



# CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT

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## 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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## 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><i>REVISION #</i></b>	<b><i>DATE</i></b>	<b><i>PAGE NO.</i></b>	<b><i>DESCRIPTION OF REVISION</i></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

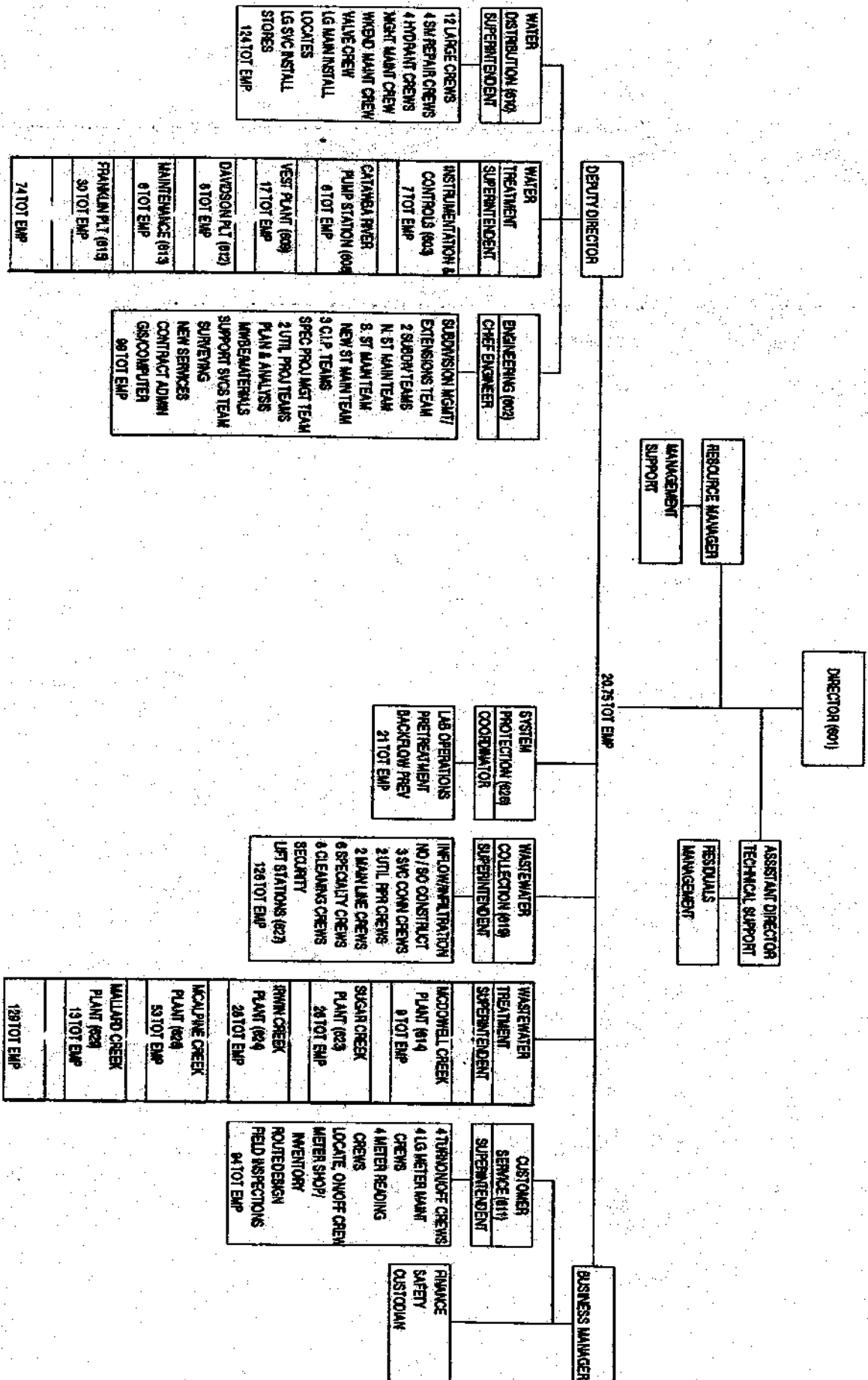
### **WASTEWATER TREATMENT PLANTS**

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

667.75 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**

**382-5547**

6325 Wilkinson Boulevard

Charlotte, NC 28214

### **AT&T**

**335-2873**

900 Franklin Avenue

Charlotte, NC 28206

### **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**

**525-5585**

P.O. Box 33068

Charlotte, NC 28233

### **Cablevision of Charlotte**

**377-2228, Ext. 311**

P.O. Box 34614

Morehead Street

Charlotte, NC 28205

### **Vision Cable of Charlotte**

**545-0136**

4606 Margaret Wallace Road

Matthews, NC 28105

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

**845-7644**

Engineering Department

P.O. Box 428

Matthews, NC 28106-0428

### **MCI Telecommunications Corporation**

**1-800-288-6295**

377 Carowinds Boulevard

Fort Mill, SC 29715

## 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
Mooreville 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

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), regrading 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:

{PRIVATE } SERVICE	TYPE	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**

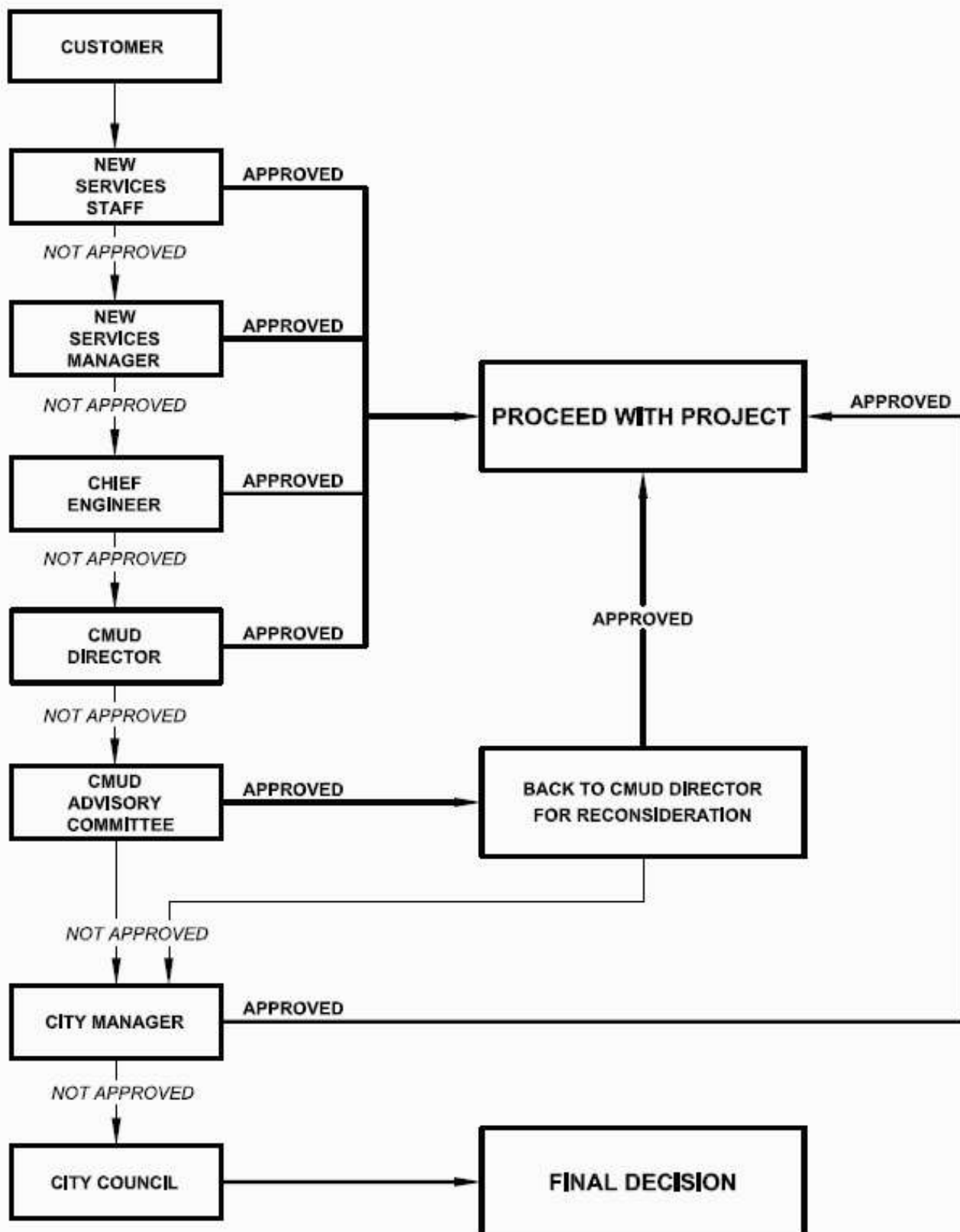
- a. The financial assistance program as approved by the City Council as part of this Policy and in effect on January 1, 2010 shall remain in effect until and unless revised by Utilities as authorized in subsection (b) of this section.
- b. Utilities is authorized to revise the financial assistance program from time to time and to administer said program for qualified property owners to assist with the cost of connecting to the system. Utilities shall give notice of a revision to said program to the City Council and to the Utilities Advisory Committee at least 10 days in advance of the effective date of such revision. Further approval by the City Council or the Committee is not required for such revisions to take effect. Without limiting the foregoing, Utilities shall have the right to establish and modify the qualifying criteria for any applicable financial assistance. Property owners qualifying for financial assistance are not guaranteed assistance. A copy of the financial assistance program shall be maintained and made available for public inspection and copying in the office of the Director of Utilities and in the office of the City Clerk for the City of Charlotte.

### **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.

**Acreage 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. Acreage 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:

- a. 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.
- b. Use Manning Equation or Charts to determine pipe size.

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

Where  $n = .013$

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

$S = \text{slope}$

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

- c. Check the velocity flowing full  
 $V = Q/A$   
Velocity must be  $> 2 \text{ fps}$  and  $< 10 \text{ fps}$
- d. 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**

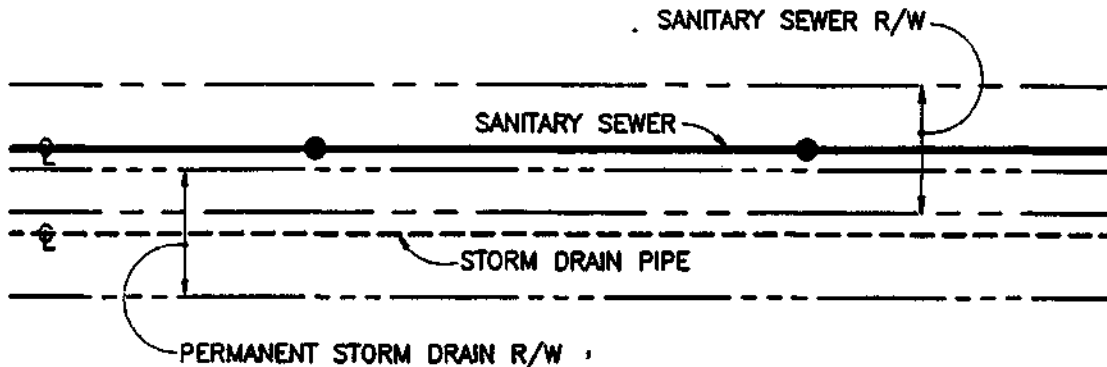
1. Permanent right-of-way and temporary construction easements shall be provided according to Table 3. Temporary construction easements should be increased for difficult construction areas (e.g. sewers on steep slopes).

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.

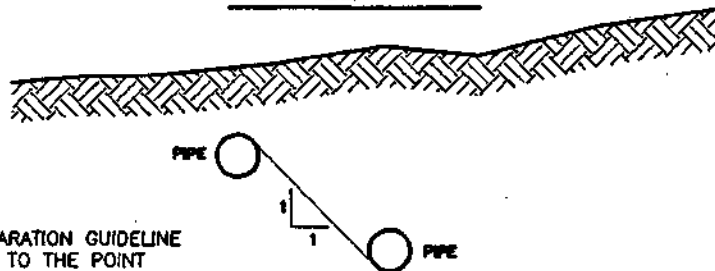
- j. Submit an original map and one copy with the original signature and original seal of the N.C. Registered Surveyor, as required by G.S. 47-30(M). In addition, seven (7) blue-line copies are required.
- 4. Check right-of-way maps against construction plans and make sure they agree. When a revision 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:

CITY ENGINEERING

*W. W. [Signature]*

DATE:

3/4/93

COUNTY ENGINEERING

*M. K. [Signature]*

3/15/93

C.M.U.D.

*Earl L. [Signature]*

3/4/93

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. _____ File No. _____		STANDARD DETAIL	
Scales _____			
PLAN	N.T.S.	OVERLAPPING SANITARY SEWER & STORM DRAINAGE R/W'S	
PROFILE	Hor _____ Vert _____		
As Built	Date _____		
Surveyed By	Designed By	Drawn By	Project Engr
Approved By	Date	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>TRENCH DEPTH</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 *
Carrier Pipe	Casing Pipe	D.O.T.	R.R.	Min. Tunnel
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.

**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:

Maximum daily flow = Average daily flow times 1.5  
Peak hourly flow = Average daily flow times 2.1

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

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### 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 ( $45^\circ$ ,  $22\text{-}1/2^\circ$ ,  $11\text{-}1/4^\circ$ ).
6. At creek crossings, use  $45^\circ$  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.












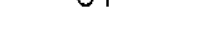









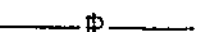

Bearings on sewer lines shall be labeled in the upstream direction.

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 rectangle] —	(0) OR .35
RAILROAD _____	— + + + + —	(0) OR .35
GUARD RAIL _____	— [I I I] —	(0) OR .35
PIERS _____	— [vertical bars] —	(0) OR .35
BRIDGE _____	— [arches] —	(0) OR .35
FENCE ( LABEL TYPE ) _____	— X —	(0) OR .35
STREET SIGN ( LABEL TYPE ) _____	— [sign symbol] —	(0) OR .35
STORM DRAIN / CATCH BASIN OR DROP INLET	— [rectangle] —	(0) OR .35
SEDIMENT FENCE (SILT FENCE) STD. 6.62 —	— [chain link] —	(0) OR .35
TEMPORARY SEDIMENT TRAP STD. 6.60 —	— [trap symbol] —	(0) OR .35
CHECK DAM STD. 6.83 —	— [dam symbol] —	(0) OR .35
TEMPORARY DIVERSION STD 6.20 —	TD — TD — TD	(0) OR .35
TEMPORARY STREAM CROSSING STD. 6.70 —	— [crossing symbol] —	(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) _____	— [cross-hatched 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:





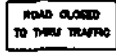















City of Charlotte Department of Transportation (704) 336-2261  
North Carolina Department of Transportation (704) 596-6900

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:

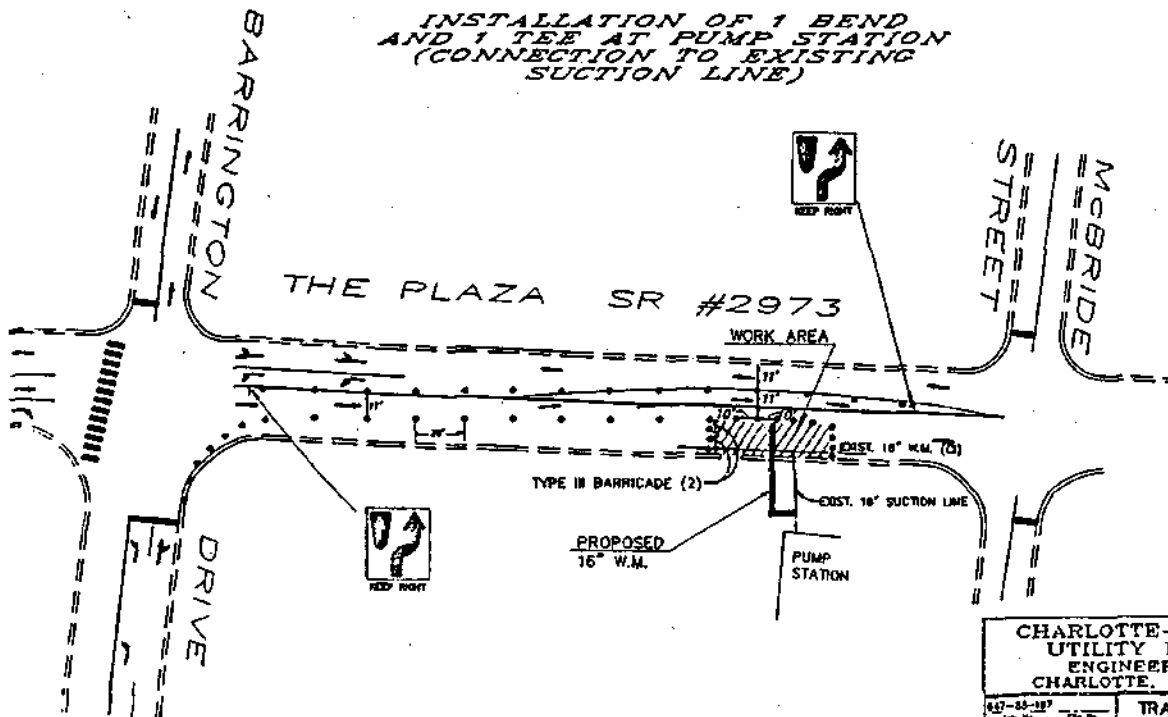
# LEGEND

	NON-METALLIC DRUM		G20-2 OR M1		R4-7 OR S2
	TYPE III BARRICADE W/ WARNING LIGHT		R11-4		R1-1
	POLICE OFFICER		W20-1 OR D1,E1,F1		
	FLAGPERSON		W20-5R OR M1,N1		
	W20-7A OR G1		W20-5L OR P1,Q1		R3-5
	W6-3 OR V1		W12-1 OR K3		R5-1
	W4-2 OR J1				
	W4-2 OR K1				

## PHASE 4

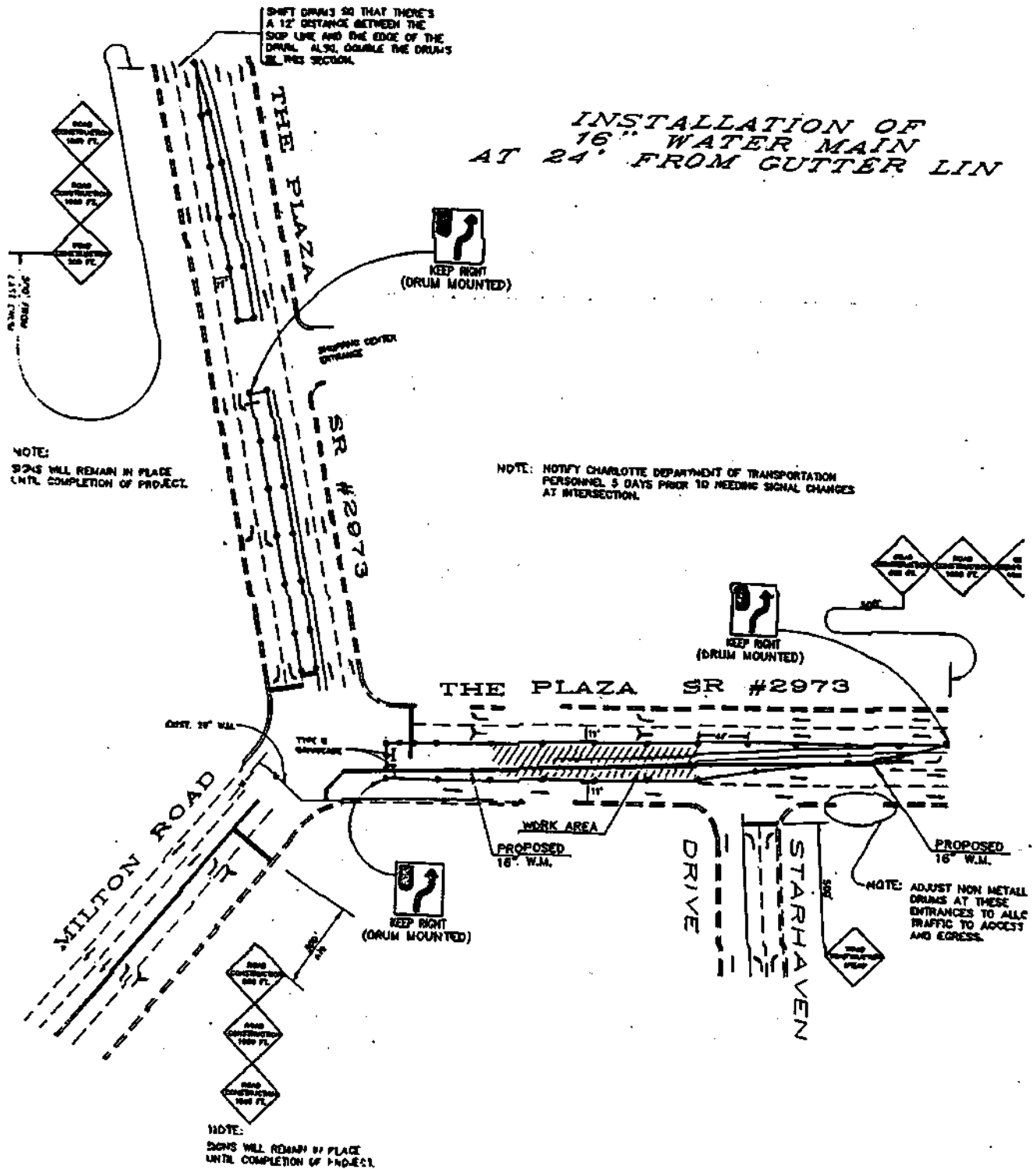
INSTALLATION OF 16" W.M.  
FROM C OF THE PLAZA  
TO THE PUMP STATION

INSTALLATION OF 1 BEND  
AND 1 TEE AT PUMP STATION  
(CONNECTION TO EXISTING  
SUCTION LINE)



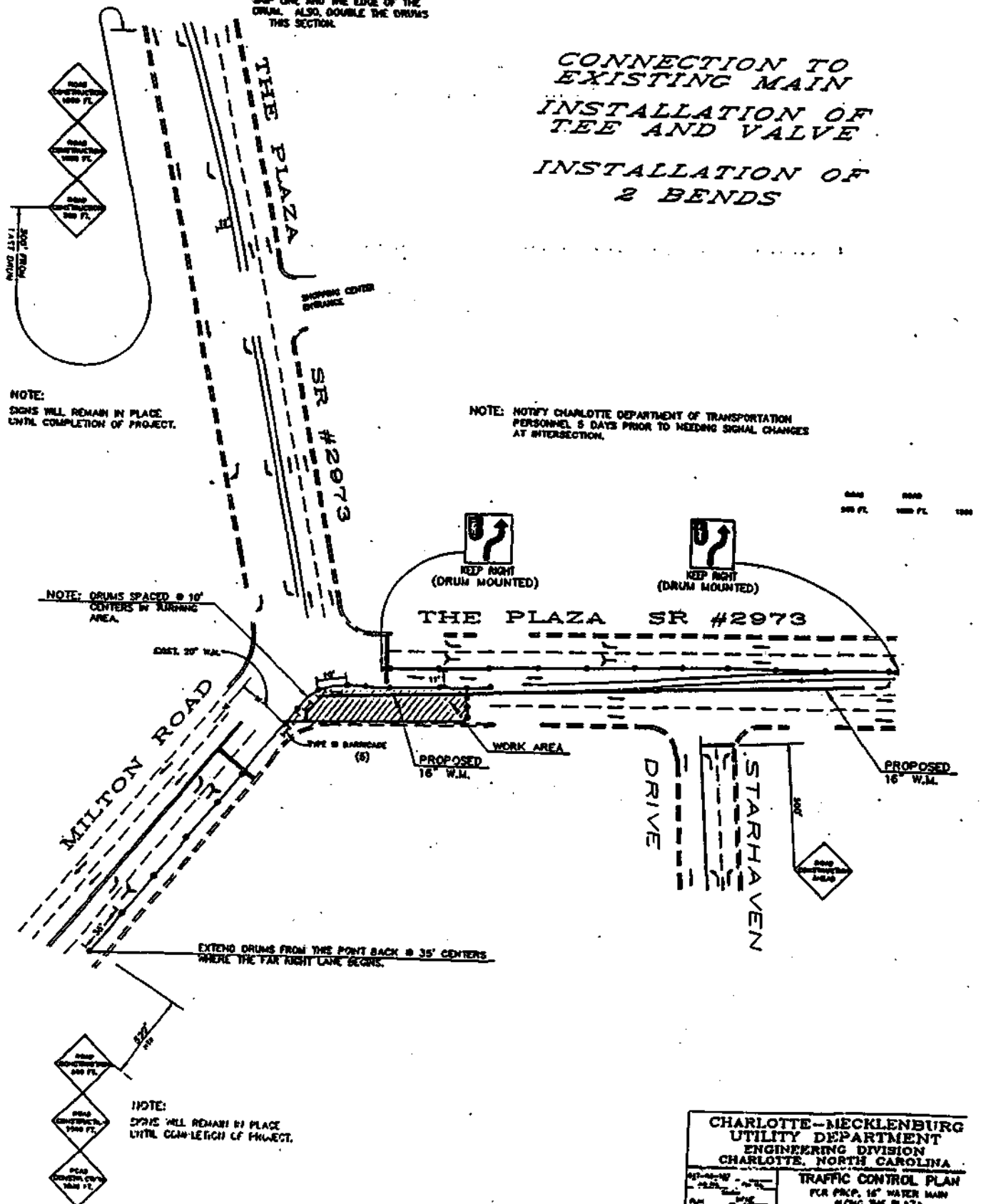
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

837-88-187	TRAFFIC CONTROL PLAN FOR PROPOSED 16" WATER M ALONG THE PLAZA
PLAN	PHASE 3-5 AND PHASE 4
DATE	
BY	
CHECKED	
APPROVED	
OC	TAB



<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>			
FILE NO. _____ DATE _____ BY _____ CHECKED BY _____ APPROVED BY _____ DC _____ TAG _____ SCM _____	<b>TRAFFIC CONTROL PLAN</b> FOR PROPOSED 16" WATER MAIN ALONG THE PLAZA <b>PHASE 1, PHASE 2 AND PHASE 5</b>		

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



CHARLOTTE--MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA			
10-10-79 10-10-79		TRAFFIC CONTROL PLAN FOR PHCP, 16" WATER MAIN ALONG THE PLAZA	
PHASE 1, PHASE 2 AND PHASE 5			
DC	TAR	47M	10

## **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 NCDENR. 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

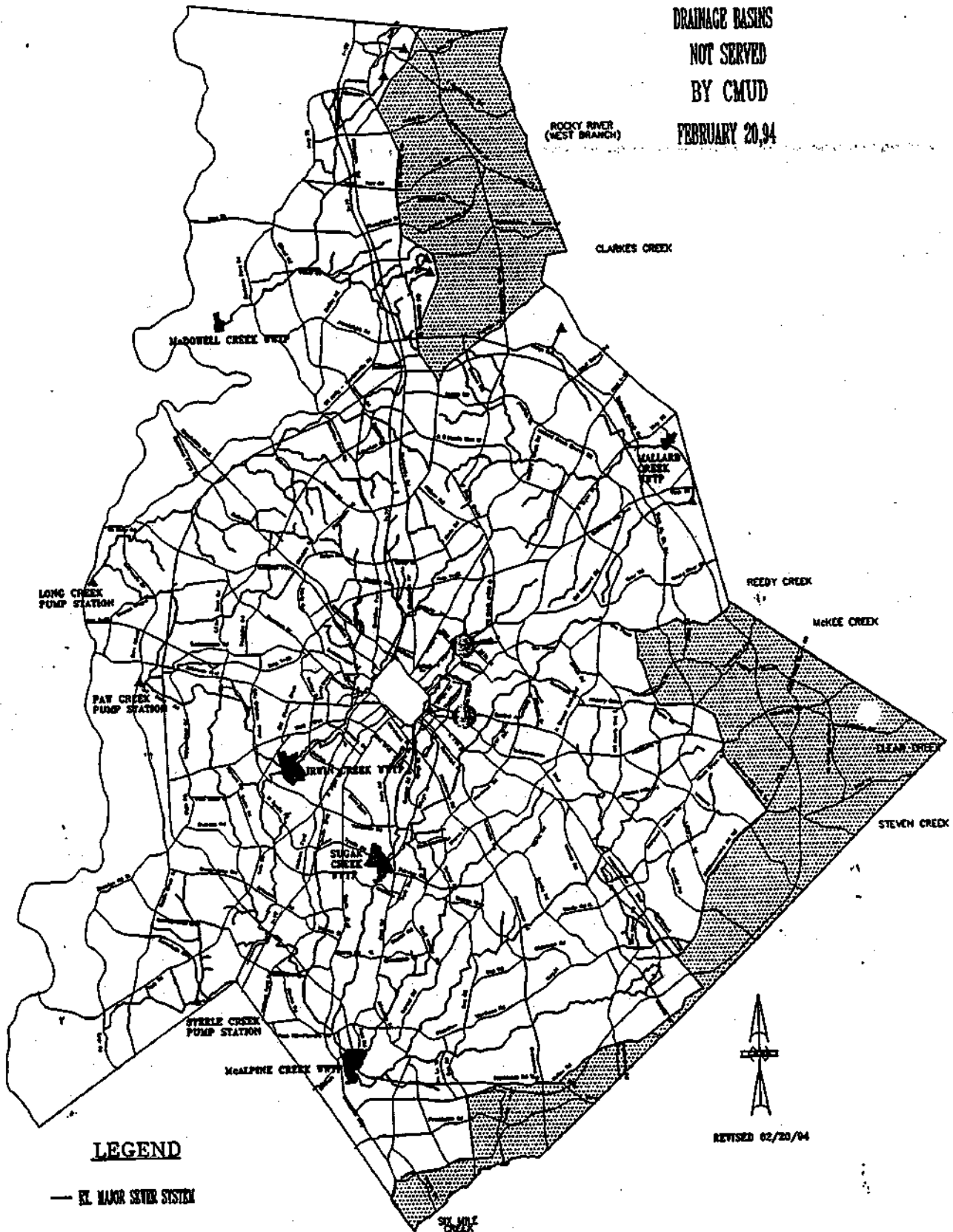
UTILITY DEPARTMENT

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

ENG CERT6.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;

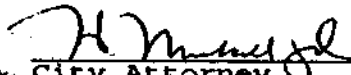
- (B) whether the petitioner promptly abated continuing environmental damage resulting from the violation giving rise to the assessment;
  - (C) whether the violation giving rise to the assessment was inadvertent or the result of an accident;
  - (D) whether the petitioner has been assessed civil penalties 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**  
Post Office Box 1507  
Washington, NC 27889  
(919) 946-6481  
Fax (919) 975-3716

**Raleigh Regional WQ Supervisor**  
Post Office Box 27687  
Raleigh, NC 27611  
(919) 571-4700  
Fax (919) 571-4718

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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  
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Chatham  
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Halifax  
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Lee

Nash  
Northampton  
Orange  
Person  
Vance  
Wake  
Warren  
Wilson

**Fayetteville Regional WQ Supervisor**  
Wachovia Building, Suite 714  
Fayetteville, NC 28301  
(910) 486-1541  
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  
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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

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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  $> \text{ or } = 2.5'$ )
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)**

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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

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127 Cardinal Drive Extension  
Wilmington, NC 28405-3845  
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Randolph  
Stokes  
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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.

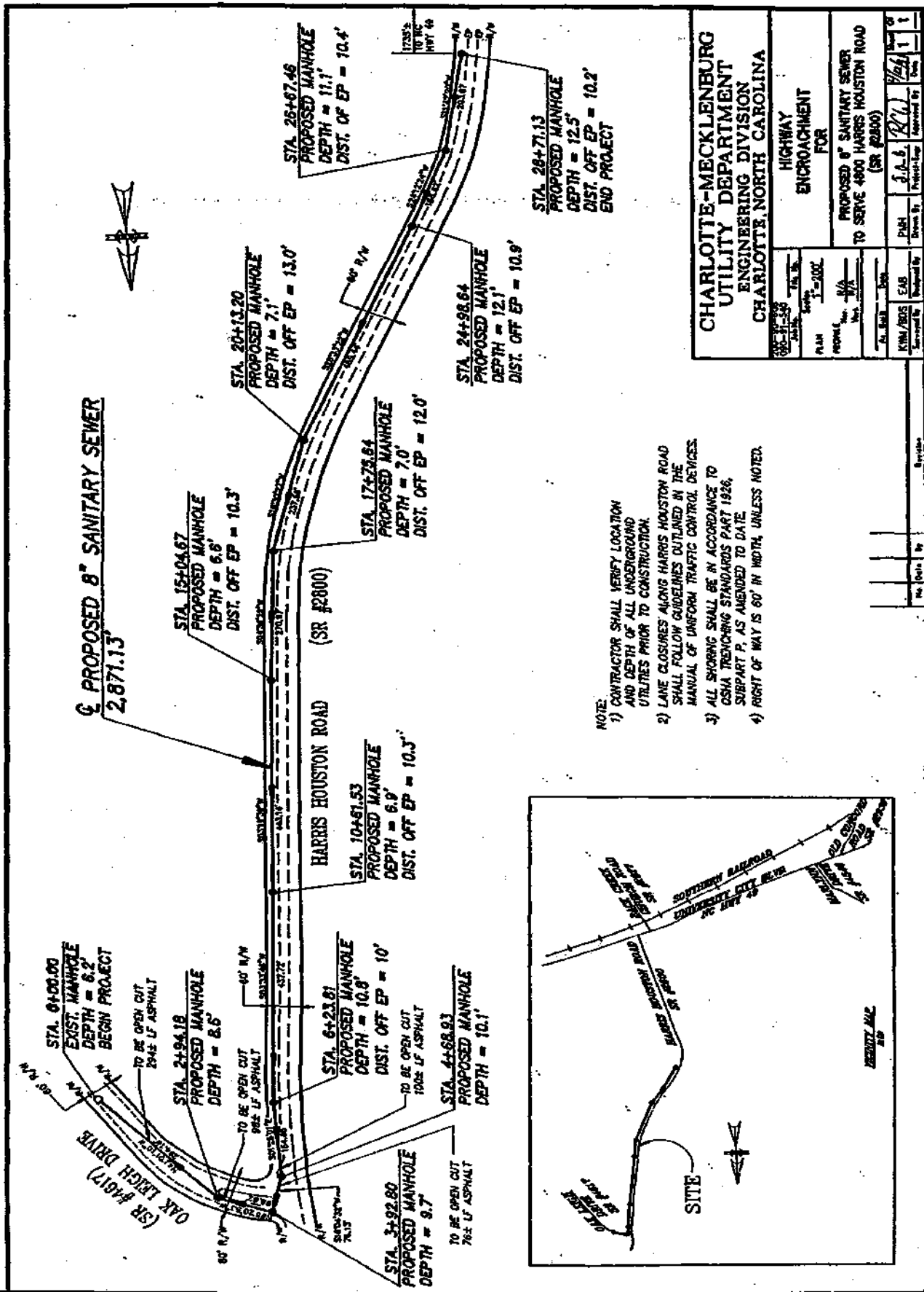
- \* O. If a misfire occurs, all personnel shall remain at a safe distance for at least one hour from the time of initiation. Correction of misfires shall be handled under the direction to the blaster in charge. A thorough search shall be made for unexploded charges before correction is attempted.
- \* 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.

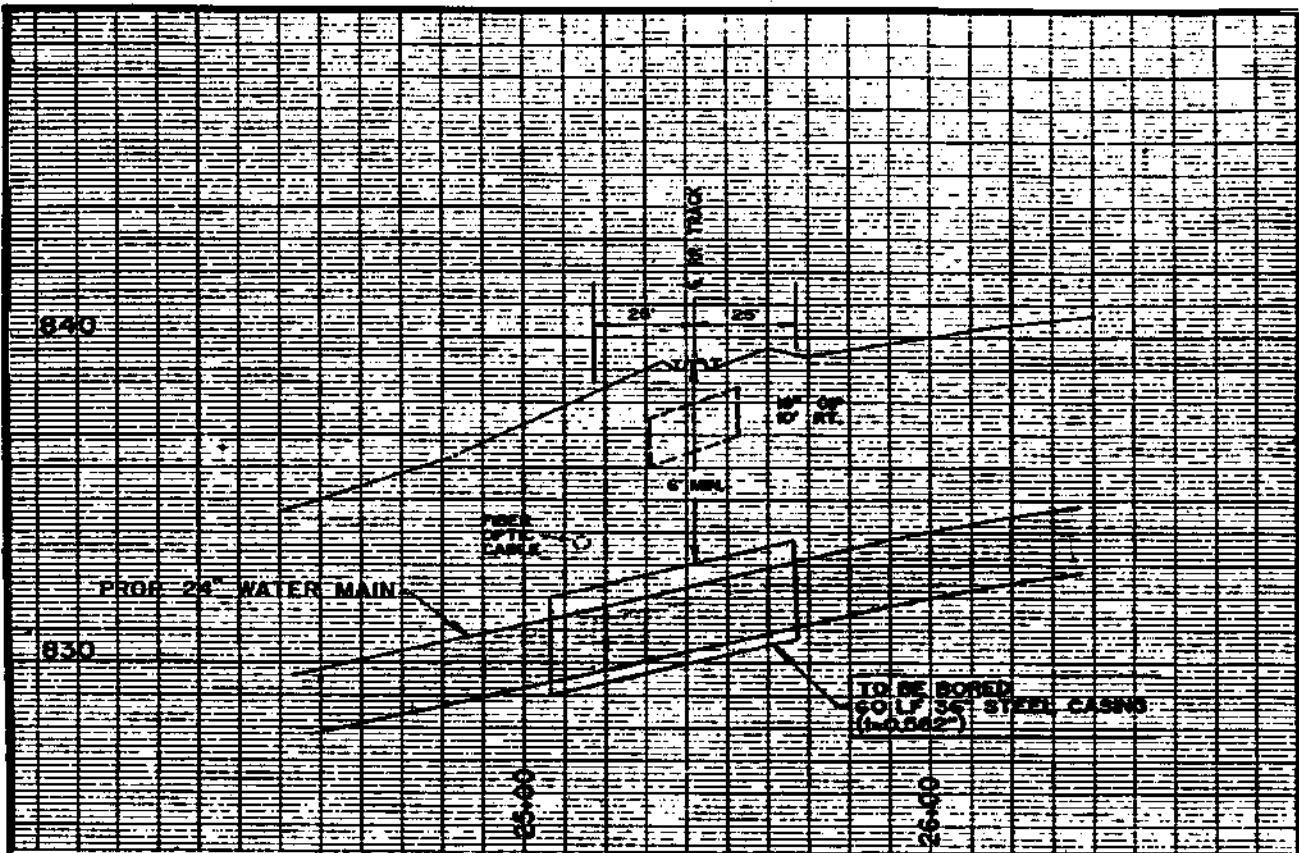
IV. POP SHOTS (\* Applicable in Addition to Below)

- 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.**

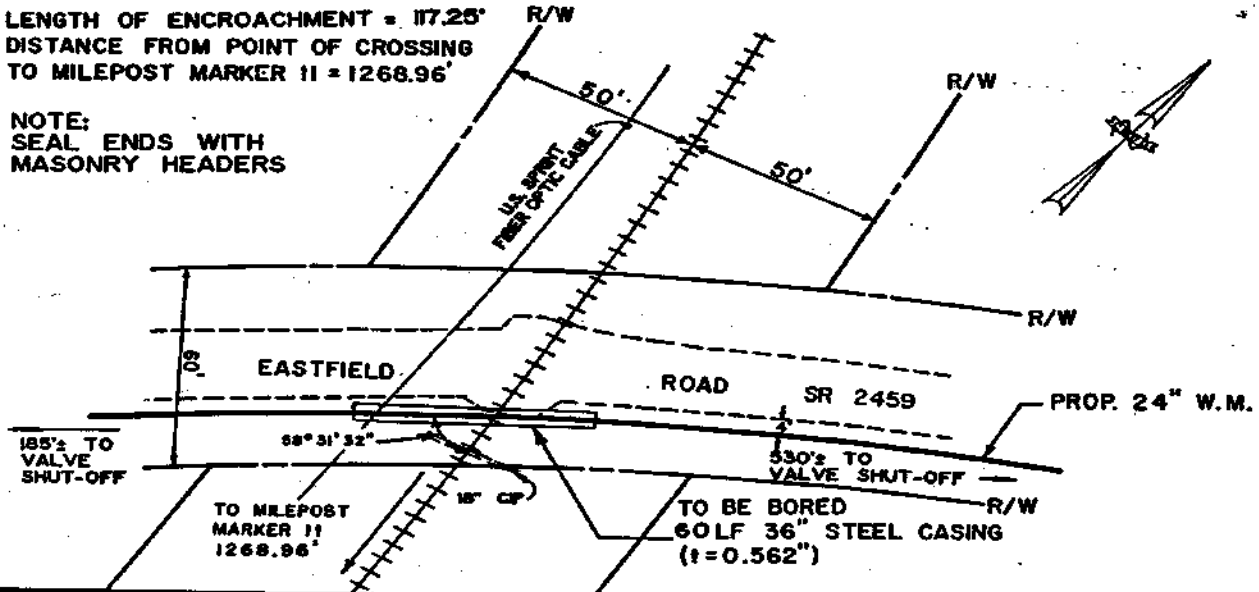
Revised September 1992





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"	34.98"
OUTSIDE DIAMETER	25.98"	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	
691-98-201 691 Job No. File No. Scale: 1" = 40' PLAN PROFILE: 1" = 40' 1" = 4'	SOUTHERN RAILROAD ENCROACHMENT FOR PROP. 24" WATER MAIN ALONG EASTFIELD RD.
DESIGNED BY: KJB CHECKED BY: KJB DATE: 11/1/88	DRAWN BY: KJB CHECKED BY: KJB DATE: 11/1/88



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:

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 \_\_\_\_\_

#### 11 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.

**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>WIDTH</u>	<u>HEIGHT</u>	<u>LENGTH</u>	<u>WIDTH</u>	<u>HEIGHT</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:

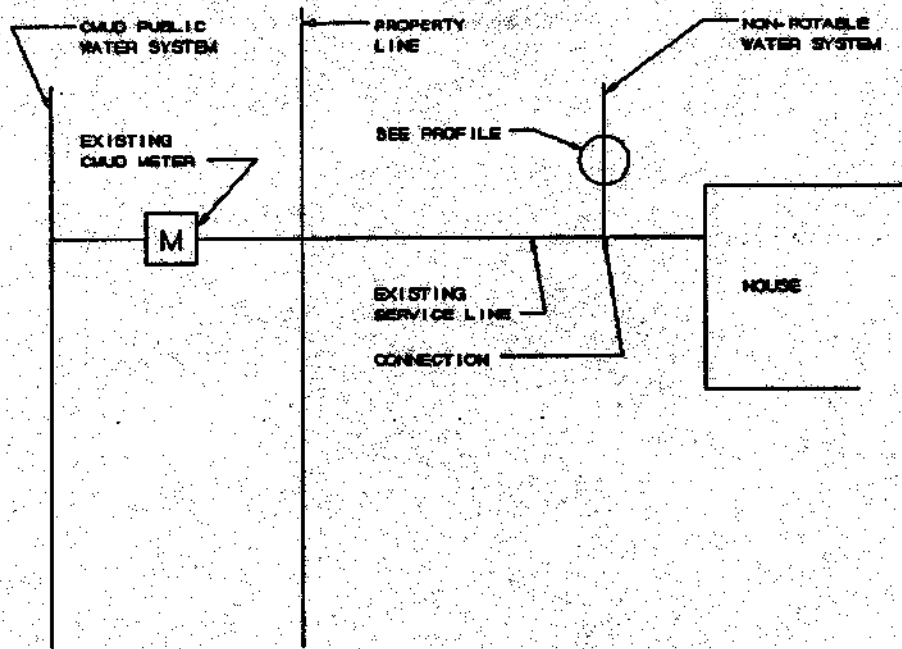
##### I-REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION

- 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.

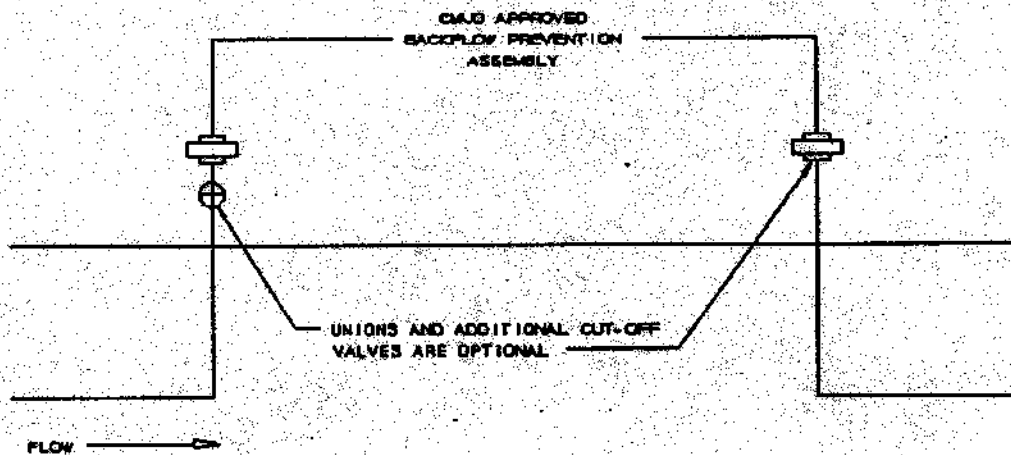
##### II-PROCEDURES FOR APPROVAL OF INSTALLATION

- 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



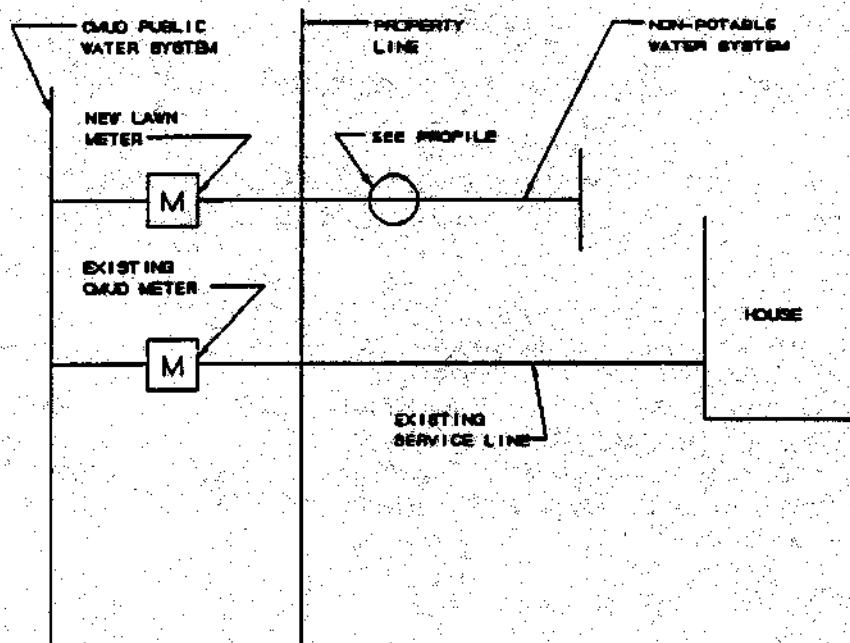
NEW RESIDENTIAL LAWN IRRIGATION SERVICE  
WITH NEW LAWN IRRIGATION SYSTEM TIED TO NEW LAWN METER:

I-REQUIREMENTS FOR BACKFLOW PREVENTION ASSEMBLY INSTALLATION

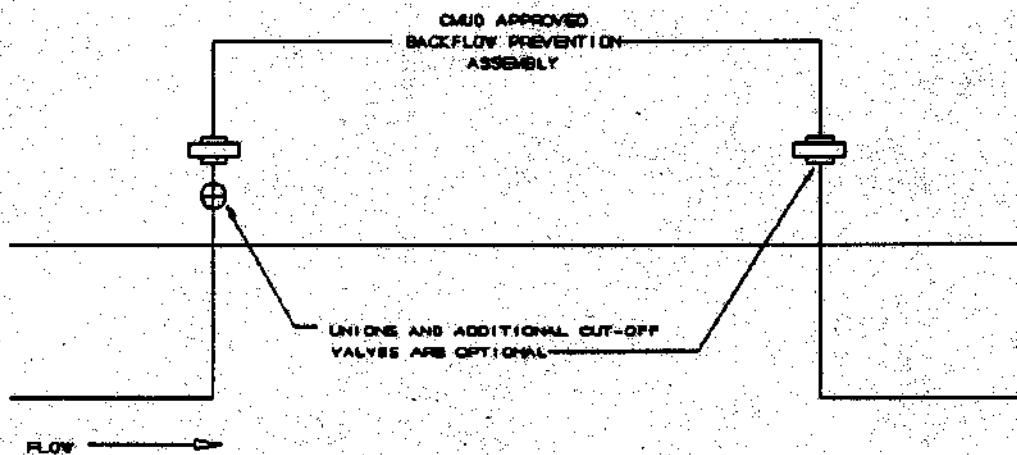
- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW IRRIGATION SYSTEM OUTSIDE ZONING SET BACK AREAS, PER CMUD STANDARD DETAILS.
- B. LOCATE 12" ABOVE GROUND MIN. 30" MAX. IN HORIZONTAL DIRECTION. 30" MIN. CLEAR OF ANY PERMANENT OBSTRUCTION. SEE INSTALLATION SPECIFICATIONS FOR BELOW GROUND REQUIREMENTS.
- 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

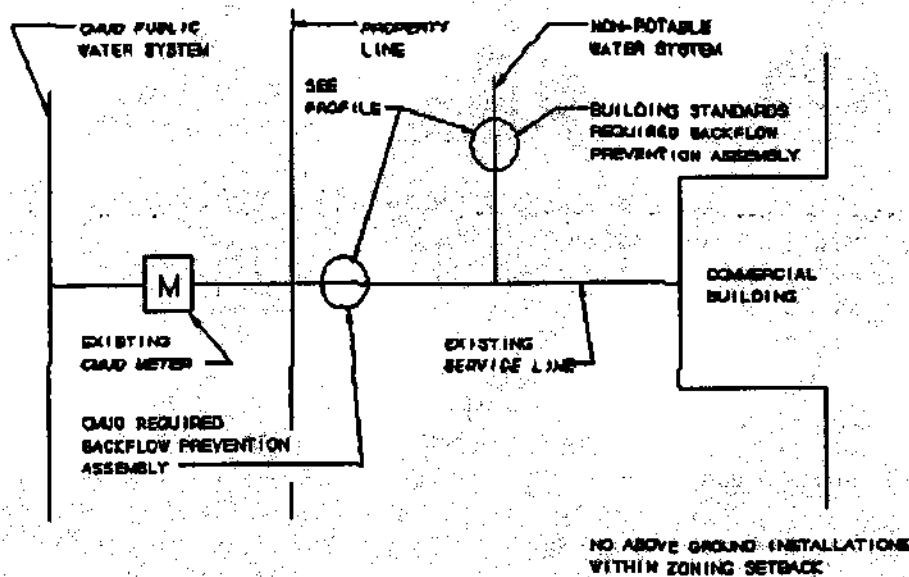
- A. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW SYSTEM OUTSIDE ZONING SETBACK AREAS, PER CMUD STANDARD DETAILS OUTSIDE AND ACCESSIBLE TO CMUD AT ALL TIMES. **ON FIRE LINES SHUT-OFF VALVES MUST BE OS&Y TYPE, AND BE PROVIDED WITH SUPERVISORY TAMPER SWITCHES WITH TROUBLE SIGNAL TO GO TO THE EMERGENCY CONTROL 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

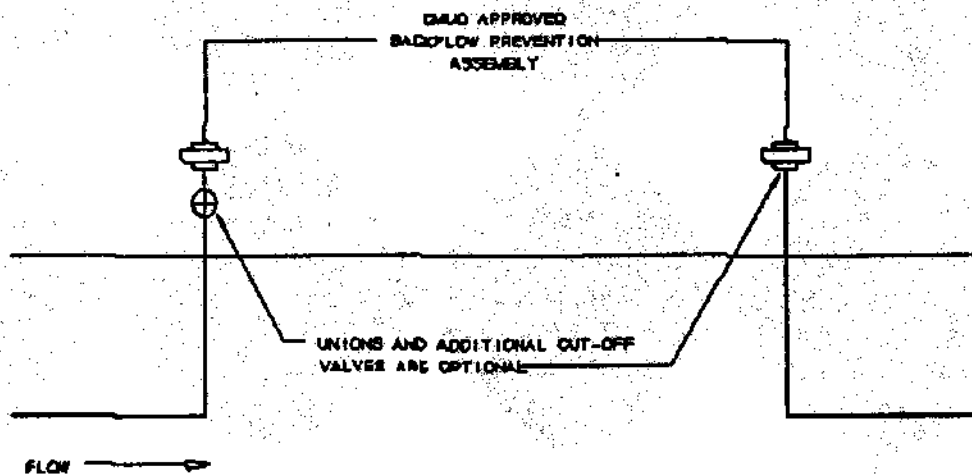
- A. LOCATE 12" ABOVE GROUND MIN. 30" MAX. BEFORE ANY BRANCHES IN NEW SYSTEM, IN HORIZONTAL DIRECTION. 30" MIN. FROM ANY OBSTRUCTION.
- B. PROTECTIVE STRUCTURE REQUIRED WITH INSULATED PROTECTION 7.4R FACTOR MINIMUM. INSULATION SHALL NOT BE WRAPPED AROUND ASSEMBLY. **ALL ASSEMBLIES USED ON FIRE LINE SERVICES 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.

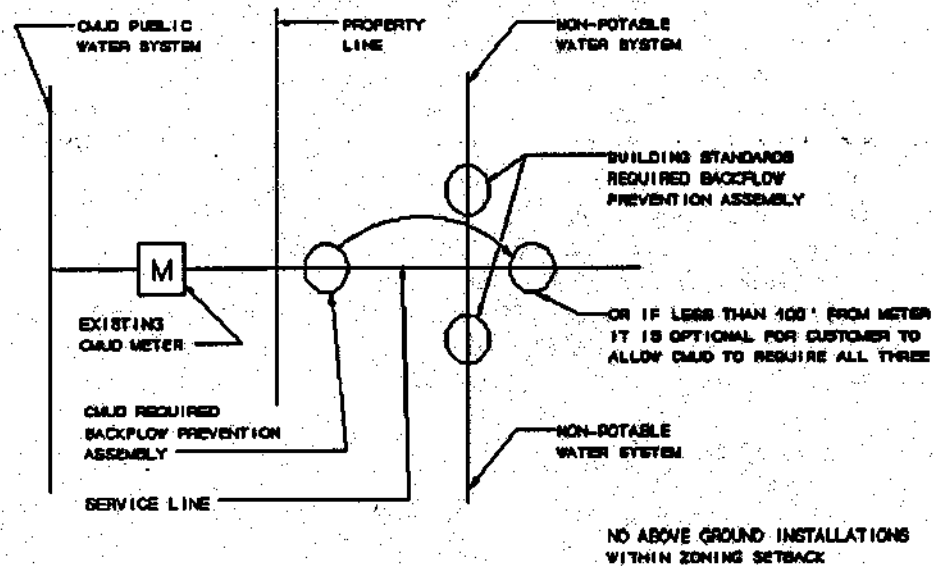
2. BUILDING STANDARDS REQUIREMENTS FOR BACKFLOW ASSEMBLY AT  
CONNECTION OF NEW LAWN IRRIGATION OR FIRE SYSTEM

- 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.

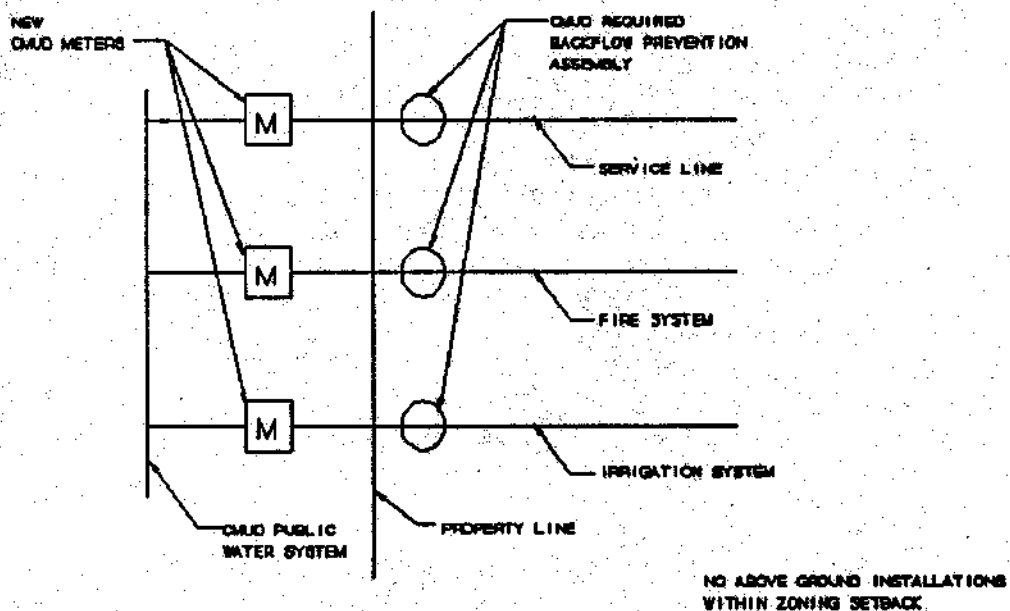
II-PROCEDURES FOR APPROVAL OF INSTALLATION

- 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

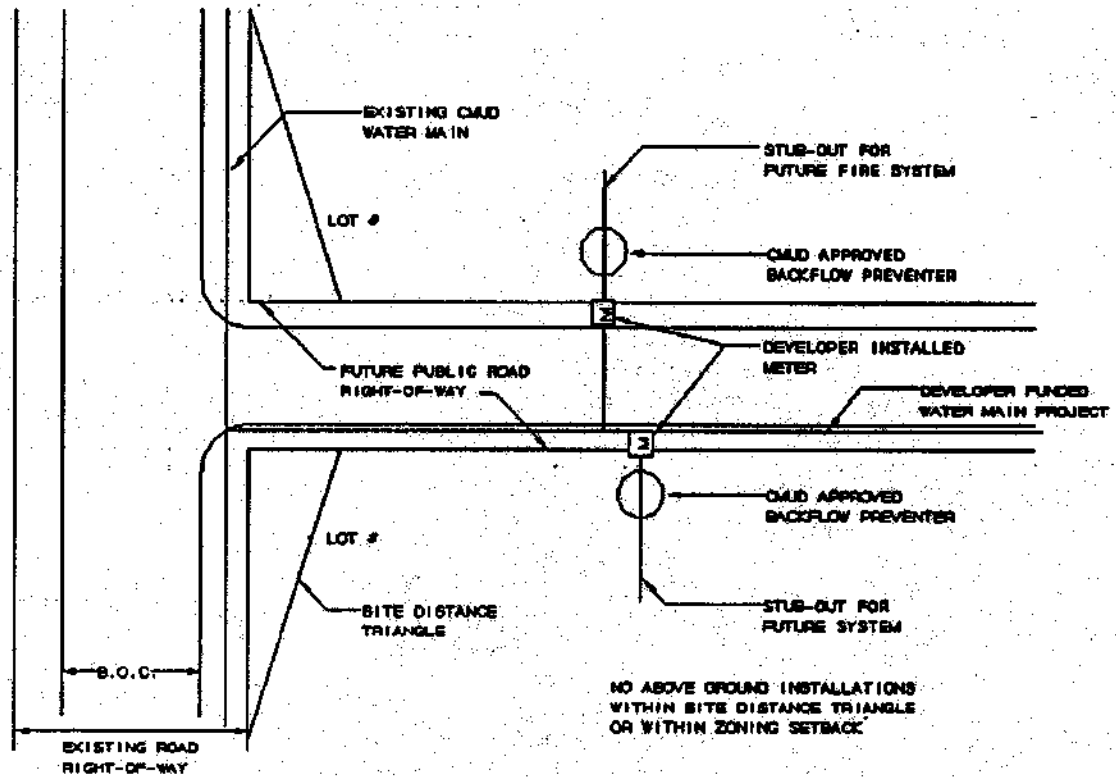
- A. INSTALLATIONS MUST BE INSTALLED OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON CUSTOMER PROPERTY.
- B. INSTALL ASSEMBLY BEFORE ANY BRANCHES IN NEW SERVICE, PER CMUD STANDARD DETAILS. **ON FIRE LINES SHUT-OFF VALVES SHALL BE OS & Y TYPE, AND BE PROVIDED WITH SUPERVISORY 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

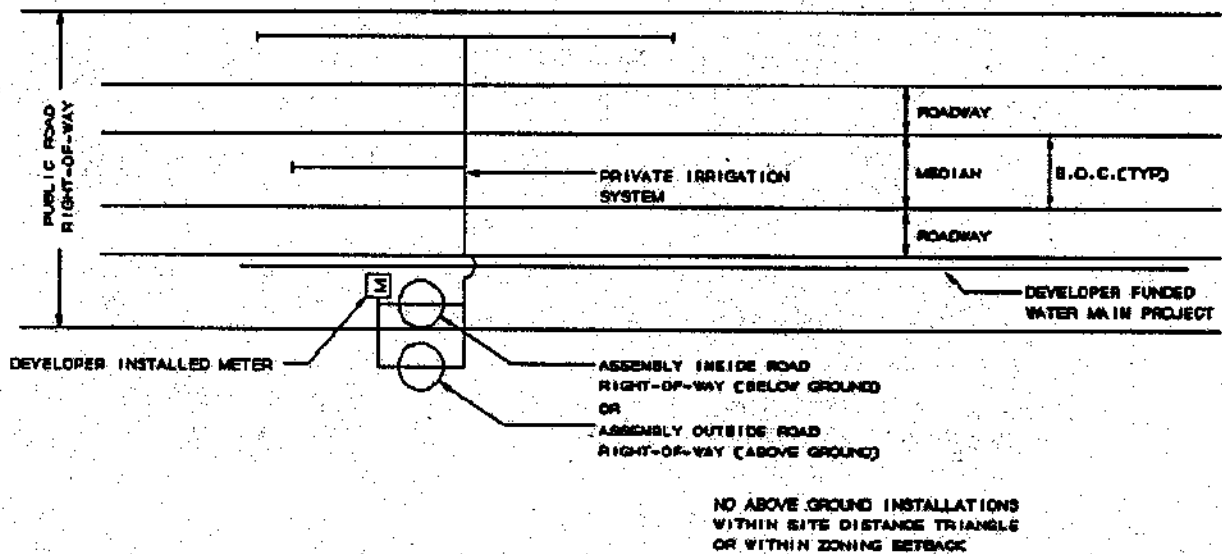
- A. ALL CONSTRUCTION ACTIVITIES, AND MATERIALS IN AN EXISTING OR FUTURE PUBLIC ROAD RIGHT-OF-WAY SHALL COMPLY WITH THE CURRENT NCDOT POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS OF WAY, OR CDOT POLICIES AND PROCEDURES AND ANY ADDITIONAL REQUIREMENTS OF ACTIVE ENCROACHMENT AGREEMENTS.
- 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



### 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

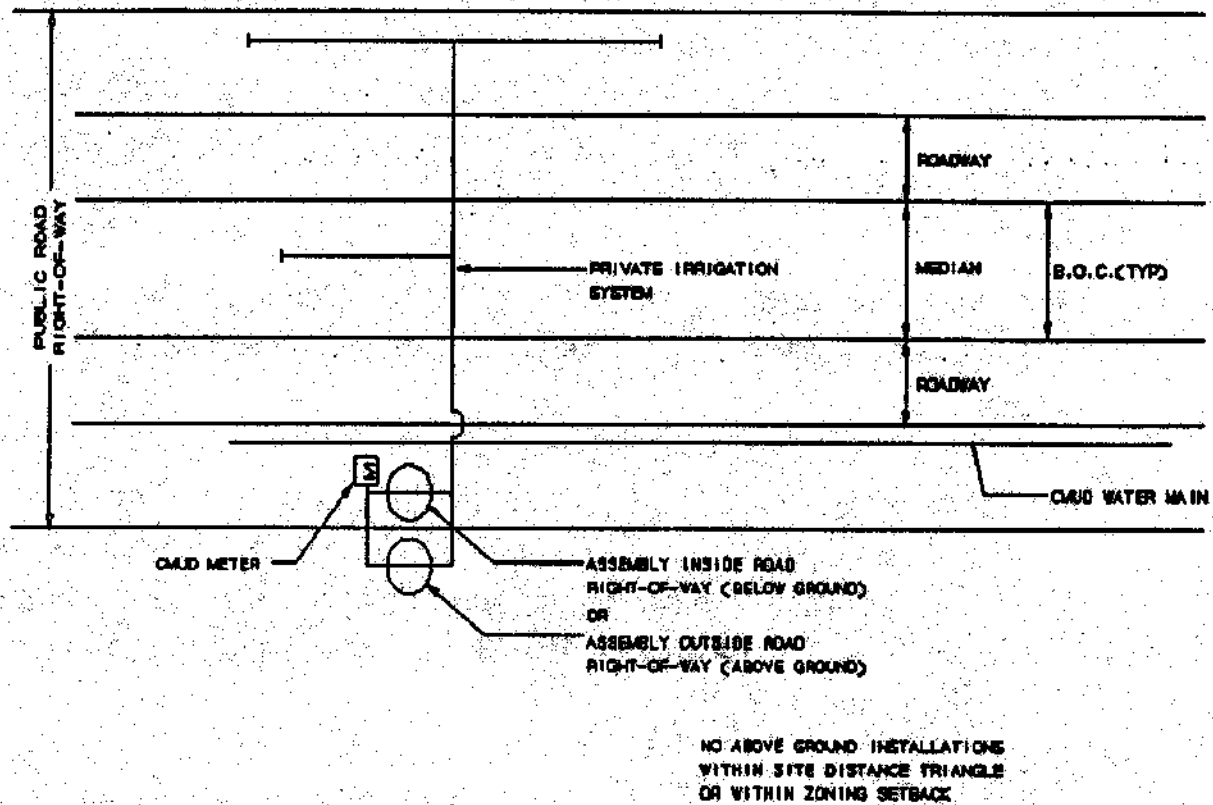
- A. ANY ABOVE GROUND INSTALLATIONS MUST BE INSTALLED OUTSIDE THE PUBLIC ROAD RIGHT-OF-WAY, AND OUTSIDE ZONING SETBACK AREAS ON PRIVATE PROPERTY. ALL INSTALLATIONS ARE REQUIRED TO BE LOCATED OUTSIDE AREA OF SITE DISTANCE TRIANGLE. ANY WORK IN AN EXISTING PUBLIC ROAD RIGHT-OF-WAY(R/W) REQUIRES AN ENCROACHMENT 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 CONFINED 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.



## 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.
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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.
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- 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
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
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 TO 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) ? \_\_\_\_\_ HIGH OR MODERATE HAZARD

CMUD PROJECT NAME: \_\_\_\_\_ DCVA OR RPBPA

CMUD JOB NUMBER: \_\_\_\_\_ ASSESSMENT DATE

DATE: \_\_\_\_\_ NEW OR EXISTING SERVICE

SERVICE # \_\_\_\_\_

METER SIZE: \_\_\_\_\_

TOPD NUMBER: \_\_\_\_\_

NUMBER OF SERVICES @ ADDRESS: \_\_\_\_\_

DOMESTIC, FIRE LINE, COMBINATION

OR IRRIGATION: \_\_\_\_\_

**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

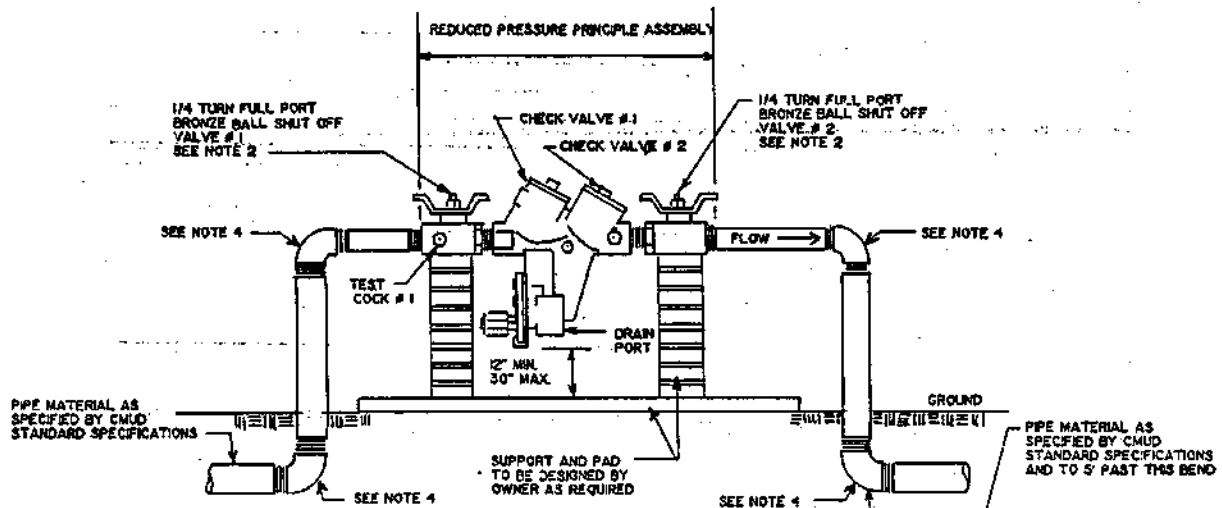
NOTE: ALL REPAIRS MUST BE COMPLETED WITHIN (10) DAYS.

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

I HEREBY CERTIFY THAT THIS DATA IS ACCURATE AND REFLECTS THE PROPER OPERATION AND MAINTENANCE OF THE ASSEMBLY.

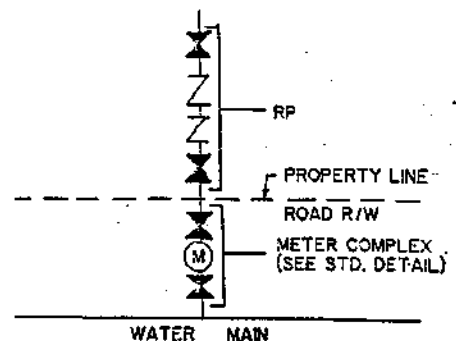
TESTER: \_\_\_\_\_ CERT. NO.: \_\_\_\_\_ DATE: \_\_\_\_\_  
 TEST KIT: DIFFERENTIAL ☐ DUPLEX ☐ ELECTRONIC ☐

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.



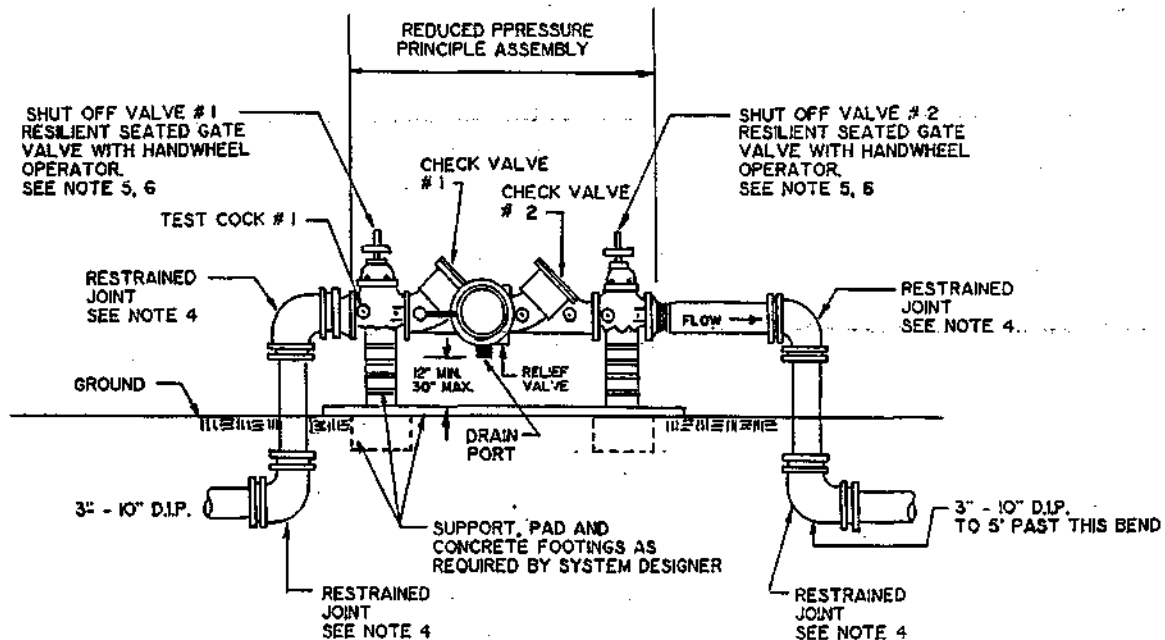
### CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA

Job No. _____		File No. _____	
PLAN _____		NTS	
PROFILE _____		Ver. _____	
No. _____		Date _____	
Surveyed By _____		Designed By _____	
Drawn By _____		Project-Eng. _____	
J.S.		JAT	
JAT		JAT	
6-3-94		12	

#### STANDARD DETAIL BACKFLOW PREVENTION

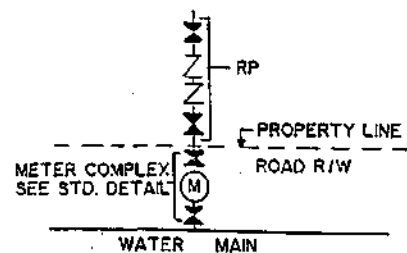
#### REDUCE PRESSURE PRINCIPLE ASSEMBLY (RP) 3/4" - 2"

2 5/92 GG GENERAL REVISIONS  
1 6/91 JS BY M&M 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.



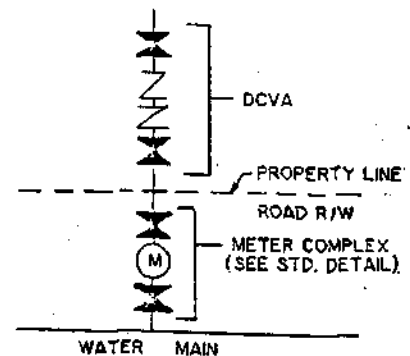
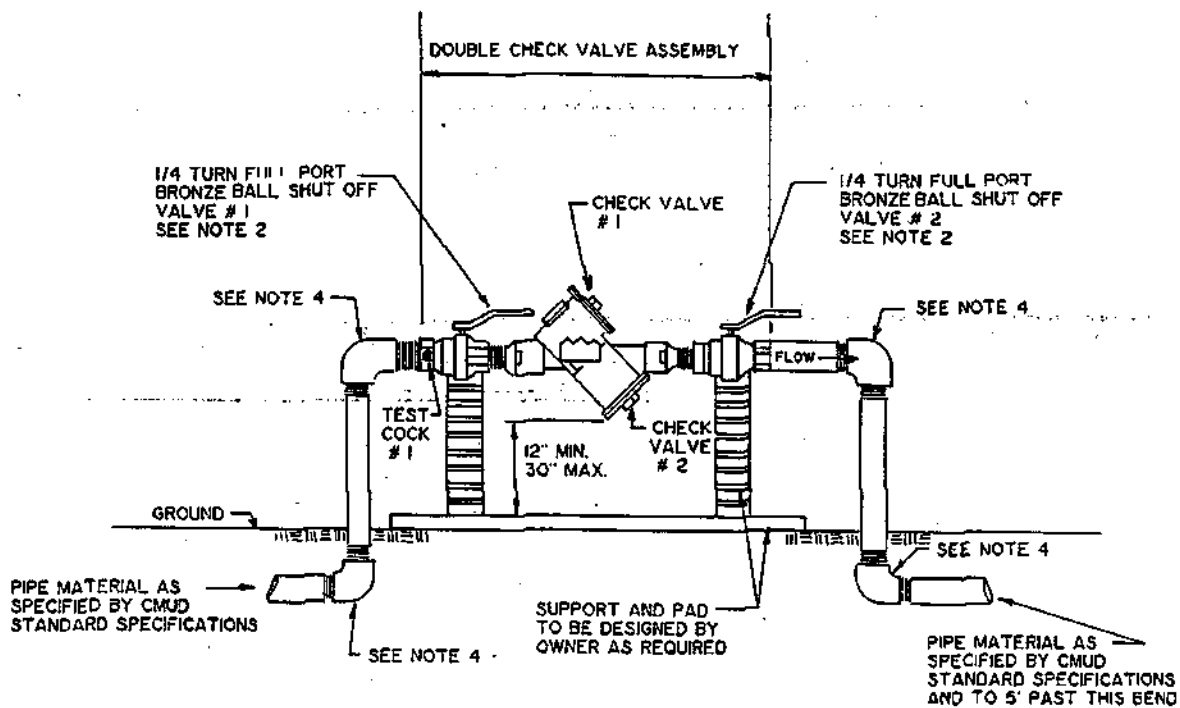
## CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA

### STANDARD DETAIL BACKFLOW PREVENTION

#### REDUCED PRESSURE PRINCIPLE ASSEMBLY (RP) 2-1/2" - 10"

2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY MBM COMMITTEE
No	Date	By	Revision

Job No.	File No.	J.S.	JAT	JAT	5/30/92	Sheet	Of
PLAN	Notes	Drawn By	Project-Eng	Approved By	Date	2	12
PROFILE	Var	Surveyed By	Designed By				



#### 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

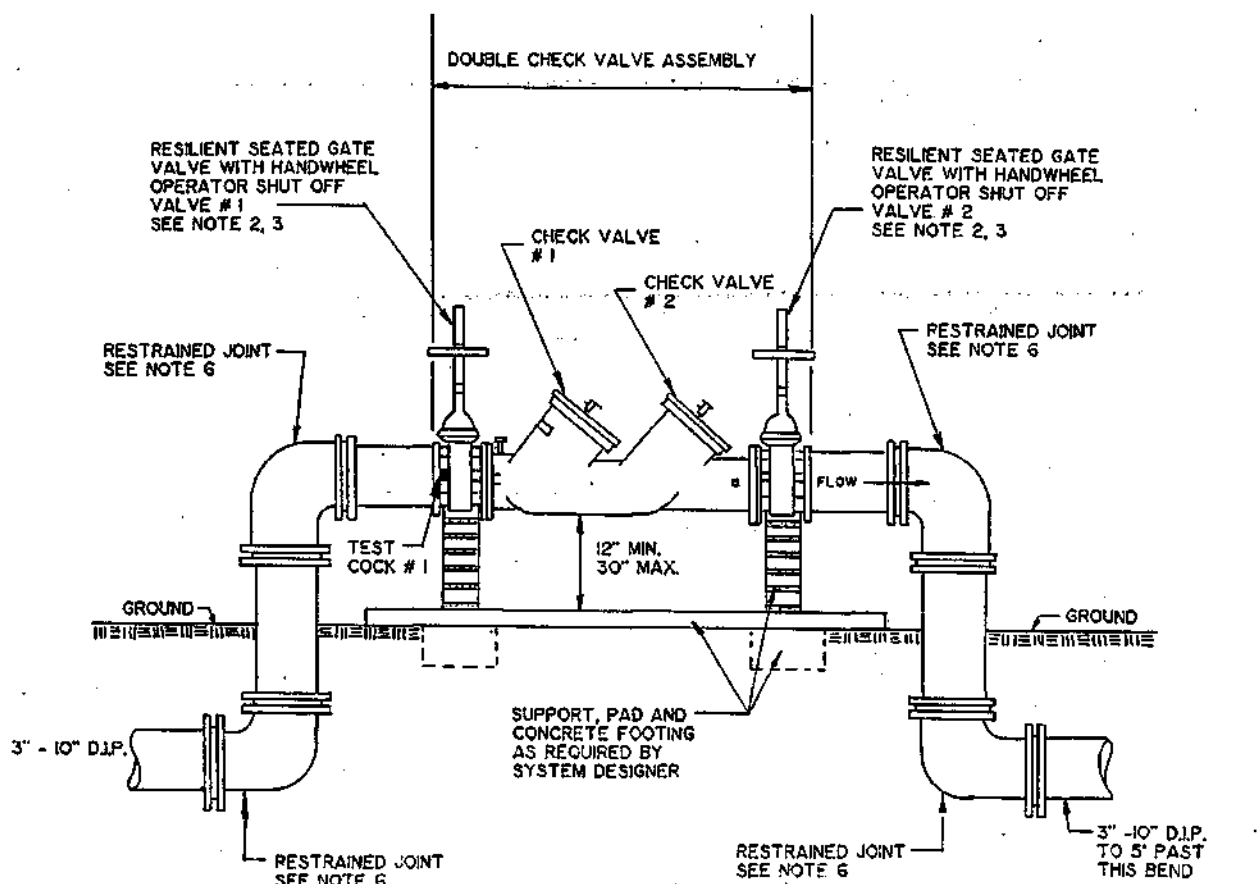
#### STANDARD DETAIL BACKFLOW PREVENTION

#### 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

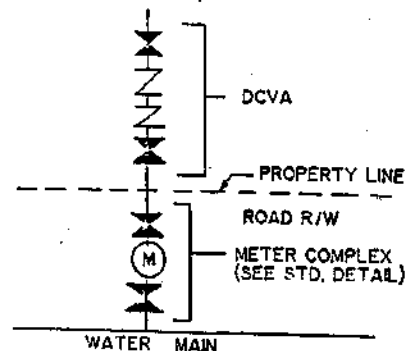
Sub No.	File No.
PLAN	Series N.T.S.
PROFILE	Per. Var.
Dr. Scale	Date
Survised By	Designed By
J.S.	JAT
Drawn By	Project-Eng.
JAT	Approved By
5/4/91	Date
3	12

DUNCAN-PARNELL, INC., CHARLOTTE 467 704-372-7765



# 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 UPSTREAM 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.



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

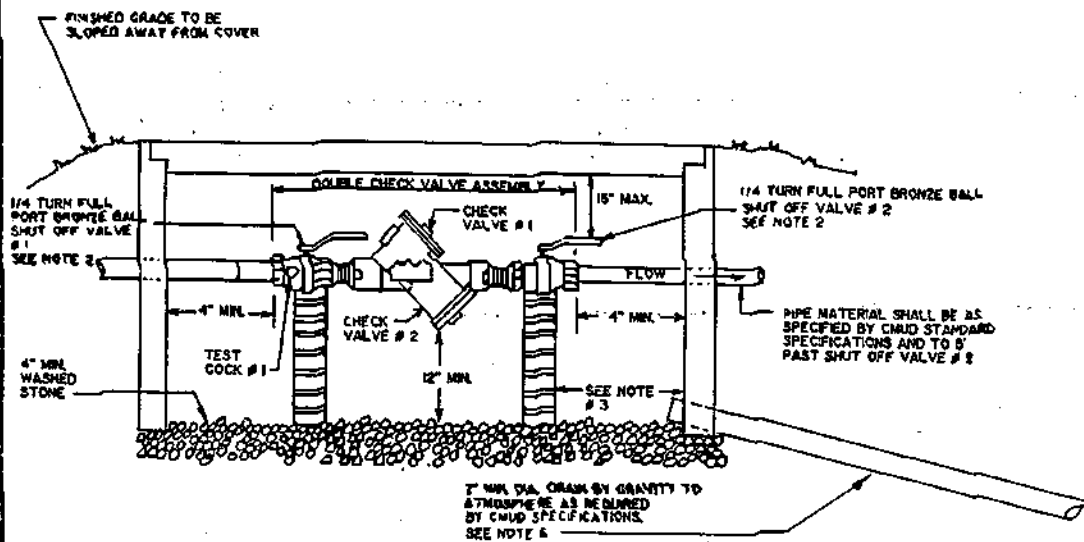
### STANDARD DETAIL

### BACKFLOW PREVENTION

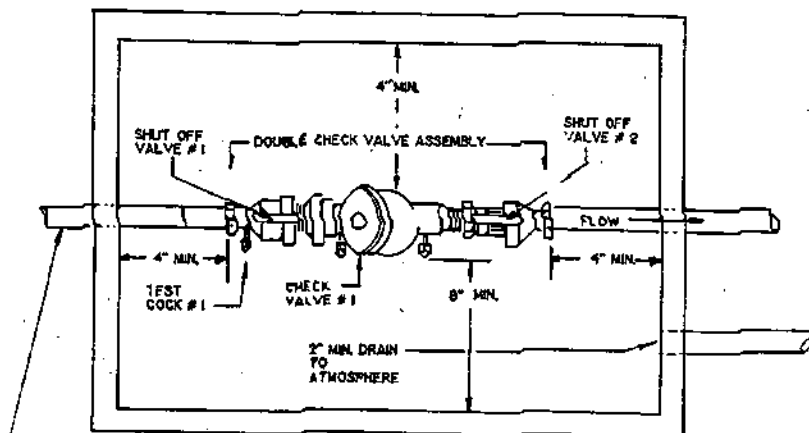
### DOUBLE CHECK VALVE ASSEMBLY (DCVA) 2-1/2" - 10" ABOVE GROUND

2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY M&M COMMITTEE
Mo	Date	By	Revision

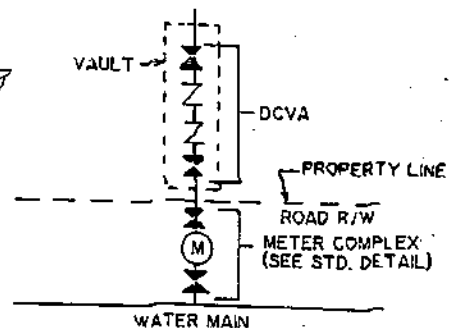
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PROFILE	Hor. Vert.
As Built	Date
Drawn By	Designed By
JS	JAT
Drawn By	Project-Eng
JAT	Approved By
6/4/93	Date
Sheet	Of
4	12



**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.

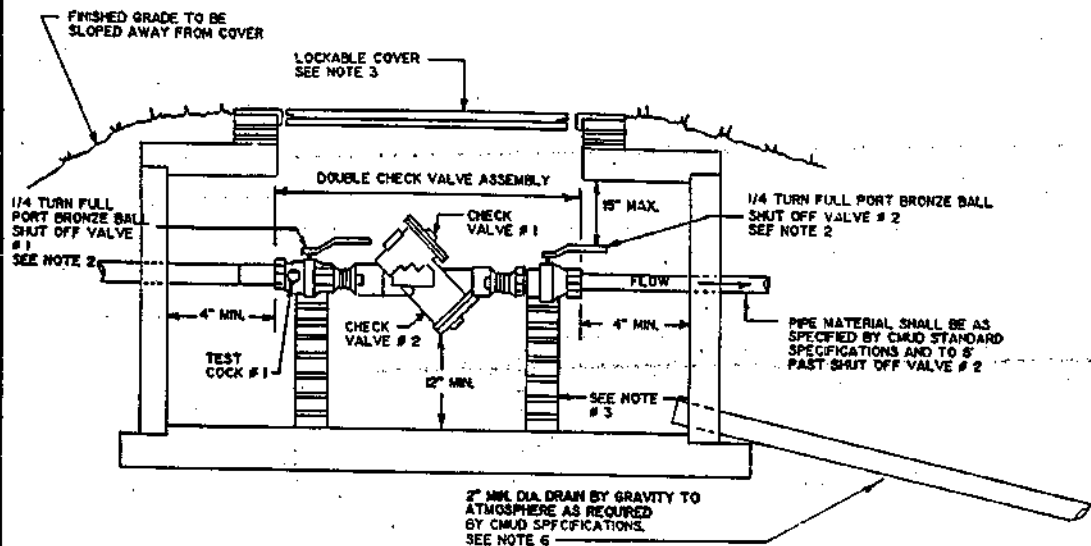
2 6/92 GG GENERAL REVISIONS  
1 6/91 JS BY M&M COMMITTEE

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

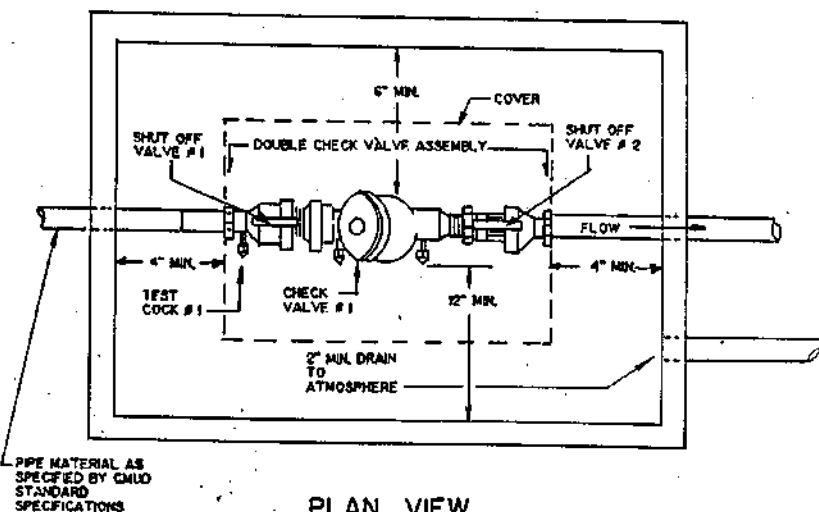
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 3/4" & 1" VAULT**

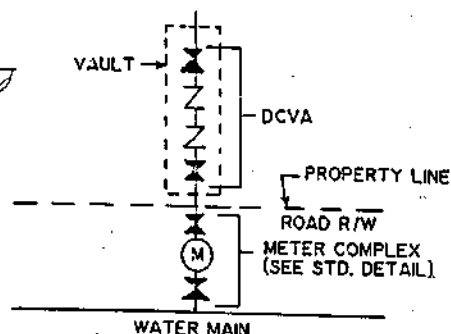
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Sheet No.	5	Of	12
Drawn By	J.S.	Project Eng.	JAT
Designed By	JAT	Approval By	JAT
Checked By	JAT	Date	5/30/91



**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.

2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY MBM COMMITTEE

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

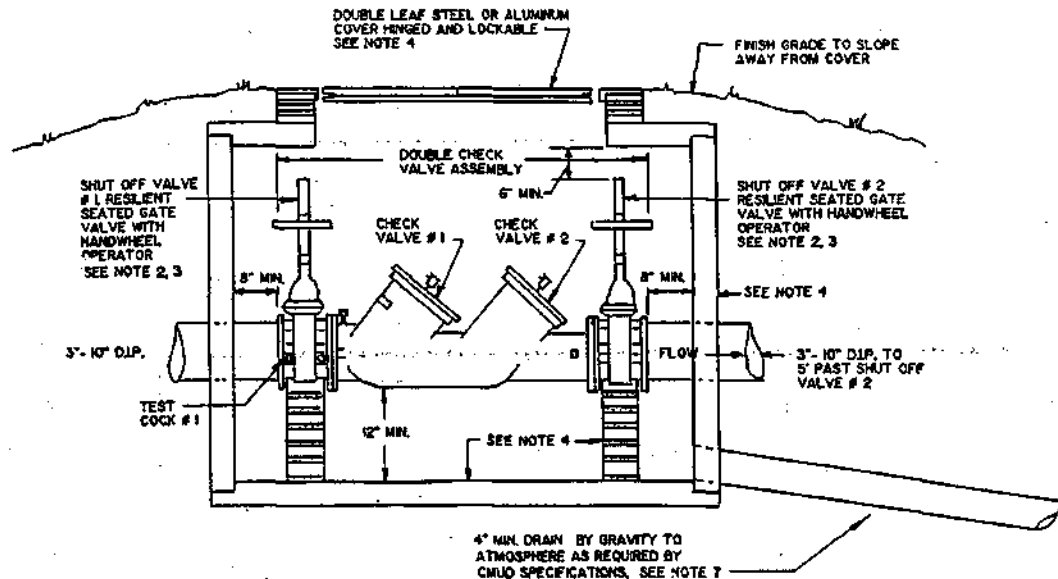
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 1-1/2" & 2" VAULT**

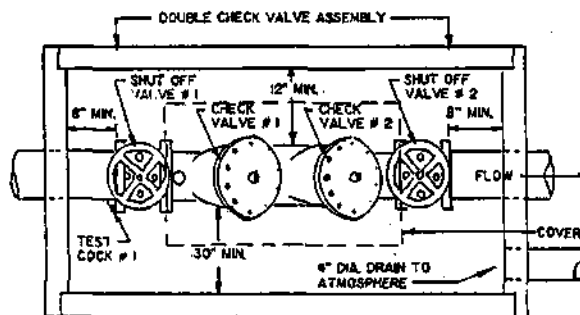
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Survived By	Designed By	Drawn By	Project-Eng.
J.S.	JAT	JAT	5/30/92
Approved By	Date	Sheet	6
		Of	12

CUNGAN-PARNELL, INC., CHARLOTTE 704-522-7728

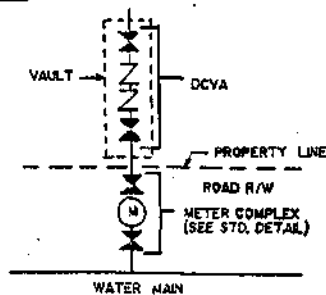




**ELEVATION**



**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**

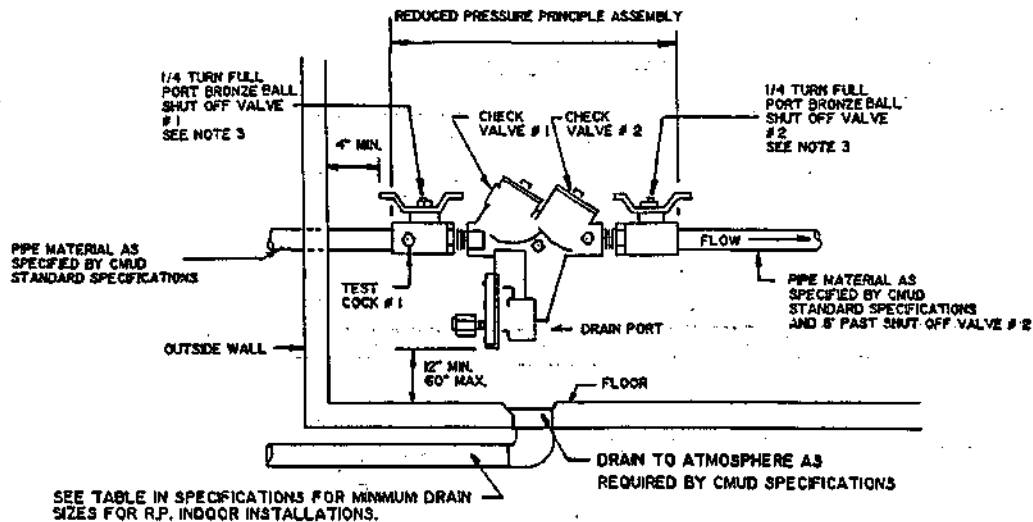
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**DOUBLE CHECK VALVE  
ASSEMBLY (DCVA) 2-1/2" - 10"  
VAULT**

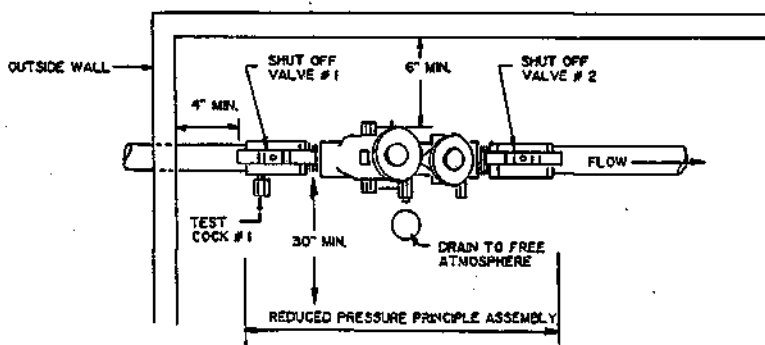
2	5/92	GG	GENERAL REVISIONS
1	6/91	JS	BY M&M COMMITTEE

No. 10 Date: By: Revision:

Job No.	File No.	Scale	N.T.S.
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JS	JAT	JAT	5/30/97
Sheet	17	Of	12



ELEVATION VIEW



PLAN VIEW

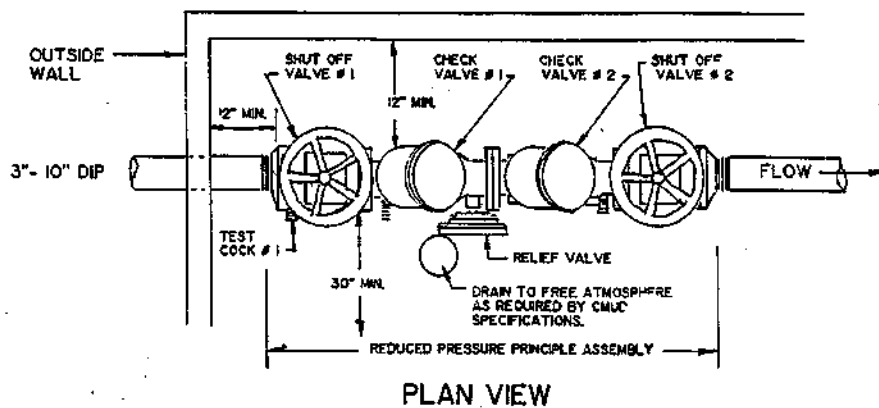
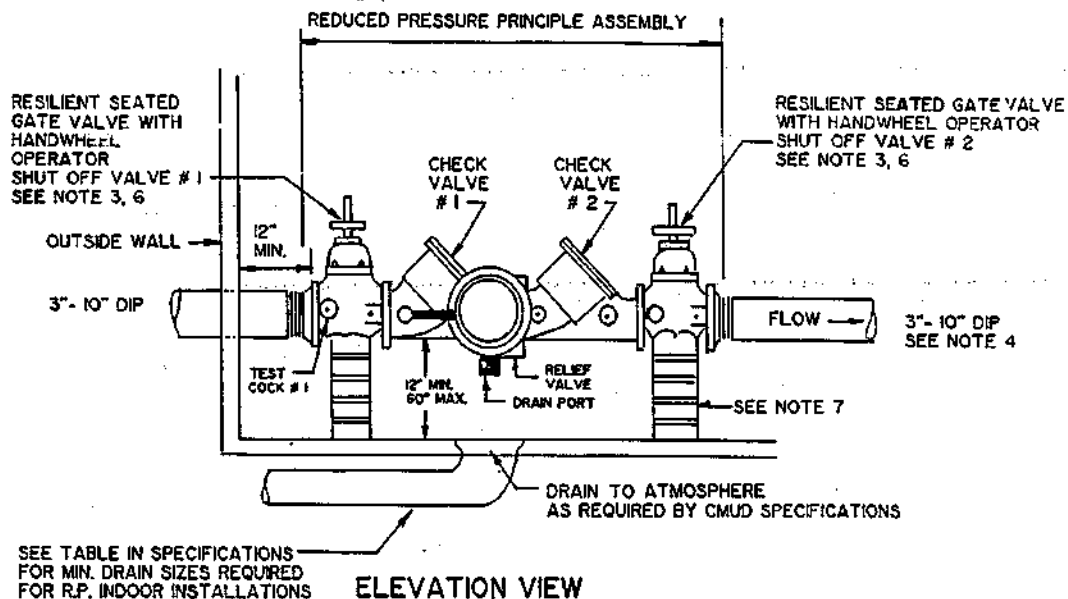
NOTES:

1. INDOOR INSTALLATION SHALL ONLY BE PERMITTED IN CASES WHERE ADEQUATE SPACE FOR THE BACKFLOW PREVENTION ASSEMBLY IS NOT AVAILABLE OUTSIDE. CMUD 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.

