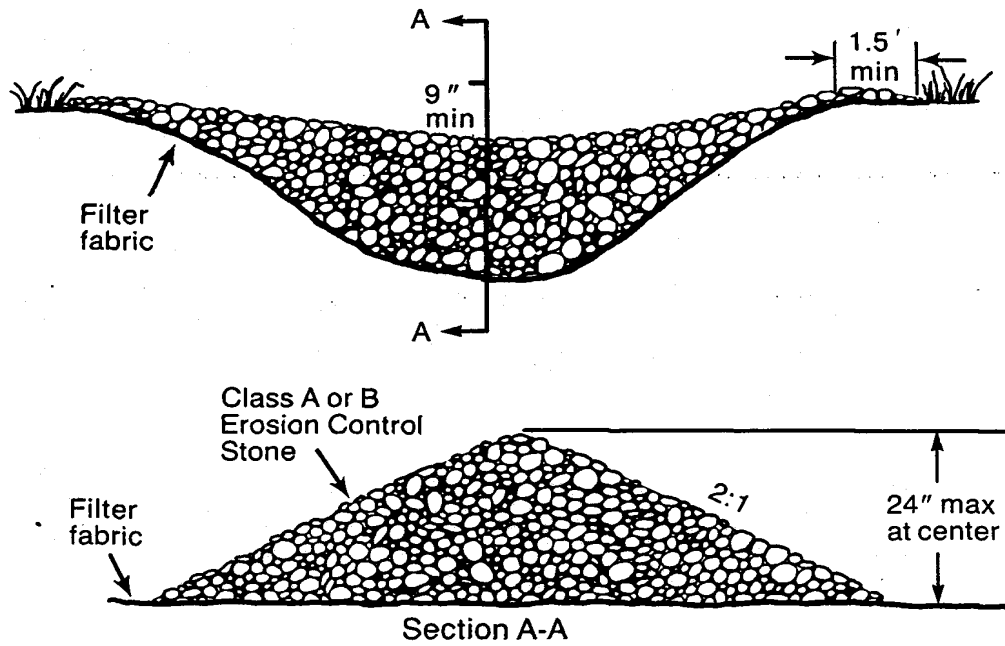


Figure 6.83b Stone check dam—Stone should be placed over the channel banks to keep water from cutting around the dam.

References

*Runoff Conveyance Measures*

6.30, Grass-lined Channels

6.31, Riprap-lined and Paved Channels

*Outlet Protection*

6.41, Outlet Stabilization Structure

*North Carolina Department of Transportation*

Standard Specifications for Roads and Structures

## **XVIII. LOW PRESSURE SEWERS**

Pressure sewers are permitted in the CMUD sewer system only in areas that are specifically designated for pressure sewer service. These areas are designated in the 1990 CMUD Lake Area Study and are primarily in the areas bordering Lake Norman, Lake Wylie and Mountain Island Lake where gravity service would involve numerous small lift stations. Material and construction specifications and Standard Details for pressure sewer connections are included in Section XVI of this document.

### **A. Design of Pressure Sewer Systems**

The developer shall have all pressure sewers designed by a professional engineer licensed in North Carolina. In addition to drawings and specifications, the developer shall include a design memorandum detailing the design procedures used for the pressure sewer system. The design memorandum shall include:

1. Hydraulic calculations demonstrating that the total dynamic head (TDH) does not exceed 100 feet at any existing or potential grinder pump location.
2. Profiles of all pressure sewer lines demonstrating that the system will be under positive pressure at all time. Specifically, the discharge elevation shall be above all intervening high points.
3. Calculations indicating determination of pressure main sizing. Initial pipeline sizing shall be based on providing a minimum of 3.0 foot per second (fps) velocity at a discharge calculated according to the following equation:

$$Q \text{ (in gpm)} = 15 + 0.5D$$

where: D = The number of dwelling units upstream of the reach under investigation.

4. Calculation of final pipe size may be adjusted based on evidence from hydraulic calculations, provided that such calculations indicate that a minimum of 2.0 fps can be achieved in all lines with no more than 5% (or a minimum of 2) pumps operating simultaneously through the line under determination.
5. Determination of Hazen-William coefficient. A Hazen-Williams coefficient, C, of 140 to 150 may be used, provided that if C=150, the nominal pipe size only may be used, and an allowance for minor losses associated with fittings should be included in the hydraulic calculations.
6. Calculation of Impeller Diameters for each pump. The impeller diameter of individual pumps in a system with varying pump elevations shall be sized such that full size impellers are used at pumps at the lowest elevations, and reduced size impellers are used at higher pumps such that the total TDH of any one pump is within 20% of all other pumps.

7. Calculations of the maximum flow discharged from the pressure sewer system with all pumps operating. This condition will be experienced upon restoration of power following a system wide power outage. If the maximum flow calculated, including other pressure sewers, exceeds the rated maximum pumping capacity of any downstream pump stations, the discharge shall be into a gravity sewer of sufficient diameter and length to provide 150 gallons of storage capacity per grinder pump within the gravity pipeline. All gravity sanitary sewers shall be constructed in accordance with the ***Requirements and Specifications for Sanitary Sewer Construction***.
8. Private pressure sewers shall connect to the CMUD maintained system at a stub from the property line side of the dual ball valve/check valve assembly according to the service connection Standard Details (See Pressure Sewer Material Specifications).

**B. Material And Installation Specifications For Low Pressure Sanitary Sewer**

Unless superseded or modified by a Special Provision, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications for same contained in this Section. National material standards (ASTM, ANSI, etc.) referred to herein shall be considered to be the latest revisions only.

The Engineer may waive certain requirements of these Material and Installation specifications, provided that the Contractor requests such waiver in writing and provided that the function of the material is not impaired. The Contractor may request to substitute for a material that has been specified. The Engineer, in writing only, may accept or reject such request.

1. Piping: All pressure sewer piping shall be ductile iron, or PVC as specified below. All pressure sewer force main within street or highway rights-of-way shall be clearly identified with green plastic locator tape made specifically for that purpose. The tape shall be marked with black lettering clearly identifying the pipeline as sanitary sewer. The tape shall be Type III Detectable Marking Tape as manufactured by Lineguard, Inc., or approved equal.
  - a. Ductile Iron Pressure Sewer: All ductile iron pipe furnished shall be Pressure Class 350, conforming to the requirements of ANSI/AWWA C-151/A21.51 and shall have a cement mortar lining in accordance with AWWA C-104. DIP shall be furnished with push-on joints in accordance with AWWA C-111.
  - b. PVC Pressure Sewer: Unless amended on the Construction Drawings, all four, six and eight-inch pressure sewer may be PVC 1120, furnished in accordance with AWWA Standard C-900, and shall be Pressure Class 150 with a SDR of 18 or less. All three inch and smaller pressure sewer mains may be PVC 1120 pipe furnished in accordance with ASTM D-2241, and shall be Pressure Class 160 with an SDR of 26 or less. PVC Pressure Pipe shall be made from materials whose Cell Classifications are either Class 1245A or 1245B, and shall be furnished in lengths of 20 feet. Lesser lengths will be



accepted to allow the proper placement of fittings, valves, etc. All PVC Pipe will be shipped, stored, and strung at the project in such a manner as to be protected from total accumulated exposure to sunlight and possible ultraviolet radiation of no more than four (4) weeks.

Pipe jointing for all main line pipe shall be by ELASTOMERIC GASKET JOINTS only, conforming to ASTM standard D-3139. Pipe Bells for all pipes three-inch and larger shall be integral to the pipe; sleeve couplings are not allowed.

Whenever a 4-inch or larger PVC pressure sewer crosses over or within 1.5 feet below a water main, the PVC pipe shall be replaced with ductile iron pipe as specified above. For lines smaller than three-inches, the PVC pipe may be installed within a length of 3-inch or 4-inch Ductile Iron Pipe. The ductile iron pipe shall extend not less than 10 feet on each side of the water main.

2. Fittings: All fittings for pipes four-inch and larger shall be Ductile Iron or Cast Iron. All fittings for pipes smaller than 4-inch shall be solvent weld PVC.
  - a. Cast Iron and Ductile Iron Fittings: All cast iron or ductile iron fittings shall be Pressure Class 250, mechanical joint fittings, in accordance with AWWA C-110 or pressure class 350 compact fittings in accordance with AWWA C-153. All fittings shall be furnished bell and bell unless otherwise indicated on the drawings. All fittings shall have a cement mortar lining of standard thickness in accordance with AWWA C-104.
  - b. PVC Fittings: PVC fittings for pressure sewer mains shall be Schedule 80 fittings furnished in accordance with ASTM D-2467 with solvent weld joints installed according to ASTM D-2855.
  
3. Valves: All valves on pressure sewer mains shall be plug or ball valves as specified below. Valve operation shall be open left.
  - a. Plug Valves: All valves on pressure sewer mains shall be eccentric plug valves as follows:
    1. Plug valves shall be non-lubricated, with a plug facing of a material specifically recommended by the valve manufacturer for the indicated service and shall have stainless steel permanently lubricated upper and lower plug stem bearings. Valve seats shall be nickel. Valves shall be designed with adjustable seals which are replaceable without removing the bonnet. The bearing and seal area shall be protected with grit seals.

Area of port opening for all valves shall be no less than 81% of full pipe area.

12-inch and smaller valves shall be rated at 175 psi. 14-inch and larger valves shall be rated at 150 psi. Bi-directional shut off is required.

Plug valves shall be as manufactured by Dezurik Corporation, Milliken Valve Co., Keystone Valve, or approved equal.

- a) Buried valves four-inches and larger and other valves specifically indicated shall have mechanical joint ends conforming to ANSI A21.11.
  - b) Buried valves three inches and smaller shall have schedule 80 threaded ends and shall be connected to the pressure main by schedule 80 PVC threaded by socket adapters.
- 2) Buried plug valves shall have 2-inch operating nuts within 10-inches to 15-inches below finish grade.
  - 3) Extension stems, stem guides, operating levers, and other miscellaneous items required for a complete installation shall be provided in accordance with the requirements and recommendations of the manufacturer.
  - 4) Buried plug valves shall be provided with adjustable valve boxes. Valves boxes shall be cast iron conforming to ASTM A-48, Class 30. Valve box castings shall be fully bituminous seal coated. Valve box shall be Tyler 462A or equal.
- b. Thermoplastic ball valves: Thermoplastic ball valves shall be used at each service connection and shall be made of PVC Thermoplastic. The valves shall be furnished with teflon seats and true union threaded ends. Thermoplastic ball valves shall be as manufactured by Hayward, Incorporated or approved equal.
  - c. Thermoplastic ball check valves: Thermoplastic ball check valves shall be used at each service connection and shall be made of PVC Thermoplastic. The valves shall be furnished with elastomeric seats and true union threaded ends. Thermoplastic ball check valves shall be as manufactured by Hayward, Incorporated or approved equal.
4. Service Boxes and Lids: All service connections and clean outs shall be placed in an appropriately sized box, in accordance with the Standard Details, and shall be as manufactured by Brooks Products Company (36 Series) or approved equal.

Concrete boxes shall be made of concrete mix, 1-2-1, one part cement, two parts granite screenings, and one part 3/8" granite stone. The meter boxes shall be

concrete machine made and tamped with pneumatic tamps to ensure the proper density. All concrete items shall be steam cured 24 hours and yard cured for two weeks. All service connection boxes shall be made of green plastic with the physical dimensions shown in the Standard Details, and constructed of standard thermoplastic materials using the structural foam approach, and shall be as manufactured by Brooks Products Company (Series 1730). The plastic composition shall be uniform and substantially resistant to moderate acid attack, ultraviolet ray action, and weathering as may be encountered in outdoor application and semi-buried service.

Plastic lids shall be furnished with "snap lock" tabs, interchangeable with existing CMUD meter boxes, and imprinted with the words "Pressure Sewer" on the lid.

5. Installation of PVC Low Pressure Pipe: PVC pressure sewer main shall be installed substantially in accordance with the Standard Recommended Practices for UNDERGROUND INSTALLATION OF FLEXIBLE THERMOPLASTIC SEWER PIPE, ASTM D-2321. The following exceptions shall be taken to the Standard:

- a. Installing Valves and Fittings: Valves and fittings shall be installed in the manner specified for cleaning, laying and jointing pipe. Valves shall be installed at locations shown on the Plans and/or as directed by the Engineer.

- 1) Valve Boxes: A valve box shall be installed at every buried plug valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the box cover flush with the pavement or other existing surface. Where the box is not in pavement, the top section shall be anchored by an 18" x 18" x 6" concrete pad, or an approved pre-cast concrete pad, set flush with the existing terrain. The top section will be grouted into the pre-cast concrete pad. The location of the valve will be identified by the letters "P.S.V." imprinted onto the curb adjacent to the pressure sewer valve.

- b. Alignment and Grade: Unless specifically approved by the Engineer, the curb must be in place and backfilled, and the area between curb and street right-of-way line graded smooth and to finished grade before the pressure sewer mains are installed. The pressure sewer mains shall be installed on the opposite side of the road from the water main and five feet behind the curb except as shown on the approved plans or as directed by the Engineer. In special circumstances, the Engineer may approve installation of pressure sewers before the curb is installed. In such cases, the street must be graded according to approved grading plans for the entire street right-of-way, the pressure sewer staked eight feet behind the proposed curb line with 90 degree offset stakes every 50 feet, and "cut sheets" provided showing the vertical distance between each offset stake and the trench bottom point. Such staking shall be done only by a surveyor registered in the State of North Carolina. The

pressure sewer shall be laid and maintained at the required lines and grades with fittings and valves at the required locations, spigots centered in bells, and all valve stems plumb.

After curb and gutter has been installed, the location and depth of the pressure sewer main and valves, etc., will be checked for conformance to CMUD standards. Any deficiencies will be corrected to the satisfaction of the Engineer prior to testing and activation of the mains.

Depth of Pipe Installation: Unless otherwise indicated on the Plans, or required by existing utility location, all pipes shall be installed with the top of the pipe at least 5.0' below the edge of the adjacent roadway pavement or 4.5' below the ground, above the pipe, whichever is greatest. The Contractor is instructed to check construction plans and blow-up views for additional requirements.

The Contractor may be required to vary the depth of the pipe to achieve minimum clearance from existing utilities while maintaining the minimum cover specified whether or not the existing pipelines, conduits, cables, mains, etc., are shown on the plans. PVC pressure sewer shall be installed with 12-inches clearance above other utilities or 18-inches clearance below other utilities.