2	5/92	TR	GENERAL REVISION
1	6/91	J.S.	BY MBM COMMITTEE
Mo	Date	By	Specimen

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

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Submitted By		Designed By	
J.S.		JAT	
JAT		G-3-91	
Project-Eng		Approved By	
Date		8	
Sheet		12	



**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.

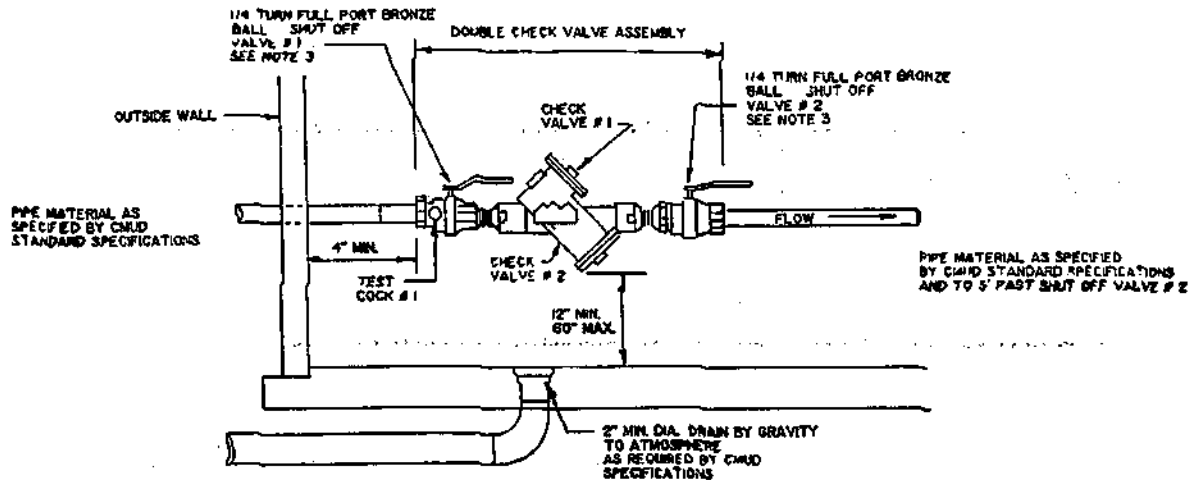
2	5/92	GG	GENERAL REVISIONS
1	7/91	J.S.	BY M&M COMMITTEE

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

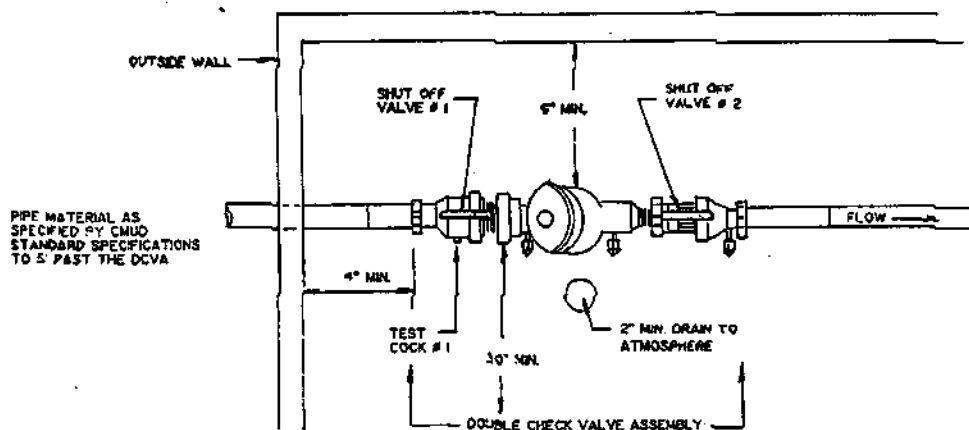
**STANDARD DETAIL  
BACKFLOW PREVENTION**

**REDUCE PRESSURE PRINCIPLE  
ASSEMBLY (RP) 2-1/2" - 10" INDOOR**

Job No.	Proj. No.	Scale: <b>N.T.S.</b>	
PLAN	No.	Ver.	
As Built	Date		
Surveyed By	Designed By	Drawn By	Project-Eng.
JS	JAT	JAT	63-31
Approved By	Date	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.

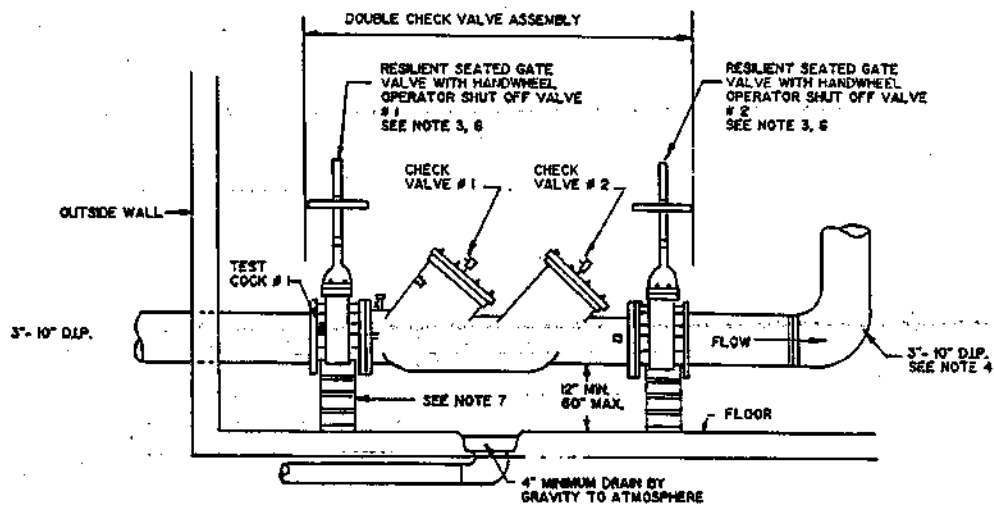
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
BACKFLOW PREVENTION

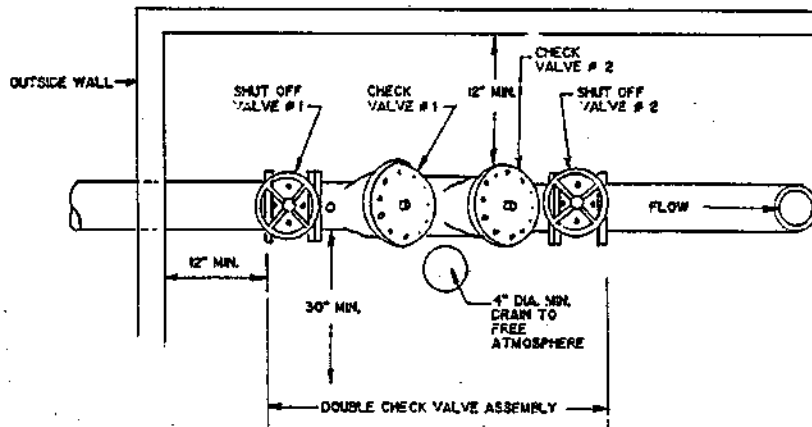
DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 3/4" - 2" INDOOR

2 5/92 GG GENERAL REVISIONS  
1 7/91 JS BY MBM COMMITTEE

Job No.	File No.	Scale: N.T.S.	
Plan	Sheet	1 of 1	
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Drawn By	Project-Eng	JAT	6-6-91
Surveyed By	Designed By	Approved By	Check Of
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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.

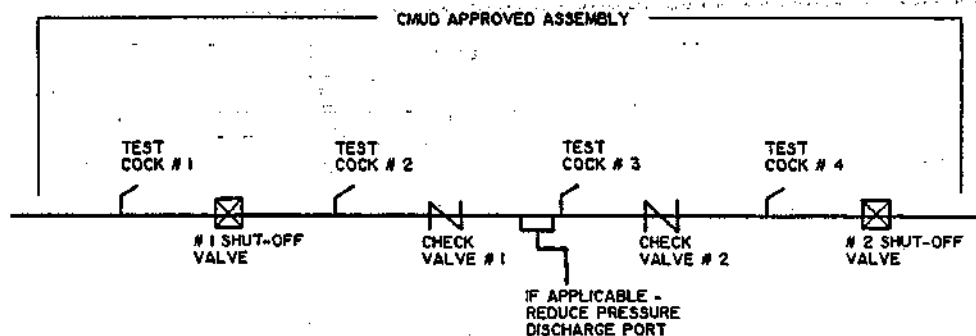
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
BACKFLOW PREVENTION

DOUBLE CHECK VALVE ASSEMBLY  
(DCVA) 2 1/2" - 10" INDOOR

2	5/92	TR	GENERAL REVISION
1	7/91	JS	BY MBM COMMITTEE

Job No.	File No.	Section	N.T.S.
PLAN		PROFILES	
As Built	Date	JS	JAT
Drawn By	Designed By	Drawn By	Project-Eng
		Approved By	SSJ:91
		Date	11/12



Flow  
→

<b>CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA</b>									
Job No. _____ File No. _____ Scale _____ PLAN _____ PROFILE _____ As Built _____ Date _____				<b>STANDARD DETAIL BACKFLOW PREVENTION</b>					
				<b>TEST COCK LOCATION</b>					
Drawn By: TAR		JAT		JAT		5/92		Sheet 12 of 12	
Supervised By:		Designed By:		Drawn By:		Project-Eng:		Approved By:	

## **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 2~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 4~" and shall be furnished with a 6" mechanical joint inlet. The operating nut shall be 1~" 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:

<u>MANUFACTURER</u>	<u>MODEL</u>
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:

MANUFACTURER	MODEL
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:

DI/CI MECHANICAL JOINT	STAINLESS STEEL	STEEL
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**

Manufacturer	2" PVC	6" PVC	8" PVC	12" PVC
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 ½ " 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:

Manufacturer	5/8" Meter	1" Meter
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 1~-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. Check 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 Embeco 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, sledgeing, 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. Service 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 1/2" 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.

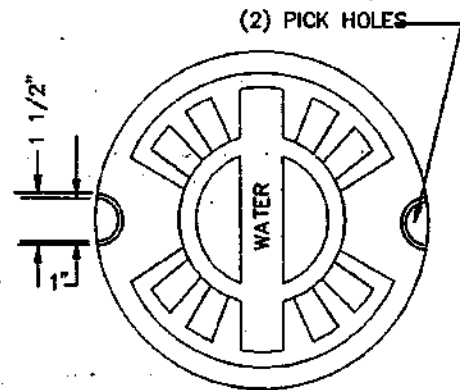
2. Certain notices are required in writing before any work can proceed within the Department of Transportation's rights-of-way. Upon ample notice by the Contractor, the Engineer will make this notification.
3. Proper signing before, during, and after construction in conformance with the manual on Uniform 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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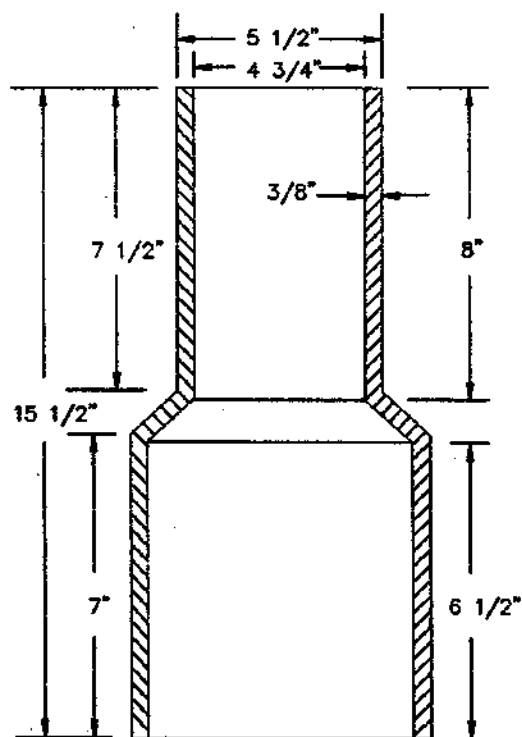
VALVE BOX - TOP SECTION  
(SECTION VIEW)

**NOTE:**

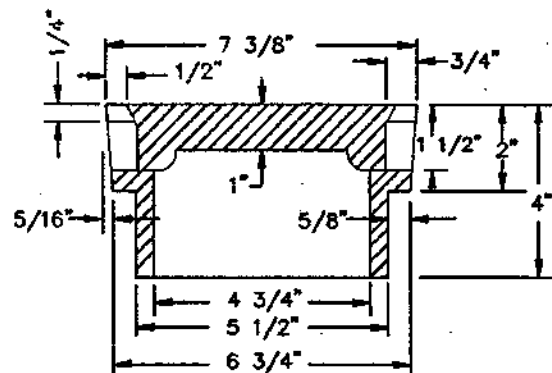
1. FERROUS CASTINGS SHALL BE  
PER ASTM A-48, CLASS 30.



COVER - TOP VIEW

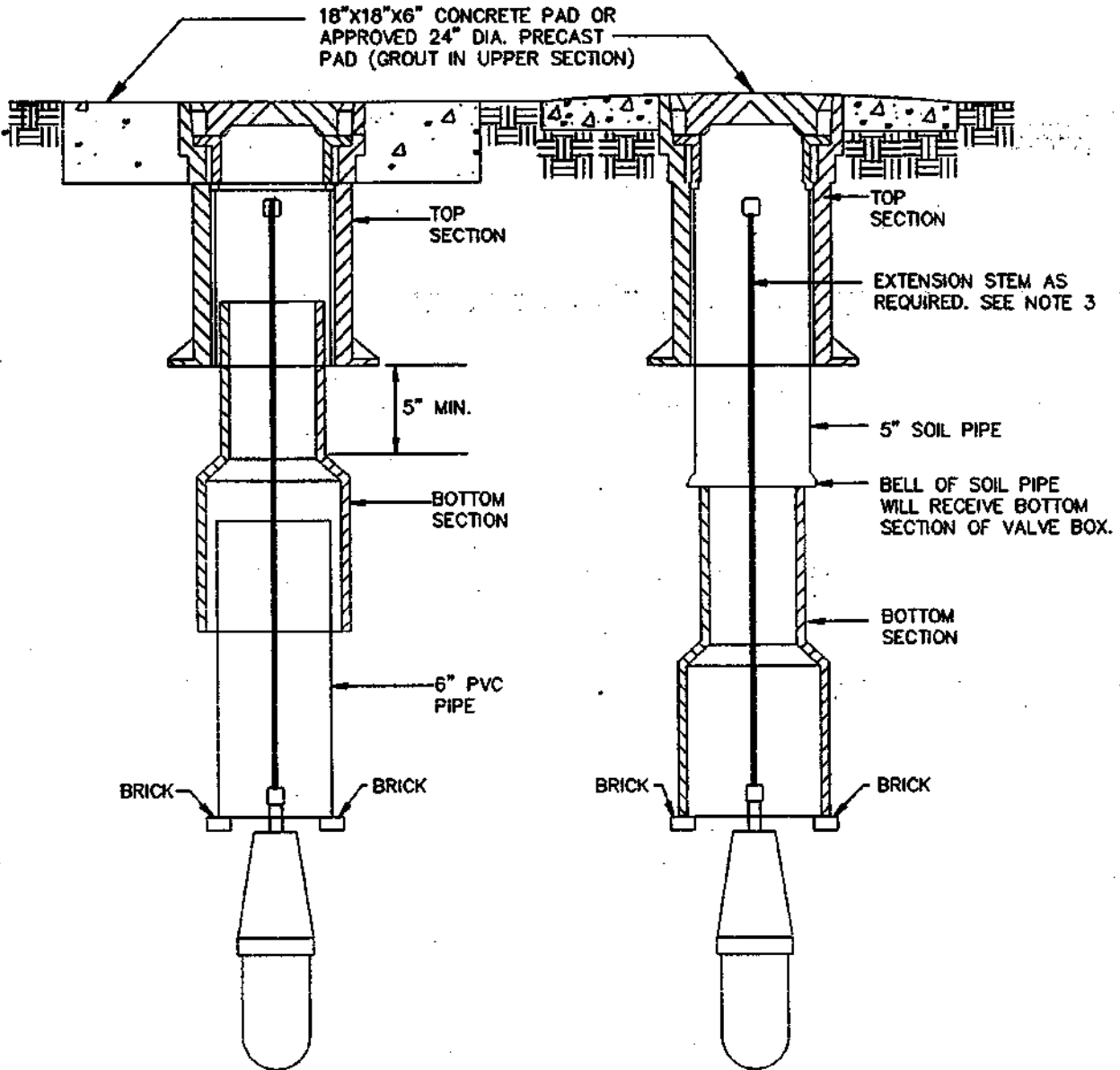


VALVE BOX - BOTTOM SECTION  
(SECTION VIEW)



**COVER - SECTION VIEW**

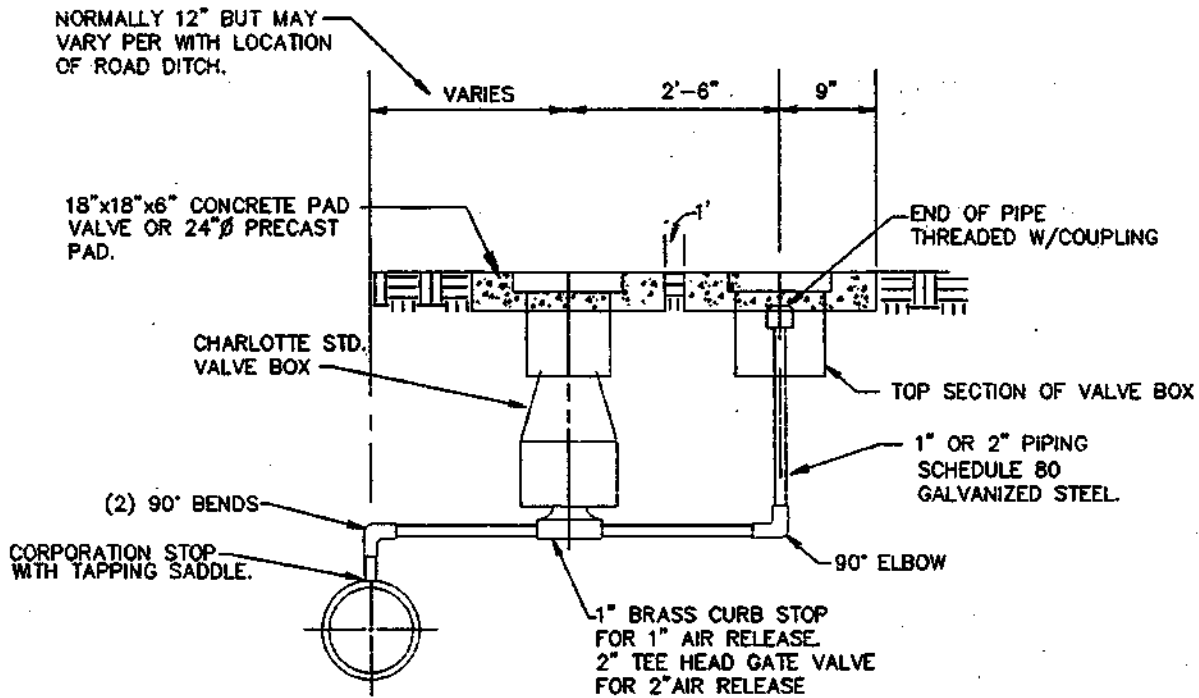
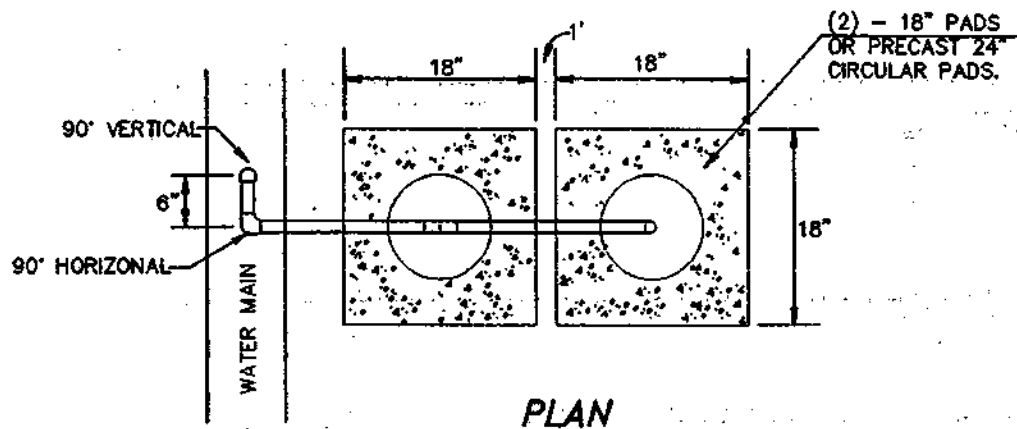
CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA				
Job No. _____ File No. _____ Scales _____ PLAN _____ PROFILE _____ Hor. _____ Vert. _____ As Buil _____ Date _____		STANDARD DETAIL WATER WATER VALVE BOX		
Surveyed By _____ Designed By _____		SC Drawn By _____	K. B. [Signature] Project-Eng _____ Approved By _____	[Signature] Date _____ Sheet 1 Of 1



**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. _____ Scale <u>N.T.S.</u>		<b>STANDARD DETAIL WATER</b>	
PLAN _____ PROFILE _____ Hor. _____ Vert. _____		<b>VALVE BOX INSTALLATION</b>	
As Built _____ Date _____		S.C. _____	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr. _____
No. _____	Date _____	By _____	Revision _____
Approved By _____		Date _____	Sheet 2 of 2



#### NOTES:

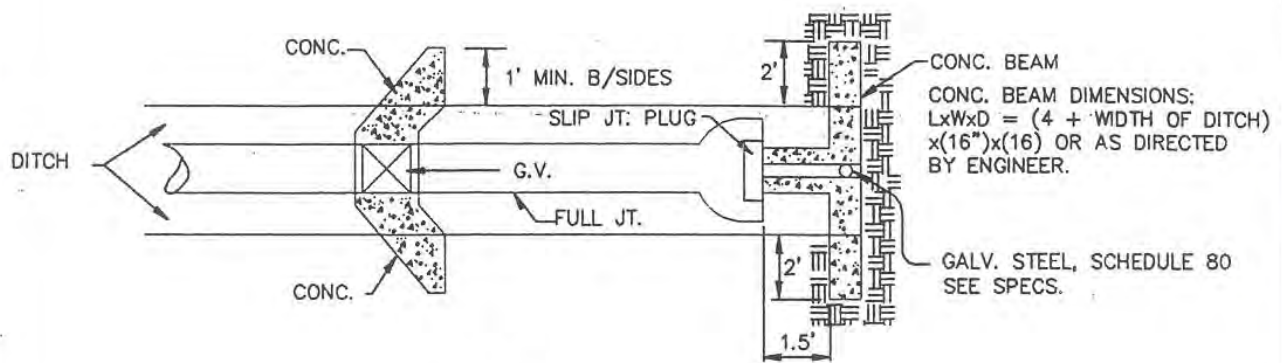
1. AIR VALVES TO BE INSTALLED AT ALL HIGH POINTS AS DIRECTED BY THE ENGINEER.
2. ON 12" PIPE & SMALLER, 1" ASSEMBLY REQUIRED.
3. ON 16" PIPE & LARGER, 2" ASSEMBLY REQUIRED.
4. VALVE & B.O. SHALL NOT BE PLACED IN ROAD DITCH.

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

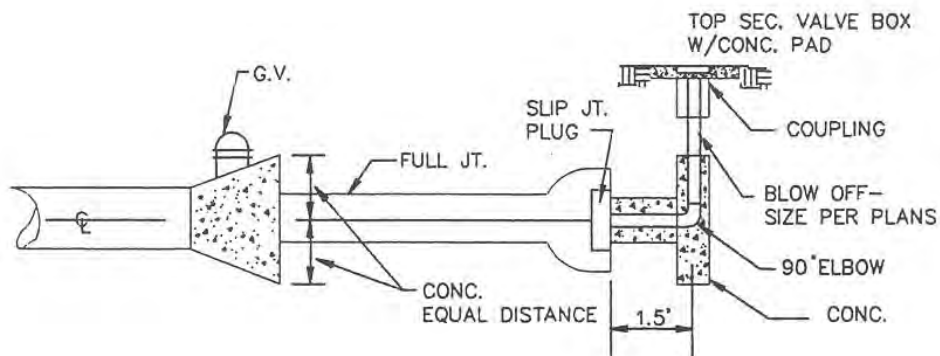
STANDARD DETAIL  
WATER

MANUAL AIR RELEASE

Job No.	File No.	Scale	N.T.S.
PLAN	PROFILE		
Hor.	Vert.	As Built	Date
Surveyed By	Designed By	Drawn By	Project-Engr
Approved By		Date	Sheet 3 of 3



**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.

Scales

PLAN N.T.S.

PROFILE

Hor. Vert.

As Built Date

Surveyed By Designed By

**STANDARD DETAIL  
WATER**

**DEAD END BLOCKING  
6", 8", AND 12" MAINS**

S.C.

Project-Engr

Approved By

Date

Sheet

Of

No.	Date	By

Revision

Surveyed By

Designed By

Drawn By

Project-Engr

Approved By

Date

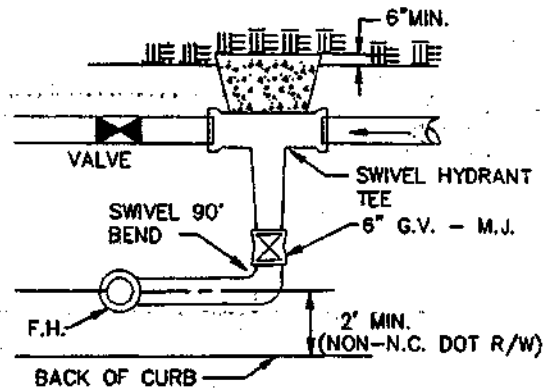
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Of

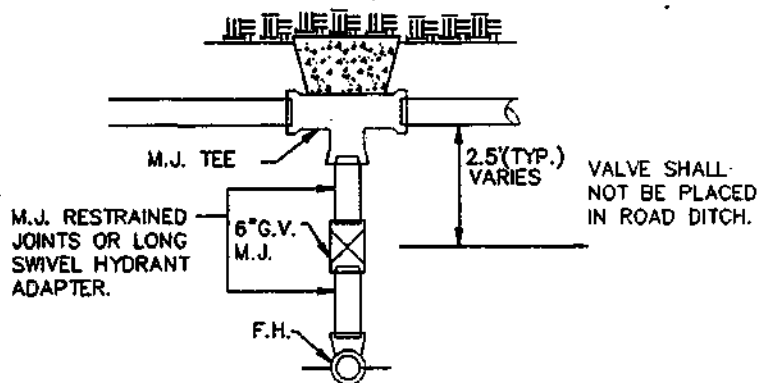
SDWA  
01/21/94

# NOTES:

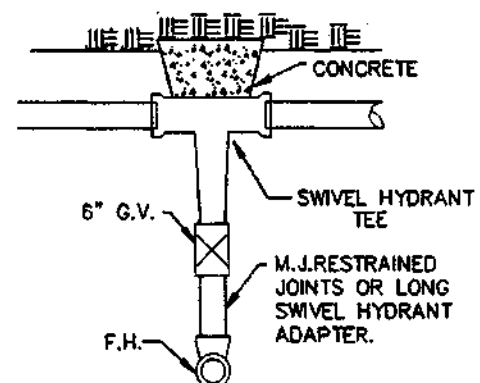
1. HYDRANT LOCATION:  
ON ROADS WITH CURB & GUTTER, USE DETAIL (1).  
IN ALL CASES UNLESS OTHERWISE NOTED ON MAP.
2. BURIAL TO BE 3.0' UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
3. FOR HYDRANTS ON DEAD END LINES, MAIN LINE VALVES ARE LOCATED DOWNSTREAM OF HYDRANT.
4. EXTENSIONS REQUIRED AS DETERMINED 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



(4) PLAN VIEW

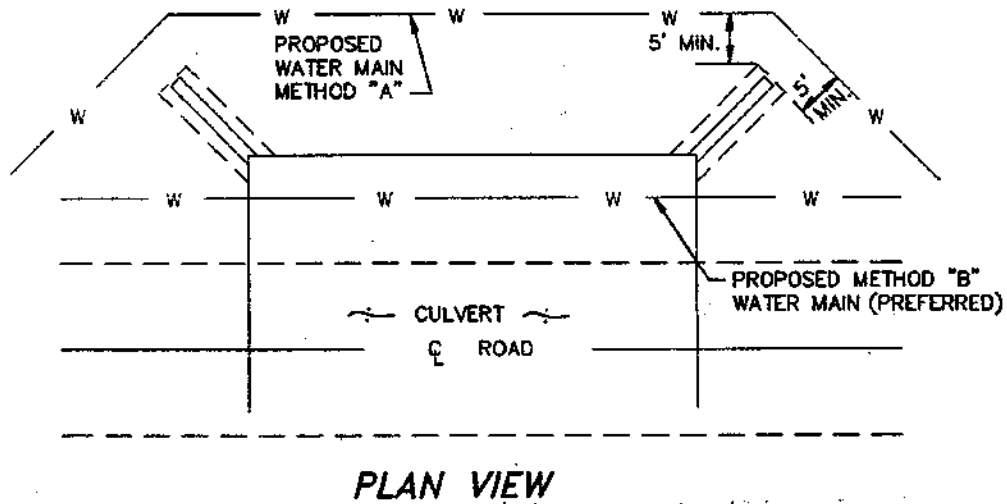
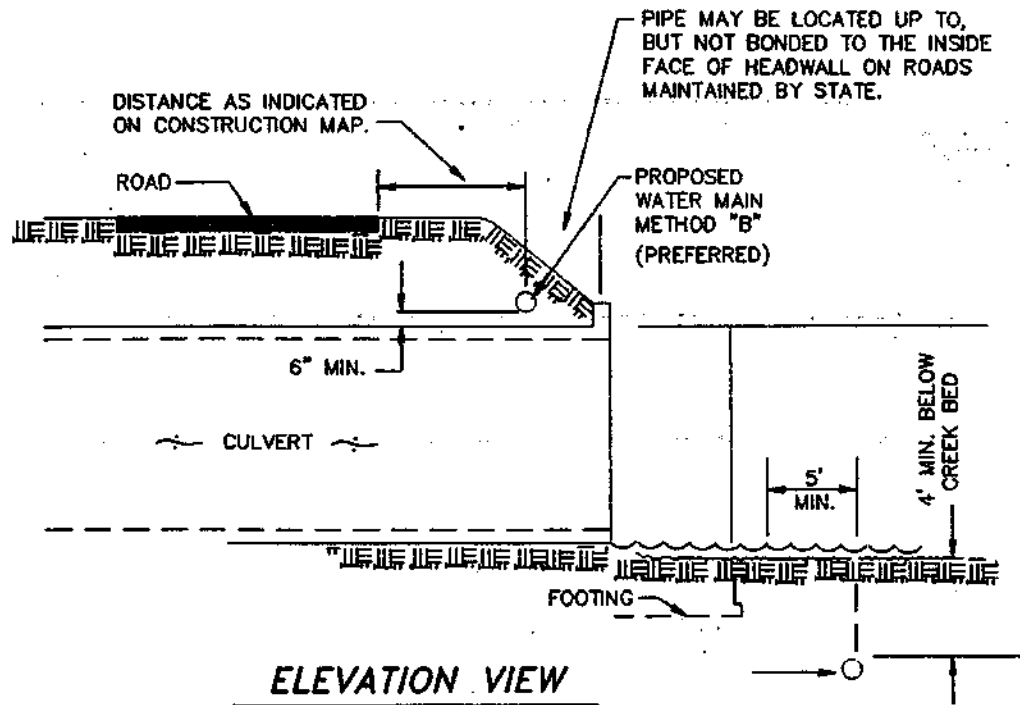
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
WATER

FIRE HYDRANT DETAIL

Job No.	File No.
PLAN	Scale
PROFILE	Hor.
	Vert.
As Built	Date
Surveyed By	Designed By

SC	Project-Eng.	Approved By	Date	Sheet	Of
				5	



**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.

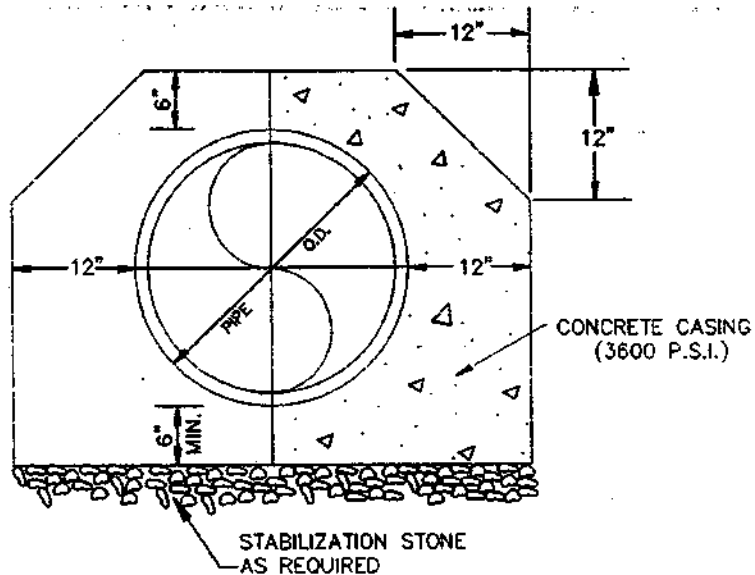
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**WATER MAIN LOCATIONS  
AT CULVERTS**

Job No. _____	File No. _____
PLAN _____	Scale _____
PROFILE _____	Hor. _____
_____	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By _____	Project-Engr _____
Approved By _____	Date _____
Sheet 6 of 6	





### ELEVATION SECTION

#### NOTE:

1. PIPE O.D. SHALL BE OUTSIDE DIAMETER AT BELLS IF BELLS ARE TO BE ENCASED.

CHARLOTTE-MECKLENBURG  
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ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. \_\_\_\_\_ File No. \_\_\_\_\_  
Scales \_\_\_\_\_  
PLAN \_\_\_\_\_ NTS  
PROFILE \_\_\_\_\_  
Hor. \_\_\_\_\_  
Vert. \_\_\_\_\_  
As Built \_\_\_\_\_ Date \_\_\_\_\_

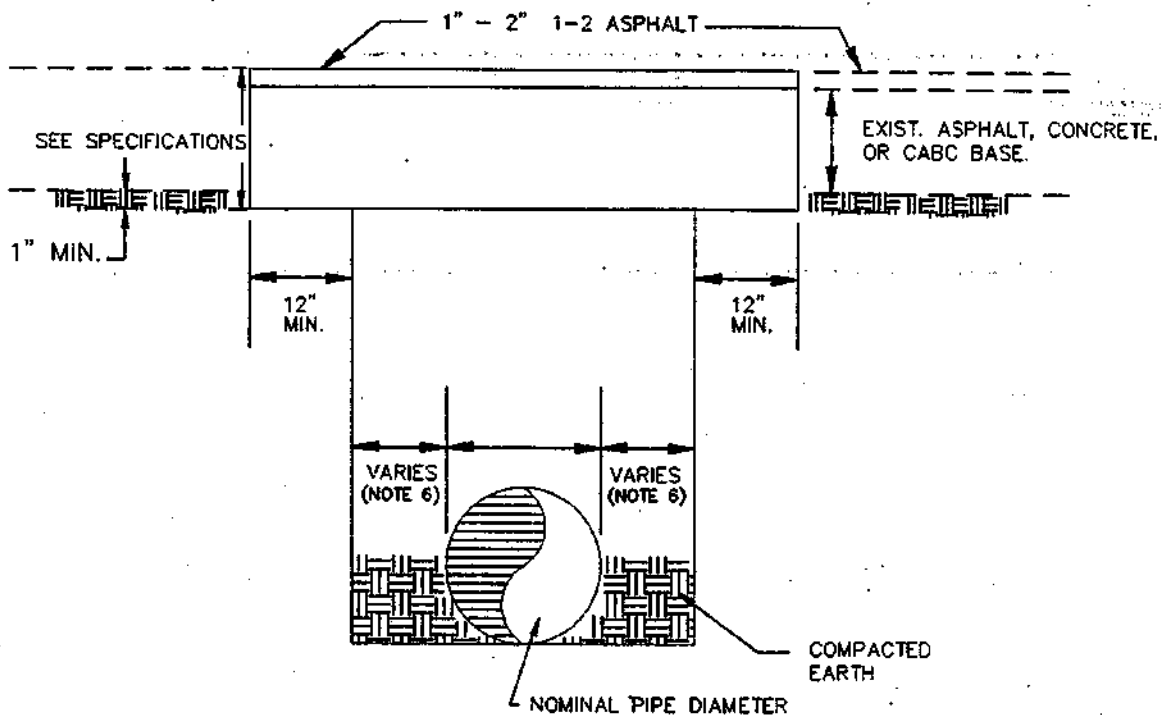
**STANDARD DETAIL  
WATER**

**CONCRETE ENCASEMENT**

No.	Date	By

Revision

Surveyed By	Designed By	SC	Drawn By	Project-Engr	Approved By	Date	Sheet	Of
							7	



### 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. \_\_\_\_\_

Scales \_\_\_\_\_

PLAN \_\_\_\_\_

PROFILE \_\_\_\_\_

Hor. \_\_\_\_\_

Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_

Surveyed By \_\_\_\_\_

Designed By \_\_\_\_\_

Drawn By \_\_\_\_\_

Project-Engr \_\_\_\_\_

Approved By \_\_\_\_\_

Date \_\_\_\_\_

**STANDARD DETAIL  
WATER**

**PAVEMENT REPAIR DETAIL**

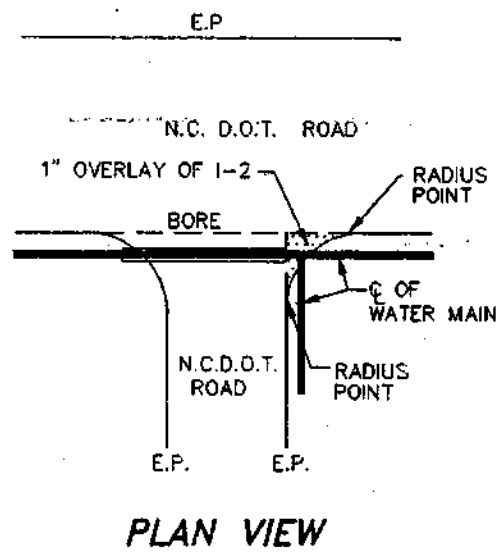
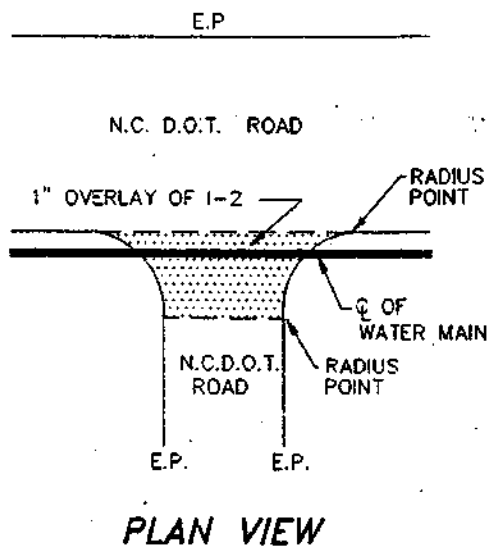
SC \_\_\_\_\_ K. Blum \_\_\_\_\_

Project-Engr \_\_\_\_\_ Approved By \_\_\_\_\_

Date \_\_\_\_\_

Sheet 9 of 9

05/13/94



**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**

**STANDARD DETAIL  
WATER**

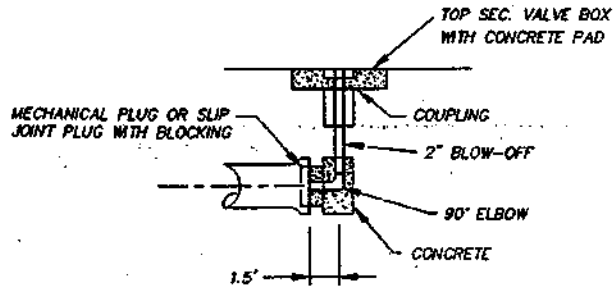
**1-2 SURFACE COURSE  
OVERLAY**

No.	Date	By

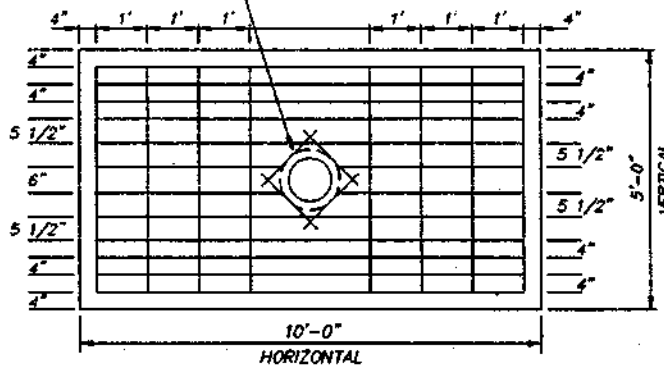
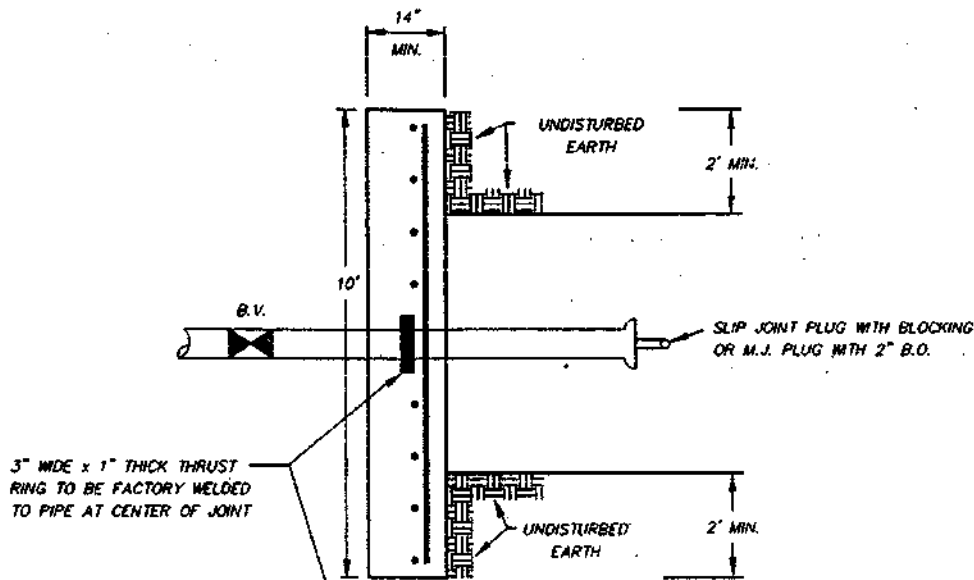
Revision

Job No.	File No.
Scale	NTS
PLAN	
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By

SC									
Drawn By	Project-Engr	Approved By	Date						



**ELEVATION VIEW**



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**

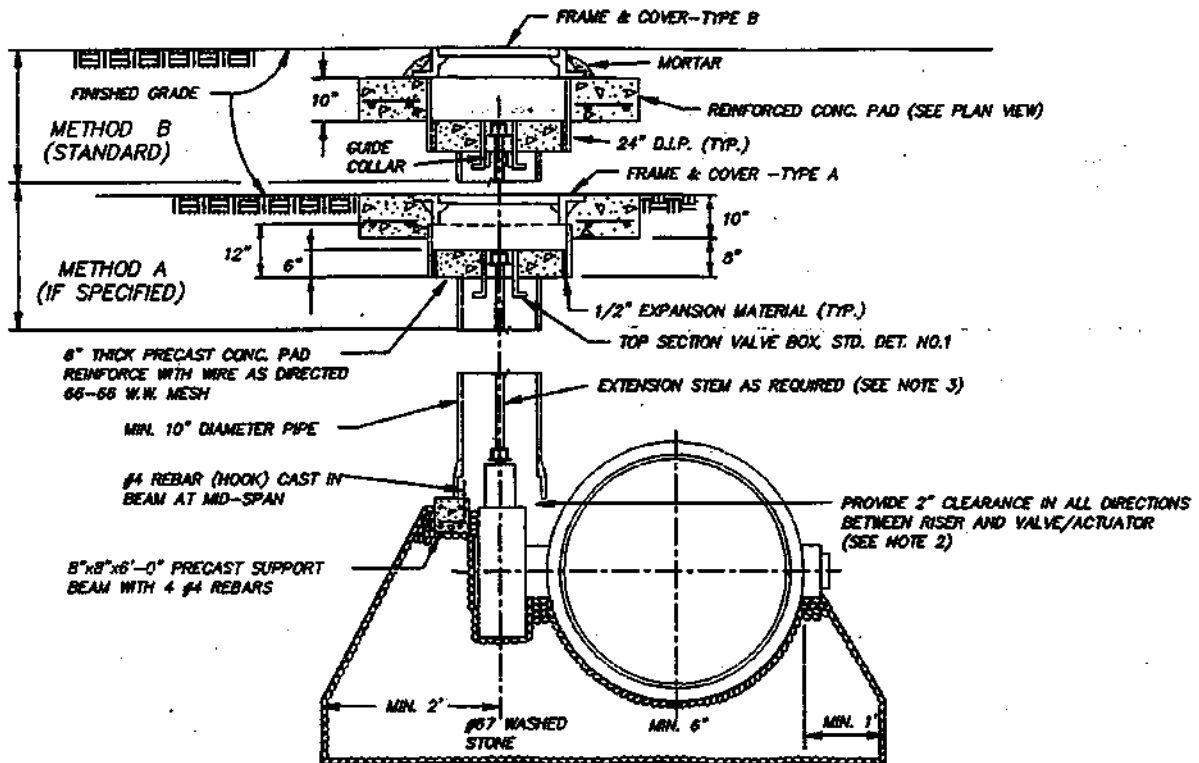
**STANDARD DETAIL  
WATER**

**BLOCKING FOR  
16" 20" 24" PIPES**

Job No.	File No.
Scale	
PLAN N.T.S.	
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Eng

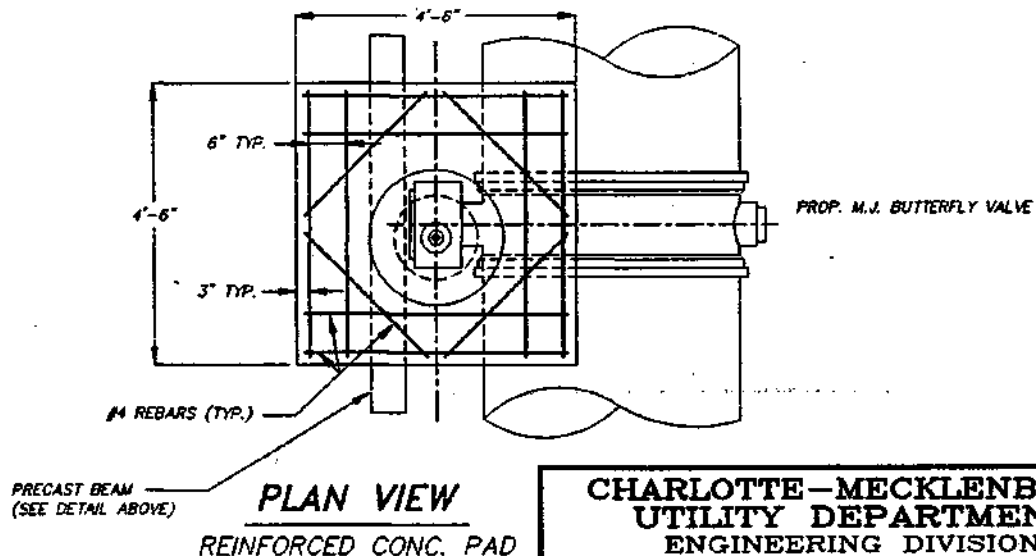
J.F.B.	K. Blum	10	OF
Approved By	Date		

SUNSHINE  
01/12/84



**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.



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

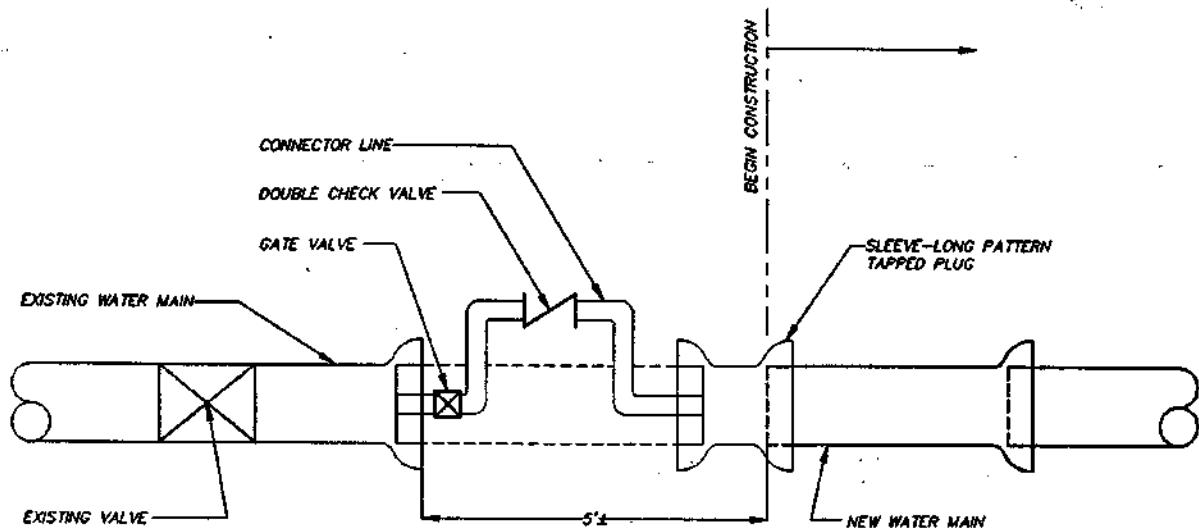
**STANDARD DETAIL  
WATER**

**DIRECT BURY BUTTERFLY  
VALVE INSTALLATION**

No.	Date	By

Revision

Job No. _____		File No. _____	
Scale _____		N.T.S.	
PLAN	Ver. _____	Date _____	
PROFILE	Ver. _____	Date _____	
As Built		Date _____	
Surveyed By	Designed By	Drawn By	Project-Engr
J.F.B.		K.D. [Signature]	
Approved By		Date 11/11	



**NOTES:**

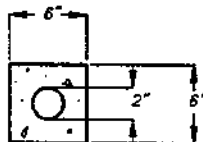
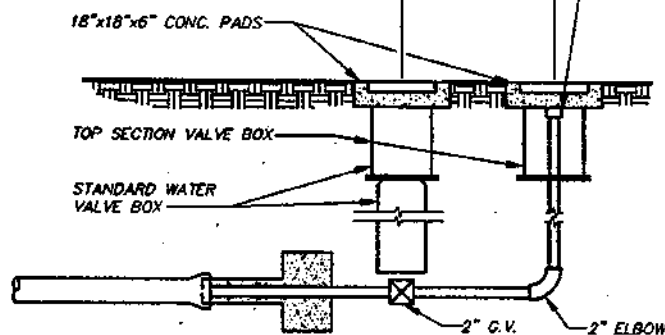
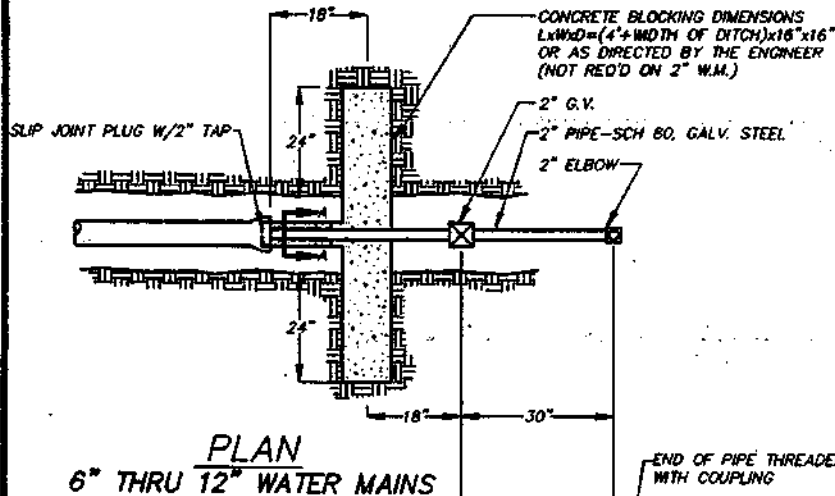
1. INSTALL CONNECTOR LINE FROM EXISTING BLOW OFF ASSEMBLY TO NEW MAIN FOR FILLING, TESTING AND STERILIZING NEW MAIN.
2. CONNECTOR LINE TO BE ASSEMBLED WITH CHECK VALVE AND TO BE OPERATED INDEPENDENT OF EXISTING MAIN.
3. BLOCKING ON EXISTING LINE NOT TO BE DISTURBED.
4. FINAL CONNECTION TO EXISTING MAIN 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.

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

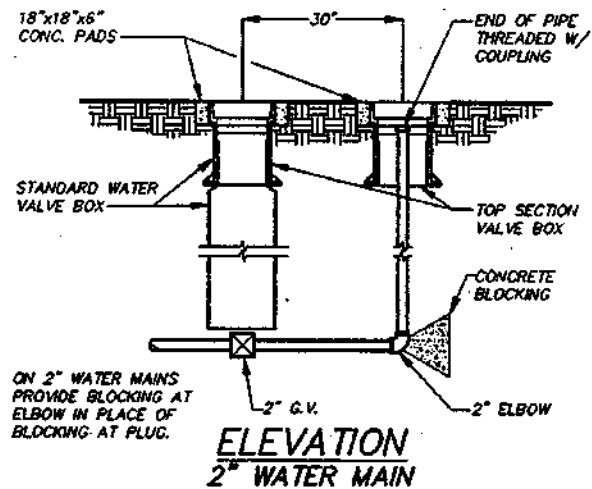
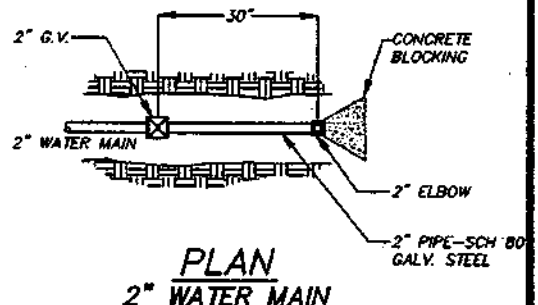
**STANDARD DETAIL  
WATER**

**JUMPER CONNECTION**

Job No. _____		File No. _____	
PLAN _____		Scale _____	
PROFILE _____		NTS	
As Built _____		Date _____	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____
Approved By _____		Date _____	
K.B.H.		Sheet 12 of _____	



NOTE:  
 24" DIAMETER x 6" THICK PRECAST CONCRETE PADS MAY  
 BE USED IN LIEU OF 18"x18"x6" CAST IN PLACE PADS.



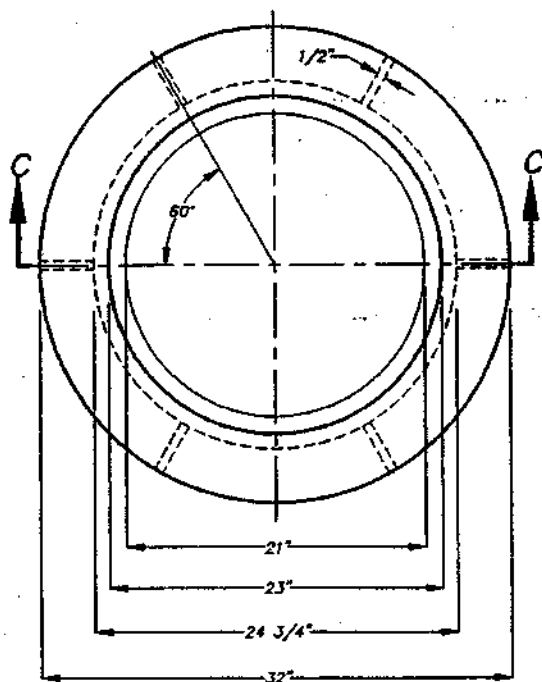
**CHARLOTTE-MECKLENBURG  
 UTILITY DEPARTMENT  
 ENGINEERING DIVISION  
 CHARLOTTE, NORTH CAROLINA**

Job No.	File No.
Scale	NTS
PLAN	
PROFILE	
Hor.	
Vert.	
As Bldg	Date
Surveyed By	Designed By

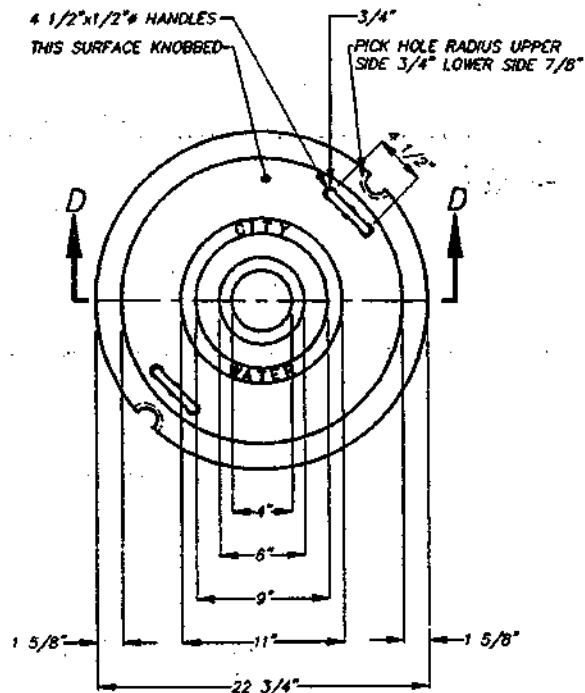
**STANDARD DETAIL  
 WATER**

**2" VALVE  
 WITH BLOW OFF**

KHP	Project-Engr	Approved By	13
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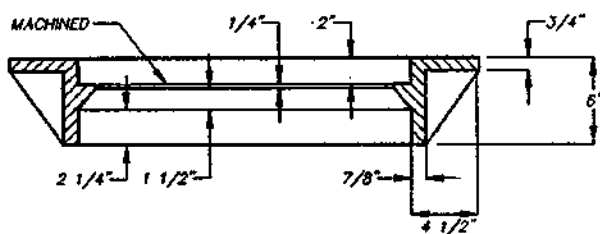


PLAN-RING

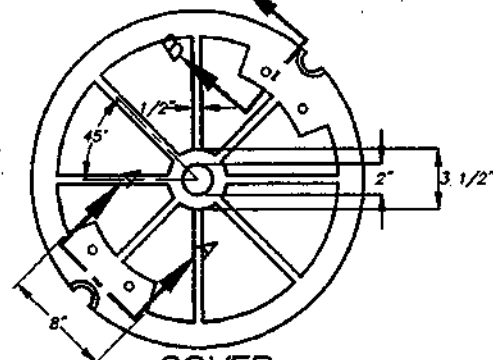


PLAN-COVER

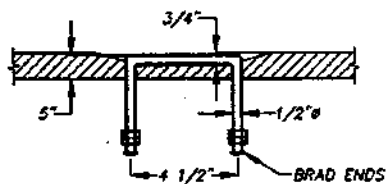
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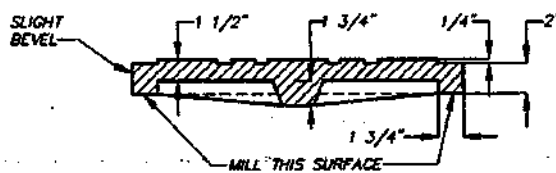
SECTION C-C



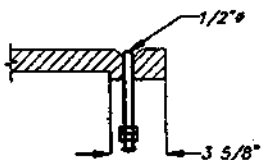
COVER  
BOTTOM



SECTION A-A



SECTION D-D



SECTION B-B

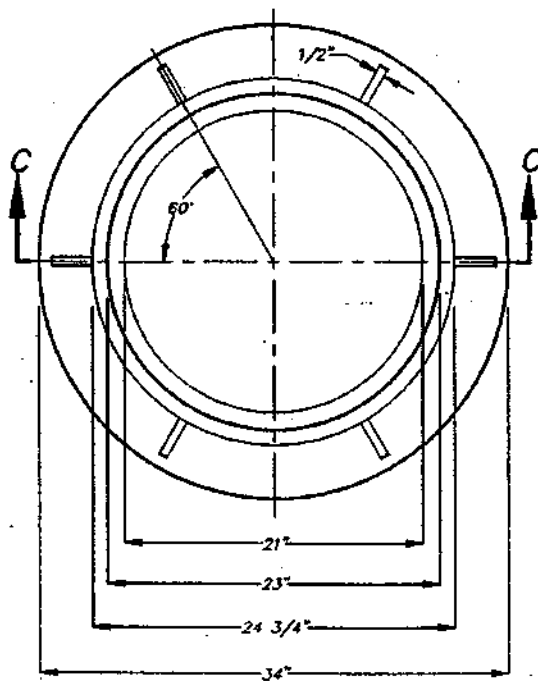
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

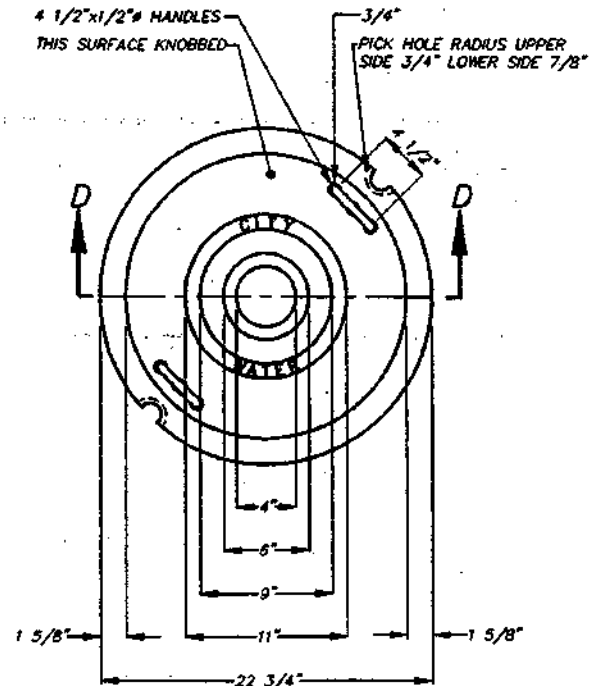
**CAST IRON RING & COVER  
TYPE A**

Job No. _____	File No. _____
PLAN _____	Scale _____
PROFILE _____	NTS
Hor. _____	Vert. _____
As Built _____	Date _____
Surveyed By _____	Designed By _____
Drawn By _____	Project-Engr _____
Approved By _____	Date _____

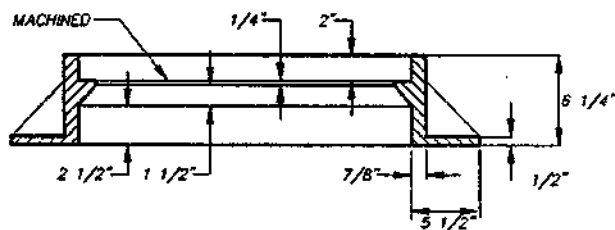




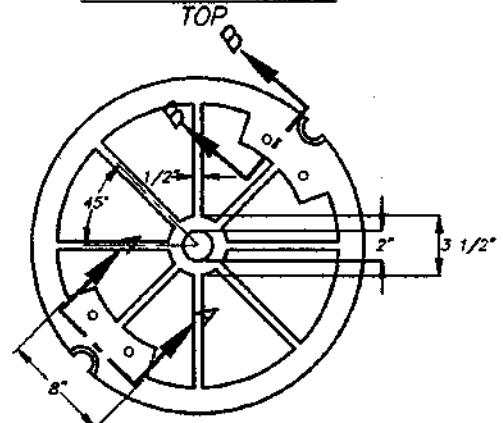
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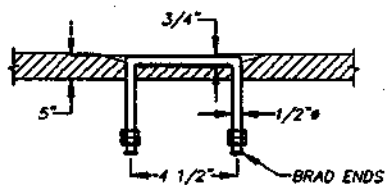
PLAN-COVER



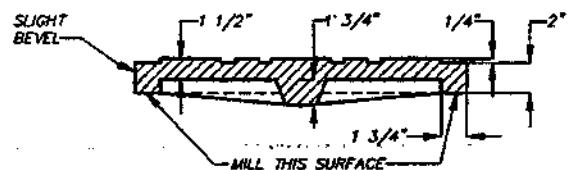
SECTION C-C



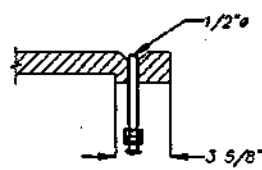
COVER  
BOTTOM



SECTION A-A



SECTION D-D



SECTION B-B

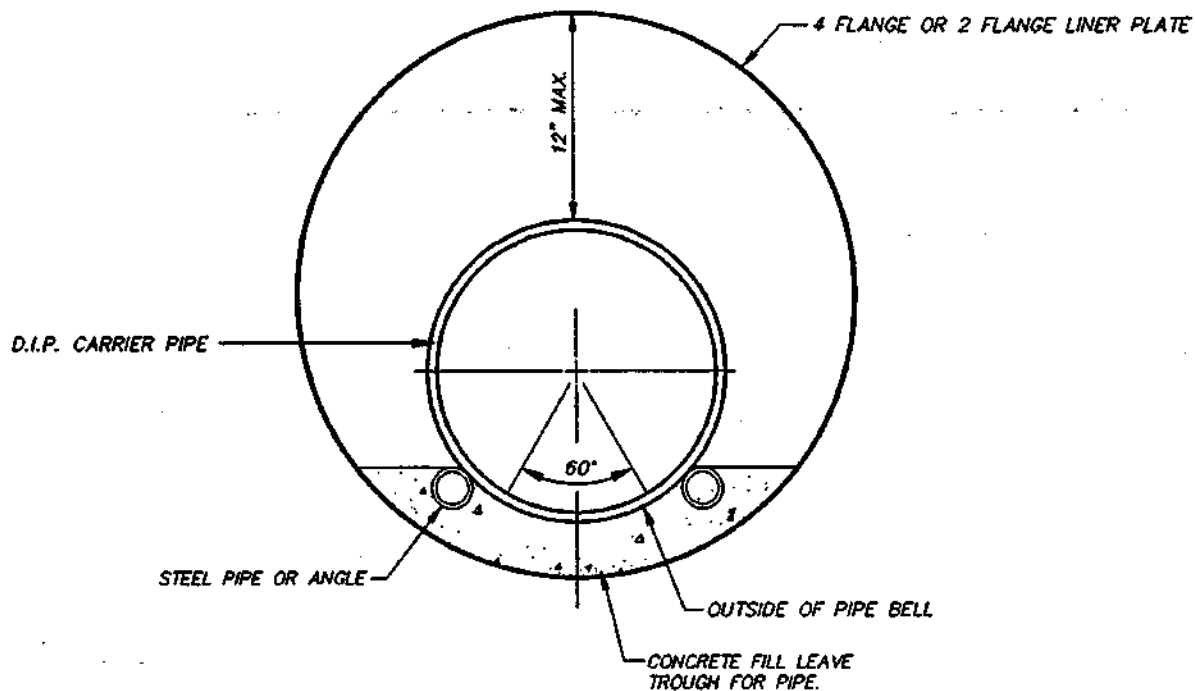
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
WATER**

**CAST IRON RING & COVER  
TYPE B**

Job No.	File No.
PLAN	Scale NTS
PROFILE	Hor. _____
	Vert. _____
As Built	Date _____
Surveyed By	Designed By
	Drawn By
	Project-Engr
	Approved By
	Date

KHP	26	15	15
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.
Scale	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By

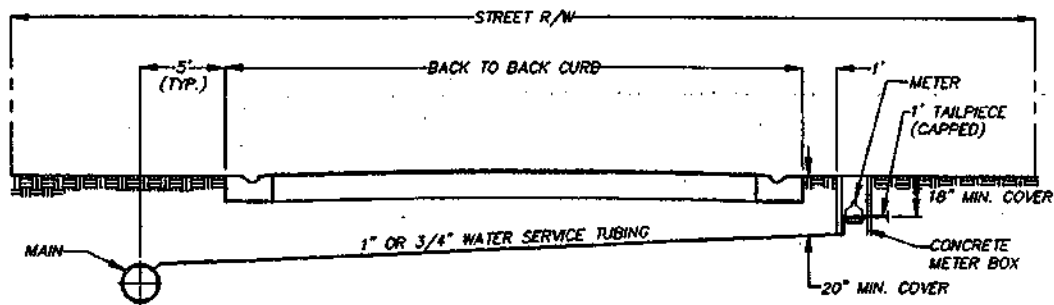
**STANDARD DETAIL  
WATER**

**TUNNEL LINER SECTION**

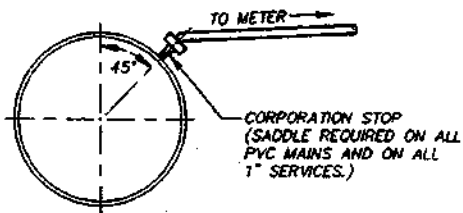
No.	Date	By

Revision

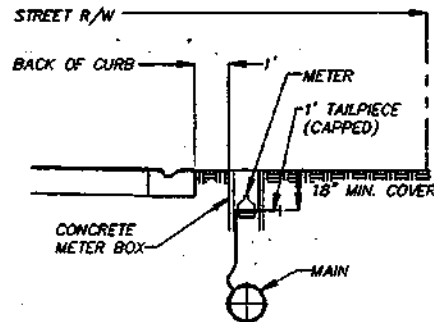
MSW	Project-Eng	Approved By	Date	Sheet	Of
				16	



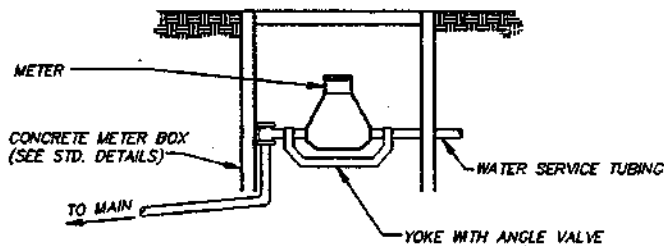
**1" OR 3/4" SERVICE CONNECTION**  
(LONG SIDE)



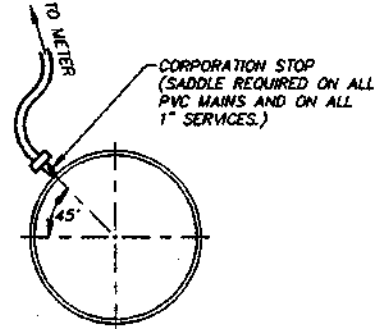
**DETAIL AT MAIN**  
(LONG SIDE)



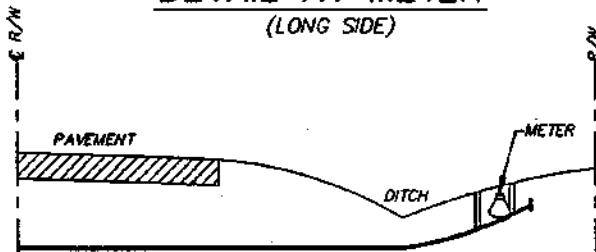
**1" OR 3/4" SERVICE CONNECTION**  
(SHORT SIDE)



**DETAIL AT METER**  
(LONG SIDE)



**DETAIL AT MAIN**  
(SHORT SIDE)

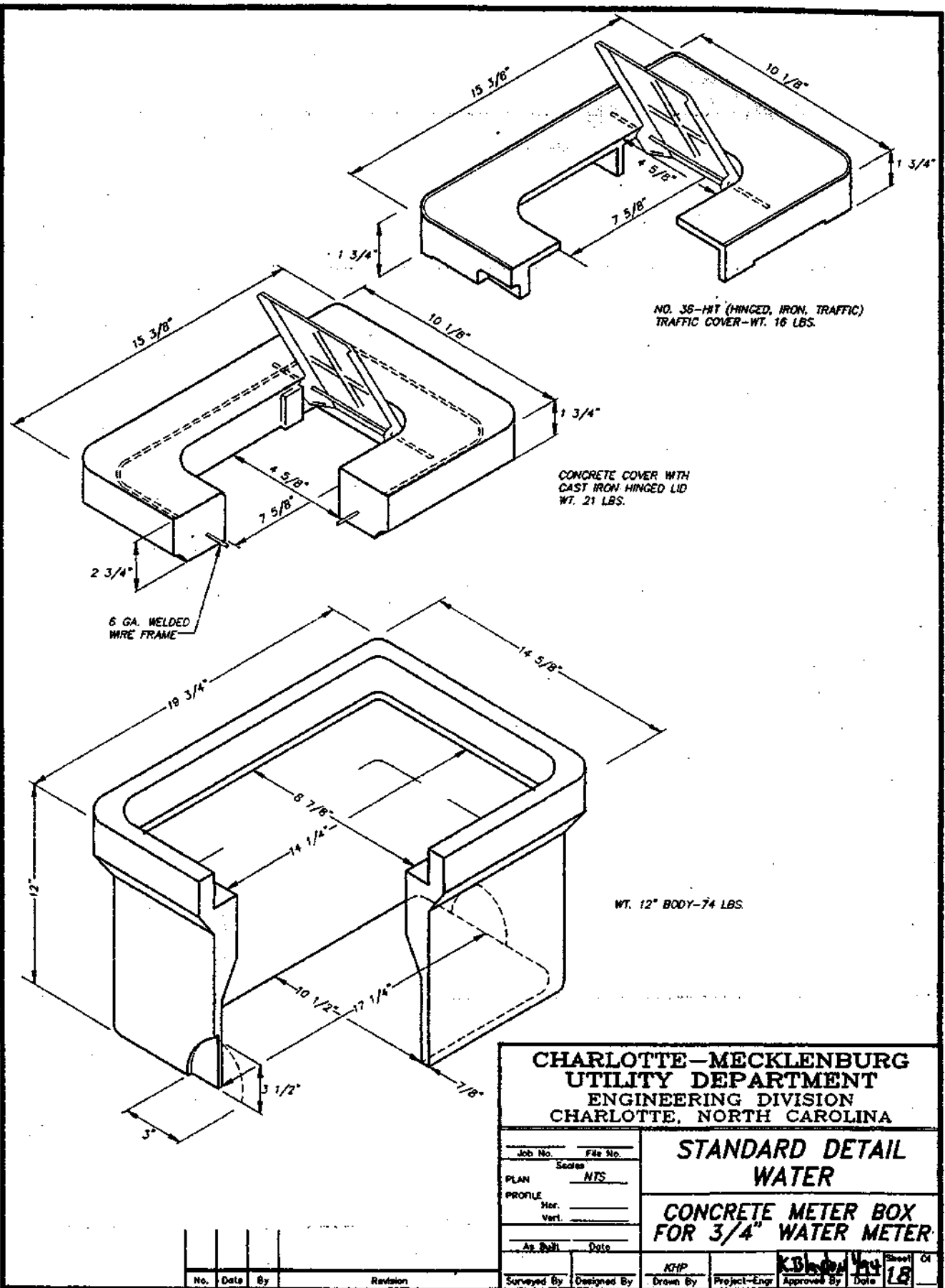


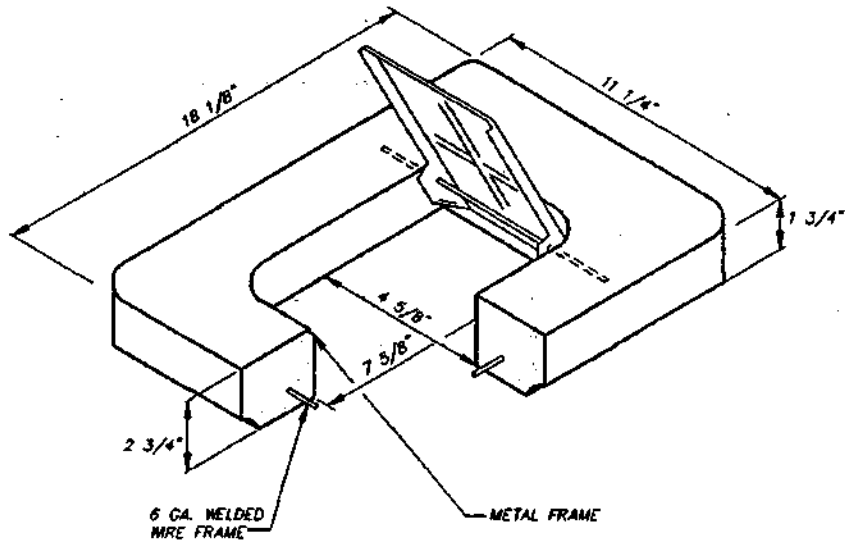
**ROAD WITH SIDE DITCH**

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**

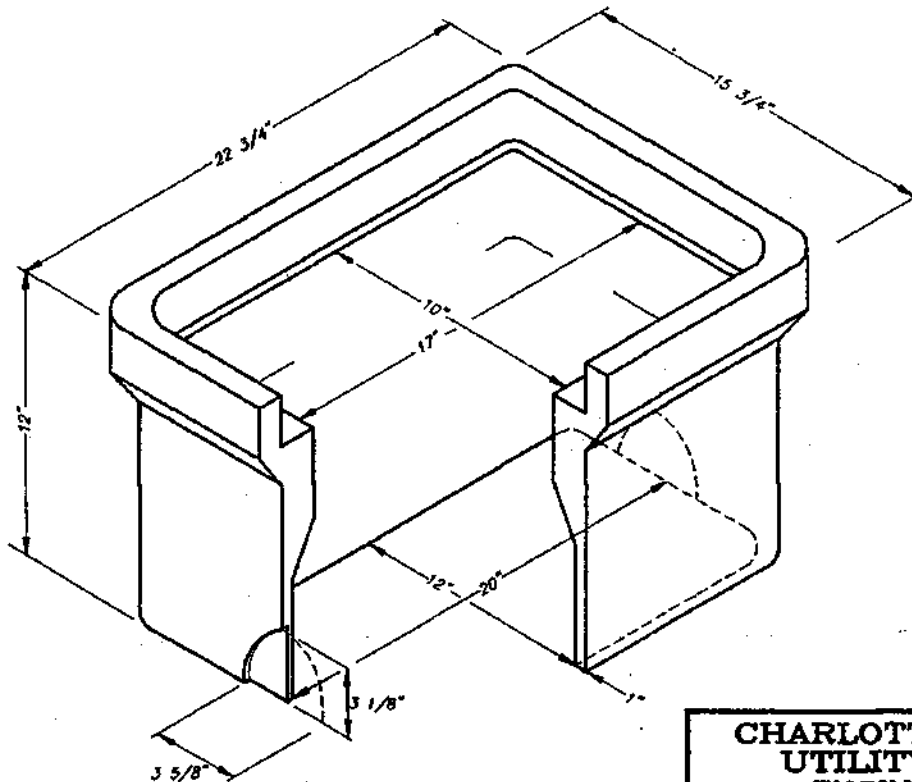
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PLAN _____		Scale <u>NTS</u>			
PROFILE _____		Hor. _____		<b>3/4" AND 1" WATER SERVICE CONNECTION</b>	
Vert. _____		Date _____			
As Built _____		Date _____		KHP	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____	Approved By _____	Sheet 17 of 17





### 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. \_\_\_\_\_

Scale \_\_\_\_\_

PLAN \_\_\_\_\_ NTS \_\_\_\_\_

PROFILE \_\_\_\_\_

Hor. \_\_\_\_\_

Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_

Surveyed By \_\_\_\_\_

Designed By \_\_\_\_\_

KHP

Drawn By \_\_\_\_\_

Project-Engr \_\_\_\_\_

Approved By \_\_\_\_\_

K. B. Blevins

Date \_\_\_\_\_

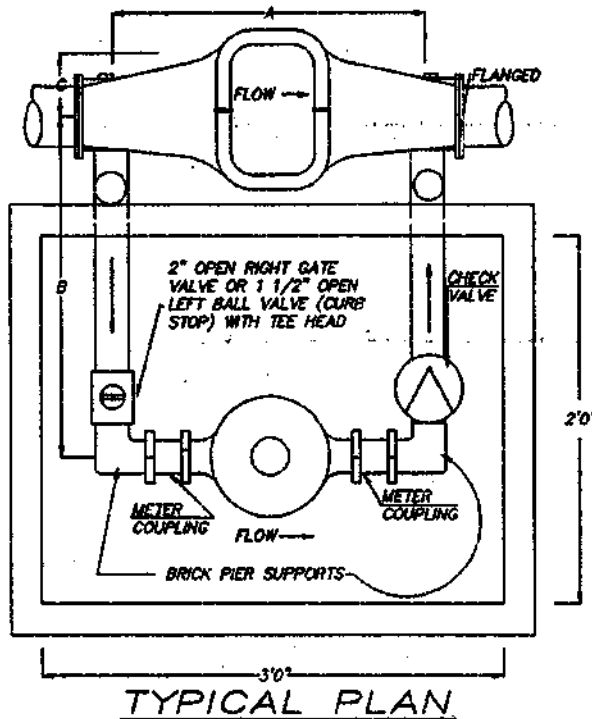
Sheet \_\_\_\_\_

Of \_\_\_\_\_

19

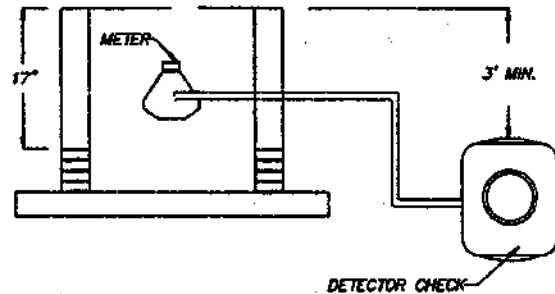
No.	Date	By

Revision

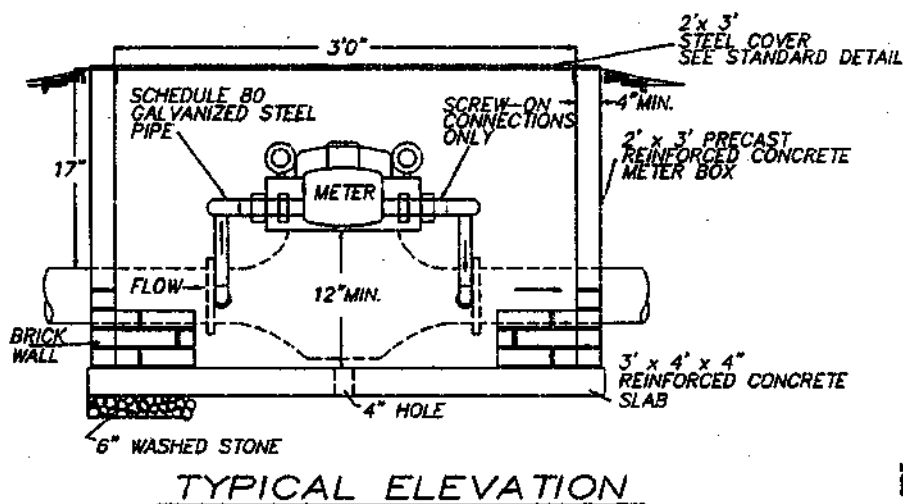


SIZE	A	B	C	SIZE METER
4"	12-1/2"	22"	5-1/4"	1"
6"	17"	23-1/2"	6-7/16"	1-1/2"
8"	21"	25"	7-7/8"	2"
10"	28"	25"	9-11/32"	2"

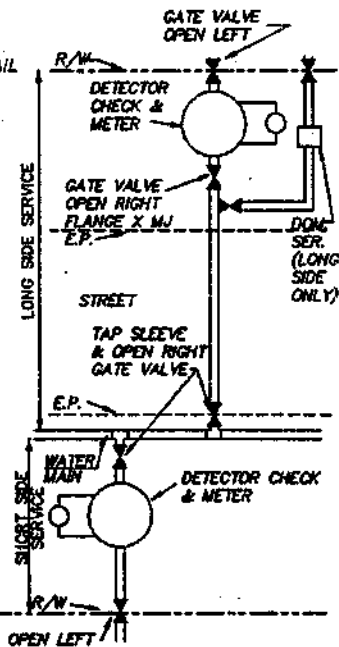
METER COUPLING SHALL BE "GRAND" NO. 2008 FOR 1 1/2" & NO. 2010 FOR 2".



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.

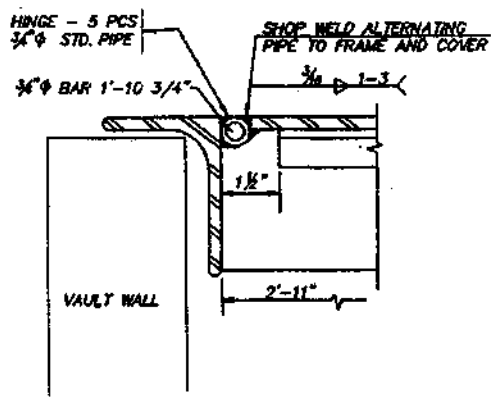
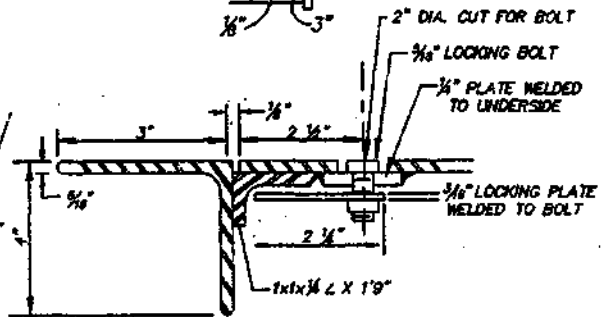
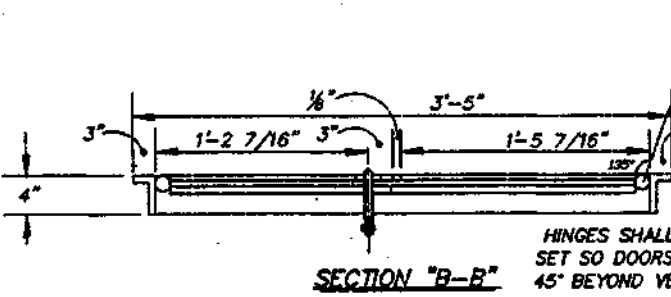
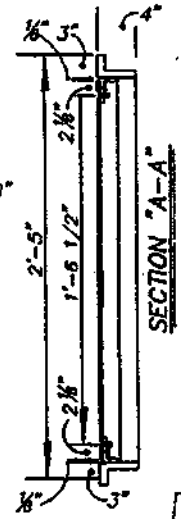
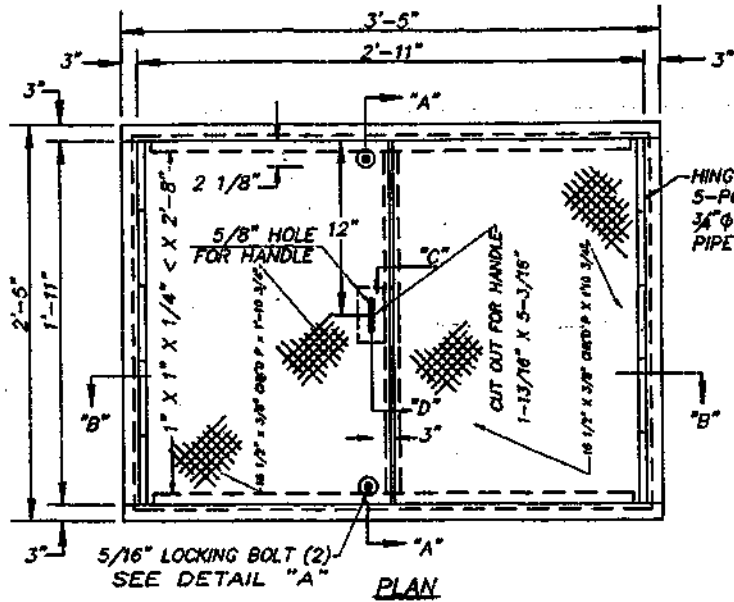
ALL VALVES SHALL HAVE STANDARD VALVE BOX.

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

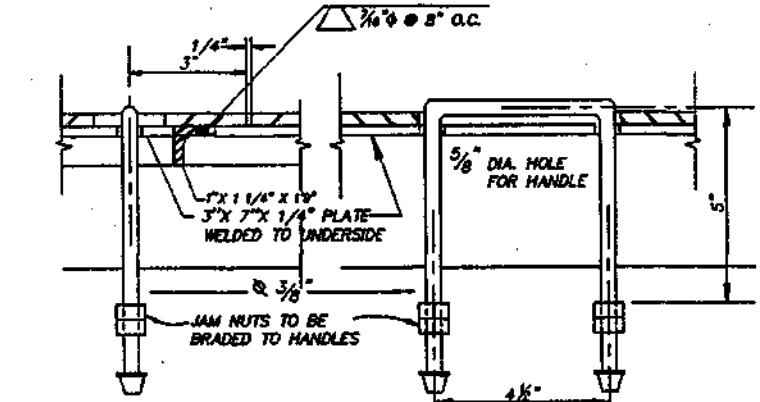
**STANDARD DETAIL  
WATER**

**FIRE LINE  
CONNECTION**

Job No. _____	File No. _____
PLAN	Scale: <u>NO SCALE</u>
PROFILE	Hor. _____
	Vert. _____
As Bld _____	Date _____
Surveyed By _____	Designed By _____
Drawn By <u>JRM</u>	Project-Engr _____
Approved By <u>K. Blanton</u>	Date <u>20</u>



HINGES SHALL BE SET SO DOORS OPEN 45° BEYOND VERTICAL



**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.

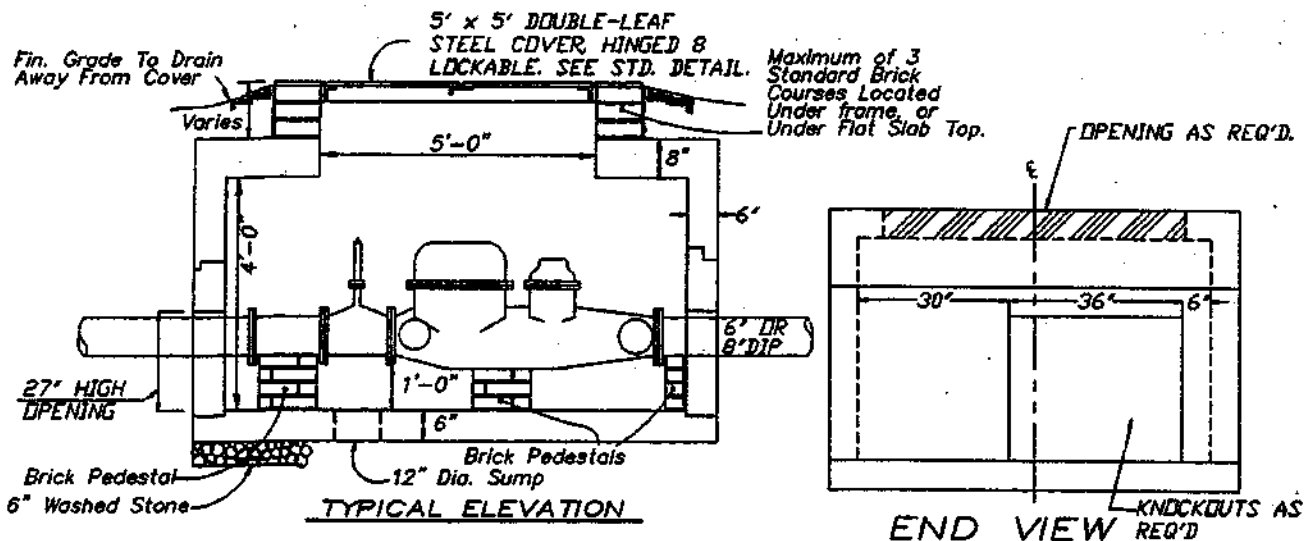
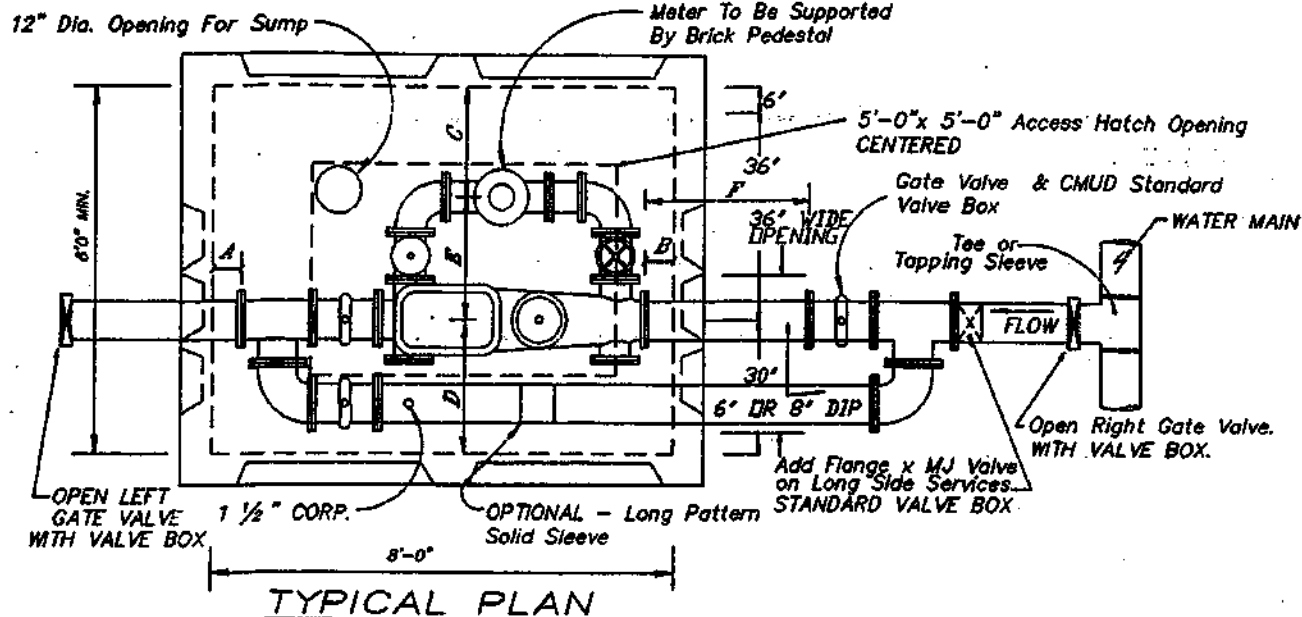
<b>CHARLOTTE-MECKLENBURG          UTILITY DEPARTMENT          ENGINEERING DIVISION          CHARLOTTE, NORTH CAROLINA</b>			
Job No. _____ File No. _____ Scale: <b>NO SCALE</b>		<b>STANDARD DETAIL          WATER</b>	
PLAN _____ PROFILE _____ No. _____ Ver. _____		<b>2' X 3' METER VAULT          FRAME AND COVER</b>	
As Built _____ Date _____		Drawn By: <b>JRM</b> Project-Engr: <b>K.B.</b> Approved By: <b>4/11</b> Date: <b>21</b>	
Surveyed By: _____ Designed By: _____		Sheet <b>21</b> of _____	

01021.DWG  
 1/05/94









#### 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 OR AS APPROVED.

METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.

BOTTOM SLAB TO BE SAME AS WALL PANELS WITH FLAT SIDE UP.

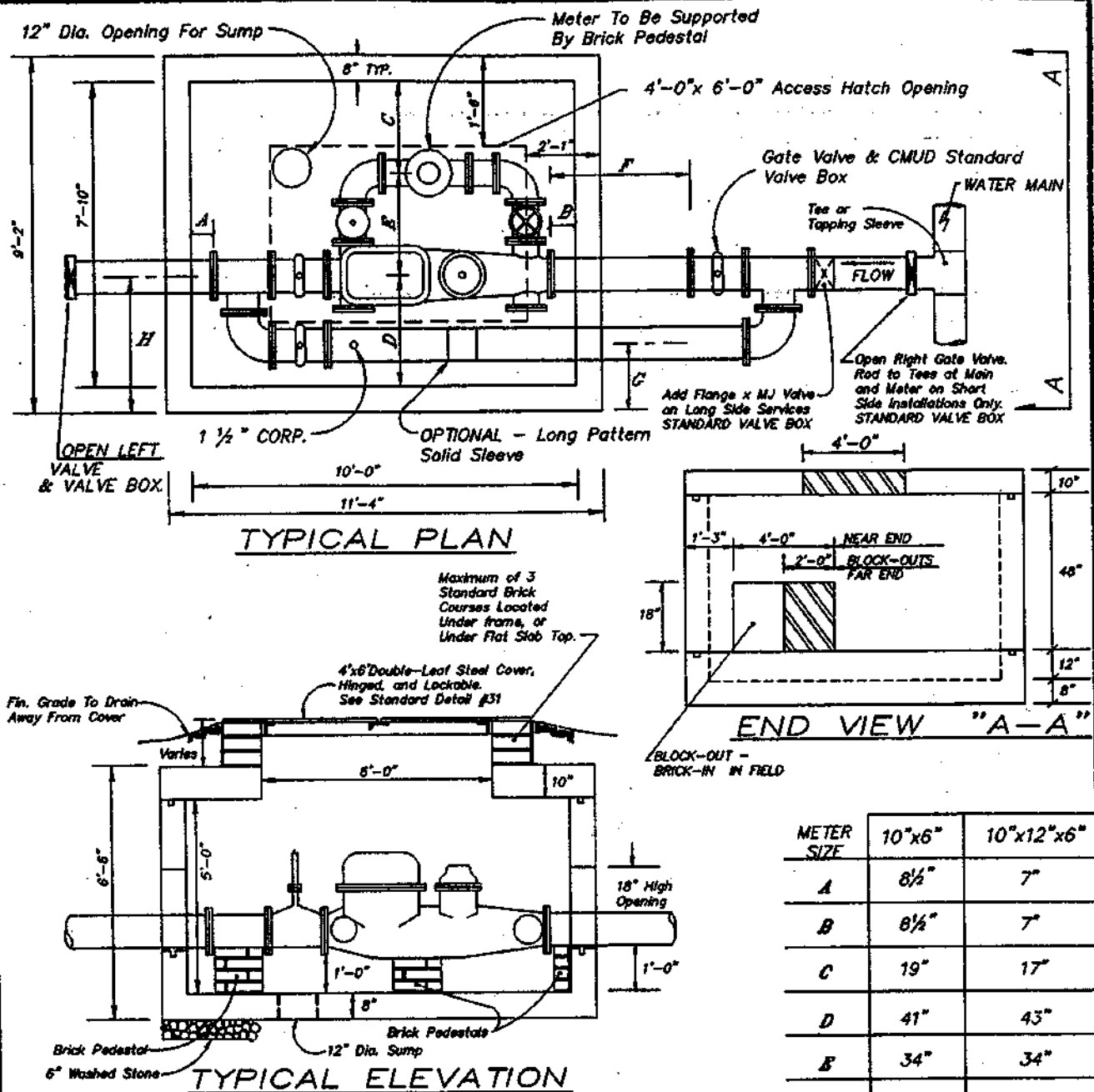
INSTALL OPEN RIGHT GATE VALVES INSIDE METER VAULT, EXCEPT HAND WHEEL VALVE WHICH IS OPENED LEFT.