- c. Testing: The water for testing purposes can be taken from the nearest available CMUD water main under the supervision of the Engineer's Inspector and leakage will be measured by the Inspector with a meter furnished by CMUD.

The Contractor shall use great care to be sure that all air is expelled from each section under test. If service connection or other openings are not available for the purposes of expelling air, the Contractor shall provide air release of sufficient size (as determined by the Engineer) in accordance with Standard Detail 1.

The test pressure will be 125 PSI at the low point of the section under test.

Allowable leakage will be determined by Table 6A, AWWA C-600 (See Section XIV.R-1.b) or by the formula  $L=0.000083(D)(S)$  where L is the allowable leakage in gallons per hour, S is the length of pipe under test in feet and D is the pipe diameter in inches. Add 0.0050 gal/hr. for each 1-1/2 inch lateral.

Required testing of pipelines and valves shall be done under the direct supervision of the Project Inspector. Field testing shall not negate the requirements for material certifications as contained in the material specification section of this contract. Unless otherwise directed by the Engineer, all testing will be completed prior to connection to any existing line. The Contractor shall provide open ventilation of confined spaces.

The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

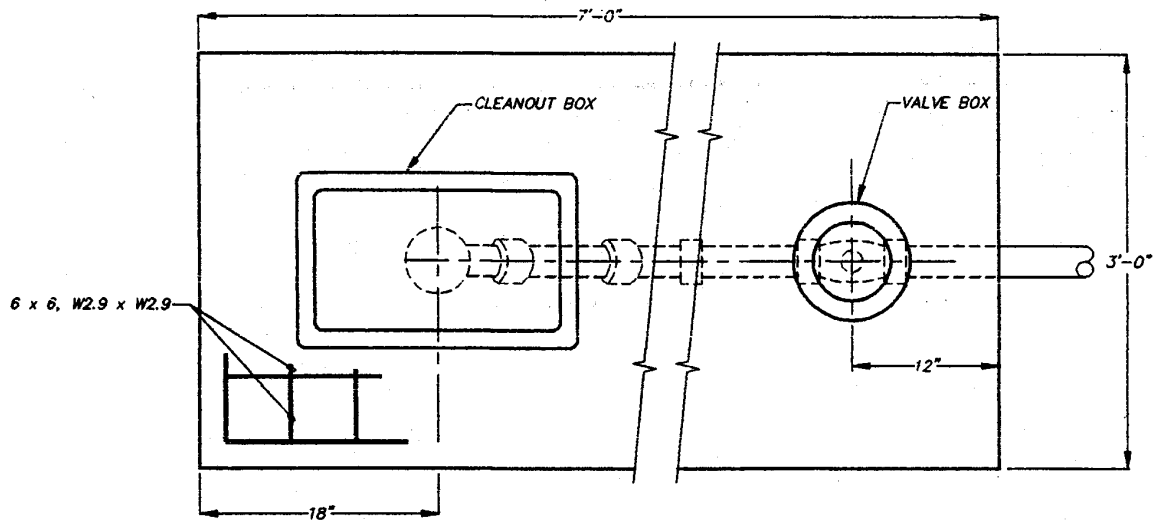
On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. All leaks and any defective material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification are met. Any special equipment, pumps, etc. required to make the test shall be furnished and operated by the contractor as directed by the Inspector.

Specific procedures for testing mains are as follows:

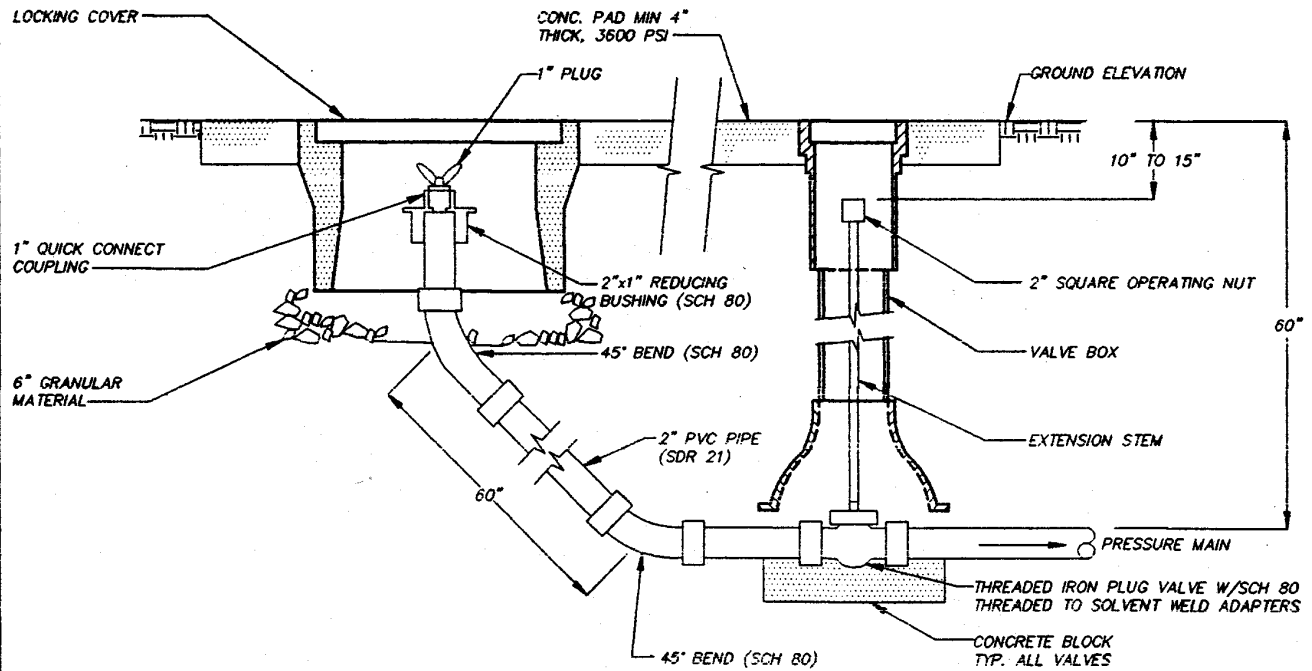
- (a). Pressure and leakage tests will be run concurrently and for a duration of four hours except as modified below.
- (b). The Contractor will pressurize the line and verify that it is within allowable leakage before the official test is started.
- (c). During the official test, the Contractor is to maintain the pressure within " 5 PSI for the duration of the test period. The contractor will pump the line to full test pressure at the end of each hour AND when the test pressure drops 5 PSI. The contractor will record the time, meter reading and pressure reading before and after each pumping occurrence.
- (d). The Inspector will begin the test and remain at the job for the first hour, making sure that the test pressure is maintained within " 5 PSI. At the end of the first hour, with the line pumped to full test pressure, he will read the meter and record the first hour leakage. If the first hour leakage is within allowable, he will return at the end of the fourth hour and again read the meter. If the total leakage for the four hour period does not exceed four times the first hour leakage, the test will be terminated. If the total leakage exceeds four times the first hour leakage, but is still within allowable, the test will be held an additional hour. If the fifth hour leakage does not exceed the average hourly leakage for the first four hours, the test will be terminated at the end of the fifth hour. Otherwise, the test will be held until the leakage is non-increasing and within allowable for two consecutive hours.
- (e). If leakage exceeds allowable for the four hour test, the test will be terminated and re-scheduled after the Contractor has verified that actual leakage is within the allowable leakage, but no earlier than the next work day.
- (f). If the first hour leakage does not exceed 10% of the allowable, or if the allowable leakage rate does not exceed .4 gal/hr., the test may be terminated at the end of two hours provided the second

hour leakage does not exceed the first hour leakage. If the second hour leakage exceeds the first hour leakage, the test will be held for an additional period as described in Paragraph (d) above.

- (g). The maximum length of pipe tested in one test shall be 5,000 feet or as close to 5,000 feet as possible depending on valve spacing.
  - (h). During the last stages of the test and without any reduction in pressure, progressing in an orderly manner from the end opposite the test pump, each main line valve will be closed and pressure released to determine if it is holding test pressure (minimum 10 minutes per valve closing).
- d. 1.5" Service Connections: On 3-inch and smaller mains, the 1.5" laterals shall be connected to the street main with schedule 80 PVC solvent weld wyes. On 4-inch and larger mains, the 1.5 inch laterals shall be connected to the street main with a MJ tee plugged and tapped for a threaded by solvent weld schedule 80 PVC Adaptor. The 1.5" service lateral shall be completed to the property line where a service connection meter box shall be installed. The service connection shall contain the following fittings in accordance with the Standard Details, 45 degree solvent weld elbow, solvent weld nipple, solvent weld by threaded adapter, two (2) true union threaded ball valves, threaded adapter, threaded 1.5"x1.5"x1.5" tee, threaded adapter, threaded nipple, true union ball check valve, threaded x solvent weld nipple, 1.5"x1.25" solvent weld reducing bushing. The top of the 1.5" tee shall have a threaded 1.5" x .75" reducing bushing and a brass .75" hose bib.
- e. Partial Service Connections: Partial service connections shall be installed according to the Standard Details at the locations indicated on the Plans. The location for this future service connection stub-out shall be marked by cutting an "S" on the curb above the service. Also, a PVC encapsulated magnet shall be attached near the valve and cap for magnetic locating purposes.



**PLAN VIEW**



**ELEVATION**

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
PRESSURE SEWER**

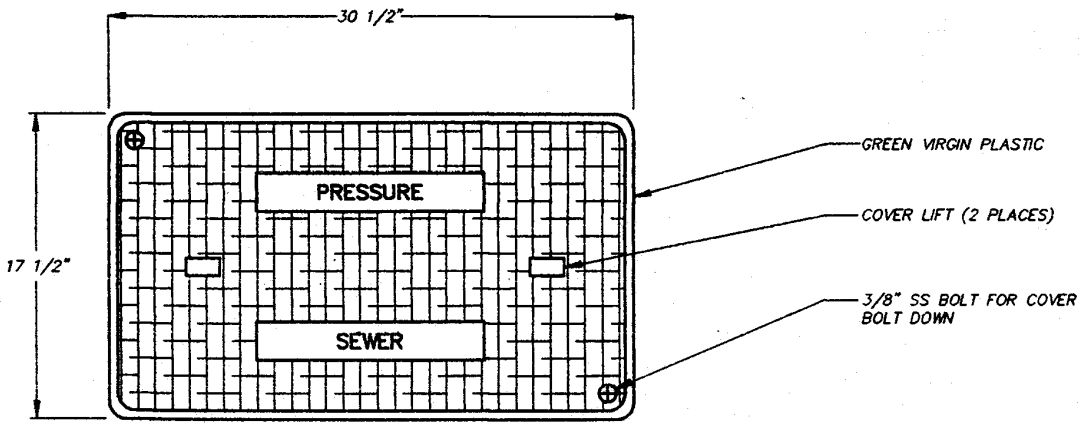
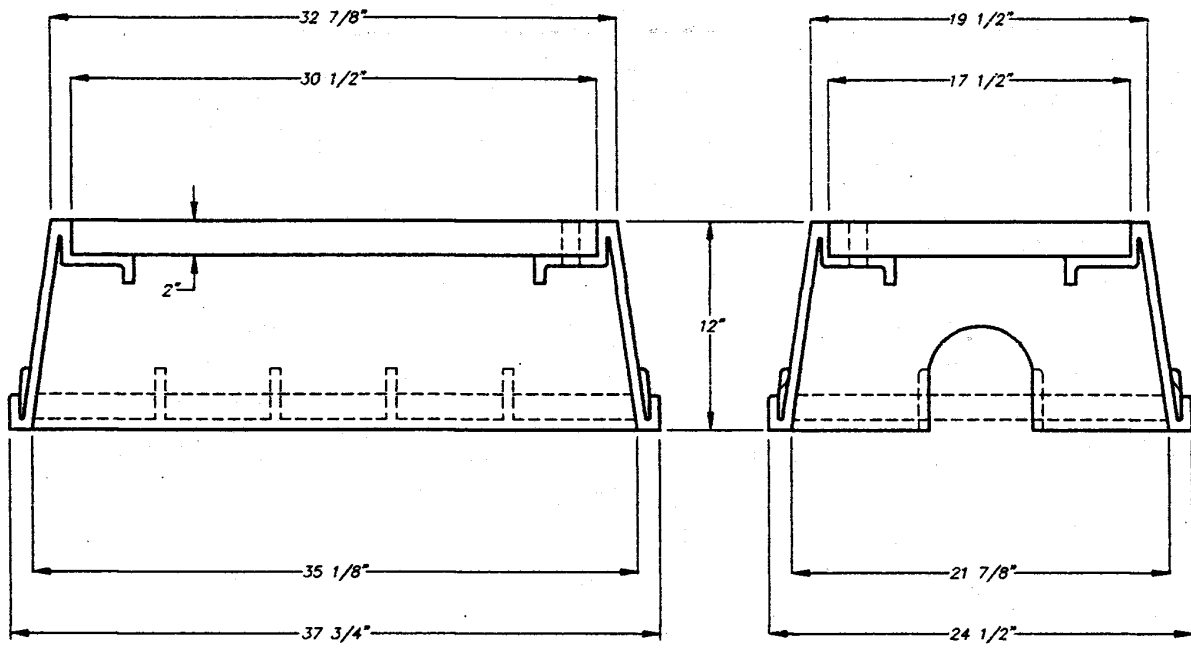
**CLEANOUT AT  
END OF MAIN**

Job No. _____	File No. _____
Scales _____	
PLAN _____	NTS
PROFILE _____	
Hor. _____	
Vert. _____	
As Built _____	Date _____
Surveyed By _____	Designed By _____

Drawn By <b>KHP</b>	Project-Engr _____	Approved By <b>K. O'Brien</b>	Date <b>4/14/94</b>	Sheet <b>2</b> Of _____
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No.	Date	By	Revision