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**

Job No. _____		File No. _____	
PLAN		Scale: <b>NO SCALE</b>	
PROFILE		Hor. _____	
		Vert. _____	
As Built		Date _____	
Surveyed By	Designed By	Drawn By	Project-Engr
			Approved By
No.	Date	By	Revision
Sheet			Of
24			





#### NOTES:

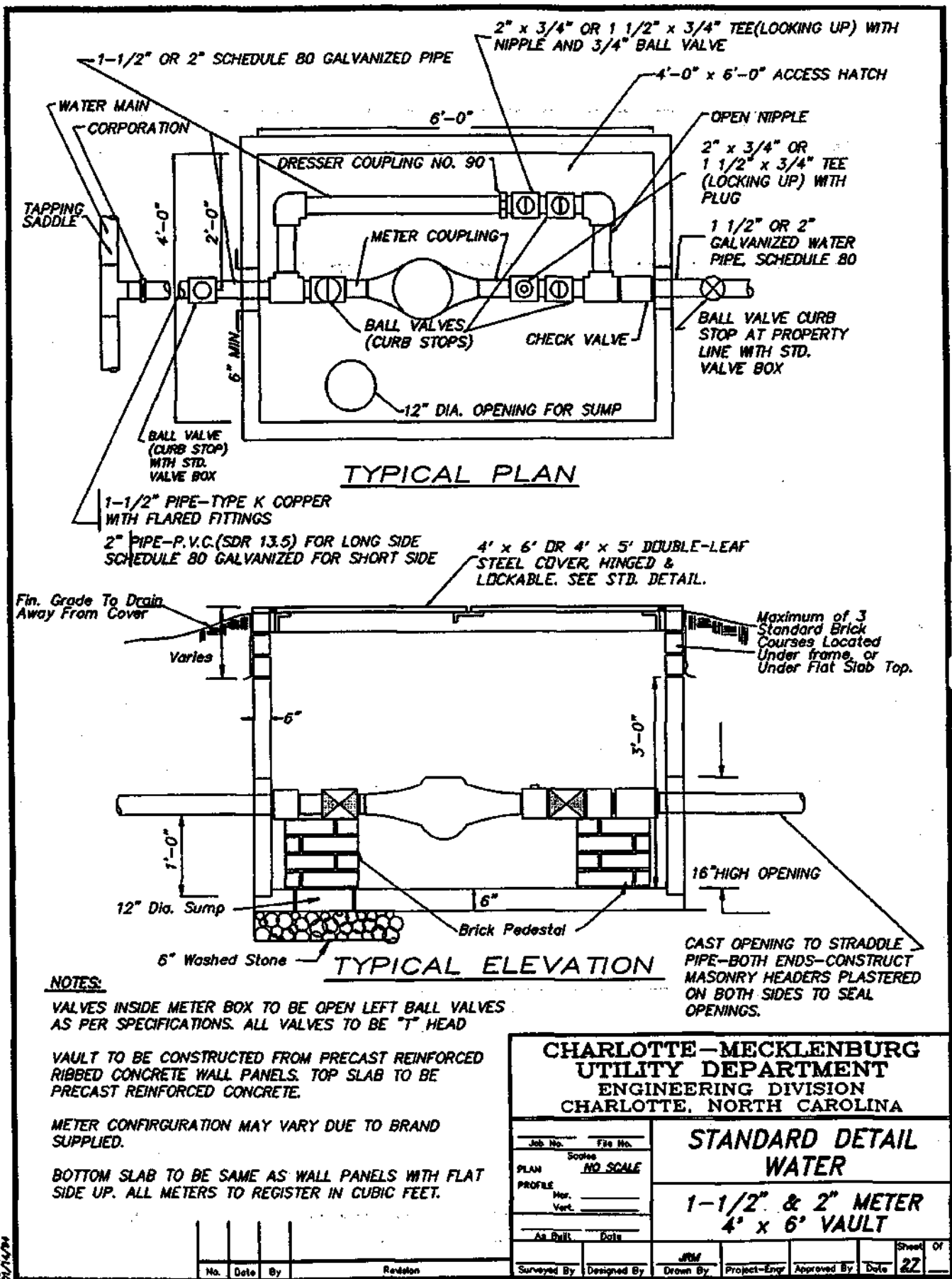
ALL PIPE FOR 10"x 6" METER SHALL BE 10" D.I.P. ONLY  
ALL PIPE FOR 10"x 12"x 6" METER SHALL BE 12" D.I.P. ONLY  
METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.  
INSTALL OPEN RIGHT GATE VALVES INSIDE METER VAULT, EXCEPT HAND WHEEL VALVE WHICH IS OPEN LEFT.  
ALL PIPE SHALL BE RESTRAINED JOINT FROM 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.	Fee No.
PLAN	Scale NO SCALE
PROFILE	Hor. _____ Vert. _____
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Eng
Approved By	Date





### 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~in ches 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 & Rasor 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 Embeco 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~ 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>				
Pipe Size	Pressure Class	BEDDING		
		Type I	Type II	Type III
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"-1½" 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 furroughs 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.

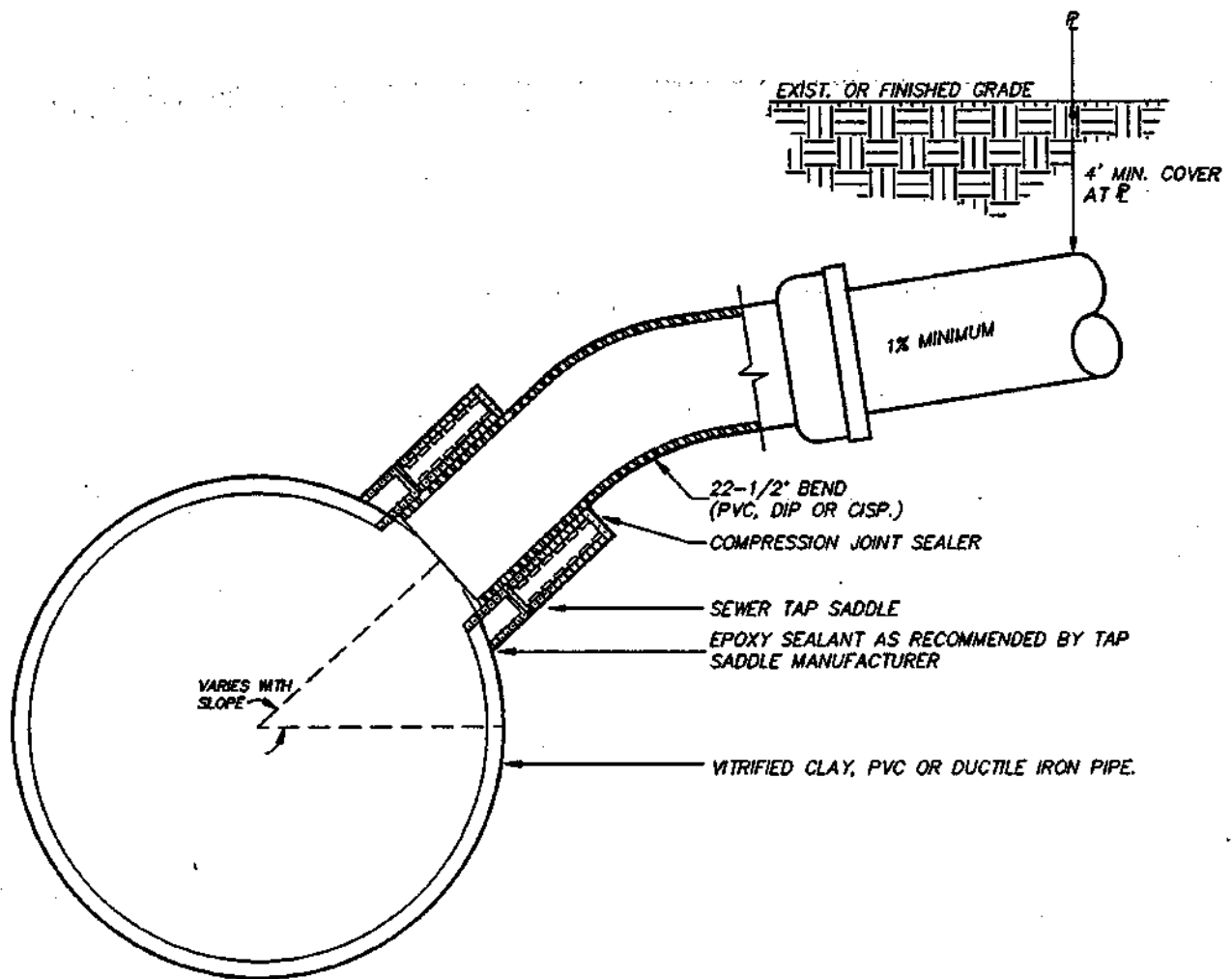
**W. WORK WITHIN NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RIGHTS-OF-WAY**

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:**

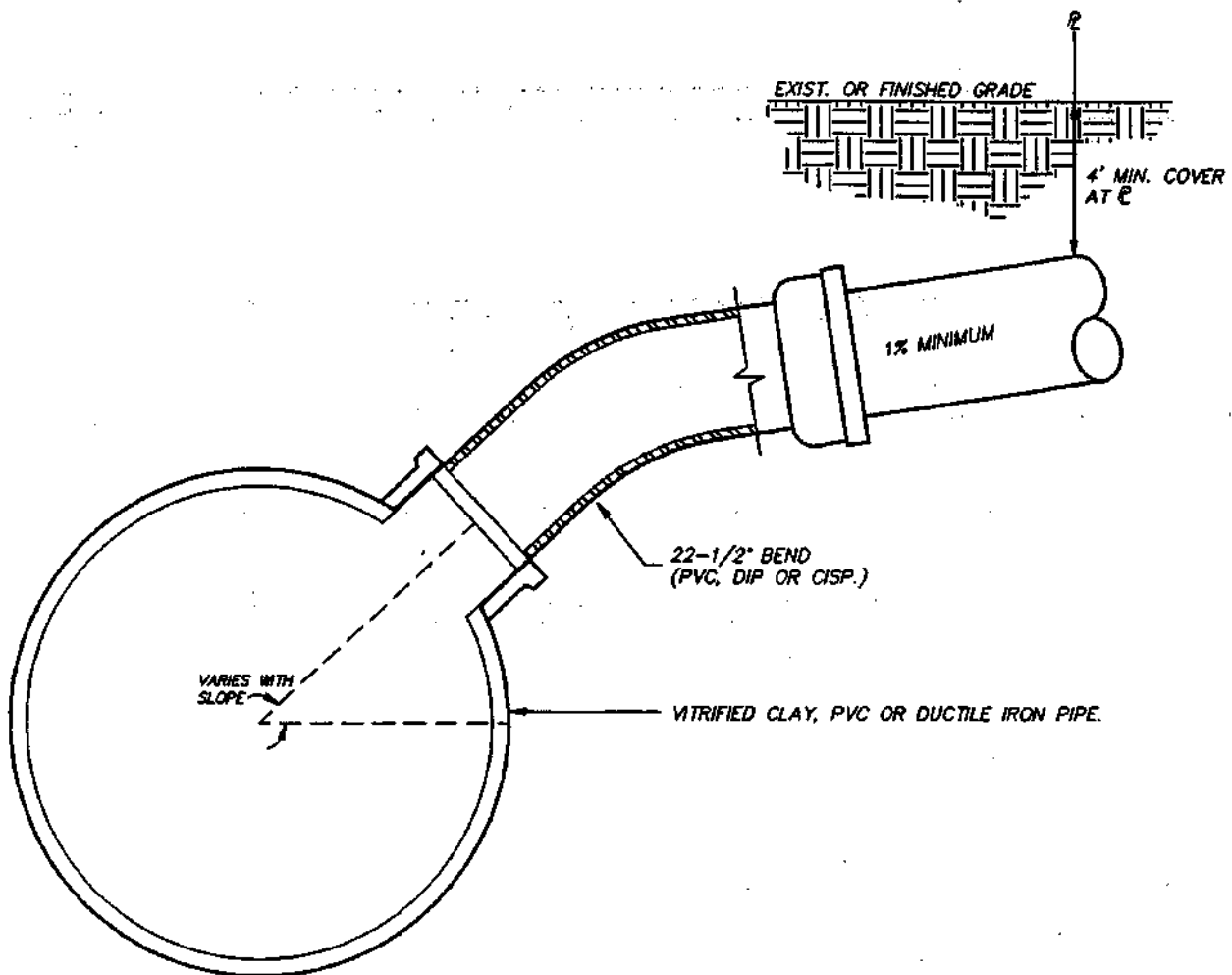
1. THE OPENING IN PIPE SHALL BE CUT WITH A TAP MACHINE ONLY.
2. THE TAP SHALL BE MADE IN THE UPPER HALF OF THE PIPE AT 45° FROM THE HORIZONTAL.
3. MAXIMUM SIZE TAP SHALL BE FOUR INCHES.
4. TEE & BEND TO BE FULLY ENCASED WITH #67 CRUSHED STONE.
5. SDR 35 PVC LATERAL PIPE REQUIRE TYPE III GRANULAR BEDDING.
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.

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

**STANDARD DETAIL  
SEWER**

**4" LATERAL (TAP)**

Job No. _____	File No. _____
Scale _____	
PLAN _____	NTS
PROFILE _____	
Hor. _____	
Vert. _____	
As Bldg. _____	Date _____
Surveyed By _____	Designed By _____
Drawn By _____	Project-Engr _____
MSW	Approved By _____
Date _____	Sheet 1 of 1



**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.

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

**STANDARD DETAIL  
SEWER**

**4" LATERAL (TEE)**

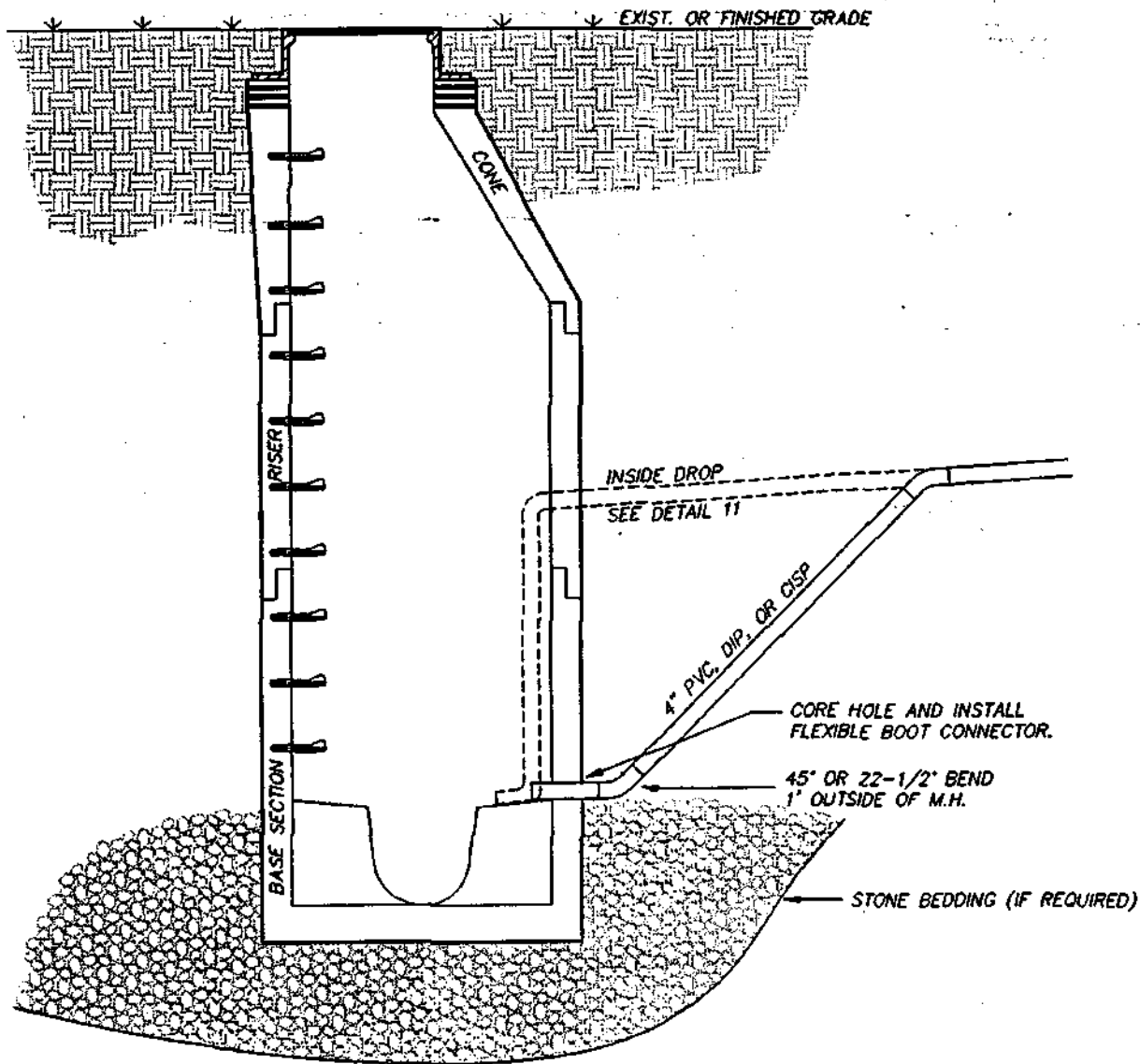
No.	Date	By

Revision

Job No.	File No.
PLAN	Scale
PROFILE	Hor.
	Vert.
As Built	Date
Surveyed By	Designed By

MSW	Drawn By	Project-Eng	Approved By	Date	Sheet	Of
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**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

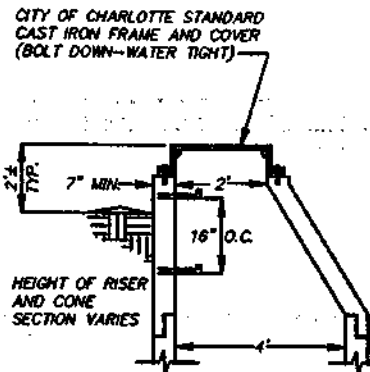
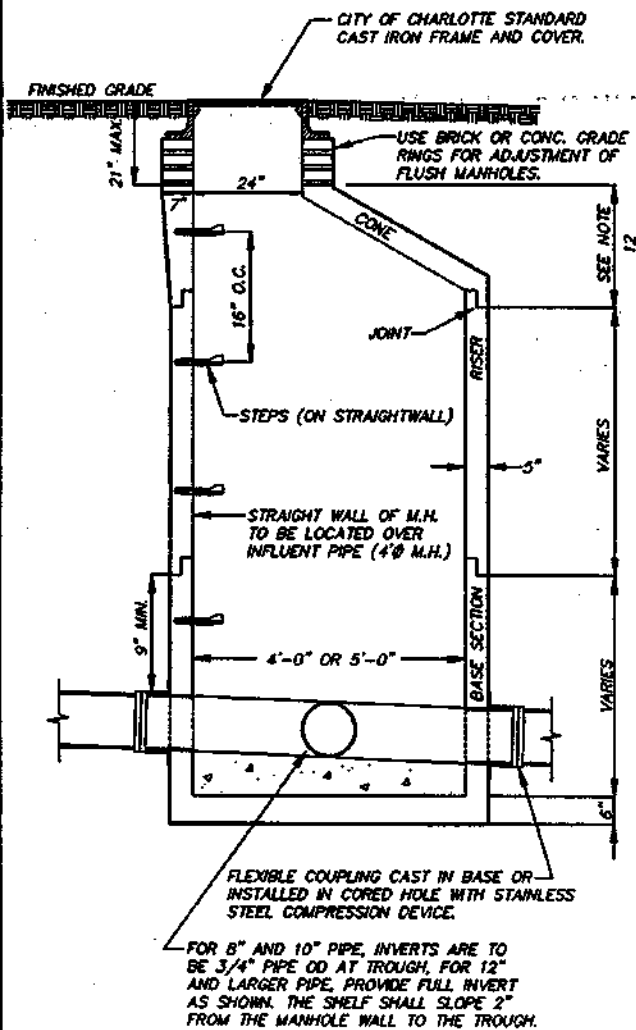
**LATERAL INSTALLATION  
AT MANHOLE**

Job No.	File No.
Scale	
PLAN	NTS
PROFILE	
Hor.	
Vert.	
As Bldg	Date
Surveyed By	Designed By

MSW	Project-Eng	Approved By	Date	Sheet 3 of 3
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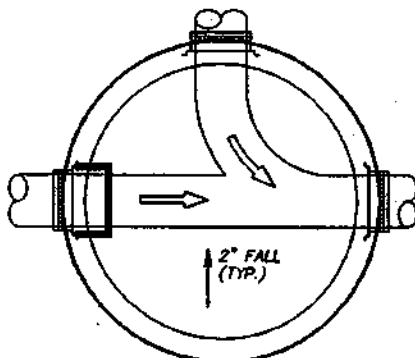
No.	Date	By	Revision

MSW/UT  
DWG/SD



#### 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 MAYBE 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".

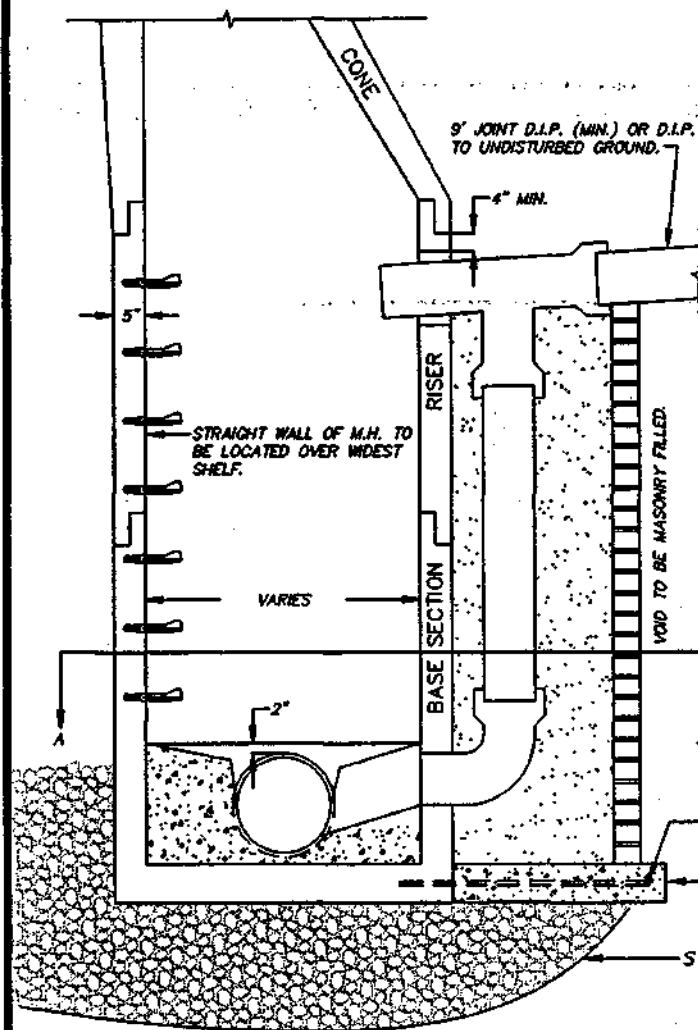


### CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA

#### STANDARD DETAIL SEWER

#### PRECAST MANHOLES 4' AND 5' DIAMETER

Job No.	File No.	Scale	NTS
PLAN	Hor.		
PROFILE	Vert.	As Built	Date
Surveyed By	Designed By	Drawn By	Project-Eng.
MSW		Approved By	Date
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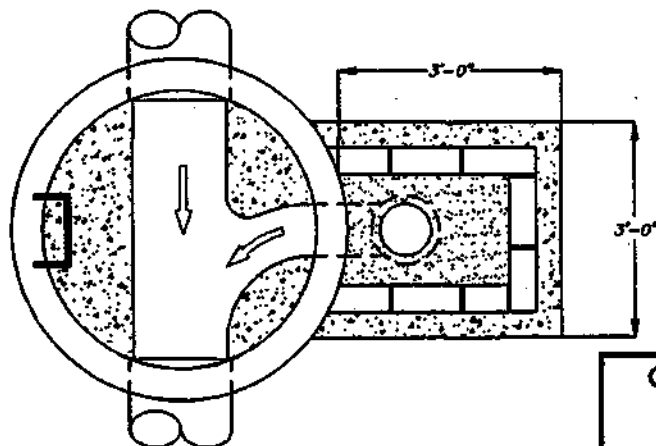
# NOTES:

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.

3-#6 REBARS

POUR 3" X 3" CONCRETE FOOTING 6 INCHES THICK TO SUPPORT DROP STRUCTURE.

STONE (IF REQUIRED)



SECTION A-A

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
SEWER

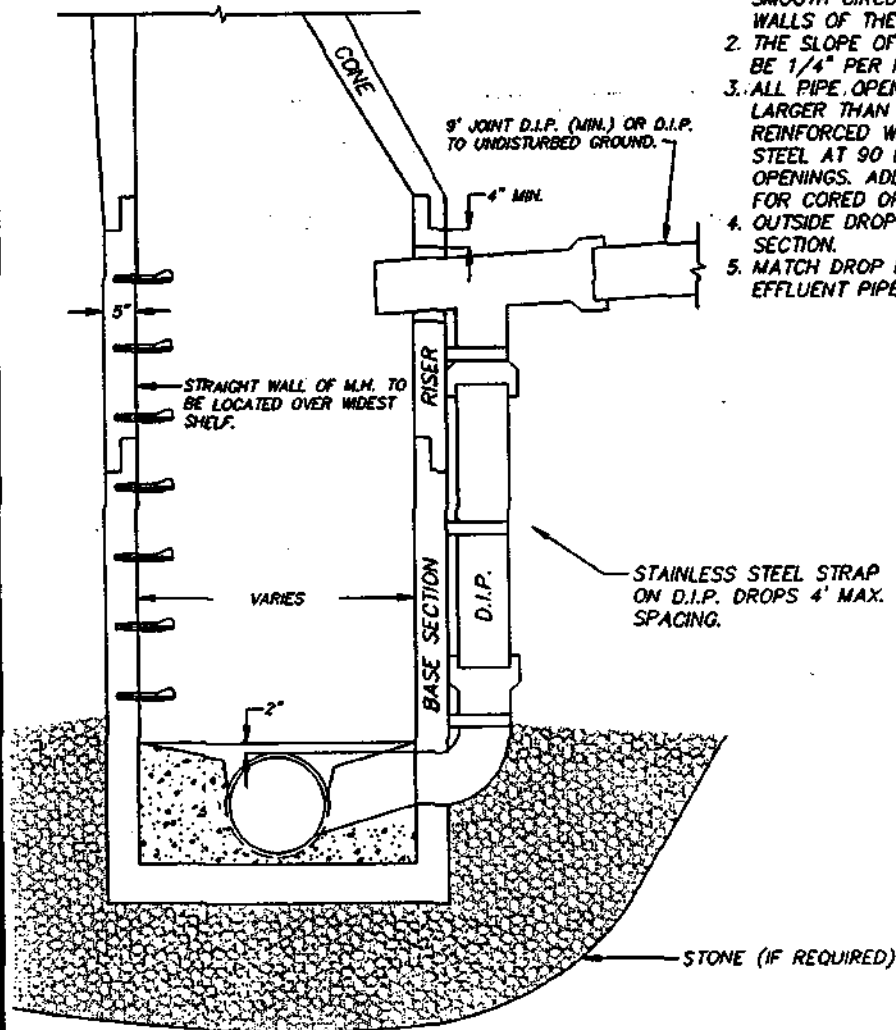
OUTSIDE DROP

Job No.	File No.
Scale	
PLAN NTS	
PROFILE	Hor.
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As Bldg	Date
Surveyed By	Designed By
Drawn By	Project-Eng

Approved By	Date	Sheet	Of
K. D. [Signature]	2/95	5	

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

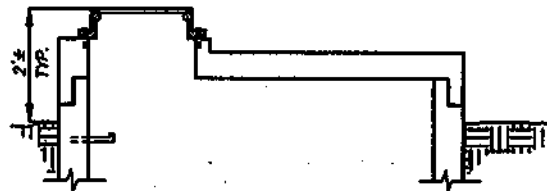
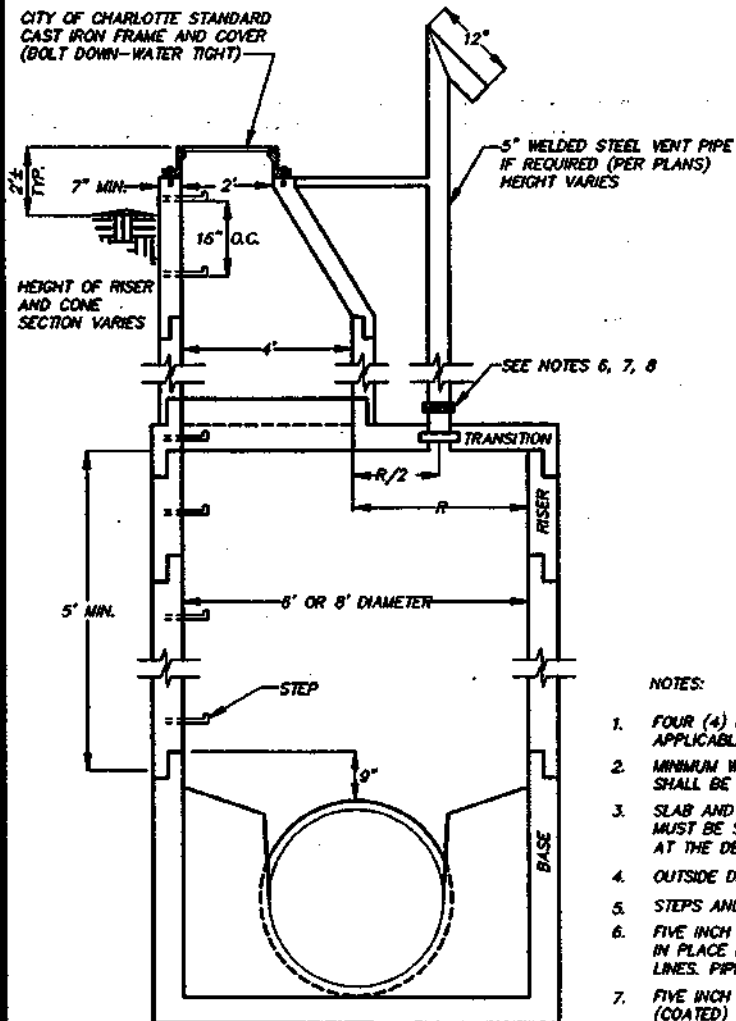
STANDARD DETAIL  
SEWER

OUTSIDE DROP  
INSTALLATION (ALTERNATE)

Job No.	File No.
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PROFILE	Hor.
	Vert.
As Built	Date
Surveyed By	Designed By

MSW	Project-Eng	Approved By	Date	Sheet	Of
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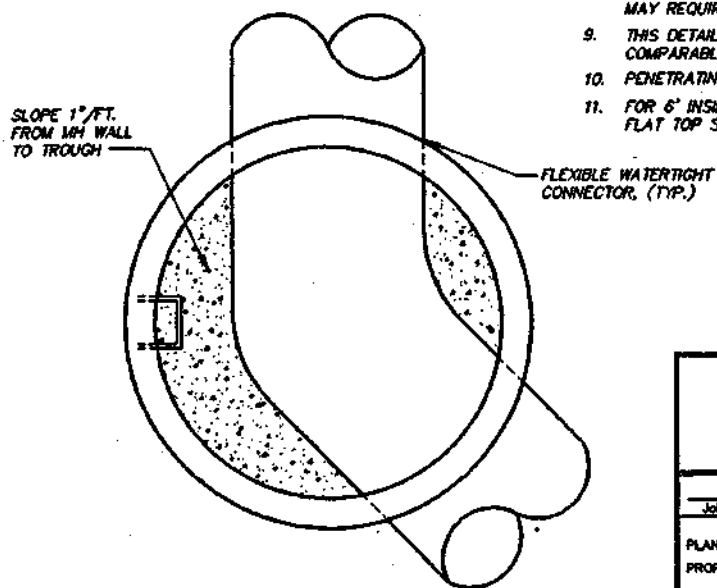
CITY OF CHARLOTTE STANDARD  
CAST IRON FRAME AND COVER  
(BOLT DOWN-WATER TIGHT)



**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.

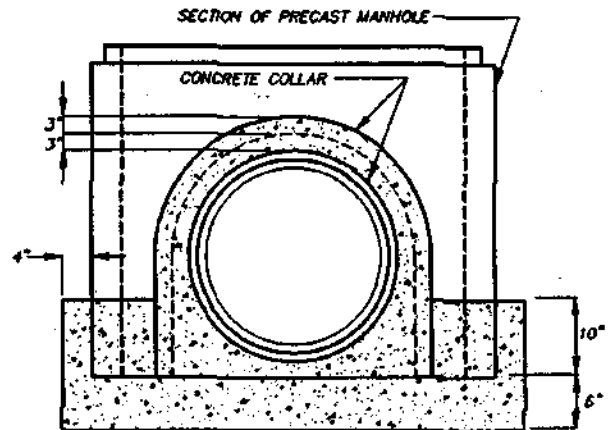
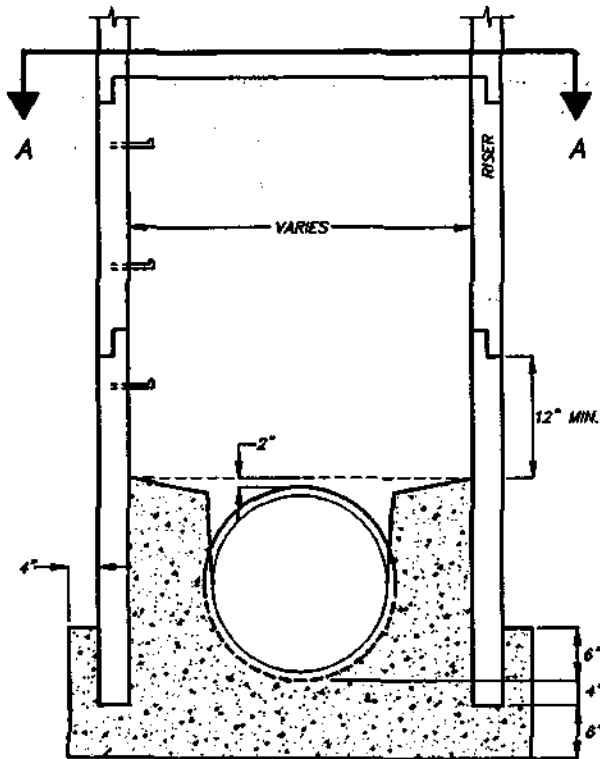


**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

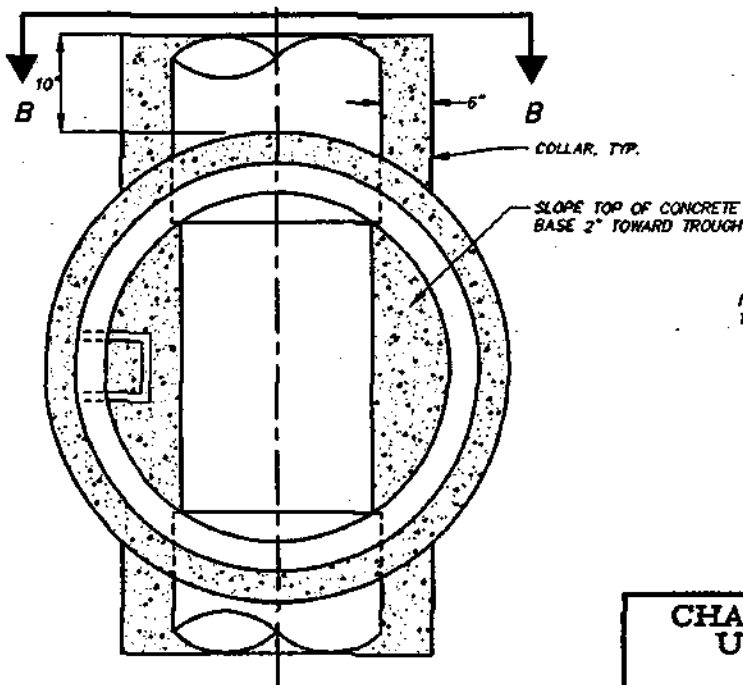
**STANDARD DETAIL  
SEWER**

**PRECAST MANHOLE  
6' AND 8' DIAMETER**

Job No.	File No.
PLAN	Scales NTS
PROFILE	Hor. _____
	Vert. _____
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Eng
Approved By	Date
Sheet	Of
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**SECTION B-B**



**SECTION A-A**

NOTES:  
1. MANHOLES SHALL ALSO COMPLY WITH STANDARD  
DETAILS 4 AND 7 AS APPLICABLE.

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

**STANDARD DETAIL  
SEWER**

**PRECAST MANHOLES  
INSTALLED OVER EXISTING PIPE**

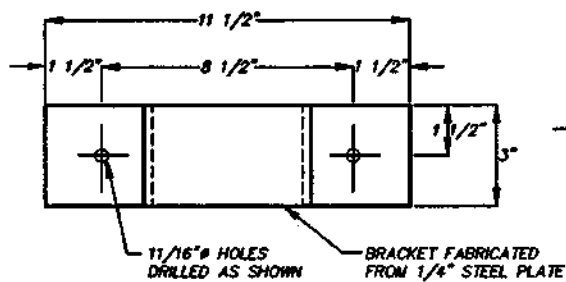
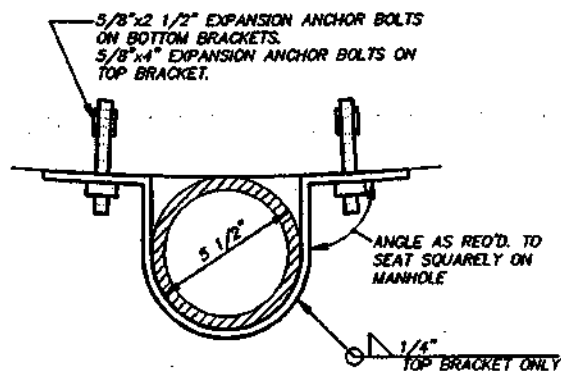
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Surveyed By \_\_\_\_\_ Designed By \_\_\_\_\_

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Project-Engr \_\_\_\_\_  
Approved By \_\_\_\_\_  
Date \_\_\_\_\_  
Sheet 8 of 8

No. \_\_\_\_\_ Date \_\_\_\_\_ By \_\_\_\_\_  
Revision \_\_\_\_\_

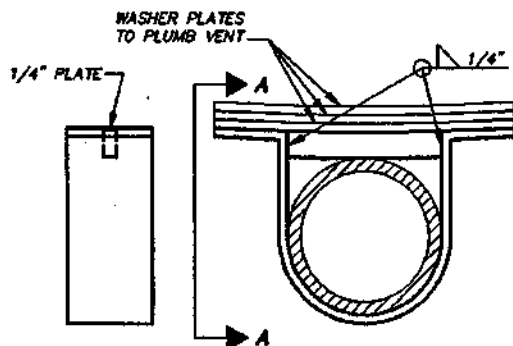
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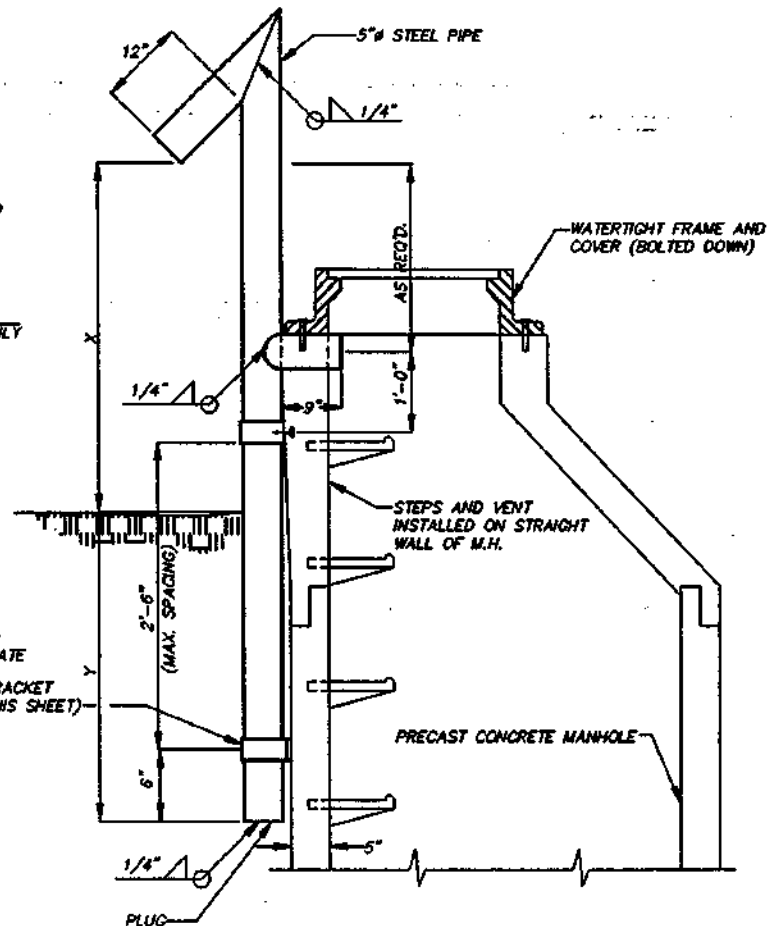
### PIPE BRACKET

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 CREEK SIDE.

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

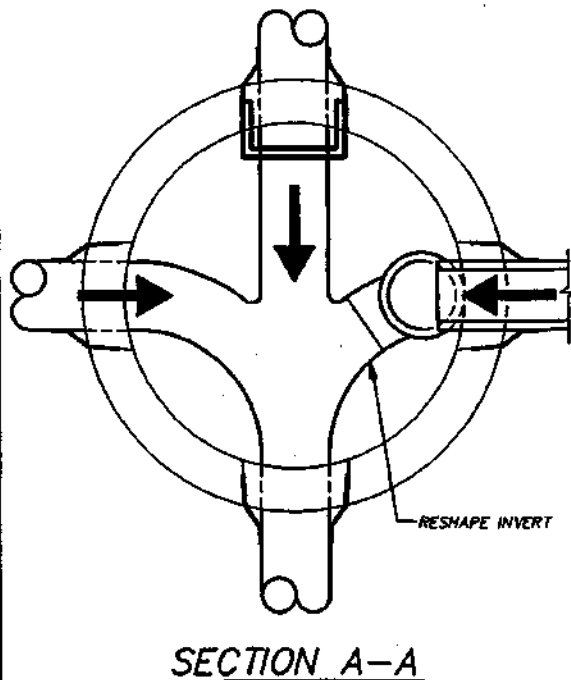
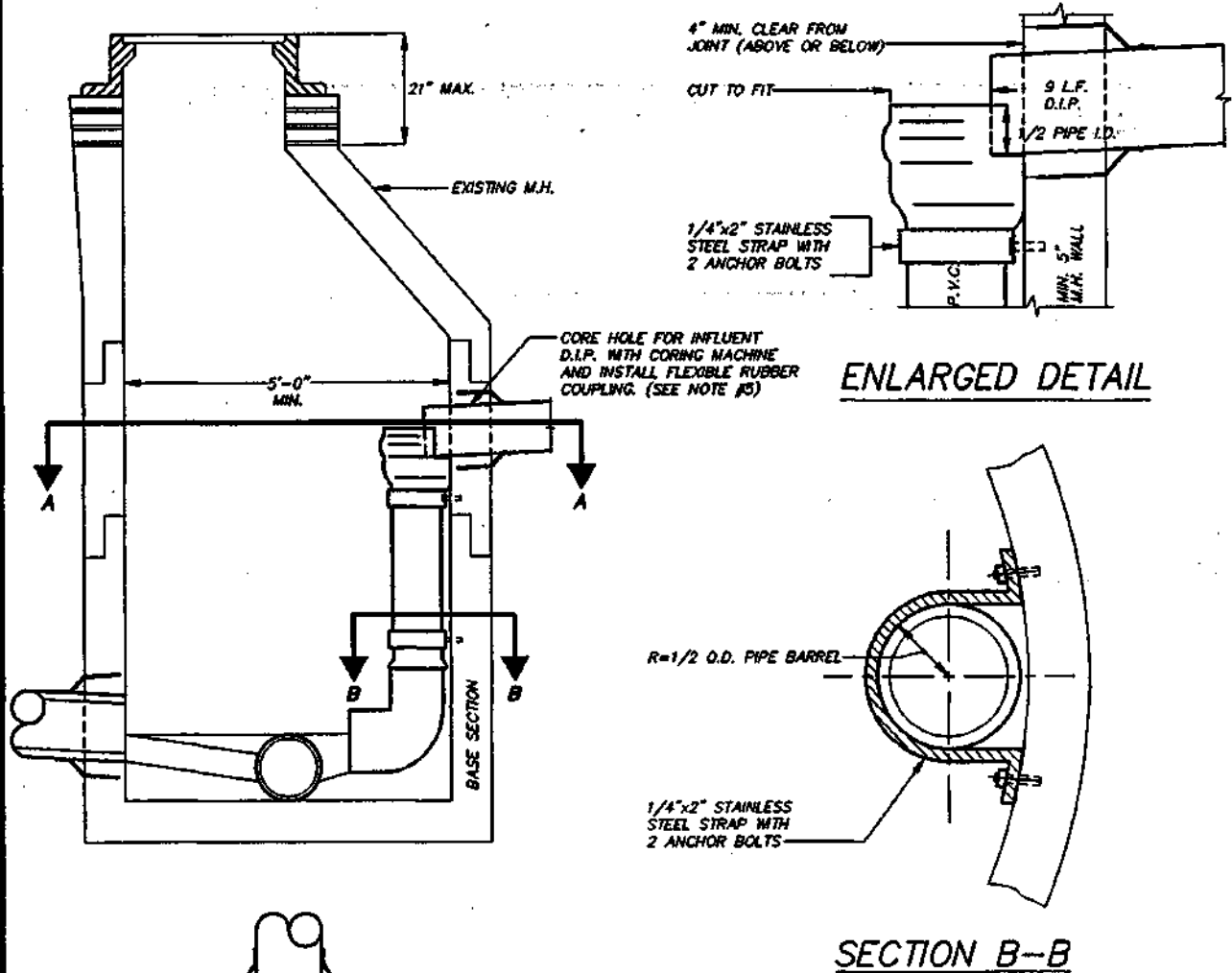
No.	Date	By

Revision

Job No.	File No.
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As Built	Date
Surveyed By	Designed By
Drawn By	Project-Eng
Approved By	Date

KNP	K.B. Blythe	Sheet 10
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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

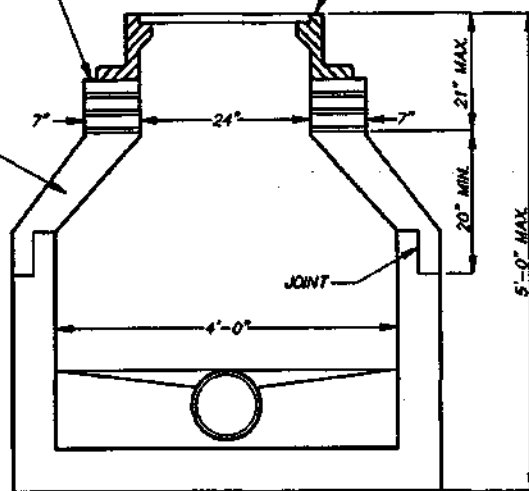
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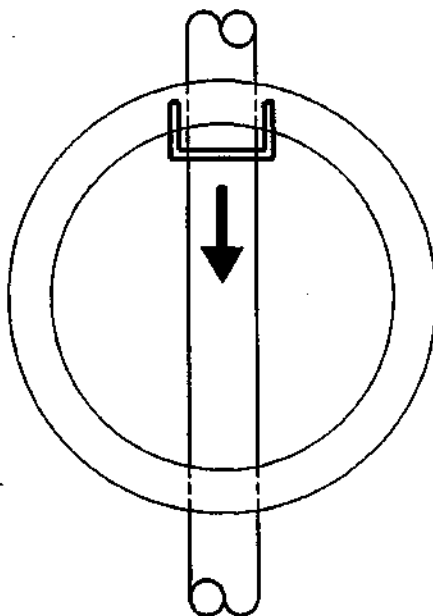
USE BRICK OR CONC. GRADE RINGS  
FOR ADJUSTMENT

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. \_\_\_\_\_

Scale \_\_\_\_\_

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As Built \_\_\_\_\_ Date \_\_\_\_\_

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Project-Engr \_\_\_\_\_

Approved By \_\_\_\_\_

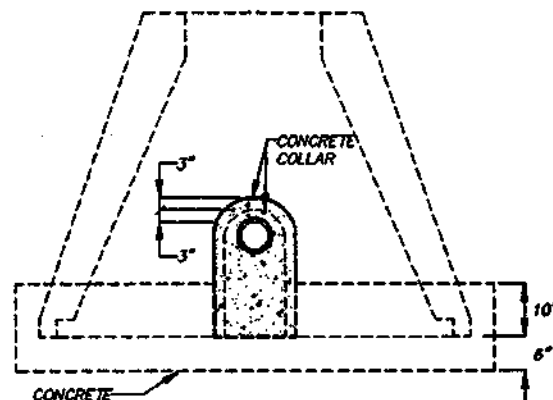
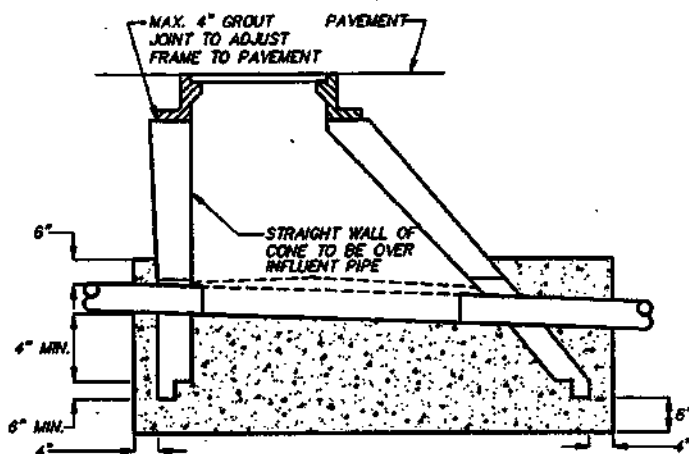
K. Blanton

Date \_\_\_\_\_

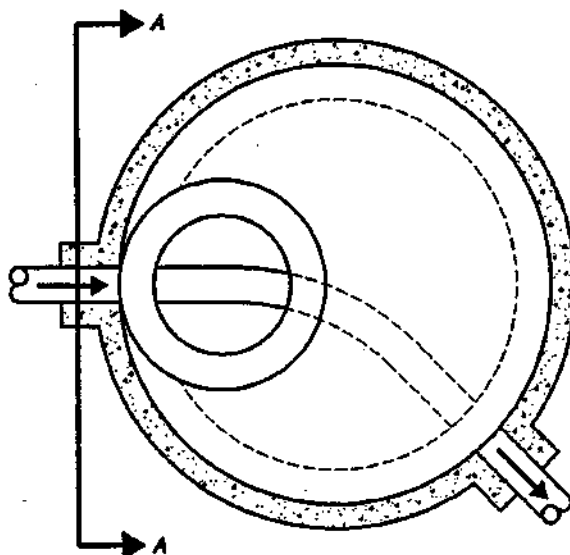
Sheet 12

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No.	Date	By	Revision



### SECTION A-A

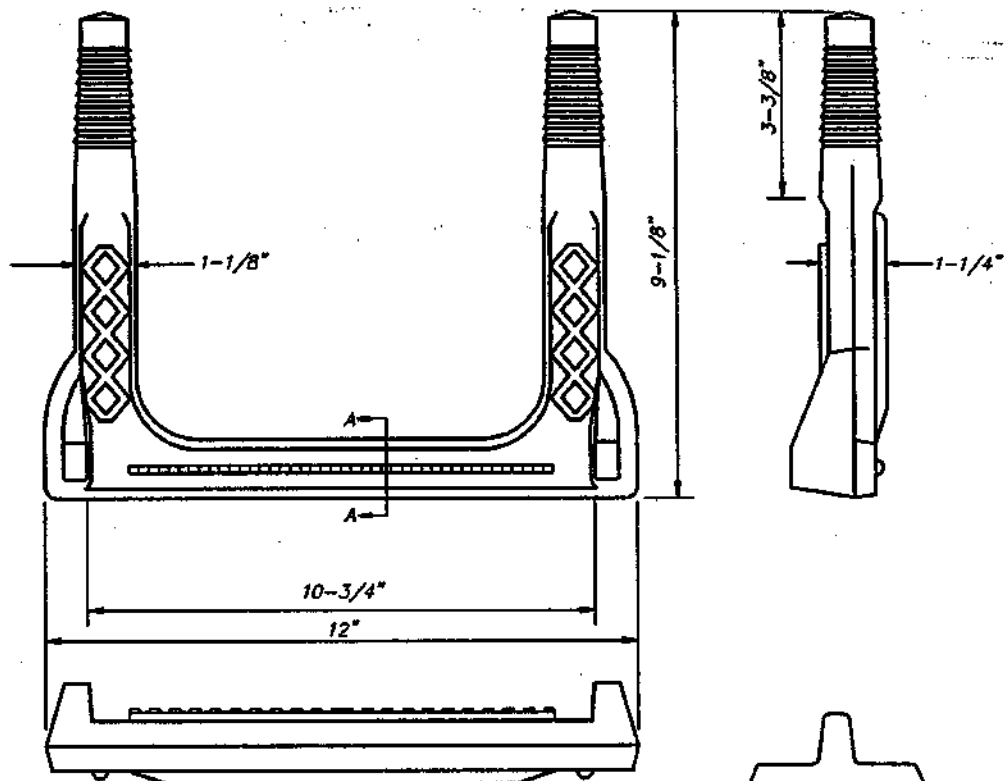


#### NOTES:

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

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Approved By	Date	Sheet	Of
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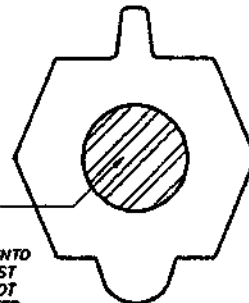


COPOLYMER POLYPROPYLENE PLASTIC

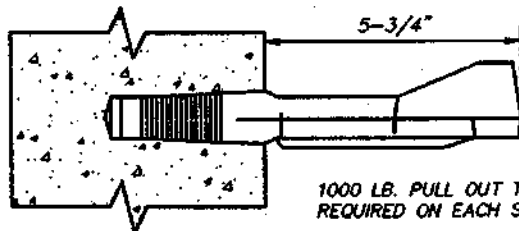
1/2" GRADE 60 STEEL REINFORCEMENT

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**

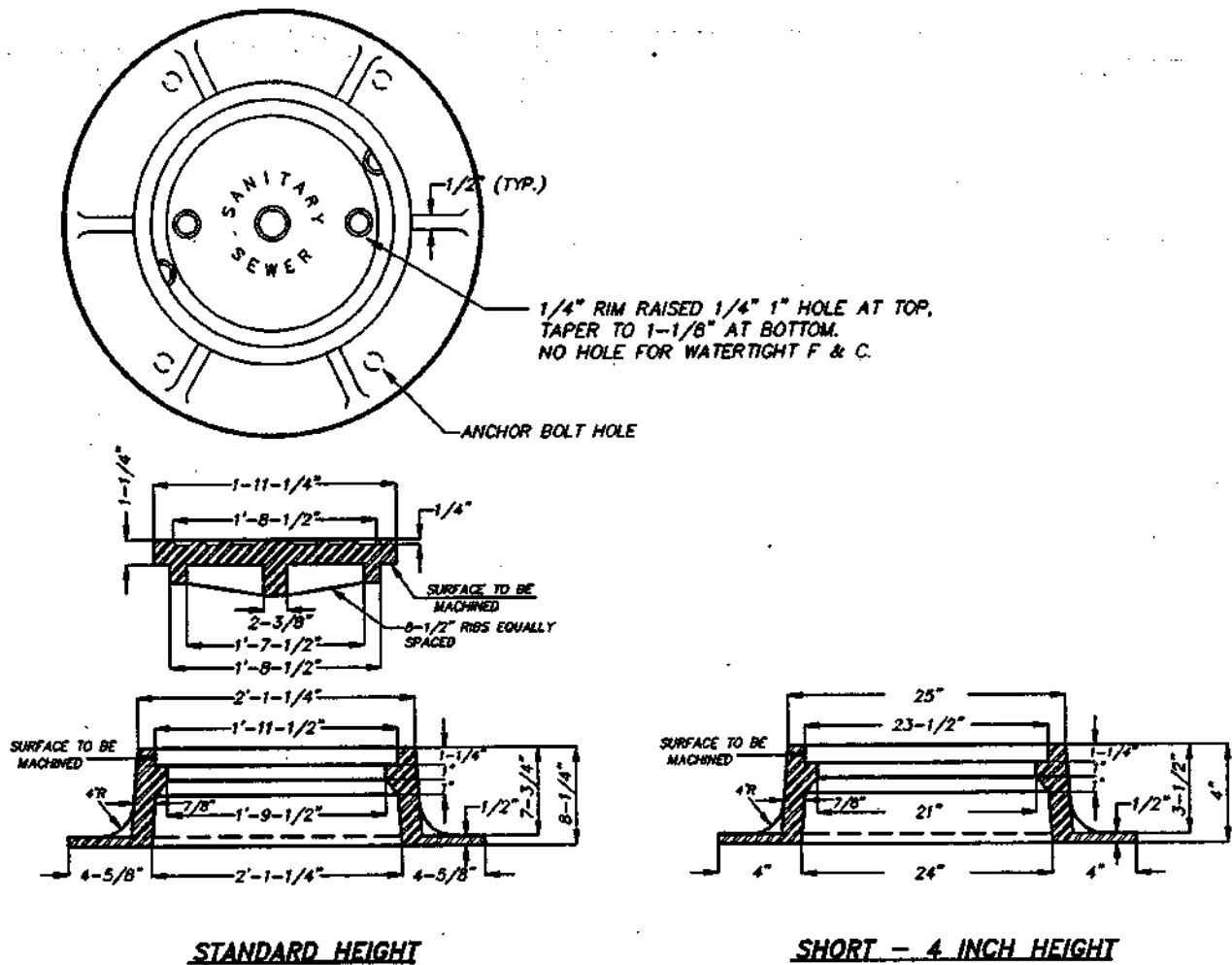
**STANDARD DETAIL  
SEWER**

**PLASTIC STEP CORED HOLE  
DRIVEN IN PLACE**

Job No.	File No.
Scale	NTS
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Vert.	
As Built	Date
Surveyed By	Designed By

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Drawn By	Project-Eng	Approved By	Date

No.	Date	By	Revision



**NOTES:**

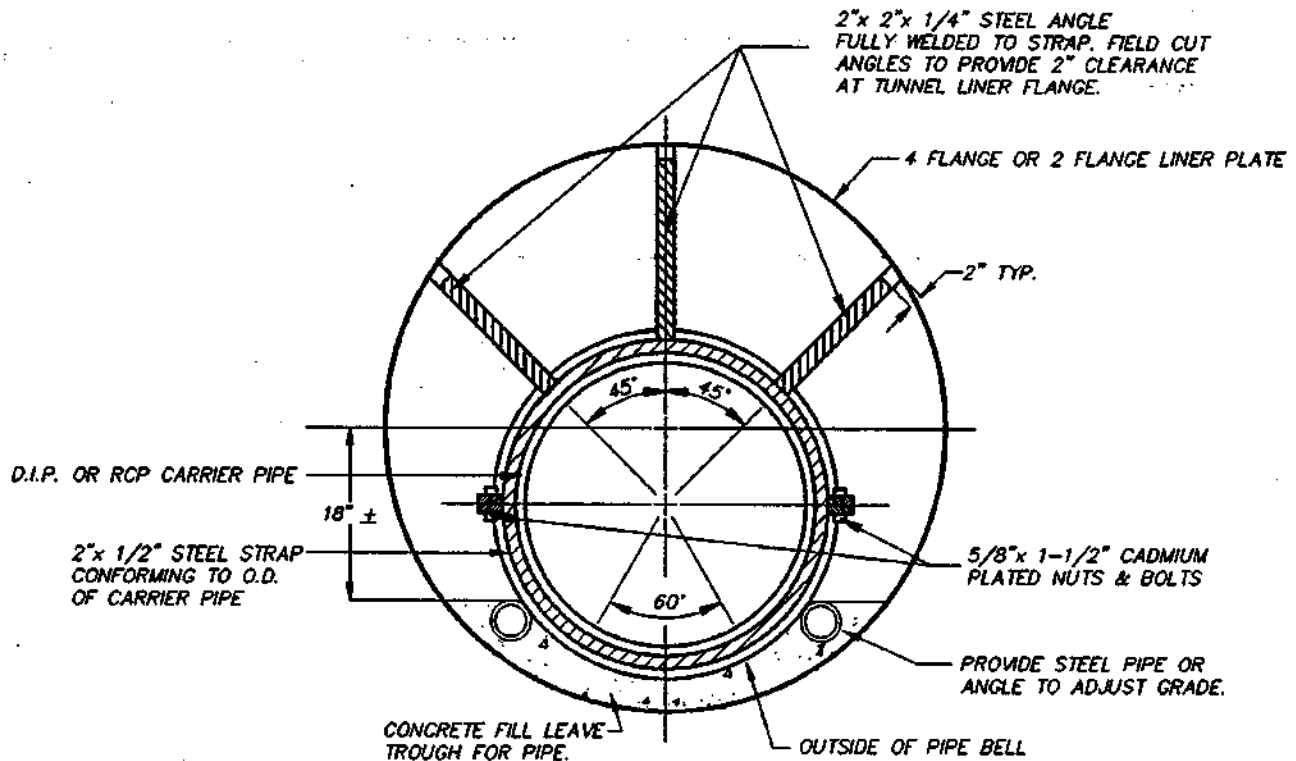
1. ALL CASTING TO BE FREE FROM SAND HOLES AND NO PLUGGING WILL BE ALLOWED.
2. CAST WITH THE USE OF ALUMINUM PATTERNS.
3. SLIGHT DRAFT ALLOWED ON STRAIGHT FACES.
4. APPROXIMATE WEIGHT OF FRAME 230 LBS.  
APPROXIMATE WEIGHT OF FRAME 143 LBS.  
APPROXIMATE WEIGHT OF FRAME 373 LBS.
5. WHEN THE MANHOLE RIM 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.
PLAN	Scale <u>NTS</u>
PROFILE	Hor. _____
	Vert. _____
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Engr
Approved By	Date
MSW L. B. [Signature] 2/24/94 Sheet 15 of 15	



**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. \_\_\_\_\_

Scale \_\_\_\_\_

PLAN \_\_\_\_\_ NTS

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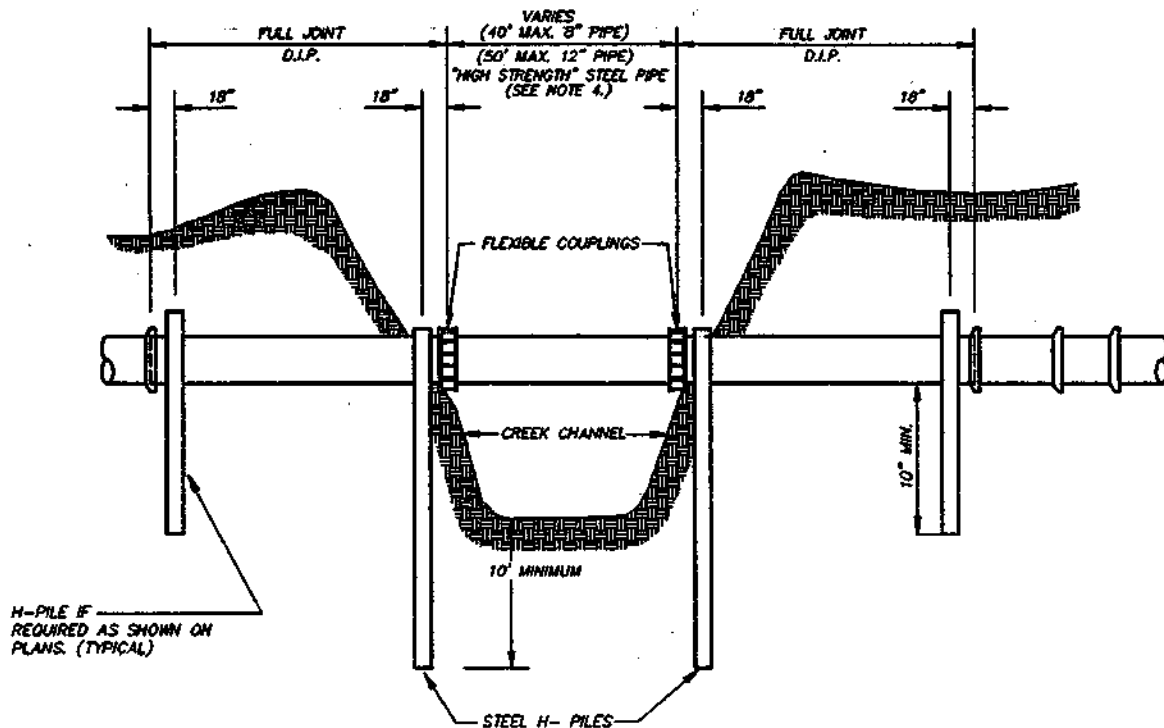
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Approved By \_\_\_\_\_

Date \_\_\_\_\_

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No.	Date	By	Revision



**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**

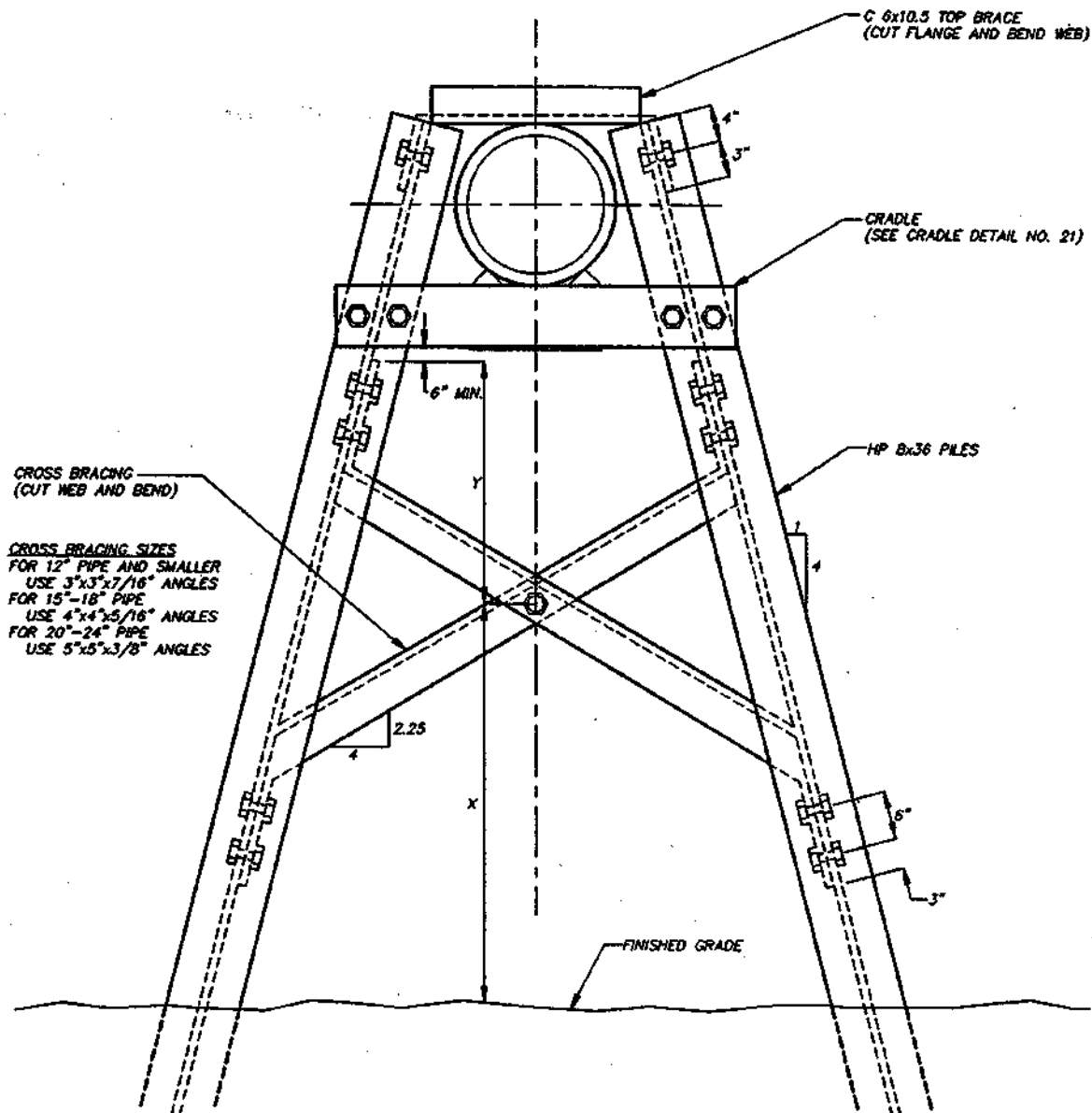
**CREEK CROSSING  
STEEL H-PILES**

No.	Date	By

Revision

Job No.	File No.
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As Built	Date
Surveyed By	Designed By

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# 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 HPBx36 FOR THE PILES.

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

### STANDARD DETAIL SEWER

### STEEL H-PILES PIERS FOR 24" PIPE AND SMALLER

Job No. \_\_\_\_\_ File No. \_\_\_\_\_

Scale \_\_\_\_\_

PLAN \_\_\_\_\_

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As Built \_\_\_\_\_

Date \_\_\_\_\_

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Designed By \_\_\_\_\_

Drawn By \_\_\_\_\_

Project-Engr \_\_\_\_\_

Approved By \_\_\_\_\_

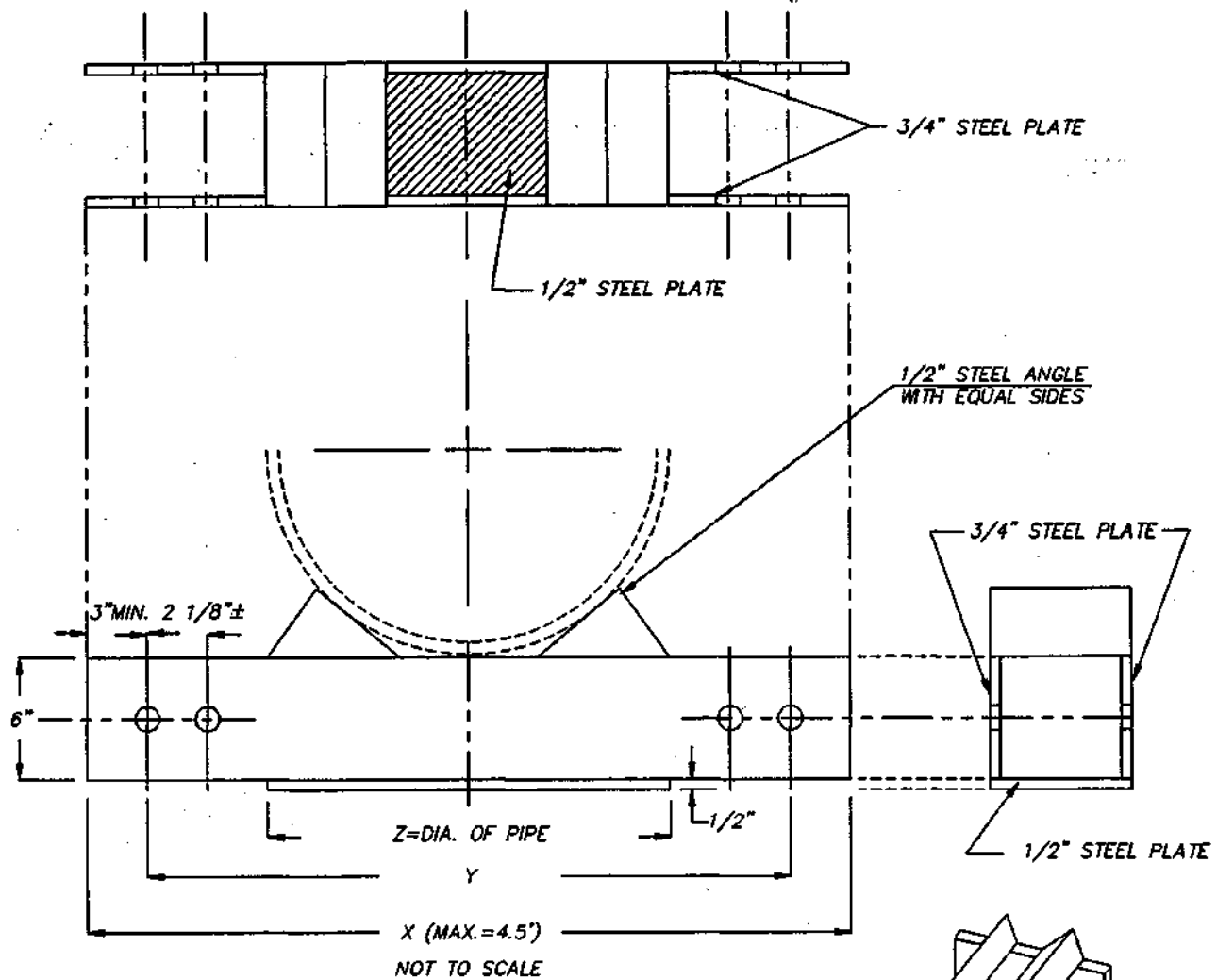
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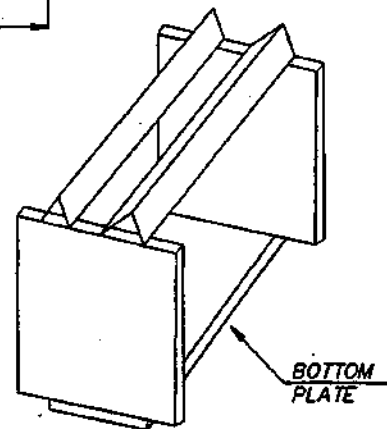
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### NOTES:

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**

**STANDARD DETAIL  
SEWER**

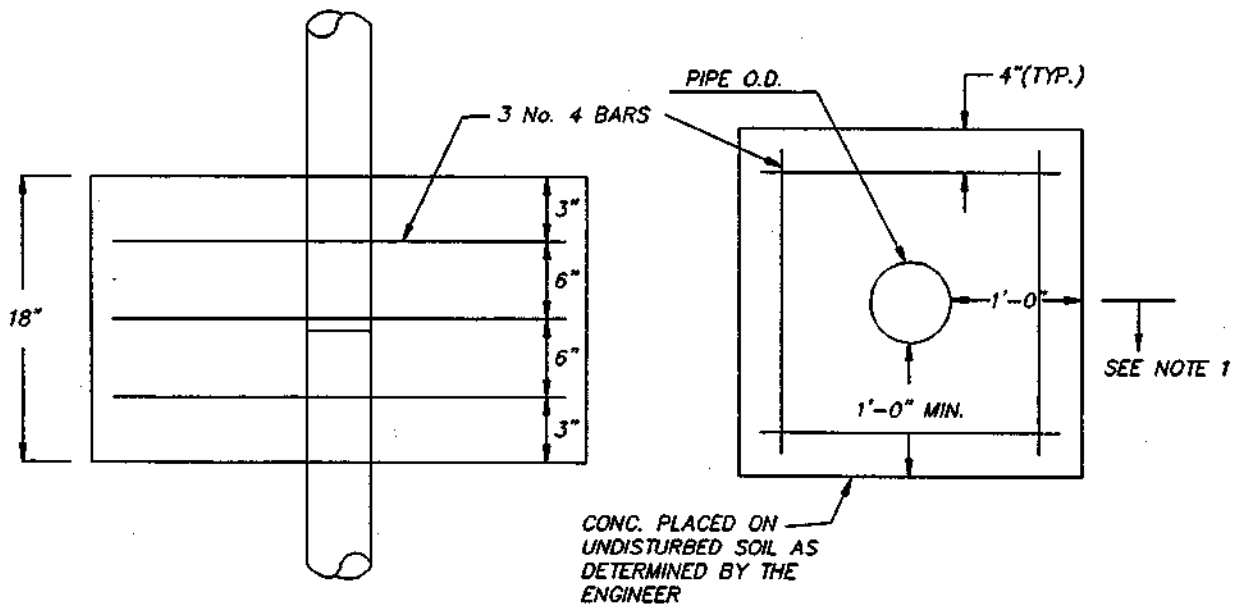
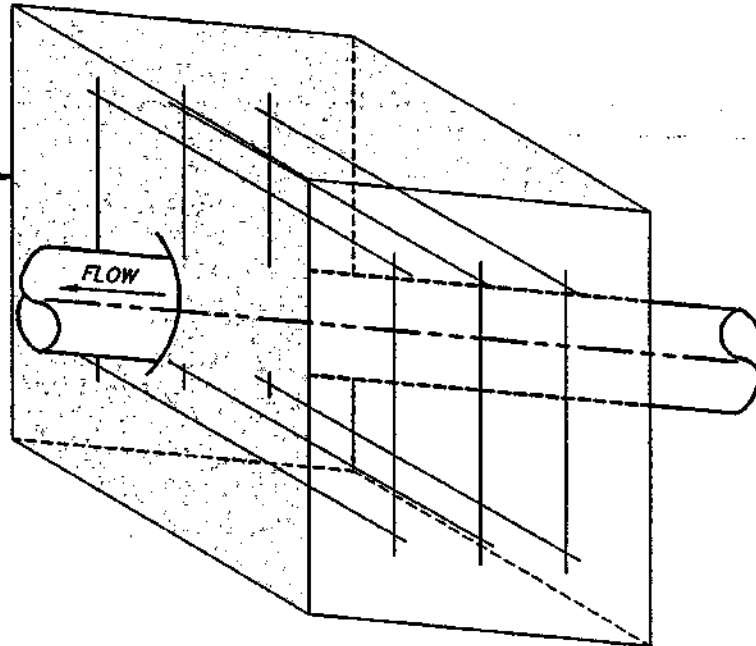
**PIER CRADLE  
24" PIPE & SMALLER**

Job No.	File No.
PLAN	Scale
PROFILE	None
Hor.	Vert.
As Built	Date
Surveyed By	Designed By
Drawn By	Project-Engr
Approved By	Date

No.	Date	By	Revision

POURED IN PLACE

CONCRETE



PLAN VIEW

VERTICAL VIEW

**NOTES:**

1. FORMS NOT REQUIRED BELOW SPRING LINE, CONCRETE MAY BE PLACED AGAINST SHAPED BANKS IN LIEU OF FORMS.

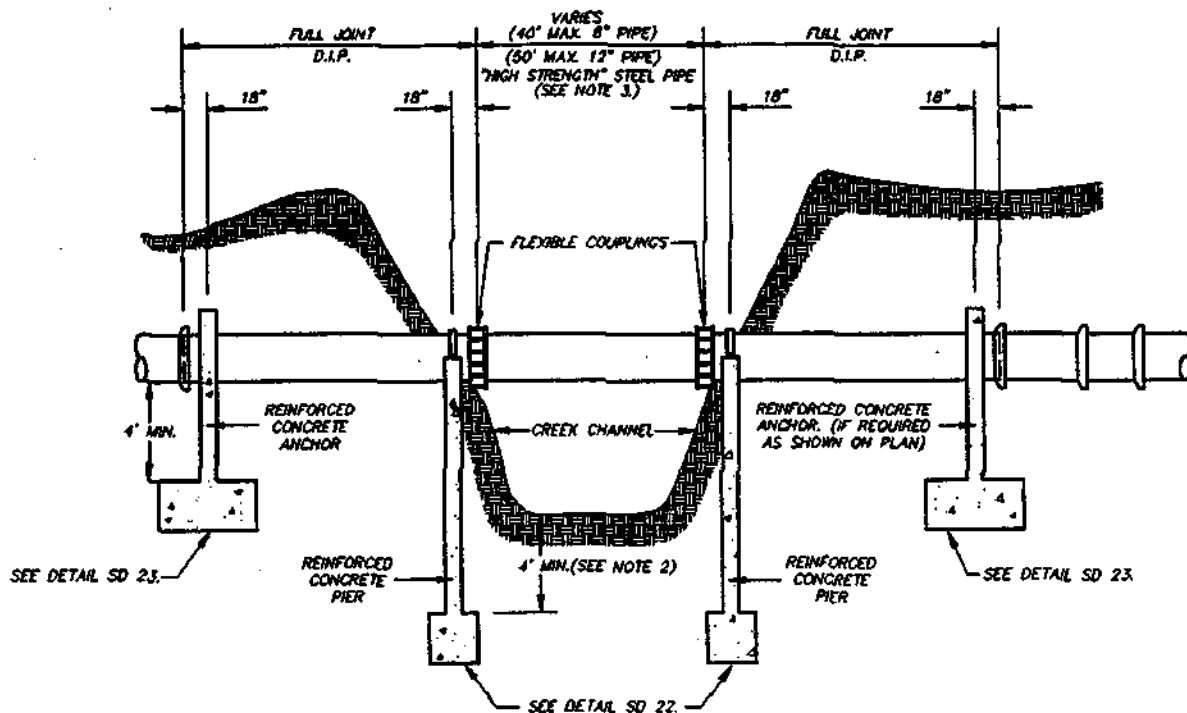
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
SEWER**

**CONCRETE COLLAR**

Job No.	File No.
Scale	NONE
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PROFILE	
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As Built	Date
Surveyed By	Designed By
Drawn By	Project-Eng
Approved By	Date

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**NOTES:**

1. FLEXIBLE COUPLING SHALL BE LONG BODY TYPE, AND COMPLETELY EXPOSED.
2. FOOTING DEPTH SHALL BE TO SUITABLE GRADE AS DETERMINED BY THE ENGINEER, SHALL NOT BE LESS THAN AS SHOWN. (EXCEPT WHEN PIER IS ANCHORED TO SOLID ROCK.)
3. STEEL PIPE MUST BE SEAMLESS OR STRAIGHTSEAM. SPIRAL WELD IS NOT ALLOWED.

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

**STANDARD DETAIL  
SEWER**

**ELEVATED CREEK CROSSING  
WITH CONCRETE PIERS**

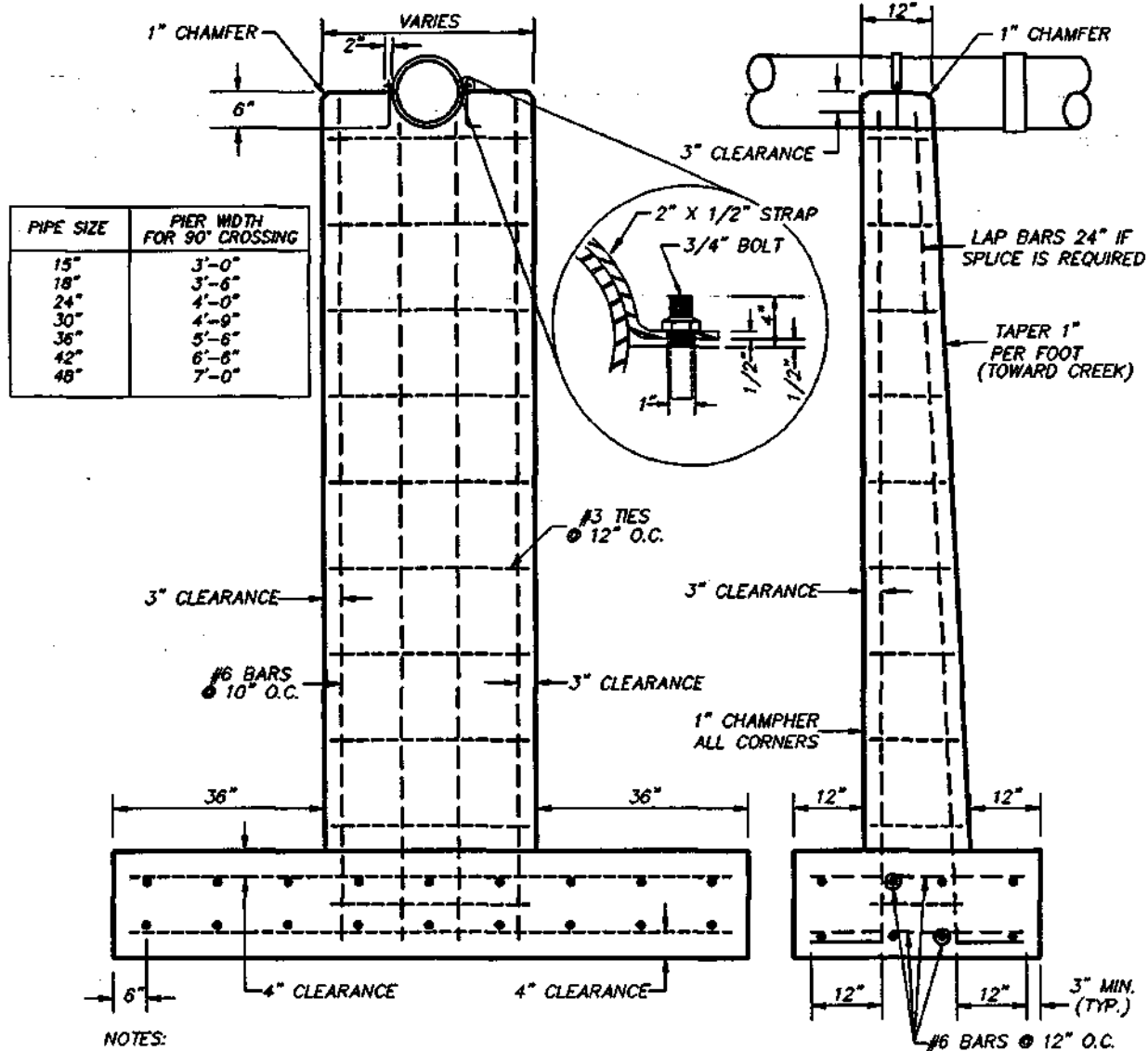
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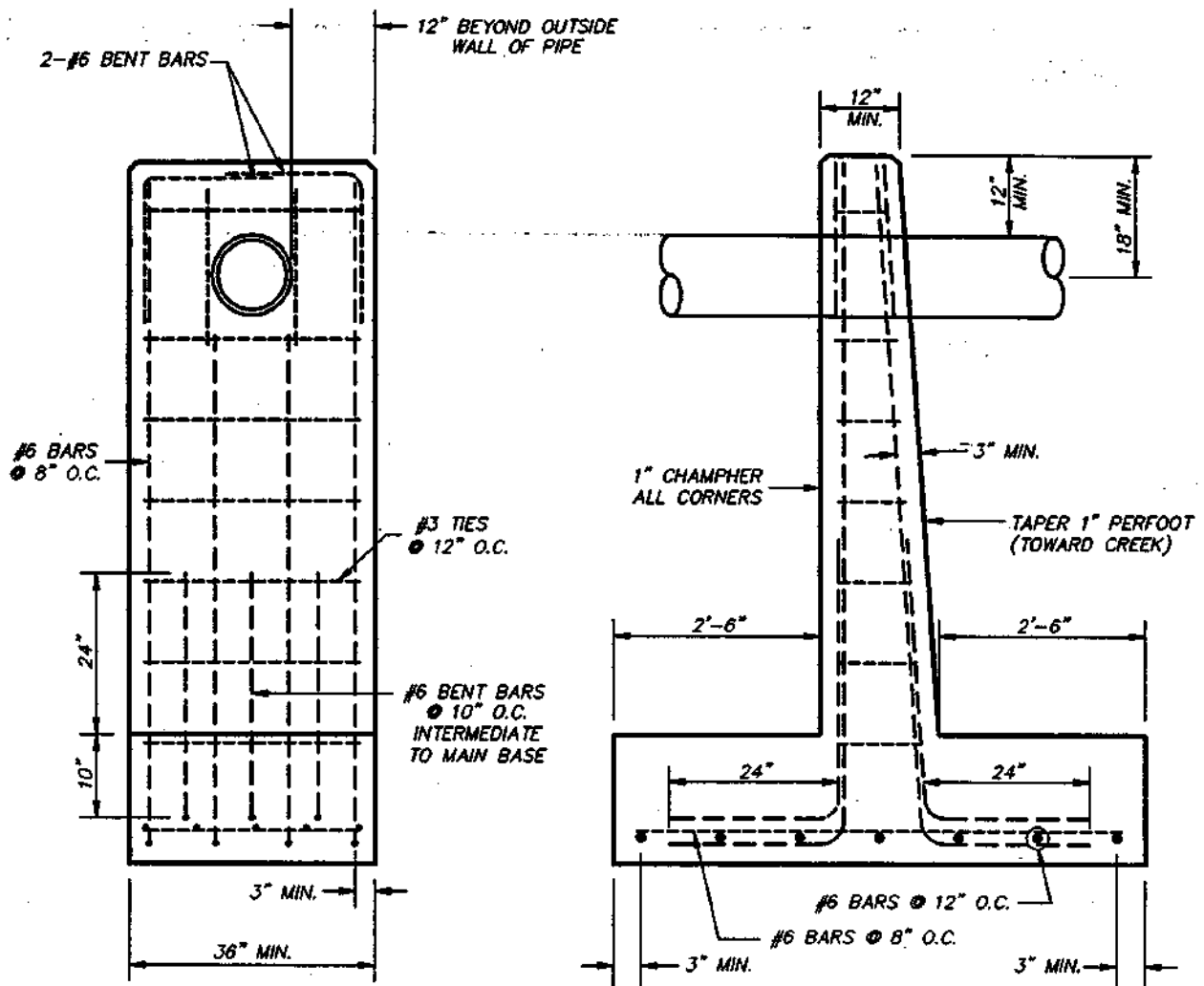
CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

STANDARD DETAIL  
SEWER

REINFORCED CONCRETE  
PIER

Job No.	File No.
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**NOTES:**

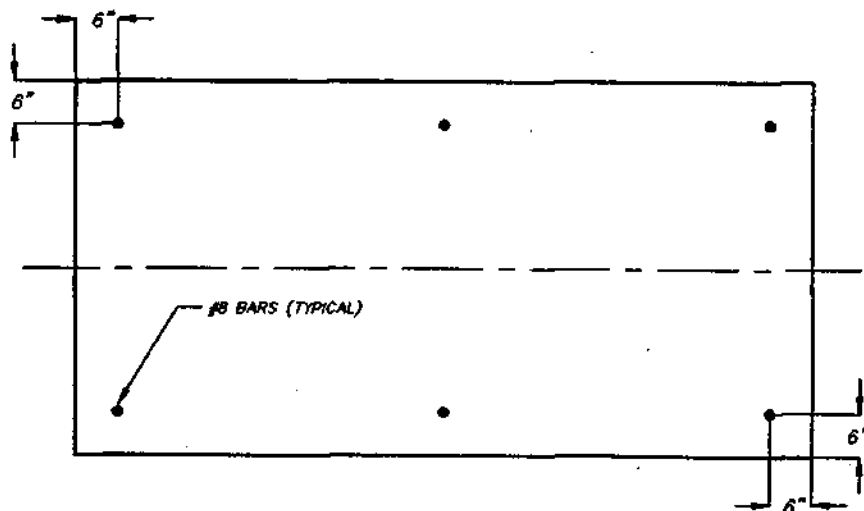
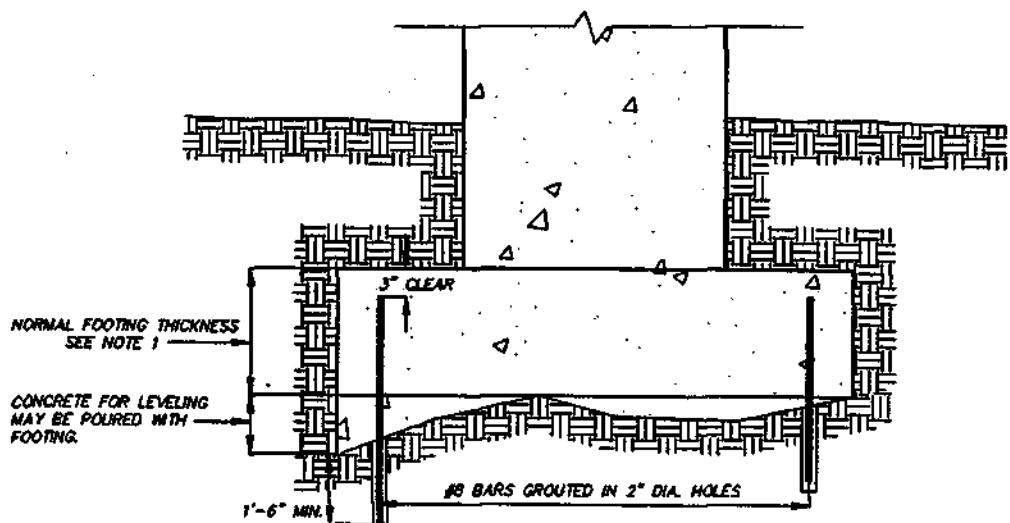
1. ALL CONCRETE TO BE 3500 PSI.
2. DEPTH OF PIERS TO BE DETERMINED BY THE ENGINEER.
3. FOOTING THICKNESS SAME AS BASE THICKNESS OF PIER, BUT NOT TO EXCEED 2'-0".
4. PIERS TO BE BUILT WITH LONG SIDE OF FOOTING PERPENDICULAR TO CREEK FLOW.
5. REINFORCING STEEL TO BE PLACED WITH A MINIMUM CLEARANCE OF 3" WITH THE SURFACE OF THE CONCRETE.

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

**STANDARD DETAIL  
SEWER**

**REINFORCED CONCRETE  
ANCHOR PIER**

Job No. _____		File No. _____		Scale _____		Date _____		Sheet _____ of _____	
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Surveyed By _____		Designed By _____		Drawn 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**

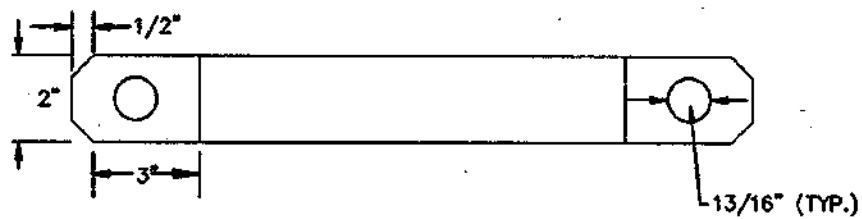
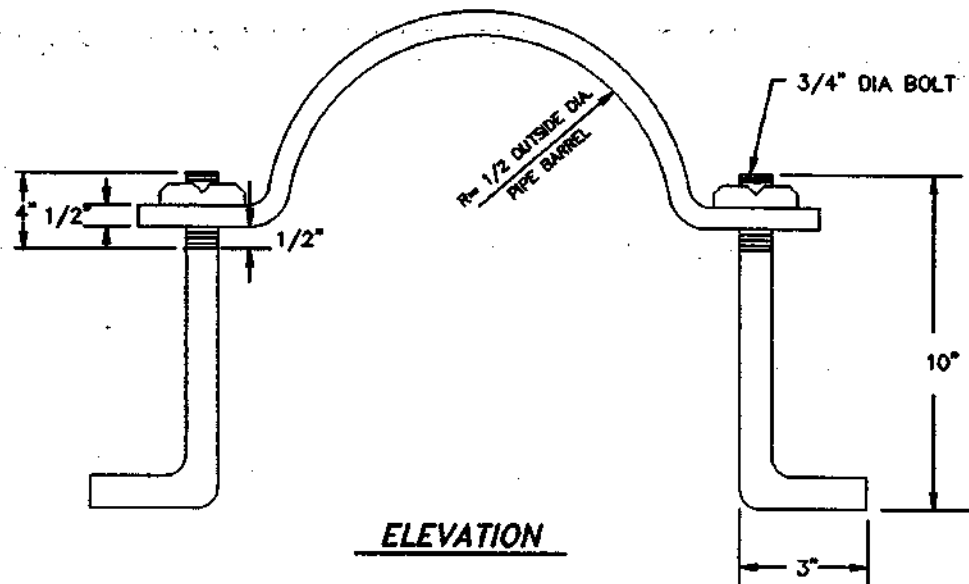
**STANDARD DETAIL  
SEWER**

**PIER FOOTING ON ROCK**

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As Bldg.	Date
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**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" Ø HOLE IN STRAP
4. HOLES TO BE DRILLED IN STRAP.
5. PROVIDE WASHERS UNDER STRAP SUCH THAT STRAP IS PULLED DOWN TIGHT.

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

**STANDARD DETAIL  
SEWER**

**PIPE STRAPS FOR PIERS**

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PLAN Scale NTS

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Vert. \_\_\_\_\_

As Built Date \_\_\_\_\_

Surveyed By \_\_\_\_\_

Designed By \_\_\_\_\_

Drawn By S.C.

Project-Eng. \_\_\_\_\_

Approved By L. Blalock

Date \_\_\_\_\_

Sheet 25

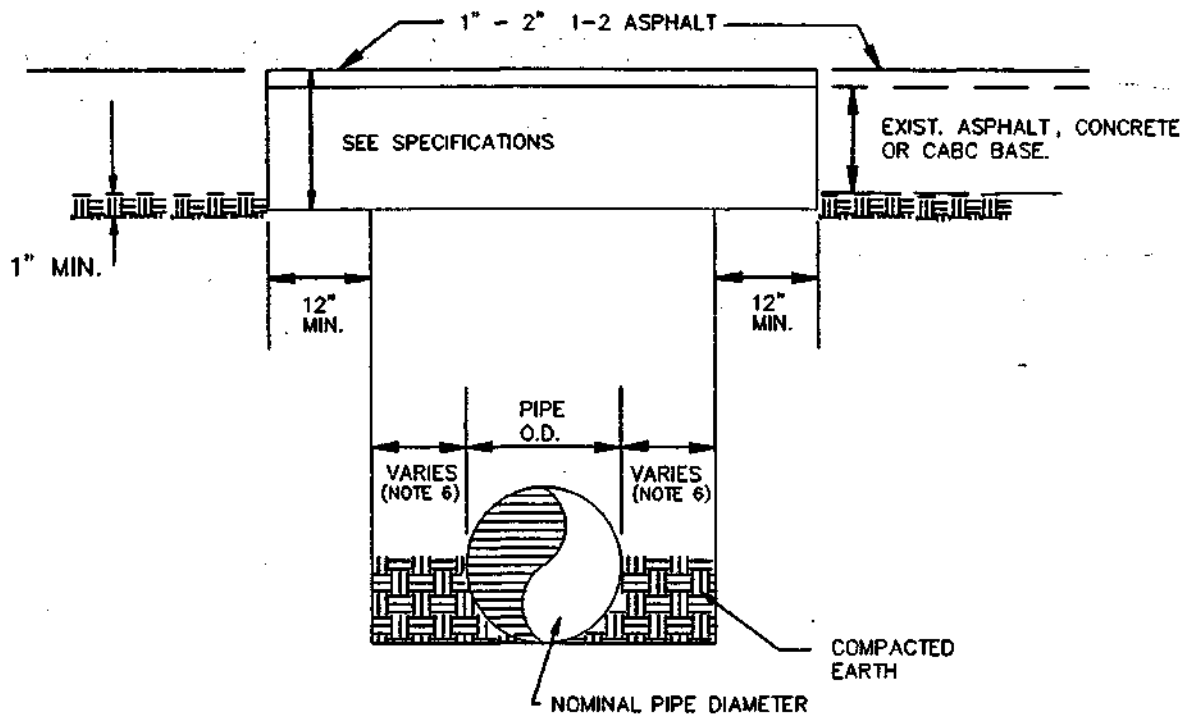
Of \_\_\_\_\_

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### 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.