KHP/2/24

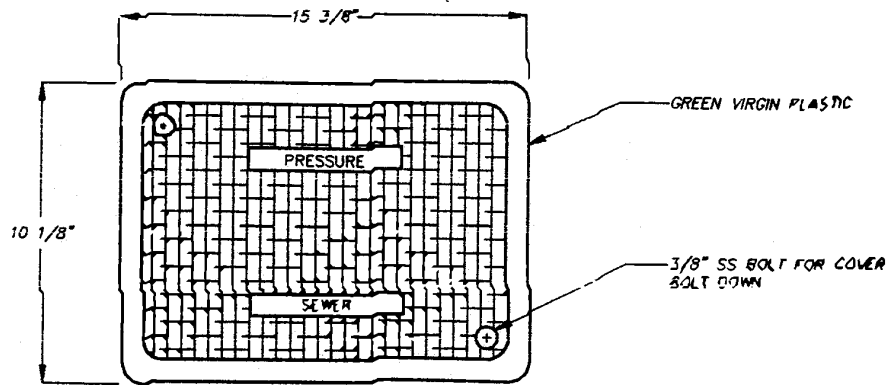
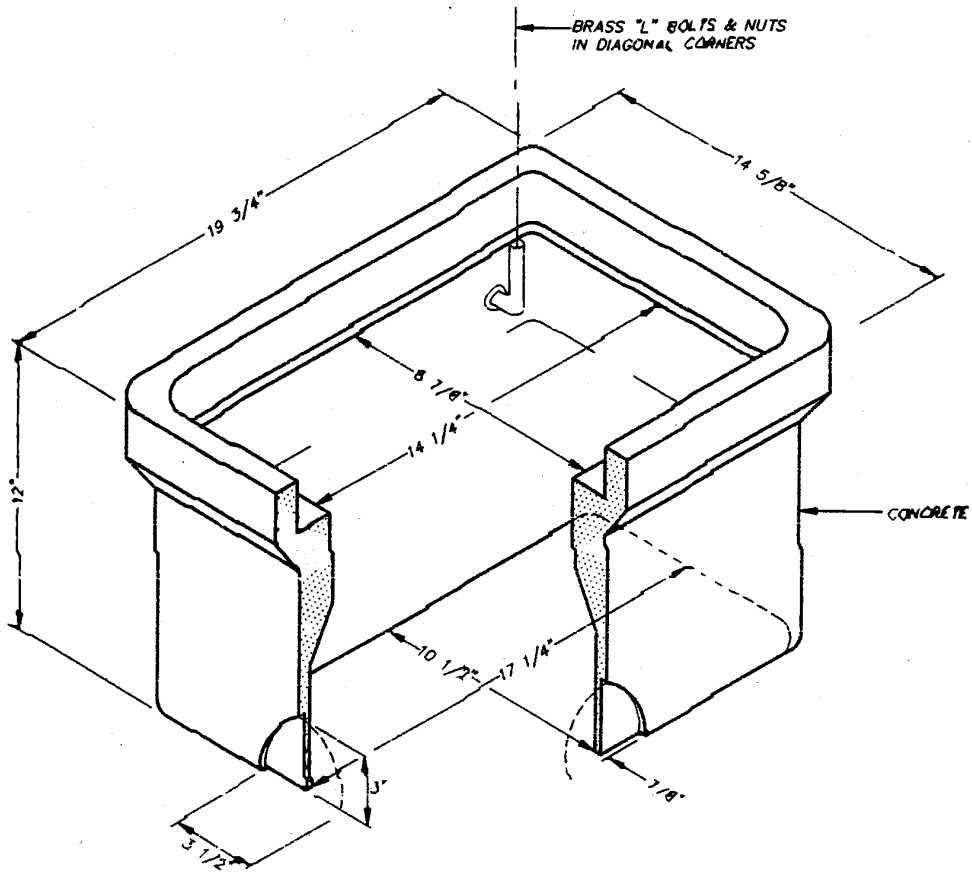


PLAN VIEW

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____		<b>STANDARD DETAIL PRESSURE SEWER</b>	
Scales PLAN _____ NTS			
PROFILE Hor. _____ Vert. _____			
As Built _____ Date _____		<b>SERVICE BOX</b>	
Surveyed By _____	Designed By _____	Drawn By <b>KHP</b>	Project-Engr <b>K.B. [Signature]</b>
No. _____ Date _____ By _____		Approved By <b>[Signature]</b>	Date <b>1/14/94</b> Sheet <b>3</b> Of _____
Revision _____			

K.B. [Signature]





PLAN VIEW

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

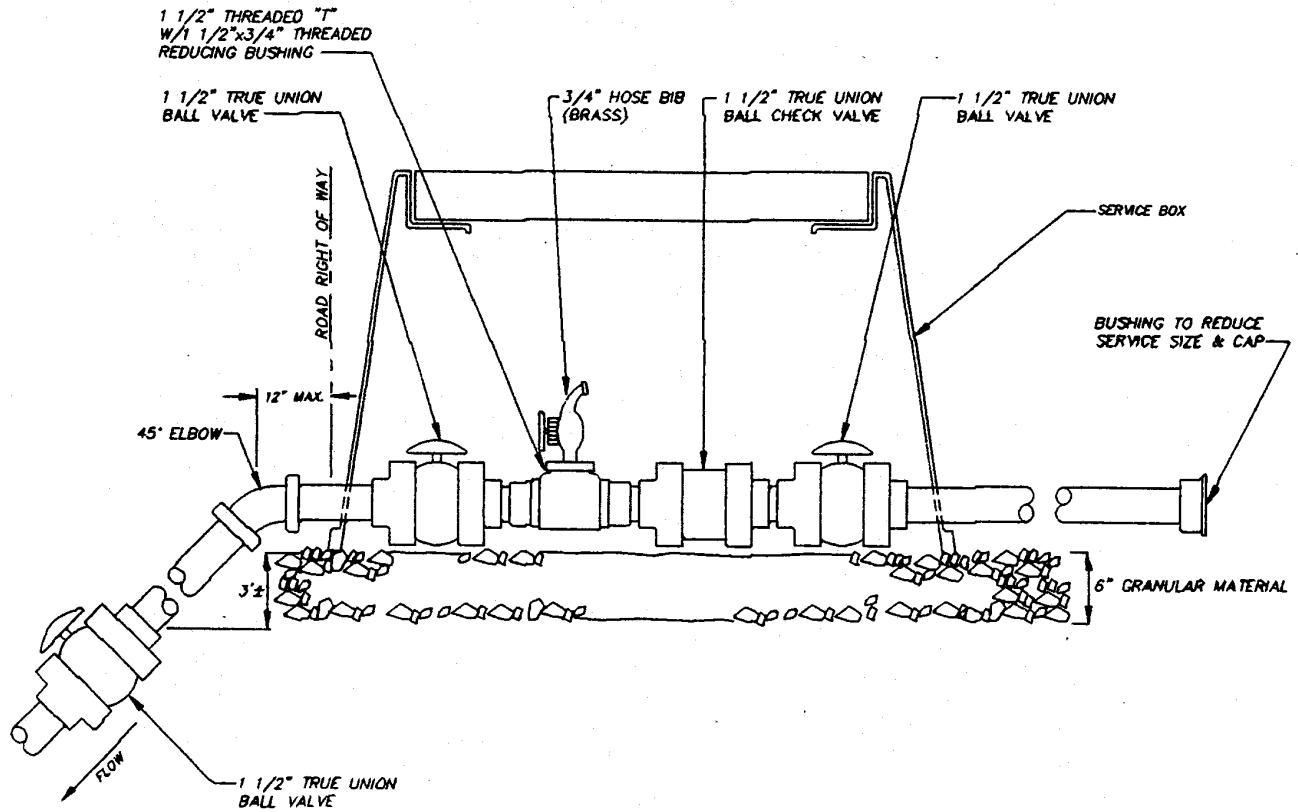
**STANDARD DETAIL  
PRESSURE SEWER**

**CLEANOUT BOX**

Job No.	File No.
PLAN	Scale <i>NTS</i>
PROFILE	Hor. _____
	Vert. _____
As Built	Date _____
Surveyed By	Designed By

Drawn By	Project-Engr	Approved By	Date	Sheet	Of
<i>KHP</i>		<i>KB</i>	<i>7/14</i>	<i>4</i>	

No.	Date	By	Revision



**NOTES:**

1. SERVICES SHALL BE CENTERED IN THE LOT ROAD FRONTAGE.
2. BOX SHALL NOT BE IN SIDEWALKS OR DRIVEWAYS.
3. TOP OF BOX SHALL BE FLUSH WITH FINISH GRADE OF LOT.