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

Job No. \_\_\_\_\_ File No. \_\_\_\_\_

Scales \_\_\_\_\_

PLAN \_\_\_\_\_

PROFILE \_\_\_\_\_

Hor. \_\_\_\_\_

Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_

Surveyed By \_\_\_\_\_ Designed By \_\_\_\_\_

Drawn By \_\_\_\_\_ Project-Engr. \_\_\_\_\_

Approved By \_\_\_\_\_ Date \_\_\_\_\_

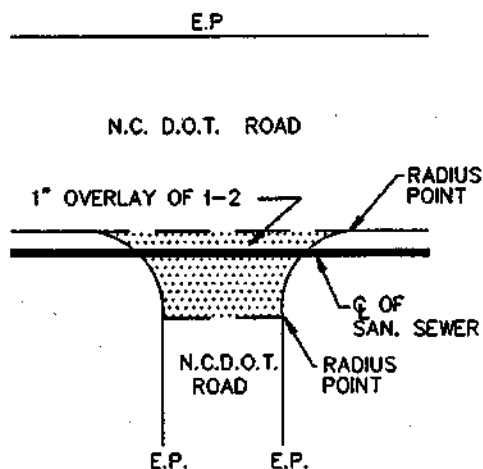
**STANDARD DETAIL  
SEWER**

**PAVEMENT REPAIR DETAIL**

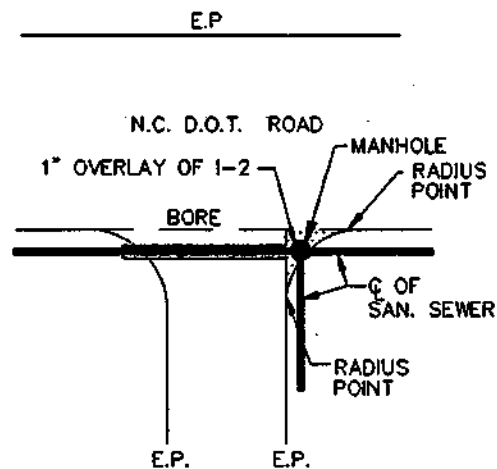
SC \_\_\_\_\_ KDL 4/26/95 Sheet 26 OF 26

No.	Date	By	Revision





**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**

**STANDARD DETAIL  
SEWER**

**1-2. SURFACE COURSE  
OVERLAY**

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 27 of \_\_\_\_\_

## **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.

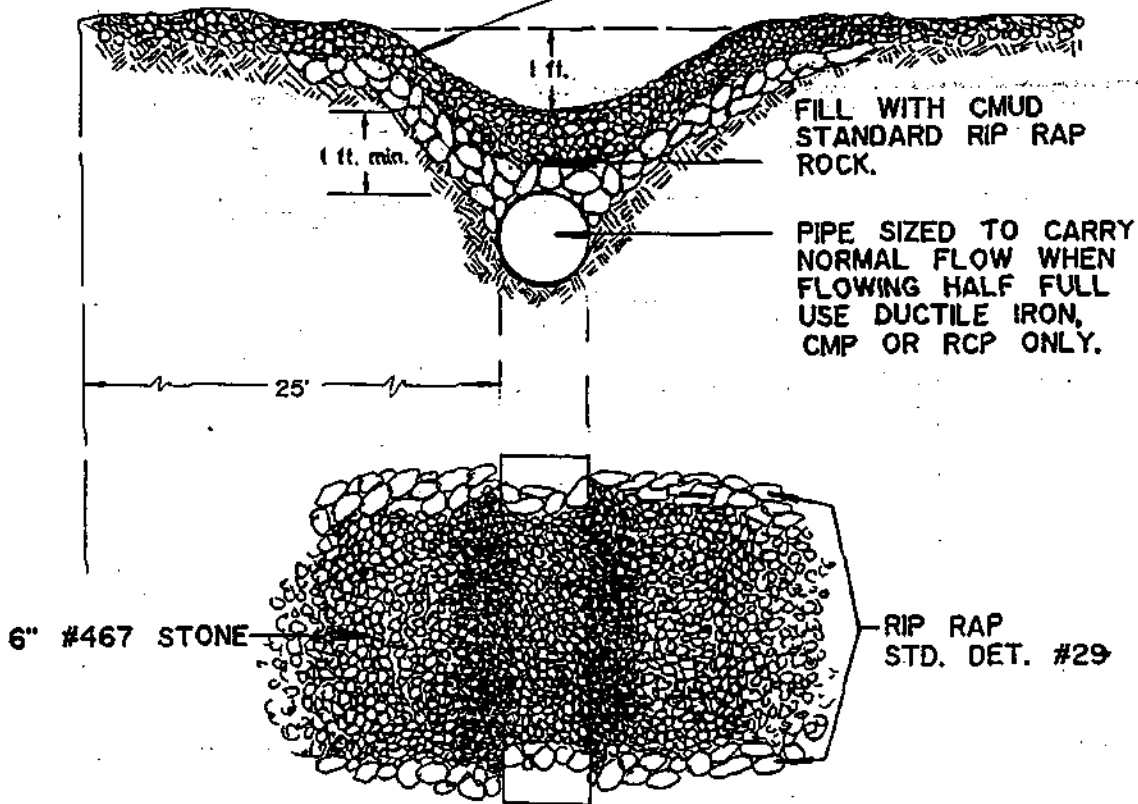
Before crossing wet-weather or drainage ditches, the Contractor shall construct temporary sediment traps conforming to Erosion Control Detail 6.60 or check dams conforming to Erosion Control Detail 6.83. These devices shall be located downstream from the crossing as directed by the Engineer. When working 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.



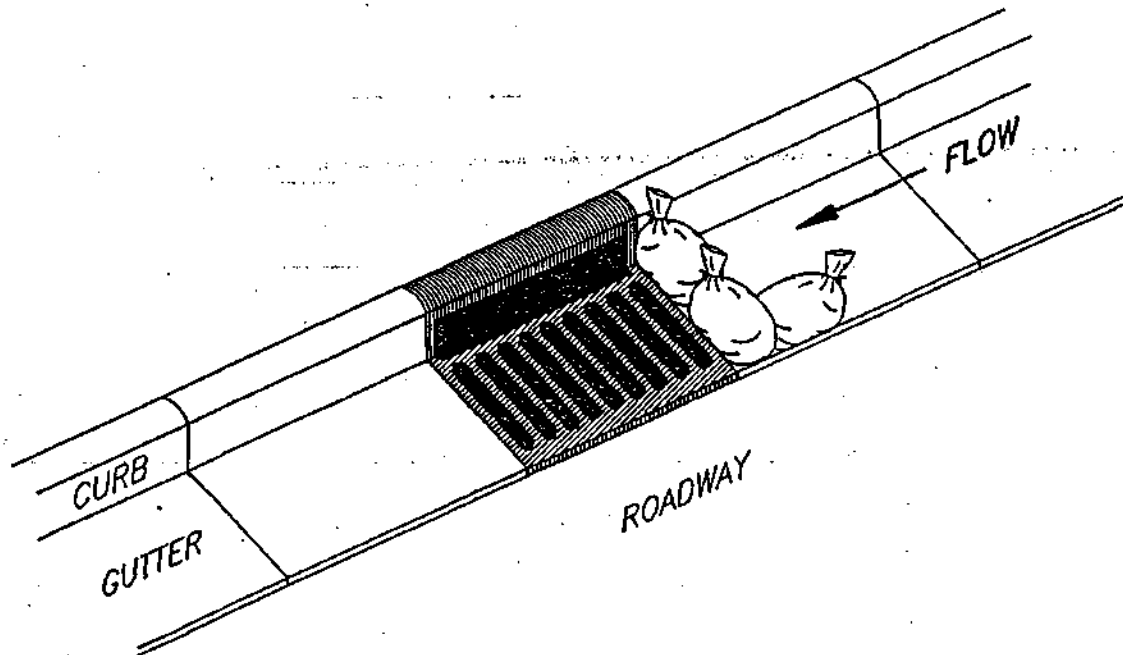
NOTES:

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. _____		<b>STANDARD DETAIL EROSION CONTROL</b>	
Scale: <u>NONE</u>		Scale: <u>NONE</u>			
PLAN _____		Profile _____		<b>TEMPORARY STREAM CROSSING</b>	
As Built _____		Date _____			
Drawn By	Checked By	WDC	Project Eng.	Approved By	Date
					1





#### STONE FILLED BURLAP BAGS

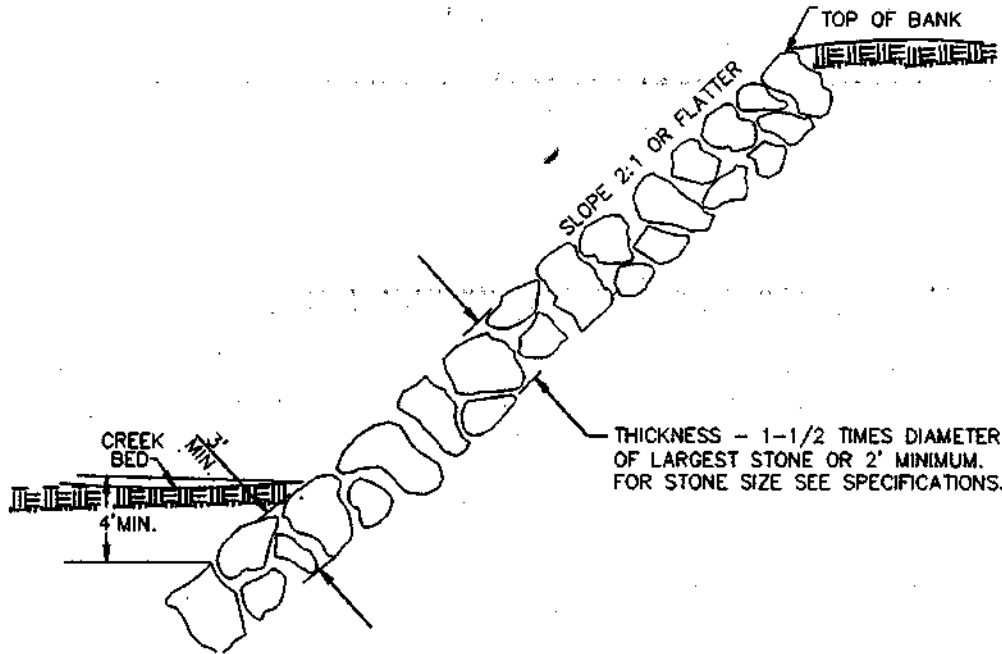
ALL STONE SHALL BE ANGULAR, CLEAN WASHED CRUSHED STONE GRADED IN ACCORDANCE WITH STANDARD SIZES #467 OR #357 IN ASTM D448 FOR "STANDARD SIZES FOR COARSE AGGREGATE".

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.

CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA

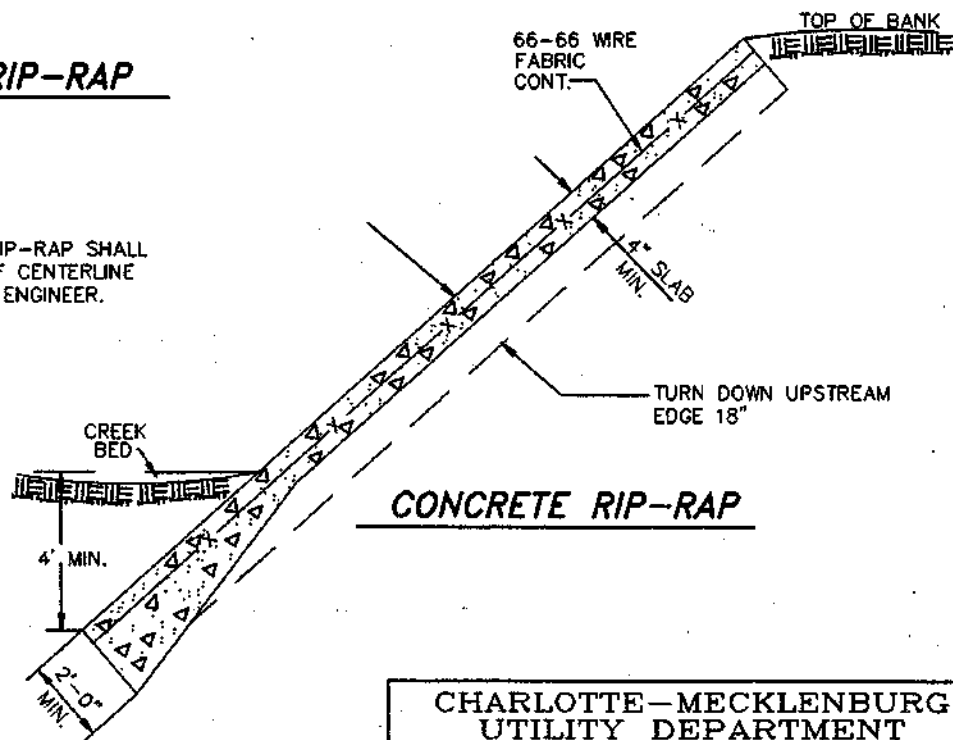
Job No. _____ File No. _____		Scale _____		STANDARD DETAIL	
PLAN		NONE		EROSION CONTROL	
PROFILE		None		STONE FILLED	
At _____		Date _____		BURLAP BAGS	
Drawn By _____	Checked By _____	Designed By _____	Reviewed By _____	Project Eng. _____	Approved By _____
Date _____		Date _____		Date _____	
Sheet _____		Sheet _____		Sheet _____	



### 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. \_\_\_\_\_  
Scale \_\_\_\_\_

PLAN \_\_\_\_\_ NTS  
PROFILE \_\_\_\_\_

Hor. \_\_\_\_\_  
Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_

Surveyed By \_\_\_\_\_ Designed By \_\_\_\_\_

**STANDARD DETAIL  
EROSION CONTROL**

**STONE & CONCRETE  
RIP-RAP**

SC \_\_\_\_\_  
Project-Engr \_\_\_\_\_ Approved By \_\_\_\_\_ Date \_\_\_\_\_

Sheet Of  
**3**

No.	Date	By	Revision

## TREE PROTECTION - BARRIERS

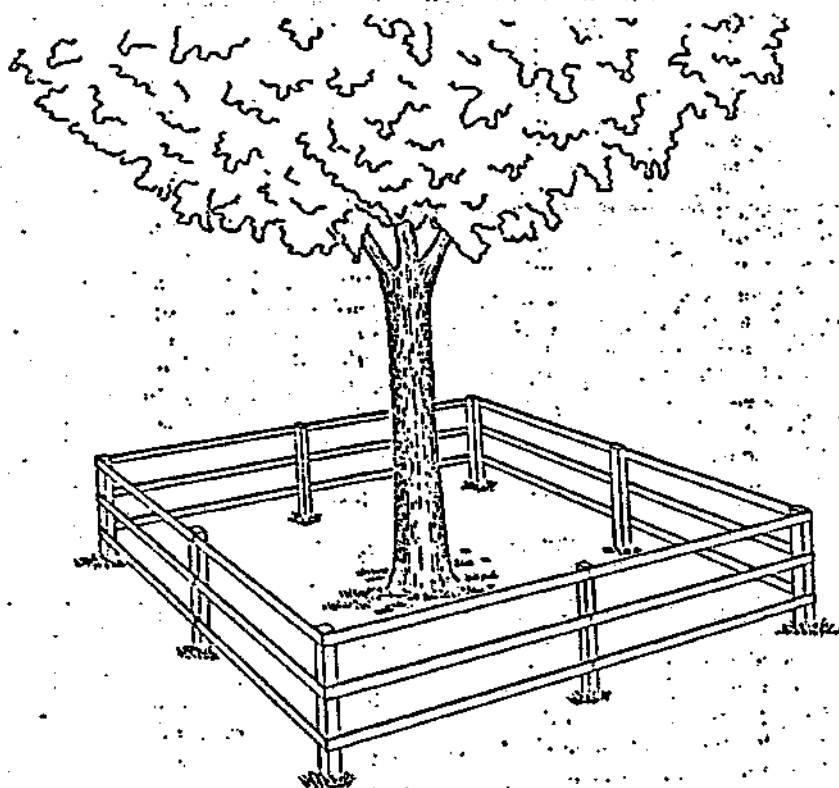
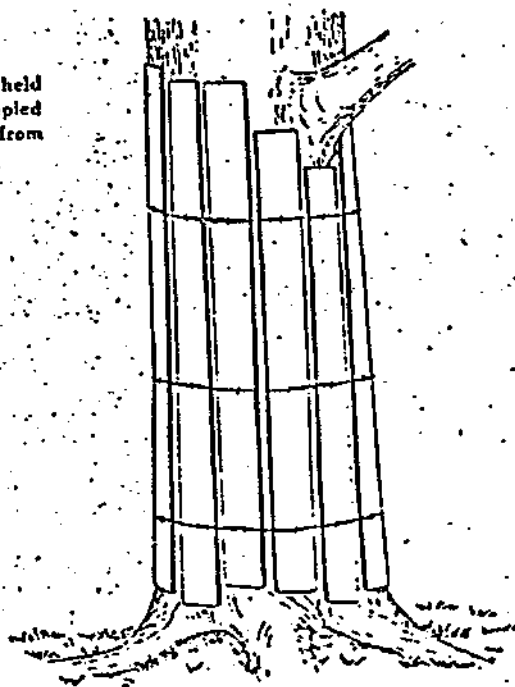


FIGURE 1.—A simple barrier to protect the tree trunk and part of the root system from mechanical injury.

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.

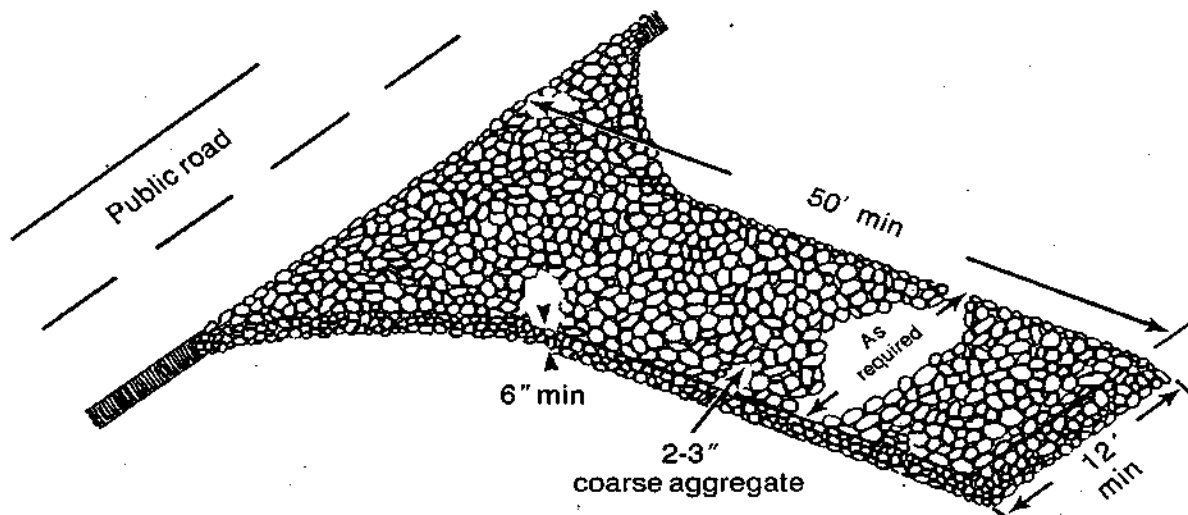


Figure 6.06a Gravel entrance/exit keeps sediment from leaving the construction site (modified from Va SWCC).

**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

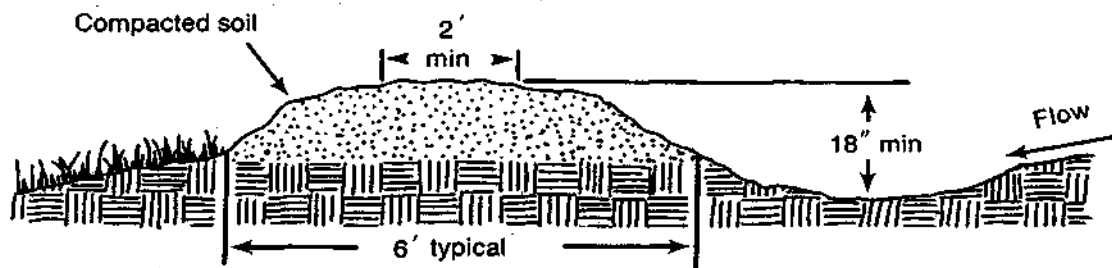


Figure 6.20a Temporary earthen diversion dike.

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).

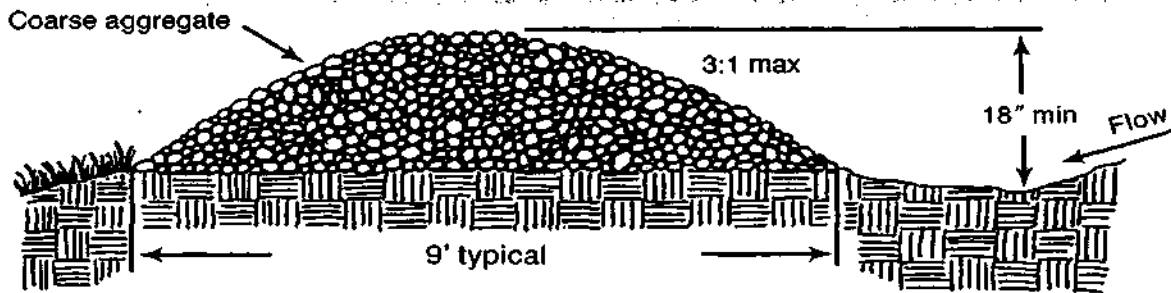


Figure 6.20b Temporary gravel diversion dike for vehicle crossing (modified from Va SWCC).

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*

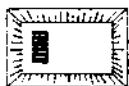
- 6.10, Temporary Seeding
- 6.11, Permanent Seeding
- 6.14, Mulching

### *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*.

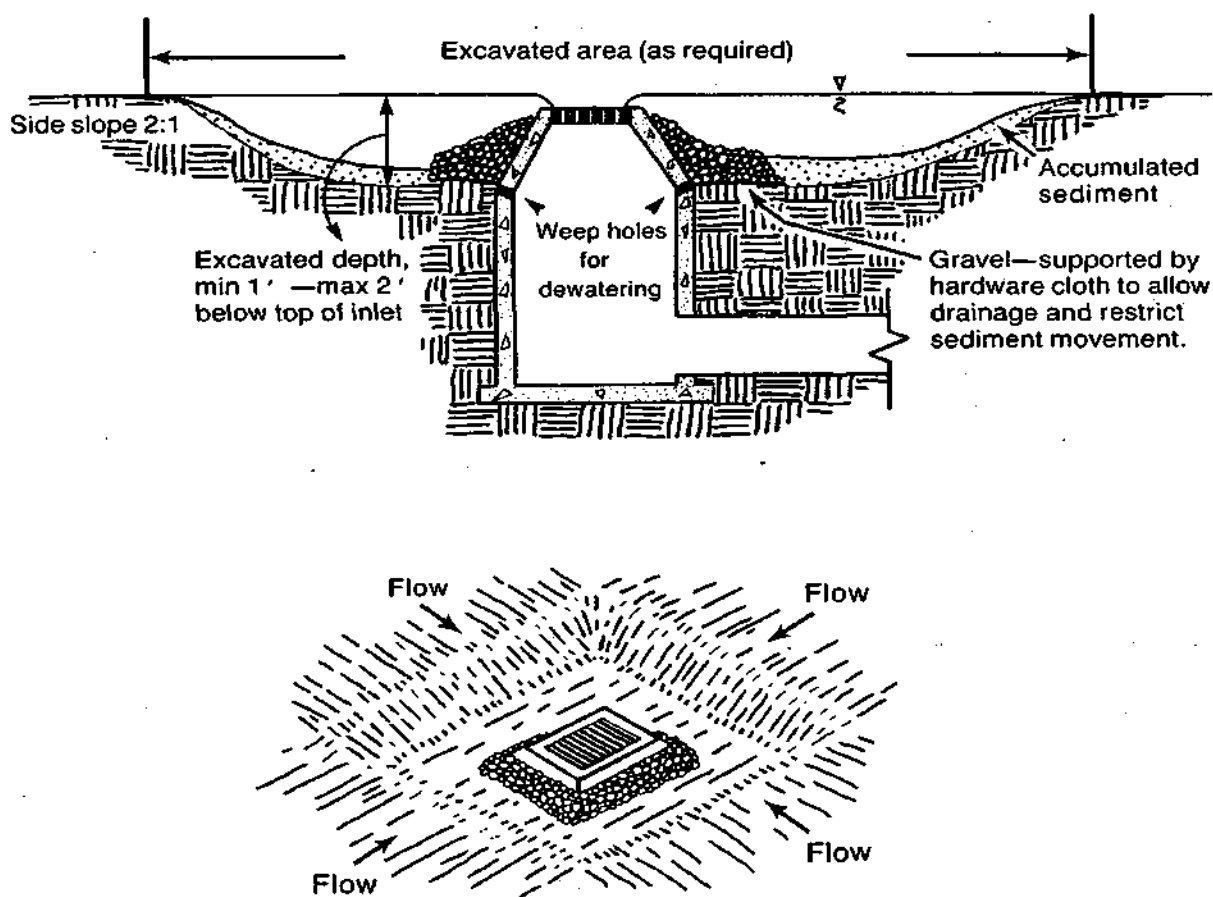


Figure 6.50a Excavated drop inlet protection.

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

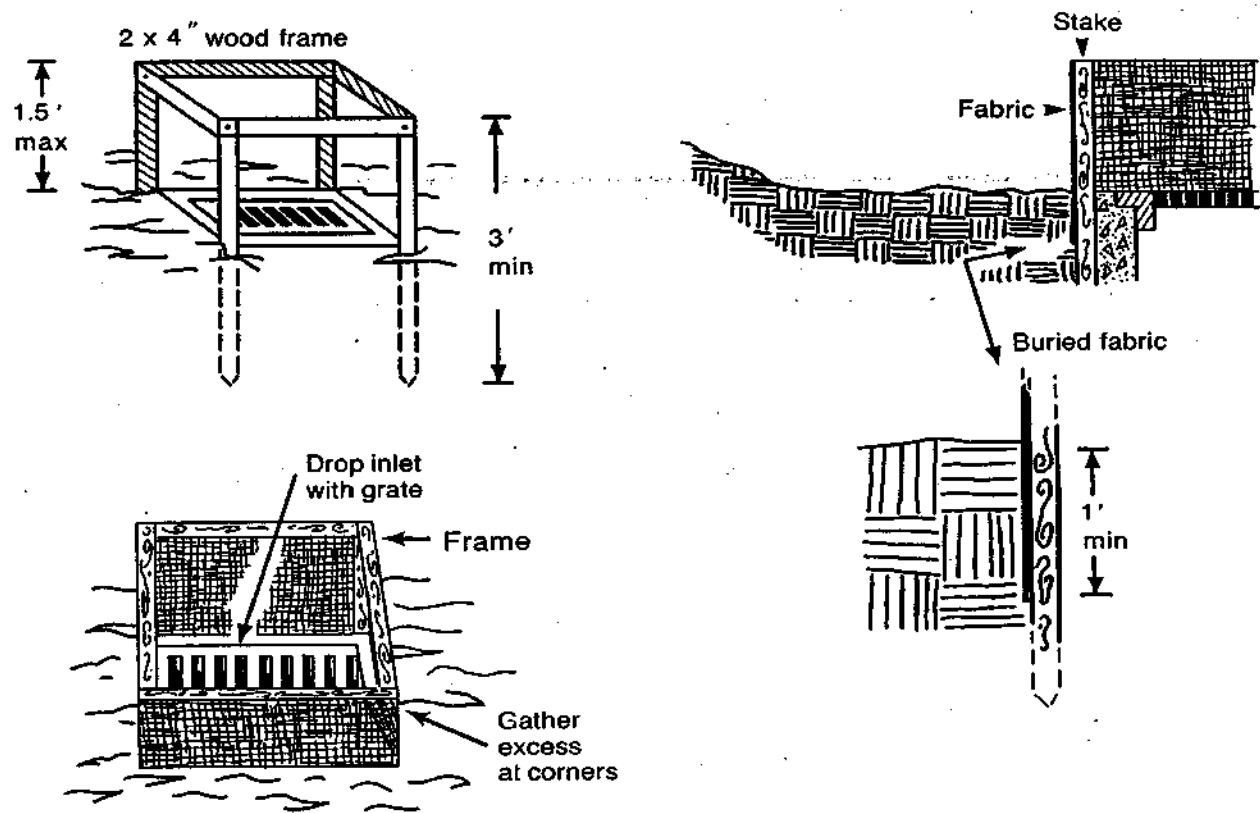


Figure 6.51a Installation of fabric and supporting frame for inlet protection.

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.

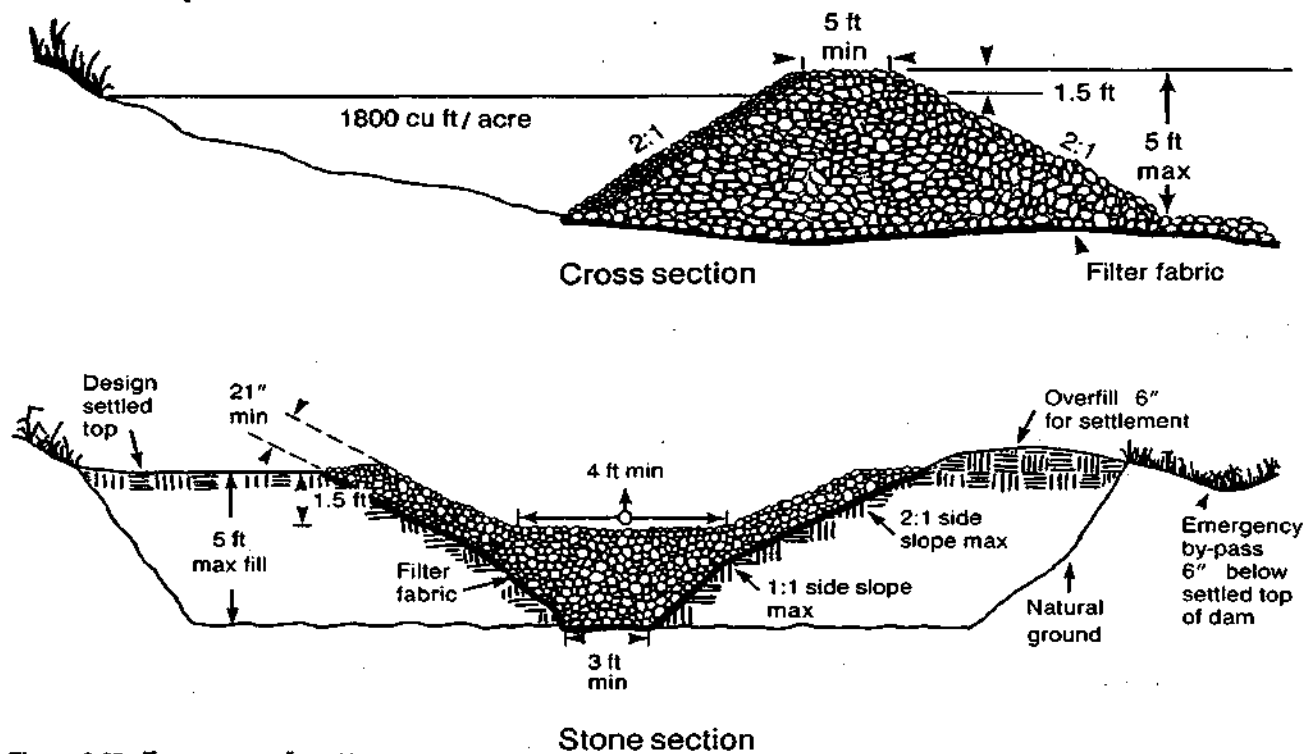
**Protection from piping**—Place filter cloth on the foundation below the riprap to prevent piping. An alternative would be to excavate a keyway trench across the riprap foundation and up the sides to the height of the dam.

**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<sub>50</sub> 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

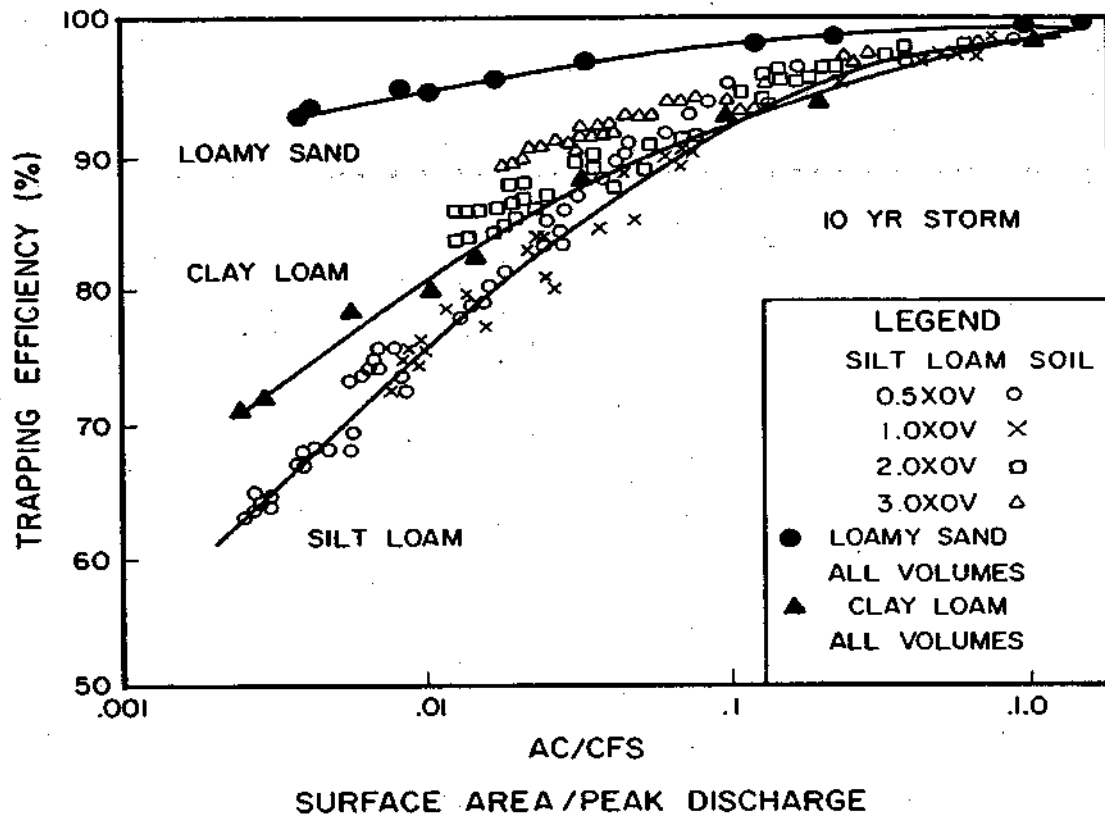


Figure 6.61a Graph showing the relationship between the ratio of surface area to peak inflow rate and trap efficiency.  
(source: Barfield and Clar)

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

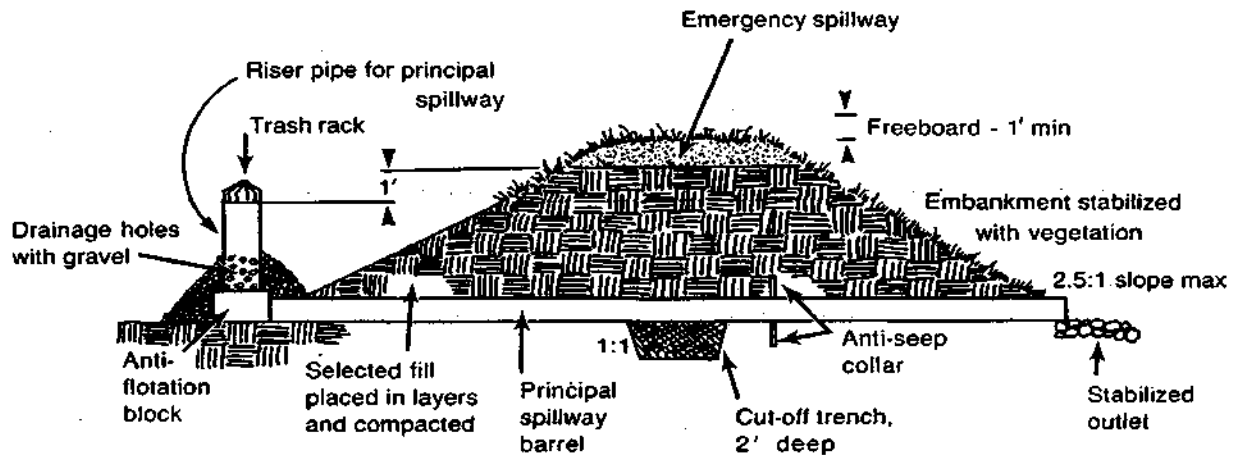


Figure 6.61b Section through embankment and basin controls.

- **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**

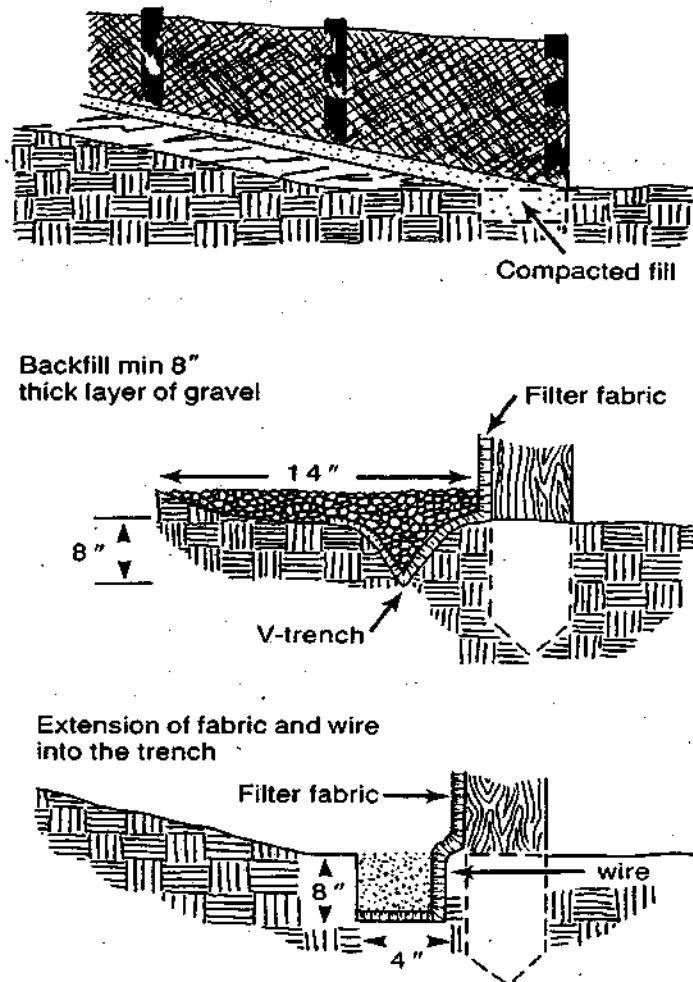
Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

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 d50 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

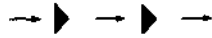
### *Outlet Protection*

6.41, Outlet Stabilization Structure

North Carolina Department of Transportation

*Standard Specifications for Roads and Structures*

6.83

**CHECK DAM**

**Definition** Small temporary stone dams constructed across a drainageway.

**Purpose** To reduce erosion in a drainage channel by restricting the velocity of flow in the channel.

**Conditions Where Practice Applies** 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. Do not use check dams in live streams.

Check dams may be used to:

- reduce flow in small temporary channels that are degrading, but, where permanent stabilization is impractical due to their short period of usefulness;
- reduce flow in small eroding channels where construction delays or weather conditions prevent timely installation of nonerosive liners.

**Planning Considerations** Check dams are an expedient way to reduce gullying 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.

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.

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.

**Design Criteria** The following criteria should be used when designing a check dam:

- Ensure that the drainage area above the check dam does not exceed 2 acres.
- Keep the maximum height at 2 ft at the center of the dam.
- Keep the center of the check dam at least 9 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the dam at 2:1 or flatter.
- 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).
- Stabilize overflow areas along the channel to resist erosion caused by check dams.

6.83.1



L = The distance such that points A and B are of equal elevation

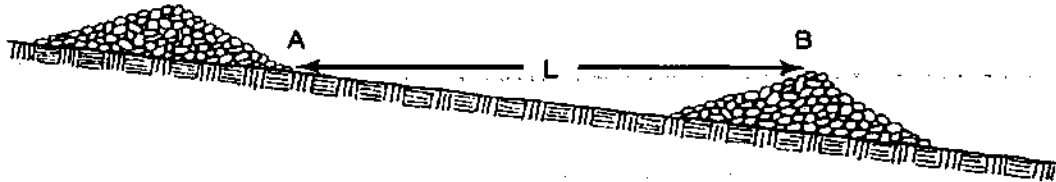


Figure 6.83a Space check dams in a channel so that the crest of downstream dam is at elevation of the toe of upstream dam.

- 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.

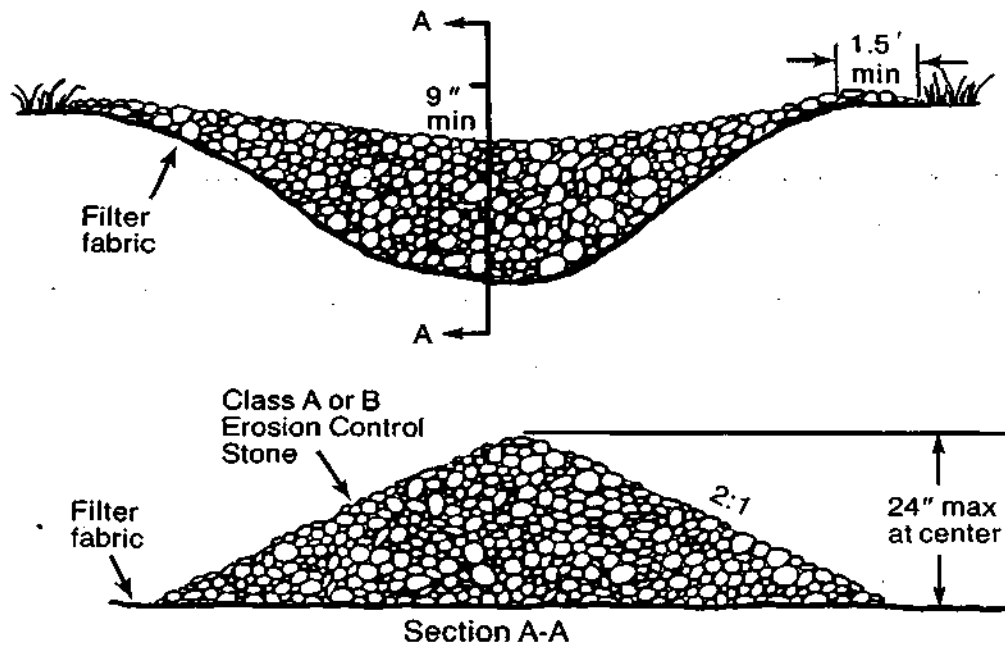


Figure 6.83b Stone check dam—Stone should be placed over the channel banks to keep water from cutting around the dam.

## 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



**Charlotte Mecklenburg Utilities**

**Pump Station, Force Main,**

**And**

**Emergency Power System**

**Specifications**

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## Policy

It is the policy of Charlotte-Mecklenburg Utilities (CMU) to minimize the need for wastewater pump stations and to limit their construction and use within the system. The basis for this policy is that pump stations cause disproportionate expense in order to provide service to a limited customer base and that failure of pump stations poses significant environmental risks.

It is recognized, however, that there are situations where pump stations are a feasible alternative to certain small, permanent treatment facilities as well as a feasible temporary solution for new development. CMU provides the large regional pump stations it deems necessary for orderly system development and operation under the Capital Improvement Plan (CIP). CMU will also consider, on a case-by-case basis, requests to accept new developer funded pump stations in the situations described below.

- A The pump station can be eliminated by a project or combination of projects, all of which are included for funding in the approved 5-year CIP. The pump station can be eliminated by a project being done under a reimbursable program and the funds have been made available to CMU for construction.
- B The proposed pump 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.
- C The construction of the proposed pump station would include elimination of one or more existing pump stations.
- D The construction of the proposed pump 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 capacity to carry the proposed pump station discharge. Any upgrades required will be the responsibility of the customer requesting the pump station.

## 1.00 General Provisions

All wastewater pumping stations must comply with the North Carolina Department of Environment and Natural Resources' Minimum Design Criteria for the Fast Track Permitting of Pump Stations and Force Mains, as amended to date and available at <http://h2o.enr.state.nc.us/ndpu/ndpuapps.html> - Sewer.

Pumping Stations with peak, firm capacities of less than 2 million gallons per day (MGD) or pumps of 150 horsepower(HP) or less may be supplied with submersible type pumps depending on head conditions and the availability of suitable pumps. The type of pump used near this limit will be approved by CMU on a case-by-case basis. A detailed description of submersible type stations is found in Sections 6 & 7. Stations with a peak, firm capacity of 2 MGD or pumps larger than 150 horsepower (HP) shall be individually engineered and housed in a building appropriate for the specific application. Pumping Stations accepting flow from low pressure sewer systems shall employ odor control measures. Each pumping station shall include an emergency power generator capable of operating the station and all its systems at full capacity with both pumps operating.

Each pump station plan set shall contain a sheet with the total service area (drainage basin) outlined, land use assumptions, and detailed flow calculations used to determine the required station capacity. Additional engineering calculations that have been signed, sealed, and dated by a Professional Engineer (PE) licensed in North Carolina shall include, at a minimum, the following:

- A Total dynamic head calculations for all applicable pumping situations.
- B System curve/pump curve analysis used to determine pump selection and operational point.
- C Detailed surge analysis under all operating conditions.
- D Pump station cycle and pump run times, including an evaluation of any depressed sections of the force main to determine if the pump station is capable of completely flushing the force main section being evaluated in a single pumping cycle.
- E Pump station flotation/buoyancy.
- F Available emergency storage capacities at average and peak wastewater flows for pump stations.
- G Minimum velocity within the force main.
- H Maximum detention times within the pump station and force main.
- I Downstream sewer evaluation demonstrating that the pump station discharge will not overload the receiving sewer line:
  - 1 In situations where the pump station discharges into a gravity sewer, the downstream gravity sewer shall be evaluated based on peak flow from the proposed project as well as peak flows already tributary or permitted to the downstream gravity sewer.
  - 2 In situations where the pump station discharges into another pump station, the downstream pump station shall be evaluated to verify its ability to convey peak flows from the proposed project as well as peak flows already tributary or permitted to the downstream pump station.
  - 3 In situations where the pump station discharges into a force main, the common force main shall be evaluated on peak flows from the proposed project as well as peak flows already tributary to the common force main. The ability of each pump station tributary to the common force main to pump against additional head created by

greater flows through the force main shall also be evaluated. An evaluation of the discharge point of the downstream force main shall also be performed.

## **2.00 Pump Design**

### **2.01 General Requirements**

- A Only non-clog pumps designed and manufactured for use in conveying raw, unscreened wastewater shall be acceptable. Pumps shall be adequately protected from damage due to failure conditions specific to the selected pump type and pump station configuration.
- B Pump selection and construction shall consider the duty requirements as well as the physical and chemical characteristics of the wastewater.
- C Pumps shall be suitable for continuous duty in conveying raw, unscreened wastewater.
  - 1 Pumps shall be capable of handling a three-inch solid and any trash or stringy material that can pass through a four-inch hose. Impellers shall have blades that are generally forward rounded or otherwise configured to avoid catching solids, trash, and stringy material.
  - 2 Pump suction and discharge openings shall be no less than four inches in diameter.

### **2.02 Number and Capacity**

- A Pump Stations shall be provided with pumps as outlined below.
  - 1 Multiple pumps shall be used such that the pump station is capable of conveying the peak hourly wastewater flow to its desired outfall location with the largest single pump out of service.
    - a In duplex pump stations, the pumps shall be of the same capacity.
    - b If pumps in series are required to meet capacity or total dynamic head requirement, each set of pumps in series shall be viewed as a single pumping unit.
    - c Priming pumps as well as any other auxiliary system that is required for pump functionality shall also be provided in multiple numbers.
  - 2 Determination of pump capacity shall be based on wastewater flows expected to become tributary to the pump station for the entire drainage area at build out. For regional pump stations, pump capacity shall be based on wastewater flows expected to become tributary from the entire service area over the life of the pump station.
  - 3 The minimum allowable design daily wastewater flow to the pump station shall be determined as follows:

- a Where a pump station is designed to serve a developed service area, historical potable water use or wastewater flow generation data may be used to determine design daily wastewater flows.
- b Where a pump station is designed to serve a broad service area for which specific development is not known, design daily wastewater flows may be established based on historical data for the broad service area or CMU planning criteria.

The selected peak hourly wastewater flow to the pump station shall be appropriate for the service area as well as the associated wastewater generation patterns and population being served by the pump station. In small community type stations, this should also include the discharge capacity of any public or community pool. The minimum peak hourly wastewater flow to the pump station can be calculated using the design daily wastewater flow along with a peaking factor determined from the following equation with a minimum factor of 3.0.

$$PF = \frac{Q_{phf}}{Q_{ddf}} = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

*PF = peaking factor*

*Q<sub>phf</sub> = peak hourly flow (gallons per day)*

*Q<sub>ddf</sub> = design daily flow (gallons per day)*

*P = service population (thousands)*

- B Pump capacity shall also be based upon the need to maintain a minimum velocity of two feet per second.

## 2.03 Selection Methodology

- A Pump selection shall be based on a hydraulic analysis of the system through which the wastewater is to be conveyed.
  - 1 The design operating point(s) of the pump(s) shall be determined using a pump curve-system curve analysis. Pumps shall be selected such that the pumps shall be capable of pumping the required capacity for all total dynamic head requirements developed by the system for the lifetime of the pump station. All pumps shall be designed in accordance with applicable portions of ANSI / Hydraulics Institute 1.1- 1.6, 2.1-2.6 and 9.1-9.6.
    - a A system curve, plotting total dynamic head versus capacity, shall be developed for all operating conditions that may be imposed on the system. Total dynamic head requirements for the system shall be calculated as the total of the following individual components:



- (1) Static head requirements of the system, including that associated with both the suction and discharge sides of the pumps, shall be evaluated. In addition to calculating static head with the discharge elevation of the force main, any intermediate high points in the force main that would have an effect on the total dynamic head requirements of the pump shall be analyzed.
- (2) Friction head requirements of the system, including that associated with both the suction and discharge sides of the pumps, shall be evaluated. The friction head shall be calculated using the Hazen-Williams formula:

$$h_f = L \left( \frac{10.44 Q^{1.85}}{C^{1.85} D^{4.87}} \right)$$

*h<sub>f</sub> = friction head for pipe segment evaluated (feet)*

*L = length of pipe segment evaluated (feet)*

*Q = pumping rate (gallons per minute)*

*C = Hazen-Williams coefficient*

*D = diameter of pipe segment evaluated (inches)*

All operating conditions shall be evaluated including, but not limited to: multiple pump operation within the subject force main, simultaneous pump station operation for common force main situations, as well as the possibility for gravity flow conditions in force main segments with extreme negative slopes that may not flow full.

- (3) Head derived from any minor losses of the system, including that associated with the both the suction side and discharge side of the pump, shall be evaluated. Such minor losses shall include head derived from valves and other fittings such as tees, bends, angles, etc.
  - (4) If applicable, the pressure head at the junction of the existing force main shall also be evaluated for its effect on the total dynamic head requirements of the system. The evaluation shall take into account the effects of simultaneous pump station operation as well as multiple pump operation in other pump stations.
- b System curves shall be generated and evaluated not only for present day conditions, but also for those conditions that may exist over the expected lifetime of the pump station.
- (1) The Hazen-Williams friction coefficient, C, appropriate for the force main pipe material and age of the force main shall be used.
  - (2) The following maximum values shall be allowable for C:

Pipe Type	Initial Service C	End-of-Service C
DI	125	100
PVC	140	120
HDPE	140	120

(3) Friction head and minor losses associated with the system shall be evaluated at both the initial service condition and the end-of-service condition.

c The design operating point(s) shall be defined as the intersection of the pump curve and the calculated system curve(s).

- 2 Pumps shall be selected such that all design operating points are on the pump curve as supplied by the pump manufacturer. In addition, pumps shall be selected such that the net positive suction head available (NPSHA) shall be greater than the net positive suction head required (NPSHR) for the pump at each of the design operating points.
- 3 Pumps shall be selected such that the pumps will not cavitate at any of the design operating points. Pumps that operate within the unstable portion of the pump curve under any of the expected design conditions shall not be allowed. Freewheeling (i.e., operating at pump run-out) or deadheading (i.e., operating at pump shut-off) of pumps shall not be allowed. All continuous duty operating conditions shall be within the manufacturer's Allowable Operating Region and the design operating points shall be within the manufacturers Preferred Operating Region as defined in ANSI/Hydraulic Institute 9.6.3. Pump selections proposing maximum diameter impellers for the given pump model and casing size will not be accepted.
- 4 Pumps shall be selected such that their operating efficiency is maximized during all hydraulic conditions that may exist over the expected lifetime of the pump station.

B Consideration shall be given to minimizing motor speeds during the pump selection process.

C The motor horsepower shall be at least 1.15 times what is required to ensure that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

## **2.04 Cycle and Pump Run Times**

A Constant speed pumps shall be cycled such that the number of starts are minimized and resting times are maximized to avoid overheating and overstressing of the pump motor.

- 1 Automatic pump alternation shall be provided.
- 2 Pumps shall be designed to operate between two and eight times per hour at design daily flow with a strong preference for 4 to 5 cycles per hour.

- a The following equation shall be used to determine the active storage volume in the pump station (i.e., the volume between the pump-on and all pump-off elevations) required to elicit the required pump cycle time:

$$V = TQ_{ddf} \left( 1 - \frac{Q_{ddf}}{Q} \right)$$

*V = active volume within the pump station (gallons)*  
*T = allowable cycle time between starts (minutes)*  
*Q<sub>ddf</sub> = design daily flow to pump station (gallons per minute)*  
*Q = pumping rate of a single pump (gallons per minute)*

- b If the wastewater generation patterns are such that less than two pumping cycles per hour will occur at design daily flow or if the pump station is intended to provide equalization of hydraulic surges, measures to control odor and corrosion shall be employed when resultant detention times cause septic conditions. These measures shall take into consideration protection of the pump station, the force main, the outfall sewer, any related appurtenances, as well as the surrounding area.
- B Consideration shall be given to using variable speed pumps for main pump stations or those pump stations that discharge directly into a wastewater treatment facility.
- C Pump run times shall be such that excessive wear of the pumps does not occur.
- 1 At design daily flow, adequate time shall be provided to allow a constant speed pump to “ramp up” to full speed before the pumping cycle ends.
  - 2 Pump run times at design daily flow shall not be less than or greater than those recommended by the pump manufacturer.
- D Submersible pump/motor assemblies, including lifting brackets, are to remain completely submerged at all times.

### **3.00 Pump Station Design**

#### **3.01 Location and Access**

- A The pump station shall be located on a tract of land with an assigned address or easement properly deeded and recorded to the City of Charlotte. The deeded tract shall include the immediate pump station site and any access drive. The tract shall be large enough to locate the pump station structures, an area suitable to locate an emergency generator, and have enough space to park and maneuver maintenance vehicles. The tract or easement should include any cut or fill areas adjacent to the access drive and fenced station site and a 20' wide by 25' deep turnaround area.

- 1 Pump stations shall be located and designed to minimize the development of nuisance conditions (i.e., noise, odor, etc.) in the surrounding area. A grading and landscape plan shall be included in all pump station plans.
  - a Pump station sites shall be accessible by an all-weather driveway, dedicated solely to station access, provided from a hard surface road.
  - b The driveway shall be at least two feet above the 100-year flood elevation as identified on the most recent FEMA Flood Insurance Rate map when available or as established through appropriate modeling techniques.
  - c The roadway shall be designed to accommodate the largest vehicle expected to service the pump station. In no case shall the driveway be less than 14 feet in width or a curve radius of less than 90 feet.
  - d At a minimum, the driveway shall be constructed from a six-inch layer of compacted aggregate base course (ABC) stone over a suitable compacted subgrade. Stone and subgrade shall be compacted to 100% of max. dry density as determined by the standard proctor test (ASTM D-698). In no case shall uncompacted gravel or stone material be allowed for driveway construction. Drives with a slope of less than 5% may be gravel. Drives with a slope over 5% must be paved with six inches of compacted stone and 1 ¾-inches of I-2 bituminous concrete or superpave equivalent. The maximum allowable slope is 10%. Driveways in existing or planned developments shall be surfaced to match adjacent drives from road to station.
  - e Stations in close proximity to sensitive or significant streams or bodies of water may be required to have a spill containment basin. This basin will have a minimum storage volume of 24 hours of the average hourly flow. A larger basin may be required and the exact volume required will be determined on a case-by-case basis.

## B Security

All ports of entry into pump station structures, vaults, panels, etc. shall be lockable.

The pump station shall be provided with adequate outdoor and indoor lighting to facilitate normal and emergency operation and maintenance activities during daylight and non-daylight hours.

Safety placards for all pump station structures and equipment, as required by Federal, State, County, and City agencies shall be provided and be readily visible.

Fencing: Fence shall be 7'-0" high overall around entire the perimeter of the station site. Double-swing gates shall have a minimum clear opening of 14 feet. Fencing shall be colored and supplied with matching privacy slats of brown,

black, or green. Local ordinances may require additional visually enhanced materials.

- 1 Installation: Fencing shall be installed true to the line and grade indicated or directed. Fabric shall be pulled tight and shall maintain an even clearance above grade. Unless otherwise specified, fencing shall be installed in strict accordance with the manufacturer's instructions. At ditches and low points, rods, bars, or extra fabric shall be used to close the area. All fittings necessary to make a complete installation are to be malleable iron, pressed steel, or aluminum. All ferrous material shall be hot dip galvanized to insure uniform heavy zinc coating. Concrete shall be 3000 pounds per square inch (psi) minimum strength.
- 2 Fabric: The fabric shall be composed of 9 gauge steel wire helically wound to form a continuous chain link fabric having a 2-inch mesh. Top and bottom edges shall have a twisted and barbed finish. The fabric shall be manufactured in accordance with ASTM A-392 Class 1 and in accordance with the Chain Link Fence Manufacturers Institute.
  - a Fabric shall be hot-dip galvanized after weaving to produce a zinc coating not less in weight than 1.2 ounce per square foot of uncoated wire surface.
  - b Wire in the fabric shall meet minimum breaking strength of 1,290 pounds after galvanizing.
- 3 Line Posts shall be 2.375 inch O.D. galvanized pipe, schedule (Sch.) 40, 3.65 lbs./ft. Posts to be spaced no more than 10 feet on center and set 28-inches deep in full 3 foot deep, 8-inch diameter bell-shaped concrete footings, crowned to shed water.
- 4 Top Rail shall be 1 5/8" O.D. Sch. 40 pipe hot galvanized and shall be furnished in random lengths averaging not less than 20 feet, jointed with extra long pressed steel sleeves, hot galvanized, making a rigid connection but allowing for expansion and contraction. Top rail to pass through base of line post tops or barbed wire arms and form a continuous brace from end of each stretch of fence. Rail to be securely fastened to terminal posts by beveled edge bands and rail end fittings.
- 5 Fabric Ties for attaching fabric to line posts, top rail or top wire, shall be aluminum strip or 9 gauge wire. Used on top rail every 24-inches; on line posts every 14-inches.
- 6 Barbed Wire: The fabric shall be surmounted with 3 strands of barbed wire. Each strand shall consist of 2 (two) No. 12-1/2 twisted copper-bearing steel line wires hot galvanized, with No. 14 gauge aluminum 4 point barbs spaced not more than 5-inches apart. The barbed wire shall be manufactured in accordance with ASTM A-121.

All intermediate, gate, and corner posts shall be equipped with extension arms for supporting barbed wire with gate and end post arms vertical. Line post arms shall be galvanized pressed steel with self-locking slot and provision for passing top rail. The corner arm base shall be malleable iron and the extension pressed steel with set screw.

- 7 End and corner posts shall be 2.875-inch O.D. galvanized pipe weighing 5.79 lbs./LF. Gate posts to be 4-inch O.D. copper bearing galvanized pipe weighing 9.11lbs./ft. All to be set in full 3 feet deep 10-inch diameter bell-shaped concrete footings crowned to shed water.
- 8 End and Gate Posts Tops shall be galvanized malleable iron, drive fitting outside of post to exclude moisture.
- 9 Brace and Tension Bands shall be unclimbable beveled edge type with 5/16-inch diameter square shouldered galvanized steel carriage bolts, non-removable from outside fence. Tension bands shall be spaced no more than 14-inches apart.
- 10 Bracing: All corner, gate, and terminal posts shall be braced by means of 1-5/8-inch O.D. horizontal compression member, securely attached to terminal and first line posts with malleable iron fittings, beveled edge bands, and truss braced from first line post to bottom of terminal by 3/8-inch rod and turnbuckle. Corner posts to be so braced in each direction.
- 11 Tension Bars for attaching fabric to terminal posts shall be 3/16" x 3/4" high carbon steel attached to terminal posts by means of beveled edge bands.
- 12 Bottom Tension Wire shall be 7 gauge marcelled galvanized high carbon coiled steel wire.
- 13 Gates: Gates shall be double-swing and frames shall be 2-inch O.D. with 1 5/8 -inch internal bracing welded at all joints to provide rigid watertight construction. Filler fabric shall be same as used in line of fence with barbed wire at top. Hinges shall be pivot type malleable iron or pressed steel. Latch shall be drop bar type securely fastened to gate frame and to engage a 2-inch I.D. pipe sleeve driven 18-inches minimum into earth.

### **3.01 Structural Design**

#### **A Materials of Construction**

- 1 Pump station structures shall be designed and built in complete compliance with all applicable state, local, and federal codes as well as any applicable Occupational Safety and Health Administration (OSHA) and National Fire Protection Association (NFPA) standards.
- 2 Material selection for pump station structures shall be based on installation and operating factors including, but not limited to, the following:
  - a Physical, chemical, and biological wastewater characteristics.
  - b Corrosive gas production.
  - c Soil characteristics.
  - d Groundwater presence.
- 3 Pump station structures shall be completely separated unless made completely watertight and gas-tight.

- 4 Pump station structures shall be adequately protected to minimize damage from vehicular traffic.
- 5 Wet wells and valve vaults shall be concrete and sized with adequate clearances for equipment maintenance.
- 6 Shop drawings for wet well, valve vault, and pump dimensions shall be submitted to the owner for approval.
- 7 Wet wells shall have a minimum diameter of six feet and precast wet wells a maximum of 12 feet.

#### B Buoyancy Protection

- 1 Below-ground pump station structures shall be protected from the buoyant forces of groundwater.
- 2 Buoyancy protection shall be demonstrated through the use of flotation calculations.
  - a Flotation calculations shall be performed on below-ground pump station structures using the assumption that the elevation of the groundwater table is equivalent to the ground elevation.
  - b Flotation calculations shall not add the weight of the pumps, internal piping and appurtenances, or wastewater present in the pump station, including the wastewater below the all pumps-off activation level, into the downward forces used to counteract buoyancy.
  - c The saturated weight of any soil above the extended footing of the pump station structure shall be allowed in the flotation calculations.
- 3 Flotation calculations shall show that the design of the below-ground pump station structures will be protected from buoyancy with a factor of safety that is greater than 1.5.

#### C Flood Resistance

- 1 Pump station structures as well as all associated equipment and appurtenances shall be protected so that the pump station remains fully functional, operational, and free from physical damage during a 100-year flood.
- 2 The pump station shall be protected from inundation of floodwaters by elevating finish grade at least two-feet above the 100-year flood elevation.
- 3 The 100-year flood elevation shall be that as identified on the most recent FEMA Flood Insurance Rate map as amended by local agencies when available, or as established through appropriate modeling techniques.

#### D Solids Collection

- 1 Wet wells shall be designed to minimize pump or pump suction piping operational problems resulting from the accumulation of solids and grit material within the wet well.

- a Acceptable designs include the use of fillets and sloped wet well floors. Preference is for a self-cleaning design employing a steeply sloped influent line entering near the bottom of wet well.
  - b The design of fillets and slopes shall be such that solids are effectively moved toward the pump or pump suction piping.
- 2 No projections within the wet well or on the well wall which would allow deposition of solids under normal operating conditions shall be allowed.

#### E Depth

##### 1 Pump Submergence Depth

- a Sufficient submergence of the pump or pump suction piping shall be provided to prevent the occurrence of vortexing within the wet well.
- b In no case shall the all pumps-off activation level be less than the minimum level required for successful pump operation, as recommended by the pump manufacturer.
- c Submersible pumps, including lifting brackets, shall be fully submerged at all times.

The wet well shall be provided with a depth as required to maintain the active storage volume and emergency storage volume.

### 3.03 Piping and Valves

#### A Influent Line

A single influent line shall be oriented so that turbulence and air bubbles do not affect pump operation. Incoming flow shall not fall onto any pump. Influent piping shall be ductile iron within the station fence enclosure or a minimum of 36 feet.

#### B Suction and Discharge Piping Configurations

- 1 Each pump shall be provided with separate suction (when applicable) and discharge piping systems. Pump suction and discharge piping shall be PC 350 Ductile Iron no less than four inches in diameter with the final size being selected to achieve velocities between four and ten feet per second(fps) with a preference for six to eight fps. The pipe and fittings shall have a minimum of twelve inches (12") clearance from any wall or floor and there shall be a minimum 30-inch clearance between the piping of each pump.
- 2 Flange joints and accessories: All fittings inside pump station and through the emergency pump connection shall be flange joint ductile iron fittings. Flange joints shall be 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 be ASTM F593 316 stainless steel (SS) and have standard hexagonal heads and ASTM F 594 304 SS nuts. An anti-seize compound shall be used during assembly. No all-thread connections are allowed between valves or between valves and piping.

- 3 The suction and discharge piping systems shall be provided with sufficient valves to effect proper operation and maintenance of the pump station during both normal and emergency conditions. Pump isolation valves shall have the seat oriented towards the pump. All valves within the station enclosure shall be open left.
  - a Valves shall be suitable for use with raw, unscreened wastewater and shall be of a design suitable for its function, its installation location, as well as the normal and maximum operating pressures expected at the pump station. Valves and piping shall have sufficient room for a nut/bolt fastener.
  - b A full-closing eccentric plug shut-off valve shall be provided on the discharge piping of each pump and on the suction piping of each dry well pump.
  - c A swing check valve shall be provided on the discharge piping of each pump, between the pump and the shut-off valve. Check valves shall be placed in the horizontal position. All valves shall be located so that they are readily accessible.
- 4 An emergency pump-out connection shall be provided outside the pump station per standard detail 2. The force main shall be fitted with an eccentric plug valve and downstream of this valve shall be a flanged tee with a riser pipe extending vertically to the surface. The riser pipe shall have an eccentric plug valve fitted on the end. This plug valve shall have a blind flange with a male cam-lok connector with a 1/4" National Pipe Taper (NPT) ball valve and dust cap. The buried plug valve shall operate with a two-inch square nut and the surface plug valve shall operate with a wrench. The Contractor shall furnish a valve key and a wrench as part of the permanent station equipment. The surface plug valve shall be set in a drain bed of #67 crushed stone at least six inches deep and shall be housed in a pre-cast concrete vault or .5 Cubic Yard minimum.

C All valves shall be as specified below.

- 1 Ball valves shall be 304 stainless steel construction with iron pipe thread, screw ends, as required and having a working pressure of 200 PSI.
- 2 Swing Check Valves: Check valves 3-inches and larger shall be horizontal swing check valves for sewage service furnished with iron bodies, bronze mounted, single disc, swing type full opening, with lever and weight assist (compatible with the specified pumps and working pressure) and with flange ends conforming to ANSI Specification B16.1. Valves 8-inches and larger shall be cushioned. Valves shall be manufactured by Kennedy, CCNE, or M&H. All working parts shall be removable through the top of the valve unless

otherwise required by the installation. When check valves are located in vaults or other areas with limited access, Mega-flange or equivalent fittings with stainless steel bolts will be located immediately upstream of each check valve to facilitate maintenance.

Materials used in the construction of swing check valves required herein shall be in accordance with the following specifications:

- a Shaft Seals: Shaft seals shall be designed for the use of Standard O Ring Seals, or for a conventional stuffing box.
  - b Inspection: The manufacturer shall furnish to the Engineer written certification that all valves and material furnished under this specification have been tested and found to conform with the requirements of AWWA Standards for valves C-508 and ASTM and ANSI requirements for materials as applicable.
  - c Coating: Check valves shall be factory epoxy coated.
  - d Valve Body Types: Valve bodies shall be manufactured with flanged ends conforming in dimensions and drilling to ANSI B16.1 Class 125 Cast Iron Flanges. The short style valve body will be furnished as required to complete the installation as shown on the Plans.
  - e Valve Drawings: Plans for valves and assemblies will be approved by the Engineer prior to construction.
- 3 Plug Valves: All valves for pressure sewers and force mains shall be eccentric plug valves as follows:
- a 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 that are replaceable without removing the bonnet. The bearing and seal area shall be protected with grit seals. Valves shall be factory epoxy coated. Area of port opening for all valves shall be no less than 81% of full pipe area. Valves shall have a direct pressure rating of 100 psi with a working pressure of 175 psi for 12-inch and smaller valves and 150 psi for 14-inch and larger valves. Bi-directional shutoff is required. Plug valves shall be as manufactured by Dezurik only, due to standardization of spare parts. Valves with flange ends shall be provided where indicated. Flanges shall be in accordance with ANSI B16.1 except that the four holes straddling the principal axis of the valve may be tapped and connected to the adjacent piping with cap screws of adequate size as recommended by the valve manufacturer and approved by the Engineer.
  - b Plug valve operation shall be as indicated on the Plans and as follows:

- (1) Buried valves, and all valves under 8-inches in size, shall have 2-inch square operating nuts.
  - (2) Valves 8-inches and larger require gearing in enclosed gear cases. Gearing shall be in accordance with the valve manufacturer's recommendations as required to permit easy operation of the valve by one man without excessively large hand wheel or cranks. Hand wheels shall not exceed 16 inches in diameter.
- c 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 valve manufacturer. Operating nut shall be within 12" of grade.
- d Discharge valves in vault shall be installed with adjustable aluminum pipe cradle and stainless steel standpipe. Buried valves shall be provided with a valve box conforming to CMU water standard detail 2. 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 a concrete pad, or an approved precast concrete pad, set flush with the existing terrain. The top section will be encased into the concrete pad.

#### D Pipe Connections

- 1 Flexible pipe joints shall be used between the pump station structures to allow for differential settlement without compromising the integrity of the overall pump station.
- 2 Pipe inlets and outlets of pump station structures shall be made watertight with flexible boots according to ASTM C-923 and grouted.
- 3 Existing pump station structures shall be core drilled or saw-cut when connections are made through the structure wall. In no case shall penetrations into pump station structures be made by hammering.

#### E Water Service

In areas where potable water is available, the station shall be furnished with a  $\frac{3}{4}$ " water service and freeze-proof yard hydrant. A reduced pressure principle backflow prevention device is required per CMU specifications. This shall be located within the fenced station enclosure and supplied with a strainer screen, heating element, and an insulated cover anchored with stainless steel hardware. If municipal water is not available, a well and yard hydrant shall be provided. The well shall have a minimum capacity of 10 gal./min. at 40 psi and be clearly labeled as non-potable. Yard hydrants shall be mounted 30-inches high, frost-proof and equipped with stems and seat washers that are removable through the top of the hydrant. Operating rod shall be brass. The yard hydrant shall be installed complete with washed stone drain bed of at least 1 cubic foot and an 18-inch square concrete splash pad.

### **3.04 Appurtenances**

#### **A Pump Removal Methods/Equipment**

- 1 Provisions shall be made so that the largest piece of equipment installed at the pump station may be removed such as supplying a hoist or designing sufficient clearance for mobile hoisting equipment.
- 2 Pump station structures shall be provided with access of sufficient size such that the largest piece of equipment may be removed without damaging the integrity of the structural design.
- 3 Pump stations shall be provided with a system that allows for the removal and installation of the pumps without requiring entry into the wet well and with clear vertical access.
  - a Each pump shall be provided with a 304 stainless steel guide rail and lift-out chain section with guide cable.
  - b Both the guide rail and the lift-out chain shall be capable of withstanding the forces required to disengage the pump from the wet well.
  - c Both the guide rail and the lift-out chain shall be manufactured of stainless steel.

#### **B Access Equipment**

Structure shall be designed so that access to perform both routine and emergency operations is convenient, unobstructed, and safe. Each structure shall have a separate means of access. Steps, ladders, stairs, landings, hatches, and other means of access shall conform to OSHA standards as well as all applicable local and state building codes regarding design characteristics.

#### **C Ventilation Equipment**

- 1 Pump stations shall be adequately vented in accordance with local and state building codes as well as OSHA and NFPA standards. The Class 1 explosion hazard zones, as defined in the NFPA 820 code, shall be identified on the plans. Pump station temperature and humidity shall be controlled to a level appropriate for reliable operation of the electrical and instrumentation/control equipment.
  - a At a minimum, pump station wet wells shall be provided with a 3" ductile iron gooseneck-type vent with a stainless steel insect / bird screen.
  - b Vent elevations shall be a minimum of four feet above the 100-year flood elevation as identified on the most recent FEMA map when available or as established through appropriate modeling techniques.
  - c

#### **D Other Equipment**

Pump station structures other than the wet well shall be provided with a means to remove accumulated water and wastewater from the structure. All

floor and walkway surfaces shall be sloped such that water and wastewater drains to the removal area under the influence of gravity. Acceptable removal means include the following:

- 1 A sump for installing a portable pump.
- 2 A non-arcng sump pump system that is capable of automatic and manual operation with three automatic operating levels: all pumps-off, pump-on, and high water alarm. It shall have a minimum ½ HP motor and a capacity of 1000 gallons per hour at a TDH of 30'. The discharge piping of the sump pump shall be provided with an appropriate check valve and shut-off valve to prevent back flow of wastewater from the wet well into the structure and to facilitate removal of the sump pump.

#### **4.00 Force Main Design**

##### **4.01 Material**

A Pipe material and specifications shall be selected based on the installation and operating conditions of the force main following installation. Such factors shall include, but shall not be limited to:

- 1 Installation depth and overburden pressure.
- 2 Soil conditions and groundwater presence.
- 3 Corrosion resistance from both external and internal sources.
- 4 Strength required to withstand internal pressures expected during normal operation as well as those resulting from hydraulic surges and water hammer.

B Force mains shall be constructed of one of the following types of pipe:

- 1 Ductile iron pipe (DIP), Pressure Class 350
  - a Pipe shall conform to ANSI/AWWA C151/A21.51 "Ductile Iron Pipe, Centrifugally Cast in Metal Molds for Water or Other Liquids" and shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4.
  - b All fittings shall be ductile iron and shall conform to ANSI/AWWA C110/A21.10 "Ductile Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids" or ANSI/AWWA C153/A21.53 "Ductile Iron Compact Fittings, 3 In. through 66 In., for Water Service." All fittings shall be epoxy lined and coated according to AWWA C116/A21.16-98.
  - c Force mains of DI pipe shall have mechanical or gasketed push-on type joints. Restrained joint DI pipe will be used for thrust restraint. Retrofit restraining devices will not be allowed.
  - d Gaskets shall be manufactured of vulcanized natural or synthetic rubber in accordance with ANSI/AWWA C111/A21.11 "Rubber Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings."

- e Flanged DI pipe shall conform to ANSI/AWWA C115/A21.15 “Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges”.
- f Consideration shall be given to the existence of or the potential for development of corrosive environments within and outside the force main. Sources of corrosion may include: acidic soils, septic wastewater, and air entrainment within the force main. Where corrosion is deemed to be a serious problem, DI pipe shall be provided with an alternate coating appropriate for the pipe material and situation. Such coatings shall be manufactured or applied in accordance with the appropriate ANSI and AWWA standards.

## 2 Polyvinyl chloride (PVC)

- a PVC material used in the manufacture of PVC pipe shall conform to ASTM D1784 “Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.”
- b PVC pipe shall conform to AWWA C900 or C905. The thickness and pressure class of PVC pipe required for the installation and operating conditions during the expected service life of the force main shall be determined in accordance with AWWA C900 or AWWA C905 but shall be a minimum of Pressure Class 200 with an SDR of 14 or less.
- c Force mains of PVC pipe shall have elastomeric gasketed push-on type joints. Gaskets shall be manufactured in accordance with ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.”
- d Mechanical joint DI epoxy coated pipe fittings conforming to ANSI/AWWA C110/A21.10 and C116/A21.16-98 shall be used for force mains four inches in diameter and larger.
- e PVC pipe shall be shipped, stored, and strung in a manner to limit its total accumulated exposure to sunlight and UV radiation to no more than four weeks.

## 3 All pipe used for force main construction shall be labeled or otherwise identified as conveying wastewater.

- a All force mains 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. The tape will be placed both approximately 1 foot above the pipe and also 2-feet below the ground surface.
- b A 16-gauge solid copper coated tracer wire shall be laid on top of PVC force mains. This wire shall be secured to the pipe near every bell and at the center of each pipe joint. This wire shall be brought into air release valve vaults and secured to the stainless steel hook along with the valve shutoff cable.

- c Aboveground markers shall be used every 300' on straight runs, 100' on curves, and at every significant change in direction or when otherwise limited by sight distance. Above-ground markers shall be 72"h x 3 ¾" w, and white in color as manufactured by Rhino Fiber3rail (product FR72-W) or approved equal. Markers shall be installed as recommended by the manufacturer.
- d

#### **4.02 Velocity**

- A Wastewater velocity occurring in a force main shall be calculated using the continuity equation.  
A self-cleansing velocity of at least two feet per second shall be provided throughout the length of the force main. The ability to provide velocities of between three and eight feet per second is desirable to resuspend any solids that may have settled out.
- B Anchorage
  - 1 Force mains shall be adequately anchored to resist thrusts that may develop at bends, tees, plugs, end-of-line valves, and at any other location where a change in flow direction occurs. Such anchoring shall be provided through the use of original manufacture restrained joint pipe. Retrofit restraining devices are not allowed.
  - 2 Anchoring devices shall be designed to withstand force main pressures of at least 25 percent greater than the maximum pump shut-off head plus an allowance for water hammer and an appropriate factor of safety or to test pressure.

#### **4.03 Surge Control**

- A Force mains and their associated pump stations shall be analyzed with respect to the development of hydraulic transients and force main design shall be such that active devices for control of transient hydraulic conditions are minimized. When necessary, the following shall be acceptable control strategies when approved by CMU:
- B Variable-speed pumps or constant-speed pumps in combination with soft start / stop motor starters.
- C Pumps with augmented rotational inertia.
- D Construction of the force main using a higher-strength pipe.
- E Vacuum relief valves.
- F Specialized control and/or release valves and other devices designed to prevent transient pressures from reaching levels that could damage the pump station and force main systems.

#### **4.04 Appurtenances**

- A Air Release and Air / Vacuum Relief Valves

- 1 The route of the force main shall be such that the number of air release and vacuum relief valves is minimized.
- 2 An automatic air release valve shall be provided at all high points to prevent air locking of the force main. An automatic combination air release and vacuum relief valve will be located at the ultimate high point and when necessary for surge control where sub-atmospheric pressures or column separation may occur. Automatic air release valves shall be used at other local high points. Air release valves are required when the difference between the low point and high point exceeds one pipe diameter. These valves shall be of the quick-opening, slow-closing type and may be standard height or short body design with a minimum 2-inch diameter screw-threaded inlet. Valve body shall have a removable bonnet secured with 316 stainless steel fasteners to facilitate maintenance of the internal working parts. Outlet is to be screw-threaded. Air and vacuum sewer valves shall be mounted to force main through the use of a bronze corporation stop and stainless steel tapping saddle followed by a stainless steel ball valve. Shop drawings shall be submitted to the Engineer for approval prior to ordering materials. Air release valves shall be as manufactured by APCO, Crispin, Vent-o-mat or approved equal. Combination air and vacuum relief valves shall be as manufactured by Vent-o-mat only, due to their unique design.

#### **4.05 Installation**

##### **A Joints and Bedding**

- 1 Force mains shall be installed such that pipe and joint deflection is minimized. CMU installation methods will be followed and will require no less than the following:
  - a Force mains of DI pipe shall be installed in accordance with AWWA C600 "Installation of Ductile Iron Water Mains and Their Appurtenances."
  - b Force mains of PVC pipe shall be installed in accordance with AWWA C605 "Installation of Underground Installation of Polyvinyl Chloride (PVC) Pipe and Fittings for Water."
- 2 Continuous and uniform bedding and backfill that is appropriate for the soil type and pipe material shall be provided in the force main trench.

##### **B Burial**

A minimum burial depth(cover) of five feet and a maximum of ten feet as measured from the crown of the pipe to the ground surface shall be provided throughout the length of the force main. If cover must be less than 5 feet, the force main shall be ductile iron pipe.

##### **C Separations**



- 1 Minimum separations between pump stations/force mains and natural features, other utilities, etc. shall be maintained in accordance with CMU standards and 15A North Carolina Administrative Code 2H.0219(i)(2)(G) available online at <http://ncrules.state.nc.us/ncadministrativ> .
- 2 Stream Crossings
- 3 Force mains shall be routed such that the number of stream crossings is minimized. When a stream crossing is required by the design, the crossing shall be as nearly perpendicular to the stream flow as possible using ductile iron pipe. The DIP shall be extended horizontally for a length equal to that required by 15A NCAC 2H .0219(i)(2)(G) either side of the stream or a minimum of a full pipe joint.
- 3 Force mains shall not be closer than 25 feet from a private water supply well or 50 feet from a public water supply well, even if ferrous pipe material with joints equivalent to water main standards is used.

## **5.00 Quality Assurance and Quality Control**

### **5.01 Shop Drawings and Operations and Maintenance (O&M) Manuals**

- A Three sets of shop drawings shall be submitted for review and approval prior to manufacture, fabrication, and construction.

The shop drawings shall include the following at a minimum:

- 1 Outline drawings showing equipment and shipping dimensions and weights, location of accessories, and clearances required.
- 2 Force main piping and appurtenances
- 3 Pumps
- 4 All electrical components
- 5 Control panel
- 6 Generator / transfer switch
- 7 Valve vault / Wetwell
- 8 Auxiliary equipment
- 9 Certified factory test and characteristic curves showing field performance for each pump and a pump curve / system curve with beginning and end of life operating points.
- 10 Wiring and schematic diagrams including accessories.
- 11 Spare parts list

- B An O&M Manual shall be prepared for each pump station and three copies shall be submitted to CMU for review within 14 days of startup date. After approval, three copies and a bookmarked and indexed PDF file on CD that reflect any changes during construction shall be provided by the start up date, along with the spare parts specified elsewhere. O&M Manuals shall contain the following information, at a minimum:

- 1 Approved shop drawings, including design data for all installed equipment and each major component.

- 2 Control panel wiring diagrams and a reduced set of station/force main plans.
- 3 Warranty information for all installed equipment and each major component.
- 4 Inventory, functional descriptions, and complete operating instructions for all installed equipment and each major component, including all valves.
- 5 Instructions for start-up/shut-down as well as for calibration and adjustment of all installed equipment and each major component.
- 6 Recommended maintenance plan, including preventative and predictive maintenance, for all installed equipment and each major component including odor control.
- 7 Contingency plan and analysis of critical safety issues.
- 8 Contact information for local parts suppliers and service companies as well as instructions for replacement of all installed equipment and each major component.
- 9 Contact information for local contractors capable of performing emergency repairs.
- 10 Factory start-up report.

## **5.02 Service Manual and Spare Parts**

- A Service Manuals shall be furnished for all mechanical and electrical equipment specified and shall be bound in a single book. The manual shall contain a description of the equipment, a complete accessory and parts list, and complete installation, operation and maintenance instructions. Three copies shall be submitted for review within 30 days after approval of shop drawings. After approval of manual, three copies of each manual shall be submitted by start up date.
- B Equipment manufacturer shall furnish the proper lubricants for initial operation of each piece of equipment. Each type of lubricant shall be furnished in a separate sealed container, clearly labeled showing the type of lubricant, equipment for which it is intended, and instructions for use.
- C The manufacturer is to furnish a list of all recommended spare parts including, at a minimum, two sets of mechanical seals, o-rings, gaskets, and wear rings. Each pump shall be provided with an extra full size impeller in addition to other spares recommended by the pump manufacturer. The spare parts shall be provided by start-up date. Spare parts shall be provided in original packaging in factory new condition.
- D The contractor is to furnish two sets of record drawings by the start-up date. These drawings shall include any changes during construction with any such changes recorded on original design drawings by design engineer.

## **5.03 Pump Station Testing**

### **A Watertightness Testing**

- 1 Wet wells and other wastewater-containing structures at the pump station shall be inspected and tested for watertightness. The watertightness test shall be performed in the presence of a CMU authorized representative.

- 2 The watertightness test shall be performed in accordance with ACI (American Concrete Institute) 350.1R "Testing Reinforced Concrete Structures for Watertightness" for cast-in-place wetwells.
- 3 Pre-cast wetwells shall be filled with water and allowed to saturate over 24 hours. Then the level will be noted at two places 180 degrees apart on the perimeter. Over the next 24 hours the leakage must be one inch or less of wetwell depth. A vacuum test method, prior to backfilling, in accordance with ASTM C1244 "Standard Test Method for Concrete Sewer Manholes by Negative Test Pressure (Vacuum) Test" may be used in lieu of a hydraulic test.
  - a Testing shall not commence until the structure being tested has been fully assembled and backfilling is complete, unless the pump station wet well is constructed of cast-in-place concrete.
  - b All inlets and outlets in the structure shall be temporarily plugged and braced or otherwise sealed prior to initiating the test.
  - c Pump station wet wells that fail to meet the watertightness test requirements shall be inspected, made watertight, and retested until the test passage is assured.

The results of all watertightness testing shall be maintained as part of the construction record documentation.

Suitable backfill around the wetwell and valve vault shall be compacted to 95% of max. dry density as determined by the standard Proctor curve (ASTM D-698). Foundation subgrade for these structures shall be compacted to 100% of Max. dry density. All fill material shall be non-plastic in nature and free of roots, vegetative matter, waste, construction material, rocks, or other objectionable matter. Materials deemed unsuitable by the inspector shall be removed and replaced with suitable fill.

#### **5.04 Pump Testing**

- A Factory Testing: All pumps shall be tested by the manufacturer in accordance with the appropriate Hydraulics Institute standard prior to shipment for installation and the results of all factory testing shall be maintained as part of the construction record documentation.
- B Drawdown Testing: Following installation, each pump in the pump station shall be subjected to drawdown and "shut-off" head tests to verify that pump performance meets the design criteria with a full, operational force main. Surge pressure will also be measured.

These tests shall be performed in the presence of an authorized CMU representative and in conjunction with other instrumentation and control testing.

The results shall be maintained as part of the construction record documentation.
- C Witnessed Testing: Witnessed testing may be required by CMU for large pumps or critical installations. The results of all witnessed testing shall be maintained as part of the construction record documentation.

## 5.05 Force Main Testing

### A General

- 1 Prior to testing any segment of force main, care shall be taken to prevent the pipe from moving while under pressure.
- 2 All testing shall be performed in the presence of an authorized CMU representative.
- 3 The results of all testing shall be maintained as part of the construction record documentation.

### B Force mains shall be installed in a manner such that pipe deflection is minimized. CMU water main compaction standards shall apply.

### C Pressure Testing

- 1 A hydrostatic pressure test shall be performed on each segment of installed force main after the force main has been backfilled.
- 2 The following procedures shall be followed in performing hydrostatic pressure tests on force mains:
  - a The force main segment shall be carefully filled with water so that air is eliminated from the system. Once full of water, the force main segment shall be pressurized and allowed to stabilize at a minimum test pressure of 200psi or 1.5 times the maximum design pressure of the force main pipe material, whichever is greater. This pressure shall be maintained within 5 psi for at least two consecutive hours.
- 3 Leakage shall be measured with a calibrated test meter and shall not exceed the amount given by the following formula:

$$L = \frac{ND\sqrt{P}}{7,400}$$

L = allowable leakage (gallons per hour)  
N = number of joints in length of pipe segment tested  
D = nominal diameter of pipe segment tested (inches)  
P = test pressure (pounds per square inch)

All visible leaks shall be repaired regardless of the amount of leakage. If leakage exceeds this rate, the contractor is responsible for assuring that the cause of test failure is determined, all necessary repairs are made, and repeating the test until the force main segment passes.

## 5.06 Electrical and Instrumentation/Control System Testing

All start-up sessions shall be scheduled at least 72 hours in advance with the Pump Station Supervisor. The design engineer, pump and control panel representative(s), Electrical, and General contractors shall be present with the CMU representative. A preliminary test prior to the "official" test is strongly recommended. Testing shall commence within one hour of appointed time or be rescheduled.

The Contractor is responsible for testing the pump as follows:

- A Check incoming voltage prior to energizing panel or pumps.
- B Place the operating mode switch in the off position.
- C Check motor resistance readings.
- D Fill wet well with water.
- E Manually start and stop each pump sequentially and then both pumps together.
- F With water level lower than pump's "shut-off" point, place selector switches in "auto" position.
- G Fill wet well slowly and observe lead pump start, pump down, and shut off at proper level.
- H Check lead pump motor current.
- I Increase water level so that lag pump starts, pumps, and shuts off at proper level.
- J Check lag pump motor current.
- K Level control points for lead / lag on and lead/ lag off should be at least 6-inches apart.
- L Disconnect power to pumps and fill well to alarm level to verify operation of visual, audible, and telemetry alarms. Verify that "alarm on" level is at least 6-inches above the "lag on" level.
- M Disconnect level controller and verify that pumps are turned on and off at proper levels by the float switches.
- N Verify that lead and lag pumps alternate.
- O Measure pump operating head and "shut-off" head and perform a timed drawdown test to verify that actual performance of each pump meets the design criteria.
- P Verify that emergency back-up power systems function and will operate both pumps simultaneously.
- Q Verify that the UPS system operates the alarm and telemetry systems.
- R Verify that submersible pumps are properly seated.
- S Verify the proper time delays between pump starts and adjust, if applicable.
- T Check other controls as necessary by design.
- U Test phone and alarm dialer / telemetry alarms and other alarms as required by design.

The results of all testing shall be made part of the construction record documentation. Any changes or modifications will be updated in the O&M manual.

## **6.00 Submersible Pumping Stations**

Items not specifically covered in this heading of the specifications are subject to requirements in other sections and in Charlotte-Mecklenburg Utilities' "Standards and Specifications" as well as the direction of the owner.

### **6.01 Materials**

All materials for the pumping stations shall be new and shall be furnished by the Contractor in accordance with the following requirements:

A Pumps:

Contractors shall furnish at least two (2) explosion-proof, non-clog submersible centrifugal type sewage pumps designed and manufactured to convey raw unscreened wastewater. The pumps shall be suitable for the physical and chemical properties of the wastewater conveyed and conform to the following:

- 1 Pump shall be capable of delivering the specified GPM at the specified total dynamic head as shown on the plans. Pumps shall be as manufactured by Flygt, Ebara, Pumpex, or approved equal. Pump data plate shall be mounted on inside of control panel door and identify the pump manufacturer, voltage, full load amperes, impeller size, pump model, pump serial number, and pump rating (GPM @ TDH).
- 2 The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30 or 35 B. The pump discharge shall be fitted with standard ANSI 125 lb. flanges. All external-mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable.
- 3 Bearings and shaft: The pump shaft shall rotate on two (2) permanently lubricated bearings. These shall be heavy duty single or double row ball bearings as needed to provide an American Bearing Manufacturers Association(ABMA) L10 bearing life of a minimum of 50,000 hours at the anticipated axial and radial loadings. Double row sealed grease pack bearings are not acceptable.  
The pump shaft shall be solid and of a material suitable to the application. The shaft shall be of a sufficient diameter with minimum overhang to reduce shaft deflection and bearing wear. Shaft stiffness factor shall not exceed 60.
- 4 Seals: Each pump shall have a tandem mechanical shaft seal system. The upper set of tandem seals shall operate in an oil chamber located below the stator housing. The set shall contain one stationary tungsten carbide ring and one positively driven rotating carbon ring, functioning as an independent secondary barrier between the pumped liquid and the stator housing. The lower tandem set shall function as the primary barrier between the pumped liquid and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring both being tungsten carbide or silicone carbide.  
Each seal interface shall be held in contact by its own spring system. The seals shall not require maintenance or adjustment, but shall be easily replaceable.  
The pump shall be equipped with a seal leak detection device and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.  
There shall be a seal failure sensor installed in the seal chamber between the two tandem mechanical seals or in the stator housing. If the lower seal fails, contaminants which enter the seal chamber or the

stator housing shall be detected by the sensor and send a signal to operate the specified warning device.

Units equipped with opposed mechanical seals shall not be acceptable.

- 5 Impeller: The impeller shall be enclosed, non-clogging, and have pump out vanes to prevent grit and other materials from collecting in the seal area. The impeller shall be capable of passing a minimum 3-inch solid sphere. Impellers shall have replaceable wear rings. Impellers must be dynamically balanced and shall be slip fit to a tapered shaft and key driven. The impeller shall be fastened to the shaft with a 300 series stainless steel washer and bolt.

A volute case wear ring or wear plate shall be provided to minimize impeller wear. The wear ring/plate shall be field replaceable.

- 6 Motors: The pumps shall have a UL or FM listed, hermetically sealed, air filled submersible type, electric motor for operation at 460 Volt, 3 phase, 60 hertz power. Standard motor speed is 1800 RPM. Horsepower shall be as specified on the plans. They shall be designed for use in electrically hazardous locations (Class 1, Division 1, Group D) and for general use in pumping sewage. The motor shaft shall be stainless steel. The motor shall be provided with thermal overload protection. The motor shall be designed for continuous duty, capable of sustaining a minimum of 10 starts per hour. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15.

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

- 7 Rail Assembly: The pumps shall be mounted on a 304 stainless steel schedule 40 rail assembly with at least two rails and stainless steel brackets. Pump removal shall not require personnel entering the wetwell. A machined metal-to-metal contact shall accomplish sealing of the pump to the discharge connection. The rails shall be plumb and the distance between rail supports shall not exceed 15 feet. The rail/pump interface shall be non-sparking through the use of bronze bushings or other method.

- B Wetwell: Precast wetwells shall be 6 feet to 12 feet in diameter constructed conforming to ASTM C-478. Joints shall be made to receive rubber gasket, butyl mastic rope sealer, and a non-shrink type grout especially made for this purpose. Additionally, all joints shall be coated inside and out with Flex-Seal Utility Sealant by Sealing Systems, Inc, Loretto MN, or approved equal. The sealant coverage shall be 18-inches wide with a minimum dry thickness of 80 mils. Wetwell bottom shall be integrally cast with extended base and walls shall conform to ASTM C-478 or to minimum dimensions shown on the drawings. Wetwell top shall be casted with access doors and pipe penetrations. All exposed concrete finishes for the valve vault and wetwell shall be uniform and finished to a light brush finish after all patchwork is completed. The wetwell shall be installed plumb. Stations with a peak capacity of over 1MGD shall use a cast in place wetwell.

- 1 Wetwell supplier shall design manhole sections to resist earth loads and to resist uplift resulting from buoyant forces calculated with groundwater table at finished grades. Wall and/or base dimension shall be increased accordingly.
  - 2 Wetwell / Valve Vault Access Door: Shall be constructed of aluminum with  $\frac{1}{4}$ " thick one-piece aluminum extruded frame, having a continuous concrete anchor as part of the frame. Door panels shall be  $\frac{1}{4}$ " thick aluminum diamond plate capable of withstanding 300 pounds per square foot. All hardware detail and hinges shall be 316 stainless steel with tamper-proof fasteners. Doors shall open 90 degrees and be locked in this position with a stainless steel positive locking arm and aluminum release handle. Doors shall close flush with the top of the frame and be fully supported around the perimeter on a  $\frac{1}{2}$ " wide lip. Doors shall be lockable with a built in locking point, welded to the frame and have lift assist if weight is over 50 pounds. Doors shall be as manufactured by Bilco, Halliday, or US Foundry.
- C Piping: All piping inside the wetwell and through the valve vault shall be flanged ductile iron pipe with 300 series stainless steel nuts and bolts. There shall be a flexible restrained joint between the wet well and valve vault to prevent damage from differential settlement.
- D Valves and Valve Vaults: Valves and appurtenances shall be the type, size and class shown on the plans and as specified elsewhere in this document. Valves smaller than 4" on pump sewer discharge piping shall not be allowed. Valves shall be located in a separate valve vault. Vaults shall have a 12"x12"x12" deep sump pit along wall nearest the wet well with a 2" sch. 40 304 stainless steel sleeve pipe between the vault and the wet well. This sleeve shall be plugged at each end with common expansion plugs. Swing check valves for pump discharge shall include a  $\frac{1}{4}$ " NPT tap in the check valve cover with a  $\frac{1}{4}$ " full port ball valve and dust cover.

## **6.02 Handling and Installation**

- A All equipment shall be carefully handled and protected from damage while in storage and during installation. Equipment shall be protected from the weather at all times. Equipment damaged by the weather, handling or construction shall be immediately repaired or replaced to the Engineer's satisfaction.
- B Equipment shall be installed in strict accordance with the manufacturer's instructions and approved shop drawings.
- C Equipment manufacturer shall furnish all instructional and assistance necessary for proper installation of all equipment specified herein. After installation, a qualified service representative of the equipment manufacturer shall inspect the complete installation and make adjustments as needed prior to scheduling a CMU representative to witness performance testing, and place the equipment in permanent operation after CMU approval.

## **7.00 Submersible Pumping Station Electrical Specifications**



## **7.01 General Provisions**

The Contractor shall furnish all labor, materials, equipment and supplies and shall perform all work necessary for the complete construction of submersible pumping station as shown on the plans and specified herein. Items not specifically covered in this heading of the specifications are subject to requirements in other Charlotte-Mecklenburg Utilities (CMU) "Standards and Specifications" and the direction and approval of the owner. The contractor shall coordinate power and phone service installation in their own name and arrange for the account to be transferred to the City of Charlotte at final acceptance of project. All bills shall be paid current prior to account transfer.

### **A Applicable Standards, Codes & Design Criteria:**

- 1 All equipment shall meet Standards of Underwriters Laboratories, Incorporated (U.L.) and the National Electrical Manufacturer's Association (NEMA) in every case where they have established a standard for the particular type of material to be installed. All equipment shall be U.L. listed and labeled.
- 2 Installation shall meet or exceed the standards established by the National Fire Protection Association (NFPA) as currently referenced under the North Carolina State Building Code (NCSBC). Additionally, CMU facilities shall meet or exceed the requirements of NFPA-820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
- 3 The pump station equipment and installation shall meet the North Carolina Department of Environment & Natural Resources – Minimum Design Criteria (NCDENR-MDC) for the Fast-Track Permitting of Pump Stations & Force Mains. Unless otherwise directed by CMU, and approved by NCDENR, no variance to the Minimum Design Criteria is permitted.

### **B Installation: Installation shall comply with the applicable rules of the National Electric Code (NFPA 70), rules/regulations of the SBC and local codes. In no case shall the materials or workmanship fail to meet the minimum requirements of the National Electric Code (NEC). All power and phone lines shall be located within CMU right-of-way and shall be underground within the station enclosure.**

- 1 The regulations of the local electric company shall govern the service connection and metering provisions. A pad mounted transformer located outside the fenced enclosure is preferred.