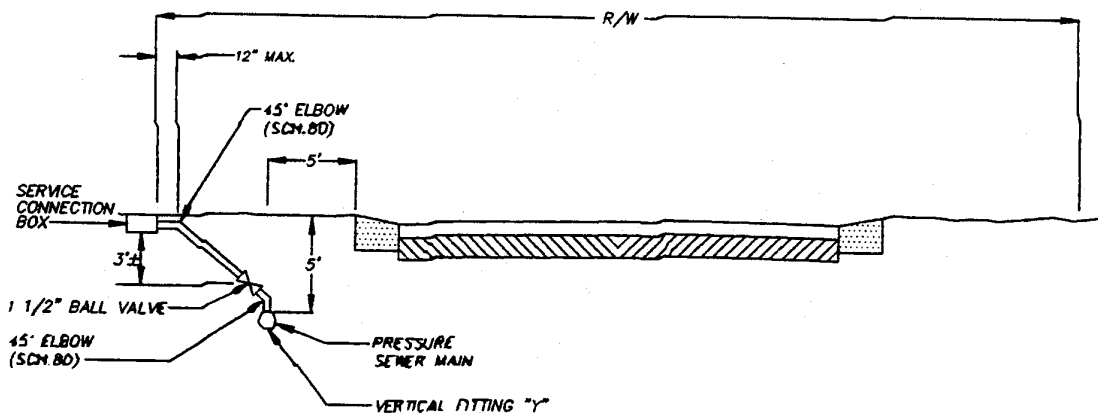
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
PRESSURE SEWER**

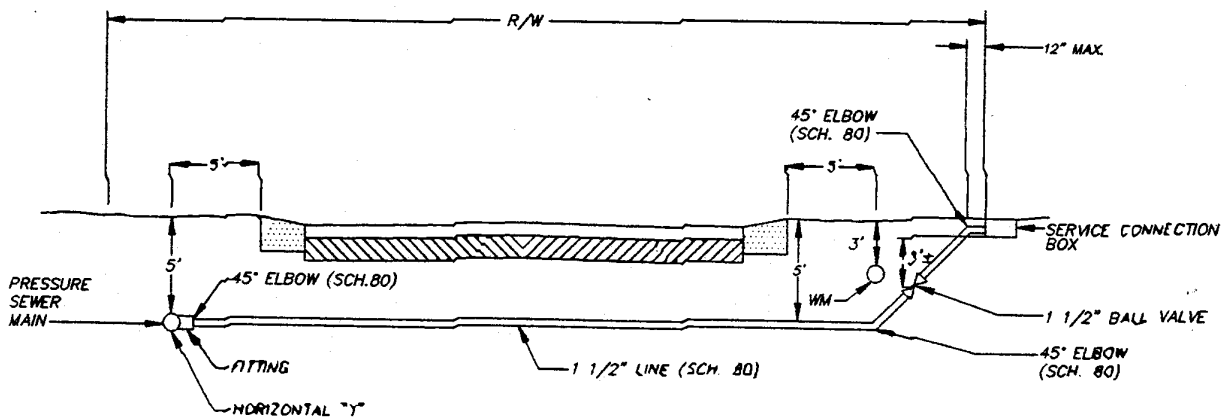
**SERVICE CONNECTION**

Job No. _____	File No. _____	Scales	PLAN _____	PROFILE _____	Hor. _____	Vert. _____	As Built _____	Date _____	KHP	Project-Engr	Approved By	Date	Sheet 5 of 5
PLAN _____	NTS												
Surveyed By	Designed By	Drawn By											

No.	Date	By	Revision



**SHORT SIDE LATERAL SERVICE**



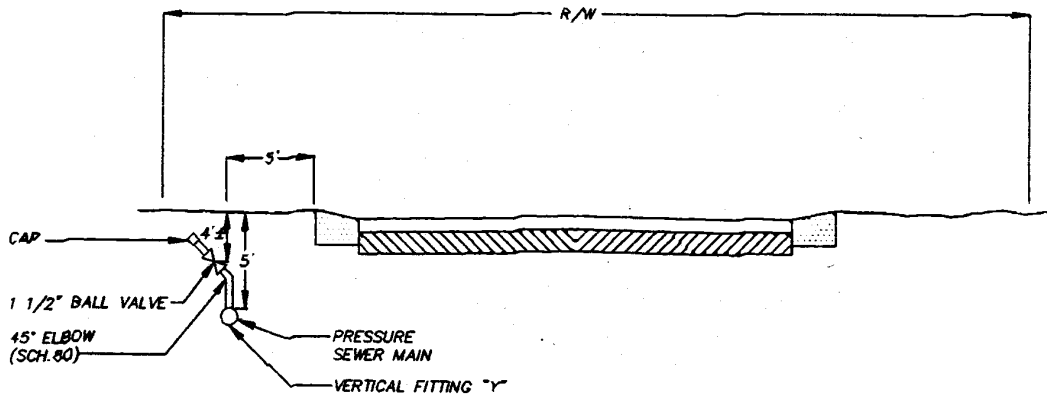
**LONG SIDE LATERAL SERVICE**

**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

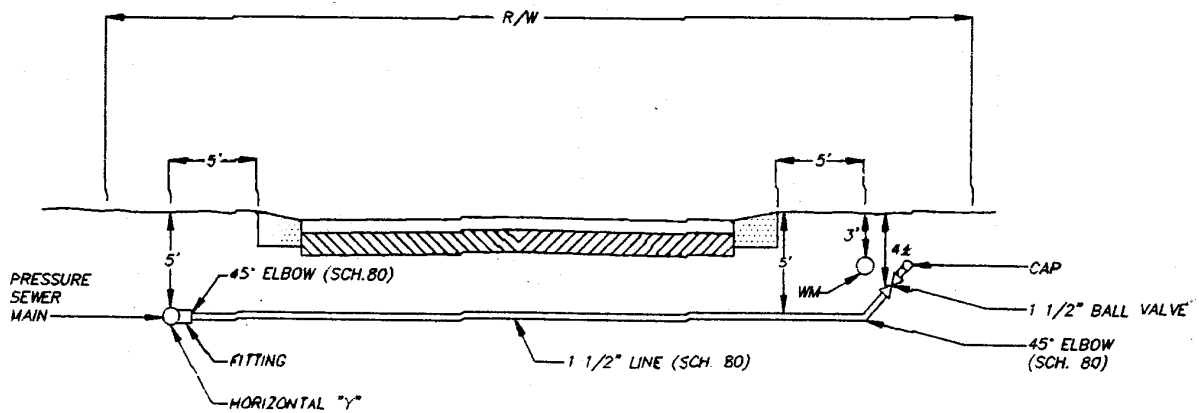
Job No.	File No.	<b>STANDARD DETAIL PRESSURE SEWER</b>					
PLAN	Scale <b>NTS</b>						
PROFILE	Hor. _____						
	Vert. _____						
As Built	Date	<b>LATERAL SERVICE</b>					
Surveyed By	Designed By	<table border="1"> <tr> <td>Drawn By <b>KHP</b></td> <td>Project-Engr</td> <td>Approved By <b>KBP</b></td> <td>Date <b>1/14/94</b></td> <td>Sheet <b>6</b> Of</td> </tr> </table>	Drawn By <b>KHP</b>	Project-Engr	Approved By <b>KBP</b>	Date <b>1/14/94</b>	Sheet <b>6</b> Of
Drawn By <b>KHP</b>	Project-Engr	Approved By <b>KBP</b>	Date <b>1/14/94</b>	Sheet <b>6</b> Of			

No.	Date	By	Revision

1/5/94



**SHORT SIDE PARTIAL LATERAL SERVICE**



**LONG SIDE PARTIAL LATERAL SERVICE**

**NOTE:**

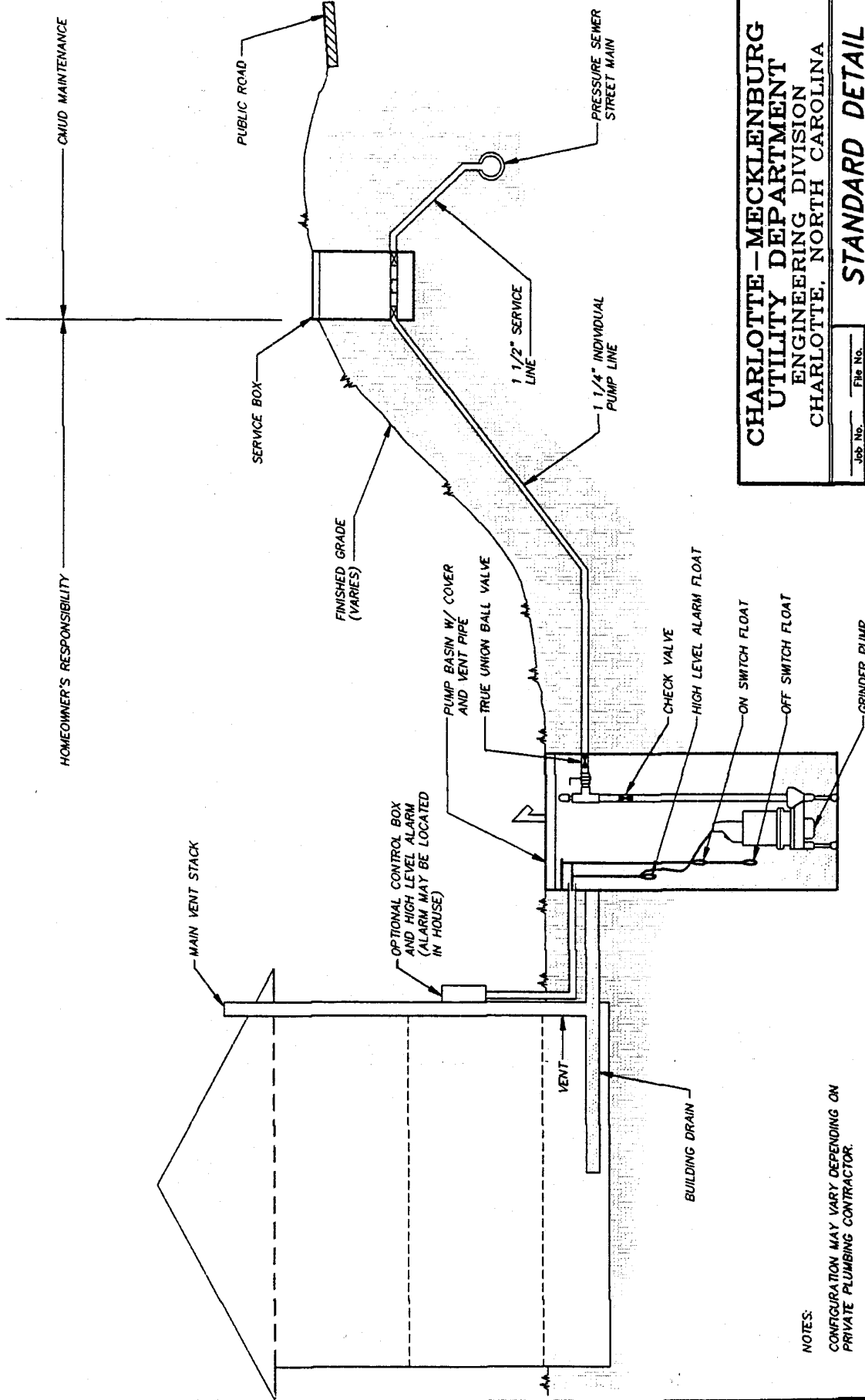
1. A PVC ENCAPSULATED MAGNET SHALL BE ATTACHED TO THE VALVE FOR MAGNETIC LOCATION PURPOSES.

**CHARLOTTE—MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____	File No. _____	<b>STANDARD DETAIL PRESSURE SEWER</b>
Scales <u>NTS</u>		
PLAN _____	Ver. _____	<b>PARTIAL LATERAL SERVICE</b>
PROFILE _____	Ver. _____	
As Built _____	Date _____	
Surveyed By _____	Designed By _____	Drawn By <u>KHP</u>
		Project-Engr _____
		Approved By <u>[Signature]</u>
		Date <u>1/28/95</u>
		Sheet <u>7</u> Of _____

No.	Date	By	Revision

1/21/94



NOTES:  
 CONFIGURATION MAY VARY DEPENDING ON  
 PRIVATE PLUMBING CONTRACTOR.  
 ALL PRIVATE PLUMBING SHALL BE IN  
 ACCORDANCE WITH NORTH CAROLINA  
 BUILDING CODE.

**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

Job No. \_\_\_\_\_ File No. \_\_\_\_\_  
 PLAN \_\_\_\_\_ Scale \_\_\_\_\_  
 PROFILE \_\_\_\_\_ Hor. \_\_\_\_\_  
 \_\_\_\_\_ Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_  
 JHB  
 Surveyed By \_\_\_\_\_ Designed By \_\_\_\_\_  
 KHP  
 Drawn By \_\_\_\_\_  
 Project-Engr. Approved By \_\_\_\_\_  
 Date \_\_\_\_\_  
 Sheet 8 of 8

**STANDARD DETAIL  
 PRESSURE SEWER  
 INDIVIDUAL GRINDER  
 PUMP SYSTEM**

No.	Date	By	Revision

***XIX. CMUD METHODS AND MATERIALS COMMITTEE***

The methods and materials committee was established to review CMUD standard specifications for materials and construction methods. The committee is responsible for review of changes/additions to the specifications as requested by manufacturers, suppliers, contractors, CMUD personnel or other interested parties.