### **C Materials: All materials used in this work shall be new and listed by Underwriters Laboratory (UL). All nuts, bolts, struts, supports, etc. shall be stainless steel (grade 316 or higher).**

### **D Grounding: The conduit and neutral conductors of the wiring systems and all electrical equipment shall be grounded. The ground connection of the wiring system neutral shall be made at the main service switch or circuit breaker.**

- 1 Grounding electrodes, service ground conductor and equipment ground conductors shall be furnished and sized in accordance with NEC 250 requirements.
- 2 All ground conductors running outside of the electrical equipment enclosures, cable trays etc., shall be run in PVC-RGS (Rigid Galvanized Steel) conduit. All conduits shall be bonded at terminations to provide a continuous grounding path in accordance with NEC.
  - a In addition & supplementary to grounding inherent to continuous, bonded metallic conduit, a separate equipment-grounding conductor, sized per NEC, shall be installed in each conduit.
- 3 The grounding electrode connection shall be made below finished grade with provisions for periodic inspection and adjustment without need for excavation.

## **7.02 Basic Electrical Materials and Methods**

- A Wiring: All power & control wiring shall be individual conductors installed in conduit unless otherwise required by CMU or application.
- 1 Conductors shall be THWN-THHN, stranded copper. Minimum conductor size shall be #12 AWG for 120-volt (or greater) branch circuits. #14 AWG may be used for control circuits provided it is adequately protected from overcurrent in accordance with NEC requirements. All conductors shall be rated 600 VAC and 75-90°C terminations.
    - a Motor connections shall be made using insulated multi-cable connector block (NSI type) connections.
  - 2 Conductors shall run continuous between termination points, and wire-to-wire splicing is prohibited.
  - 3 Contractor installed service, distribution and branch circuit wiring shall be color coded as follows:
    - a 120/240-volt, 1-phase, 3-wire systems (Serving 120-volt branch circuits): Phase "A", black; Phase "B", red, Grounded neutral, white, ground conductor, green.
    - b 240-volt, 3-phase, 3-wire systems: Phase "A", black; Phase "B", red; Phase "C" blue; ground conductor, green.
    - c 277/480-volt, 3-phase, 4-wire systems: Phase A, brown; Phase B orange, Phase C; yellow; Grounded neutral, white with stripe, ground conductor, green.
- B Conduit Raceways: All wiring, other than those in cable trays, shall be in PVC- coated RGS conduit manufactured by Robroy or Ocal.

- a Conduit size shall accommodate the installed, and/or the anticipated future conductors in accordance with NEC. Minimum size is ¾-inch.
- b All conduit connections at enclosures shall be made using Myers STG type, PVC-coated hubs that accommodate bonding. All interconnections between adjacent enclosures shall utilize Myers STG type, PVC-coated hubs; chase nipple connections are not permitted. Only Form 8 style fittings shall be used.
- c PVC-RGS conduit shall be installed using specific tools and techniques that do not damage the PVC coating.

(1) Conduits with damaged coatings shall be replaced as judged by CMU solely. Contractor applied coatings or patching compounds (repairs) are not permitted.

C Cable Tray: A cable tray system shall be furnished for routing wet well power and control cables to control enclosure. Material and installation requirements are as follows:

- 1 Cable tray system shall consist of a heavy-duty trough type tray with solid bottom, louver-ventilated flange type cover and full height barrier strip. Tray, cover & barrier strip shall be constructed of 6063-T6 aluminum alloys.
- 2 Tray system shall meet all state and local building codes requirements and be listed/labeled for outdoor applications as manufactured by B-line, Chalfant, MP Husky, Thomas & Betts, or approved other.
- 3 Cable tray shall be sized in accordance with NEC requirements, but shall be no smaller than 12" wide & 4" high.
- 4 Load rating requirements shall be based on support spans and the anticipated loading (cable weight plus 250 lbs). Load capacity shall be no less than 400 lbs at a span of 6'. Vertical deflection between span supports shall not exceed 1/200th of the span length (>3/8" for a 6' span). Maximum distance between supports is 6 feet.
- 5 A full height barrier strip shall be installed over full length of tray system to provide an isolated 2" wide raceway for the intrinsically safe circuit extension cables. Said cables shall be installed, secured and guarded from contact from all other wiring per NEC 504 requirements.
- 6 Unless indicated otherwise, tray system shall be routed along fence line in areas that will not hinder station access or maintenance operations. Tray system shall be installed no closer than 12" to permit reasonable access for installation/removal of cables, covers & cover clamps.
- 7 Cable tray shall be installed level (for level lots) or be run parallel to the finished grade (for sloping lots). Where practical, vertical offsets should be made using standard, factory assembled inside & outside vertical bends. Offsets that do not correspond to those possible with factory-assembled fittings may be achieved using hinged splice plates.
- 8 Horizontal bends shall be factory assembled; no field modifications will be allowed.

- 9 Covers shall be segmented in 3' sections (where possible) and cover clamps installed at intervals not exceeding 3'. No less than two clamps shall secure a cover segment.
- 10 Tray system shall be elevated 8" above finished grade on cylindrical or rectangular reinforced concrete piers with 1-5/8", 316 stainless steel channel grouted into support pier. Tray shall be attached using resilient mounts (guide clamps), and expansion type fittings shall be installed at section joints, as necessary to alleviate stresses due to thermal expansion intermittent loading.
- 11 Tray system shall have adequate provisions for cable drop-in (at panel) and dropout (at wet well). Cable shall be adequately protected & supported. Contractor shall maintain adequate separation for intrinsically safe cables in accordance with NEC 504.
  - a Tray section below control panel shall be terminated using blind end plate with 3-sided bushed opening in cover to permit cable drop-in from control panel. Cables entering control enclosure shall be terminated using cable seal fittings in accordance with NEC 501-5(d)(1).
  - b A 4" radius dropout bushing shall be installed at cable entrance to wet well. Tray system shall be extended over wet well opening and be terminated with a blind end plate. Strain relief devices (stainless steel, wire mesh cord grips) shall be installed where cables enter wet well.

D Electrical Service Entrance Equipment: A U.L. Service Entrance listed disconnecting means shall be provided as follows:

- 1 Disconnect enclosure shall be NEMA 4X, heavy-duty type constructed of stainless steel. Contractor shall clearly label disconnect enclosure with the Service Voltage & Phase. Label plate shall be engraved phenolic permanently cemented, using 2-part, marine epoxy, to the front surface of the enclosure.
- 2 Disconnect shall be furnished with all necessary grounding and neutral connection kits required for installation and/or service entrance listing. Where terminations of multiple phase, neutral or ground conductors is necessary, equipment shall have the proper multi-barrel lugs to accommodate them.
- 3 Disconnect shall have overcurrent protection provided integral (breaker type) or located within disconnect enclosure (fusible) as indicated below:
  - a Where approved by NCDENR (on a case-by-case basis) a thermal magnetic type circuit breaker shall be used for the service disconnect.
  - b For NCDENR-MDR, fully compliant installations, a fusible switch shall be used for the service disconnect.

E Concrete Equipment Pads: Concrete Pads shall be furnished below all electrical equipment racks or as mounting surfaces for freestanding enclosures or generators. Pad shall be located and oriented such that all

electrical enclosures will remain outside any NFPA 820 designated hazardous area. Hazardous areas for all CMU wastewater-pumping facilities shall be based on a non-ventilated "combined" or "sanitary" sewer (NFPA 820, Table 2, Row 16a); "Residential" wastewater classification (Row 11a) shall not be used.

- 1 Pads shall be furnished to accommodate equipment load without cracking or settling, but in no cases shall they be less than 3600psi concrete; 10" minimum thick with 6x6/W1.4xW1.4 welded wire mesh reinforcement. Final elevation shall be 8" above grade. Pads at electrical racks or enclosures fully accommodate full width of enclosure & rack installation with 6" additional space on each side, and a minimum 3'6" in front of deepest cabinet and shall extend at least 6" behind enclosures.
  - 2 Pads shall be formed with two or more access windows to permit stub-ups for electrical/communications connections in control panel, generator/transfer switch or service equipment.
  - 3 Equipment pads shall have light brush (non-skid) finish and all edges, including those for wiring access, shall be chamfered.
- F Auxiliary Mounting rack: A steel mounting rack shall be provided at all facilities equipped with permanent generators for mounting of service disconnect, automatic transfer switch, telephone service terminal & other appurtenances not integral or attached to a freestanding enclosure. Rack & enclosures shall be located outside all hazardous areas (see mounting pad requirements above). Rack components and installation shall comply with the following:
- 1 Horizontal support members shall be constructed of 1-5/8" stainless steel, channel (Unistrut #P1100 or approved equal). Structure width shall be sufficient to accommodate mounting of designated equipment.
    - a Enclosures shall be mounted using stainless steel spring nuts & bolt connections at the enclosure's mounting bushings or brackets.
    - b Supports shall be mounted level and square to vertical posts using 3/8" stainless steel U-bolts, nuts & washers. The open side of the Unistrut channel shall face away from posts.
    - c Install protective end caps on all channels.
  - 2 Vertical posts shall be furnished and installed as follows:
    - a Posts shall be constructed of 3" ID rigid galvanized steel conduit and shall extend from 6'6" (max) above finished grade and 2'6" minimum below finished grade. Tops shall be sealed using threaded sleeves and insert plugs.
    - b Post shall be embedded in ground and ballasted with concrete (minimum 60lbs per post) to provide a rigid and plumb support for electrical equipment. Additional supports, embedding depth

or ballast material shall be provided as necessary to maintain a plumb & square installation.

### **7.03 Pump Station Electrical Equipment & Installation**

All materials for the pumping stations shall be new and shall be furnished by the Contractor in accordance with the following requirements:

A Pumps & Floats: Contractor shall furnish two (2) non-clog submersible centrifugal type pumps with electrical characteristics as follows (See Civil specifications for pumping and construction requirements):

- 1 Pump Motors: The pumps shall have a UL or FM listed, hermetically sealed, air filled submersible type, electric motor for operation at 460 Volt, 3 phase, 60 hertz power. They shall be designed for use in electrically hazardous locations (Class 1, Division 1, Group D) and for general use in pumping sewage. The motor shall be provided with thermal overload protection and a moisture detection system.
- 2 Motor & Float cable: Assemblies shall be UL approved for extra-hard usage and shall be of sufficient length to reach the control panel without the need of any splices. Where required by local authorities, each cable shall contain a grounding conductor in addition to any circuit conductors. Outer covering shall be oil resistant, thermoplastic. Conductor size shall be per NEC standard requirements.

B Pump Control System:

- 1 General: It is the intention that this specification shall cover a complete Electrical Pump Control System as hereinafter described and all necessary appurtenances that might normally be considered a part of the complete electrical system of this installation. All of the automatic control equipment is to be furnished by one manufacturer and supplied by the pump manufacturer. It shall be factory assembled, wired, and tested. Complete electrical drawings and instructions shall be submitted for approval.
- 2 Required Submittal Information
  - a In order for a system to be considered, it will be necessary for the contractor to provide three sets of written information completely describing the system. Should the system or the information describing it fail to describe its capability in meeting the job requirements or if the contractor fails to furnish complete information, the engineer shall regard the submittal as an inferior system and disregard the submittal.
  - b Electrical Contractor shall submit product information for all materials that will be used in the installation and interconnection of pumping system equipment. Such items shall include, but are not necessarily limited to: electrical wiring, conduits, fittings, cable tray, mounting struts, etc.
  - c This information shall include complete mechanical dimensions, electrical details and specifications of every

electrical device, valve, meter and instruments to be provided by this section. If a microprocessor or any other similar programmable system is being provided, manufacturer's literature shall be provided.

- d System sketches shall be provided of the hydraulic processes identifying the locations schematically of all process equipment being provided by this contract and the schematic location of the devices being provided in relation to the process equipment.
  - e A written system description of how the control system interacts with the process equipment shall be provided. A system schematic shall be provided indicating the relationship of telemetry equipment to the system. A sketch shall be provided of the main control panel indicating enclosure size and relative location of panel mounted equipment. All panel-mounted equipment is to be identified on this panel sketch so that their existence can be checked and functional relationships determined and wire routing can be verified.
- 3 Field Supervision: The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment.
- 4 Guarantee: All equipment shall be guaranteed against defects in material and workmanship for a period of one year from date of owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the owner.
- 5 Wiring: All wiring shall be of a single manufacturer. It shall be stranded, minimum 600-volt (UL) type MTW or AWM and have a current carrying capacity of not less than 125% of the full load current. The conductors shall be in complete conformity with the National Electric Code, state, local and NEMA electrical standards.
- a Wire ID Labeling: To ensure the safety of personnel and aid circuit tracing or troubleshooting efforts, all wiring shall be affixed with permanent ID labels at every termination. Application of ID labels shall be in strict accordance with the manufacturers wiring diagram. ID labels shall be pre-printed, heat-shrink sleeves (closed tube type). Wrapped tape or tag type labeling is not acceptable.
  - b Color Codes: All control/signal wiring shall be color coded as follows:
    - (1) "Normal" powered (hot) conductors, red; neutral (common) conductors, white.
    - (2) "Emergency/UPS connected" powered (hot) conductors, purple; neutral (common) conductors, white.
    - (3) Dialer alarm conductors shall be yellow.

- 6 U.L. Approval, Listing & Labeling: The control panels shall be constructed in compliance with Underwriter's Laboratories "Enclosed Industrial Control Panels Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions" (UL 698) listing and follow-up service, utilizing UL listed and recognized components where applicable. The control panels shall bear the Underwriter's Laboratory listed & serialized label.
- 7 Control panel Enclosure: The described equipment shall be housed in individual UL Type 3R stainless steel enclosures arranged for integral pedestal mounting where shown on the drawings. The enclosure shall be approximately 60" high, 12" deep and sufficiently wide to house control panel components & accessories. Enclosure shall have no pumping eyes or other nonessential penetrations.
  - a The enclosure shall be constructed of not less than 14-gauge stainless steel and suitable for installation in an unprotected outdoor location. It shall have a gasketed, hinged front weather door with three-point latching mechanism and padlockable handle.
  - b Data pockets shall be mounted to interior panel doors with bolts on welded steel anchors as follows:
    - (1) One 6" wide X 6" high X 1" deep data pocket shall be installed on front side of the inside door. Locate data pocket below elapsed time meters.
    - (2) One 12" wide X 12" high X 1" deep data pocket (for O & M manuals) shall be installed on the backside of the inside door.
  - c Control enclosure shall incorporate a hinged, dead front panel, behind the weather door such that all controls and meters necessary for routine operation are accessible without exposing the internal components and circuitry.
  - d All major components and sub-assemblies shall be identified as to function with laminated, engraved phenolic nameplates or similar approved means. A 12" X 18" laminated control panel print shall be permanently bonded to the backside of the exterior door. Pump data plate shall be mounted on inside of panel door identifying the pump manufacturer, voltage, full load amperes, impeller size, pump model, pump serial number, and pump rating (GPM @ TDH).
  - e Equipment control panels shall be sheltered by a white aluminum awning structure extending one foot beyond the back and sides and three feet to the front of the control panel. In no case shall the awning be smaller than the concrete slab for the equipment rack. See standard detail 6.
- 8 Power Supply and Metering



- a The incoming service shall be as noted on the drawings. All metering shall be done ahead of the main disconnect and control panel.
- b Control panel shall have an emergency battery backup system (UPS) to operate the local alarm light and horn for at least 120 minutes. Additionally, this backup power source shall power the intrinsically safe relay module monitoring the high wet well float such that a high level condition will be recognized and reported by the telephone dialer during losses of power and/or failure of on-site power back-up systems.
- c UPS power output shall be isolated during normal operation such that UPS failure cannot effect the normal operation of the pump station. UPS output shall be connected via a maintenance by-pass switch to allow easy maintenance, removal or replacement of the UPS.

9 Pump Circuit Breaker & Branch Circuit Breakers:

- a Symmetrical RMS fault current ratings for all circuit breakers (operating at service voltage) shall be coordinated to no less than maximum fault current availability from electric utility. Breakers serving pumps/motors shall be equipped with padlock hasp for lockout capability.
- b All circuit breakers shall be heavy-duty type with handles operable through the inner door. Circuit breakers shall be properly sized to protect equipment and wiring from overcurrent conditions.
- c Sufficient 120-volt, branch circuit breakers & transformer capacity shall be provided to serve all pump station appurtenances. Branch circuit breakers shall have fault current ratings of 10,000 amps symmetrical or greater. Branch circuit loads include, but are not necessarily limited to, the following:

- (1) GFCI outlet, Condensation Heater & Area Light
- (2) SCADA System (Future)
- (3) ½ hp Sump Pump (Future)
- (4) Electronic Control module
- (5) Block Heater
- (6) Battery Charger
- (7) Dialer & UPS input
- (8) Spare circuit.

10 Three Phase Voltage Monitor: A Three Phase Voltage Monitor shall be provided in control panel. Unit shall protect against phase loss, phase reversal and under voltage. Unit shall be fully adjustable and wired for offsite monitoring capability. Unit shall have automatic restart capability along with adjustable restart delays. Dialer shall be provided with (2) Form C contacts (to disable motors & alarm condition reporting via dialer).

11 Motor Starters: A motor starter shall be provided for each submersible pump motor. Overload devices shall be selected (or

adjusted) based on nameplate data of installed pump. Coil voltage and pump controls shall be 120-volt. Depending on pump size, starters will be NEMA rated, Full Voltage, Non-Reversing (FVNR) magnetic type or solid state, "Soft-Start" units as indicated:

- a FVNR motor starters shall be furnished for pump motors up to 20hp (unless otherwise directed by CMU, or required by local electric utility). Starters shall have ambient insensitive, thermal overload relays with manual reset.
  - b Soft-Start starters shall be provided for all pump motors exceeding 20hp. Starters shall be optimized for centrifugal pumping loads and equipped with integral shorting contactors (to by-pass Silicon Control Rectifier (SCR) circuit after start-up for increased efficiency & reduced heat build-up). Benshaw, Inc is the only approved manufacturer for the soft-start unit. Starter shall have adjustable, electronic motor protection/overload relay with auxiliary contacts for telemetry annunciation of pump failure.
- 12 Pump Data: The motor HP, full load amps, circuit breaker size, and motor starter size shall be shown on the vendor's shop drawings.
- 13 Control System: A packaged digital control system shall be furnished to monitor wet well levels and generate outputs for stop/run operation of two or more submersible pumps. System shall be equipped with an integral bubbler system providing analog output (for SCADA) and programmable start/stop/alarm indications & outputs for integration into the motor control circuits and/or local alarm/telemetry equipment. System shall have input connections for two (or more) backup floats. If bubbler system should fail, pumping operations will continue automatically via float level sensing. The electronic control system shall be by Digital Control Corporation (DCC) (part & specification numbers #11928 & #DS11928I respectively) or MultiTrobe/Flygt Model MT2PC.
- 14 Level Float Switches: High and low level float switches shall be installed to provide redundant level sensing to the control system for backup operation when bubbler system is off-line. Floats shall be wired via U.L. 913 listed, intrinsically safe control relays. All intrinsically safe wiring, terminals and components, shall be installed in accordance with the requirements of U.L. 698. All contractor installed connections & equipment shall be installed in full compliance with NEC 504.
- 15 Bubbler Tubing & Connections: Bubbler Tubing shall be 3/8" OD with 40 mil wall thickness. Tubing shall be black thermoplastic polyethylene. Tubing from panel through tray shall have no low points that may allow condensation to collect. Connections shall be made using flairless fittings of brass or stainless steel; "push-to-connect" type fittings are unacceptable.
- 16 Running Time Meter: A running time meter measuring hours and tenths of hours of operation up to 99999.9 hours shall be furnished for each pump motor indicated. This shall be a 120 VAC device operating

from the control voltage by an auxiliary contact of the motor starter or other run contact.

- 17 Selector Switches: A heavy-duty, three-position, hand-off-automatic selector switch shall be flush-mounted on the inner door of the control center for the operation of each motor magnetic starter. This selector switch shall operate the starter when it is in either the "hand" position or the "automatic" position and the automatic control system is calling for the operation of the equipment in the manner as herein described.
- 18 Status Indicators: Status indicator lights shall be incandescent only, furnished and mounted on the inner door as follows:
  - a Red pilot light indicating wet well "high level".
  - b Red pilot light indicating wet well "low level".
  - c Green "pump running" indicator lamps.
  - d Red "Over Temperature" indicator lamps.
  - e Amber "Pump Seal Failure" indicator lamps.
- 19 Enclosure Heaters: 120-volt protective heaters (for condensation prevention) with high temperature safety switch shall be supplied in the control panel. Heater wattage, quantity and placement shall be determined by panel manufacturer to suit panel volume and anticipated site conditions.
- 20 Weatherproof Alarm Light: A weather proof, high water alarm light assembly including a high impact resistant lexan red lens shall be included. The alarm light bulb shall be replaceable from inside the control panel without having to remove the weatherproof red lens from the panel. A solid-state flasher shall be included to strobe the alarm light for any of the specified alarm conditions.
- 21 Weatherproof Alarm Horn: A weatherproof audible alarm horn shall be provided. The horn will be side mounted to the control center and operate on 115 VAC with a typical 95 dB output. An alarm silence push button shall be included, mounted on the inner door.
- 22 Solid-State Telephone Dialer: Telephone dialer shall be furnished integral to control panel. Dialer shall have an assignable channel capacity of 16 and cellular phone back-up. Manufacturer/model shall be Antx, Inc./DiaLog Elite. Additional requirements are indicated below:
  - a Dialer shall have internal reporting for loss of AC power input. This capability shall be intrinsic to the device and should not require additional connections or the use of any assignable channels. Dialer shall have a published operational temperature range between -5° & 130°F.
  - b Upon detection of any alarm or status unit shall commence dialing up to 16, 10-digit, telephone numbers from a list associated with the particular alarm condition or combination thereof, and deliver a voice message describing the alarm condition(s).
  - c Message shall be a digitized human voice using channel specific vocabulary messages recorded by user. Once alarm receipt is positively acknowledged, (by keyed-in code), unit will

- enter a user programmable time-out mode, after which time, if the condition has not been addressed & corrected, the dialup operation will resume.
- d Unit shall have data logging capability, showing alarm conditions along with time/date stamp. Unit shall be capable of downloading such information to a printer via an integral RS-232C (parallel) printer port.
  - e An integral battery back-up power system shall have sufficient capacity to operate dialer for 16 hours (minimum) at full load (worst case) conditions.
  - f Unit shall have capability of functioning in as an intercom allowing the called or calling party to "listen-in" on the monitored environment (after satisfying the security access code).
  - g All alarm channels shall be programmable to accept either normally open or normally closed contacts. Dialer channel inputs shall be accept "dry" contact closures for monitoring alarm conditions as follows:
    - (1) Power failure (internal to dialer)
    - (2) (CH 11) High level (electronic control system alarm set point)
    - (3) (Ch 12) High level (float switch via intrinsically safe relay)
    - (4) (CH 13) Low level (electronic control system alarm set point)
    - (5) (CH 14) Low level (float switch via intrinsically safe relay)
    - (6) (CH 15) Power problem
    - (7) (CH 16) Overload Alarm Pump #1
    - (8) (CH 17) Overload Alarm Pump #2
    - (9) (CH 18) Pump 1 (thermal failure)
    - (10) (CH 21) Pump 2 (thermal failure)
    - (11) (CH 22) Pump 1 (seal failure)
    - (12) (CH 23) Pump 2 (seal failure)
    - (13) (CH 24) Generator failure
    - (14) (CH 25) Generator running
    - (15) (CH 26) Emergency power "ON" (ATS)
    - (16) (CH 27) SPARE
    - (17) (CH 28) SPARE
  - h Dialer shall be configured with a 3-watt analog cellular phone operating over the Advanced Mobile Phone System (AMPS). The dialer shall be capable of voice and data communication with calls originating from the dialer or an outside source. The DiaLogOnline internet service shall operate with the dialer over a cellular phone connection. Dialers shall operate using a landline or analog cellular phone without programming modifications. Cellular phones shall be equipped with an external directional antenna, surge protection, 120VAC power supply, back-up battery, and integrated battery charger.

Cellular phones shall be mountable on a sub-panel and connect to the dialer through a single modular phone jack connection. The directional antenna shall provide a minimum of 6dB gain in the 824-896 MHz frequency range. Antennas shall include an N-type female connection, lightning surge protection, and a minimum of 20 feet of cable.

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#### **7.04 Spare Parts**

The manufacturer is to furnish a list of all recommended spare parts including at a minimum two sets of fuses, indicator lamps and gaskets. The spare parts shall be provided, together with service manuals, prior to start-up date.

### **8.00 Emergency and Standby Power Systems**

#### **8.01 Systems**

The system shall be provided complete with all necessary automatic starting equipment, transfer switch, fuel tank, supply and return fuel oil piping, exhaust system/silencer, generator output circuit breaker, and all other necessary appurtenances for complete and operable system.

#### **8.02 Products**

A Engine Generator Set: The Generator, consisting of a performance matched diesel engine and electrical alternator, (see engine & alternator below) shall be the product of Caterpillar, Kohler, or Cummins.

- 1 The distributor must be authorized to perform warranty work on both the engine and generator. The distributor shall have factory-trained service personnel under their direct employ.
- 2 Supplier must have no less than sixty percent of all generator replacement parts in his stock at all times. Certified proof of this requirement shall be available from the distributor.
- 3 Generator capacity shall be sufficient to power all connected loads. Size shall be based on a 2-step generator loading sequence; Step #1 = "lead" pump & all appurtenances, Step #2 = "lag" pump. Acceptable performance under installed conditions shall be as follows:
  - a Starting voltage dip shall not exceed 30%.
  - b Steady state voltage shall be maintained within +/-0.25% from no load to full load.
  - c Steady state frequency regulation shall be +/-0.33% with a frequency dip of less than 5% from no load to full load.
- 4 Generator set capacity shall not be greater than 30% of fully loaded pump station facility.
- 5 The complete operating system, including engine generator set, accessories, and transfer switch, shall be furnished to the Contractor

by one vendor as a single, complete package to assure system responsibility and that vendor shall be the local factory authorized distributor of the engine company.

- 6 Generator shall be furnished in weatherproof enclosure. Batteries shall be located inside a weatherproof enclosure separate from main enclosure.
- 7 Generator shall be equipped with an NFPA 110, 12-light monitor and meter package as indicated below:

- a AC volt/ammeters w/phase selector switch.
- b Dual scale frequency/tachometer
- c A/C rheostat with  $\pm 5\%$  output voltage adjustment.
- d Light indicators w/alarm contacts as follows:

- (1) Generator run (green)
- (2) Low oil pressure alert (yellow)
- (3) High coolant temp alert (yellow)
- (4) Low oil pressure alarm (red)
- (5) High coolant temp alarm (red)
- (6) Overcrank shutdown (red)
- (7) Overspeed shutdown (red)
- (8) Switch Off, Auto-start mode off (flashing red)
- (9) Low coolant temp (yellow)
- (10) Low fuel (yellow)
- (11) Two (2) Auxiliary fault indicators (red lights)

- (a) Fuel leak detection
- (b) Unused spare indication

Alarms 2 through 11 shall be tied to a common failure alarm and routed to the control panel dialer as a "generator failure" - channel 13.

- B Engine: The engine shall be the product of Caterpillar, Kohler, or Cummins and shall be a model that has been manufactured and successfully operated for a period of one year.

- 1 The engine shall be of the four-cycle type, multi-cylinder, and capable of starting solely on No. 2 diesel fuel. The engine shall develop its respective rated horsepower at 1800 rpm. Rating shall be in accordance with the requirements of the Diesel Engine Manufacturer's Association of 85-degrees and elevation of 1500-feet.
- 2 Maximum or gross engine horsepower to produce standby generator KW ratings is unacceptable. Minimum engine horsepower at 1800 rpm will be determined by the formula below:

$$HP = [KW \div (EFF \times 0.746)] + RF + ACC + MF$$

Where,

HP = Minimum Engine Horsepower  
KW = Generator Rating in Kilowatts  
EFF = Gen-Set Efficiency  
RF = Radiator Fan Horsepower  
ACC = Accessory Horsepower  
MF = Manufacturing Tolerance

- 3 The engine shall be equipped with a 12 or 24-volt electrical starting system capable of starting cold on No. 2 diesel fuel. Engine shall automatically start on power failure and transfer to standby power and retransfer to normal power upon restoration. Engine shall be equipped with all auxiliaries recommended by the Manufacturer for proper, sure, quick starting of the engine including coolant heater as a cold weather starting aid.
- 4 Engine shall be liquid cooled via fin-tube radiator and engine driven blower fan. Radiator shall dissipate full load engine heat at a 110-degree F ambient temperature using a 50% ethylene glycol solution. Radiator top tank temperature shall not exceed 205°F.
- 5 Engine shall be equipped with an adjustable isochronous type electronic governor with stalled work capacity 50% greater than required. Governor shall be Woodward 2301 or equal by Barber Coleman.
- 6 Combustion exhaust shall be routed via a critical or hospital grade silencer and terminated with a hinged rain cap. Silencers furnished integrally with the sound attenuating weather housing are equally acceptable.

C Alternator: Alternator shall be the product of an established generator manufacturer and shall be a model that has been manufactured and successfully operated for a period to sufficiently establish its reliability.

- 1 Design shall be revolving field, single bearing, 4-pole, brushless, drip-proof construction. Temperature rise shall be no greater than 130°C at rated output.
- 2 Output shall be reconnectable, 12-lead type.
- 3 Excitation system shall employ a Permanent Magnet Generator (PMG) and shall provide 300% short circuit capacity for a 10 second duration to provide a reliable source of excitation power for optimum motor starting and short circuit performance.

D Batteries & Charger: Heavy-Duty lead-acid batteries and charger shall be provided with generator and mounted within weather enclosure.

- 1 12 or 24-volt battery system shall be provided to match engine cranking system. Capacity shall be for at least three cranking cycles (each cycle consisting of three 10-second cranks with five-second rest period between each crank), total cranking time of 160 seconds.
- 2 An automatic "float" type battery charger shall be provided to maintain the batteries at normal capacity and to recharge batteries after cranking.

- a The charger shall have fused 120-volt input with fused 12 or 24-volt output with ammeter/voltmeter displays.
  - b Regulated DC output with complete isolation from A.C. input to prevent battery in event of failure.
  - c Unit shall be capable of recharging a completely discharged battery in eight hours or less.
  - d The charger shall be U.L. listed and labeled.
  
- E Sound Attenuated Housing: A weather enclosure with noise attenuation features shall be furnished to limit the combined engine & exhaust noises produced by the generator. All generator installations shall limit noise to 75 dBA (average readings taken at 8 positions, measured 23' (7m) from unit centerline in a free field environment).
  
- F Automatic transfer switch (ATS): ATS shall be enclosed contactor type unit. Unit shall be continuous rated for all load types and furnished with all necessary contacts, relays and accessories required for proper operation. Transfer switches utilizing molded case or insulated case circuit breakers shall not be acceptable.
  - 1 ATS enclosure shall be weather/corrosion resistant stainless steel with UL-3R (or NEMA 4X) listing.
  - 2 ATS control shall be such that the engine shall continue to run for five minutes after retransfer to normal power and then shut down.
  - 3 ATS shall be furnished with 7-day exerciser clock for unattended exercising of engine.
  - 4 Auxiliary control and status contacts shall be furnished for generator starting, shutdown & off-site monitoring.
  
- G Low-Profile Platform or Sub-Base Fuel Storage Tank: Fuel storage tank of capacity indicated on drawings shall be of double-wall construction to provide secondary containment of fuel in the event of a weld, seam or other failure in the storage sections of the tank. The secondary containment shall provide at least 10% of the storage tank capacity. Tank capacity shall be of sufficient to provide no less than 24 hours of operation at the generator's full rated load. All materials shall be new and rust free and shall meet ASTM A36 Standards. On smaller units, sub-base type tanks are permitted if no generator controls, meters or breaker handles will be more than 6' above finished grade. For larger generators, a platform type tank shall be furnished providing a non-skid standing surface (18" minimum width) around the perimeter of the generator's weather housing. The overall enclosure should not be more than 8 feet in height.
  - 1 Tank design shall incorporate structural steel channels or I-beam side rails common to both the fuel tank and the secondary confinement. Top and bottom of both the fuel tank and secondary confinement sections shall be 10-gauge minimum sheet steel. Secondary confinement section of tank shall have a minimum depth of three inches.
    - a All internal cross members shall be sized to support the specified generator and all necessary appurtenances. Cross



- members shall be designed to allow free and equal flow of fuel through the storage tank and the secondary confinement section.
  - b A "stub-up" sleeve shall be provided through both the main fuel tank and secondary confinement section. Sleeve shall be 12-inches square and shall not compromise the secondary containment criteria. Sleeve shall be located below the output circuit breaker and generator control panel.
- 2 Construction of the tank shall be in two steps. The fuel tank section shall be constructed, deburred and pressure tested. The secondary containment section then shall be constructed, deburred and pressure tested.
- a Pressure tests shall be at 10 PSI minimum. Any defects shall be repaired and retested.
  - b All welds shall be continuous MIG or dual shield type.
- 3 The tank shall be equipped with the following fittings and appurtenances:
- a 2-inch N.P.T. manual fill pipe with cap located outside of enclosure.
  - b Mechanical fuel level sight located to allow monitoring during filling and to prevent over filling.
  - c Fuel supply and return fittings. Flexible fuel lines shall be provided between tank and engine.
  - d 3/4-inch N.P.T. vents with screened mushroom caps shall be provided for fuel storage and secondary containment sections of the tank.
  - e A leak detection device mounted in the secondary containment section of the tank with dry contacts for annunciation at the engine panel shall be provided.
  - f Provide low fuel alarm contacts to indicate at the engine panel when there is only three hours fuel remaining in the tank.

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### **8.03 Execution**

- A Shop Drawings, Manuals & Submittals: Drawings, details, and instructions necessary for installation of the generating unit and accessories shall be submitted prior to the purchase of any equipment. Such documents shall indicate compliance with performance specifications for loads served. The Contractor shall furnish operating and maintenance instructions and manuals and dimensional drawings.
- B Personnel instructions: Provisions shall be made for instruction of Owner's operating personnel during the construction period, and a concentrated instruction course during the final check and acceptance test stages.
- C Field tests: The engine generator sets shall first be broken in, in accordance with the recommendations of the Engine Manufacturer, and all safeties checked. After this the set shall be run two hours at 75% rated load, and then

immediately after by two hours at 100% rated load. Voltage performance shall be verified. Any problems or deficiencies found shall be corrected and test repeated until satisfactory. All required instrumentation for testing shall be provided.

- D Fuel: Upon installation of the tank, the Electrical Contractor shall fill the tank with diesel fuel and refill the tank at completion of testing and operation just prior to acceptance of the Project.

#### **8.04 Guarantee and Service**

- A Guarantee: All equipment and wiring shall be guaranteed against defects in materials and workmanship for a two year period from the activation of the system.
- B Service: the Manufacturer's factory trained service representatives shall perform all service.
  - 1 Routine warranty service for the equipment will be performed during normal working hours, (Monday thru Friday, 8:00 a.m. to 5:00 p.m., excluding City of Charlotte holidays). Emergency service provided at times other than stipulated above shall be provided from the same source at no additional cost to the Owner.
  - 2 The Manufacturer shall have a service facility within 120 miles of the Charlotte CBD with effective dispatching to assure a maximum two-hour on-site response to the Owner's request for service. The Manufacturer shall demonstrate this capability to the Owner and shall provide this minimum response under all reasonable circumstances.
  - 3 Upon satisfactory completion of all tests the Manufacturer's representative shall present to the Owner a proposal to provide semi annual inspection, service and testing of the system.

## **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. Valve 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.

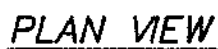
On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. All leaks and any defective material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification 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.

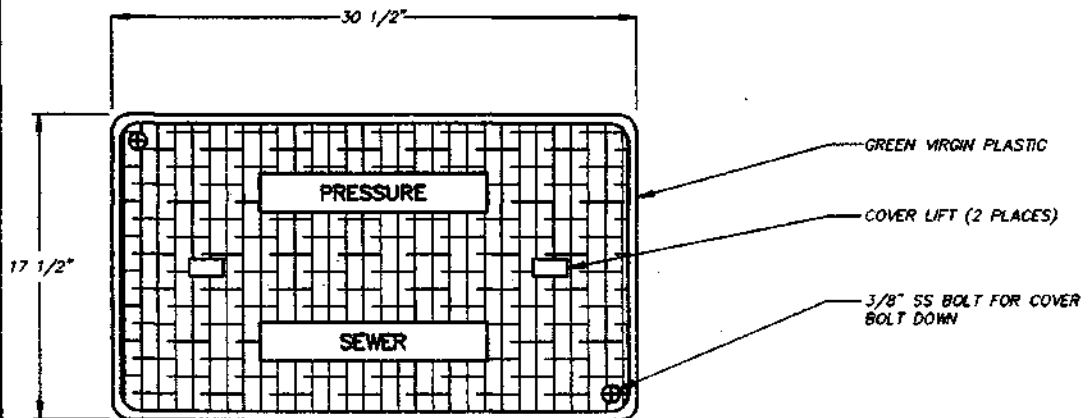
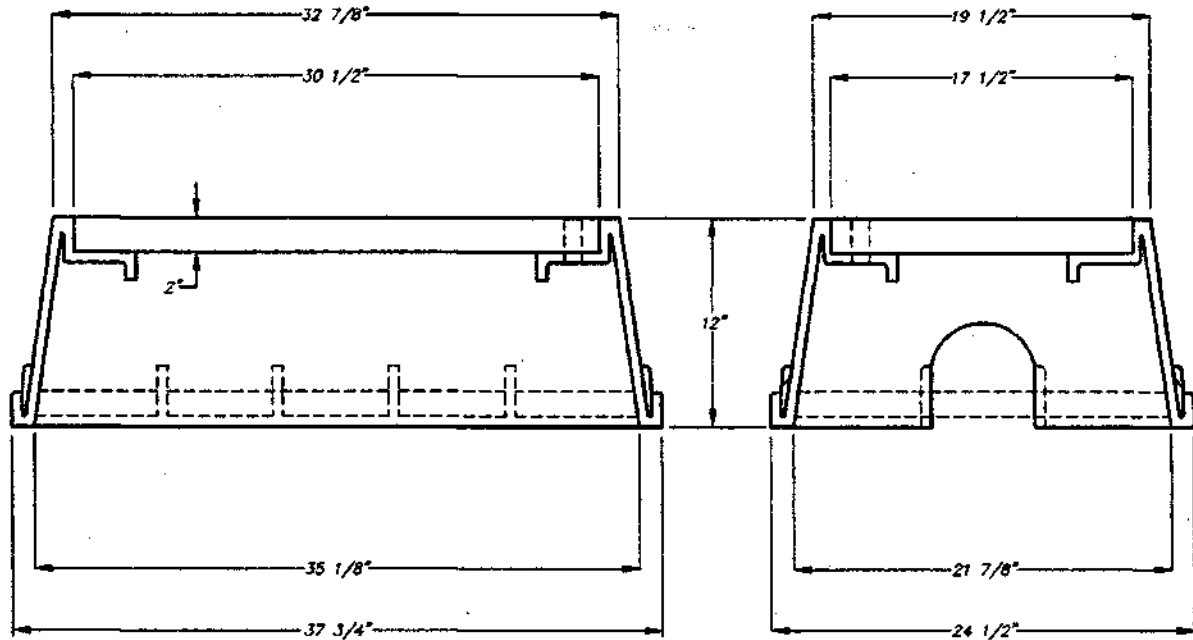
Specific procedures for testing mains are as follows:

- (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

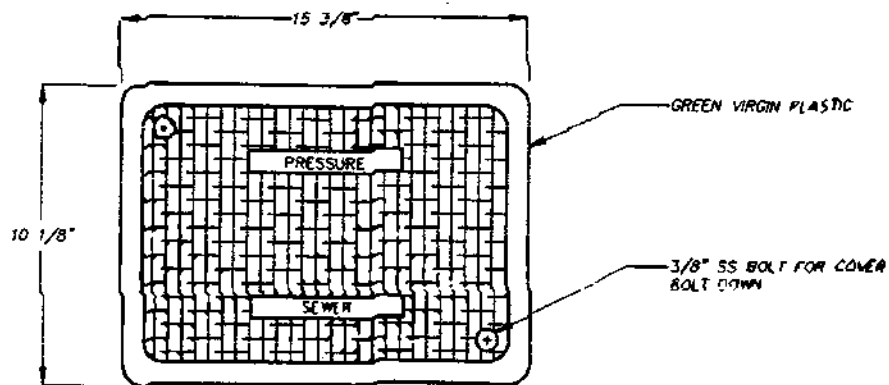
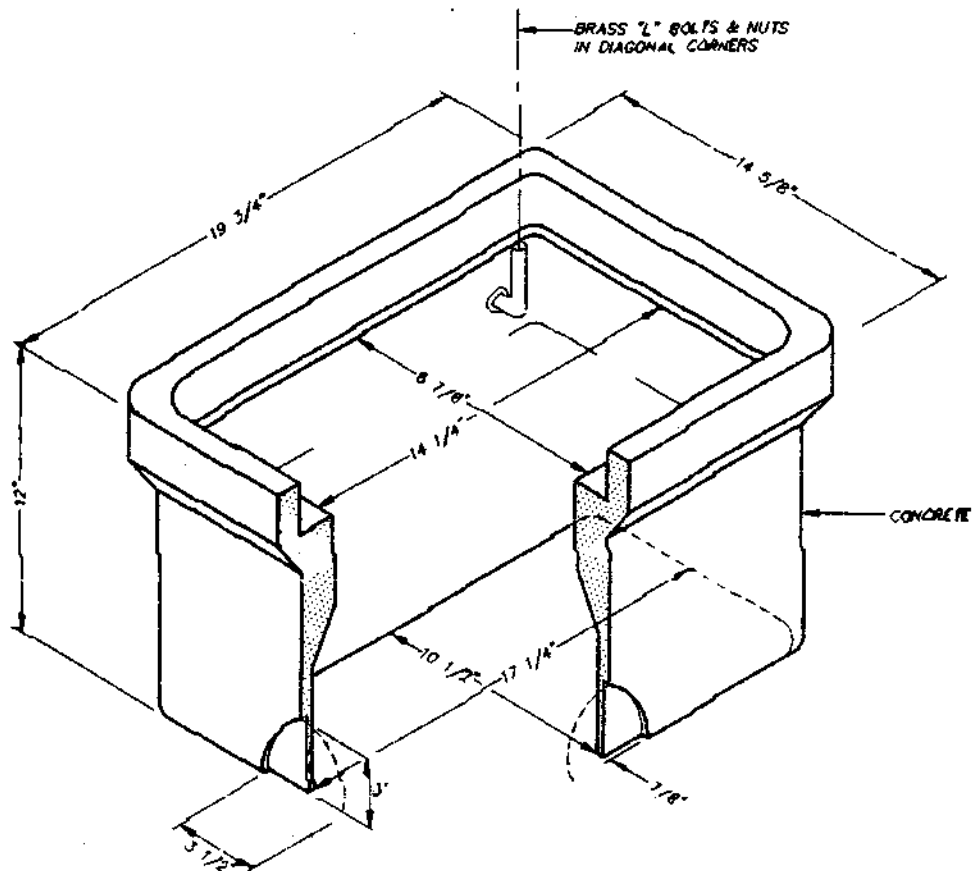
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

**STANDARD DETAIL  
PRESSURE SEWER**

**SERVICE BOX**

Job No. _____		File No. _____	
Scales		NTS	
PLAN			
PROFILE			
Hor.			
Vert.			
As Built	Date _____		
Surveyed By	Designed By	Drawn By	Project-Engr
KHP			
Approved By	K.B. [Signature]	Date	1/14/94
Sheet	3	Of	1

No.	Date	By	Revision



PLAN VIEW

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

Job No.	File No.
Scale	NPS
PLAN	
PROFILE	
Hor.	
Vert.	
As Built	Date
Surveyed By	Designed By

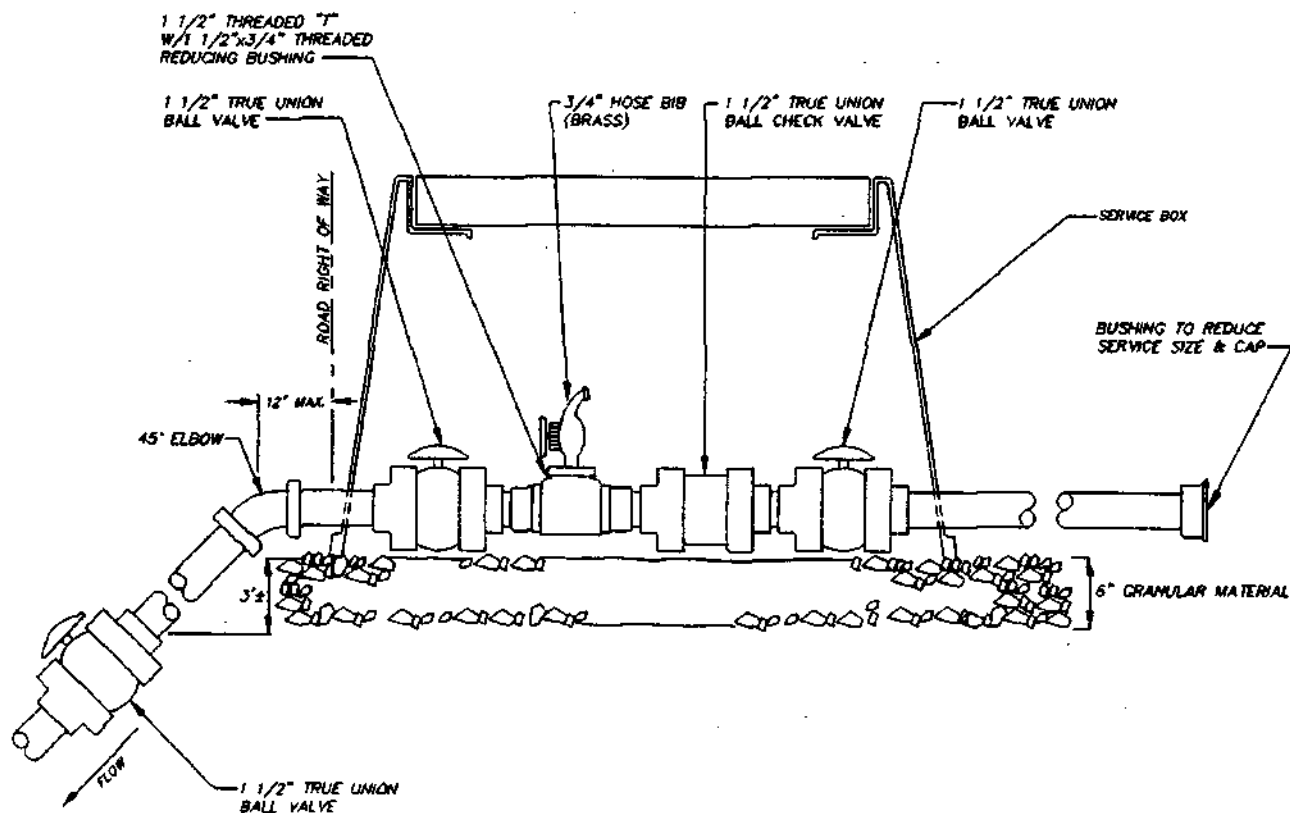
**STANDARD DETAIL  
PRESSURE SEWER**

**CLEANOUT BOX**

No.	Date	By
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Revision

KHP	Project-Eng	Approved By	Date	4
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**NOTES:**

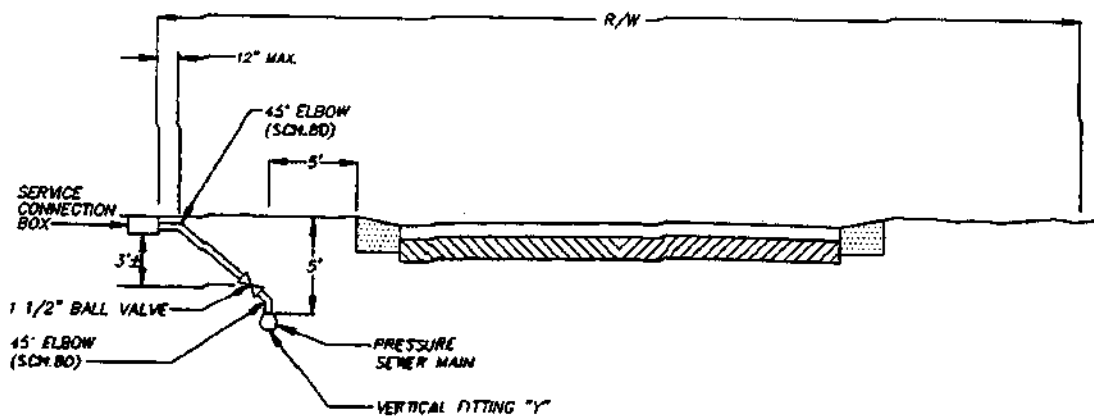
1. SERVICES SHALL BE CENTERED IN THE LOT ROAD FRONTAGE.
2. BOX SHALL NOT BE IN SIDEWALKS OR DRIVEWAYS.
3. TOP OF BOX SHALL BE FLUSH WITH FINISH GRADE OF LOT.

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

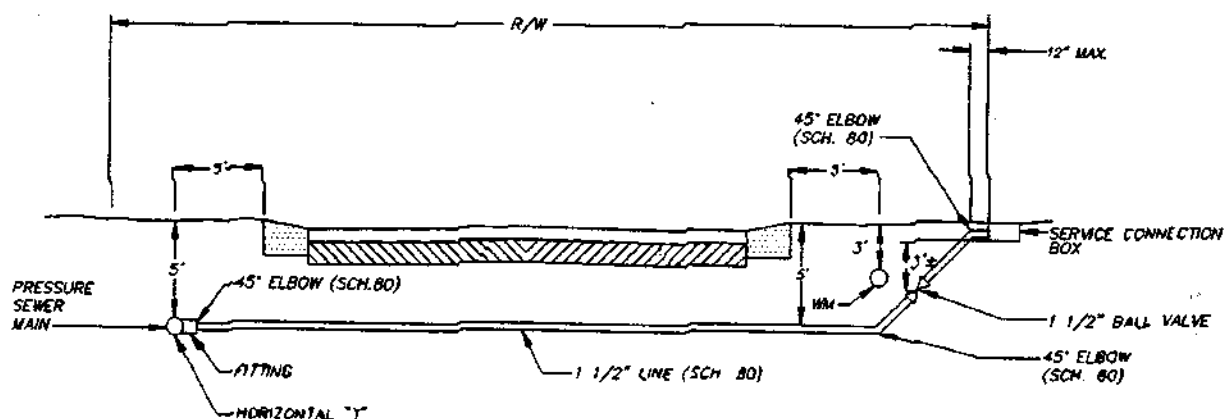
Job No. _____		File No. _____	
PLAN _____		Scale _____	
PROFILE _____		Hor. _____	
_____		Vert. _____	
As Built _____		Date _____	
Surveyed By _____		Designed By _____	
Drawn By _____		Project-Eng _____	
Approved By _____		Date _____	
Sheet _____		Of _____	

**STANDARD DETAIL  
PRESSURE SEWER**

**SERVICE CONNECTION**



**SHORT SIDE LATERAL SERVICE**

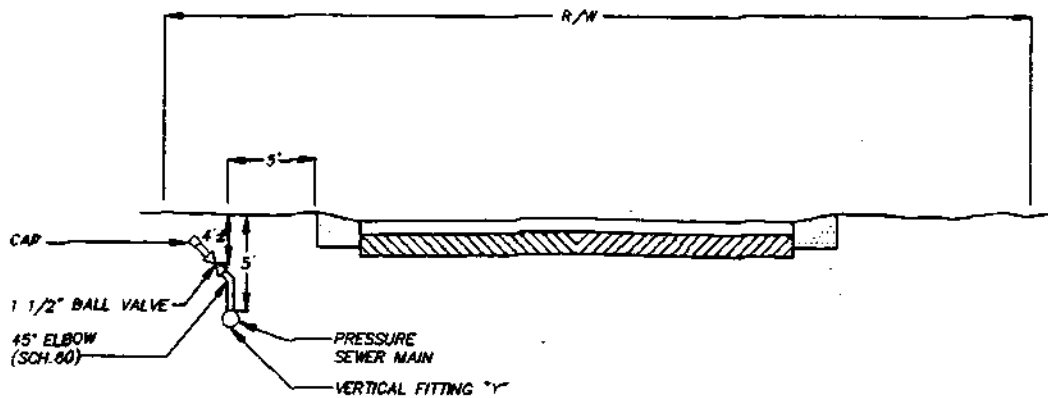


**LONG SIDE LATERAL SERVICE**

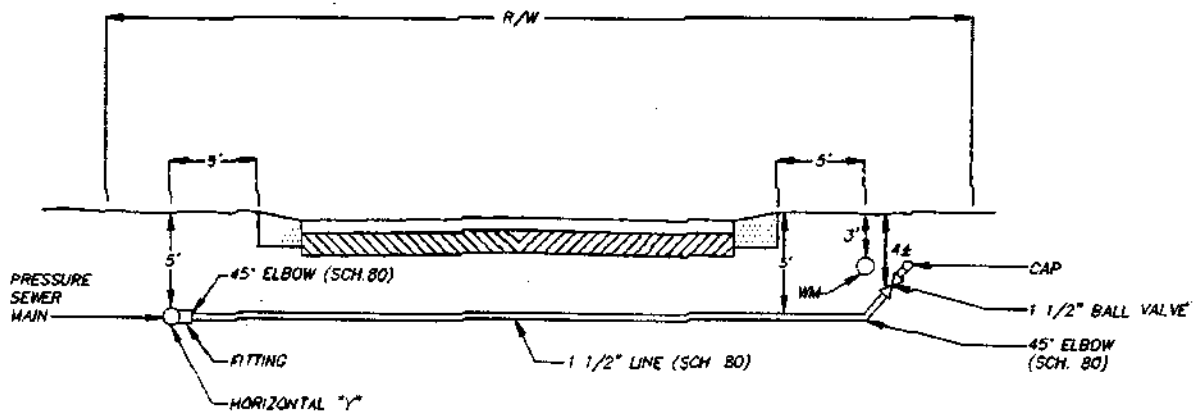
**CHARLOTTE-MECKLENBURG  
UTILITY DEPARTMENT  
ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____		File No. _____	
PLAN _____		NTS	
PROFILE _____		_____	
As Built _____		Date _____	
Surveyed By _____	Designed By _____	Drawn By _____	Project-Engr _____
Approved By _____		Date _____	
Sheet _____		Of _____	

1/5/94



### SHORT SIDE PARTIAL LATERAL SERVICE



### LONG SIDE PARTIAL LATERAL SERVICE

**NOTE:**

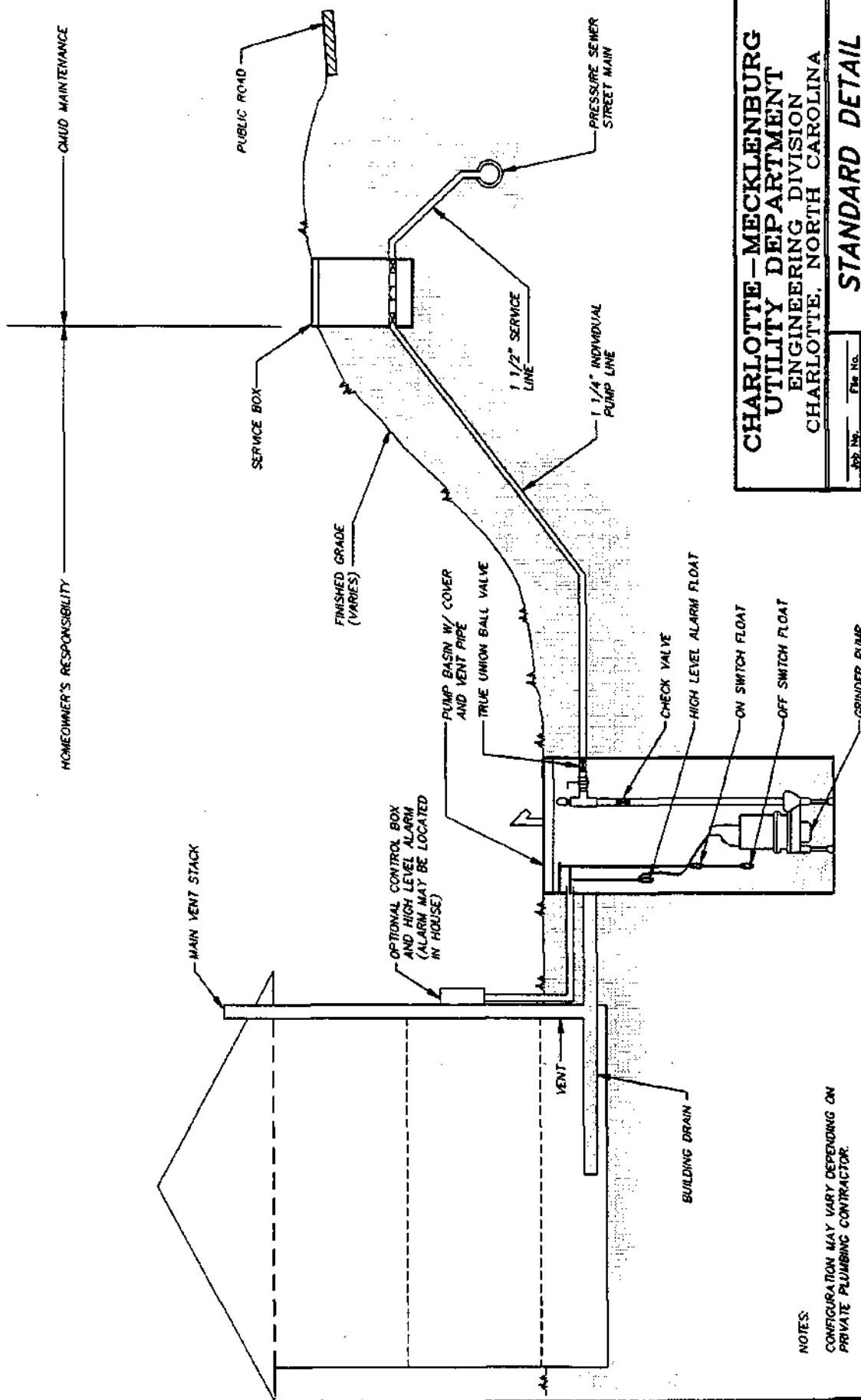
1. A PVC INCAPSULATED MAGNET SHALL BE ATTACHED TO THE VALVE FOR MAGNETIC LOCATION PURPOSES.

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ENGINEERING DIVISION  
CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL PRESSURE SEWER</b>	
Scale _____			
PLAN _____	NTS	<b>PARTIAL LATERAL SERVICE</b>	
PROFILE _____	Hor. _____		
Ver. _____	_____		
As Built _____	Date _____		
Surveyed By _____	Designed By _____	Drawn By <b>KHP</b>	Project-Engr _____
Revision _____		Approved By <b>[Signature]</b>	Date <b>1/28/95</b>
No. _____	Date _____	By _____	Sheet <b>1</b> of <b>1</b>



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**

**STANDARD DETAIL  
 PRESSURE SEWER  
 INDIVIDUAL GRINDER  
 PUMP SYSTEM**

Job No.	File No.	Scale	NTS
PLAN	PROFILE	Hor.	Vert.
As Built	Date	JMB	Designed By
Surveyed By	Drawn By	KHP	Project-Eng
Approved By	Sheet	8	Date

**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.

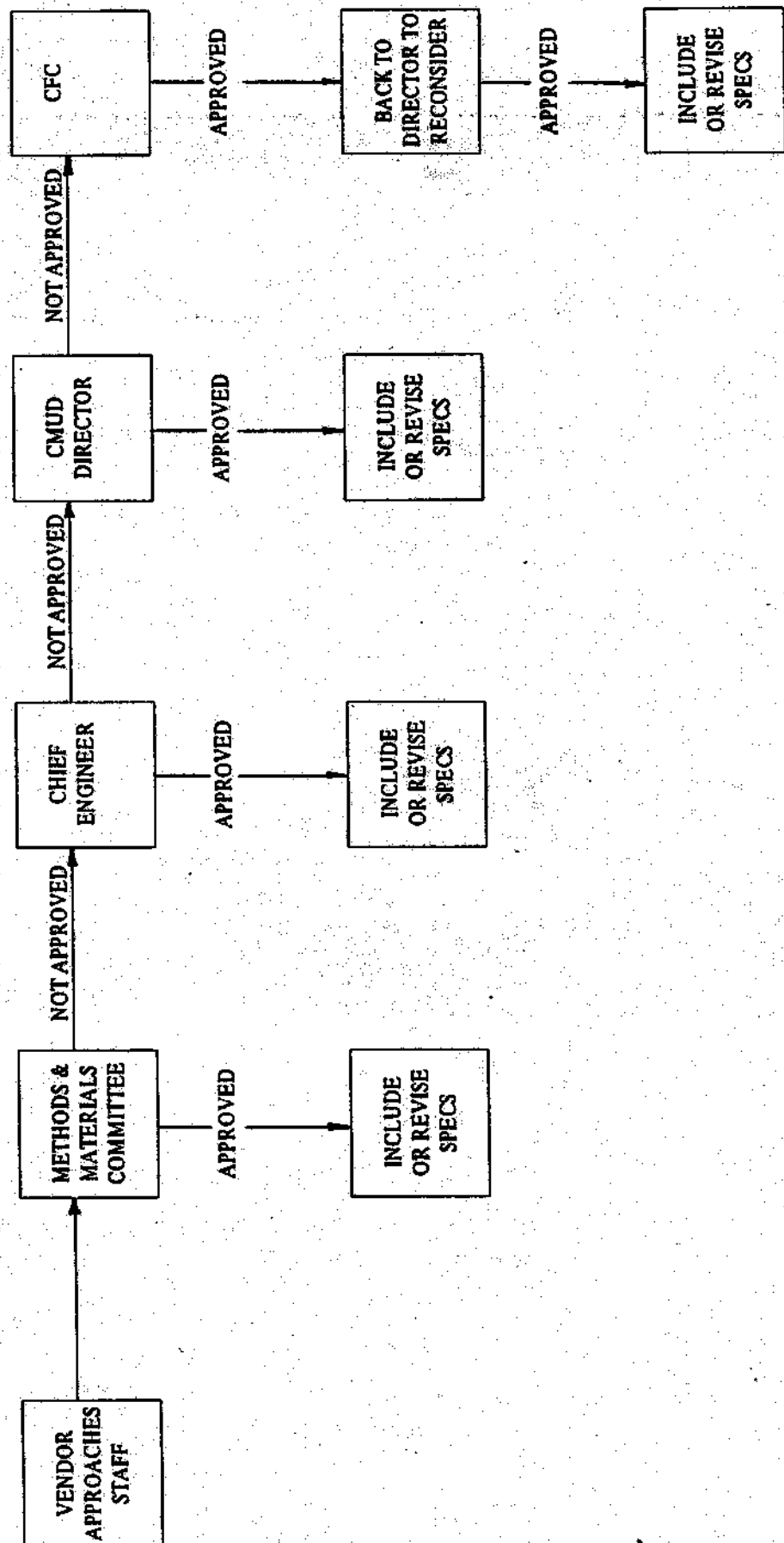
The committee is composed of two representatives from water/sewer contractors and the following CMUD personnel:

- 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

# **STANDARD SANITARY SEWER REHABILITATION SPECIFICATIONS**

## **MATERIAL SPECIFICATIONS FOR SANITARY SEWER REHABILITATION**

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, NSF, etc.) referred to herein shall be considered to be the latest revisions only.

### **A. CURED-IN-PLACE PIPE LINING**

1. Product Requirements: Cured-in-place pipe (CIPP) lining shall be one of the following products:

- Invert-A-Pipe by Improved Technologies Group
- National Liner by National EnviroTech Group, LLC
- Inliner by Inliner Technologies, Inc.
- Insituform by Insituform Technologies, Inc.
- Diamond Lining Systems by Daystar Composites LLC
- Premier-Pipe USA by J.W.M. Environmental, Inc.

The above products shall adhere to all requirements specified herein and shall be modified as necessary to meet these requirements.

The liner shall be composed of tubing material consisting of one or more layers of a flexible non-woven polyester felt with or without other additives such as fiberglass or other reinforcing additives. The felt tubing shall be impregnated with a thermosetting isothalic polyester resin and catalyst or vinyl ester and catalyst. The liner material and resin shall be completely compatible. The inside and/or outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric. The liner shall cure in the presence of water at the required temperature for the resin system. Steam-cure shall not be allowed unless approved by the Engineer in writing.

The felt material shall be manufactured by companies specializing in felt production for CIPP. The manufacturer shall have manufactured felt material for CIPP for at least 2 years as documented by references. The felt manufacturer, references and location of the manufacturing facility shall be submitted to the Engineer for review and approval. The felt material manufacturer and facility shall not change during construction unless specifically approved by the Engineer in writing.

The polyester or vinyl ester resin shall be PREMIUM, NON-RECYCLED resin only. Polyethylene Terephthalate (PET) resins, or those containing fillers, additives or enhancement agents shall not be used. The resin manufacturer shall not include any old resin or rework in the product shipped to the wet-out facility (i.e., where the liner

is impregnated with the resin). The resin shall be manufactured under ISO 9002 certified procedures. Such certification shall be submitted to the Engineer for each shipment of resin to the wet-out facility. The proposed resin shall equal or exceed the published properties of Reichhold PolyLite 33420 resin (for isothallic polyester resin) or Reichhold Atlac 580-20 (for vinyl ester resin).

The exact makeup of the resin shall be submitted to the Engineer including chemical resistance information, cure logs and temperatures. Polyester resins shall have a minimum Heat Distortion Temperature of 212°F per ASTM D648. Vinyl ester resins shall have a minimum Heat Distortion Temperature of 220°F per ASTM D648.

The exact mixture ratio of resin and catalyst shall also be submitted. The catalyst system shall be identified by product name. The resin/catalyst ratio shall be approved by the resin manufacturer in writing. The catalyst system shall be made up of a primary catalyst and a secondary catalyst. The primary catalyst shall be Akzo Perkadox 16 or approved equal and shall be added at a maximum of 1% of the resin volume by weight unless otherwise approved by the Engineer. The secondary catalyst shall be Akzo Trigonox or approved equal and shall be added at a maximum of 0.5% of the resin volume by weight unless otherwise approved by the Engineer. The resin/catalyst system shall be formulated so that the CIPP will cure as specified below. Quick-cure or accelerated resin systems that cure in half the specified time or substantially quicker than the minimum 3 hours specified below will not be allowed. Quick-cure resin systems include those formulated by substantially increasing the amount of catalysts from that specified above. Resins, catalysts and resin/catalysts mixing ratios shall not be changed during this Contract unless specifically approved by the Engineer in writing.

The cure schedules for the CIPP shall be submitted to the Engineer for review. The curing process/schedules shall be approved by the resin manufacturer in writing. The cure schedules shall include specific information on stepping the temperature up to “cooking” temperatures, “cooking” temperatures and durations, and cool-down procedures – all to be approved in writing by the resin manufacturer.

The resin shall be shipped directly from the resin manufacturer’s facility to the CIPP wet-out facility. The resin shall not be sent to any intermediate mixing facility. Copies of the shipment documents from the resin manufacturer shall be submitted to the Engineer showing dates of shipment, the originating location and the receiving location.

The resin shall be used to manufacture the CIPP as shipped. No fillers or additives shall be added at the wet-out facility except for the required catalyst as recommended by the resin manufacturer. The Contractor shall submit the catalyst product and quantity recommended by the resin manufacturer (submittal to include direct correspondence from the resin manufacturer). The Contractor shall also submit a Certificate of Authenticity from the resin manufacturer for each shipment to the wet-out facility (to include the date of manufacture and the Heat Distortion Temperature).

This information shall be submitted prior to manufacturing any CIPP.

The application of the resin to the felt tubing (i.e., wet-out) shall be conducted under factory conditions and the materials shall be fully protected against ultraviolet (UV) light, excessive heat and contamination at all times.

The Contractor shall identify the wet-out facility where all CIPP will be manufactured. All CIPP shall be manufactured from this designated wet-out facility unless specifically approved otherwise by the Engineer in writing. Multiple wet-out facilities shall not be allowed.

The Engineer, Owner and/or an agent of the Owner may inspect the CIPP during manufacturing (i.e., wet-out). The Contractor shall submit a schedule for manufacturing the CIPP to the Engineer every Friday for the following week. The Engineer and Owner must be given an opportunity to witness the manufacturing of all CIPP. If the CIPP is manufactured without providing the required notice to the Engineer, the CIPP will be marked as rejected prior to installation and will not be approved for installation.

If the Engineer and/or Owner decide to inspect the manufacturing of the CIPP, the Contractor shall provide full access to witness the wet-out process and shall provide any and all information related to the manufacturing as requested by the Engineer, Owner or the Owner's agent without delay and without claims of confidentiality or product privacy.

The Engineer or Owner may take samples of the resin from the wet-out facility for infrared (IR) analyses (i.e., IR Scan) throughout the duration of construction. This standard analytical test involves shining a beam of light in the IR frequency region through a thin sample of the subject resin. The frequency of light is then varied across the IR spectrum. Chemical functional groups present in the resin being analyzed will absorb IR light as specific frequencies and with characteristic absorption intensities.

The Owner will pay for all such IR analyses and resin testing. To allow the resin samples to be taken, the Contractor shall place a sampling valve in-line at a point prior to the resin/catalyst mixing stage and after the resin/catalyst mixing stage. These sampling valves shall remain in place throughout the duration of construction and shall always be accessible to the Engineer and Owner.

The IR analyses will be used to verify that the resin and resin/catalyst composition and mixture being used is the approved resin and resin/catalyst system. Payment will not be made for any CIPP manufactured with unapproved resin and resin/catalyst mixtures. The Contractor shall submit results of IR analyses of the proposed resin and resin/catalyst mixture, performed and certified by the resin manufacturer, prior to manufacturing any CIPP as a shop drawing. The results of these analyses (the resin's chemical fingerprint) will be used as the standard for verifying the resin and

resin/catalyst mixture being used throughout construction.

The Engineer will compare the submitted chemical fingerprint with the fingerprint of Reichhold PolyLite 33420 resin (for isothalic polyester resin) or Reichhold Atlac 580-20 (for vinyl ester resin) for a baseline comparison. The Contractor and resin manufacturer shall fully describe, explain and justify any differences between the Reichhold and proposed resin fingerprints without delay or claim to confidentiality.

When cured, the CIPP shall form a continuous, tight-fitting, hard, impermeable liner, which is chemically resistant to any chemicals normally found in domestic sewage. The liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to the sewer pipe to be lined.

The CIPP shall be fabricated to a size that will tightly fit the sewer being rehabilitated after being installed and cured. The liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing the liner. All dimensions shall be verified in the field by the Contractor prior to fabrication of the liner. Field measurements shall be used to ensure maximum closure between the new liner and the existing sewer pipe. There shall be no leakage of groundwater between the existing pipe and the CIPP at the manhole connection or service lateral connections. Any leakage found shall be eliminated by the Contractor at no additional cost to the Owner.

The length of the liner shall be the length deemed necessary by the Contractor to effectively carry out the insertion of the liner and sealing of the liner at the outlet and inlet manholes. The required length of liner shall be verified in the field by the Contractor prior to fabrication of the liner.

The cured liner shall have the following minimum structural properties:

- Flexural Strength of 4,500 psi per ASTM D790
- Flexural Modulus of 250,000 psi per ASTM D790
- Tensile Strength of 3,000 psi per ASTM D638

The Contractor shall submit complete shop drawings of CIPP to demonstrate compliance with these specifications, to show materials of construction (including resins, catalysts, etc.) and to detail installation procedures. Installation procedures shall include acceptable inversion heads and pressures, heating (i.e., cooking) and cool-down procedures and temperatures, times for each stage of the process, and cure logs for the resin/resin system used. The Contractor shall provide this information without delay or claim to any confidentiality. Testing procedures and quality control procedures shall also be submitted.

Certifications that the CIPP was manufactured in accordance with these specifications

and the appropriate ASTM standards shall be submitted with each shipment. The certifications shall include a signed statement by the wet-out manager/supervisor that no fillers were added to the resin system during manufacture of the CIPP. In addition, wet-out forms documenting the wet-out shall be submitted for each section of CIPP manufactured. The wet-out forms shall be submitted prior to requesting payment and shall be provided without delay or claim to any confidentiality. The wet-out forms shall document the date and time of wet-out, the wet-out supervisor, the wet-out facility address, the location where the CIPP will be installed (by work order and manhole numbers), the CIPP diameter, the length of wet-tube and dry-tube, the thickness of the CIPP, the roller gap setting for establishing the liner thickness, the felt manufacturer, the resin used (by product name and batch/shipment number) and quantity, the catalyst(s) used (by product name) and quantity, any quality control samples taken, and all else pertinent to the wet-out process.

2. Liner Thickness: The Contractor shall submit liner thickness calculations to the Engineer for review. The CIPP shall be designed in accordance with the applicable provisions of ASTM F1216 and ASTM D2412 for “fully deteriorated gravity pipe conditions” and shall meet the following design conditions:
  - a. AASHTO H-20 Live Load with two trucks passing over CIPP in streets (16,000 lbs).
  - b. A soil modulus of elasticity of 1,000 psi, soil weight of 120 pounds per cubic foot and a coefficient of friction of  $K_u' = 0.130r$ .
  - c. Short-term flexural modulus of 250,000 psi and long-term flexural modulus of 125,000 psi. Flexural strength of 4,500 psi.
  - d. Safety factor of 2.0 shall be used.
  - e. Groundwater elevation at the ground surface.
  - f. Pipe ovality of 2%.
  - g. Poisson’s ratio of 0.3.
  - h. Enhancement factor (K) of 7.
  - i. Service temperature range shall be 40°F to 140°F.
  - j. Maximum long term deflection shall be 5 percent.
  - k. The installed, cured thickness shall be the largest thickness as determined by calculations for deflection, bending, buckling and minimum stiffness. The minimum installed, cured liner thickness shall be as follows, regardless of what the calculations indicate as the required minimum thickness:



8" sewer:	6 mm up to 17 feet deep 7.5 mm up to 25 feet deep
10" sewer:	6 mm up to 11 feet deep 7.5 mm up to 18 feet deep 9 mm up to 25 feet deep
12" sewer:	7.5 mm up to 12 feet deep 9 mm up to 18 feet deep 10.5 mm up to 25 feet deep
15" sewer:	7.5 mm up to 10 feet deep 9 mm up to 14 feet deep 10.5 mm up to 20 feet deep

The installed thickness shall be measured as specified elsewhere herein. The Contractor shall submit his proposed plan for ensuring that the installed CIPP meets the above minimum thickness requirements. The plan shall include the proposed CIPP thickness to be installed (pre-installation thickness) and detailed inversion or pull-in procedures to reduce stretching and to reduce migration of resin.

3. Reference Standards: The following American Society for Testing and Materials (ASTM) standards are referenced herein:
  - a. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
  - b. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - c. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
  - d. ASTM D5813 – Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
  - e. ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
  - f. ASTM F1743 – Standard Practice of Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)

Where reference is made to one of the above standards, the latest revision shall apply.

## **B. MANHOLE LINING**

1. Cementitious Manhole Lining System: The cementitious manhole lining system for the interior of manholes shall be a monolithic system suitable for use as a trowel or spray-applied monolithic surfacing in sewer manholes. The cementitious lining system shall be one of the following products or approved equal:

- Strong Seal MS-2A, MS-2C, or High Performance by Strong Seal Systems
- QM-1s Restore or Aluminaliner by Quadex
- Cemtec Silatec MSM or CAM by A.W. Cook Cement
- Sewpercoat PG by Kerneos, Inc.
- Permacast MS-10,000 or CR-5000 by Action Products Marketing Corp.
- PerpetuCrete MSC or CA by Protective Liner Systems
- Mainstay ML-72, ML-CA or ML-PF by Madewell
- Reliner MSP or Maximum CA Cement by Standard Cement Materials

Where hydrogen sulfide resistance is required and when specified by the Engineer, the cementitious lining system shall be a 100% calcium aluminate product (product comprised of calcium aluminate cement and calcium aluminate aggregate). Partial calcium aluminate products (or blended products) shall not be considered an equal and shall not be approved. The 100% calcium aluminate products shall be one of the following products or approved equal:

- High Performance by Strong Seal Systems
- Sewpercoat PG by Kerneos, Inc.
- Mainstay ML-PF by Madewell
- Maximum CA Cement by Standard Cement Materials

The cementitious lining system shall be a pumpable cementitious mortar product specifically for manhole rehabilitation and shall be installed via low-pressure application only. The materials shall be suitable for all the specified design conditions.

The cementitious lining shall be installed on the benches and walls of existing manholes as shown in the Details. All cementitious lining shall be troweled smooth after spray application. The cured cementitious lining shall be applied to a minimum total thickness of 1 inch.

The cured surfacing thickness shall be smooth, even (without ridges or bumps) and continuous with proper sealing connections to all unsurfaced areas.

The materials used in the cementitious lining systems shall be mixed on site in accordance with the manufacturer's recommendations. Water shall only be added to the materials during the mixing process and prior to material pumping or spray application. No water shall be added at the nozzle.

The cementitious liner when cured shall have the following minimum characteristics at 28 days as measured by the applicable ASTM standards referenced herein:

Minimum compressive strength of 6,000 psi

Minimum bond strength of 130 psi

Shrinkage of less than 0.05%

The cementitious lining shall provide a minimum service life of 25 years.

The cured cementitious lining shall be continuously bonded to all the brick, mortar, concrete, chemical sealant, grout, pipe and other surfaces inside the sewer manhole. Provide bond strength data on cured, cementitious lining based on ASTM test methods referenced herein.

Chemical sealants or grouts used to seal active manhole leaks, to patch cracks, to fill voids and to otherwise prepare the manhole surfaces for the lining installation shall be suitable for the intended purpose and shall be compatible with the lining as certified by the manufacturer.

When cured, the monolithic cementitious lining shall form a continuous, tight-fitting, hard, impermeable surfacing which is suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage.

The monolithic cementitious lining shall cover the complete interior of the existing sewer manhole including the benches (shelves). The lining shall effectively seal the interior surfaces of the sewer manhole and prevent any penetration or leakage of groundwater infiltration.

The lining shall be compatible with the thermal condition of the existing sewer manhole surfaces. Surface temperatures will range from 20oF to 100oF. Provide test data on shrinkage of the cementitious lining based on the ASTM standards referenced herein.

All invert channels shall be coated with grout or cementitious mortar to build up the invert channel to the invert elevations of the new liner pipes; to fill all voids, cracks, holes, etc.; and to form a smooth flow channel. The entire channel shall be coated. The coating shall be a minimum ¼-inch thick.

The Contractor shall submit complete shop drawings of manhole lining system to demonstrate compliance with these specifications, to show materials of construction and to detail installation procedures. Testing procedures and quality control procedures shall also be submitted. Certifications that the manhole lining was manufactured in accordance with these specifications and the appropriate ASTM standards shall be submitted with each shipment.

2. Epoxy Manhole Lining System: In some applications, the Engineer may specify that

an epoxy product be installed for hydrogen sulfide protection in lieu of the specified 100% calcium aluminate products. The minimum thickness of the epoxy coating shall be 160 mils. The epoxy shall be Raven 405 by Raven Lining Systems, NPR-5300 by NeoPoxy International, or approved equal.

3. Outside Coating: Whenever the outside of exposed manholes walls are specified to be coated with a special exterior cementitious mortar product, the exterior mortar shall be HB2 Repair Mortar by ThoRoc, SikaTop 123 by Sika Corporation, or approved equal.

## **C. PIPE BURSTING**

1. Product Requirements: Replacement pipe installed by pipe bursting shall be high density polyethylene (HDPE) pipe. The pipe shall be manufactured from a high density, high molecular weight polyethylene resin which conforms to ASTM D1248 and meets the requirements for Type III, Class A, Grade P34, Category 5 and has a Plastic Pipe Institute (PPI) rating of PE 3408 when compounded. The pipe produced shall have a minimum cell classification of 345434D or 345434E under ASTM D3350. The HDPE installed shall be minimum SDR 17 and shall be capable of supporting the full-bearing load. Contractor shall submit thickness calculations. Sections of HDPE shall be butt-fused in accordance with the HDPE manufacturer's specifications.
2. Service Connections: Connection of the new service lateral to the mainline shall be accomplished by means of a compression-fit service connection saddle or an electrofuse saddle. The service connection shall be specifically designed for connection to the sewer main being installed, and shall be Romac CB Saddle as manufactured by Romac Industries, Inc., Central Plastics Electrofuse Saddle, or approved equal.
3. Reference Standards: The following American Society for Testing and Materials (ASTM) standards are referenced herein:
  - a. ASTM D1248 Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
  - b. ASTM D3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials

Where reference is made to one of the above standards, the latest revision shall apply.

## **D. INJECTION GROUTING**

1. Product Requirements: The grout used to completely stop identified leaks shall be Hydro Active Cut by DeNeef Construction Chemicals or approved equal.

The grout shall be suitable for injection and shall expand to seal identified leaks. The grout shall be installed per the manufacturer's recommendations. The material shall be suitable for all the specified design conditions.

The grout shall provide a minimum service life of 25 years. When cured, the grout shall be suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage. The grout shall be compatible with the thermal condition of the existing sewer manhole surfaces. Surface temperatures will range from 20°F to 100°F.

The grout shall effectively seal the identified leak in the sewer manhole and prevent any penetration or leakage of groundwater infiltration at this location or other nearby locations or within the same pre-cast manhole joint as a direct result of the injected grout.

The Contractor shall submit complete shop drawings of the injectable grout to demonstrate compliance with these specifications, to show materials of construction and to detail installation procedures. Testing procedures and quality control procedures shall also be submitted.

## **DETAILED SPECIFICATIONS FOR SANITARY SEWER REHABILITATION**

### **A. CURED-IN-PLACE PIPE LINING**

1. Qualifications: The Contractor performing the CIPP lining work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by the CIPP manufacturer. The Contractor shall have installed a minimum of 300,000 feet of CIPP for a minimum of five years. The full-time, on-site superintendent/foreman that will supervise the CIPP installation shall have installed at least 150,000 feet of a cured-in-place pipe lining system for a minimum of two years. The total footage claimed shall be supported by Owner references. The Contractor shall submit information to document his experience and the experience of the proposed superintendent/foreman.
2. Delivery, Storage and Shipping: Care shall be taken in shipping, handling and laying to avoid damaging the CIPP. Extra care shall be taken during cold weather construction. Any CIPP damaged in shipment shall be replaced as directed by the Engineer. Any CIPP showing a split or tear or has been mishandled shall be marked as rejected and removed at once from the work site. The liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. Any liner showing evidence of premature curing will be rejected for use and will be removed from the work site immediately.
3. Cleaning and Television Inspection of Main Sewers Prior To Installing CIPP Lining: The Contractor shall first thoroughly clean and televise the sewer and submit one copy of the final television inspection videos to the Engineer for review as specified herein.

The Contractor's cleaning operations shall fully clean the sewers and remove all roots, grease and debris to facilitate the CIPP lining installation. The cleaning shall be performed prior to the pre-rehabilitation television inspection. No cleaning equipment shall be in the sewers while the pre-rehabilitation CCTV inspections are being performed. Acceptance of the cleaning portion of the work shall be dependent upon the results of the pre-rehabilitation television inspection. Lines not acceptably clean as to permit television inspection or the subsequent lining installation shall be re-cleaned, re-inspected and re-submitted to the Engineer for review at no additional cost to the Owner.

The equipment used for the cleaning operations shall be specifically designed for cleaning sewers. The Contractor shall use the appropriate equipment to clean all debris, roots and grease from each sewer segment thoroughly. The required equipment may be high velocity water jet cleaning equipment with various attachments or mechanical cleaning equipment such as power buckets or power rodders. The Contractor shall select the cleaning equipment and procedures based on the conditions of the sewers at the time the work commences. All solids shall be removed at the downstream manhole of the section being cleaned - passing material

from one sewer segment to another will not be permitted. Cleaning operations shall begin at the most upstream sewers and proceed downstream. The solids shall be removed from the site and properly disposed of at approved locations provided by the Contractor. A Vehicle Mounted Permit from CMUD will be required to obtain water from fire hydrants for cleaning operations.

The Contractor shall take precautions to avoid damage or flooding to public or private property being served by the line being cleaned. The Contractor shall be responsible for all flooding and pay for cleanup from flooding to the satisfaction of the property owner. The Contractor shall document all backups and submit documentation to the Engineer including the reason for the backup, the time and date of the backup, the property owner's name, address and phone number, the resolution to problem, the time and date the problem was resolved, and any special cleanup work that had to be performed. This required documentation shall be submitted for all backups regardless of when they occur.

All cleanup shall be completed within 4 hours of the backup. The Contractor shall take care in cleaning older sewers and shall protect existing sewers from damage caused by improper use of cleaning equipment.

After the sewers are completely cleaned, the sewers shall be inspected via closed circuit television (CCTV). The purposes of the CCTV inspections are to verify that the sewers have been thoroughly cleaned, to document the condition of the existing sewers and the locations of service connections, to locate sewer defects requiring repair prior to lining, and to confirm that the lining can be properly installed and cured. The Contractor shall use extreme caution during all cleaning and television inspection work, as the sewer mains are likely old and may be in poor structural condition.

Upon completion of the cleaning and television inspection work, the Contractor shall submit one copy of the final CCTV inspection videos to the Engineer. The videos shall be clearly labeled as to their contents. The final inspection shall mean that the sewer has been completely cleaned (no roots, debris or grease), the inspection is complete from manhole to manhole without the need for a reverse setup unless otherwise approved, and all protruding service connections have been cut flush with the existing pipe wall. If point repairs, service lateral replacements or manhole replacements are performed after the inspections are submitted, it shall be the Contractor's responsibility to confirm that the work was performed properly, including proper alignment, grade and connection to the existing sewer (no offset joints) and that no debris has entered the sewer. Any problems with the work shall be corrected by the Contractor prior to CIPP installation or such corrections will be required after the liner installation if the problems are evident from the post-rehabilitation CCTV inspections.

4. Removal of Protruding Service Connections: Service connections that are protruding into the main sewer shall be cut flush with the pipe wall prior to installing the CIPP.

The cutting shall be accomplished using an internal robotic cutter specifically designed for such work. The internal remote cutter shall be capable of cutting PVC, vitrified clay, cast iron, ductile iron and orangeburg pipe. All cut pieces of the service connection shall be removed from the main sewer pipe. The Engineer will not approve payment for excavating protruding services in lieu of cutting them internally unless there is a specific reason or circumstance in which the lateral cannot be cut.

5. Installation: The Contractor shall clean and televise each length of pipe to be lined as specified. Prior to lining the main sewer and the pre-rehabilitation television inspection, protruding service lateral connections shall be internally cut/ground down flush with the pipe wall with a robotic cutter specifically designed for this purpose and all required point repairs shall be completed. The internal cutter shall be capable of cutting cast iron, PVC, vitrified clay pipe, ductile iron pipe and orangeburg pipe.

The Contractor shall notify all property owners that will be affected by the work 72 hours in advance of the work, giving the date, start time and estimated completion time for the work being conducted and the expected impacts to the property owner.

The Contractor shall bypass pump sewage flows around the lining work while it is being performed. The Contractor will be required to submit, for approval by the Engineer, a detailed plan of the method the Contractor proposes in order to maintain the existing flow during construction. The plan must include a provision for handling the existing peak flow by pumping. When pumping is used, an identical standby pump(s) shall be on site in the event of failure of the primary pump(s).

If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored and work shall be suspended until the problem is resolved to the satisfaction of the Engineer. This includes wastewater flow into trenches during excavation work. Sewer system overflows will not be tolerated. All fines imposed on the Owner associated with overflows caused by the Contractor's work shall be paid by the Contractor.

The Contractor shall furnish and install the CIPP lining in the full length of sewer. The installation of the CIPP shall be in complete accordance with the applicable provisions of ASTM F1216 or ASTM F1743, these specifications and the manufacturers' specifications.

Water shall be used to invert CIPP installed via ASTM F1216 or to invert the calibration hose through CIPP installed via ASTM F1743. Air shall not be used to invert the CIPP or calibration hoses under any circumstances. The water inversion of the CIPP and calibration hoses shall be accomplished by using natural water pressure (head) only. Natural water pressure shall be achieved by erecting platforms or scaffolding to an elevation determined by the Contractor necessary to provide adequate inversion heads (pressure). CIPP installation vessels/units of any kind used to create water pressure shall not be used. Water pressure shall not be varied by any means throughout the inversion process except by increasing the height of the



platform/scaffolding when approved by the Engineer. The Contractor shall submit required inversion heads for each installation as a shop drawing without delay and claim to confidentiality or product/installation privacy.

Where possible, the Contractor shall line multiple sewer segments at one time as determined by the Contractor. When this is done, the top one-half of the liner in the intermediate manhole shall be neatly removed, and the void behind the liner pipe shall be filled with non-shrink grout. The manhole bench shall be reconstructed if necessary to make a smooth transition at no additional cost to the Owner.

There shall be no leakage of groundwater into the manhole between the CIPP and existing sewer pipe and between the existing sewer pipe and manhole wall. A hydrophilic waterstop (non-bentonite) comprised of modified chloroprene rubber shall be installed 6 inches from each manhole wall prior to processing the liner to provide additional waterstop protection. As the CIPP is expanded, the waterstop shall be pressed tightly between the liner and existing sewer to provide a leak-tight seal. The waterstop shall be Hydrotite as manufactured by Greenstreak (St. Louis, Missouri) or a pre-approved equal. The Contractor shall submit detailed drawings of the pipe-manhole connections to the Engineer for approval, including termination points in manholes and transitions with manhole linings where installed.

The CIPP shall cure in the presence of water only. The minimum cure (i.e., cook) time shall be 3 hours at 180°F. The cure time shall be increased as deemed necessary by the Contractor/resin manufacturer, including but not limited to, longer CIPP installations, active ground water infiltration into the existing sewers, pipe type, pipe location, etc.

The CIPP shall be neatly cut 2 inches from the manhole walls after installation and cure to facilitate the application of the 1-inch thick cementitious manhole coating where required.

The Contractor shall fully reopen all of the existing active service connections in each length of sewer following lining. The service connections shall be reopened from inside the sewer by means of a CCTV camera controlled cutting device appropriate for the CIPP. All openings shall be clean and neatly cut and shall be flush with the lateral pipe. The openings shall also be buffed with a wire brush to remove rough edges and provide a smooth finish. The bottom of the openings shall be flush with the bottom of the lateral pipe to remove any lip that could catch debris. Openings shall be 100% of the service lateral pipe. The Contractor shall re-open any service lateral that does not meet this requirement as evidenced by the post-rehabilitation inspections at no additional cost to the Owner. The Contractor shall be fully responsible for all backups and damage caused by not fully opening a lateral connection, including paying all costs associated with repairing damage as required by the Engineer, Owner and/or property owner.

Installation reports shall be generated for each segment of liner installed. The reports

shall document installation, including manhole numbers, street names/sewer location, project number, date, time, temperature, curing temperature, curing time, liner thickness, etc. A sample report shall be submitted to the Engineer for approval prior to installing any lining. The reports shall be submitted to the Engineer prior to requesting payment.

6. Post-Rehabilitation Television Inspection: Following installation of the CIPP, reopening and brushing the service connections, and completion of all manhole rehabilitation work including vacuum testing, the Contractor shall conduct a final post-rehabilitation television inspection of the completed work to verify that the liner installation is acceptable as defined in the Sanitary Sewer Rehabilitation Material Specifications.

Payment will not be made for the installed CIPP or the cementitious coating of the manholes until the post-rehabilitation CCTV inspections are submitted and approved by the Engineer.

The Owner will consider payment of the installed CIPP prior to completion of the manhole rehabilitation work and the above specified final post-rehabilitation CCTV inspections if the Contractor performs preliminary CCTV inspections of the installed liner. The preliminary inspections must be performed after all service connections are fully opened and brushed and must be submitted to the Engineer for review. The inspections must clearly show the installed CIPP from manhole to manhole and each service connection to demonstrate that the installed CIPP meets the requirements of the Material Specifications of the Design Manual.

Logs must be submitted with the preliminary inspections. The submittal and approval of preliminary CCTV inspections does not waive the requirement for the final post-rehabilitation inspections specified above. Payment will not be made for cementitious coating of manholes until the final post-rehabilitation CCTV inspections are submitted and approved by the Engineer.

7. Acceptance Tests: For every sewer segment that is lined (sewer segment is defined as the sewer between two manholes), the Contractor shall remove one restrained sample of the installed liner at least 12 inches in length for testing of installed CIPP flexural properties and thickness. The CIPP testing shall include determining flexural strength, flexural modulus, tensile strength and thickness of each sample. These four separate individual tests make up one completed CIPP test. Payment will be made for each completed CIPP test at the unit price bid after the test results are submitted to the Engineer.

For sewers 12 inches in diameter and smaller, the sample shall be captured by installing the lining through a section of PVC pipe (same diameter as the existing sewer diameter) within the most downstream manhole of the installation and at all intermediate manholes if multiple sewer segments are lined at the same time. For sewers 15 inches in diameter and larger, plate samples shall be taken and cured in the

same water as the installed CIPP.

The Contractor shall be responsible for capturing the samples and preparing the samples for testing (i.e., cutting the samples to the required dimensions, removing the PVC pipe, etc.). The testing laboratory shall specify the dimensions for the samples. In addition, the Contractor shall cut a 1-inch wide representative sample (taken at least 2 inches from the end of the specimen) for the Engineer's records. The Contractor shall label all samples including writing on the samples where they were taken (manhole numbers and work orders) and the date they were taken.

Each day, the Contractor shall submit the samples taken that day to the Engineer. The Engineer will forward the samples to the testing laboratory. The Contractor shall select the independent testing laboratory and shall pay the laboratory for all tests. The Engineer will copy the Contractor on all submittals to the testing laboratory. The testing laboratory shall submit all test results directly back to the Engineer with a copy to the Contractor. The test results shall be returned to the Engineer within 21 days from the laboratory receiving the samples. If the results are not received in this timeframe, payment will be withheld. It shall be the Contractor's responsibility to ensure that the laboratory meets the specified schedule.

All testing shall be performed by an independent, ASTM-certified testing laboratory. The Contractor shall submit the name and location of the testing laboratory along with a certified statement from the laboratory that they are independent from and not associated with the Contractor in any way for approval. The testing laboratory shall also submit their ASTM certification. The Contractor shall consider utilizing a local testing laboratory for these services.

The tests shall be used to verify that the installed CIPP meets these specifications. CIPP thickness shall be measured in accordance with ASTM D5813. Flexural properties shall be determined per ASTM D790. Tensile strength shall be determined per ASTM D638.

Any lining that does not meet the specified installed strength and/or thickness requirements, regardless of the amount below the specified requirements, shall be corrected by the Contractor in a manner approved by the Engineer at no additional cost to the Owner. The Engineer's decision on how to correct deficient CIPP installations shall be final. Options for correcting deficient liner that will be considered by the Engineer include removing the liner and re-lining the sewer, excavating and replacing the sewer from manhole to manhole, re-lining sewers completely from manhole to manhole, installing a sectional CIPP patch to repair the defective area.

Credits will be considered for lining that does not meet the required thickness. If a credit is acceptable to the Engineer and Owner, the credit shall be calculated by multiplying the bid price by the percent that the liner thickness is below the minimum required installed thickness as follows:

$$\text{Credit} = (1 - (\text{installed CIPP thickness}/\text{min required thickness})) \times \text{Bid Price}$$

The Contractor shall not assume that a credit will be acceptable to the Engineer or Owner.

If a CIPP patch is approved as a repair method, the Owner will not pay the full bid price for that sewer segment (manhole to manhole). The price reduction (credit) shall be negotiated with the Contractor and shall be acceptable to the Owner. The credit shall be equal to at least 25% of the unit price bid for the CIPP installation and shall apply to the entire CIPP lining from manhole to manhole. The Owner shall have the final decision on the amount of the credit.

In addition, there shall be no groundwater leakage through the CIPP or between the liner and the existing pipes. Any leakage shall be completely eliminated in a manner approved by the Engineer. Options for eliminating leaks that will be considered by the Engineer include installation of specialized grout by injection methods and sealing leaks with specialized waterstop materials.

Following installation of the CIPP, reopening and brushing of all active service lateral connections, and completion of all manhole rehabilitation including vacuum testing, the Contractor shall conduct a final post-rehabilitation CCTV inspection of the completed work to verify that the liner installation is acceptable as defined herein. The sewers shall be thoroughly cleaned prior to performing the CCTV inspections, and the pipe shall be dry so that the entire CIPP can be seen. This will require that temporary plugging or bypass pumping be provided for all post-rehabilitation CCTV inspections.

The Contractor shall submit a sample television inspection after the final inspection of the first section of sewer is performed so that the Contractor and Engineer can agree on performance and quality of the inspections which must be met throughout the Contract. Sewers not inspected to the Engineer's satisfaction shall be re-inspected by the Contractor at no additional cost to the Owner.

One copy of the final post-rehabilitation videos shall be submitted to the Engineer for review and approval. The videos must be clearly labeled as to their contents. In addition, they must be in order or they will be returned to the Contractor. If post-rehabilitation inspections on the submitted videos are not approved by the Engineer, the videos will be returned to the Contractor. The Contractor shall remove all unapproved sewers from the videos so that the final videos submitted to the Engineer include only those sewers approved and acceptable. The Contractor shall provide correct counter numbers on the videos after all such editing is performed.

Payment will not be made for any sewer lining until the Engineer has reviewed and approved the final videos. As mentioned previously, the Owner will consider payment of the CIPP lining based on preliminary television inspections. In either

case, the Contractor shall submit the required videos a minimum of 10 days in advance of any payment request to provide the Engineer ample time to review the information.

There shall be no holes, dry spots, lifts, ribs, wrinkles, ridges, splits, bulges, cracks, delaminations or other type defects in the CIPP lining unless predicted in writing by the Contractor prior to lining. Defective lining or groundwater leakage shall be repaired in a manner suitable to and approved by the Engineer at no additional cost to the Owner.

## **B. MANHOLE LINING**

1. Qualifications: The cementitious product and epoxy product shall have been manufactured for installation specifically in manholes for at least five years. The cementitious and epoxy product shall have been installed in at least 5,000 manholes. References that are documented and that can be verified shall be submitted to demonstrate that the cementitious product meets these requirements. Contact names and numbers shall be included with the references.

In addition, the Contractor performing the work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be an approved installer as certified and licensed by the manufacturer. The Contractor shall have held such certification by the manufacturer to install the specific product being used for a minimum of one year prior to the bid date. The Contractor, as a company, must have at least three years of experience coating manholes with cementitious mortar and/or epoxy product (whichever product is being applied) and shall have successfully installed a cementitious lining and/or epoxy product (whichever product is being applied) in a minimum of 1,000 manholes as documented by verifiable Owner references. Further, the Contractor's proposed superintendent/foreman for the work under this Contract shall have successfully installed a cementitious lining product and/or epoxy product (whichever product is being applied) in a minimum of 500 manholes as documented by verifiable Owner references. The Contractor shall submit information to demonstrate that he meets the experience requirements.

2. Delivery, Storage and Shipping: Care shall be taken in shipping, handling and placing to avoid damaging the lining products. Any lining product damaged in shipment, showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work. While stored, the lining products shall be adequately packaged and protected. The lining products shall be stored in a manner as recommended by the manufacturer.
3. Installation: The Contractor shall clean each sewer manhole to be surfaced and shall dispose of any resulting material. The cleaning shall be performed using a high power jet wash at a minimum of 3500 psi water pressure to remove all dust,

biological growths, grease, oil, paint or any other surface contaminants or coatings. Coatings that cannot be removed shall be sanded with coarse sand paper to rough the surface sufficient to obtain and insure adequate bonding of the cementitious lining. Roots shall be removed by manually cutting the roots from inside the manhole.

The Contractor shall conduct a visual inspection of each manhole after it is cleaned. All active, hydrostatic infiltration leaks shall be plugged or sealed with an appropriate grout compatible with the cementitious or epoxy lining. Injection grouting may be required to seal active leaks including leaks in existing invert channels and benches. All loose mortar and rubble of existing walls, benches and inverts shall be removed. The Contractor shall prepare the manhole to receive cementitious or epoxy lining as necessary by reshaping and repairing benches, inverts, and walls where required including smoothing out irregular shaped corbel and chimney sections prior to spray application. All interior surfaces shall be prepared as recommended by the manufacturer. Minimum requirements are as listed below.

- a. All cracks and other voids must be repaired and filled with suitable non-shrinking cements, sealants or grouts, including all voids between the existing sewer pipes and manhole walls. All patches shall be smooth and even with the manhole wall.
- b. All voids around existing manhole rungs/steps shall be filled.
- c. All surfaces shall be suitably prepared for the required bonding of the Cementitious or epoxy lining as recommended by the manufacturer.

The Contractor shall notify all property owners who discharge sewage directly to the manhole being rehabilitated 72 hours in advance, giving the date, start time and estimated completion time for the work being conducted and the impacts to the property owner.

The Contractor shall bypass pump sewage flows around the manhole when the work is being performed. Contractor shall submit a detailed bypass pumping plan to the Engineer prior to starting any work.

The Contractor shall furnish and place cementitious and/or epoxy lining in each manhole as shown in the Details. The installation of the lining shall be in complete accordance with the applicable provisions of ASTM and the manufacturers' specifications. The Contractor is advised that a number of manholes will surcharge during rain events.

Prior to installing the lining, the Engineer along with the Contractor must inspect and approve the surface preparation work. The Contractor shall notify the Engineer when the manholes are ready for inspection. The Contractor is responsible for ensuring proper preparation and installation conditions including temperature and moisture regardless of the findings by the Engineer during his inspection. The manhole lining

shall be completed immediately after the inspection, or the manhole may need to be re-cleaned prior to spraying to remove accumulated debris on the benches and walls.

For cementitious lining applications, the walls and benches shall be coated monolithically to the required thickness by spray-on methods in one pass or application. Spray-applied cementitious linings shall be troweled smooth after application. The invert channel shall be coated with an appropriate quick-set grout product in complete accordance with the manufacturer's instructions.

All epoxy coatings shall be spray-applied in one or two passes. Hand-applied applications (trowel-applied) shall not be allowed. When epoxy is specified, the Contractor shall install one of the specified cementitious mortar products (minimum 1" thick) followed by a minimum 160 mil thickness epoxy coating to provide the required hydrogen-sulfide resistance. The cementitious product and epoxy shall be completely compatible as documented by the material manufacturers. In this case, payment will be made separately for the cementitious mortar lining and the epoxy lining under the corresponding bid items.

In some situations, the Engineer may specify that an epoxy coating (minimum thickness of 160 mils) be applied directly to the manhole instead of placed over a cementitious mortar product (when the manhole walls are satisfactory and do not need to be re-built). In this situation, all preparatory work will be as specified by the epoxy manufacturer and as outlined herein for preparing the manhole for a cementitious mortar product. Payment will be made for the epoxy lining only under the corresponding bid item. Testing shall be as specified herein.

All other requirements specified herein for cementitious mortar lining installation shall also be met for epoxy coating, including preparation and installation.

A complete, watertight seal shall be provided at pipe and manhole wall connections. Contractor shall submit details of how the watertight connections will be made to the Engineer for review and approval.

The manhole lining shall not be installed until all required main sewer rehabilitation and other manhole rehabilitation work are complete.

4. Acceptance Tests: Field acceptance of the manhole lining shall be based on the Engineer's field inspections and evaluation of the appropriate installation and curing test data. The lining shall provide a continuous monolithic surfacing with uniform thickness throughout the manhole interior. If the thickness of the lining is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the Owner.

If the Engineer has to enter the manholes to inspect the work, the Contractor shall provide forced air ventilation, gas monitors and detectors, harnesses, lights, confined space entry permits, etc. for the Engineer or Owner to enter the manhole and perform

the inspection in complete accordance with OSHA requirements at no additional cost to the Owner.

- Cementitious Mortar Lining: Samples shall be taken of the installed liner each day that cementitious lining is installed as follows: one sample if one to five manholes were coated that day, two samples if six to ten manholes were coated that day, three samples if eleven to fifteen manholes were coated that day, and four samples if sixteen or more manholes were coated that day. Samples shall be taken at equally spaced intervals throughout the day. The frequency of tests may be increased by the Engineer and performed by the Contractor at no additional cost to the Owner when the required tests show that the installed lining does not meet the specifications.

Samples shall be cube samples. At least six cubes shall be taken for each sample for testing. All cube samples shall be taken in the field from the material being sprayed. The Contractor shall show the samples to the Engineer each day and the Engineer shall initial the samples for delivery to the testing laboratory. The Contractor shall properly take and store the samples and shall deliver the samples to the testing laboratory. The laboratory shall document that they received the initialed samples. The tests shall be performed by an independent testing laboratory. All costs associated with the tests shall be paid for by the Contractor. The test results shall be submitted to the Engineer immediately when available, no later than 30 days after the lining is installed or payment will be withheld.

The samples shall be tested in accordance with the applicable ASTM standards to verify that the installed liner meets the compressive strength requirements specified herein and the lining manufacturer's published data on the product. Tests shall include 7-day and 28-day strength tests (3 tests/cubes for each time period for each sample). Shrinkage and bond strength tests shall be performed on each batch or lot of material shipped to the Contractor.

- Epoxy Lining: A wet film thickness gage meeting ASTM D4414 or approved equal shall be used to ensure a monolithic coating and uniform thickness during application. After the coating has set hard to the touch, it shall be inspected with high-voltage holiday inspection equipment. The spark tester shall be initially set at 20,000 volts minimum and shall be increased as deemed necessary by the Engineer. The Engineer may require the Contractor to create a "test" holiday in the coating to determine the minimum/maximum voltage to be used. All detected holidays shall be marked and repaired as approved by the Engineer. The manhole shall then be re-tested as specified.

All manholes (cementitious and epoxy coatings) shall be tested via vacuum testing when all manhole rehabilitation work to that manhole is complete. Manholes shall not be vacuum tested until at least 7 days after the cementitious or epoxy lining was installed. Vacuum testing shall be performed in accordance with ASTM C-1244,



CMUD standard specifications and the Details, except that the minimum test time shall be 1 minute. The testing shall be paid for by the Contractor and be included in the bid price for manhole lining. The Engineer or Owner shall be present for all testing. The Contractor shall notify the Engineer 48 hours prior to testing. The Contractor shall submit test reports of the testing which include the project name, manhole tested, data on testing (vacuum pressure, test duration, etc.), and whether the manholes passed or failed the test. Test reports must be submitted for failed tests with the reason for failure noted on the report. The Engineer shall sign all test reports to document that he was present for the testing. Any manhole that fails the vacuum test shall be repaired and retested immediately by the Contractor at no additional cost.

There shall be no groundwater infiltration or other leakage (active or previously active) through the manhole walls, benches, inverts or pipe connections at the manholes after it has been lined. If leakage is found, it shall be eliminated with an appropriate cement mortar, grout or sealant as recommended by the manufacturer and approved by the Engineer at no additional cost to the Owner. Injection grouting may be required to stop leaks around the pipe connections or in the invert channel or benches. The Engineer's decision on how defective lining is repaired shall be final. If any defective lining is discovered after it has been installed or during the warranty period, it shall be repaired or replaced in a satisfactory manner at no additional cost to the Owner. Repaired manholes including those repaired during the warranty period shall be vacuum tested at no additional cost to the Owner.

Payment shall not be made for the installed cementitious lining and/or epoxy until (1) the manhole passes the vacuum test and (2) the final post-rehabilitation television inspections of the installed CIPP connecting to the manhole as specified elsewhere in these Special Provisions are approved by the Engineer (where applicable).

5. Reference Standards: The following American Society for Testing and Materials (ASTM) standards are referenced herein:

ASTM C78 Standard Test Method for Flexural Strength of Concrete

ASTM C94 Standard Test for Ready Mix Concrete

ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

ASTM C234 Standard Test Method for Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel

ASTM C267 Standard Test Method for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing

ASTM C321 Standard Test Method for Bond Strength of Chemical- Resistant Mortars

ASTM C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

ASTM C596 Standard Test Method for Drying Shrinkage of Mortar Containing Portland Cement

ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

ASTM C827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

ASTM C882 Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear

ASTM C952 Standard Test Method for Bond Strength of Mortar to Masonry Units

ASTM C1072 Test Method for Measurement of Masonry Flexural Bond Strength

ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test

### **C. PIPE BURSTING**

1. Qualifications: The Contractor shall be fully experienced in installing HDPE via pipe bursting methods. The pipe bursting equipment and method of installation shall be the Grundocrack and Grundoburst Systems as manufactured by T.T. Technologies, Inc.; the InneReam Pipeline Replacement System by Nowak Pipe Reaming, Inc.; or approved equal.

Contractors must obtain all licensing required to use the particular technology proposed for this work. Proof of licensing must be provided prior to any pipe bursting taking place. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the HDPE pipe. Training shall be performed by a qualified representative.

The Contractor shall be experienced with installing HDPE pipe using the pipe bursting method and shall be certified by the particular Pipe Bursting System Manufacturer that the Contractor is a fully trained user of the pipe bursting system.

Contractor shall provide proof to the Engineer of having successfully installed a cumulative footage of replacement sewer by means of pipe bursting equal to or greater than 10,000 linear feet of HDPE pipe using the particular Pipe Bursting System Manufacturer proposed on the Bid Form.

The Contractor shall hold harmless and defend the City and the Engineer in any legal action resulting from patent infringements by the Contractor. The Contractor shall be solely responsible for obtaining any necessary licenses and paying any applicable patent fees.

2. Submittals: The Contractor will submit the following information:
  - a. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, dimensions of new pipe and fittings and calculations and assumptions used to support the proposed pipe wall thickness design. Include manufacturer's recommendations for handling, storage, installation and repair of damaged pipe and fittings.
  - b. Method of construction and restoration of existing sewer service connections if different from the details in the Plans.
  - c. Pipe installation training certification for employees installing and fusing pipe on the project.
  - d. Plans and procedures for wastewater flow control supplying temporary sewer service including but not limited to withdraw/discharge points, type and size of pumps and temporary piping, proposed fittings, security measures, etc.
  - e. CCTV inspection reports and color videos made after new pipe installation.
3. Installation: The Contractor shall perform the pipe bursting in strict accordance with the equipment and HDPE manufacturers' specifications and recommendations. The Contractor shall locate all utilities in the area prior to performing the pipe bursting and shall be responsible for all restoration and damage caused by the installation, including upheaval of the ground and damage to adjacent utilities.

Before any excavation is done for any purposes, the Contractor shall contact the various utility companies (via NC One Call) for determining field location of existing utilities. All work is to be completed within existing street rights-of-way or easements. Any damage to adjacent properties that are not part of the work shall be repaired and property restored to its original condition at the Contractor's expense.

For main sewer replacement, the Contractor shall disconnect existing service laterals from the main sewer prior to pipe bursting to prevent excessive damage to the lateral. After the bursting is complete, the Contractor shall connect all active service laterals to the HDPE with a CMUD-approved strap-on saddle or connection fitting, replace the laterals to the edge of the sewer right-of-way and install a cleanout. Reconnection of laterals shall only occur after the HDPE replacement pipe has passed the initial air test.

All joints shall be inspected by the Engineer before insertion. The HDPE sewer line will be joined on site in appropriate working lengths near the launching pit.

The new HDPE pipe shall be connected to the existing manholes in accordance with the Standard Details for connecting liner pipes to existing manholes. The connection shall be leak-tight. The manholes shall be rehabilitated after the pipe bursting work is completed in accordance with the manhole lining requirements in this section of the specifications.

Where the HDPE pipe is connected with ductile iron fittings, an HDPE flange adapter shall be fused to the end of the pipe and the connection made with bolted flange components, in accordance with the manufacturer's recommended procedures. Prior to installation, the Contractor shall submit to the Engineer for review and approval, information from the manufacturer including detailed drawing and description of the flanged system, design capabilities/limitations, and installation procedures.

4. Testing: After installation of the replacement pipe and subsequent to connections at manhole inlets and outlets and at service laterals, the replacement pipe shall be air tested under low pressure as follows:

The pipe shall be plugged at each manhole with pneumatic plugs. The design of the plugs shall be such that they will hold against the test pressure without requiring external blocking or bracing. One of the plugs shall have three air hose connections: one for inflating of the plug, one for reading the air pressure in sealed line, and one for introducing air into the sealed line.

Low pressure air shall then be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure resulting from any ground water that may be over the pipe. At least two minutes shall elapse to allow the pressure to stabilize.

The time required for the internal pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure resulting from any ground water that may be over the pipe, shall not be less than the time shown for a given pipe diameter in the following table:

Carrier Pipe Diameter (Inches)	Minimum Elapsed Time (Minutes)
8	4
10	5
12	6
15	7
18	8

After the replacement pipe has been secured and finished at manhole inlets and outlets and service lateral connections, lateral lines, and cleanouts have been installed, the Contractor shall perform leak testing in accordance with the CMUD Design Manual.

#### **D. INJECTION GROUTING**

1. Qualifications: The Contractor performing the work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor, as a company, must have at least three years of experience with the product and shall have successfully installed a grout product in a minimum of 250 manholes as documented by verifiable Owner references. Further, the Contractor's proposed superintendent/foreman for the work under this Contract shall have successfully installed the product in a minimum of 100 manholes as documented by verifiable Owner references. The Contractor shall submit information to demonstrate that he meets the experience requirements.
2. Delivery, Storage and Shipping: Care shall be taken in shipping, handling and placing to avoid damaging the product. Any product damaged in shipment, showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work. While stored, the products shall be adequately packaged and protected. The products shall be stored in a manner as recommended by the manufacturer.
3. Installation: The Contractor shall clean each sewer manhole to be treated as appropriate and shall dispose of any resulting material. The cleaning shall be performed using a high power jet wash at a minimum of 3500 psi water pressure to remove all dust, biological growths, grease, oil, paint or any other surface contaminants or coatings. As appropriate, roots shall be removed by manually cutting the roots from inside the manhole.

The Contractor shall notify all property owners who discharge sewage directly to the manhole being rehabilitated 72 hours in advance, giving the date, start time and estimated completion time for the work being conducted and the impacts to the property owner.

The Contractor shall bypass pump sewage flows around the manhole when the work is being performed if necessary. Contractor shall submit a detailed bypass pumping plan to the Engineer prior to starting any work.

The Contractor shall furnish and place grout in each manhole as identified by the Engineer. The installation of the grout shall be in complete accordance with the manufacturers' specifications.

4. Acceptance Tests: Field acceptance of the grout shall be based on the Engineer's visual inspections, the Engineer's evaluation of the appropriate installation, and the absence of any visible active leaks in the general area of the original leak location or within the same pre-cast manhole joint.

If the Engineer has to enter the manholes to inspect the work, the Contractor shall provide forced air ventilation, gas monitors and detectors, harnesses, lights, confined space entry permits, etc. for the Engineer or Owner to enter the manhole and perform the inspection in complete accordance with OSHA requirements at no additional cost to the Owner.

There shall be no groundwater infiltration or other leakage (active or previously active) at or near the original leak location or within the same the pre-cast manhole joint after it has been repaired. If leakage is found and deemed to be a direct result of the original repair as determined by the Engineer, it shall be eliminated as approved by the Engineer at no additional cost to the Owner. The Engineer's decision on how additional leak(s) are repaired shall be final. If any additional leaks are discovered after it has been installed or during the warranty period, they shall be repaired in a satisfactory manner at no additional cost to the Owner.

## **VIDEO INSPECTION OF SANITARY SEWER SYSTEM**

The purpose of this section is to provide the Contractor with specific guidelines pertaining to the closed circuit television (CCTV) inspection of CMUD sanitary sewer mains and manholes. The Contractor shall fully comply with the provisions of this section, and with any provisions pertaining to CCTV inspections contained in the project-specific special provisions (if any). In the event of conflicting requirements, the more restrictive shall apply.

### **A. CCTV DIGITAL VIDEO INSPECTIONS**

The camera equipment used for the CCTV inspections shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be a color, pan-and-tilt camera. The Contractor shall submit a sample television inspection so that the Contractor and Engineer can agree on performance and quality of the inspections which must be met. Sewers not inspected to the Engineer's satisfaction shall be re-inspected by the Contractor at no additional cost to the Owner.

All cameras shall move through the main sewers via self-powered tractor assemblies – no skid assemblies shall be permitted. The tractor assemblies used for the inspections shall be the appropriate size assembly for the pipe being televised according to the manufacturer of the television equipment. For example, an 8-inch tractor assembly shall be used to televise 8-inch-diameter sewers.

The camera shall move through the sewers in either direction at a uniform rate but not greater than 30 feet per minute. The camera shall be stopped at major defects and service connections and shall be panned, tilted and rotated to fully view the defects and connections. All such inspections shall be documented on computer-generated logs. Particular attention should be paid to service connections and whether the services are active or plugged.

The inspections shall be complete from manhole to manhole without the need for reverse setups unless approved otherwise by the Engineer. If, during the work, the CCTV inspection is blocked by debris, a protruding lateral or sewer system defect, the Contractor shall remove the blockage or repair the defect as authorized by the Engineer and then continue the inspection.

If the Contractor's cleaning or television equipment becomes lodged in the sewers during the work, the Contractor shall be responsible for removing the equipment, including excavation of the sewer, and paying all costs associated with the removal unless otherwise agreed to by the Engineer (for example, if the equipment is hung in pipe with major structural damage that definitely needs to be repaired, the Engineer may agree to pay for removing the equipment).

The inspections shall begin at the center of the manhole, shall clearly show the pipe connection of the sewer to be inspected at the manhole and shall pan and tilt around the

manhole to provide a clear view of the manhole and all pipe connections. At every downstream manhole, the camera shall be panned and tilted within the manhole to provide a clear view of the manhole and all pipe connections.

The television inspection shall include video documentation and computer generated logs to document the inspection. The camera shall be panned, tilted and rotated at any defects and at service lateral connections for a complete video documentation. Footages and locations of any defects and service laterals shall be documented. The entire lateral opening shall be clearly shown.

The accuracy of the measurements cannot be stressed too strongly. Daily calibration of measuring devices shall be performed. Sewer lengths shown and reported on the CCTV inspection tapes and logs shall be within 3 feet (plus or minus) of the actual sewer length as measured above ground from center of manhole to center of manhole. CCTV inspections that do not meet this criteria shall be re-performed and re-submitted to the Engineer at no additional cost to the Owner.

The maximum flow depth for CCTV inspection work is 25% of the pipe diameter or as approved by the Engineer. The Contractor may be required to perform inspections during off-peak hours (night inspections) if specifically requested by the Engineer to achieve this maximum flow standard.

## **B. DIGITAL VIDEO FORMAT**

All televised sewer inspections performed (including sewer laterals) shall be submitted to the Engineer in electronic (digital) format. All inspections performed will be imported into CMUD's I.T.pipes inspection software. The import tools used by CMUD will not function properly if data is not submitted in the exact format required below.

All inspections shall be performed using I.T.pipes software in the field. I.T.pipes must be installed in the truck that is performing the television inspections and used for the live field inspections. If I.T.pipes with the specific CMUD template is not in the truck(s), the work shall immediately cease until it is installed in the truck(s) to be used during the inspection process.

The contractor must use the I.T.pipes CMUD template available from I.T.pipes. This template contains all correct data entry fields, all observation inputs and required parameters, template settings for overlay control and setup, and other settings. The Contractor shall obtain the template prior to performing any CCTV inspections. Inspections performed without using the CMUD template will be rejected, and the Contractor will have to re-perform the inspections at no cost to the City.

WMV recording with embedded meta-data is required. Each submittal to the Engineer shall include the I.T.pipes software database file within the approved structure along with the WMV video files. The Contractor shall make all adjustments necessary to adhere to the required format specified herein including performing the work using the required



software at no additional cost to the City. After the first submittal, the Engineer will notify the Contractor of any required changes in the data and file format, and the Contractor shall make such modifications at no additional cost.

The digital recording shall include both audio and video information that accurately reproduces the original picture and sound of the video inspection. The video portion of the digital recording shall be free of electrical interference and shall produce a clear and stable image. The audio portion shall be sufficiently free of background and electrical noise as to produce an oral report that is clear and discernible.

1. Video Overlay: The video shall include overlay/text display with an initial display screen and with a continuous running screen. Each inspection start shall include overlay display of section details including at a minimum:

1. Owner Name
2. Project Name
3. Contractor Name
4. Street Name (if applicable)
5. Date/Time of Inspection
6. MH Start #/MH End #
7. Pipe Material
8. Pipe Size
9. Direction of Video
10. Weather or Flow Level
11. Pipe Identifier Number

The continuous running screen shall include a constant display of the street name, MH start #/MH End #, date and distance shall appear on screen. The CCTV inspector shall move or remove overlay display accordingly so it does not interfere with the inspection review of particular observations/defects as the inspection is occurring.

As an observation/defect is noted by the inspector, a text display shall appear with the text describing the observation/defect. Text shall display for 4-5 seconds.

Distance shall appear continuously in the lower right corner of the video image as the camera is traveling down the line.

It is imperative that distance is accurate. The CCTV inspector shall calibrate/test footage at the beginning of each day as incorrect footage will result in return of inspections.

2. Video Format: Completed work shall consist of WMV video files captured live off the inspection camera.

Each pipe inspection's observations shall be related to a time point within the video.

Each pipe inspection WMV file shall have a related text file, with an identical name

but different extension on the file. This file shall contain the distances of each observation and the related time point for that observation.

During the inspection, the video file recording shall pause as the operator selects the observation/defect notation, eliminating “on hold” video.

The WMV files shall be named as follows:

EXAMPLE:

Pipe ID is GM-31619 and manhole numbers are (Upstream) MH-249417 to (Downstream) MH-249341

Then, the video filename = **GM-31619\_249417\_249341.wmv**

The video file resolution shall be 640 x 480

The audio shall be included within the WMV and not as a separate file.

3. Video Media: The database file and the corresponding video files shall be submitted to the Engineer on DVD, flash drive or portable external hard drives. One copy of the printed logs (in color) that correspond to the inspections shall be submitted to the Engineer. The Engineer will return the hard drive to the Contractor after the inspections have been reviewed.

Each submittal to the Engineer shall include a transmittal letter, listing the file names and all sewer segments and video files included on the hard drive.

4. Customized Data Fields: CMUD has developed customized data fields for its viewing software. The Contractor will be required to use these data fields, without any modifications, to enter project information for each inspection. These data fields are available for download from I.T.pipes.

Observations for each inspection shall include:

- Observation distance (part of the CMUD catalog)
- Observation defect/description (part of the CMUD catalog)
- Counter time observation occurs within digital video (part of the CMUD catalog)
- Severity rating for each observation/defect (part of the CMUD catalog)
- Infiltration rating (part of the CMUD catalog)

5. PACP: All work submitted by the Contractor shall be completed by PACP Certified professionals. A current PACP certification number shall be included for each person creating/gathering inspection reports. All work shall be performed using CMUD’s PACP format. The Contractor shall use CMUD’s template in I.T.pipes so the format is correct. Note that CMUD’s module is different from the standard PACP module.

## **CHEMICAL ROOT CONTROL**

The purpose of this section is to provide the Contractor with specific guidelines pertaining to the use of chemical root control within Charlotte-Mecklenburg Utilities sanitary sewer system. The goal of chemical root control is to kill the root growth present in the mains and to inhibit re-growth, without damaging the vegetation producing the roots. The Contractor shall fully comply with the provisions of this section, and with any provisions pertaining to chemical root control contained in the project-specific special provisions. In the event of conflicting requirements, the more restrictive shall apply.

### **A. POLLUTION LIABILITY INSURANCE**

In addition to all other insurance required in these General Conditions or by law, the Contractor shall purchase and maintain with a company acceptable to the City and authorized to do business in the state of North Carolina, pollution liability insurance for limits of not less than \$2,000,000. This coverage shall protect against claims for damages for bodily or personal injury, sickness or disease, including death, and from claims for damages to property and/or the environment, which may arise directly out of the use of chemicals and/or pollutants.

### **B. PRODUCT REQUIREMENTS**

The chemical root control treatment material shall be EPA registered and labeled for use in sewer lines and acceptable to the State agency having jurisdiction over its use. The Contractor shall submit a specimen product label of the material to be used in treatment process to the Engineer. The chemical agent shall be non-systemic, which will not permanently affect parts of trees distant from the treated roots. Diquat dibromide is the accepted chemical root control agent. Razoroooter II, or approved equal, is the accepted root control product.

### **C. QUALIFICATIONS**

Chemical root control shall be performed by a company with not less than five years of experience in providing the required root control services, employing experienced workers and experienced supervisory personnel. Supervisory personnel shall have not less than three years of experience in providing the required services, backed up with project references, and shall be present at the jobsite during all work related to the required services.

The Contractor, as well as the specific individual(s) mixing and applying the chemicals, shall be licensed in the State of North Carolina to apply the approved chemical agents for the purpose of sanitary sewer root control. Supervisory personnel shall have treated a minimum of 500,000 lf of sanitary sewer lines using the approved products within the last 3 years, backed up with project references and shall remain on site at all times while the mixing and application process is under way.

The Contractor is directed to ensure compliance with all Federal, State and Local ordinances pertaining to chemical root control. Particular attention shall be paid to those laws and ordinances relating to transportation of material (DOT), the application of sewer chemical root control herbicides (US EPA), and traffic safety regulations. The Contractor's Federal DOT number and material EPA registration number must be submitted with bid.

#### **D. APPLICATION AND TREATMENT**

The Contractor shall carry out all preparatory work, flow control, mixing and application procedures as described below:

1. Preparatory Procedures: At the beginning of each day, the Contractor shall bring equipment, chemicals and supplies to the project site (area to be treated). The Contractor shall not use streets, right-of-ways, individual property owner lands, or easements as staging areas. At the end of each day, Contractor shall remove all equipment, chemicals and supplies from the project site.

No cleaning is allowed in lines prior to chemical root treatment unless extensive grease, root masses, or debris preclude proper application of the material.

2. Flow Control: Generally, sewer service shall not be interrupted during root control treatment. In situations where it is necessary to shut down upstream pumping stations or block/bypass upstream flows, the Contractor shall coordinate his activities with the Engineer and do the work at night or during periods of low flow. The entire procedure of maintaining existing flows shall be fully discussed with the Engineer well in advance of the interruption of any flow. Sewer system overflows will not be tolerated. All fines imposed on the Owner and associated with overflows caused by the Contractor's work shall be paid by the Contractor
3. Mixing Procedures: All materials shall be delivered to the site in undamaged, unopened containers bearing the manufacturer's original label. Mixing of the root treatment material shall be done at the time of application. The water used shall be clear and free of acid, alkali, oxidizing agent, oil, or other organic materials. Mixing water temperature shall be between 40°F and 80°F. Mixing of root treatment with water must be accomplished immediately before injection of foam into sewer line.
4. Application Procedures: Where conditions permit, the volume of foam shall be sufficient to completely fill the air space above the flow, manhole to manhole. In all cases, the volume of foam delivered to the sewer line shall be sufficient to attach to and permeate all root masses. The foam shall be applied at sufficient pressure to penetrate several feet into service connections. The hose insertion method is the most common and preferred of foam application. Use of any other method must be approved by the Engineer.
5. Protection of Wastewater Treatment Plans: The Contractor shall take all steps

necessary and appropriate to prevent adverse effects on wastewater treatment plant operations during the application process.

Notwithstanding the requirement that the active ingredient shall not adversely effect wastewater treatment plant operations, in the event that a wastewater treatment plant experiences any reduction in operating efficiency during the execution of the contract, the Contractor shall immediately suspend all applications, at the direction of the Engineer. The Contractor shall continue operations only after problems at the wastewater treatment plant have been corrected to the satisfaction of CMUD's Environmental Division. CMUD reserves the right to suspend or terminate the chemical root control contract at any time for any reason.

The Contractor shall be limited to the amount of line footage treated per day in any one treatment plant basin and shall adhere to the following production schedule:

Diquat Dibromide Basin Limits

Irwin Creek WWTP Basin – 6,800 ft/day

Mallard Creek WWTP Basin – 6,800 ft/day

Sugar Creek WWTP Basin – 8,000 ft/day

McAlpine Creek WWTP Basin – 13,600 ft/day

McDowell Creek WWTP Basin – 2,250 ft/day

CMUD reserves the right to reduce or add to these production limits if deemed necessary or appropriate.

All CMUD wastewater treatment plants are required to perform toxicity testing on a quarterly basis, more often if any of these tests fail. If directed by the Engineer, the contractor may be required to suspend treatment during the testing periods. The testing schedules for the various plants are as follows:

Irwin Creek and McDowell Creek WWTPs – January, April, July and October

Sugar Creek and Mallard Creek WWTPs – February, May, August and November

McAlpine Creek WWTP – March, June, September and December

If needed, CMUD will make every effort to provide ample work in the various basins as to not impact production during testing periods.

The Contractor shall maintain daily contact through e-mail with the CMUD's Environmental Division representative Shannon Sypolt at [ssypolt@charlottenc.gov](mailto:ssypolt@charlottenc.gov) and shall communicate to Mr. Sypolt the dosing concentration and quantities, the area being treated, as well as linear footage treated for the day. The Contractor shall also provide Mr. Sypolt with a schedule of areas to be treated, which shall be updated as needed.

**E. POST-TREATMENT INSPECTION AND WARRANTY**

The Contractor shall provide a written guarantee that meets or exceeds any claims or warranties made by the manufacturer in published advertising. As a minimum, the Contractor shall guarantee that no blockages due to roots will occur in pipes treated by the Contractor for a period of three years, from the date that treatment is performed on the pipe. The Contractor shall also guarantee that the chemical treatment foam likewise kills all roots in the service laterals, at least past the tee connection point of the lateral to the main line. Any treatment foam entering a building is unacceptable and will not be tolerated. The Contractor shall also guarantee no adverse impacts to plants and trees as well as wastewater treatment facilities operations.

No less than 3% of the total length of sanitary sewer lines treated shall be inspected via closed circuit television (CCTV). CCTV inspection shall occur no sooner than six months following treatment of the sanitary sewer. The Engineer shall choose which sanitary sewer mains are to be inspected and provide system maps identifying those mains to the Contractor. If any section of the sanitary sewer mains inspected is unacceptable to the Engineer, the Contractor shall retreat the section and inspect another main by CCTV of equal length at no charge.

## **SECTION 33 11 20**

### **HIGH DENSITY POLYETHYLENE (HDPE) WATER DISTRIBUTION PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes High Density Polyethylene (HDPE) pipe and fittings from 4-inch through 32-inch for potable water and reuse applications including distribution piping and horizontal directional drill (HDD).

##### **1.2 REFERENCE STANDARDS**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
  - 2. In the event of a conflict, the most stringent requirements prevail. Submit conflicts to the Owner in writing prior to purchase of materials.
- B. ANSI/AWWA [www.awwa.org](http://www.awwa.org)
  - 1. AWWA M55 Manual of Water Supply Practices, PE Pipe—Design and Installation
  - 2. ANSI/AWWA C111/A21.11-12 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - 3. AWWA C207-13 Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
  - 4. ANSI/AWWA C651 Standard for Disinfecting Water Mains
  - 5. ANSI/AWWA C800 Underground Service Line Valves and Fittings
  - 6. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
  - 7. ANSI/AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm to 1,650 mm), for Waterworks
- C. Plastics Pipe Institute, PPI [www.plasticpipe.org](http://www.plasticpipe.org)
  - 1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
  - 2. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
  - 3. PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
  - 4. PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
  - 5. PPI TN-34 Installation Guidelines for Electrofusion Couplings 14-inch and Larger
  - 6. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
  - 7. Municipal Advisory Board Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe
- D. NSF [www.nsf.org](http://www.nsf.org)
  - 1. NSF / ANSI 61 Drinking Water System Components—Health Effects
- E. ASTM [www.astm.org](http://www.astm.org)
  - 1. ASTM B 62 Standard Specification for Composition Bronze or Ounce Metal Castings

2. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
  3. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR- PR) Based on Controlled Inside Diameter
  4. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
  5. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
  6. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
  7. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
  8. ASTM D 3035 Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
  9. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
  10. ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  11. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR- PR) Based on Outside Diameter
  12. ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
  13. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
  14. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
  15. ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
  16. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
  17. ASTM F 1668 Standard Guide for Construction Procedures for Buried Plastic Pipe
  18. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
  19. ASTM F 2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
  20. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- F. AASHTO ([www.transportation.org](http://www.transportation.org))
1. AASHTO T-99 Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
- G. International Organization for Standardization ([www.iso.org](http://www.iso.org))
1. ISO 12176-2 Plastics pipes and fittings -- Equipment for fusion jointing polyethylene systems
  2. ISO/TR 13950 Plastics pipes and fittings -- Automatic recognition systems for electrofusion joints

### **1.3 SYSTEM DESIGN PARAMETERS**

#### **A. Surge Pressure**



1. Per AWWA C906, the repetitive surge pressure allowance is one half the pressure class of the pipe, and the occasional surge over pressure allowance is equal to the pressure class of the pipe. Allowable Total Pressure during Recurring Surge conditions equals 1.5 times the pipe's pressure class. Allowable Total Pressure during Occasional Surge conditions equals 2.0 times the pipe's pressure class.
2. Table 1 gives the Pressure Class per AWWA C906, Pressure Rating and Allowable Total Pressure During Recurring and Occasional Surge for PE4710 pipe at 80°F or less.

Pipe Dimension Ratio (DR)	Pressure Class	Pressure Rating	Allowable Total Pressure During Recurring Surge	Allowable Total Pressure During Occasional Surge
DR 9	250 psi	250 psi	375 psi	500 psi

## 1.4 SUBMITTALS

### A. Requirements

1. Submittals shall be in accordance with requirements in Submittals Section.
2. All submittals shall be reviewed by the Engineer or the City prior to delivery.
3. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications. This certification shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.
4. The Contractor shall submit shop drawings showing installation method and the proposed method and specialized equipment to be used.
5. Manufacturers recommended fusion procedures for the products.

### B. Provide Product Data

1. Manufacturer
2. Dimension Ratio
3. Joint Types
4. Restraint, if required in Contract Documents
  - a. Retainer glands
  - b. Thrust harnesses
  - c. Any other means of restraint

### C. Lay schedule/drawing

1. Lay schedule is required for 24-inch and greater diameters
2. Schedule must be sealed by a Professional Engineer licensed in North Carolina and must include:
  - a. Pipe class
  - b. Fittings – bends, tees, services, connections, MJ adapters
  - c. Stationing
  - d. Transitions
  - e. Joint deflection
3. Note that lay schedule does not need to indicate location of butt fusion joints, as these will be determined in the field based on available pipe lengths and field conditions

D. Provide Internal Stiffeners Data

E. Provide Mechanical Joint Adapters Data

F. Installer Qualifications

1. Provide certifications meeting requirements of section 3.1 for each installer. Keep certifications on project site available to Owner, Engineer, and Inspector.

G. Data Logger Records

1. Provide electronic data logger record to the inspector daily or on request of inspector.
2. Fusion Reports shall report manufacturer, component, component fusion-jointing parameters, assembly operation and joint identification, per ISO 12176-4, and the following fusion-jointing operation data:
  - a. Temp-Compensated Fusion Time & Actual Fusion Time
  - b. Resistance before & after fusion
  - c. Hi and Low output voltage & output current during fusion
  - d. Total Amp-Hours applied to fitting
  - e. Input voltage and frequency before fusion
  - f. High and Low input voltage and frequency during fusion
  - g. Input waveform
  - h. GPS position and quality
  - i. Ambient temperature
  - j. Heating iron face temperatures
  - k. Fusion pressure
  - l. Graphic representation of the fusion cycle.
3. Report shall comply with ISO 12176-2 requirements for traceability databases.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

A. Shipping Requirement

1. Ship and deliver pipe and fittings from manufacturer with dust plugs on pipe ends and fitting ends.

B. Storage and Handling Requirements

1. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.
2. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use. Damages resulting from improper delivery, storage, or handling are the responsibility of the Contractor, and no additional payment shall be allowed by the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Only the pipe and tubing manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.

1. Performance Pipe

2. Georg Fischer
  3. JM Eagle
  4. Driscoplex
  5. WL Plastics
- B. Only the electrofusion fittings manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
1. Agru America
  2. Georg Fischer Central Plastics
  3. Integrity Fusion Products
  4. IPEX, Inc.
  5. M.T. Deason Company
  6. Nupi Americas
  7. Plasson, USA
  8. Strongbridge-Tega
- C. Only the butt fusion fittings manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
1. ISCO
  2. IPEX
  3. Georg Fisher
- D. Only the fusion equipment manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
1. McElroy
- E. Any product that is not listed in this section is considered a substitution and shall be considered by the Engineer on a project basis.

## 2.2 HDPE PIPE AND TUBING DIMENSION REQUIREMENTS

- A. HDPE Pipe and Tubing shall comply with the following dimension standards:

Diameter (inch)	Dimension Ratio	Outside Diameter Standard	Pipe Dimension Standard
3/4 through 1	SDR 9	Copper Tubing Size (CTS)	ASTM D 2737
1.25 through 3	DR 9	Iron Pipe Size (IPS)	ASTM D 3035
4 through 32	DR 9	Iron Pipe Size (IPS)	ASTM F 714

- B. Section 2.3 of this specification further describes requirements for HDPE pipe.
- C. Section 2.13 of this specification further describes requirements for HDPE tubing.

## 2.3 HDPE PIPE

- A. For diameters from 1.25-inches through 3-inches, High Density Polyethylene (HDPE) pipe and fittings shall meet the requirements of AWWA C901.
- B. For diameters from 4-inches through 32-inches, HDPE pipe and fittings shall meet the requirements of AWWA C906.
- C. The outside diameter of the pipe shall be based on the **Iron Pipe Size (IPS)** sizing system.

- D. HDPE pipe shall be rated for use at a pressure class of 250 psi.
- E. Polyethylene pipe shall be made from HDPE resin having a material designation code of PE4710 or higher.
- F. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C.
- G. HDPE Pressure Pipe for potable water shall meet the requirements of NSF 61.
- H. Pressure Pipe shall be approved by the Underwriter's Laboratory (UL) or Factory Mutual (FM).
- I. Pipe Markings
  - 1. Meet the minimum requirements of AWWA C901 or C906 as appropriate. Minimum pipe markings shall be as follows:
    - a. Manufacturer's Name or Trademark and production record
    - b. Nominal pipe size
    - c. IPS
    - d. Dimension Ratio (DR9)
    - e. AWWA C901 or C906
    - f. Seal of testing agency that verified the suitability of the pipe
    - g. Resin type (PE4710)
  - 2. Color identification to identify pipe service is required.
    - a. Stripes or colored exterior pipe product shall be blue for potable water, or purple (lavender) for reclaimed water.
    - b. Permanent identification of piping shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell.
    - c. The striping material shall be the same material as the pipe material except for the color.
    - d. Plain Black HDPE Pipe without color code markings may not be used.
- J. Only smooth wall HDPE will be permitted.
- K. Socket fusion is not allowed for pipes with diameter greater than 2-inch diameter.

## **2.4 HDPE BUTT FUSION FITTINGS**

- A. Butt Fusion Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.3.
- B. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
  - 1. Fabricated Fittings shall be Equivalent Dimension Ratio to DR9.
  - 2. Pipe stock used to manufacture fabricated fittings shall meet requirements of AWWA C906 and meet the material designation code of PE4710.
  - 3. Fabricated Fittings typically require a lower DR rating than the pipe to meet or exceed the pipe pressure rating. Calculate the difference for a fabricated fitting based on a published rerating percentage.
  - 4. Fabricated bend and tee fittings shall have a minimum of 3 segments.
  - 5. Fabricated bend fittings over 45 degrees through 90 degrees shall have a minimum of four segments.

- 6. Field fabricated fittings are not allowed.
- C. All fittings shall meet the requirements of AWWA C906.
- D. Markings for molded fittings shall comply with the requirements of ASTM D 3261.
  - 1. Standard Designation (ASTM D 3261)
  - 2. Manufacturer's name or trademark
  - 3. Material designation (PE4710)
  - 4. Date of manufacture or manufacturing code
  - 5. Size
  - 6. Dimension Ratio (example: DR11)
- E. Fabricated fittings shall be marked in accordance with ASTM F 2206.
  - 1. Standard Designation (ASTM F 2206)
  - 2. Manufacturer's name or trademark
  - 3. Material designation (PE4710)
  - 4. Date of manufacture or manufacturing code
  - 5. Size
  - 6. Equivalent Dimension Ratio

## **2.5 HDPE ELECTROFUSION FITTINGS**

- A. Electrofusion Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.3.
- B. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- C. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting.
- D. Markings shall be according to ASTM F 1055.
  - 1. Standard Designation (ASTM F 2206)
  - 2. Manufacturer's name or trademark
  - 3. Material designation (PE4710)
  - 4. Date of manufacture or manufacturing code
  - 5. Size
  - 6. Equivalent Dimension Ratio

## **2.6 FLANGES AND MECHANICAL JOINT ADAPTERS (MJ ADAPTERS)**

- A. Flanges and Mechanical Joint Adapters shall have a material designation code of PE4710 or higher and a minimum Cell Classification as noted in 2.3.
- B. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206.
- C. The outside diameter of Flanges shall be based on Iron Pipe Size (IPS).
- D. The MJ Adapters shall be based on Iron Pipe Size by Ductile Iron Pipe Size (IPS x DIPS).
- E. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- F. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261.

1. Manufacturer's name or trademark
  2. Material designation (PE4710)
  3. Date of manufacture or manufacturing code
  4. Size
  5. Where recessed marking is used, take care not to reduce the wall thickness below the minimum specified.
- G. Fabricated (including machined) flange adapters shall be per ASTM F 2206.
- H. Metal gland for MJ Adapter may be either AWWA C110 (heavyweight) or AWWA C153 (lightweight).
- I. Low alloy steel bolts shall comply with AWWA C 111.4. Bolts, rods and hex nuts shall be manufactured from 304 stainless steel as per ANSI/ AWWA C111/A21.11.
- J. Van-Stone style, metallic (including stainless steel), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C 207 Class 150 Series B, D, or E.
- K. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as coal-tar epoxy, galvanization, polyether, or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the Engineer.

## **2.7 MECHANICAL JOINT WEDGE ACTION RESTRAINT**

- A. Mechanical Joint wedge action restraint shall only be allowed with specific permission of the Engineer in cases where an MJ Adapter is not feasible.
- B. Mechanical Joint wedge action restraint shall be designed specifically for use on HDPE pipe.
- C. The grip of the serrations shall increase as the hydrostatic pressure increases.
- D. There shall be no additional tool required for installation other than the tools required to install standard sizes of hex nuts from 5/8"-1 1/8". The hex heads, bolts and rods shall be designed to tighten clockwise. The hex heads, bolts and rods shall be manufactured to allow for disassembly and re-installation of the restraint.
- E. The gland halves shall be manufactured of high strength ductile iron in accordance with the ASTM A536 Standard, Grade 65-45-12.
- F. Rods are manufactured from 304 stainless steel and hex nuts are manufactured from 316 stainless steel as per ANSI/ AWWA C111/A21.11.
- G. The restraining gland shall comply with all applicable dimensions of ANSI/AWWA C111/A21.11 and shall be compatible with all bell and spigot (push-on) joint sockets of the standard.
- H. Stiffening insert required.

## **2.8 SERVICE CONNECTIONS**

- A. Service connections shall be electrofusion saddles with sidewall fusion branch saddles, or tapping tees.
- B. Electrofusion saddles shall be made from materials required in 2.5.

- C. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼-inch of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼-inch of area beyond the saddle are not acceptable.
- D. Tapping tees shall be made to ASTM D 3261 or D 2683.
- E. Electrofusion saddles are the preferred method of service connections. Mechanical strap-on saddles can only be used where approved by the Engineer. The body of the mechanical saddle shall be stainless steel. The gasket material and design must be acceptable for PE pipe. Install mechanical strap-on saddles per the manufacturer's instructions.

## **2.9 PIPELINE MARKERS**

- A. Provide markers in accordance with Project Manual.
- B. Detectable Warning Tape - 6-inch wide detectable warning tape - All force mains shall be clearly identified with blue 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 Detectable Marking Tape.
- C. Tracer wire - continuous AWG no. 12 gauge solid copper tracer wire with 30 mil thick blue HDPE insulation. Perform conductivity test on the tracer wire at final inspection.
- D. Marker post material shall be high-performance fiberglass composite. Minimum 3-foot above ground. Manufactured by Carsonite or accepted equal.

## **2.10 STIFFENING INSERT (STIFFENER)**

- A. Provide Stiffeners at each MJ adapter and coupling per Standard Details.
- B. Stiffening inserts shall be specially designed for use on the inside of HDPE pipe in conjunction with AWWA C111 mechanical joints.
- C. Provide stainless steel per ASTM 240, type 304 or 316.
- D. Stiffener shall be manufactured within the pipe or MJ adapter by the factory.
- E. Field installed stiffeners may be allowed upon approval of Charlotte Water inspector. Wedge style stiffeners are allowed.
- F. Stiffener length must be sufficient to fully encompass the area of the pipe being restrained.
- G. Inserts must be designed for underground pressurized fluid service and are pressure rated to match the pipe DR pressure rating, derated as appropriate for service temperature. Maximum test pressure limited to pipe rated pressure.
- H. Stiffener design shall prevent movement causing fitting to slide or rotate on the pipe.

## **2.11 FLEX COUPLING RESTRAINT DEVICE**

- A. HDPE flex coupling restraint devices will be rated for minimum of 8,000 pounds of force.
- B. Resin used to manufacture device shall meet requirements of ASTM 3350 with minimum cell classification of 445474C.
- C. Device will include bar code and product label tag.
- D. Device will install by electrofusion.

## **2.12 WALL ANCHOR**

- A. Butt fusion wall anchors, or force restraint collars, shall comply with requirements of DR9, Iron Pipe Size (IPS), minimum cell class 445474C, and meeting this specification's requirements for PE pipe except for striping.

## **2.13 HDPE TUBING**

- A. High Density Polyethylene (HDPE) tubing shall meet the requirements of AWWA C901.
- B. HDPE tubing shall be rated for use at a pressure class of 250 psi.
- C. Polyethylene tubing shall be made from HDPE resin having a material designation code of PE4710 or higher.
- D. Tubing material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C.
- E. HDPE Pressure tubing for potable water shall meet the requirements of NSF 61.
- F. Pressure tubing shall be approved by the Underwriter's Laboratory (UL) or Factory Mutual (FM).
- G. Tubing Markings
  - 1. Meet the minimum requirements of AWWA C901. Minimum pipe markings shall be as follows:
    - a. Nominal pipe size
    - b. Diameter Base (CTS or IPS)
    - c. Dimension Ratio (DR11)
    - d. Manufacturer's Name or Trademark
    - e. Material Designation Code / Resin type (PE4710)
    - f. AWWA pressure class
    - g. Standard designation (AWWA C901)
    - h. Seal of testing agency that verified the suitability of the pipe
  - 2. Color identification to identify pipe service is required.
    - a. Solid colored exterior pipe product shall be blue for potable water, or purple (lavender) for reclaimed water.
    - b. Plain Black HDPE Pipe without color code markings may not be used.
- H. Only smooth wall HDPE will be permitted.
- I. Socket fusion is allowed for HDPE pipe from 1.25-inch through 2-inch diameter and tubing from 3/4-inch through 1-inch diameter.

## **2.14 COPPER FITTINGS**

- A. 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.
- B. Fittings may be flared or compression as applicable, in accordance with AWWA C 800.
- C. Compression fittings shall utilize a compression nut and/or split clamp with tightening screw.
- D. Stab type fittings are not approved.



## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Only formally trained and certified fusion technicians may conduct fusions. Qualification of the fusion technician shall be demonstrated by certification in fusion training within the past year for the type of fusion, and size of the pipe, and on the specific equipment to be used on this project. Provide documentation showing current and up-to-date qualification of training obtained to fuse PE pipe in the appropriate sizes and equipment types for the job.
- B. Training in accordance with ASTM F 6220 for butt fusion.
- C. Training in accordance with ASTM F 1055 for electrofusion.
- D. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
- E. Qualified technician has documented prior experience in performing HDPE pipe installations, head fusion procedures, and testing methods.

### **3.2 INSTALLATION**

#### **A. GENERAL**

- 1. Install pipe, fittings, specials, and appurtenances as specified herein, as specified in AWWA M55, and in accordance with the pipe manufacturer's recommendations with the intention of providing a leak-free system to the Owner.
- 2. Excavate and backfill trenches in accordance with the Project Manual.

#### **B. PIPE HANDLING**

- 1. At the close of each operating day, when work is stopped for more than 30 minutes, or when the trench is unsupervised:
  - a. Keep the pipe clean and free of debris, dirt, animals, and trash – during and after the laying operation.
  - b. Effectively seal the open end of the pipe using a gasketed night cap.

#### **C. JOINING METHODS**

- 1. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations.
- 2. Saddle fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or PPI TR-41 or the fitting manufacturer's recommendations and PPI TR-41.
- 3. Socket Fusion: Molded socket fusion fittings are only to be used for joining of HDPE pipe from 1/2 inch to 2" in size. Socket fusion shall be done in accordance with ASTM F 2620 or the fitting manufacturer's recommendations. Socket fusion is the process of fusing pipe to pipe, or pipe to fitting by the use of a male and female end that are heated simultaneously, and pressed together so the outside wall of the male end is fused to the inside wall of the female end.
- 4. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source , a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used.

#### **D. MECHANICAL**

1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with this specification.
2. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
3. Mechanical coupling shall be made by qualified technicians.

**E. JOINT RECORDING**

1. Butt Fusion: The butt fusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
2. Electrofusion: The electrofusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
3. The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report.

**F. INSTALLATION**

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.
2. Lay pipe with blue stripe within 45-degrees either side of crown, if pipe has blue stripe.
3. Pipe embedment - Embedment material shall be fine aggregate defined as:
  - a. Granular and free flowing
  - b. Generally meets or exceeds the limits on deleterious substances per Table 1 for fine aggregate according to ASTM C 33
  - c. Reasonably free of organic material
  - d. Gradation:

<u>Sieve Size</u>	<u>Percent Retained</u>
1 inch	0
3/8 inch	0-10
#30	25-60
#100	95

4. Compact backfill per ASTM D 698 and AASHTO T-99 as modified by NCDOT to 85% of maximum density or 95% maximum density within a road right-of-way. Compact the top 12-inches below the road sub-grade to 100% of maximum density within a road right-of-way.

**G. MARKER INSTALLATION**

1. See Standard Detail for placement requirements for detectable tape and tracer wire.

**3.3 SITE QUALITY CONTROL**

**A. LEAK TESTING**

1. Hydrostatic leakage testing is recommended and shall comply with AWWA C651, ASTM F 2164, ASTM F 1412, AWWA Manual of Practice M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
2. Prior to scheduling a test with the inspector, preform a pre-test to confirm compliance.

3. Contractor shall perform hydrostatic and leakage tests in accordance with North Carolina state requirements.
4. Installed main shall be adequately anchored with a covering of at least 6-inches of initial backfill, if installed by an open trench method. The joints and fittings, particularly flange connections shall be left uncovered for visual leak inspection.
5. Leak tests of HDPE water system shall be conducted in accordance with ASTM F2164. The pipeline should be slowly filled with potable water and all trapped air bled off. The main should undergo a hydrostatic pressure test using pressure at the lowest elevation in the system at 150 psi. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, the pressure shall remain steady within 5% (7.5 psi) of a target 150 psi test pressure for one hour.
6. The total test time should not exceed 8 hours. If the pipeline has to be retested – the pipe must be depressurized and allowed to “relax” for at least 8 hours before the next testing sequence.
7. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, test the pressure at the lowest point.
8. Test pressure for one hour. Pressure should remain steady at 1.5 times the working pressure, but not more than the design pressure of the pipe (e.g. 200 psi for DR 11). Pressure must remain within 5% of a target test pressure for one hour.
9. In fused polyethylene water piping system no leakage shall be present. If leakage is observed at a fusion joint, complete rupture may be imminent. The Contractor shall move all personnel away from the joint and depressurize the main. Leaks, failure, or defective construction shall be promptly repaired by the Contractor at the Contractor’s sole expense.
10. Payment for pressure and leakage testing shall be considered included in the price paid per linear foot for water main installation.
11. Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

#### B. CLEANING AND DISINFECTING

1. After installation and pressure testing, disinfect water line according to AWWA C651.
2. The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection shall be a minimum of 12 hours and should not exceed 24 hours.
3. Lab samples shall be collected and analyzed by Charlotte Water laboratories.
4. Dechlorinate with sodium bisulfate prior to release. Any water discharged to the ground surface shall not exceed 0.2 ppm of free chlorine.
5. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

#### C. DISINFECTION AND BACTERIOLOGICAL TESTING

1. Newly installed potable water pipelines require disinfection in accordance with ANSI/AWWA C651/B301. The disinfection should take place after the initial flushing and after the completion of the pressure testing.
2. Air is to be exhausted from each high point, dead end, branch run, and hydrant run. The chlorinated water shall be removed prior to samples being collected for bacteriological testing.
3. After flushing to remove sediment and other foreign matter, and after testing for leaks, Contractor shall disinfect the main by the addition and thorough dispersion of a chlorine

solution in concentrations sufficient to produce a chlorine residual of at least 50 milligrams per liter (or ppm) in the water throughout the distribution system.

4. Injection of liquid chlorine solution shall be used to disinfect HDPE water mains. The disinfecting solution should not contain more than 12 percent of active chlorine. Prolonged exposure to highly concentrated disinfection chemicals may damage the inside surface of HDPE pipe and is to be avoided.
5. The chlorine solution shall remain in contact with interior surfaces of the water system for a period of 24-hours. Then the water system shall be flushed with fresh water from an approved water source until the chlorine solution is dispelled.
6. Before bacteriological testing samples are taken, each hydrant run, branch run, and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one part per million.
7. The Contractor shall measure residual chlorine concentrations by using a color comparator test that is witnessed and approved by the Inspector. After the chlorine concentration is less than 1 ppm, samples shall be gathered and tests conducted according to the provisions of AWWA C651-92, at the expense of the Contractor, by a laboratory approved by the Engineer.
8. Samples shall be taken at representative points as required to thoroughly test the installed main.
9. The Contractor will be required to perform two consecutive 24-hour apart Coliform tests. Testing laboratory used by the Contractor shall be State Certified and provide QA/QC report. The new facilities shall remain isolated and out of service until satisfactory test results have been obtained that meet the requirements of Charlotte Water and the North Carolina Department of Environment and Natural Resources – Public Water Supply Section and the Engineer has accepted the results as indicative of the bacteriological condition of the new water main. If unsatisfactory or doubtful results are obtained from the initial sampling, the chlorination process shall be repeated until acceptable test results are obtained. The bacteriological test takes at least 48 hours for results to be conclusive.
10. Individual new water services will be flushed thru the angle meter stop after connection to the new water main.
11. Payment for disinfecting water mains shall be considered included in the price paid per linear foot for water main installation.
12. Disposal of chlorinated water shall comply with all federal, state, and local regulatory requirements. Disposal directly to the storm drain system without removal of chlorine is strictly prohibited. No discharge into the storm drain system shall be allowed during rain. Upon termination of the flushing, any standing water in the gutter shall be removed by sweeping it to the nearest storm drain catch basin. Flushing of chlorinated water directly into the sanitary sewer system will only be allowed with the written approval of the Charlotte Water.
13. New water mains must be tied-in into water distribution system within 24 hours following the Engineer's acceptance of the bacteriological tests' results or the Contractor will be required to repeat flushing, disinfection, and bacteriological testing procedures at the Contractor's expense. The new pipe, connections, and fittings must be kept clean and swabbed with a 5% solution of hypochlorite before installation.

## END OF SECTION

Revision Log		
DATE	NAME	SUMMARY OF CHANGE

**SECTION 33 31 20**  
**HIGH DENSITY POLYETHYLENE (HDPE) SANITARY SEWER PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes High Density Polyethylene (HDPE) pipe and fittings from 4-inch through 12-inch for sanitary sewer applications including force mains. This section only applies to force mains with an operating pressure below 200 pounds per square inch (psi).
- B. Charlotte Water does not allow HDPE pipe for gravity sewer installed by open cut. Charlotte Water allows HDPE pipe for sewer rehabilitation projects installed by pipe bursting. HDPE specifications for pipe bursting are located in Chapter XX, Sanitary Sewer Rehabilitation Specifications, of the Charlotte Water Design Manual.
- C. Refer to Chapter XVII of the Charlotte Water Design Manual for force main valve requirements.

**1.2 REFERENCE STANDARDS**

- A. Reference Standards
  - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
  - 2. In the event of a conflict, the most stringent requirements prevail. Submit conflicts to the Owner in writing prior to purchase of materials.
- B. Charlotte Water Design Manual
  - 1. Chapter XVII – Pump Stations and Force Main Specifications and Policies
  - 2. Chapter XX – Standard Sanitary Sewer Rehabilitation Specifications
- C. ANSI/AWWA [www.awwa.org](http://www.awwa.org)
  - 1. AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation
  - 2. ANSI/AWWA C111/A21.11-12 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - 3. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
  - 4. ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- D. Plastics Pipe Institute, PPI [www.plasticpipe.org](http://www.plasticpipe.org)
  - 1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
  - 2. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
  - 3. PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
  - 4. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)

E. ASTM [www.astm.org](http://www.astm.org)

1. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter
2. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
3. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
4. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
5. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
6. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
7. ASTM F 585 Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers
8. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR- PR) Based on Outside Diameter
9. ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
10. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
11. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
12. ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
13. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
14. ASTM F 2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
15. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

### 1.3 SYSTEM DESIGN PARAMETERS

A. Surge Pressure

1. Per AWWA C906, the repetitive surge pressure allowance is one half the pressure class of the pipe, and the occasional surge over pressure allowance is equal to the pressure class of the pipe. Allowable Total Pressure during Recurring Surge conditions equals 1.5 times the pipe's pressure class. Allowable Total Pressure during Occasional Surge conditions equals 2.0 times the pipe's pressure class.
2. Table 1 gives the Pressure Class per AWWA C906, Pressure Rating and Allowable Total Pressure During Recurring and Occasional Surge for PE4710 pipe at 80°F or less.

Pipe Dimension Ratio (DR)	Pressure Class	Pressure Rating	Allowable Total Pressure During Recurring Surge	Allowable Total Pressure During Occasional Surge
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DR 11	200 psi	200 psi	300 psi	400 psi
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#### 1.4 SUBMITTALS

##### A. Requirements

1. Submittals shall be in accordance with requirements in Submittals Section.
2. All submittals shall be approved by the Engineer or the City prior to delivery.
3. The Contractor shall submit to the Owner, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers, and the appropriate shop drawings for all polyethylene pipe and fittings.
4. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications. This certification shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.
5. The Contractor shall submit shop drawings showing installation method and the proposed method and specialized equipment to be used.
6. Manufacturers recommended fusion procedures for the products.

##### B. Provide Product Data

1. Manufacturer
2. Dimension Ratio
3. Joint Types
4. Restraint, if required in Contract Documents
  - a. Retainer glands
  - b. Thrust harnesses
  - c. Any other means of restraint

##### C. Installer Qualifications

1. Provide certifications meeting requirements of section 3.1 for each installer. Keep certifications on project site available to Owner, Engineer, and Inspector.

##### D. Provide Internal Stiffeners Data

##### E. Provide Mechanical Joint Adapters Data

##### F. Data Logger Records

1. Provide electronic data logger record to the inspector daily or on request of inspector.
2. Fusion Reports shall report manufacturer, component, component fusion-jointing parameters, assembly operation and joint identification, per ISO 12176-4, and the following fusion-jointing operation data:
  - a. Temp-Compensated Fusion Time & Actual Fusion Time
  - b. Resistance before & after fusion
  - c. Hi and Low output voltage & output current during fusion
  - d. Total Amp-Hours applied to fitting
  - e. Input voltage and frequency before fusion



- f. High and Low input voltage and frequency during fusion
  - g. Input waveform
  - h. GPS position and quality
  - i. Ambient temperature
  - j. Heating iron face temperatures
  - k. Fusion pressure
  - l. Graphic representation of the fusion cycle.
3. Report shall comply with ISO 12176-2 requirements for traceability databases.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

### **A. Delivery, Storage, and Handling Requirements**

1. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property.
2. Follow manufacturer's recommendations for delivery, storage, and handling.
3. No stacking of pipe is allowed, unless within a fenced contained workspace. Pipe stacking is to be in compliance with AWWA Manual of Practice M55 Table 7-1.
4. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use. Damages resulting from improper delivery, storage, or handling are the responsibility of the Contractor, and no additional payment shall be allowed by the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Only the pipe manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
  1. Performance Pipe
  2. Georg Fischer
  3. JM Eagle
  4. Driscoplex
  5. WL Plastics
- B. Only the electrofusion fittings manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
  1. Agru America
  2. Georg Fischer Central Plastics
  3. Integrity Fusion Products
  4. IPEX, Inc.

5. M.T. Deason Company
  6. Nupi Americas
  7. Plasson, USA
  8. Strongbridge-Tega
- C. Only the butt fusion fittings manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
1. ISCO
  2. IPEX
  3. Georg Fisher
- D. Only the fusion equipment manufacturers as listed below are allowed. Other manufacturers may be considered as equals on a project basis.
1. McElroy
- E. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Substitution Request Section of the Project Manual.

## 2.2 HDPE PIPE

- A. High Density Polyethylene (HDPE) pipe and fittings shall meet the requirements of AWWA C906.
- B. HDPE must meet the following minimum Dimension Ratio:

Diameter (inch)	Min Dimension Ratio
4 through 12	DR 11

- C. The outside diameter of the pipe shall be based upon the **Iron Pipe Size (IPS)** sizing system.
- D. Polyethylene pipe shall be made from HDPE material having a material designation code of PE4710 or higher.
- E. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C.
- F. Pressure Pipe shall be approved by the Underwriter's Laboratory (UL) or Factory Mutual (FM).
- G. Pipe Markings
1. Meet the minimum requirements of AWWA C906. Minimum pipe markings shall be as follows:
    - a. Manufacturer's Name or Trademark and production record
    - b. Nominal pipe size
    - c. IPS
    - d. Dimension Ratio
    - e. AWWA C906
    - f. Seal of testing agency that verified the suitability of the pipe

- g. Resin type (PE4710)
- 2. Color identification to identify pipe service is required.
  - a. Stripes or colored exterior pipe product shall be green for wastewater/sewage,
  - b. Pipe interior shall be gray for visual inspection.
  - c. Permanent identification of piping shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell.
  - d. The striping material shall be the same material as the pipe material except for the color.
  - e. Plain Black HDPE Pipe without color code markings may not be used.
- H. Only smooth wall HDPE will be permitted. Charlotte Water does not allow the use of corrugated HDPE for sanitary sewer piping.

### **2.3 HDPE BUTT FUSION FITTINGS**

- A. Butt Fusion Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as required for HDPE Pipe.
- B. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
  - 1. Fabricated Fittings shall be Equivalent Dimension Ratio to DR11.
  - 2. Pipe stock used to manufacture fabricated fittings shall meet requirements of AWWA C906 and meet the material designation code of PE4710.
  - 3. Fabricated Fittings typically require a lower DR rating than the pipe to meet or exceed the pipe pressure rating. Calculate the difference for a fabricated fitting based on a published rerating percentage.
  - 4. Fabricated bend and tee fittings shall have a minimum of 3 segments.
  - 5. Fabricated bend fittings over 45 degrees through 90 degrees shall have a minimum of four segments.
  - 6. Field fabricated fittings are not allowed.
- C. All fittings shall meet the requirements of AWWA C906.
- D. Markings for molded fittings shall comply with the requirements of ASTM D 3261.
  - 1. Standard Designation (ASTM D 3261)
  - 2. Manufacturer's name or trademark
  - 3. Material designation (PE4710)
  - 4. Date of manufacture or manufacturing code
  - 5. Size
  - 6. Dimension Ratio (example: DR11)
- E. Fabricated fittings shall be marked in accordance with ASTM F 2206.

1. Standard Designation (ASTM F 2206)
2. Manufacturer's name or trademark
3. Material designation (PE4710)
4. Date of manufacture or manufacturing code
5. Size
6. Equivalent Dimension Ratio

## **2.4 HDPE ELECTROFUSION FITTINGS**

- A. Electrofusion Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted for HDPE pipe.
- B. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- C. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting.
- D. Markings shall be according to ASTM F 1055.
  1. Standard Designation (ASTM F 2206)
  2. Manufacturer's name or trademark
  3. Material designation (PE4710)
  4. Date of manufacture or manufacturing code
  5. Size
  6. Equivalent Dimension Ratio

## **2.5 FLANGES AND MECHANICAL JOINT ADAPTERS (MJ ADAPTERS)**

- A. Flanges and Mechanical Joint Adapters shall have a material designation code of PE4710 or higher and a minimum Cell Classification as noted for HDPE pipe.
- B. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206.
- C. The outside diameter of Flanges shall be based on Iron Pipe Size (IPS).
- D. The MJ Adapters shall be based on Iron Pipe Size by Ductile Iron Pipe Size (IPS x DIPS).
- E. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- F. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261.
  1. Manufacturer's name or trademark
  2. Material designation (PE4710)

3. Date of manufacture or manufacturing code
  4. Size
  5. Where recessed marking is used, take care not to reduce the wall thickness below the minimum specified.
- G. Fabricated (including machined) flange adapters shall be per ASTM F 2206.
- H. Metal gland for MJ Adapter may be either AWWA C110 (heavyweight) or AWWA C153 (lightweight).
- I. Low alloy steel bolts shall comply with AWWA C 111.4. Bolts, rods, and hex nuts shall be manufactured from 304 stainless steel as per ANSI/ AWWA C111/A21.11.
- J. Van-Stone style, metallic (including stainless steel), convoluted, or flat-plate back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C 207 Class 150 Series B, D, or E.
- K. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be protected from corrosion by a system such as coal-tar epoxy, galvanization, polyether, or polyester fusion bonded epoxy coatings, anodes, or cathodic protection, as specified by the Engineer.

## **2.6 MECHANICAL JOINT WEDGE ACTION RESTRAINT**

- A. Mechanical Joint wedge action restraint shall only be allowed with specific permission of the Engineer in cases where an MJ Adapter is not feasible.
- B. Mechanical Joint wedge action restraint shall be designed specifically for use on HDPE pipe.
- C. The grip of the serrations shall increase as the hydrostatic pressure increases.
- D. There shall be no additional tool required for installation other than the tools required to install standard sizes of hex nuts from 5/8"-1 1/8". The hex heads, bolts and rods shall be designed to tighten clockwise. The hex heads, bolts and rods shall be manufactured to allow for disassembly and re-installation of the restraint.
- E. The gland halves shall be manufactured of high strength ductile iron in accordance with the ASTM A536 Standard, Grade 65-45-12.
- F. Rods are manufactured from 304 stainless steel and hex nuts are manufactured from 316 stainless steel as per ANSI/ AWWA C111/A21.11.
- G. The restraining gland shall comply with all applicable dimensions of ANSI/AWWA C111/A21.11 and shall be compatible with all bell and spigot (push-on) joint sockets of the standard.
- H. Stiffening insert required.

## **2.7 PIPELINE MARKERS**

- A. Provide markers in accordance with Project Manual.
- B. Detectable Warning Tape - All force mains shall be clearly identified with 6-inch wide green plastic locator tape made specifically for that purpose. The tape shall be marked with black lettering clearly identifying the pipeline as sanitary sewer.
- C. Tracer wire - continuous AWG no. 12 gauge solid copper tracer wire with 30 mil thick green HDPE insulation. Perform conductivity test on the tracer wire at final inspection.
- D. Marker post material shall be high-performance fiberglass composite. Minimum 3-foot above ground. Manufactured by Carsonite or accepted equal.

## **2.8 STIFFENING INSERT (STIFFENER)**

- A. Provide Stiffeners at each MJ adapter and coupling per Standard Details.
- B. Stiffening inserts shall be specially designed for use on the inside of HDPE pipe in conjunction with AWWA C111 mechanical joints.
- C. Provide stainless steel per ASTM 240, type 304 or 316.
- D. Stiffener shall be manufactured within the pipe or MJ adapter by the factory.
- E. Field installed stiffeners may be allowed upon approval of Charlotte Water inspector. Wedge style stiffeners are allowed.
- F. Stiffener length must be sufficient to fully encompass the area of the pipe being restrained.
- G. Inserts must be designed for underground pressurized fluid service and are pressure rated to match the pipe DR pressure rating, derated as appropriate for service temperature. Maximum test pressure limited to pipe rated pressure.
- H. Stiffener design shall prevent movement causing fitting to slide or rotate on the pipe.

## **2.9 FLEX COUPLING RESTRAINT DEVICE**

- A. HDPE flex coupling restraint devices will be rated for minimum of 8,000 pounds of force.
- B. Resin used to manufacture device shall meet requirements of ASTM 3350 with minimum cell classification of 445474C.
- C. Device will include bar code and product label tag.
- D. Device will install by electrofusion.

## **2.10 WALL ANCHOR**

- A. Butt fusion wall anchors, or force restraint collars, shall comply with requirements of DR11, Iron Pipe Size (IPS), minimum cell class 445474C, and meeting this specification's requirements for HDPE pipe except for striping.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Only formally trained and certified fusion technicians may conduct fusions. Qualification of the fusion technician shall be demonstrated by certification in fusion training within the past year for the type of fusion, and size of the pipe, and on the specific equipment to be used on this project. Provide documentation showing current and up-to-date qualification of training obtained to fuse PE pipe in the appropriate sizes and equipment types for the job.
- B. Training in accordance with ASTM F 6220 for butt fusion.
- C. Training in accordance with ASTM F 1055 for electrofusion.
- D. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
- E. Qualified technician has documented prior experience in performing HDPE pipe installations, head fusion procedures, and testing methods.

### **3.2 INSTALLATION**

- A. General
  - 1. Install pipe, fittings, specials and appurtenances as specified herein, as specified in AWWA M55 and in accordance with the pipe manufacturer's recommendations with the intention of providing a leak-free system to the Owner.
  - 2. Excavate and backfill trenches in accordance with the Project Manual.
- B. Joining Methods
  - 1. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
  - 2. Saddle fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or TR-41 or the fitting manufacturer's recommendations and PPI TR-41.
  - 3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
- C. Mechanical:
  - 1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.

2. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
3. Mechanical coupling shall be made by qualified technicians.

D. Joint Recording

1. Butt Fusion: The butt fusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
2. Electrofusion: The electrofusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
3. The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded by an electronic data logging device. All fusion joint data shall be included in the fusion technician's joint report.

E. Installation

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.
2. Lay pipe with green stripe within 45-degrees either side of crown, if pipe has green stripe.
3. Pipe embedment - Embedment material shall be fine aggregate defined as:
  - a. Granular and free flowing
  - b. Generally meets or exceeds the limits on deleterious substances per Table 1 for fine aggregate according to ASTM C 33
  - c. Reasonably free of organic material
  - d. Gradation:

<u>Sieve Size</u>	<u>Percent Retained</u>
1 inch	0
3/8 inch	0-10
#40	20-60
#100	95

1. Compact backfill per ASTM D 698 and AASHTO T-99 as modified by NCDOT to 85% of maximum density or 95% maximum density within a road right-of-way. Compact the top 12-inches below the road sub-grade to 100% of maximum density within a road right-of-way.

F. Leak Testing

1. Hydrostatic leakage testing is recommended and shall comply with AWWA C651, ASTM F 2164, ASTM F 1412, AWWA Manual of Practice M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.
2. Prior to scheduling a test with the inspector, preform a pre-test to confirm compliance.
3. Contractor shall perform hydrostatic and leakage tests in accordance with North Carolina state requirements.



4. Installed main shall be adequately anchored with a covering of at least 6-inches of initial backfill, if installed by an open trench method. The joints and fittings, particularly flange connections shall be left uncovered for visual leak inspection.
5. Leak tests of HDPE water system shall be conducted in accordance with ASTM F2164. The pipeline should be slowly filled with potable water and all trapped air bled off. The main should undergo a hydrostatic pressure test using pressure at the lowest elevation in the system at 150 psi. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, the pressure shall remain steady within 5% (7.5 psi) of a target 150 psi test pressure for one hour.
6. The total test time should not exceed 8 hours. If the pipeline has to be retested – the pipe must be depressurized and allowed to “relax” for at least 8 hours before the next testing sequence.
7. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, test the pressure at the lowest point.
8. Test pressure for one hour. Pressure should remain steady at 1.5 times the working pressure, but not more than the design pressure of the pipe (e.g. 200 psi for DR 11). Pressure must remain within 5% of a target test pressure for one hour.
9. In fused polyethylene water piping system no leakage shall be present. If leakage is observed at a fusion joint, complete rupture may be imminent. The Contractor shall move all personnel away from the joint and depressurize the main. Leaks, failure, or defective construction shall be promptly repaired by the Contractor at the Contractor’s sole expense.
10. Payment for pressure and leakage testing shall be considered included in the price paid per linear foot for water main installation.
11. Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

**G. Pipe Marker Installation**

1. See Standard Detail for placement requirements.
2. Install detectable warning tape. Place the tape directly above the pipe embedment material and minimum 1-foot below the ground surface.
3. Install tracer wire. Place the tracer wire at bottom of the pipe embedment material and do not attach wire to pipe. Perform conductivity test on the tracer wire at final inspection.

### **3.3 SITE QUALITY CONTROL**

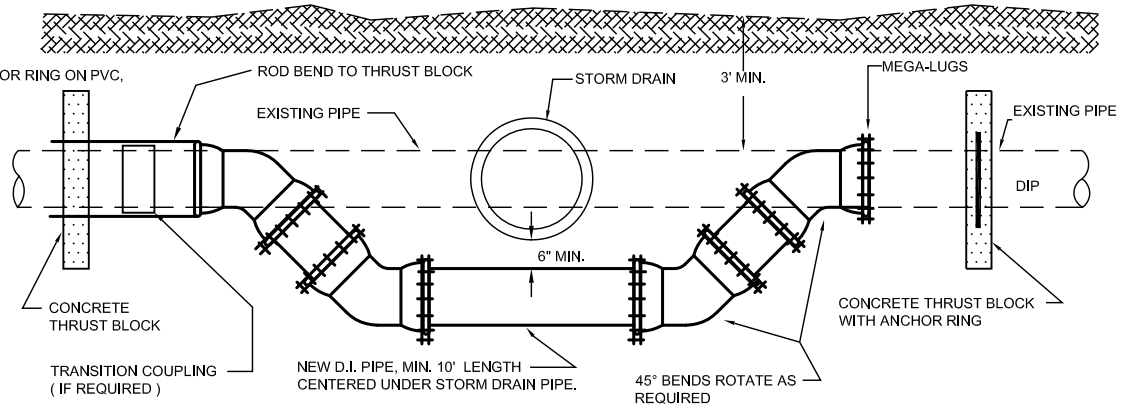
**A. Sanitary Sewer Pipe**

- a. The Contractor shall provide bypass pumping and/or flow diversion in accordance with Project Manual.
- b. Prior to final acceptance and final inspection of the pipe by the Engineer, the Contractor shall flush and clean all parts of the system by removing all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the pipe.

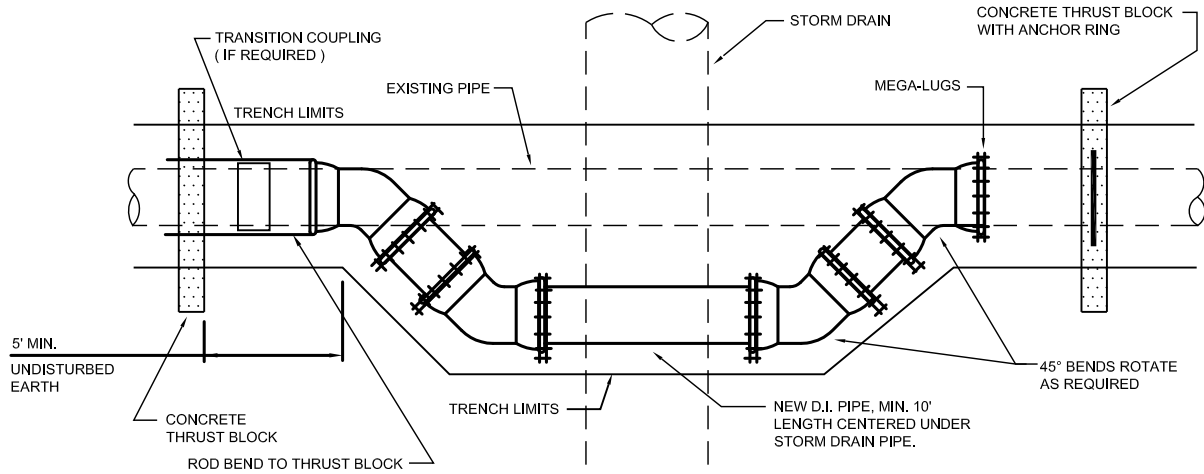
END OF SECTION

Revision Log		
DATE	NAME	SUMMARY OF CHANGE

NOTE:  
DO NOT USE ANCHOR RING ON PVC,  
CIP, OR AC PIPE.



**PROFILE VIEW**  
NTS



**PLAN VIEW**  
NTS

NOTE:

1. FITTINGS SHALL BE RESTRAINED USING MEGALUGS, STAINLESS STEEL TIE RODS, OR RESTRAINED JOINT PIPE, AS APPROVED BY ENGINEER.
2. BEARING AREAS (AxB) DETERMINED BY ACTUAL SOIL CONDITIONS. SHOULD BE BASED ON 200 PSI TEST PRESSURE. SEE CHART BELOW.

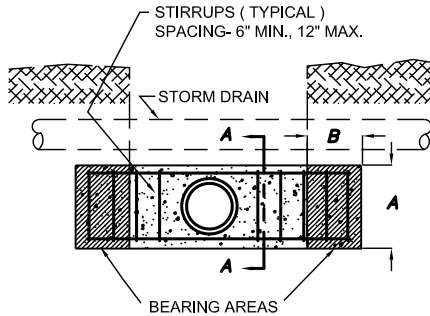
RESULTANT THRUST AT FITTINGS AT 200 PSI WATER PRESSURE.

TOTAL POUNDS	
NOM. PIPE DIAMETER	45° BEND
4 INCH	2770
6 INCH	5724
8 INCH	9846
10 INCH	14812
12 INCH	20948

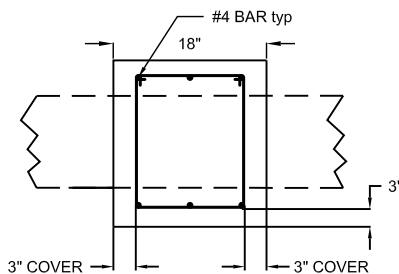
THE FOLLOWING OFTEN-USED SOIL VALUES FOR THE DEPTHS OF 4 FEET ARE LISTED ONLY AS A GUIDE\*. THE ENGINEER SHOULD SELECT THESE BEARING VALUES FOR EACH SOIL TYPE AND DEPTH OF COVER ENCOUNTERED ON THE SPECIFIC PIPELINE PROJECT. APPROPRIATE SAFETY FACTORS SHOULD BE APPLIED TO COVER FUTURE CHANGES IN PIPE DEPTH, SOIL BEARING CAPACITIES, ETC.

SOIL	BEARING LOAD (lbs/sq.ft.)
MUCK	0
SOFT CLAY	1,000
SILT	1,500
SANDY SILT	3,000
SAND	4,000
SANDY CLAY	6,000
HARD CLAY	9,000

\* NO RESPONSIBILITY CAN BE ASSUMED FOR THE ACCURACY OF THE DATA IN THIS TABLE DUE TO THE WIDE VARIATION OF BEARING LOAD CAPABILITIES FOR EACH SOIL TYPE.



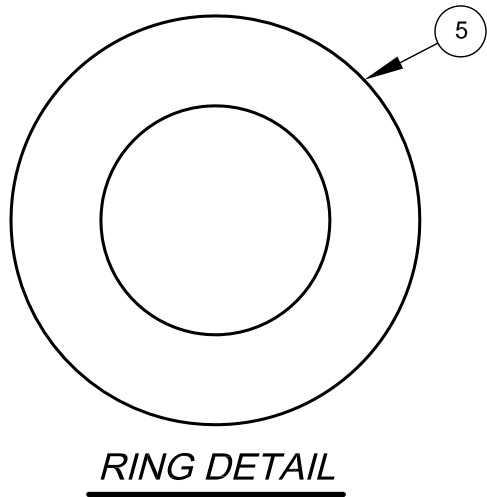
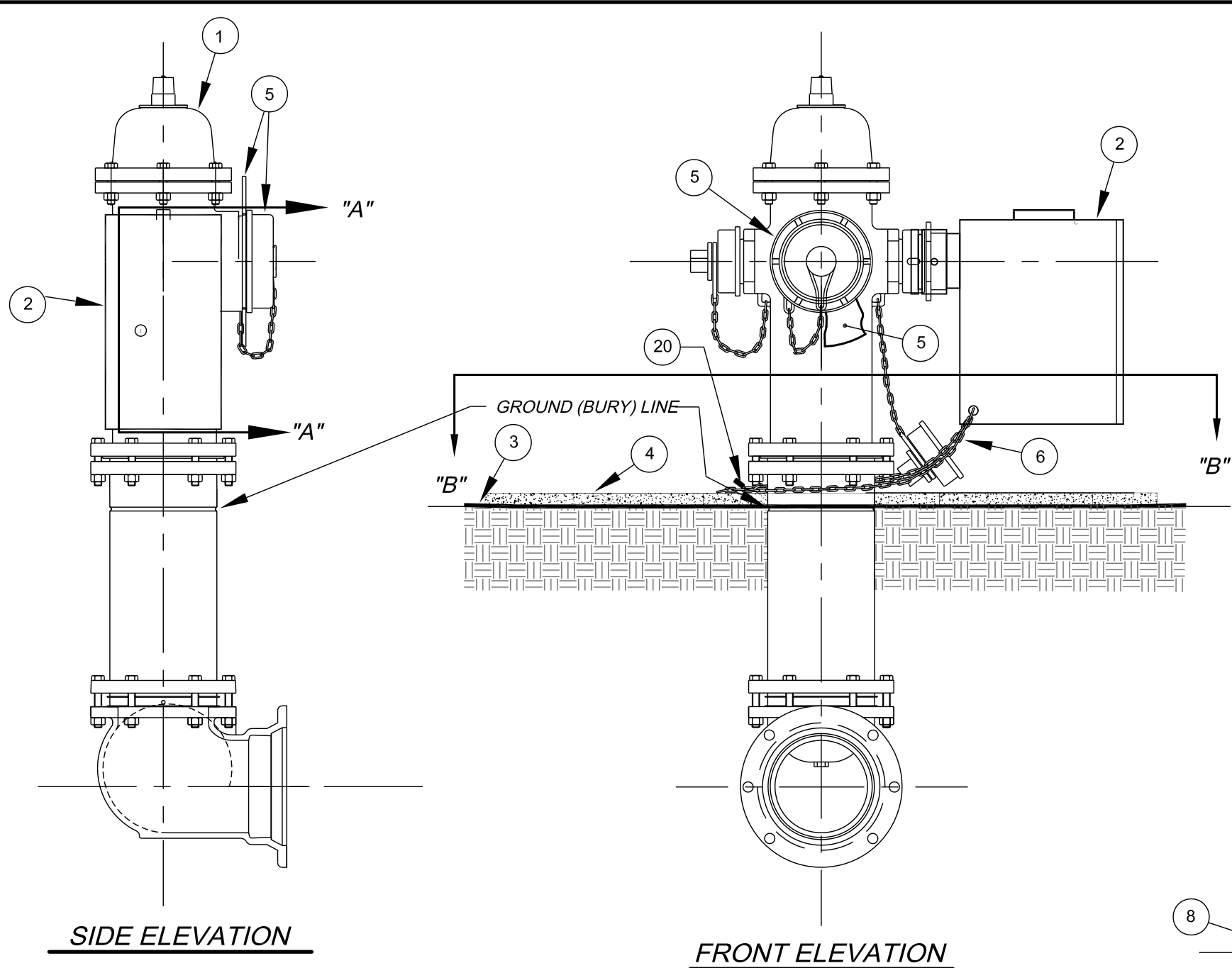
**THRUST BLOCK DETAIL**  
NTS



**SECTION A-A**

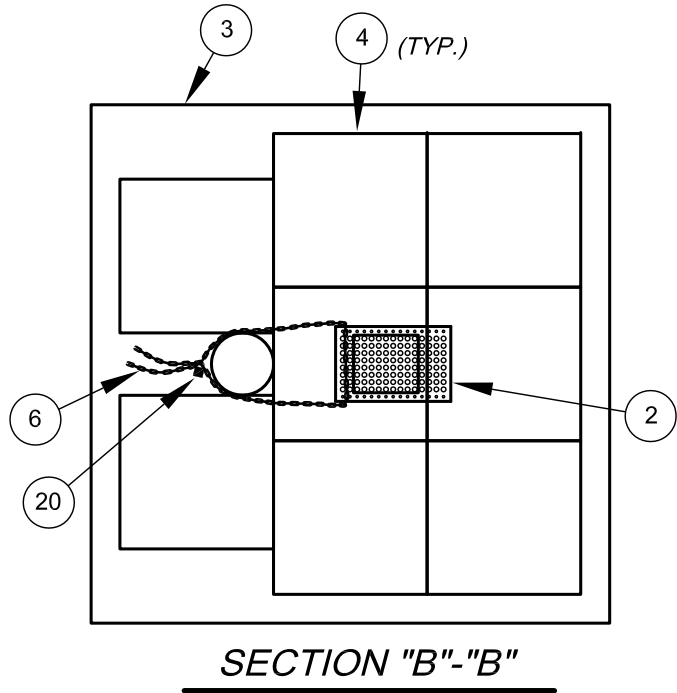
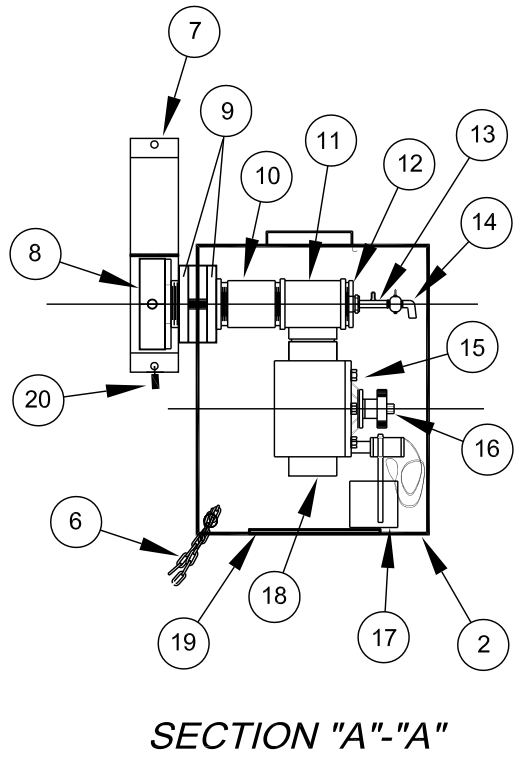
# **CHARLOTTE-MECKLENBURG UTILITY DEPARTMENT ENGINEERING DIVISION CHARLOTTE, NORTH CAROLINA**

Job No. _____ File No. _____		<b>STANDARD DETAIL WATER</b>	
PLAN _____ NTS _____			
PROFILE _____		<b>LOWERING OF 6" TO 12" WATER MAIN</b>	
Hor. _____ NTS _____ Vert. _____			
As Built _____ Date _____		BDM _____	
Surveyed By _____		Project-Engr _____	
Designed By _____		Approved By _____	
Drawn By _____		Date _____	
No. _____	Date _____	By _____	Revision _____



#### NOTES

- A AUTO FLUSHER IS INTENDED FOR WARM WEATHER USE. ASSEMBLY SHOULD BE REMOVED DURING COLD WEATHER MONTHS TO AVOID DAMAGE DUE TO FREEZING.
- B MANUAL FLUSHING REQUIRED TO MAINTAIN WATER QUALITY DURING COLD WEATHER MONTHS.
- C SHOWN AS TEMPORARY APPLICATION - IF PERMANENT INSTALLATION - REPLACE #3 AND #4 WITH CAST - IN PLACE CONCRETE PAD - MIN. 4 FT. x 4 FT. x 4 IN. THICK WITH WIRE REINFORCEMENT, FLUSH WITH FINISH GRADE.



NO.	DESCRIPTION
1	STANDARD FIRE HYDRANT
2	KUPFERLE #9700-Y HYDRANT AUTO FLUSHER (YELLOW) (INCLUDING #8-19)
3	6 MIL. HDPE PLASTIC FILM (54"x54") - SEE NOTE C
4	16"x16"x2" PATIO PAVERS-CONCRETE - 8 EA - SEE NOTE C
5	HYDRANT STORZ NOZZLE W/RED OUT-OF-SERVICE RING (O.D. = 12.5", I.D. = 7.0", t = 0.05")
6	CAMPBELL BLU-KROME 1/4" PROOF COIL CHAIN 5 LF
7	LOCKING NOZZLE COLLAR - KUPFERLE #9708-Y WITH PADLOCK (MASTERLOCK #??, KEY #??)
8	2 1/2" FH NOZZLE COUPLING
9	KUPFERLE ADAPTER
10	2" THREADED NIPPLE
11	2"x2"x2" TEE FIP THREAD
12	PLUG/TAP
13	WATER SAMPLE VALVE
14	BRASS WATER SAMPLING BIBB
15	2" SOLENOID CONTROL VALVE; P-220 SERIES
16	MANUAL FLOW CONTROL KNOB
17	HUNTER DIGITAL PROGRAMMABLE CONTROLLER WITH 9 VOLT LITHIUM BATTERY
18	2" FIP OUTLET (MAY BE HARD PIPED FOR DISCHARGE)
19	REMOVABLE DIFFUSER PLATE W/4BOLTS/NUTS
20	PADLOCK (MASTERLOCK #??, KEY #??)

NO SCALE
STANDARD NO.
A
VERSION NO.
1.1
VERSION DATE
9.02.2009

AUTOMATIC FLUSHER-HYDRANT

CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
WATER

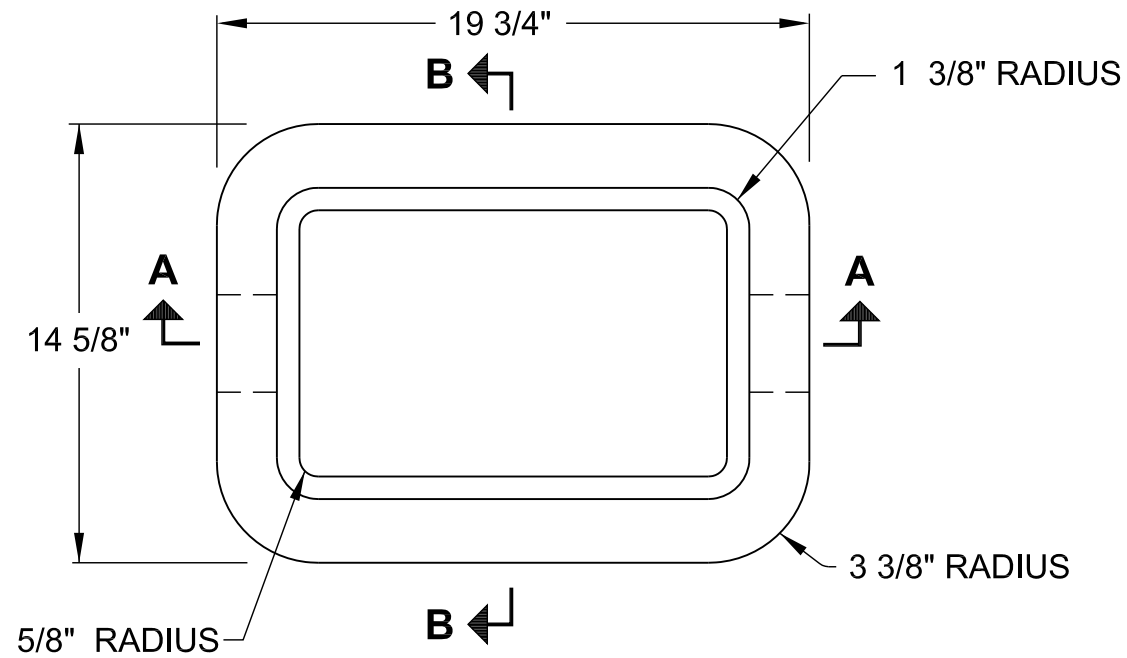
CHARLOTTE

# **MANUFACTURERS:**

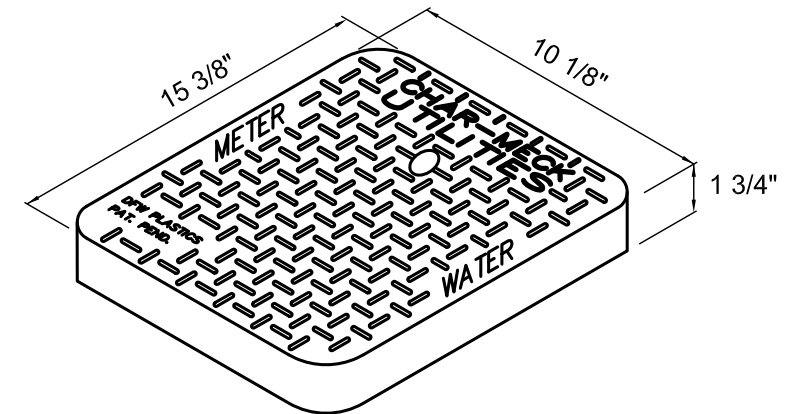
SOUTHERN METER C.H. 5/8" x 3/4" METER BOX BODY  
 BROOKS #36MB METER BOX BODY  
 OLDCASTLE #MB36 METER BODY  
 BES #CO9W METER BOX BODY  
 CHRISTY B9 METER BOX BODY

# **NOTES:**

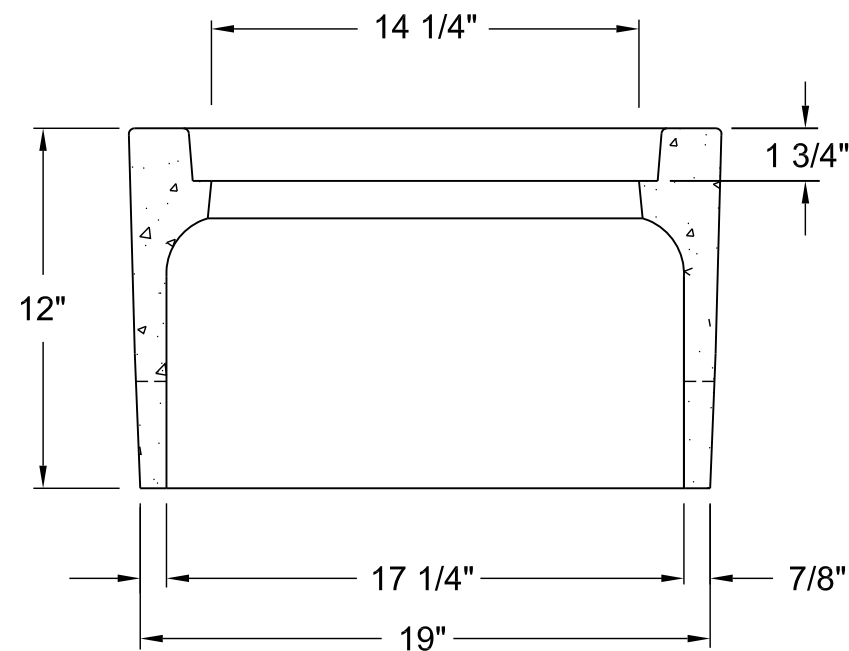
- METER BOX SHALL ACCOMMODATE COMPANION PLASTIC METER BOX LID - SEE STANDARD DETAIL.
- MINOR DIMENSION VARIATIONS ARE PERMITTED , BASED ON MANUFACTURER'S PRODUCT LINES, PROVIDED THE CMUD STANDARD PLASTIC LID FITS PROPERLY.
- CONCRETE SHALL BE MINIMUM  $f'c = 3000$  PSI COMPRESSIVE STRENGTH.
- DESIGN SHALL CONFORM TO ASTM C858-SPECIFICATIONS FOR " UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE ".
- STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C 857.
- WELDED WIRE FABRIC SHALL CONFORM TO ASTM A 185 AND A 82.



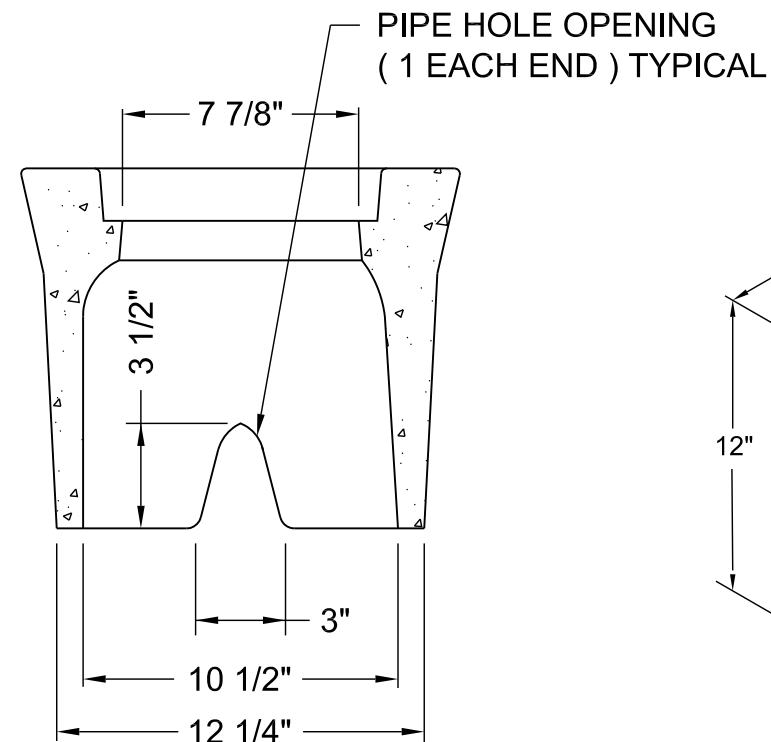
**PLAN VIEW**



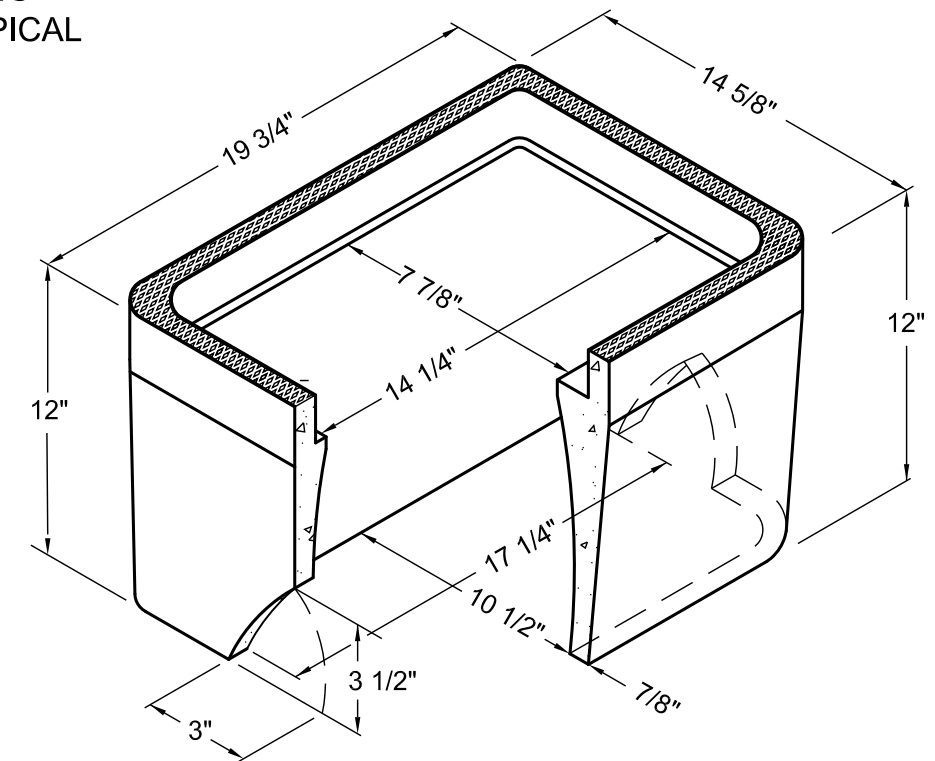
**PLASTIC LID**



**SECTION VIEW A-A**



**SECTION VIEW B-B**



**BODY**

WEIGHT - 70 LB. ( MIN. ) - 85 LB ( MAX. )

NO SCALE

STANDARD NO.