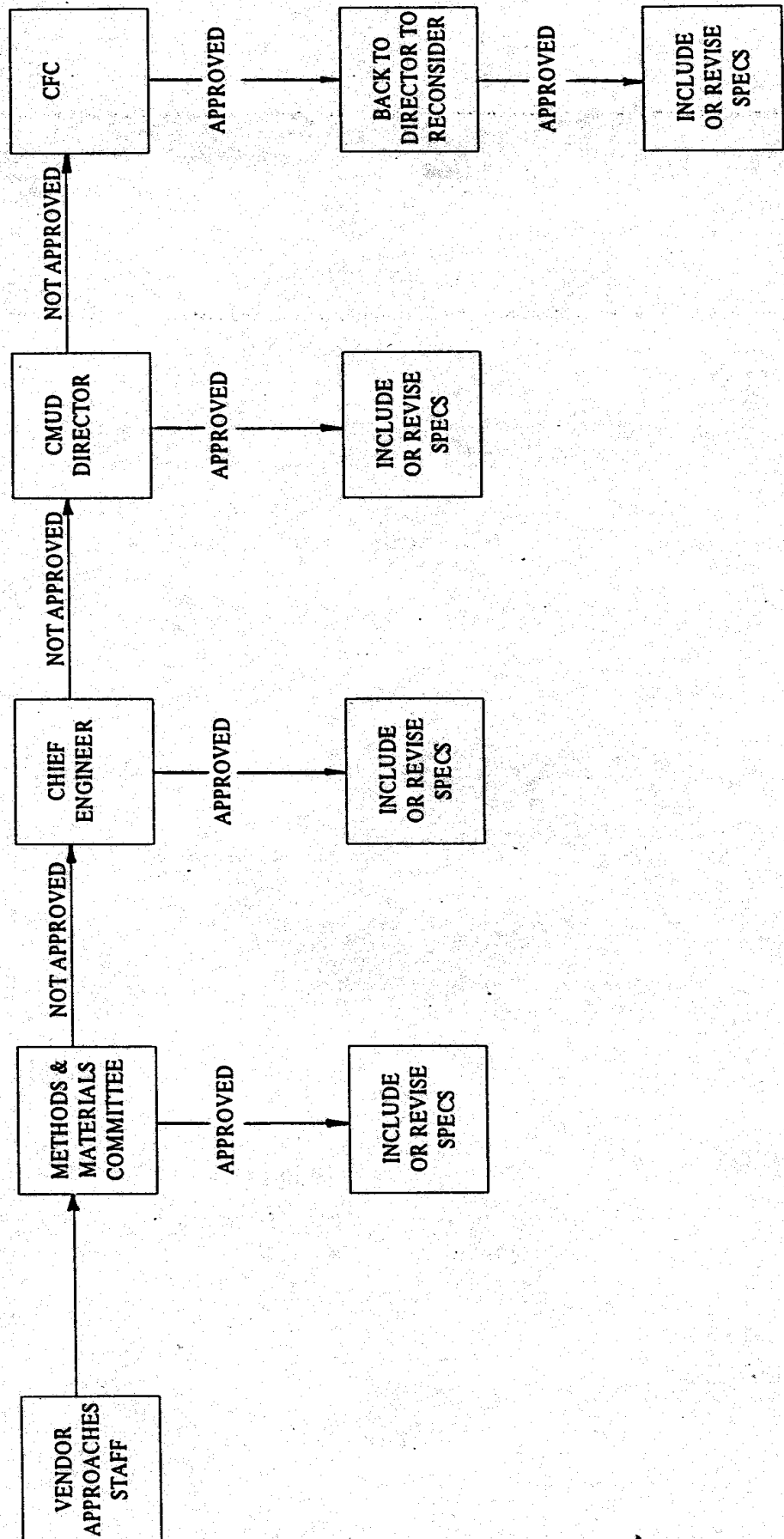
The committee is composed of two representatives from water/sewer contractors and the following CMUD personnel:

- Capital Improvements Projects Manager
- Land Development Manager
- Technical Services Manager
- Special Projects Manager
- Water Distribution Superintendent
- Wastewater Collection Superintendent
- Customer Service Superintendent
- Contractor
- Contractor

Standard evaluation criteria will be used when considering requests. Committee decisions will be made by consensus. If the committee is unable to reach consensus, opposing views will be presented to the Chief Engineer for judgement.

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PROCESS FOR MATERIALS / SPECIFICATIONS CHANGES





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## **SEWER PIPE - EVALUATION CRITERIA**

1. Flow characteristics (friction coefficient)
2. Life expectancy
3. History of past use
4. Resistance to scour (abrasion resistance)
5. Ease of handling and installation
6. Structural strength
7. Structural strength in combination with bedding system
8. Type of joint
9. Joint Tightness
10. Availability of fittings
11. Manhole connections
12. Availability of sizes
13. Material Cost
14. Installation Cost
15. Ease of Lateral Connections
16. Durability
17. Compatibility with approved materials
18. Outside and Inside diameter
19. ASTM Specification
20. Corrosion Resistance
21. Chemical Resistance
22. Weight
23. Wall Thickness
24. Manufacturing/Quality Control

## **STRUCTURES - EVALUATION CRITERIA**

1. Life expectancy
2. History of past use
3. Resistance to scour (abrasion resistance)
4. Corrosion resistance
5. Chemical resistance
6. Ease of handling and installation
7. Structural strength
8. Type of seal
9. Water/Air tightness
10. Availability of sizes
11. Pipe connections
12. Material Cost
13. Installation Cost
14. Resistance to uplift
15. Durability
16. Compatibility with approved materials
17. ASTM Specification
18. Safety
19. Aesthetics
20. Working room within
21. Conformance to Standard Detail Dimensions
22. Means of entry
23. Manufacturing/Quality Control

## **CASTINGS - EVALUATION CRITERIA**

1. Life expectancy
2. History of past use
3. Corrosion Resistance
4. Structural strength
5. Weight
6. Security
7. Safety
8. ASTM Specification
9. Water/Air tightness
10. Compatibility with approved materials
11. Ease of use
12. Durability
13. Conformance with Standard Dimensions
14. Cost
15. Manufacturing/Quality Control

## **WATER PIPE - EVALUATION CRITERIA**

1. Life expectancy
2. History of use
3. Head loss
4. Abrasion resistance
5. Ease of handling/installation
6. Structural strength
7. Durability
8. Pressure classification
9. Water hammer allowance
10. Type joint
11. Type fittings
12. Availability of sizes
13. Material cost
14. Installation cost
15. Type of Tap
16. East of Tapping
17. Compatibility with approved materials
18. Inside/Outside Diameter
19. Corrosion resistance
20. Wall Thickness
21. ASTM Specifications
22. Manufacturing/Quality Control

## **WATER VALVES - EVALUATION CRITERIA**

1. Life Expectancy
2. History of use
3. Head loss
4. Abrasion resistance
5. Strength
6. Pressure rating
7. Durability
8. Availability of sizes
9. Corrosion resistance
10. Operating Torque
11. ASTM Specification
12. Ease of Repair
13. Cost
14. Material of construction
15. Repair parts required
16. Manufacturing/Quality Control

## **FIRE HYDRANTS - EVALUATION CRITERIA**

1. Life expectancy
2. History of use
3. Strength
4. Pressure rating
5. Durability
6. Corrosion resistance
7. ASTM Specification
8. Ease of Repair
9. Repair parts required
10. Cost
11. Material of construction
12. Conformance to standard dimensions
13. Flow Performance/Characteristics
14. Compatibility with other approved hydrants.
15. Manufacturing/Quality Control