AA

VERSION NO. V1.0

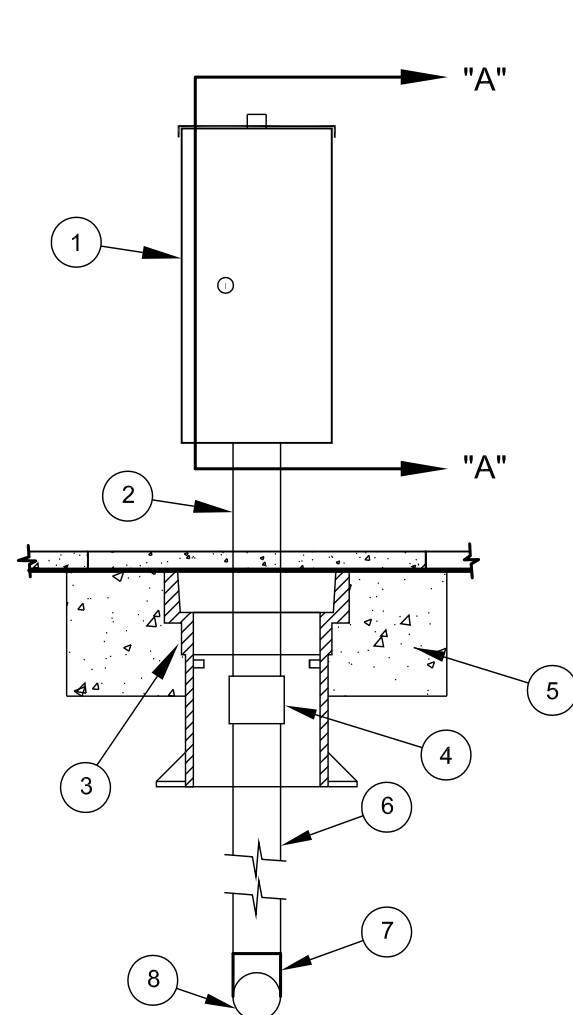
8.3.2011

**PRECAST CONCRETE METER BOX  
 FOR 3/4 - INCH DOMESTIC WATER SERVICE**

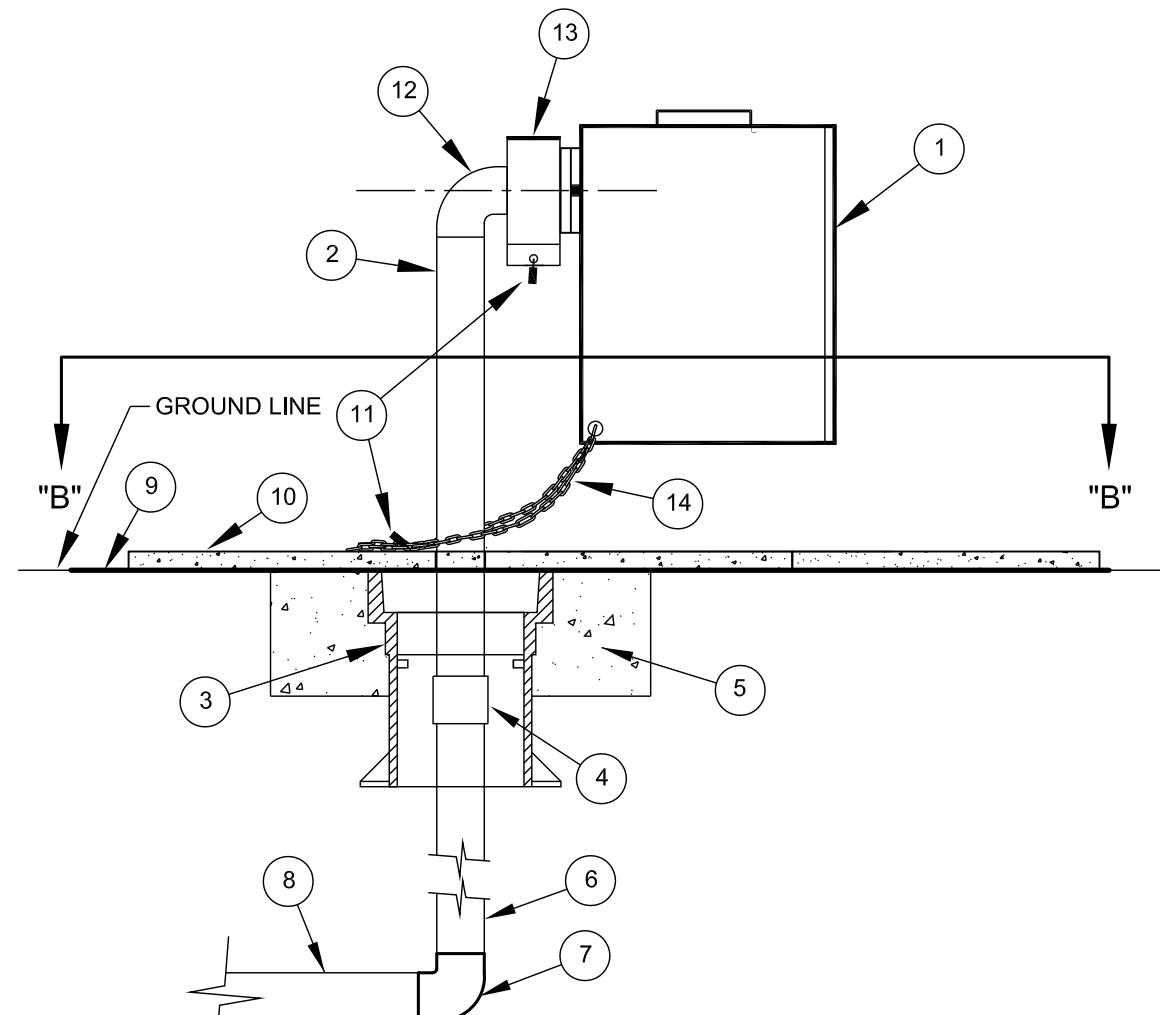
**CHARLOTTE-MECKLENBURG  
 UTILITIES**

**STANDARD DETAILS  
 WATER**

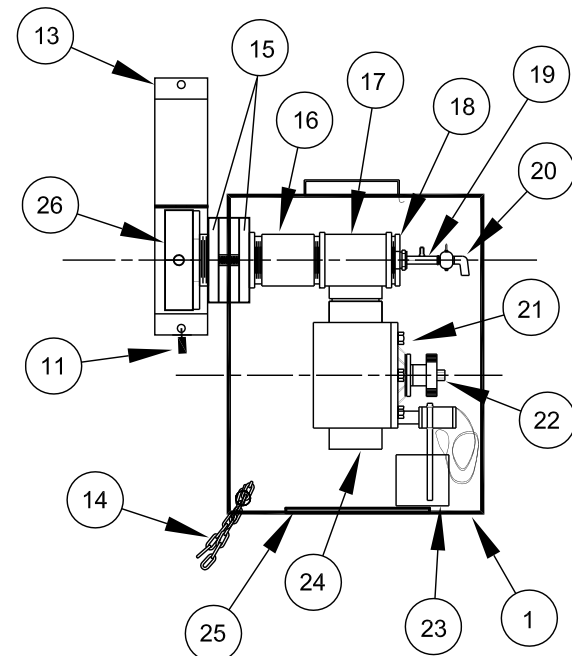




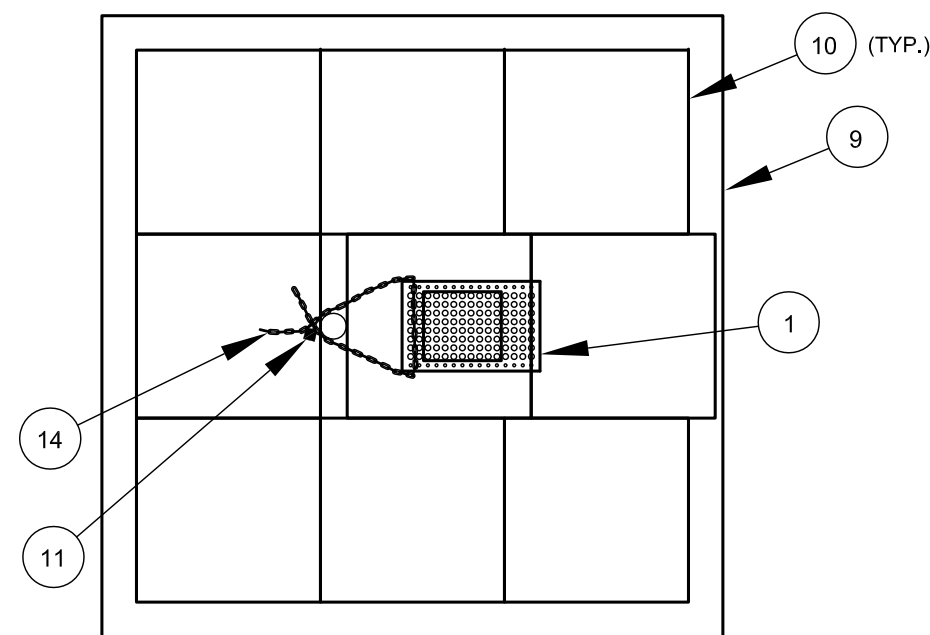
SIDE ELEVATION



FRONT ELEVATION



SECTION "A"- "A"



SECTION "B"- "B"

**NO. DESCRIPTION**

- 1 KUPFERLE #9700-Y HYDRANT AUTO FLUSHER - YELLOW (INCLUDES #15-26)
- 2 2" GALVANTIZED STEEL PIPE (SCH 80)
- 3 TOP SECTION WATER VALVE BOX
- 4 2" RED BRASS COUPLING (SCH 40)
- 5 18"x18"x6" CONCRETE PAD
- 6 2" RED BRASS PIPE (SCH 40)
- 7 2" 90° RED BRASS BEND (SCH 40)
- 8 2" RED BRASS PIPE (SCH 40)
- 9 6 MIL. HDPE PLASTIC FILM (54"x54")
- 10 16"x16"x2" PATIO PAVERS CONCRETE (9 EACH)
- 11 PAD LOCK (MASTERLOCK #??, KEY #??)
- 12 KUPFERLE #X707 2" MIP x 2" MJ ADAPTER
- 13 LOCKING NOZZLE COLLAR - KUPFERLE #9708-Y
- 14 CAMPBELL BLU-KROME 1/4" PROOF COIL CHAIN 5 LF
- 15 KUPFERLE ADAPTER
- 16 2" THREADED NIPPLE
- 17 2"x2"x2" TEE FIP THREAD
- 18 PLUG/TAP
- 19 WATER SAMPLE VALVE
- 20 BRASS SAMPLING BIBB
- 21 2" SOLENOID CONTROL VALVE; P-220 SERIES
- 22 MANUAL FLOW CONTROL KNOB
- 23 HUNTER DIGITAL PROGRAMMABLE CONTROLLER WITH 9 VOLT LITHIUM BATTERY
- 24 2" FIP OUTLET (MAYBE HARD PIPED FOR DISCHARGES)
- 25 REMOVABLE DIFFUSER PLATE WITH 4 BOLTS / NUTS
- 26 2 1/2" FIRE HYDRANT NOZZLE COUPLING

**NOTES**

- A AUTO FLUSHER IS INTENDED FOR WARM WEATHER USE. ASSEMBLY SHOULD BE REMOVED DURING COLD WEATHER MONTHS TO AVOID DAMAGE DUE TO FREEZING.
- B MANUAL FLUSHING REQUIRED TO MAINTAIN WATER QUALITY DURING COLD WEATHER MONTHS.

NO SCALE

STANDARD NO.

B

VERSION NO. 1.1  
VERSION DATE 9.02.2009

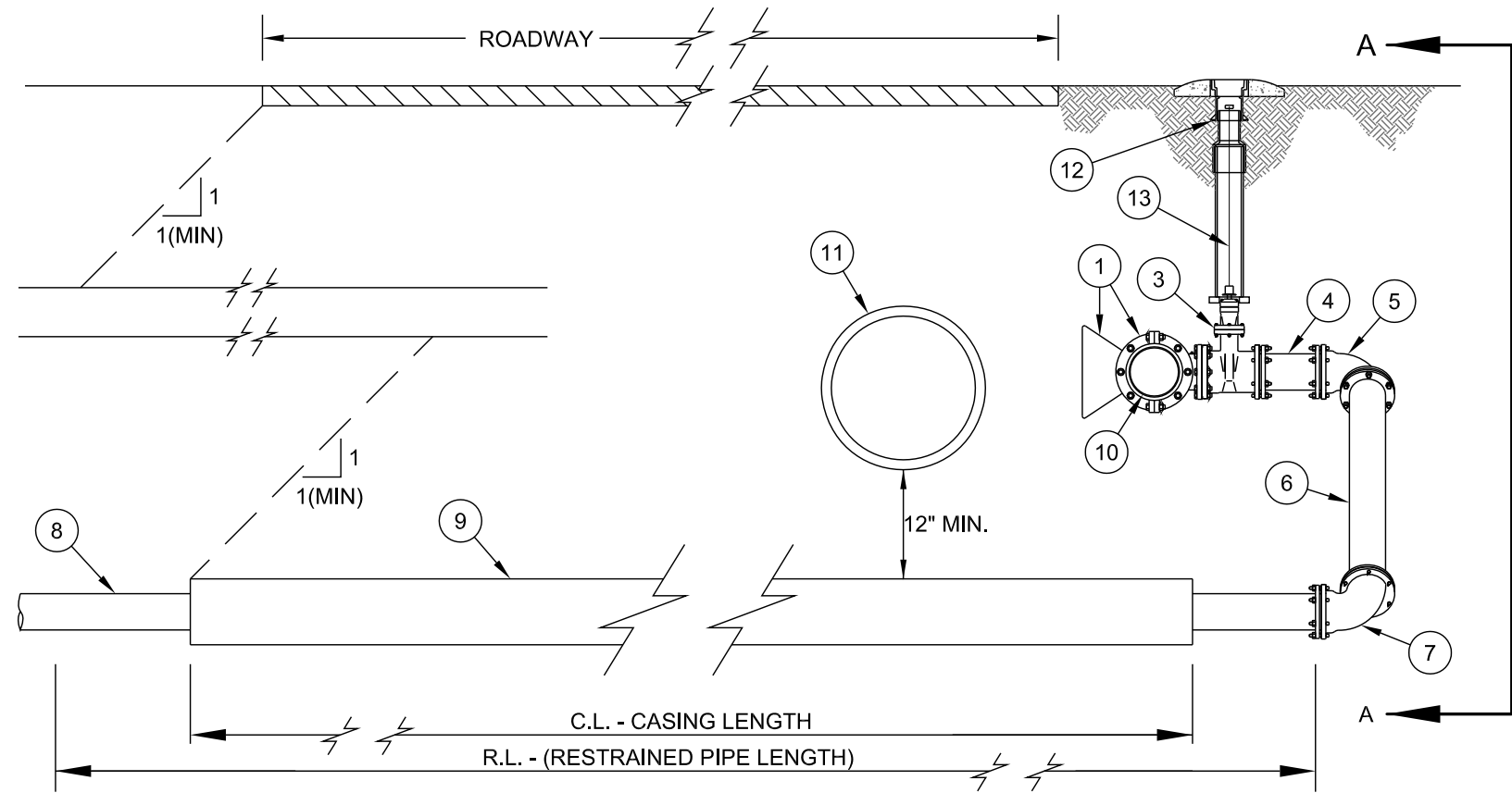
**AUTOMATIC FLUSHER - 2" BLOW-OFF**

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS

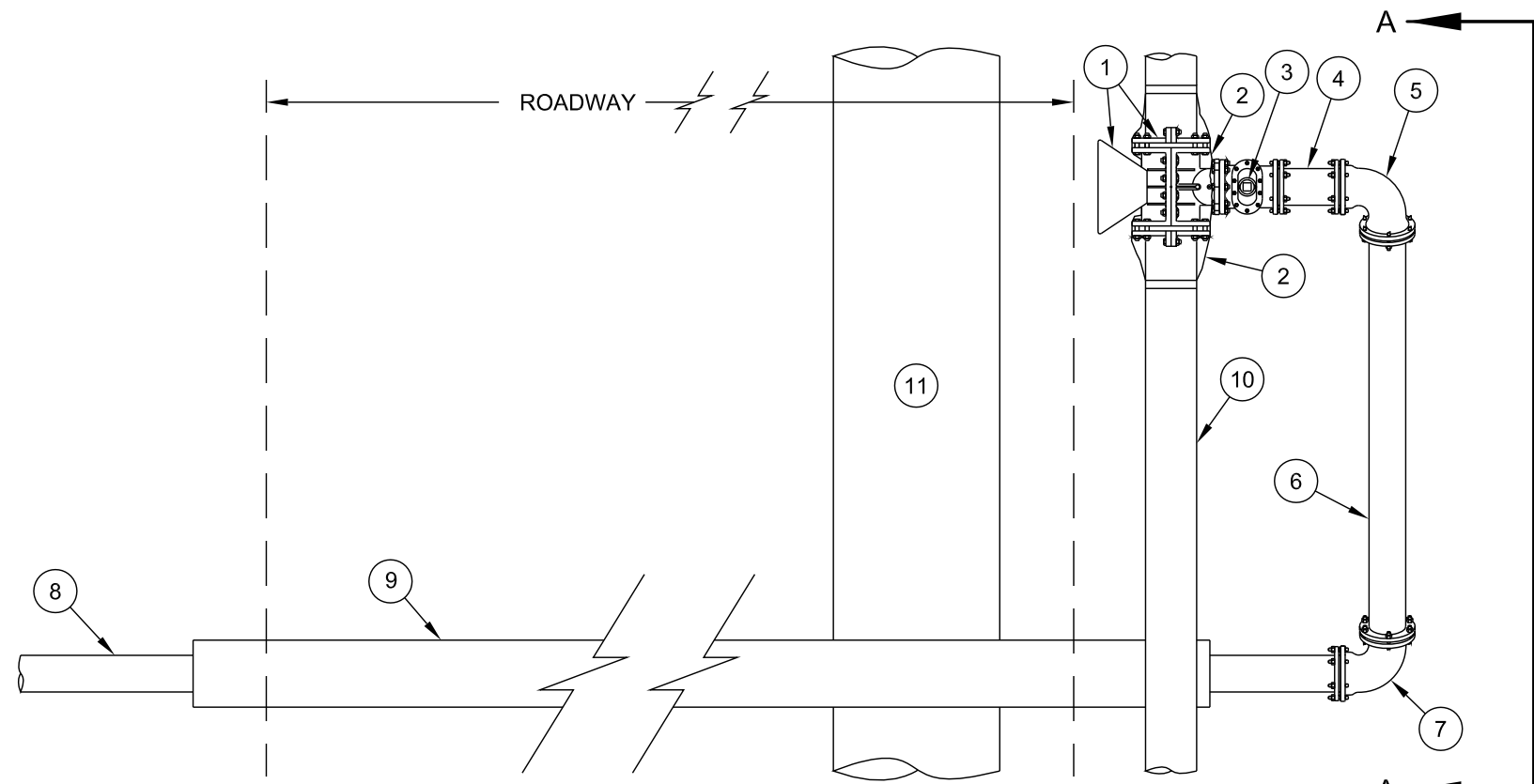
WATER







PROFILE



PLAN

- NO. DESCRIPTION
- 1 TAPPING SLEEVE WITH CONCRETE THRUST BLOCKING (REQUIRED). ④ SEE SPECIFICATIONS FOR APPROVED MODELS, ⑥ SIZE ON SIZE TAPPING SLEEVES SHALL BE MECHANICAL JOINT FULL BODY DUCTILE / CAST IRON ONLY.
  - 2 WRAP TAPPING SLEEVE WITH 2 LAYERS HDPE PLASTIC FILM (HDCLPE PER AWWA C-105) - 4 MILS. EACH LAYER - EXTEND HDPE 3 FT. EACH WAY FROM FITTINGS - DUCT TAPE ENDS.
  - 3 TAPPING VALVE - FLANGE x R.M.J.
  - 4 D.I.P. SHORT L ≥ 18"
  - 5 R.M.J. DUCTILE IRON 90° BEND - ROTATE DOWN, AS APPROVED
  - 6 DUCTILE IRON PIPE - RESTRAINED
  - 7 R.M.J. DUCTILE IRON 90° BEND - ROTATE UP, AS APPROVED, CONCRETE THRUST BLOCKING MAY ALSO BE REQUIRED. SEE NOTE IN CHART A BELOW
  - 8 DUCTILE IRON PIPE -RESTRAINED - SEE CHART A
  - 9 STEEL CASING - SEE CHART B
  - 10 EXISTING WATER MAIN
  - 11 EXISTING INFRASTRUCTURE THAT PREVENTS FRONT SIDE TAP - BACKSIDE TAP WILL BE PERMITTED ONLY WHERE EXISTING INFRASTRUCTURES PREVENTS FRONT SIDE TAP, AND REQUIRES APPROVAL OF THE CMU ENGINEER.
  - 12 STANDARD VALVE BOX ASSEMBLY
  - 13 VALVE EXTENSION (WHEN OPERATING NUT IS GREATER THAN 4.5 FEET DEEP)

CHART A - RESTRAINED LENGTH REQUIREMENTS

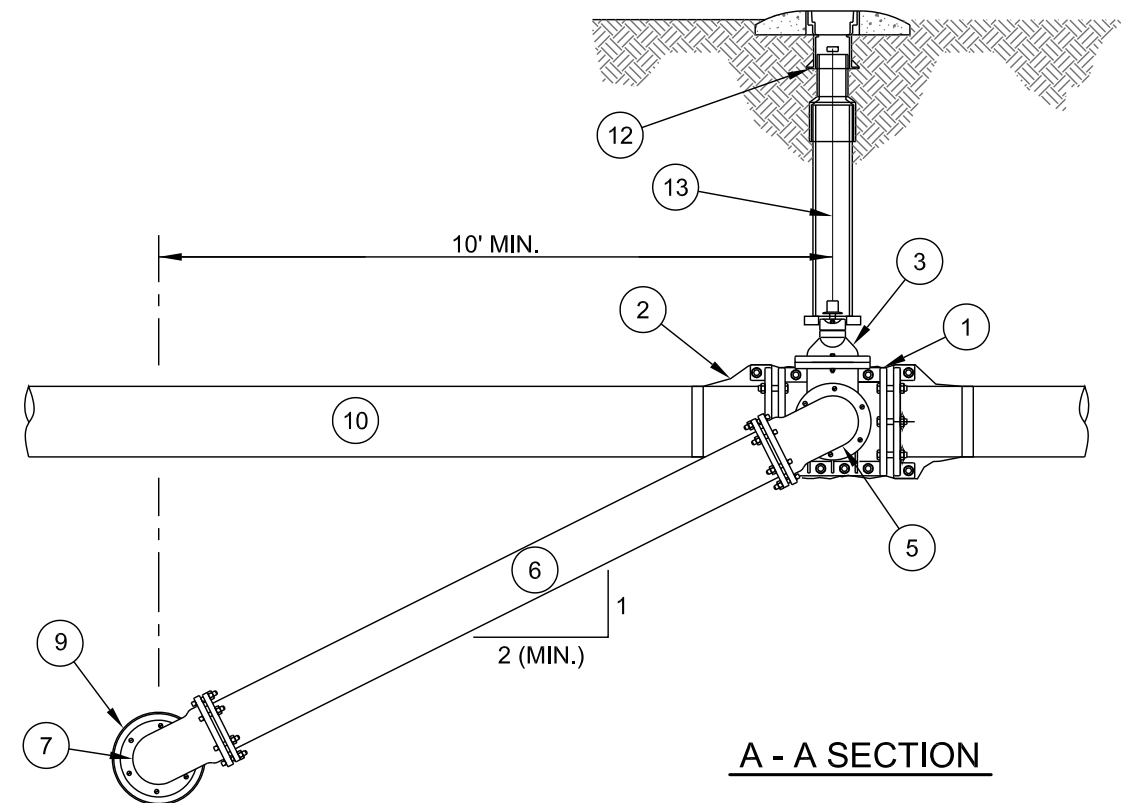
PIPE DIA. (INCHES)	TOTAL RESTRAINED LENGTH - R.L. - (FT)
3"	64' + CASING LENGTH (C.L.)
4"	77' + CASING LENGTH (C.L.)
6"	109' + CASING LENGTH (C.L.)
8"	140' + CASING LENGTH (C.L.)
10"	169' + CASING LENGTH (C.L.)
12"	196' + CASING LENGTH (C.L.)
16"	249' + CASING LENGTH (C.L.)

CONCRETE THRUST BLOCK (WRAP BEND PER ②)  
REQUIRED AT BOTTOM BEND ⑦, IF REQUIRED  
RESTRAINED LENGTH (R.L.) CAN NOT BE  
COMPLETELY INSTALLED.

CHART B - ROADWAY CASING REQUIREMENTS

PIPE DIA. (INCHES)	CASING MIN. DIAMETER (INCHES)	CASING WALL THICKNESS - MIN. (INCHES)
3"	8"	0.250"
4"	8"	0.250"
6"	12.75"	0.250"
8"	16"	0.250"
10"	18"	0.250"
12"	20"	0.250"
16"	24"	0.250"

LARGER DIAMETER CASING MAY BE REQUIRED DUE  
TO LENGTH OF CROSSINGS AND RESTRAINED JOINT  
DIMENSIONS. SEE PLANS AND SPECIFICATIONS.



A - A SECTION

NO SCALE

STANDARD NO.

C

VERSION NO. 1.1

VERSION DATE 9.02.2009

BACK SIDE TAP  
16" AND SMALLER MAINS

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS  
WATER





NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE SERIES 300 STAINLESS STEEL (ASTM F 593 / F 594) - WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH / WIDTH MAY VARY DUE TO BRAND - VERIFY DIMENSIONS TO DETERMINE MINIMUM VAULT SIZE.

D. VAULT SHALL BE SIZED AS NEEDED FOR MINIMUM CLEARANCE AS SHOWN AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

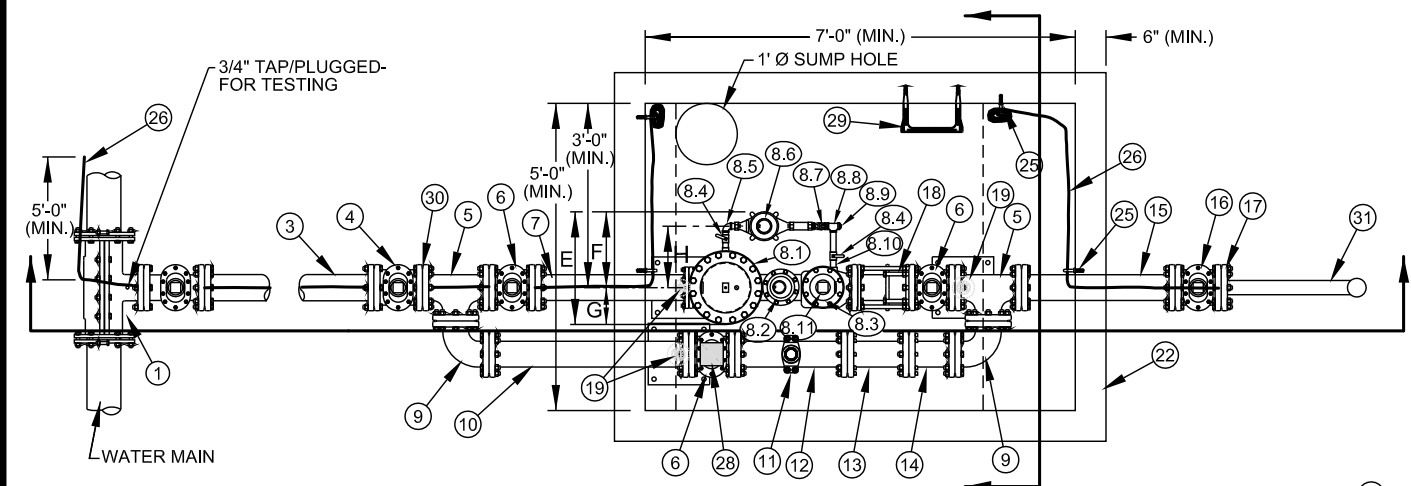
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

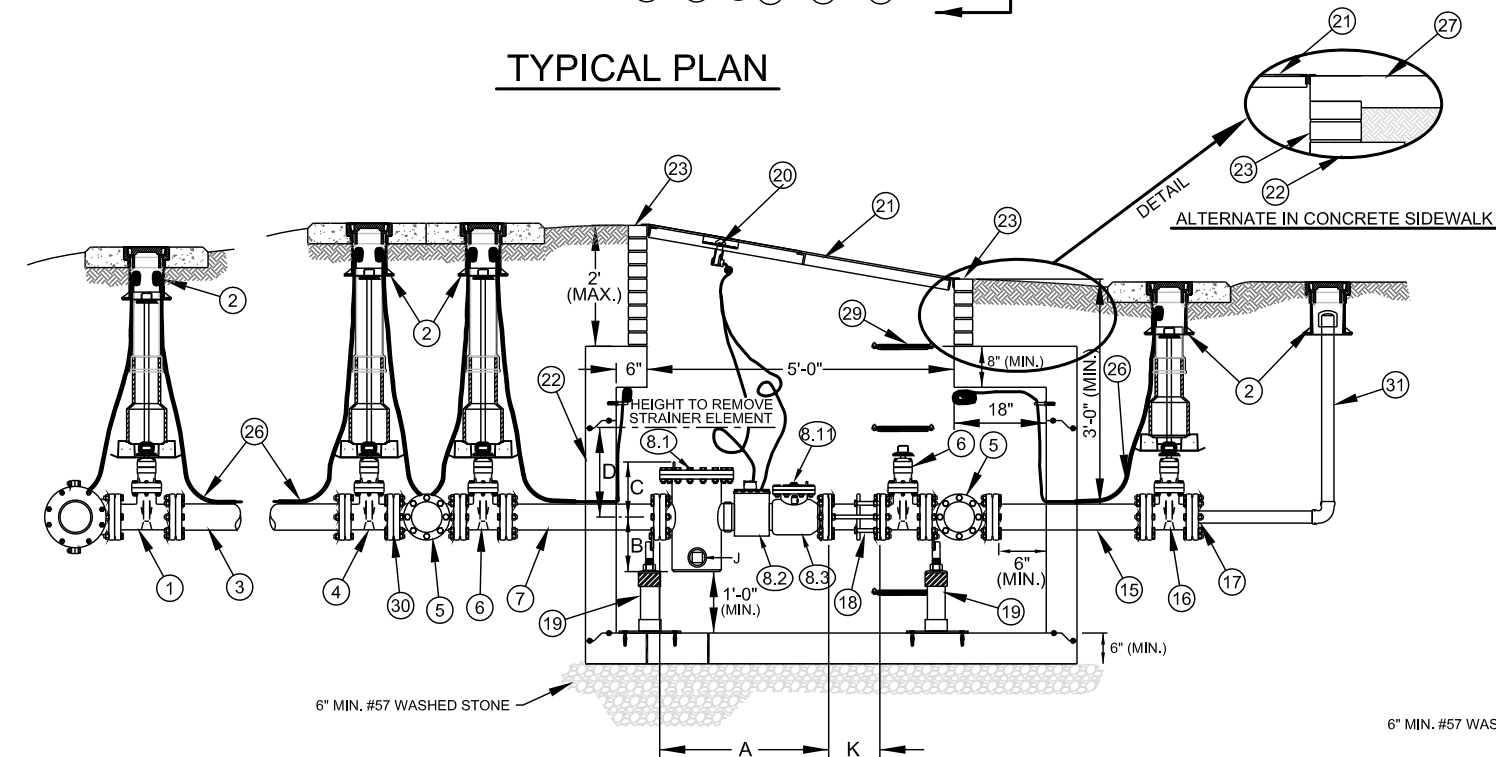
L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

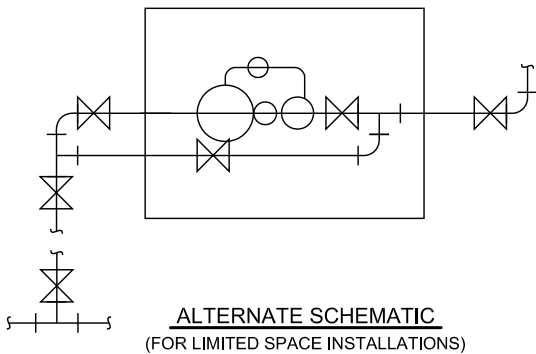
N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 16



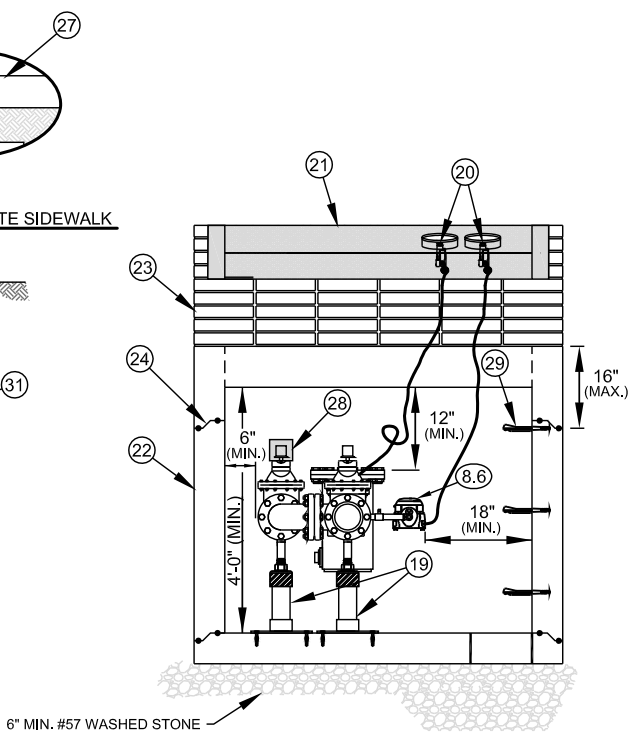
TYPICAL PLAN



TYPICAL ELEVATION



ALTERNATE SCHEMATIC  
(FOR LIMITED SPACE INSTALLATIONS)



SECTION VIEW

DIMENSION B - H VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER.

METER SIZE	A	B	C	D	E	F	G	H	J	K
4"	33"	10 5/8"	10 3/4"	17 1/2"	22"	15 1/4"	6 3/4"	12"	2"	SMITH-BLAIR = 10" ROMAC = 9"

NO. DESCRIPTION

- 1 4" - TAPPING SLEEVE AND 4" FL x MJ TAPPING VALVE ON EXISTING MAIN, 4" MECHANICAL JOINT OUTLET TEE AND 4" MJ GATE VALVE ON NEW MAIN

2 STANDARD VALVE BOX ASSEMBLY (TYPICAL) - ALL VALVES

3 4" DUCTILE IRON PIPE - RESTRAINED

4 4" MJ x FL DUCTILE IRON ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN), 4" MJ x FL GATE VALVE ON LONG SIDE SERVICE (SHOWN)

5 4" ALL FLANGE DUCTILE IRON TEE

6 4" ALL FLANGE GATE VALVE

7 4" ALL FLANGE DUCTILE IRON PIPE SPOOL - L = 30" (MIN.) (SPECIAL CLASS 53)

8 4" FMCT METER ASSEMBLY (FLANGE x FLANGE) - 4" x1"

8.1 STRAINER

8.2 METER WITH AMR / TRANSMITTER

8.3 CHECK VALVE

8.4 1" BRASS BALL VALVE WITH HANDLE (FNPT x FNPT)

8.5 1" BRASS 90° BEND (FNPT x FNPT)

8.6 1" METER WITH AMR / TRANSMITTER

8.7 1" BRONZE CHECK VALVE (FNPT x FNPT)

8.8 1" BRONZE TEE (FNPT x FNPT x FNPT)

8.9 1" BRONZE PLUG (MNPT)

8.10 1" RED BRASS PIPE NIPPLES (TYP - AS REQ'D) - ( MNPT x MNPT)

8.11 2" (MIN.) SQUARE HEAD BRASS PLUG (MNPT)

9 4" DUCTILE IRON 90° BEND FLANGE x FLANGE

10 4" DUCTILE IRON PIPE - FLANGE x FLANGE SPOOL - L = 39" (MIN.) (SPECIAL CLASS 53)

11 4" x 1" SERVICE SADDLE WITH 1" BALL CORPORATION STOP - CC - TAPER THREAD

12 4" DUCTILE IRON PIPE - FLANGE x PE - L = 22" (MIN.) (SPECIAL CLASS 53)

13 4" MECHANICAL JOINT DUCTILE IRON LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINTS

14 4" DUCTILE IRON PIPE - FLANGE x PE - L = 20" (MIN.) (SPECIAL CLASS 53)

15 4" DUCTILE IRON PIPE - FLANGE x PE - L = 30" (MIN.) (SPECIAL CLASS 53)

16 4" MECHANICAL JOINT (RJ) GATE VALVE - OPEN LEFT AT PROPERTY LINE

17 4" MECHANICAL JOINT PLUG WITH 2" TAP (FNPT)

18 DISMANTLING JOINT - FL xFL - (L = 9" OR 10" - EXTENDED) - SMITH BLAIR #975 OR ROMAC #DJ400 WITH STAINLESS STEEL TIE RODS / HARDWARE.

19 GALV. STEEL OR S.S. ADJUSTABLE FLANGE PIPE SUPPORTS (NUMBER REQ'D = 3) (WITH STAINLESS STEEL ADHESIVE ANCHORS)

20 AMR TRANSMITTERS (ERT)

21 5 FT x 5 FT ACCESS DOOR - SEE STD. DETAIL

22 PRECAST REINFORCED CONCRETE VAULT - 7 FT x 5 FT x 4 FT (MIN.) SEE NOTES C AND D.

23 MINIMUM OF (3) STD. SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME - MAX. 2 FT.

24 JOINT REQUIRED AT FLAT TOP SECTION

25 3/8" DIA. GALV. STEEL EYE BOLT (EPOXY ADHESIVE ANCHOR) - TYPICAL

26 AWG #12 GAUGE SOLID COPPER TRACER WIRE - WITH BLUE INSULATION (30 MILS HDPE) TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYPICAL)

27 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

28 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED.

29 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING.

30 ISOLATION FLANGE KIT REQUIRED WITH ALL CATHODIC PROTECTED MAINS, AND ALL MAINS 30-INCH AND LARGER.

31 2" TEMPORARY BLOW OFF ASSEMBLY (GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR9) - END WITH THREADED COUPLING)

NO SCALE

STANDARD NO.

CCC

VERSION NO. 1.0

VERSION DATE 4.10.2012

4-INCH DOMESTIC / FIRE METER COMPOUND TYPE (FMCT)

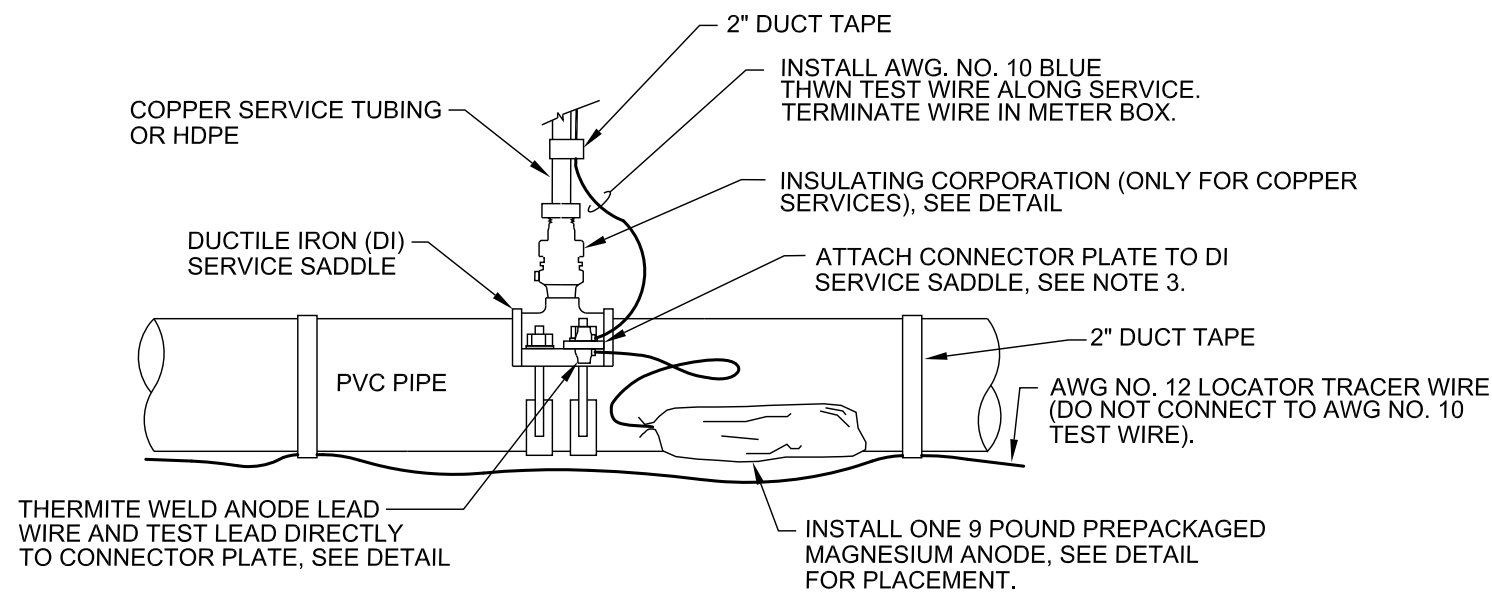
WATER METER AND PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG UTILITIES

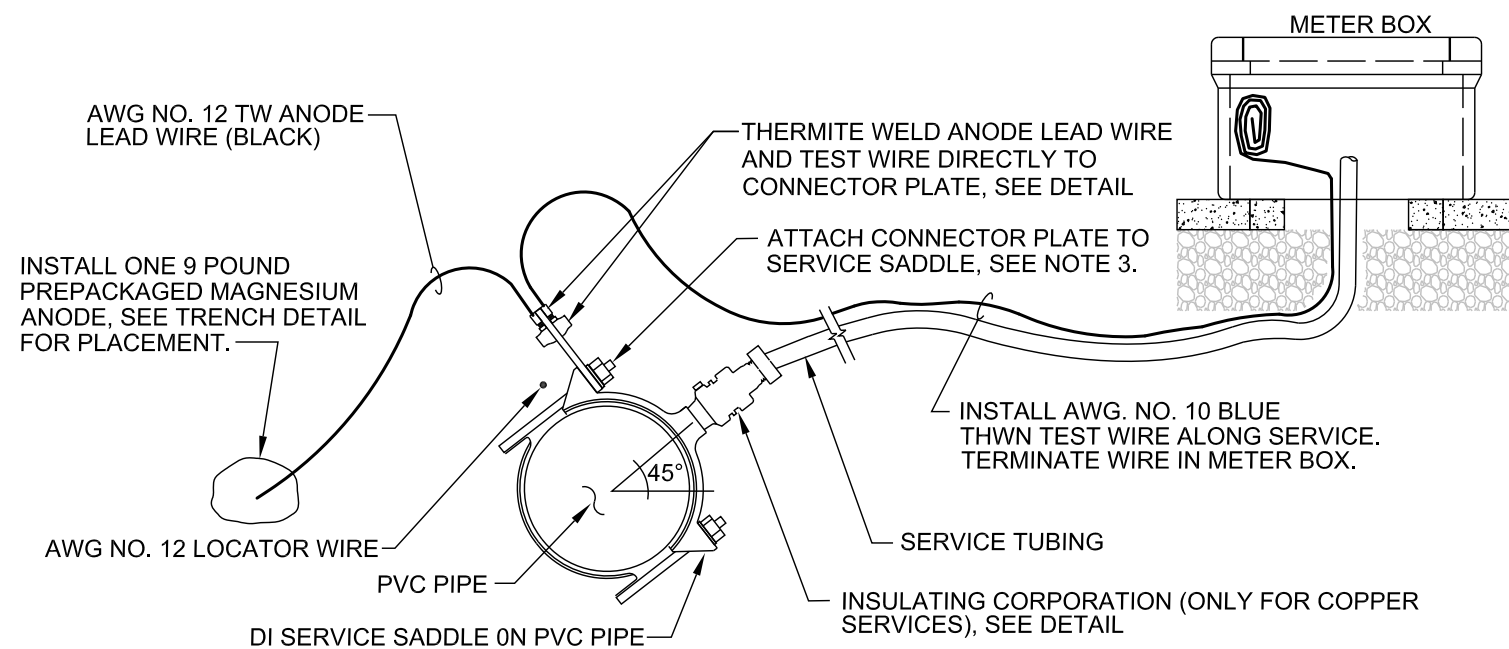
STANDARD DETAILS

WATER

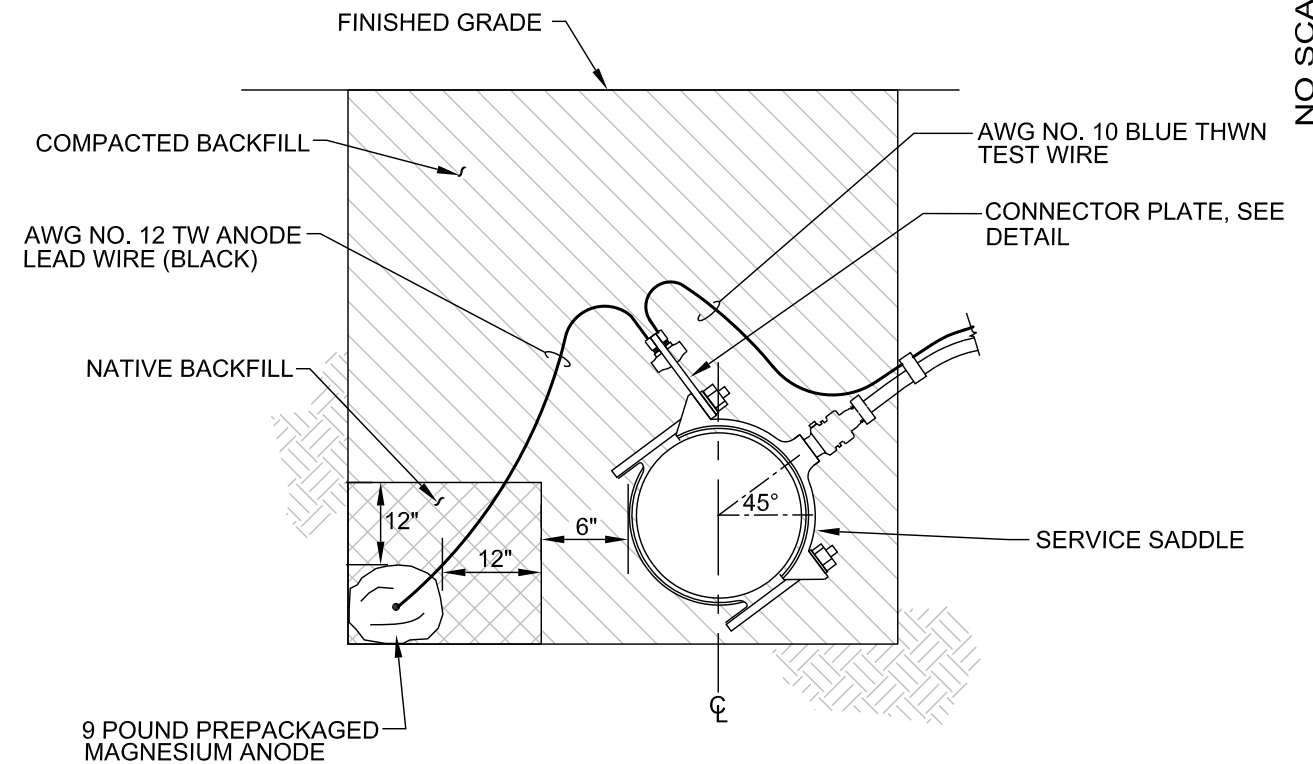




PLAN VIEW



SECTION VIEW



TRENCH DETAIL

NOTES:

1. INSTALL ANODE IN NATIVE SOIL. DO NOT BACKFILL ANODE WITH SAND OR STONE.
2. DO NOT THERMITE WELD TO PVC PIPE.

NOTES:

1. ANODE LEAD WIRE AND TEST WIRE TO BE THERMITE WELDED TO CONNECTOR PLATE PRIOR TO ATTACHING CONNECTOR PLATE TO DUCTILE IRON SERVICE SADDLE.
2. ANODES PLACED AT SAME DEPTH AS THE BOTTOM OF PIPE AND AT A MINIMUM OF 18" FROM EDGE OF PIPE, SEE TRENCH DETAIL.
3. REMOVE COATING FROM DUCTILE IRON SERVICE SADDLE WHERE CONNECTOR PLATE IS TO BE MOUNTED. REMOVE COATING IMMEDIATELY PRIOR TO ATTACHING THE CONNECTOR PLATE.
4. DO NOT THERMITE WELD TO PVC PIPE.
5. ATTACH TEST WIRE TO SERVICE TUBING WITH 2" DUCT TAPE NEAR CORPORATION, YOKE, AND AT 10 FEET INTERVALS. TERMINATE TEST WIRE WITH 24" COILED WIRE ALONG INSIDE OF METER BOX.

NO SCALE

STANDARD NO.

D-1

VERSION NO. 1.1  
VERSION DATE 9.02.2009

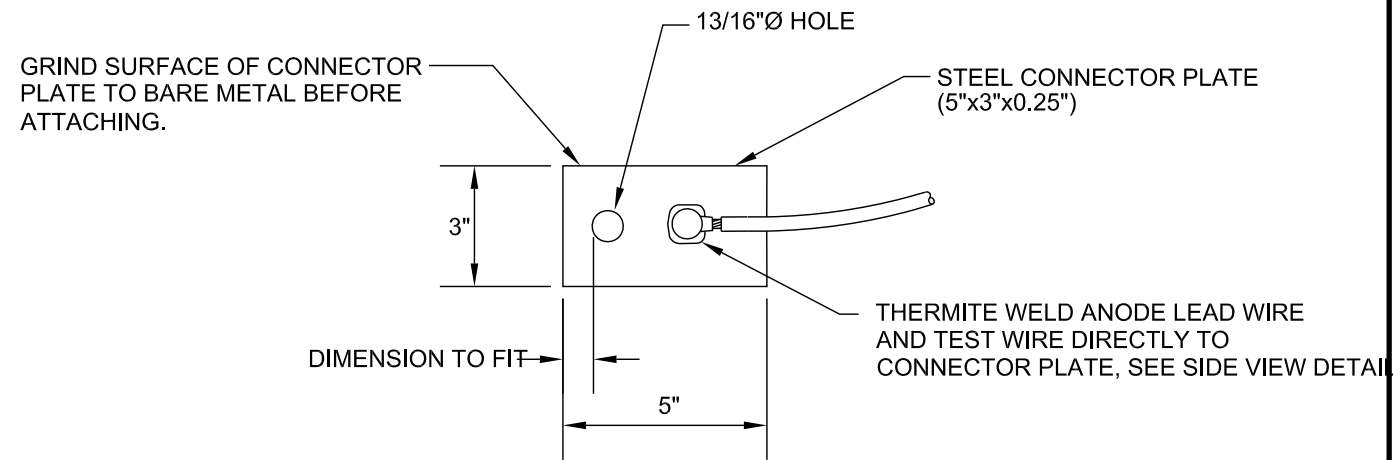
**CATHODIC PROTECTION FOR DUCTILE  
IRON SERVICE SADDLES ON PVC WATER MAINS**

CHARLOTTE-MECKLENBURG  
UTILITIES

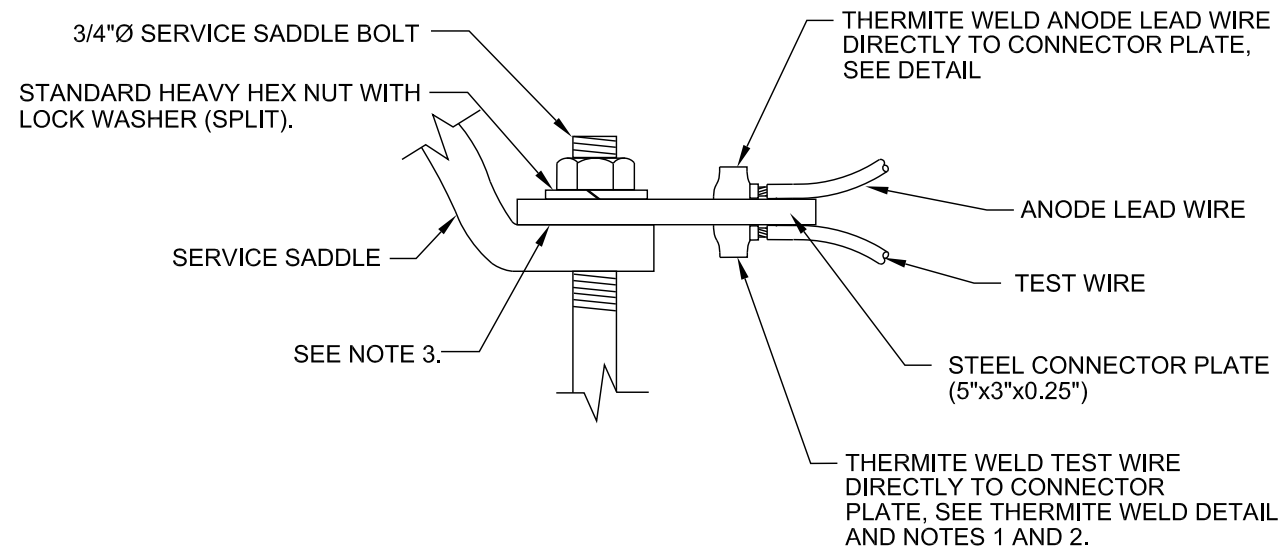
STANDARD DETAILS  
WATER



## CONNECTOR PLATE



PLAN VIEW

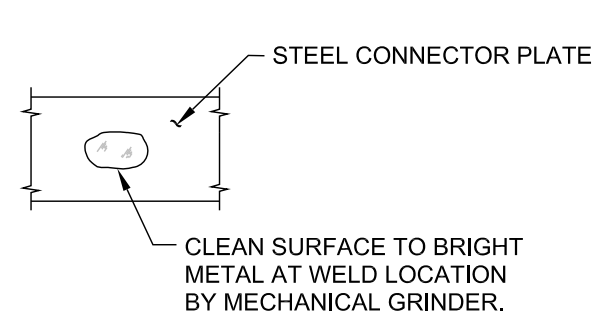


SIDE VIEW

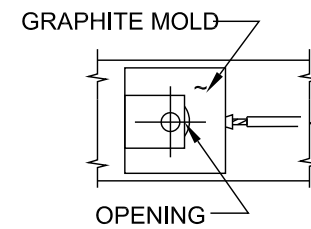
### NOTES:

1. ANODE LEAD WIRE AND TEST WIRE TO BE THERMITE WELDED TO CONNECTOR PLATE PRIOR TO ATTACHING CONNECTOR PLATE TO SERVICE SADDLE.
2. THERMITE WELDS SHALL BE COATED WITH A PREFABRICATED ONE PIECE PLASTIC CAP FILLED WITH ELASTOMERIC MATERIAL, ROYSTON HANDY-CAP OR APPROVED EQUAL.
3. REMOVE COATING FROM SERVICE SADDLE WHERE CONNECTOR PLATE IS TO BE MOUNTED. REMOVE COATING WITH MECHANICAL GRINDER IMMEDIATELY PRIOR TO ATTACHING THE CONNECTOR PLATE.

## THERMITE WELD DETAILS

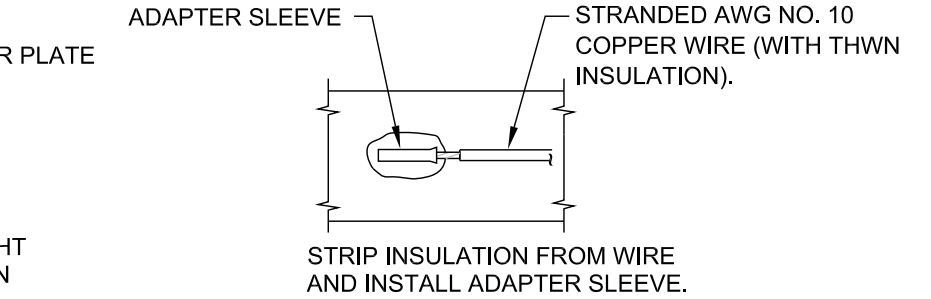


STEP 1

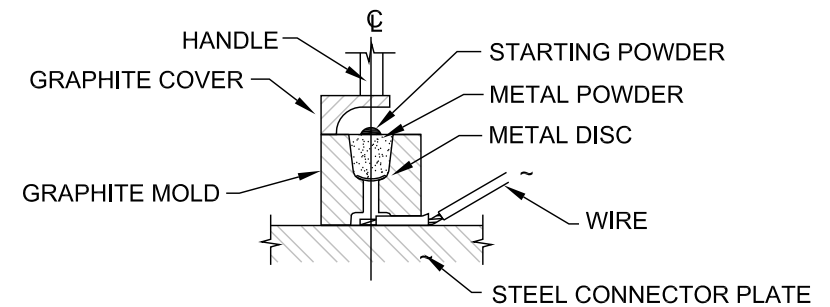


TOP

HOLD GRAPHITE MOLD FIRMLY OVER ADAPTER SLEEVE WITH OPENING AWAY FROM OPERATOR - IGNITE STARTING POWDER.

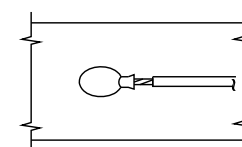


STEP 2

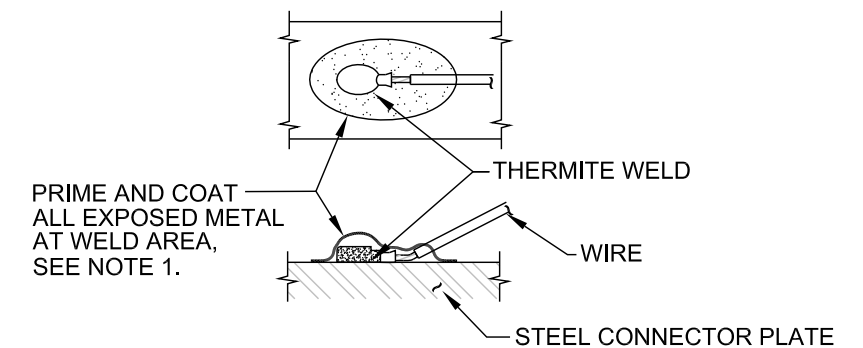


SIDE

STEP 3



STEP 4



STEP 5

### NOTES:

1. THERMITE WELDS SHALL BE COATED WITH A PREFABRICATED ONE PIECE PLASTIC CAP FILLED WITH ELASTOMERIC MATERIAL, ROYSTON HANDY-CAP OR APPROVED EQUAL.
2. DO NOT THERMITE WELD TO PVC PIPE.

NO SCALE

STANDARD NO.

D-2

VERSION NO. 1.1

VERSION DATE 9.02.2009

CATHODIC PROTECTION FOR DUCTILE  
IRON SERVICE SADDLES ON PVC WATER MAINS  
CONNECTOR PLATE AND THERMITE WELD DETAILS

CHARLOTTE-MECKLENBURG  
UTILITIES

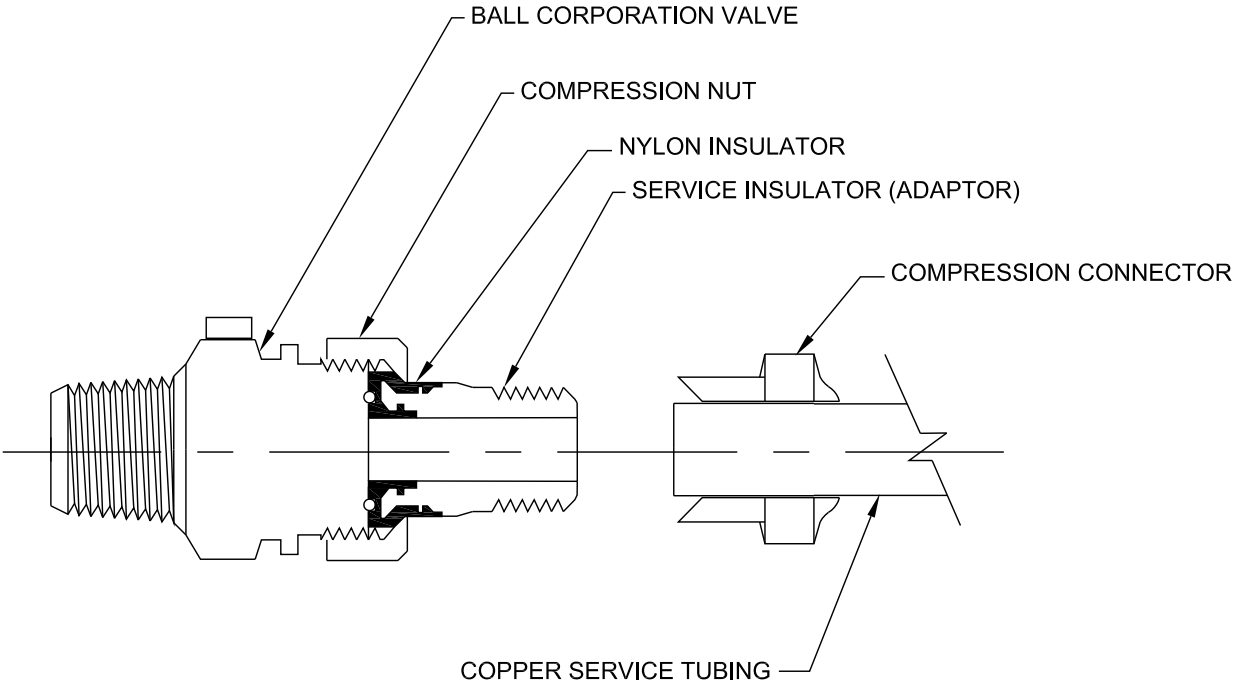
STANDARD DETAILS

WATER



MAIN TYPE	SERVICE TUBING TYPE	ANODE REQUIRED	TEST WIRE TO METER BOX REQUIRED	INSULATED CORPORATION REQUIRED	MASTIC COATING (CORP. & COPPER) REQUIRED
PVC	COPPER	9 LBS. MAGNESIUM	STRANDED AWG NO. 10 BLUE THWN	YES	YES
	HDPE	9 LBS. MAGNESIUM	STRANDED AWG NO. 10 BLUE THWN	NO	NO

BALL CORPORATION STOPS - INSULATED					
MANUFACTURER		3/4" SERVICE	1" SERVICE	1½" SERVICE	2" SERVICE
FORD	CORPORATION	FB600-3	FB600-4	FB600-6	FB600-7
	SERVICE INSULATOR (ADAPTOR)	SI-C04-33-AWT	SI-C04-44-AWT	SI-C04-66-AWT	SI-C04-77-AWT
MUELLER	CORPORATION	N-35008	N-35008	2" SADDLE W/ 2" N-30045	N-35008
	SERVICE INSULATOR (ADAPTOR)	N/A	N/A	H-15428 1½" X 2"	N/A



NOTES:

1. INSTALL ELECTRICAL ISOLATION ON ALL COPPER WATER SERVICE CONNECTIONS. ELECTRICAL ISOLATION NOT REQUIRED FOR PLASTIC WATER SERVICES.
2. COAT CORPORATION VALVE, AND COPPER SERVICE TUBING FOR A DISTANCE OF 12 INCHES WITH MASTIC COATING (ROYSTON ROSKOTE R28). MASTIC COATING TO BE MINIMUM OF 20 MILS IN THICKNESS.

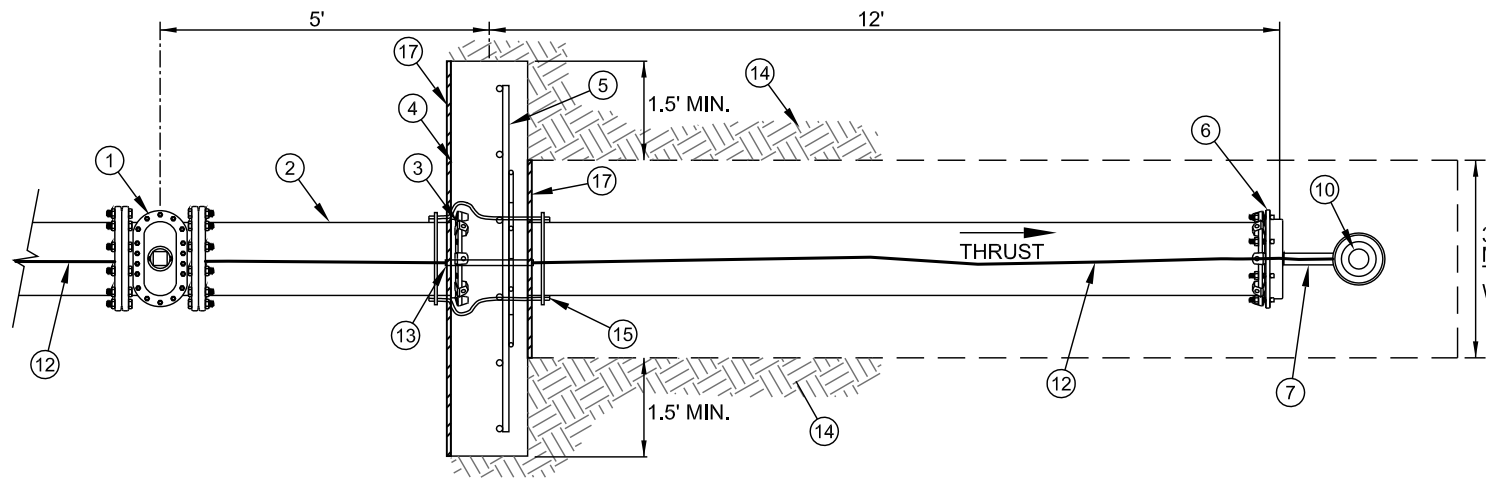
NO SCALE

STANDARD NO.	D-3
VERSION NO.	1.1
VERSION DATE	9.02.2009

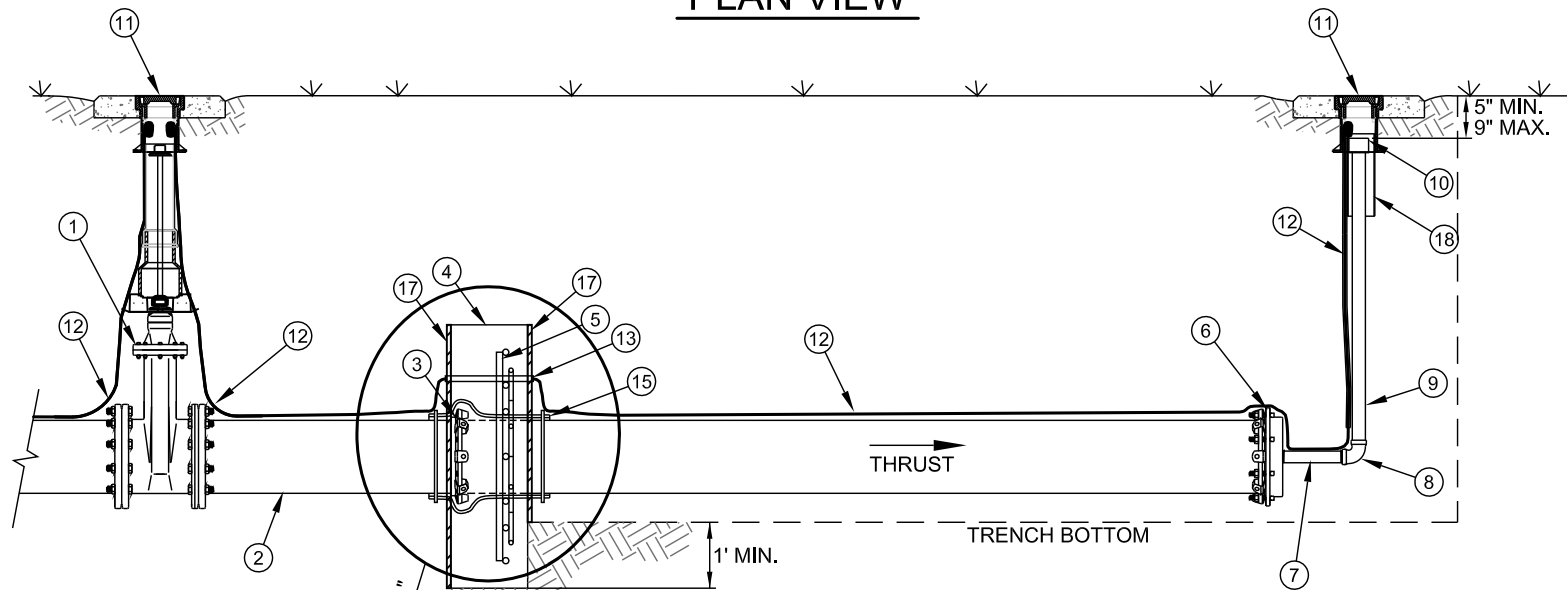
CATHODIC PROTECTION FOR DUCTILE  
IRON SERVICE SADDLES ON PVC WATER MAINS  
INSTALLTION SCHEDULE AND CORPORATION DETAIL

CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
WATER

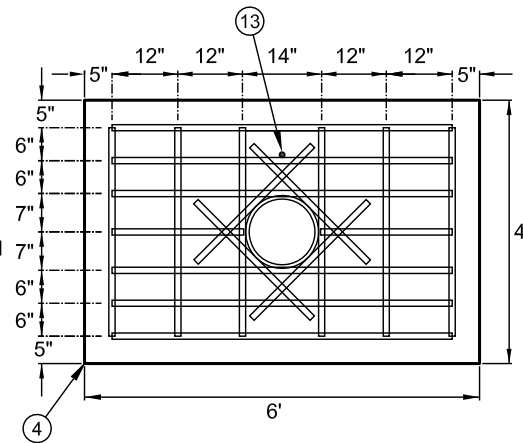




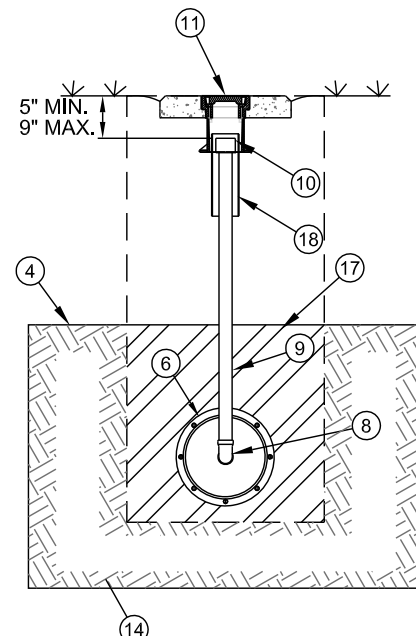
PLAN VIEW



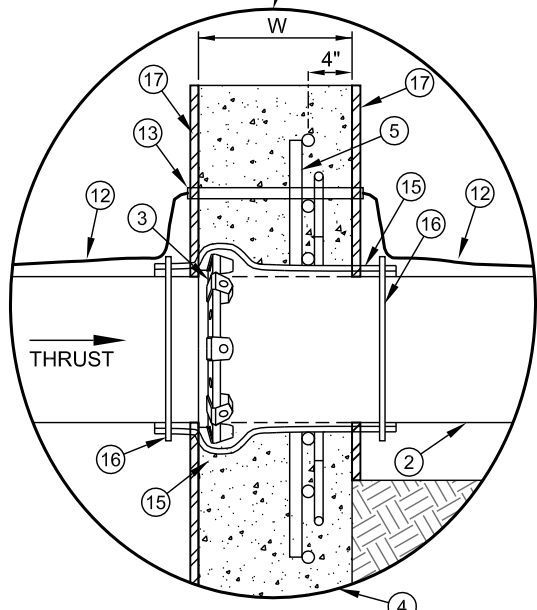
ELEVATION VIEW



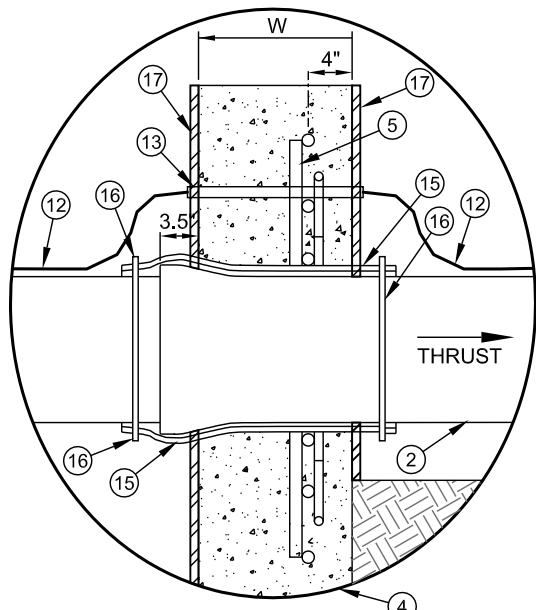
REBAR DETAIL



END VIEW



DETAIL "A"



DETAIL "A" (ALT)

NO. DESCRIPTION

- 1 END OF LINE GATE VALVE (MJ X MJ)
- 2 DIP - (PE x PE) - REMOVE BELL - LENGTH = 17 FT~ 19 FT
- 3 WEDGE ACTION THRUST RESTRAINT GLAND
- 4 CONCRETE WALL BLOCK (F'c = 3600 PSI MIN) 6 FT x 4 FT x WIDTH (W)
- 5 REBARS - GRADE 60 PER ASTM A615 - SEE REBAR SCHEDULES
- 6 MJ CAP - WITH WEDGE ACTION RESTRAINT GLAND, TAP 2" THREADED OUTLET (FNPT)
- 7 2" RED BRASS NIPPLE SCH 40 (MNPT x MNPT) - LENGTH = 12 INCH
- 8 2" RED BRASS 90° BEND (FNPT x FNPT)
- 9 2" RED BRASS NIPPLE SCH 40 ( MNPT x MNPT) - LENGTH AS REQUIRED
- 10 2" GALVANIZED MALLEABLE IRON COUPLING (FNPT x FNPT)
- 11 STANDARD VALVE BOX ASSEMBLY - SEE DETAIL
- 12 AWG #12 GAUGE COPPER TRACER WIRE - WITH BLUE INSULATION (30MIL HDPE) TERMINATE WITH 24-INCH EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
- 13 1" SCH 40 PVC ELECTRICAL CONDUIT - LENGTH AS REQUIRED
- 14 UNDISTURBED SOIL
- 15 HIGH DENSITY CROSS LAMINATED POLYETHYLENE FILM TUBE (HDCLPE) AWWA C105 - 4 MILS EACH x 2 LAYER - 8 MILS TOTAL
- 16 HDPE ADHESIVE TAPE OR HDPE ZIP LOCK TIES
- 17 PLYWOOD FORM
- 18 5" CAST IRON SOIL PIPE (L = 15") OR VALVE BOX BOTTOM SECTION

NOTES:

- A. 12 - INCH MAINS REQUIRE THIS INSTALLATION.
- B. 6 - INCH THROUGH 10 - INCH MAINS REQUIRE THIS INSTALLATION WHEN SOFT SOILS ARE ENCOUNTERED, OR WHEN REQUIRED BY THE ENGINEER.
- C. WHEN DIRECTED BY THE ENGINEER, THE CONCRETE WALL BLOCK SIZE MAY BE ADJUSTED, BASED ON ACTUAL SOIL CLASSIFICATION AND PIPE DIAMETER.
- D. FULLY RESTRAINED JOINT PIPE MAY BE USED IN LIEU OF THIS DETAIL - SEE RESTRAINED JOINT PIPE DETAILS.
- E. ALTERNATE DETAIL "A" (USING A REVERSED BELL) MAY BE USED IN LIEU OF DETAIL "A".

NO. ALTERNATE DESCRIPTION

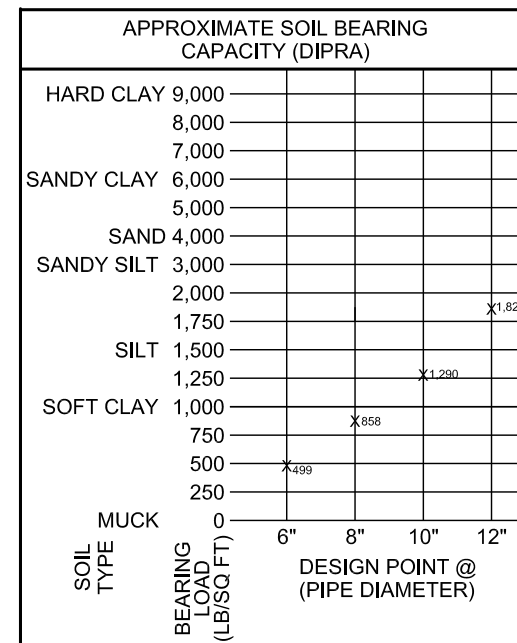
WHEN USING 2-INCH HDPE (IPS) BLOW-OFF PIPE WITH STAINLESS STEEL, BRASS OR BRONZE MNPT ENDS, USE THE FOLLOWING PRODUCTS:

- 7 2" SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - LENGTH AS REQUIRED - 12 - INCH MINIMUM.
- 9 2" SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - LENGTH AS REQUIRED.

APPROX. DEAD END THRUST (DIPRA) AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA	APPROX. SOIL PRESSURE	W (WIDTH) (MINIMUM)	CONCRETE VOLUME (APPROXIMATE)	
PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)	SQUARE FEET	BEARING LOAD (LB/SQ FT)	INCHES	FT³	CY
6	7,478	15	499	10	20	0.74
8	12,866	15	858	12	24	0.89
10	19,354	15	1,290	12	24	0.89
12	27,370	15	1,825	14	28	1.04

REBAR SCHEDULE		
TYPE	LENGTH (INCHES)	NUMBER REQUIRED
VERTICAL	38	6
HORIZONTAL	62	6
HORIZONTAL	24	2
DIAGONAL	30	4

REBAR DIAMETER SCHEDULE			
PIPE DIAMETER	BAR SIZE	TOTAL REBAR LENGTH (FT)	TOTAL REBAR WEIGHT (LB)
6"	#6	64	96
8"	#7	64	131
10"	#8	64	171
12"	#9	64	218



NO SCALE

STANDARD NO.

DD

VERSION DATE

8.23.2011

DEAD END THRUST - WALL BLOCKING  
AND 2-INCH BLOW-OFF ASSEMBLY  
6-INCH THROUGH 12-INCH MAINS

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER



NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH MAY VARY DUE TO BRAND - VERIFY LENGTH TO DETERMINE MINIMUM VAULT LENGTH.

D. VAULT SHALL BE SIZED AS NEEDED FOR PIPE (7.5'x4' MINIMUM) AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 13

NO. DESCRIPTION

- 1

4" TAPPING SLEEVE AND 4" FLANGE x MJ TAPPING VALVE ON EXISTING MAIN. 3" MJ TEE AND 3" MJ GATE VALVE ON NEW MAIN.
- 2

STANDARD VALVE BOX ASSEMBLY (TYP.) - ALL VALVES
- 3

4" x 3" REDUCER (RJ) REQUIRED ON EXISTING MAIN INSTALLATIONS. (REDUCER NOT REQUIRED ON NEW MAIN INSTALLATIONS)
- 4

FLANGE DUCTILE IRON TEE WITH ADJUSTABLE FLANGE SUPPORT
- 5

FLANGE DUCTILE IRON 90°-BEND
- 6

FLANGE x PLAIN END DUCTILE IRON PIPE (MIN. SPECIAL CLASS 53)
- 7

MJ LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINTS
- 8

3/4" BALL CORPORATION STOP WITH TAPPING SADDLE
- 9

FLANGE GATE VALVE; WITH 2" OPERATING NUT - OPEN RIGHT AND WITH ADJUSTABLE FLANGE SUPPORT ON BYPASS VALVE
- 10

FLANGE STRAINER
- 11

FLANGE COMPOUND METER ASSEMBLY W/AMR TRANSMITTERS. METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.
- 12

FLANGE CHECK VALVE W/BLIND FLANGE-2" TAP/THREADED BRASS PLUG
- 13

MECHANICAL JOINT (RJ) GATE VALVE-2" OPERATING NUT - OPEN LEFT @ PROPERTY LINE.
- 14

MECHANICAL JOINT PLUG WITH 2" TAP
- 15

2" PIPE GALVANIZED STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR 9) OR DIP WITH STANDARD VALVE BOX/CONCRETE PAD
- 16

2" THREADED COUPLING
- 17

ADJUSTABLE FLANGE SUPPORTS (3 REQUIRED)
- 18

AMR TRANSMITTERS
- 19

4' x 5' DOUBLE-LEAF ACCESS DOOR. SEE STANDARD DETAIL.
- 20

PRECAST REINFORCED CONCRETE VAULT
- 21

MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2FT.
- 22

JOINT REQUIRED AT FLAT TOP SECTION.
- 23

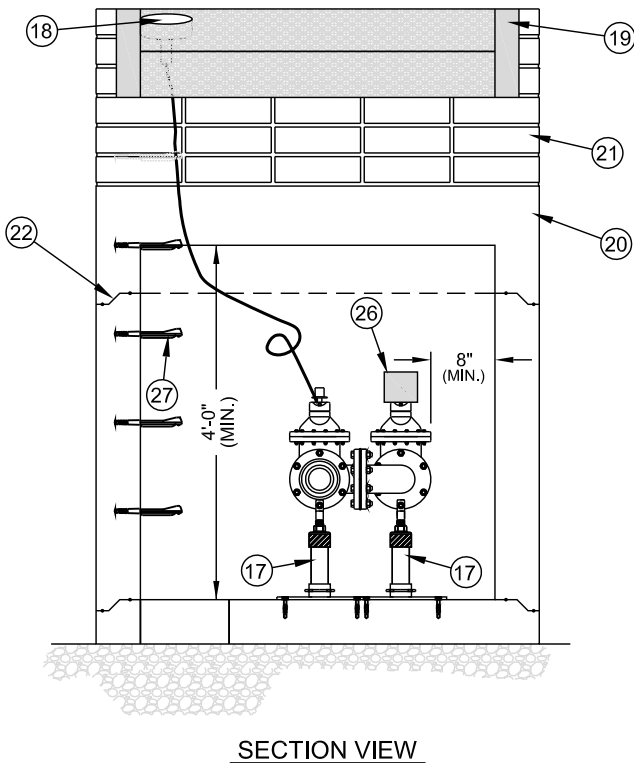
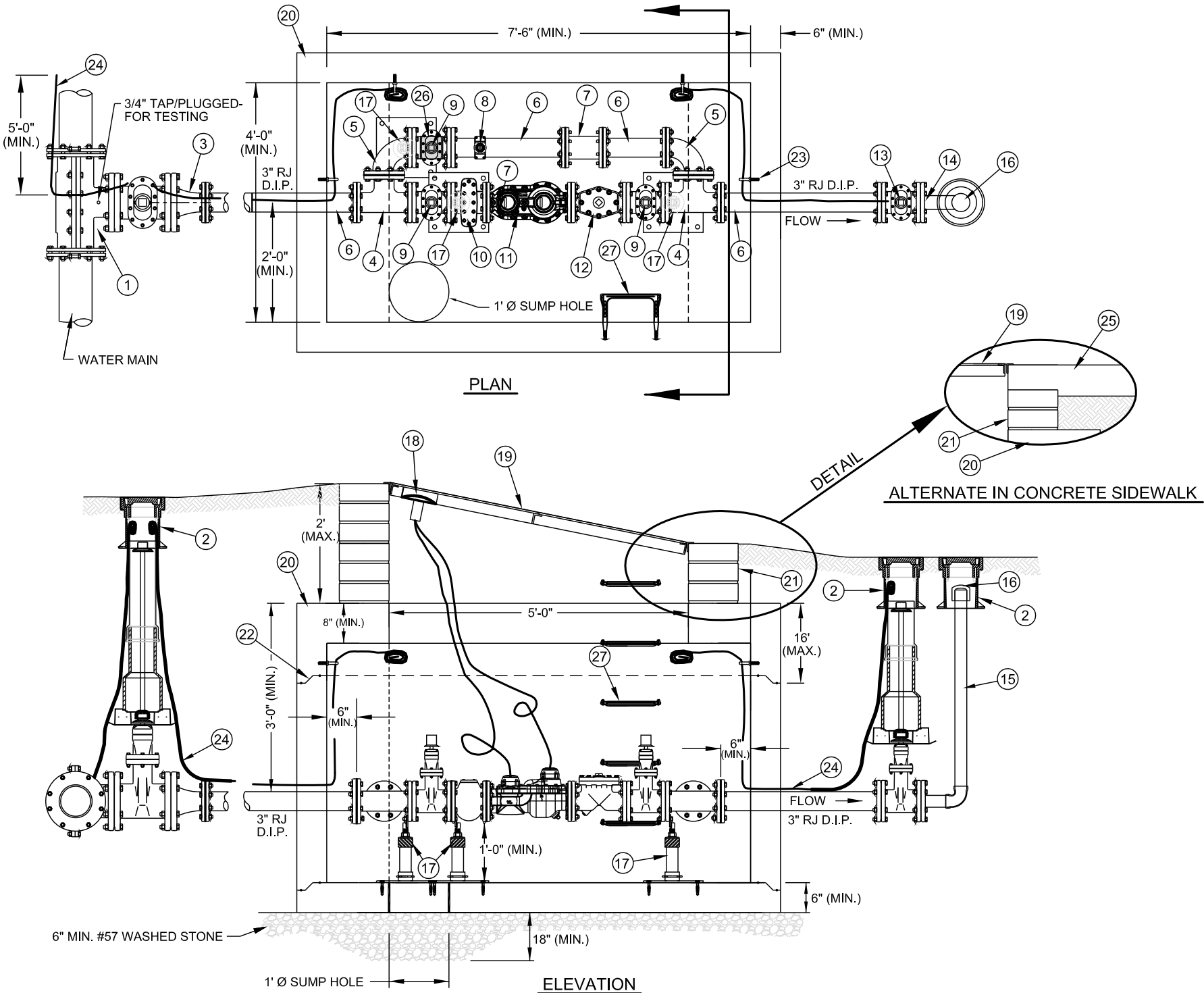
3/8" DIA. GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
- 24

AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE WITH 24" EXCESS WIRE (COILED) @ EYE BOLT AND VALVE BOX (TYPICAL).
- 25

CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.
- 26

VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED
- 27

PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING



NO SCALE

STANDARD NO.

E

VERSION DATE

05.13.2011

VERSION NO.

1.1

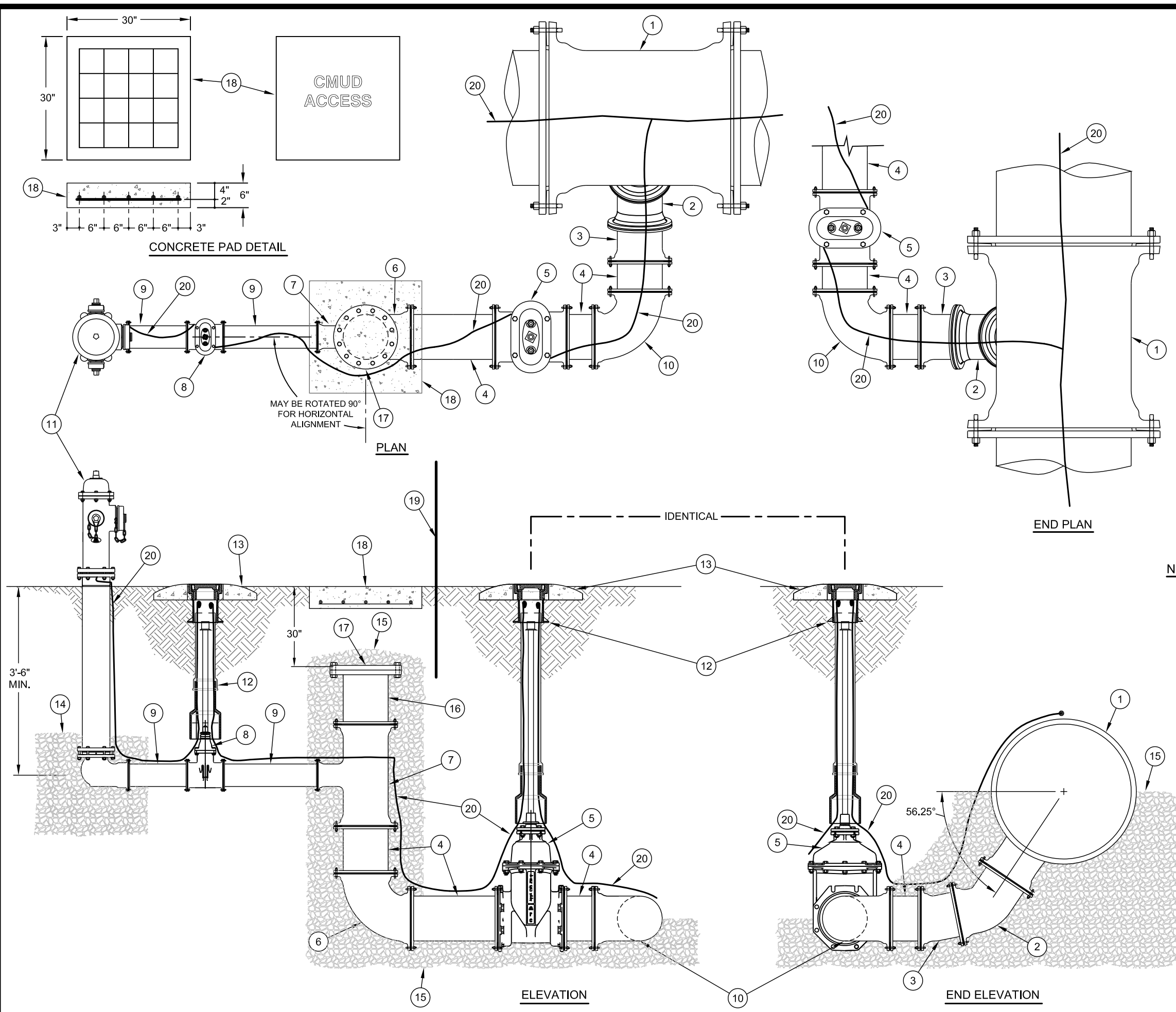
3 - inch COMPOUND WATER METER AND  
PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER





NO.	DESCRIPTION
1.	RUN X 12" TEE ( MJ - MJ ) - ROTATE DOWN 56°.
2.	12" 45° BEND ( MJ-PE )
3.	12" 11¼° BEND ( MJ-PE ).
4.	12" DIP ( PE-PE ) LENGTHS AS REQ'D.
5.	12" GATE VALVE ( MJ - MJ ).
6.	12" 90° BEND ( MJ - MJ ) - VERTICAL.
7.	12" x 12" x 6" TEE ( MJ - MJ ) - VERTICAL.
8.	6" GATE VALVE ( MJ - MJ ) ( SEE PLANS - FOR LOCATION ).
9.	6" DIP (PE-PE) LENGTHS AS REQ'D.
10.	12" 90° BEND ( MJ - MJ ) - HORIZONTAL - MAY BE DELETED FOR STRAIGHT INSTALLATION.
11.	STANDARD HYDRANT PAINTED OSHA SAFETY BLUE.
12.	STANDARD VALVE BOX ASSEMBLY W/VALVE EXTENSION / STEM ( AS REQUIRED ) PER CMUD STANDARD DETAILS.
13.	REINFORCED CONCRETE VALVE PAD - 24" DIA.
14.	# 57 OR # 67 WASHED STONE AT FH BASE - 10 CUBIC FEET.
15.	# 57 OR # 67 WASHED STONE - TYPE II BEDDING FOR PIPE, & COMPLETE VERTICAL PIPE ENCASEMENT TO 6" ABOVE BLIND FLANGE.
16.	12" D.I.P. - FLANGE x P.E.
17.	12" BLIND FLANGE.
18.	30" x 30" x 6" REINFORCED CONCRETE PAD - # 4 REBAR @ 6" O.C. EACH WAY. LOCATION MARKER - IMPRINT WITH "CMUD ACCESS".
19.	72" 3 - RAIL MARKER POST - BLUE TO SIGNIFY WATER ( RHINO OR APPROVED EQUAL ).
20.	AWG # 12 GAUGE COPPER TRACER WIRE ( THWN ) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE ( COILED ) AT VALVE BOX (TYP.)

- NOTES:
- A. ALL PIPE, FITTINGS, ETC. SHALL BE RESTRAINED JOINT, OR MJ WITH WEDGE ACTION RESTRAINT.
  - B. ALL FLANGED HARDWARE ( BOLT / WASHER / NUT ) SHALL BE TYPE 304 STAINLESS STEEL WITH ANTI - SEIZE COMPOUND.
  - C. 90° BEND (10) MAY BE OMITTED FOR STRAIGHT INSTALLATION.
  - D. TEE (7) MAY BE ROTATED 90° FOR HORIZONTAL ALIGNMENT WITH FH (11) AT ROAD RIGHT-OF-WAY.
  - E. SEE CONSTRUCTION PLANS FOR EXACT LOCATIONS OF VALVES, CMUD ACCESS POINT, AND FIRE HYDRANT.
  - F. HYDRANT EXTENSIONS SHALL BE LIMITED TO 1 EACH PER FIRE HYDRANT.

NO SCALE

STANDARD NO.	EE
VERSION NO.	V1.0
VERSION DATE	8.27.2010

12" BLOW-OFF ASSEMBLY (30" - 48" MAINS)  
MANUAL STAND PIPE WITH FIRE HYDRANT

CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
WATER





NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH MAY VARY DUE TO BRAND - VERIFY LENGTH TO DETERMINE MINIMUM VAULT LENGTH.

D. VAULT SHALL BE SIZED AS NEEDED FOR PIPE (8.5'x4' MINIMUM) AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. ⑬

NO. DESCRIPTION

- 1 4" TAPPING SLEEVE AND 4" FLANGE x MJ TAPPING VALVE ON EXISTING MAIN. 4" MJ TEE AND 4" MJ GATE VALVE ON NEW MAIN.

2 STANDARD VALVE BOX ASSEMBLY (TYP.) - ALL VALVES

3 4" RESTRAINED JOINT DUCTILE IRON PIPE.

4 FLANGE DUCTILE IRON TEE WITH ADJUSTABLE FLANGE SUPPORT

5 FLANGE DUCTILE IRON 90°-BEND

6 FLANGE x PLAIN END DUCTILE IRON PIPE (MIN. SPECIAL CLASS 53)

7 MJ LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINTS

8 3/4" BALL CORPORATION STOP WITH TAPPING SADDLE

9 FLANGE GATE VALVE; WITH 2" OPERATING NUT - OPEN RIGHT AND WITH ADJUSTABLE FLANGE SUPPORT ON BYPASS VALVE

10 FLANGE STRAINER

11 FLANGE COMPOUND METER ASSEMBLY W/AMR TRANSMITTERS. METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.

12 FLANGE CHECK VALVE W/BLIND FLANGE-2" TAP/THREADED BRASS PLUG

13 MECHANICAL JOINT (RJ) GATE VALVE-2" OPERATING NUT - OPEN LEFT @ PROPERTY LINE.

14 MECHANICAL JOINT PLUG WITH 2" TAP

15 2" PIPE GALVANIZED STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR 9) OR DIP WITH STANDARD VALVE BOX/CONCRETE PAD

16 2" THREADED COUPLING

17 ADJUSTABLE FLANGE SUPPORTS (3 REQUIRED)

18 AMR TRANSMITTERS

19 4' x 5' DOUBLE-LEAF ACCESS DOOR. SEE STANDARD DETAIL.

20 PRECAST REINFORCED CONCRETE VAULT

21 MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2FT.

22 JOINT REQUIRED AT FLAT TOP SECTION.

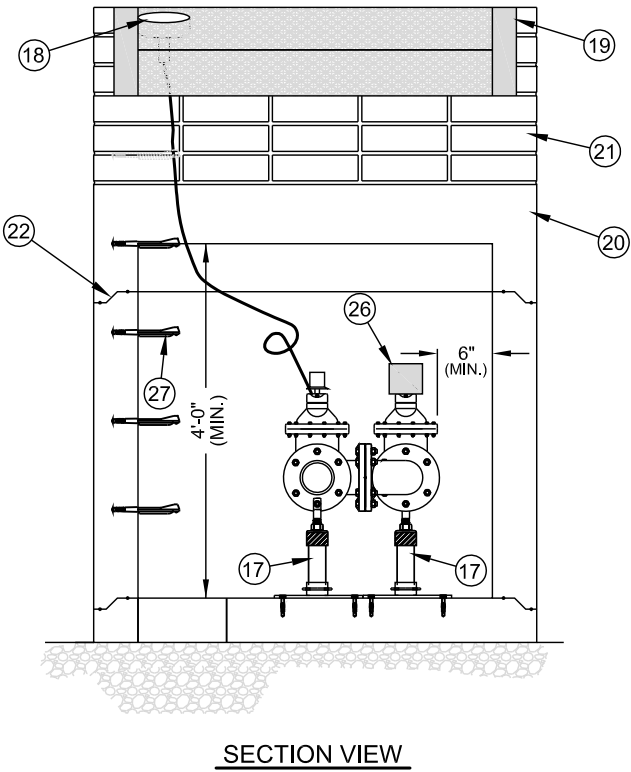
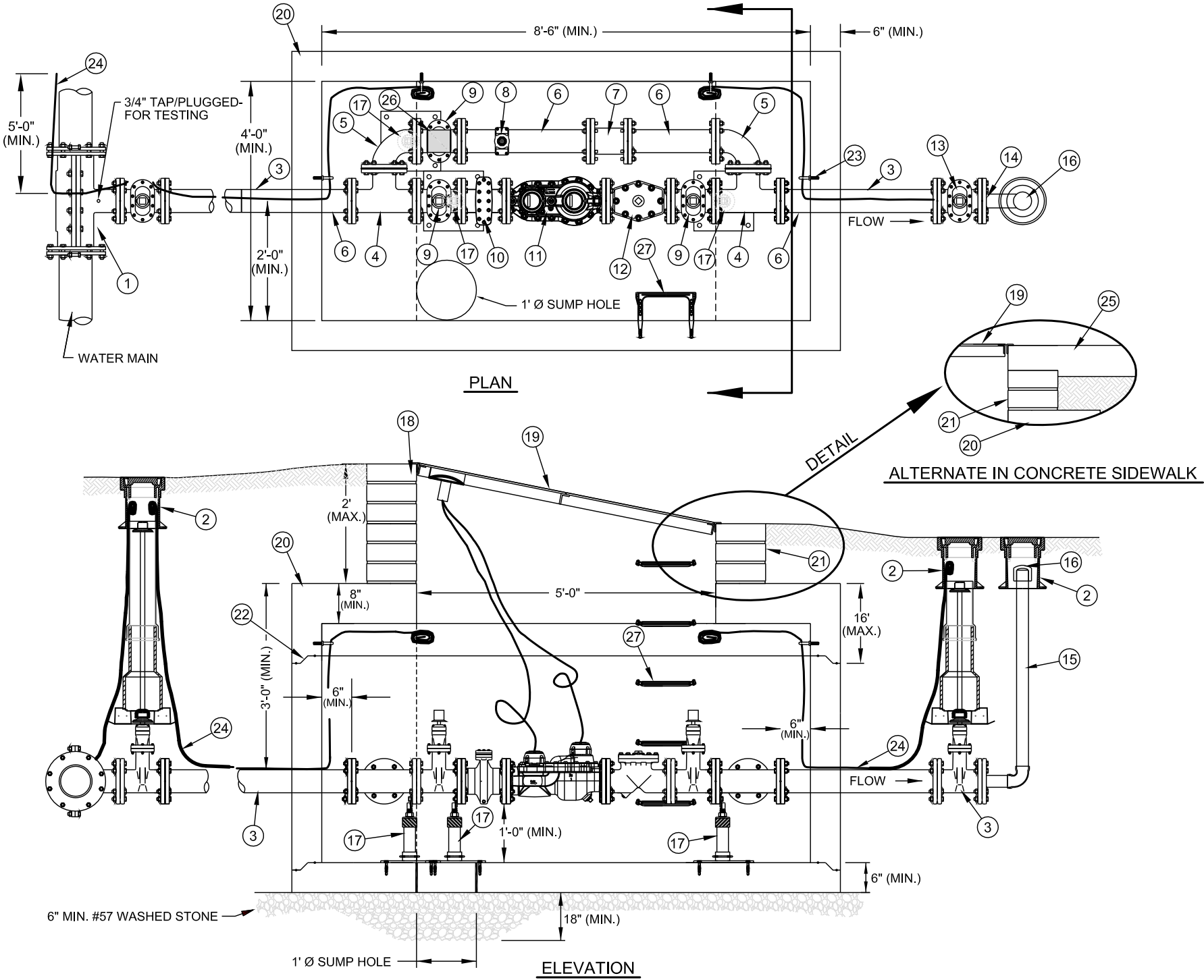
23 3/8" DIA. GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL

24 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE WITH 24" EXCESS WIRE (COILED) @ EYE BOLT AND VALVE BOX (TYPICAL).

25 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

26 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED

27 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING



NO SCALE

STANDARD NO.

F

VERSION NO. 1.1

VERSION DATE 05.13.2011

4 - inch COMPOUND WATER METER AND  
PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER





STANDARD NO.	
FF	
VERSION NO.	VERSION DATE
V1.2	05.14.2018

CAST IRON VALVE BOX

( 12" AND SMALLER VALVES - ONLY )

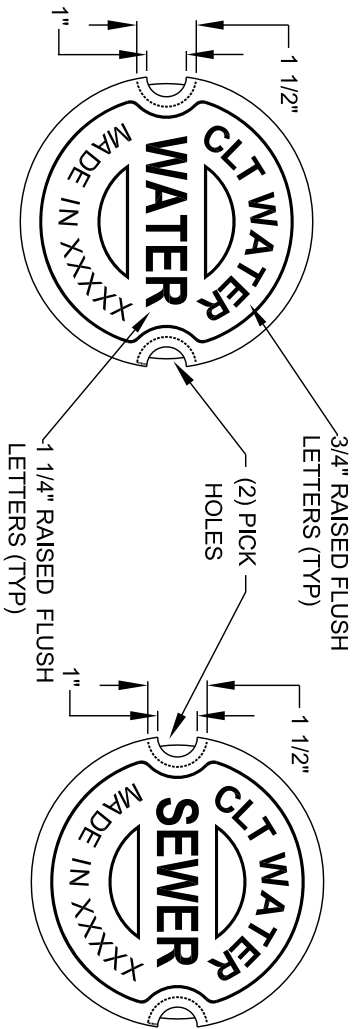
CHARLOTTE WATER		
STANDARD DETAILS		
WATER/SEWER/RECLAIM/CP		



NO: DESCRIPTION

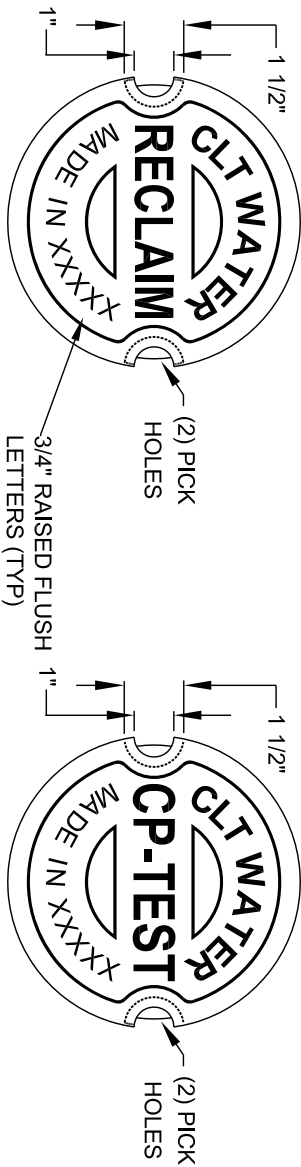
1. TYPE I ADJUSTMENT RISER.
2. VALVE BOX - TOP SECTION.
3. 18 - 8 SS 3/8"-16 x 3/8" HEX SET SCREW WITH PERMANENT THREAD LOCK (RED) - LOCTITE # 271, PERMABOND HM128, OR APPROVED EQUAL.
4. 1/2" DIA. x 1/16" - FIELD DRILL HOLE.

NO SCALE



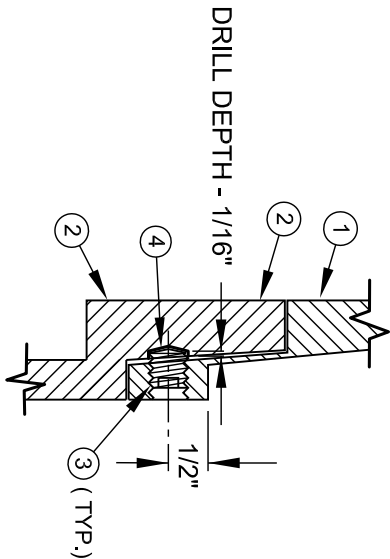
WATER COVER - TOP VIEW

SEWER COVER - TOP VIEW

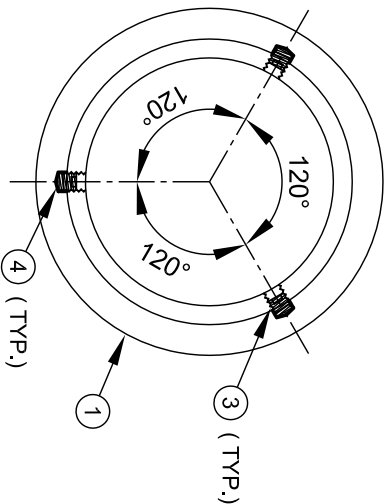


RECLAIMED WATER - TOP VIEW

CATHODIC PROTECTION COVER  
TOP - VIEW

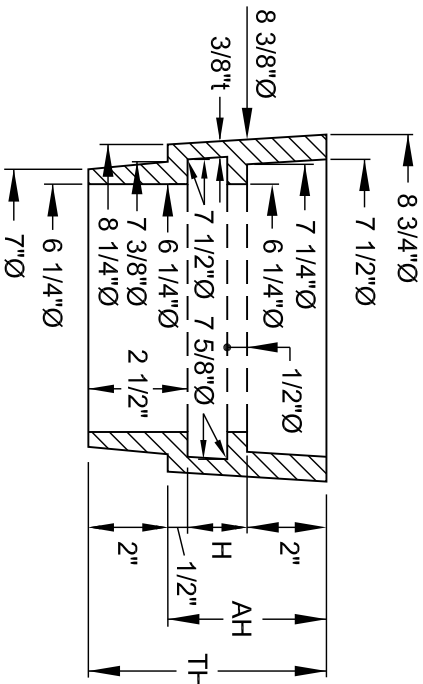


TYPE I CROSS SECTION - ASSEMBLY



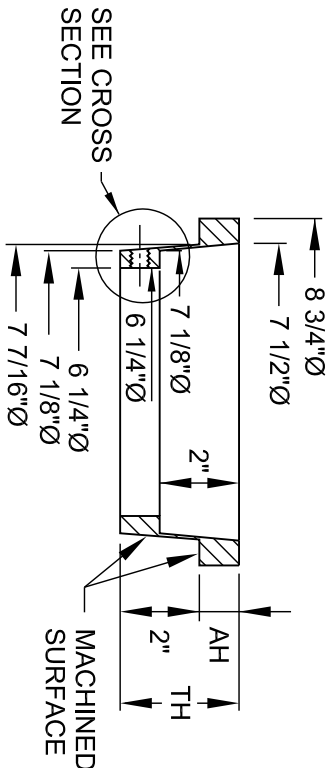
TYPE I - ADJUSTMENT RISER

TOP VIEW



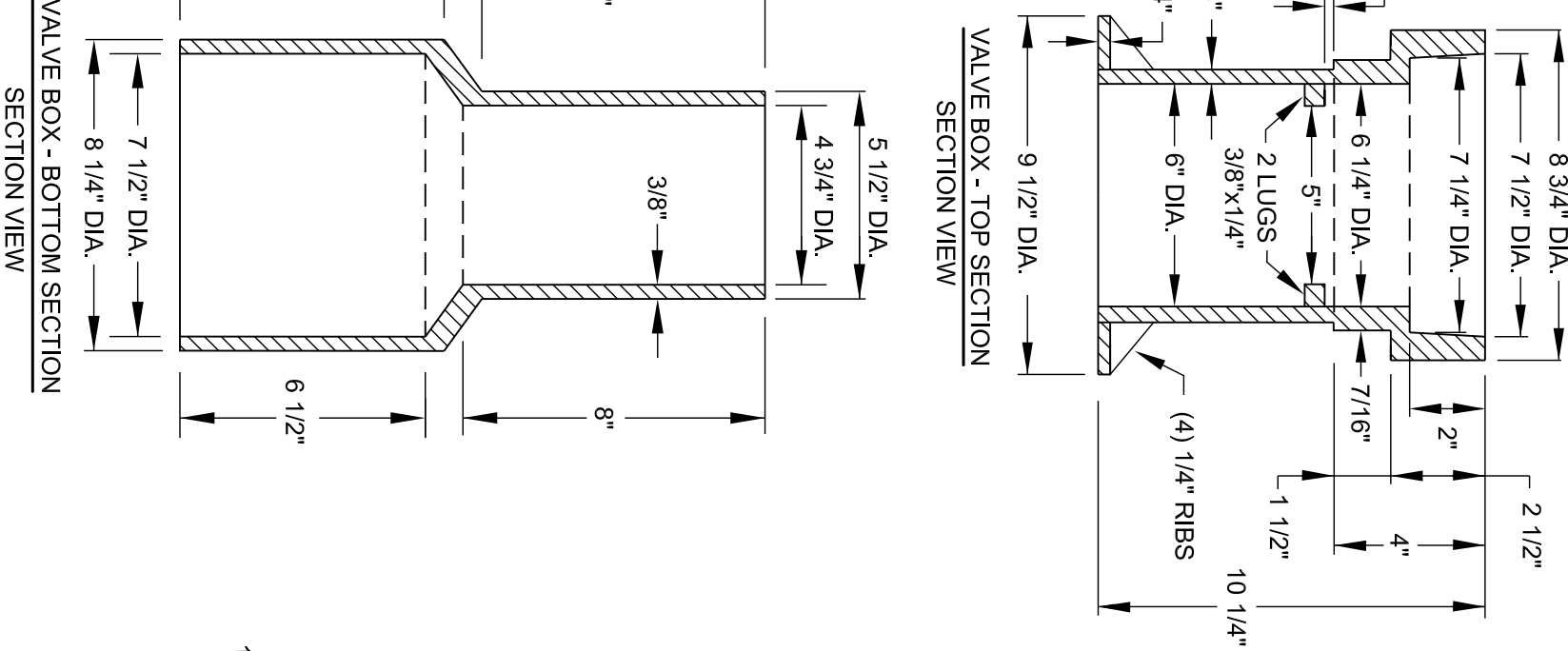
TYPE II - ADJUSTMENT RISER

SECTION VIEW



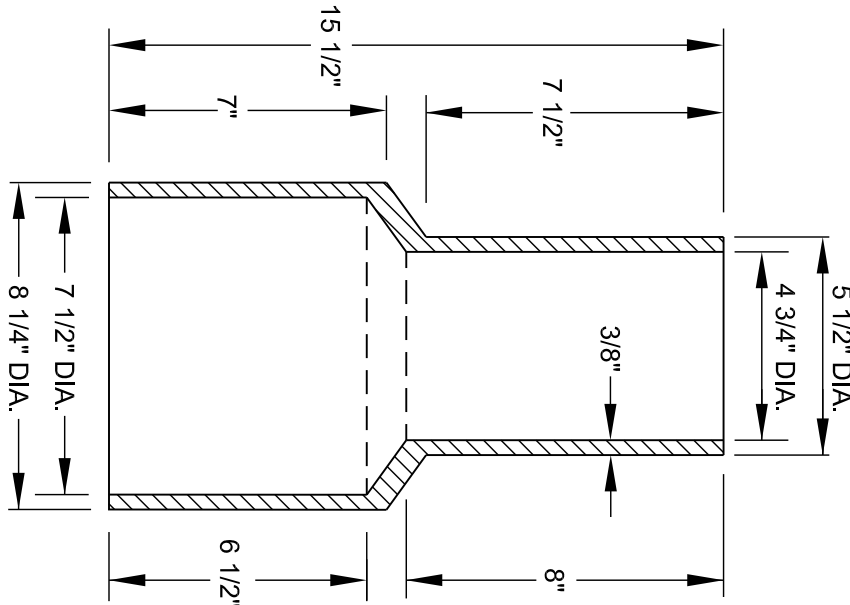
TYPE I - ADJUSTMENT RISER

SECTION VIEW



VALVE BOX - TOP SECTION

SECTION VIEW



VALVE BOX - BOTTOM SECTION

SECTION VIEW

NOTES:

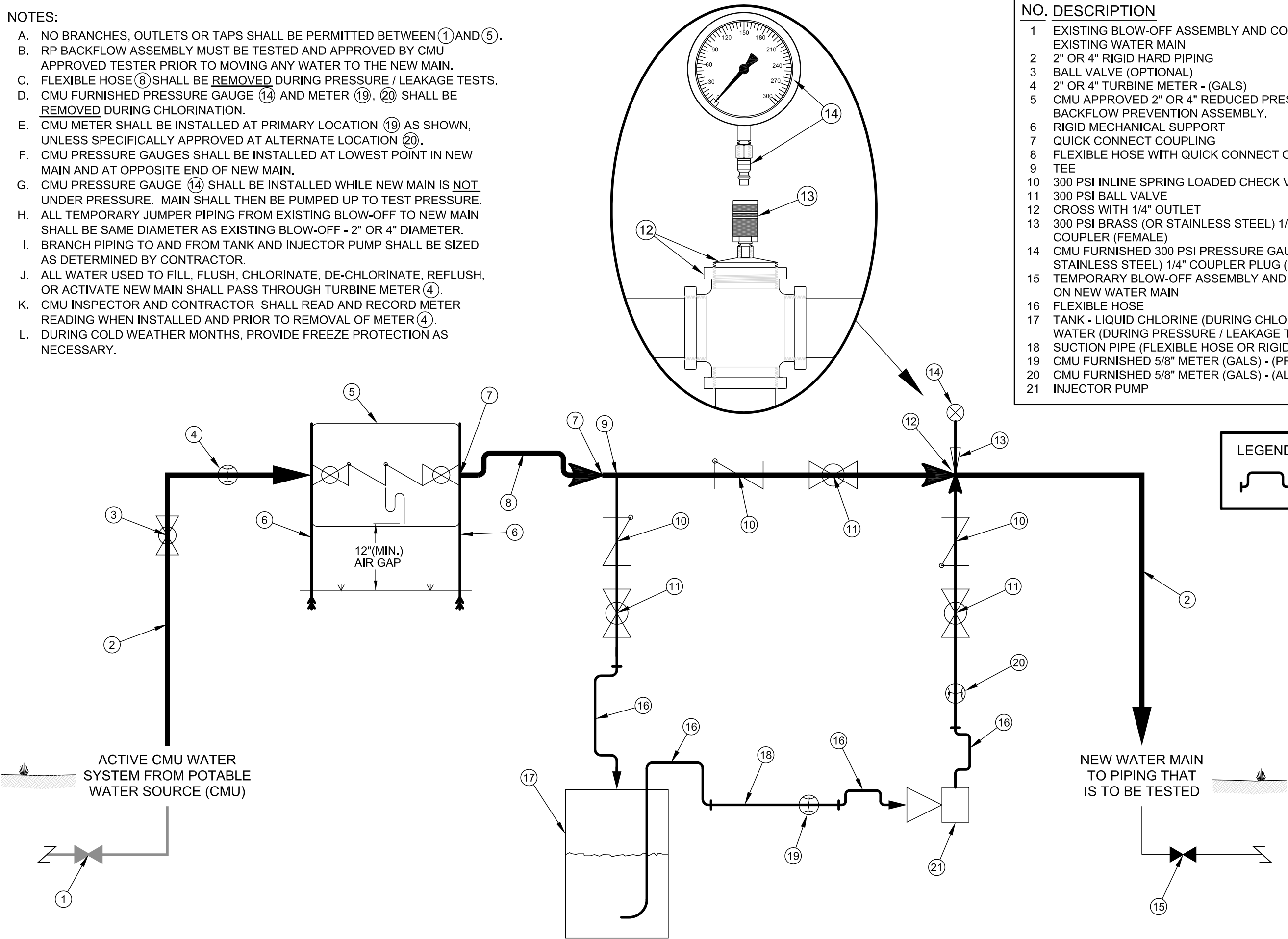
- A. LOAD RATING - HEAVY DUTY.
- B. FERROUS CASTINGS MATERIAL - ASTM A48 - CLASS 35 GRAY IRON.
- C. COATING - UNDIPPED OR ASPHALT VARNISH.
- D. WEIGHT - 0% MINUS TOLERANCE.
- E. CASTINGS SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.
- F. TYPE II ADJUSTMENT RISERS MAY BE STACKED.
- G. TYPE I ADJUSTMENT RISERS MAY NOT BE STACKED.

WEIGHT POUNDS	MINIMUM
TOP SECTION	31
BOTTOM SECTION	34
COVER	19
TOTAL	84

TYPE II - ADJUSTMENT RISER			
TH - TOTAL HEIGHT	AH - ADJUSTMENT HEIGHT	H	MINIMUM WEIGHT - LBS
< 4 1/2"	< 2 1/2"	NOT APPROVED	NOT APPROVED
4 1/2"	2 1/2"	0	16
5"	3"	1/2"	20
6"	4"	1 1/2"	22.5
7"	5"	2 1/2"	25
8"	6"	3 1/2"	27
10"	8"	5 1/2"	32

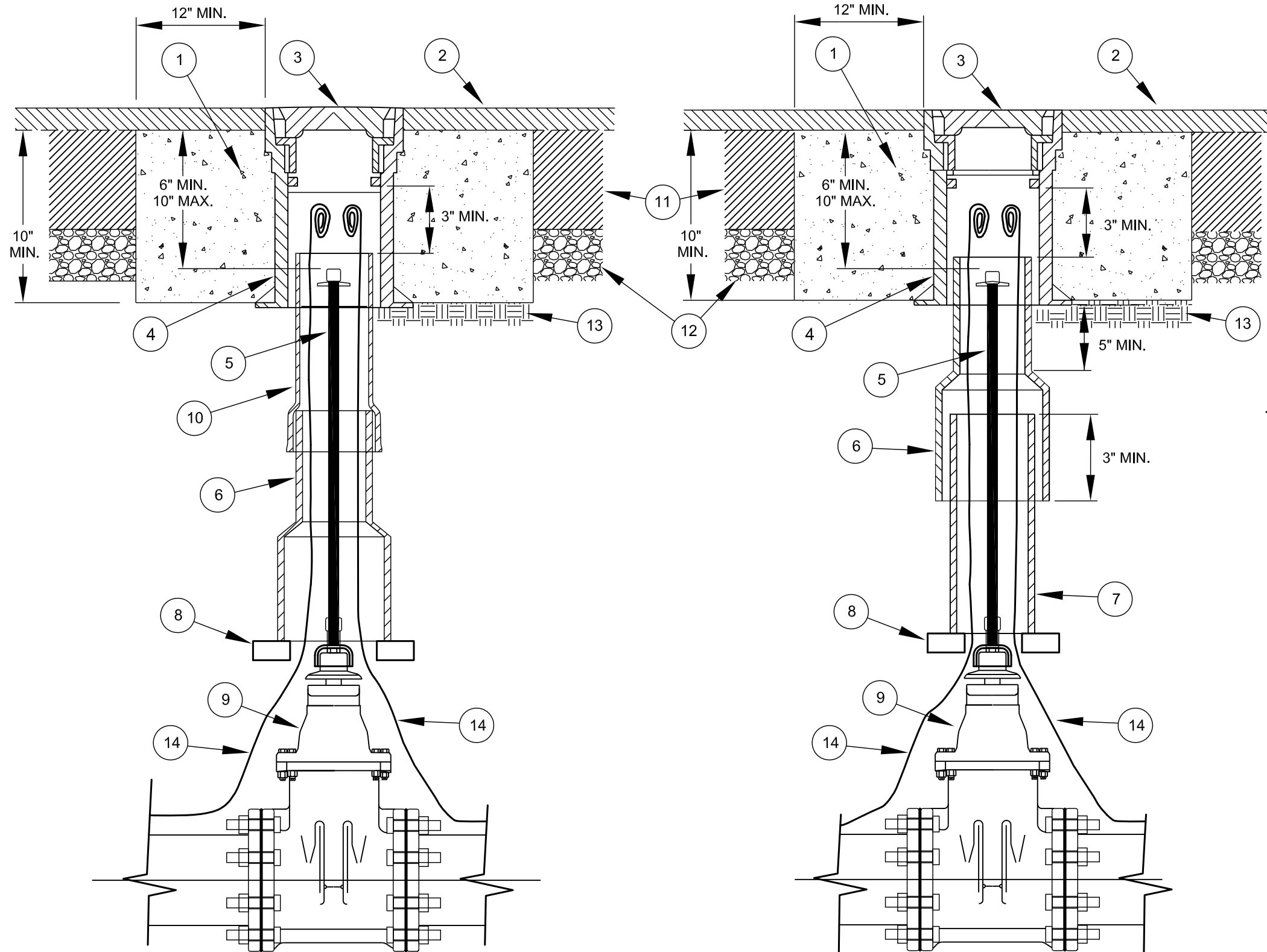
TYPE I - ADJUSTMENT RISER			
TH - TOTAL HEIGHT	AH - ADJUSTMENT HEIGHT	MIN. WEIGHT LBS	
3"	1"	7	
3 1/2"	1 1/2"	9	
4"	2"	15	
> 4"	NOT APPROVED	N/A	

- NOTES:
- A. NO BRANCHES, OUTLETS OR TAPS SHALL BE PERMITTED BETWEEN ① AND ⑤.
  - B. RP BACKFLOW ASSEMBLY MUST BE TESTED AND APPROVED BY CMU APPROVED TESTER PRIOR TO MOVING ANY WATER TO THE NEW MAIN.
  - C. FLEXIBLE HOSE ⑧ SHALL BE REMOVED DURING PRESSURE / LEAKAGE TESTS.
  - D. CMU FURNISHED PRESSURE GAUGE ⑭ AND METER ⑲, ⑳ SHALL BE REMOVED DURING CHLORINATION.
  - E. CMU METER SHALL BE INSTALLED AT PRIMARY LOCATION ⑲ AS SHOWN, UNLESS SPECIFICALLY APPROVED AT ALTERNATE LOCATION ⑳.
  - F. CMU PRESSURE GAUGES SHALL BE INSTALLED AT LOWEST POINT IN NEW MAIN AND AT OPPOSITE END OF NEW MAIN.
  - G. CMU PRESSURE GAUGE ⑭ SHALL BE INSTALLED WHILE NEW MAIN IS NOT UNDER PRESSURE. MAIN SHALL THEN BE PUMPED UP TO TEST PRESSURE.
  - H. ALL TEMPORARY JUMPER PIPING FROM EXISTING BLOW-OFF TO NEW MAIN SHALL BE SAME DIAMETER AS EXISTING BLOW-OFF - 2" OR 4" DIAMETER.
  - I. BRANCH PIPING TO AND FROM TANK AND INJECTOR PUMP SHALL BE SIZED AS DETERMINED BY CONTRACTOR.
  - J. ALL WATER USED TO FILL, FLUSH, CHLORINATE, DE-CHLORINATE, REFLUSH, OR ACTIVATE NEW MAIN SHALL PASS THROUGH TURBINE METER ④.
  - K. CMU INSPECTOR AND CONTRACTOR SHALL READ AND RECORD METER READING WHEN INSTALLED AND PRIOR TO REMOVAL OF METER ④.
  - L. DURING COLD WEATHER MONTHS, PROVIDE FREEZE PROTECTION AS NECESSARY.



NO.	DESCRIPTION
1	EXISTING BLOW-OFF ASSEMBLY AND CONTROL VALVE ON EXISTING WATER MAIN
2	2" OR 4" RIGID HARD PIPING
3	BALL VALVE (OPTIONAL)
4	2" OR 4" TURBINE METER - (GALS)
5	CMU APPROVED 2" OR 4" REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY.
6	RIGID MECHANICAL SUPPORT
7	QUICK CONNECT COUPLING
8	FLEXIBLE HOSE WITH QUICK CONNECT COUPLINGS
9	TEE
10	300 PSI INLINE SPRING LOADED CHECK VALVE (OPTIONAL)
11	300 PSI BALL VALVE
12	CROSS WITH 1/4" OUTLET
13	300 PSI BRASS (OR STAINLESS STEEL) 1/4" QUICK CONNECT COUPLER (FEMALE)
14	CMU FURNISHED 300 PSI PRESSURE GAUGE WITH BRASS (OR STAINLESS STEEL) 1/4" COUPLER PLUG (MALE)
15	TEMPORARY BLOW-OFF ASSEMBLY AND CONTROL VALVE ON NEW WATER MAIN
16	FLEXIBLE HOSE
17	TANK - LIQUID CHLORINE (DURING CHLORINATION) OR FRESH WATER (DURING PRESSURE / LEAKAGE TESTS).
18	SUCTION PIPE (FLEXIBLE HOSE OR RIGID PIPE)
19	CMU FURNISHED 5/8" METER (GALS) - (PRIMARY LOCATION)
20	CMU FURNISHED 5/8" METER (GALS) - (ALTERNATE LOCATION)
21	INJECTOR PUMP

NO SCALE	STANDARD NO.	NEW WATER MAIN JUMPER	
	G	SCHEMATIC FOR 2" - 24" MAINS	
	VERSION NO.	1.1	
CHARLOTTE-MECKLENBURG UTILITIES		STANDARD DETAILS	
WATER		CHARLOTTE	



TYPE A  
USING CAST IRON SOIL PIPE

TYPE B  
USING PVC PIPE

# NO. DESCRIPTION

1. CONCRETE PAD - CAST IN PLACE.
2. FINAL ASPHALT SURFACE COURSE.
3. VALVE BOX COVER.
4. TOP SECTION VALVE BOX.
5. EXTENSION STEM AS REQUIRED.
6. BOTTOM SECTION VALVE BOX.
7. 6" PVC PIPE ( C900 OR SDR26 ).
8. STANDARD CONCRETE BRICK - 2 EACH.
9. GATE VALVE ( OR BALL VALVE, AS APPLICABLE ).
10. 5" DIA. CAST IRON SOIL PIPE - BELL OF PIPE WILL RECEIVE BOTTOM SECTION OF VALVE BOX.
11. EXISTING OR NEW PAVEMENT.
12. COMPACTED AGGREGATE BASE COURSE ( CABC ).
13. COMPACTED SUBGRADE.
14. AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.).

## NOTES:

- A. WATER VALVE ADJUSTMENTS WILL BE COMPLETED AT LEAST 36 HOURS BEFORE RESURFACING.
- B. 12" MINIMUM WIDTH OF EXCAVATION AROUND VALVE BOX.
- C. DISTURBED AREAS AROUND STRUCTURE ADJUSTMENTS ARE TO BE TAMPED AND FILLED WITH 4000 PSI "HIGH EARLY" PORTLAND CEMENT CONCRETE.
- D. ALL DAMAGED OR MISALIGNED VALVE BOXES ARE TO BE REPORTED TO INSPECTOR, OTHERWISE CONTRACTOR ASSUMES RESPONSIBILITY FOR DAMAGE OR MISALIGNMENT.
- E. IF THE VERTICAL ADJUSTMENT CAUSES LESS THAN ONE INCH OVERLAP BETWEEN TOP SECTION AND RISER PIPE, CONTRACTOR WILL REMOVE AND REPLACE RISER PIPE FROM BOTTOM SECTION TO TOP TO PROVIDE 3 INCHES OF OVERLAP IN TOP SECTION FOR TYPE A OR IF THE VERTICAL ADJUSTMENT CAUSES LESS THAN ONE INCH OVERLAP BETWEEN TOP SECTION AND BOTTOM SECTION, CONTRACTOR WILL REMOVE AND RESET BOTTOM SECTION TO PROVIDE A MINIMUM OF 3 INCHES OVERLAP AT TOP SECTION/BOTTOM SECTION JOINT SECTION & BOTTOM SECTION/RISER PIPE JOINT FOR TYPE B.
- F. ALL CONCRETE SHALL BE VIBRATED IN ACCORDANCE WITH N.C. DEPARTMENT OF TRANSPORTATION SPECIFICATIONS.
- G. TOP & BOTTOM SECTION TO BE CENTERED OVER NUT, NOT TO BEAR ON VALVE BODY.
- H. PROVIDE CLEARANCE BETWEEN VALVE BOX/BRICK AND THE VALVE.
- I. VALVE BOX ASSEMBLY SHALL CONSIST OR NO MORE THAN 3 VERTICAL SECTIONS - 1 TOP SECTION, 1 - BOTTOM SECTION AND 1 - PIPE RISER SECTION.

NO SCALE

STANDARD NO.

GG

VERSION NO. V1.0

VERSION DATE 9.13.2010

## VERTICAL VALVE BOX ADJUSTMENT FOR PAVEMENT RESURFACING

CHARLOTTE-MECKLENBURG  
UTILITIES

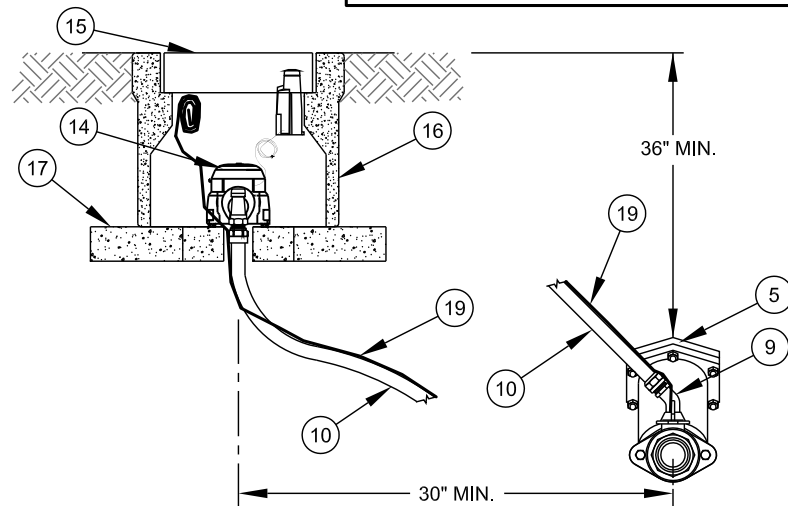
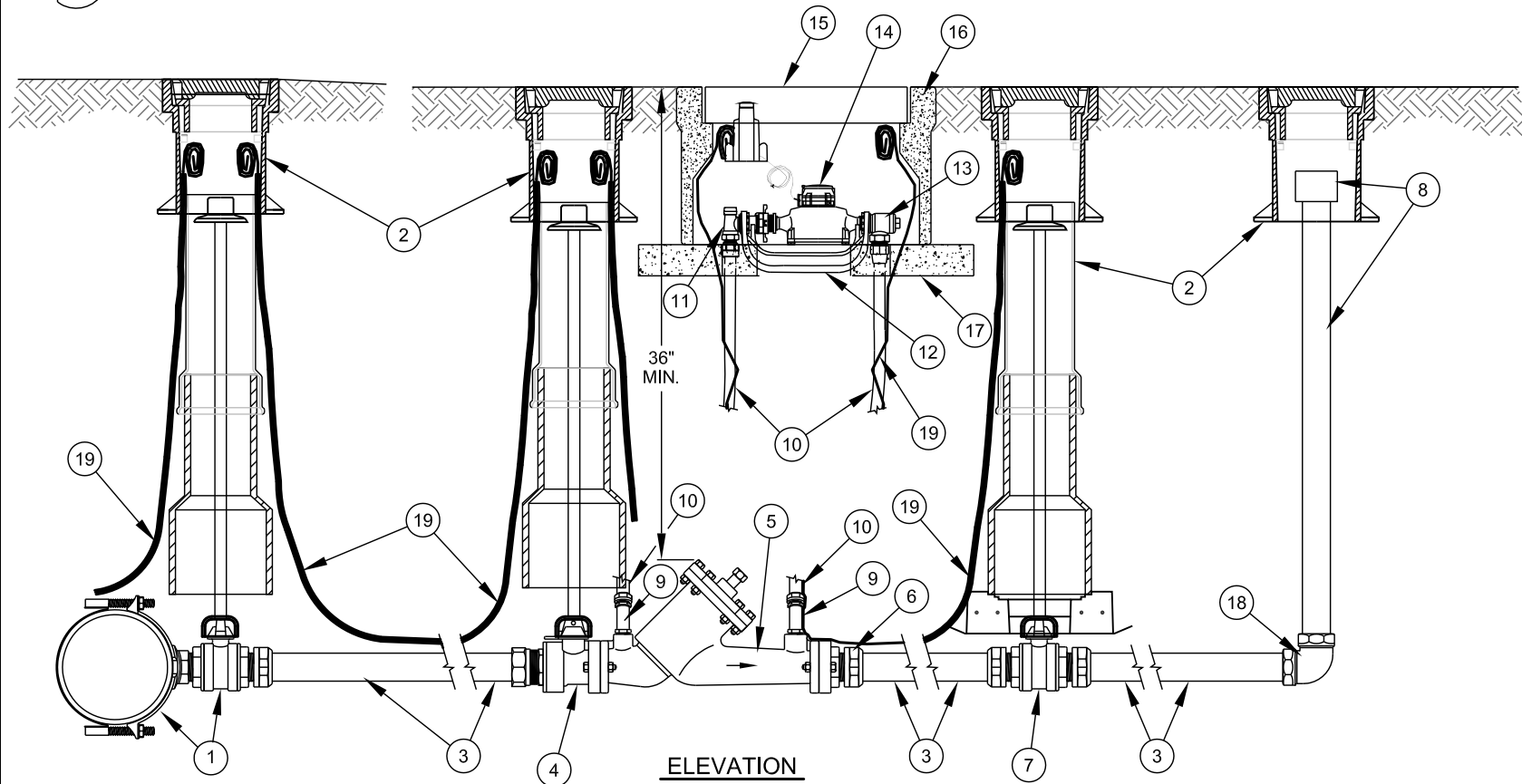
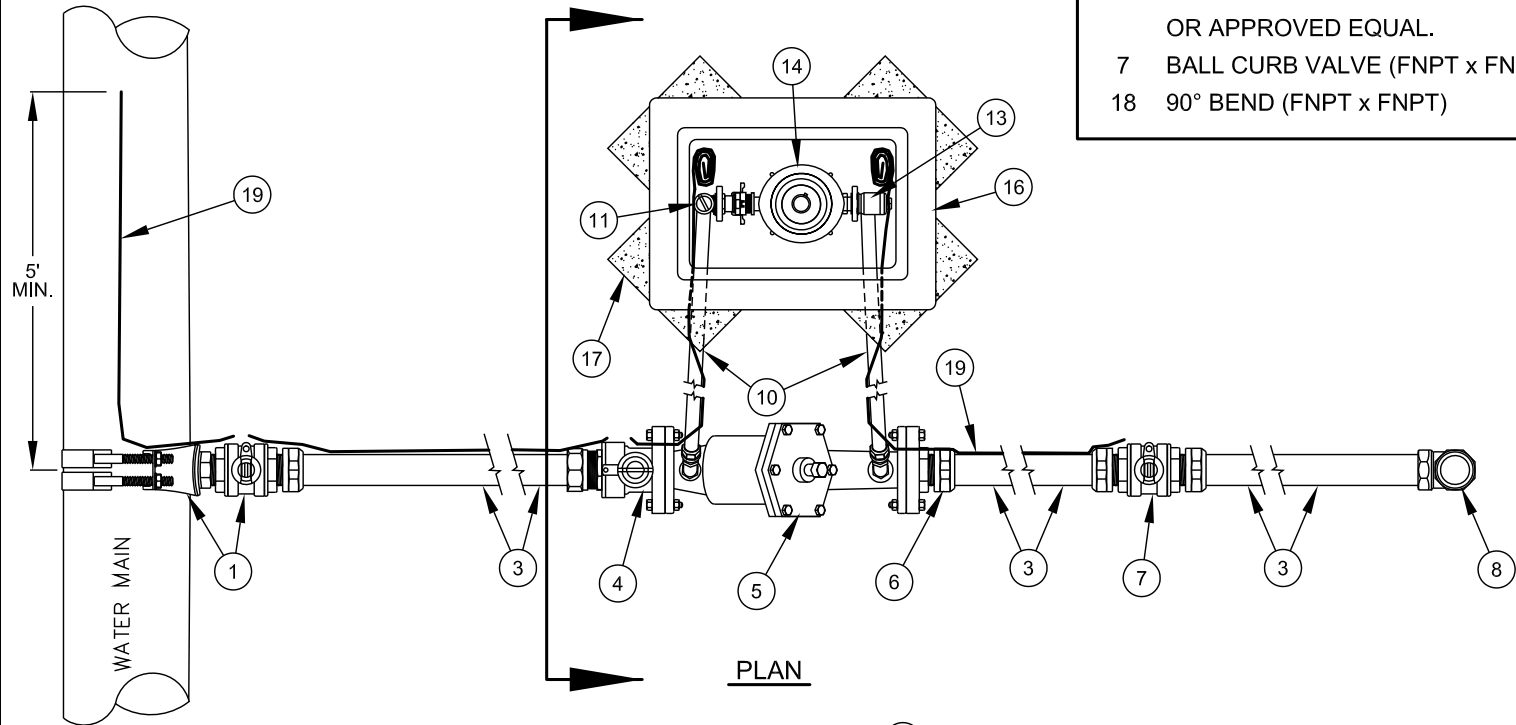
STANDARD DETAILS

WATER



NOTES:

- A. CENTER ANGLE BALL VALVE (11) AND SINGLE ANGLE CHECK VALVE (13) IN METER BOX.
- B. LOCK ANGLE BALL VALVE (11) IN OPEN POSITION. PERMANENT LOCK (WITH CMUD SERIAL #) SHALL BE FURNISHED BY CMUD.
- C. METER BOX TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM METER BOX.
- D. 5/8 INCH METER SHALL BE INSTALLED IN STANDARD CONCRETE METER BOX PER STD. DETAIL.



FIRE SERVICE SIZE	DETECTOR METER SIZE
2"	5/8"

NO. ALTERNATE DESCRIPTION

- WHEN USING HDPE (IPS) POLY IN PLACE OF COPPER TUBING - USE THE FOLLOWING PRODUCTS.
- 1 2" BALL CORPORATION STOP (CC TAPER THREAD x FNPT)
- 3 2" SDR9 HDPE (IPS) POLY WITH STAINLESS STEEL, BRASS, OR BRONZE MNPT ENDS.
- 4 BALL STRAIGHT METER VALVE (2 BOLT METER FLANGE x FNPT) MUELLER #B-24337 OR APPROVED EQUAL.
- 6 STRAIGHT METER COUPLING - (2 BOLT METER FL x FNPT) FORD #CF31-77, OR APPROVED EQUAL.
- 7 BALL CURB VALVE (FNPT x FNPT)
- 18 90° BEND (FNPT x FNPT)

NO. DESCRIPTION

- 1 TAPPING SADDLE & 2" BALL CORPORATION STOP (CC TAPER THREAD x CTS COMPRESSION)
- 2 STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES (OMIT AT CORPORATION STOP ON SHORT SIDE SERVICE).
- 3 2" TYPE K COPPER TUBING
- 4 BALL STRAIGHT METER VALVE - (2 BOLT METER FL x CTS COMPRESSION), MUELLER #B-24335 OR APPROVED EQUAL.
- 5 DETECTOR CHECK VALVE - (2 BOLT METER FL x 2 BOLT METER FL), FEBCO SERIES 406, OR APPROVED EQUAL.
- 6 STRAIGHT METER COUPLING - (2 BOLT METER FL x CTS COMPRESSION), FORD #CF34-77, OR APPROVED EQUAL.
- 7 PROPERTY LINE BALL CURB VALVE - (ALL CTS COMPRESSION), MUELLER #B-25209, FORD #B44-777, OR APPROVED EQUAL.
- 8 TEMPORARY 2" BLOW-OFF ASSEMBLY - GALV. STEEL PIPE WITH THREADED COUPLING.
- 9 3/4 INCH 45° COUPLING (MIP TREAD x CTS COMPRESSION), MUELLER #H15529, OR APPROVED EQUAL.
- 10 3/4 INCH TYPE K COPPER OR HDPE (POLY TUBING) SDR 9 (WITH INSERTS).
- 11 5/8 INCH x 3/4 INCH ANGLE BALL VALVE WITH LOCK WINGS (LOCK OPEN) (CTS COMPRESSION x YOKE STAR NUT)
- 12 5/8 INCH METER YOKE BAR
- 13 5/8 INCH x 3/4 INCH SINGLE ANGLE CHECK VALVE (YOKE STAR NUT x CTS COMPRESSION)
- 14 3/4 INCH METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CMUD)
- 15 SOLID POLYETHYLENE (HDPE) METER BOX LID
- 16 STANDARD 3/4 INCH CONCRETE METER BOX PER STANDARD DETAIL
- 17 SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH
- 18 90 ° BEND (CTS COMPRESSION x FNPT)
- 19 AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP) - OMIT WHEN SERVICE LINE IS ALL COPPER TUBING.

NO SCALE

STANDARD NO.	H
VERSION NO.	1.3
VERSION DATE	05.05.2011

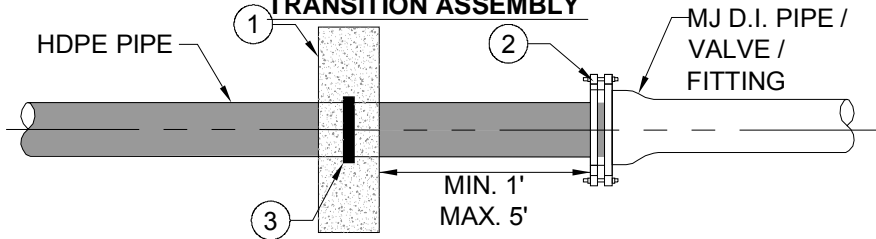
2" FIRE LINE SPRINKLER SERVICE  
WITH DETECTOR METER ASSEMBLY

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



A

HDPE TO DUCTILE IRON  
(4 TO 32-INCH ONLY)  
TRANSITION ASSEMBLY



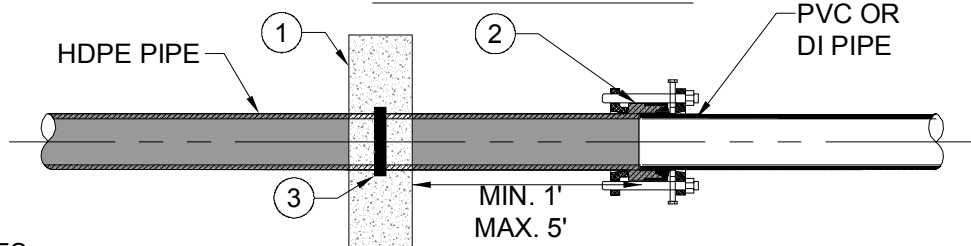
NO. DESCRIPTION

1. WALL BLOCKING, REFER TO DETAIL HD4 OR HD5
2. IPS x DIPS RESTRAINED MJ ADAPTER WITH STEEL PIPE STIFFENER AND KIT
3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO DETAIL HD4 OR HD5

- NOTES:
- A. HIGH DENSITY POLYETHYLENE (HDPE) FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - B. MECHANICAL FITTINGS SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
  - C. INSTALL STAINLESS STEEL INTERNAL STIFFENER IN THE END OF THE HDPE PIPE WHEN HDPE PIPE IS INSERTED INTO THE BELL END OF NON-HDPE PIPE, VALVE, FITTING, OR INTO THE HUB OF A MECHANICAL COUPLING.
  - D. INTERNAL STIFFENER CAN BE WEDGE TYPE OR SOLID BODY. STIFFENER WILL BE RATED FOR DR AND ID OF PIPE. FOR WATER, 304 OR 316 STAINLESS STEEL IS ALLOWED. FOR WASTEWATER, 316 SS IS REQUIRED.
  - E. MECHANICAL JOINT ADAPTERS SHALL BE PE4710 AND CAN BE MADE TO ASTM D 3261. IF MACHINED, ADAPTERS MUST MEET THE REQUIREMENTS OF ASTM F 2206. ADAPTERS SHALL HAVE A PRESSURE RATING EQUAL TO THE PIPE.
  - F. FIGURE ABOVE SHOWS TRANSITION TO BELL END OF DIP. FOR TRANSITION TO PLAIN END OF DIP, SEE PVC FIGURE.
  - G. EXTERNAL RESTRAINT DEVICES ARE NOT ALLOWED.

B

HDPE TO PVC OR DI  
(4 TO 32-INCH ONLY)  
TRANSITION ASSEMBLY



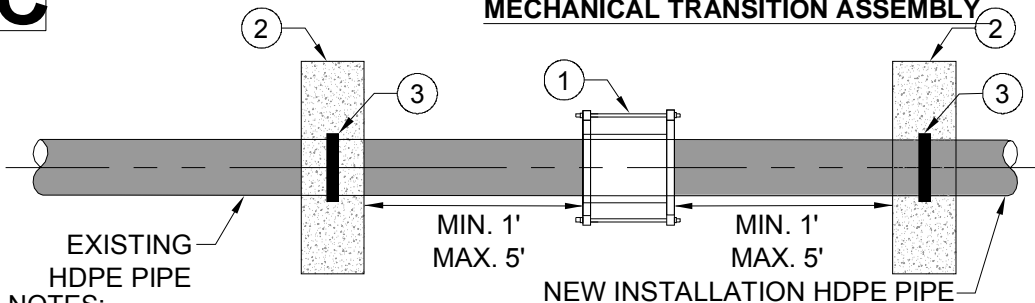
NO. DESCRIPTION

1. WALL BLOCKING, REFER TO DETAIL HD4 OR HD5
2. BELL MJ ADAPTER WITH MECHANICAL RESTRAINT KIT
3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO DETAIL HD4 OR HD5

- NOTES:
- A. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - B. MECHANICAL FITTINGS USED SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
  - C. STAINLESS STEEL INTERNAL STIFFENERS SHALL BE INSTALLED IN THE END OF THE HDPE PIPE WHEN HDPE PIPE IS INSERTED INTO THE BELL END OF NON-HDPE PIPE, VALVE, FITTING, OR INTO THE HUB OF A BOLTED COUPLING
  - D. RESTRAINT COUPLER SLEEVE SHALL BE ASTM A513 WITH FUSION BONDED EPOXY. LOW ALLOY STEEL BOLTS CONFORM TO AWWA C111.4
  - E. WHEN PVC BELL END IS ENCOUNTERED, FIELD CUT PVC TO FORM PLAIN END PER MANUFACTURER'S INSTRUCTIONS. WHEN DI BELL END IS ENCOUNTERED, USE DETAIL HD1 A.

C

HDPE TO HDPE  
MECHANICAL TRANSITION ASSEMBLY



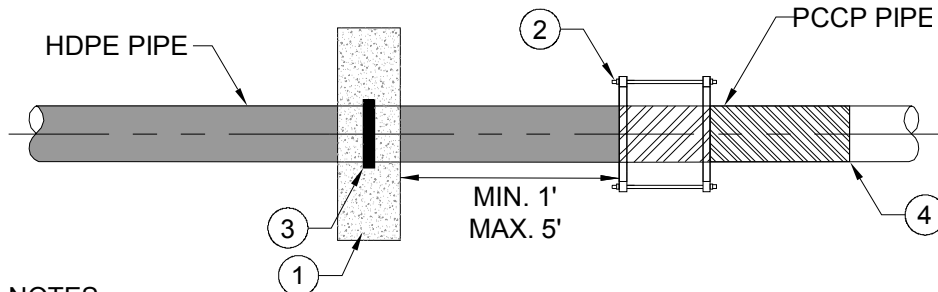
NO. DESCRIPTION

1. MECHANICAL HDPE COUPLING.
2. WALL BLOCKING, REFER TO DETAIL HD4 OR HD5
3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO DETAIL HD4.

- NOTES:
- A. ONLY ALLOWED WHEN BUTT FUSION IS NOT POSSIBLE.
  - B. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - C. MECHANICAL FITTINGS SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
  - D. INTERNAL STIFFENER CAN BE WEDGE TYPE OR SOLID BODY. STIFFENER WILL BE RATED FOR DR AND ID OF PIPE. FOR WATER, 304 OR 316 STAINLESS STEEL IS ALLOWED. FOR WASTEWATER 316 SS IS REQUIRED.

D

HDPE TO PCCP  
(16 TO 32-INCH ONLY)  
TRANSITION ASSEMBLY



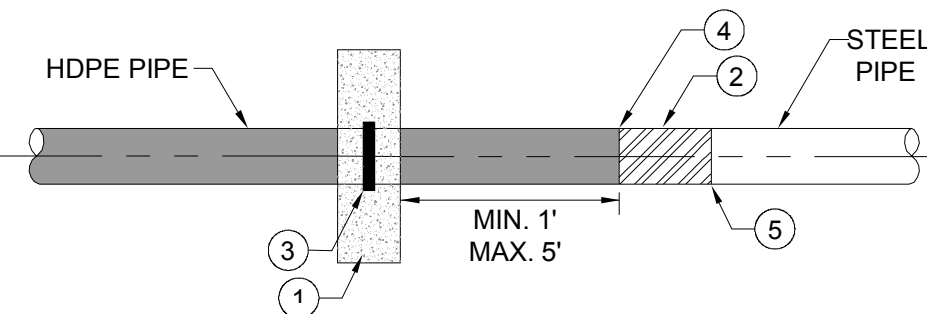
NO. DESCRIPTION

1. WALL BLOCKING, REFER TO DETAIL HD4 OR HD5
2. RESTRAINT COUPLER WITH STEEL PIPE STIFFENER
3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO DETAIL HD4
4. PCCP DEEP JOINT ADAPTER. INSTALL AT EXISTING JOINT. FIELD WELD PER MANUFACTURERS INSTRUCTIONS, IF PCCP IS RESTRAINED JOINT.

- NOTES:
- A. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - B. MECHANICAL FITTINGS SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
  - C. STAINLESS STEEL INTERNAL STIFFENERS SHALL BE INSTALLED IN THE END OF THE HDPE PIPE WHEN HDPE PIPE IS INSERTED INTO THE BELL END OF NON-HDPE PIPE, VALVE, FITTING, OR INTO THE HUB OF A BOLTED COUPLING.
  - D. INTERNAL STIFFENER CAN BE WEDGE TYPE OR SOLID BODY. STIFFENER WILL BE RATED FOR DR AND ID OF PIPE. FOR WATER, 304 OR 316 STAINLESS STEEL IS ALLOWED. FOR WASTEWATER 316 SS IS REQUIRED.
  - E. RESTRAINT COUPLER SLEEVE SHALL BE ASTM A513 WITH FUSION BONDED EPOXY. LOW ALLOY STEEL BOLTS CONFORM TO AWWA C111.4.

E

HDPE TO STEEL  
(4 TO 32-INCH ONLY)  
TRANSITION ASSEMBLY



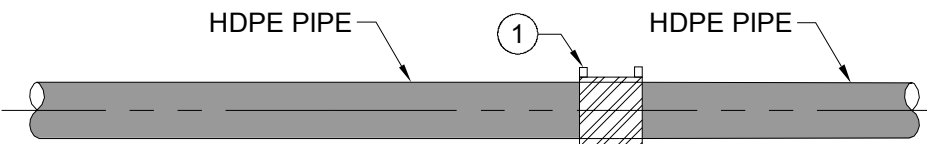
NO. DESCRIPTION

1. THRUST BLOCK, REFER TO DETAIL HD4 OR HD5
2. HDPE PLAIN END x STEEL PLAIN END WELD-ON TRANSITION FOR WATER
3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO DETAIL HD4
4. BUTT FUSION OR ELECTROFUSION JOINT
5. STEEL WELD

- NOTES:
- A. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - B. TRANSITION SHALL BE MANUFACTURED TO ASTM D2513 CATEGORY 1.
  - C. COAT INTERIOR AND EXTERIOR OF WELD PER MANUFACTURER'S INSTRUCTIONS.

F

HDPE TO HDPE ELECTROFUSION TRANSITION  
ASSEMBLY (4-INCH TO 24-INCH ONLY)



NO. DESCRIPTION

1. ELECTROFUSION COUPLING

- NOTES:
- A. ONLY ALLOWED WHEN BUTT FUSION IS NOT POSSIBLE.
  - B. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - C. PROVIDE ELECTROFUSION RECORD TO CHARLOTTE WATER INSPECTOR WITHIN ONE HOUR OF FUSION PER STANDARD SPECIFICATION.

NOTES TO DESIGNER

- A. CHARLOTTE WATER PREFERS JOINING HDPE USING BUTT FUSION. IF BUTT FUSION IS NOT POSSIBLE THEN ELECTROFUSION FITNGS ARE ALLOWED. IF ELECTROFUSION FITTINGS ARE NOT POSSIBLE, THEN MECHANICAL FITTINGS ARE ALLOWED. CHARLOTTE WATER DOES NOT ALLOW BURIED FLANGED JOINTS.

NO SCALE

STANDARD NO.

HD1

VERSION NO.

1.0

VERSION DATE

2016-05-12

TRANSITION FROM HDPE TO OTHER  
MATERIAL (4-INCH TO 32-INCH)

CHARLOTTE WATER

STANDARD DETAILS

HDPE

CHARLOTTE  
WATER

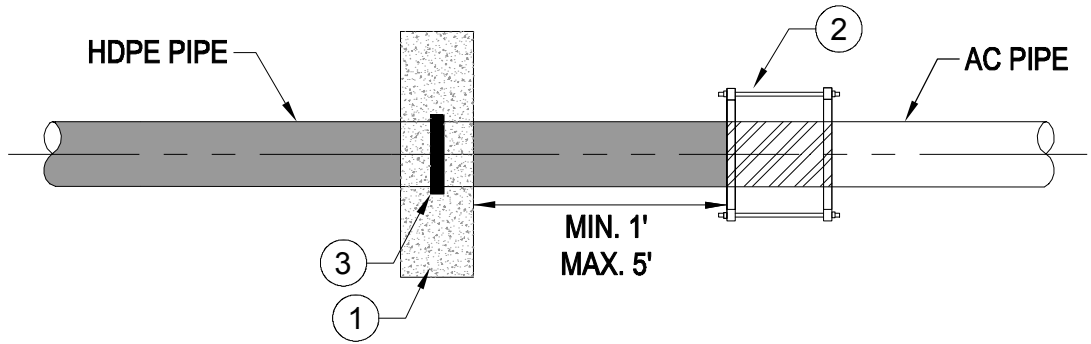
A CITY OF CHARLOTTE WATER DEPARTMENT



NOTES TO DESIGNER

- A. THIS DETAIL APPLIES ONLY TO 4-INCH THROUGH 12-INCH PIPE TRANSITIONS. LARGER DIAMETER TRANSITIONS REQUIRE SPECIFIC DESIGN AND APPROVAL.
- B. CHARLOTTE WATER PREFERS JOINING HDPE USING BUTT FUSION JOINING. IF BUTT FUSION IS NOT POSSIBLE THEN ELECTROFUSION FITNGS ARE ALLOWED. IF ELECTROFUSION FITTINGS ARE NOT POSSIBLE, THEN MECHANICAL FITTINGS ARE ALLOWED. CHARLOTTE WATER DOES NOT ALLOW BURIED FLANGED JOINTS.

HDPE TO ASBESTOS CEMENT PIPE  
(4 TO 12-INCH ONLY)  
TRANSITION ASSEMBLY



- NO. DESCRIPTION
1. WALL BLOCKING, REFER TO STANDARD DETAIL HD4
  2. RESTRAINED MECHANICAL COUPLING OR REDUCING MECHANICAL COUPLING. STEEL PIPE STIFFENER REQUIRED ON HDPE.
  3. WALL ANCHOR OR FLEX RESTRAINT, REFER TO STANDARD DETAIL HD4

TRANSITION NOTES:

- A. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
- B. HIGH DENSITY POLYETHYLENE (HDPE) FITTINGS SHALL BE MOLDED OR FABRICATED BY PIPE MANUFACTURER.
- C. MECHANICAL FITTINGS SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
- D. STAINLESS STEEL INTERNAL STIFFENERS SHALL BE INSTALLED IN THE END OF THE HDPE PIPE WHEN HDPE PIPE IS INSERTED INTO THE BELL END OF NON-HDPE PIPE, VALVE, FITTING, OR INTO THE HUB OF A BOLTED COUPLING. INTERNAL STIFFENER CAN BE WEDGE TYPE OR SOLID BODY. STIFFENER WILL BE RATED FOR DR AND ID OF PIPE. FOR WATER, 304 OR 316 STAINLESS STEEL IS ALLOWED. FOR WASTEWATER, 316 IS REQUIRED.
- E. MECHANICAL JOINT ADAPTERS SHALL BE PE4710 AND CAN BE MADE TO ASTM D3261. IF MACHINED, ADAPTERS MUST MEET THE REQUIREMENTS OF ASTM F2206. ADAPTERS SHALL HAVE A PRESSURE RATING EQUAL TO THE PIPE.
- F. WHEN BELL END IS ENCOUNTERED, FIELD CUT PIPE TO FORM A PLAIN END.

ASBESTOS NOTES:

- A. ASBESTOS CEMENT (AC) PIPE, ALSO KNOWN AS TRANSITE PIPE, IS KNOWN TO CONTAIN ASBESTOS CONTAINING MATERIAL (ACM). SPECIAL WASTE MANAGEMENT PROCEDURES AND HEALTH AND SAFETY REQUIREMENTS WILL BE APPLICABLE WHEN REMOVAL AND/OR DISTURBANCE OF THIS PIPE OCCURS.
- B. WRITTEN NOTIFICATION TO THE NORTH CAROLINA DEPARTMENT OF HEALTH AND HUMAN SERVICES OR THE DEPARTMENT OF ENVIRONMENTAL PROTECTION OF MECKLENBURG COUNTY 10 DAYS PRIOR COMMENCING WITH THE REMOVAL OF AC PIPE IS REQUIRED. AT EACH LOCATION SHOWN IN THE PLANS AND/OR IDENTIFIED BY THE CONTRACTOR TO INVOLVE AC PIPE, THE CONTRACTOR WILL BE REQUIRED TO REMOVE THE NECESSARY AMOUNT OF AC PIPE TO MAKE THE CONNECTION WITHOUT CREATING ANY FRIABLE MATERIAL. THE CONTRACTOR SHALL REMOVE WHOLE SECTIONS OF AC PIPE AND MAKE THE TIE-IN AT THE NEAREST JOINT. CONTRACTOR WILL UNCOVER NO MORE THAN 20-FEET OF AC PIPE AT ANY TIME. CUTTING OF AC PIPE SHALL BE MINIMIZED. THE CONTRACTOR SHALL REMOVE ANY CUT AC PIPE AND STORE IT IN A SECURE, ENGINEER APPROVED LOCATION FOR EVENTUAL DISPOSAL BY CONTRACTOR. PRIOR TO PERFORMING THIS WORK, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER OF THE UTILITY OF THE WORK SCHEDULE 72 HOURS IN ADVANCE OF BEGINNING THE WORK.
- C. WHEN WORKING WITH AC PIPES, CONTRACTOR WILL COMPLY WITH OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) REGULATIONS, INCLUDING BUT NOT LIMITED TO USE OF PERSONAL PROTECTIVE EQUIPMENT, SPECIALIZED TRAINING, ACCREDITATION, USE OF WET WORK PROCEDURES TO CUT AND REMOVE AC PIPE, AND HANDLING AND DISPOSAL OF AC PIPE AND MATERIAL INCLUDING CONTAMINATED SOIL.
- D. AC PIPE WILL BE ABANDONED BY REMOVAL OR ABANDON IN PLACE BY GROUTING. ALL AC PIPE AND MATERIALS REMOVED WILL BECOME THE PROPERTY OF THE CONTRACTOR. THE CONTRACTOR WILL PROVIDE THE OWNER WITH DISPOSAL RECEIPTS SHOWING PROPER DISPOSAL AT AN AUTHORIZED FACILITY.

NO SCALE

STANDARD NO.

HD2

VERSION NO.

1.0

VERSION DATE

2016-05-12

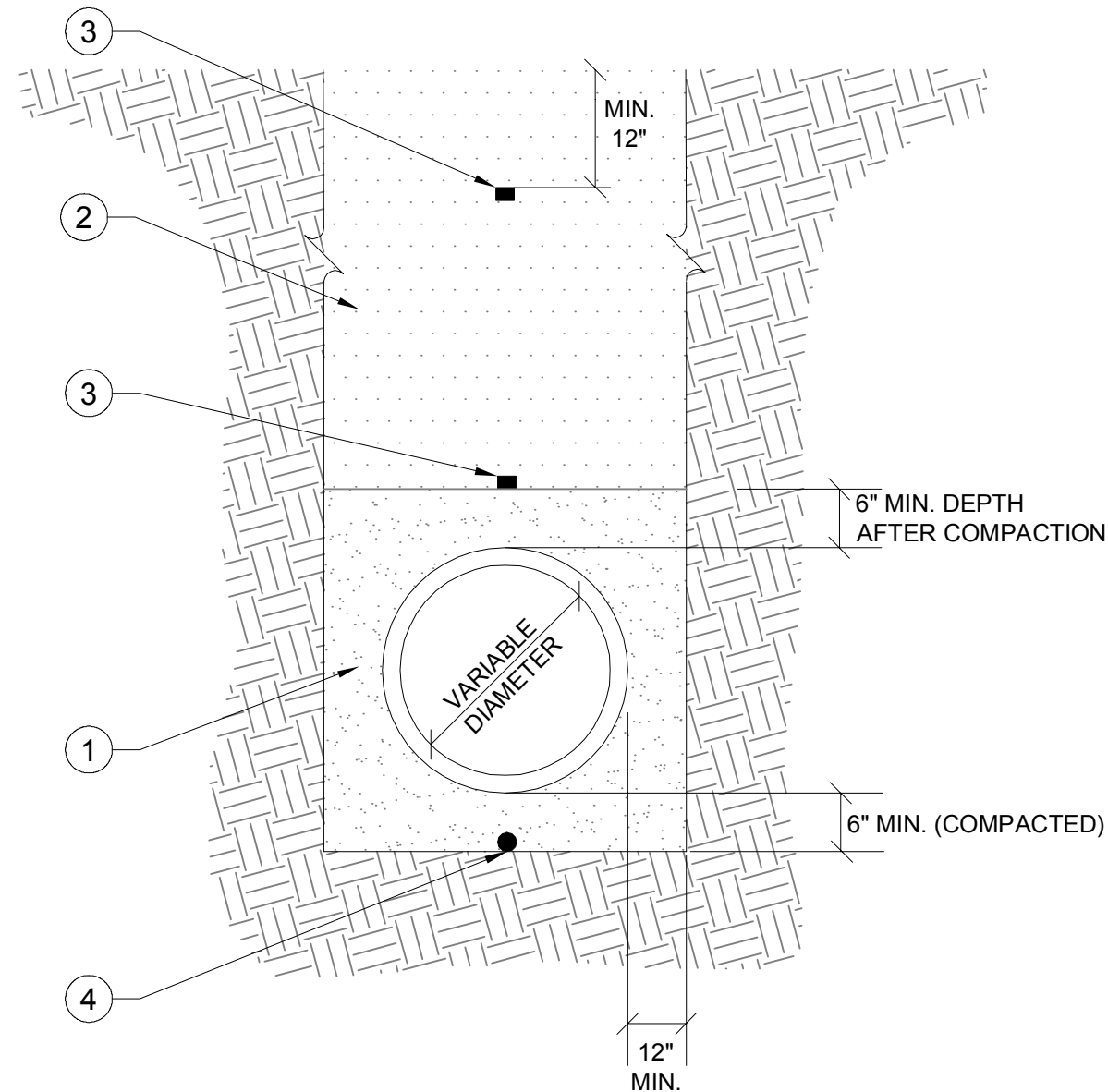
TRANSITION FROM HDPE  
TO AC PIPE (4-INCH TO 12-INCH)

CHARLOTTE WATER

STANDARD DETAILS

HDPE

CHARLOTTE  
WATER



NO. DESCRIPTION

- 1. HDPE EMBEDMENT MATERIAL – FINE AGGREGATE ACCORDING TO ASTM C33 TABLE 1
- 2. BACKFILL - COMPACT BACKFILL PER ASTM D 698 AND AASHTO T-99 AS MODIFIED BY NCDOT TO 95% MAXIMUM DENSITY WITHIN A ROAD RIGHT-OF-WAY. FINAL 6-INCHES OF SUBGRADE SHALL BE COMPACTED TO 100%. 85% MAXIMUM DRY DENSITY REQUIRED OUTSIDE ROAD RIGHT-OF-WAY.
- 3. WARNING TAPE - 6-INCH WIDE WARNING TAPE INSTALLED 1 FOOT MIN. BELOW GROUND SURFACE AS WELL AS DIRECTLY ABOVE HDPE EMBEDMENT MATERIAL.
- 4. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION AT THE BOTTOM OF THE EMBEDMENT LAYER. DO NOT ATTACH TRACER WIRE TO PIPE.

NOTES:

- A. WHERE PIPE IS INSTALLED DEEPER THAN 8 FEET, INSTALL ADDITIONAL TRACER WIRE AT A DEPTH BETWEEN 4 AND 5-Feet. INSTALL TRACER WIRE IN A PVC CONDUIT.
- B. EMBEDMENT SHOULD BE PLACED IN LIFTS, NOT EXCEEDING 6 INCHES IN THICKNESS, AND THEN TAMPED. TAMPING SHOULD BE ACCOMPLISHED WITH A MECHANICAL TAMPER.
- C. A MAXIMUM OF 100 FEET OF OPEN TRENCH WILL BE ALLOWED AT ANY TIME, UNLESS APPROVED BY ENGINEER.
- D. PERFORM CONDUCTIVITY TEST ON THE TRACER WIRE AT FINAL INSPECTION.

REQUIRED TRENCH WIDTH		
PIPE SIZE (INCHES)	MINIMUM TRENCH WIDTH (INCHES)	MAXIMUM TRENCH WIDTH (INCHES)
<18	PIPE OD + 12	PIPE OD + 30
18 to 23	PIPE OD + 12	PIPE OD + 36
24 to 32	PIPE OD + 24	PIPE OD + 36

MAXIMUM TRENCH WIDTH NOTES:

- A. LARGER TRENCH WIDTH ALLOWED TO ACCOMMODATE BUTT FUSION EQUIPMENT AT FUSION LOCATIONS.

NO SCALE

STANDARD NO.

HD3

VERSION NO.

1.0

VERSION DATE

2016-05-12

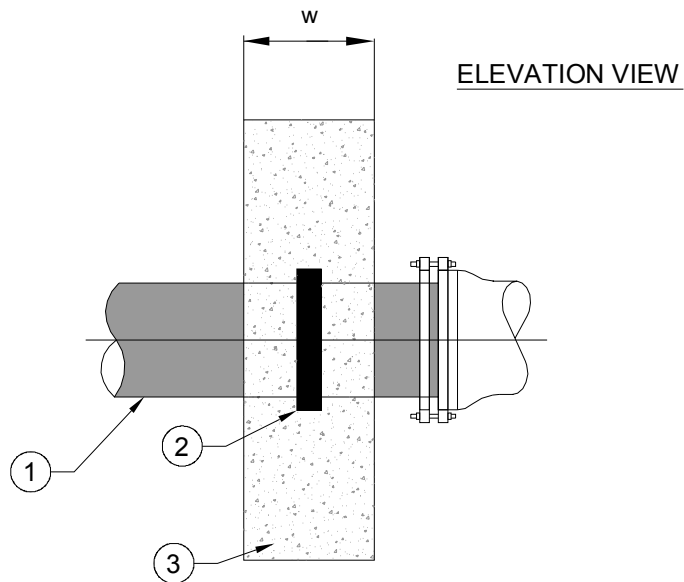
EMBEDMENT AND BACKFILL  
FOR HDPE PIPE

CHARLOTTE WATER

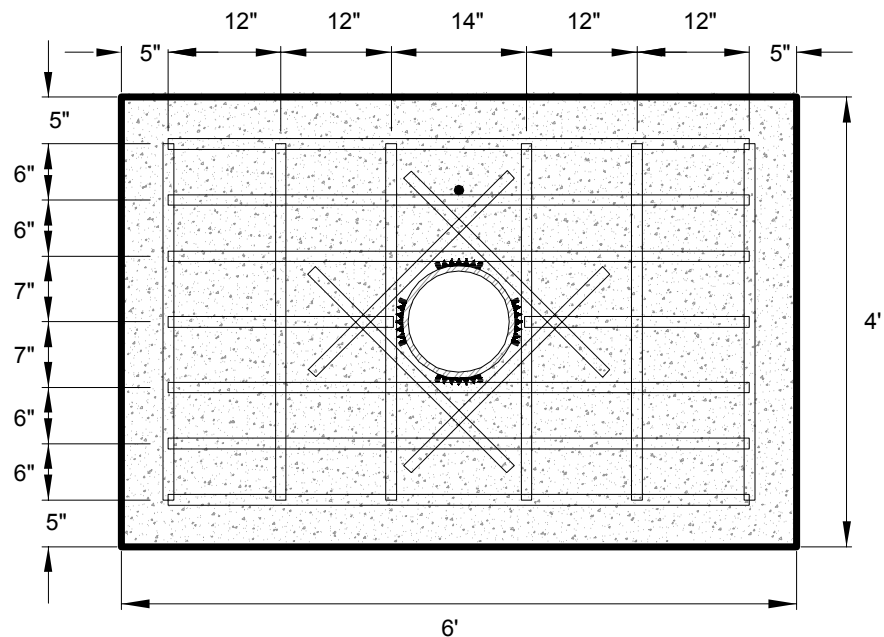
STANDARD DETAILS

HDPE

CHARLOTTE  
WATER



REBAR DETAIL: FRONT VIEW



MINIMUM NUMBER OF FLEX RESTRAINTS BY PIPE SIZE	
HDPE NOMINAL PIPE SIZE (INCHES)	NUMBER OF FLEX RESTRAINTS
4 THROUGH 8	2
10 THROUGH 12	3

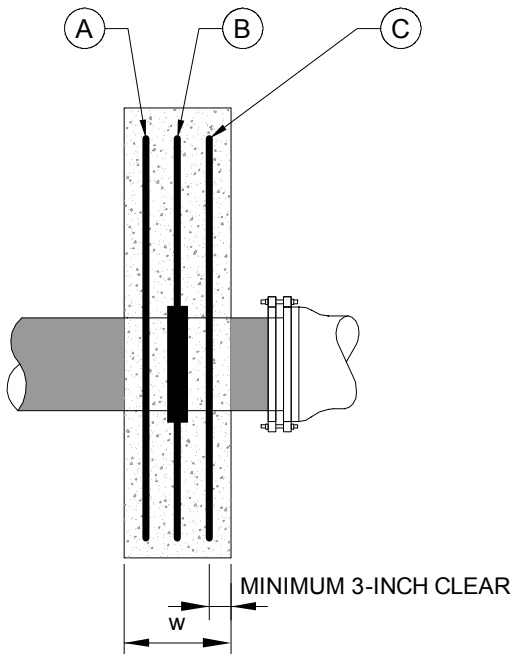
NO. DESCRIPTION

1. HDPE PIPE
2. ELECTROFUSED HDPE FLEX RESTRAINT OR WALL ANCHOR
3. CONCRETE WALL BLOCKING - F'C = MINIMUM 3,600 PSI.
4. FLEX RESTRAINTS FOR HDPE PIPE. SEE TABLE FOR REQUIRED NUMBER OF FLEX RESTRAINTS BY PIPE SIZE. COMPLY WITH MANUFACTURERS INSTRUCTIONS FOR NUMBER OF FLEX RESTRAINTS IF GREATER THAN SHOWN IN TABLE.
5. AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH BLUE 30 MIL HDPE INSULATION.

NOTES:

- A. WHEN DIRECTED BY THE ENGINEER,THE CONCRETE WALL BLOCK SIZE MAY BE ADJUSTED, BASED ON ACTUAL SOIL CLASSIFICATION AND PIPE DIAMETER.
- B. FLEX RESTRAINTS MUST BE RATED AT 8,000 LBS OF FORCE OR HIGHER.

REBAR DETAIL: SIDE VIEW



REBAR NOTES:

- A. FOR 4 TO 10-INCH PIPE, PLACE ONE REBAR MAT AT LOCATION B ON THE REBAR DETAIL: SIDE VIEW.
- B. FOR 12-INCH PIPE, PLACE TWO REBAR MATS - ONE AT LOCATION A AND ONE AT LOCATION C ON THE REBAR DETAIL: SIDE VIEW.

NOTES TO DESIGNER

- A. ENGINEER TO CONFIRM ADEQUATE SOIL PRESSURE BEARING CAPACITY FOR THRUST BLOCK

REBAR SCHEDULE			
TYPE	LENGTH (INCHES)	NUMBER REQUIRED FOR ONE MAT	NUMBER REQUIRED FOR TWO MATS
VERTICAL	38	6	12
HORIZONTAL	62	6	12
DIAGONAL	30	4	8
HORIZONTAL	24	2	4

REBAR DIAMETER SCHEDULE				
HDPE NOMINAL PIPE DIAMETER (INCHES)	BAR SIZE	TOTAL REBAR LENGTH (FT)	TOTAL REBAR WEIGHT (LB) ONE MAT	TOTAL REBAR WEIGHT (LB) TWO MATS
4	#5	64	67	134
6	#5	64	67	134
8	#5	64	67	134
10	#5	64	67	134
12	#5	64	67	134

APPROX. DEAD END THRUST AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA (SQUARE FEET)	APPROX. SOIL PRESSURE	W MINIMUM WIDTH (INCHES)	APPROXIMATE CONCRETE VOLUME	
HDPE NOMINAL PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)		BEARING LOAD (LB/SQ FT)		(CUBIC FEET)	(CUBIC YARD)
4	2,130	15	142	10	20	0.74
6	4,616	15	308	10	20	0.74
8	7,823	15	522	12	24	0.89
10	12,153	15	810	12	24	0.89
12	17,094	15	1,140	14	28	1.04

NO SCALE

STANDARD NO.

HD4

VERSION NO. 1.0

VERSION DATE 2016-05-12

CONCRETE WALL BLOCKING  
FOR HDPE PIPE (4-INCH TO 12-INCH)

CHARLOTTE WATER

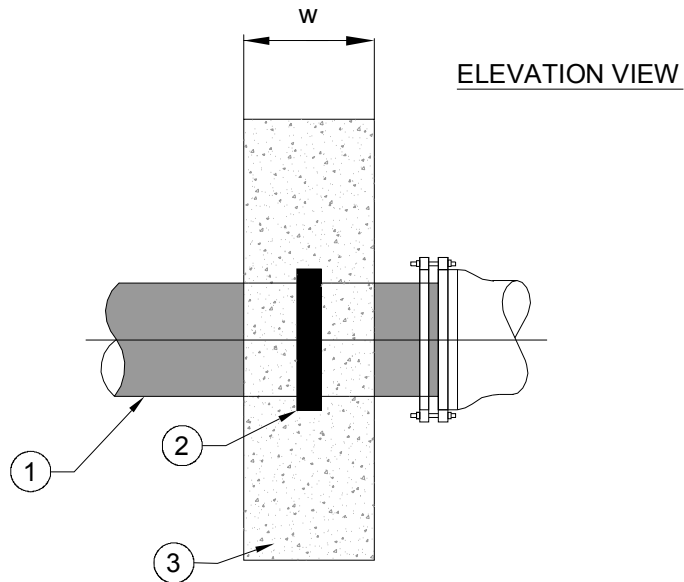
STANDARD DETAILS

HDPE

CHARLOTTE  
WATER

A CITY OF ALABAMA WATER TREATMENT



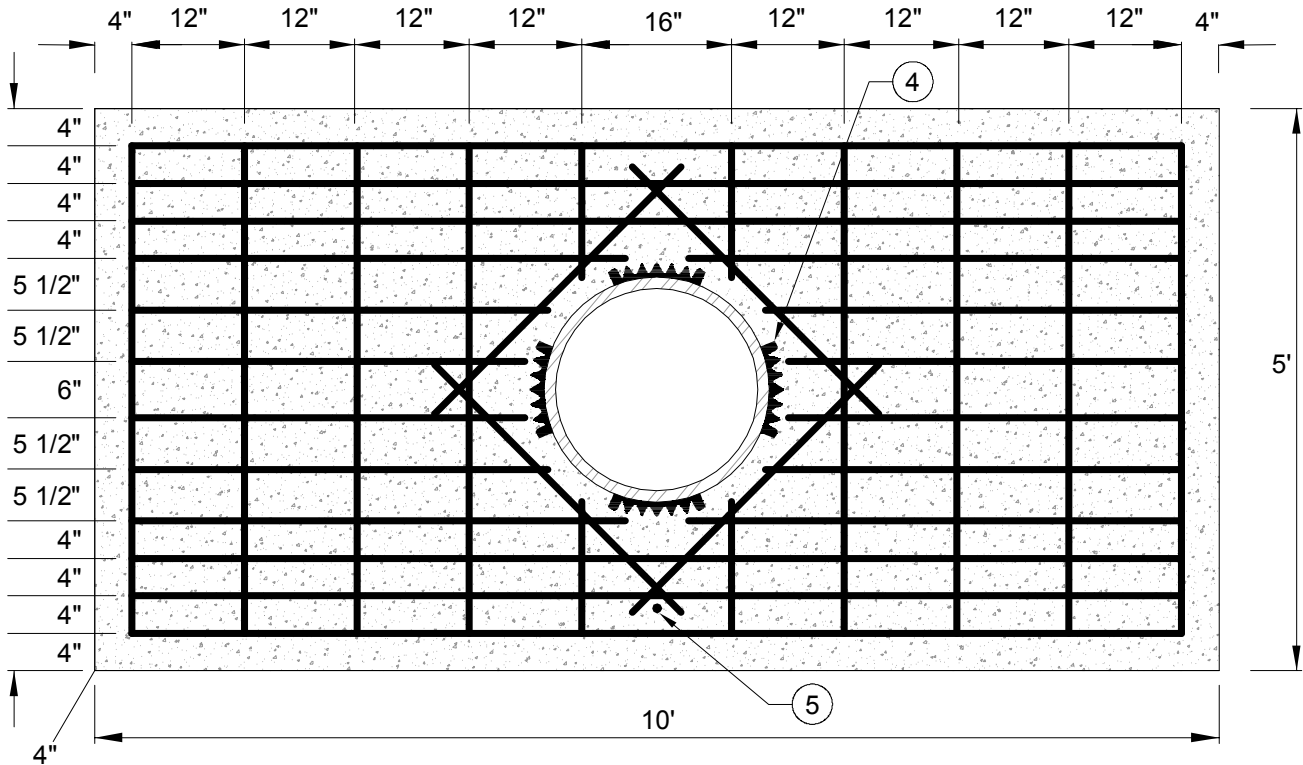


MINIMUM NUMBER OF FLEX RESTRAINTS BY PIPE SIZE	
HDPE NOMINAL PIPE SIZE (INCHES)	NUMBER OF FLEX RESTRAINTS
14	4
16	6
18	7
24	10
32	17

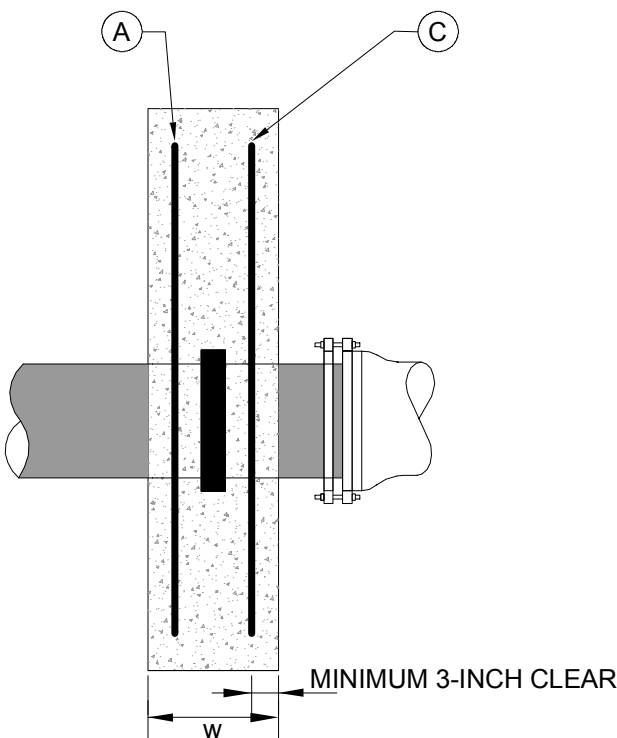
- NO. DESCRIPTION**
1. HDPE PIPE
  2. ELECTROFUSED HDPE FLEX RESTRAINT OR WALL ANCHOR
  3. CONCRETE WALL BLOCKING - F'C = MINIMUM 3,600 PSI.
  4. FLEX RESTRAINTS FOR HDPE PIPE. SEE TABLE FOR REQUIRED NUMBER OF FLEX RESTRAINTS BY PIPE SIZE. COMPLY WITH MANUFACTURERS INSTRUCTIONS FOR NUMBER OF FLEX RESTRAINTS IF GREATER THAN SHOWN IN TABLE.
  5. AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH BLUE 30 MIL HDPE INSULATION.

- NOTES:**
- A. WHEN DIRECTED BY THE ENGINEER,THE CONCRETE WALL BLOCK SIZE MAY BE ADJUSTED, BASED ON ACTUAL SOIL CLASSIFICATION AND PIPE DIAMETER.
  - B. FLEX RESTRAINTS MUST BE RATED AT 8,000 LBS OF FORCE OR HIGHER.

REBAR DETAIL: FRONT VIEW



REBAR DETAIL: SIDE VIEW



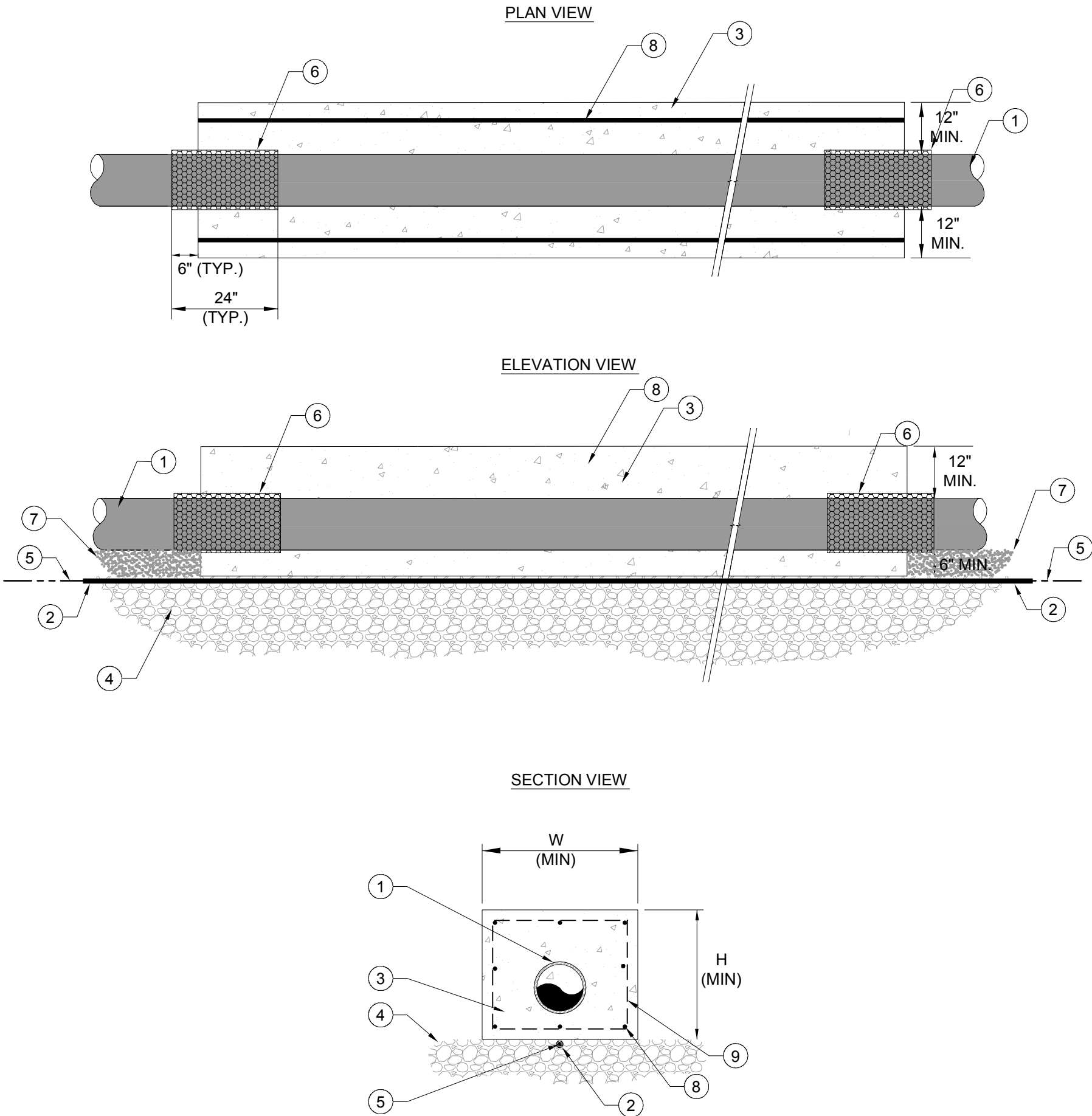
- REBAR NOTES:**
- A. FOR 14 TO 32-INCH PIPE, PLACE REBAR MATS BOTH AT LOCATION A AND LOCATION C ON THE REBAR DETAIL: SIDE VIEW.

- NOTES TO DESIGNER**
- A. ENGINEER TO CONFIRM ADEQUATE SOIL PRESSURE BEARING CAPACITY FOR THRUST BLOCK

REBAR SCHEDULE			
TYPE	LENGTH (INCHES)	NUMBER REQUIRED FOR ONE MAT	NUMBER REQUIRED FOR TWO MATS
VERTICAL	52	8	16
VERTICAL	10	4	8
HORIZONTAL	112	6	12
HORIZONTAL	48	4	8
DIAGONAL	48	4	8

REBAR DIAMETER SCHEDULE				
HDPE NOMINAL PIPE DIAMETER (INCHES)	BAR SIZE	TOTAL LENGTH OF REBAR (FT)	TOTAL REBAR WEIGHT (LB) ONE MAT	TOTAL REBAR WEIGHT (LB) TWO MATS
14	#5	126	131	262
16	#5	126	131	262
18	#5	126	131	262
20	#5	126	131	262
24	#5	126	131	262
30	#7	126	257	514
32	#7	126	257	514

APPROX. DEAD END THRUST AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA (SQUARE FEET)	APPROX. SOIL PRESSURE	W MINIMUM WIDTH (INCHES)	APPROXIMATE CONCRETE VOLUME	
HDPE NOMINAL PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)		BEARING LOAD (LB/SQ FT)		(CUBIC FEET)	(CUBIC YARD)
14	20,608	30	687	14	58	2.16
16	26,915	30	897	16	67	2.47
18	34,073	30	1,136	16	67	2.47
20	42,063	30	1,402	18	75	2.78
24	60,566	30	2,019	18	75	2.78
30	94,641	30	3,155	22	92	3.40
32	107,678	30	3,589	22	92	3.40

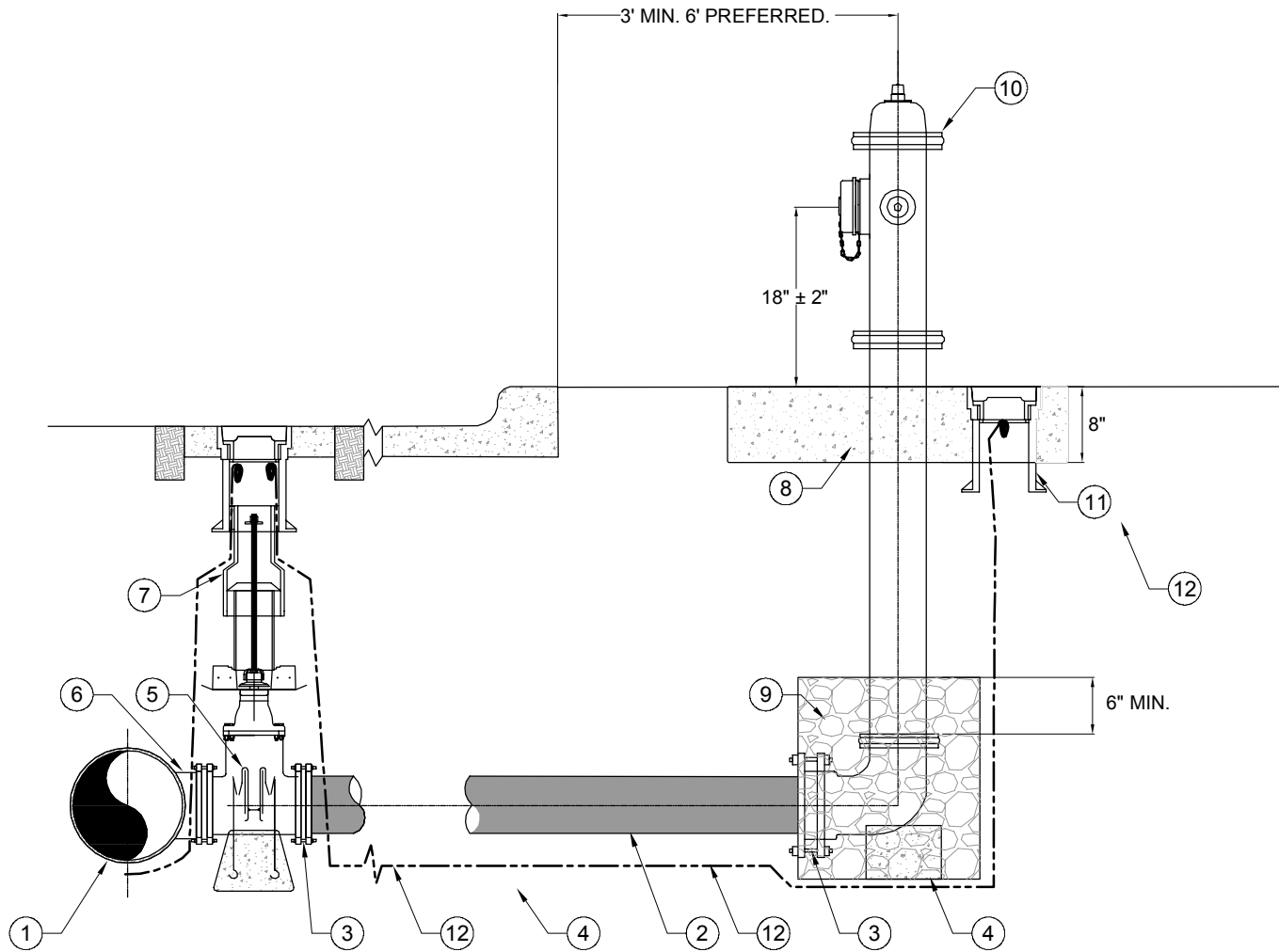


- NO. DESCRIPTION
- 1. HDPE PIPE
  - 2. CONDUIT - 1 INCH PVC CONDUIT TO CONTAIN TRACER WIRE
  - 3. CONCRETE ENCASEMENT (F'C=3600 PSI MIN).
  - 4. STONE STABILIZATION MATERIAL AS REQUIRED
  - 5. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK, BLUE HDPE INSULATION AT THE BOTTOM OF THE UTILITY SAND EMBEDMENT LAYER.
  - 6. NEOPRENE FOAM PROTECTIVE WRAPPING, 1/4 - 3/4 INCH THICKNESS.
  - 7. HDPE EMBEDMENT MATERIAL - FINE AGGREGATE ACCORDING TO ASTM C33 TABLE 1.
  - 8. #5 REBAR LONG (TYP)
  - 9. #4 REBAR TIES - MINIMUM 1.5-INCH CLEARANCE TO PIPE, MINIMUM 3-INCH COVER

- NOTES:
- A. CONCRETE ENCASEMENT SHALL ONLY BE INSTALLED WHERE SHOWN ON APPROVED PLANS OR WITH PRIOR APPROVAL BY CLT WATER ENGINEER.
  - B. THIS RESTRICTION IS IN PLACE DUE TO THE INABILITY TO EASILY MAINTAIN/REPAIR OR TAP A MAIN ENCASED IN CONCRETE.
  - C. ENGINEER TO CONFIRM TEMPERATURE FROM CONCRETE CURING AT SITE WILL BE LESS THAN THE HDPE VICAT SOFTENING TEMPERATURE OF 260°F.

Pipe Diameter (inches)	min W (in)	min H (in)	Concrete Volume per LF	
			FT^3 / LF	CY / LF
4	31	25	5.29	0.20
6	33	27	5.99	0.22
8	36	30	7.15	0.26
10	38	32	7.90	0.29
12	40	34	8.66	0.32
14	42	36	9.43	0.35
16	44	38	10.21	0.38
18	46	40	11.01	0.41
20	48	42	11.82	0.44
22	50	44	12.64	0.47
24	52	46	13.47	0.50
26	54	48	14.31	0.53
28	56	50	15.17	0.56
30	58	52	16.04	0.59
32	60	54	16.91	0.63

- NOTES TO DESIGNER
- A. CONCRETE AND REINFORCEMENT IS MINIMUM REQUIRED. SEALING ENGINEER SHALL DESIGN REINFORCEMENT APPROPRIATE TO SPECIFIC CONDITIONS AND LOADS.

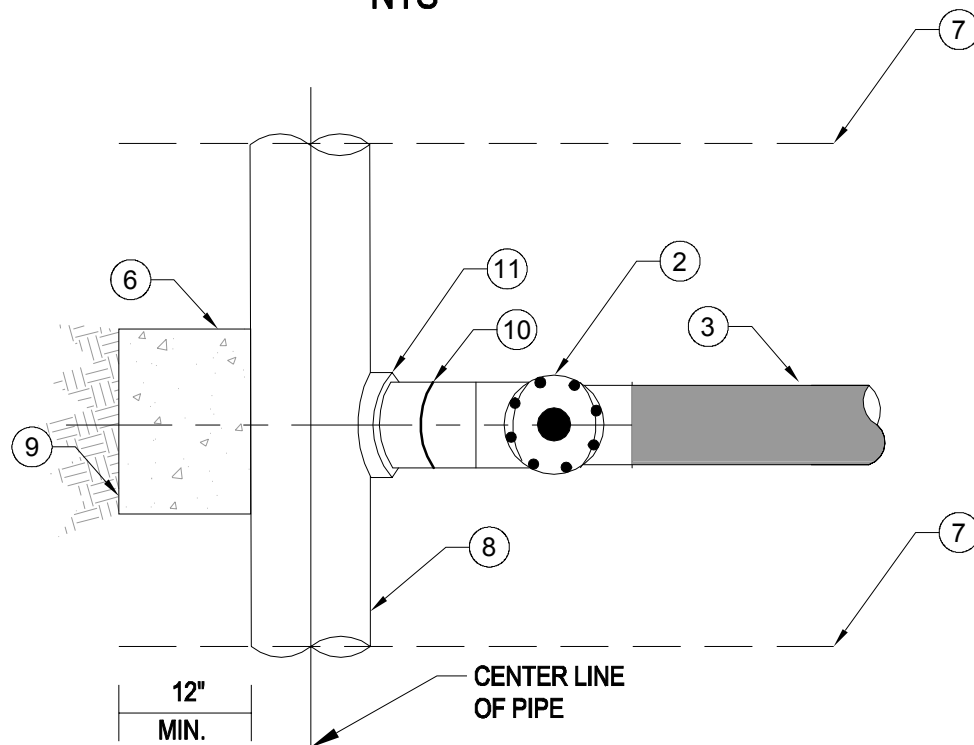


- NO. DESCRIPTION
- 1. HDPE WATER MAIN
  - 2. HDPE PIPE
  - 3. ELECTROFUSION COUPLING OR RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
  - 4. CONCRETE BLOCK - 8-INCH BY 16-INCH SOLID CONCRETE BLOCK
  - 5. RESILIENT SEAT GATE VALVE
  - 6. FOR CONNECTION TO NEW CONSTRUCTION SEE STANDARD DETAIL HD8. FOR CONNECTION TO EXISTING MAIN SEE STANDARD DETAIL HD7.
  - 7. VALVE BOX ASSEMBLY - SEE CLT WATER STANDARD DETAIL.
  - 8. CONCRETE HYDRANT COLLAR. CAST IN PLACE. 3-FEET DIAMETER BY 8-INCH THICK.
  - 9. MINIMUM 9 CUBIC FEET OF #57 OR #67 WASHED STONE PROPORTIONALLY AROUND BASE. DO NOT COVER WEEP HOLE.
  - 10. HYDRANT PER CLT WATER SPECIFICATIONS
  - 11. SEE CLT WATER TRACER WIRE STANDARD DETAILS FOR TERMINATION METHOD.
  - 12. AWG. NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH BLUE 30 MIL HDPE INSULATION

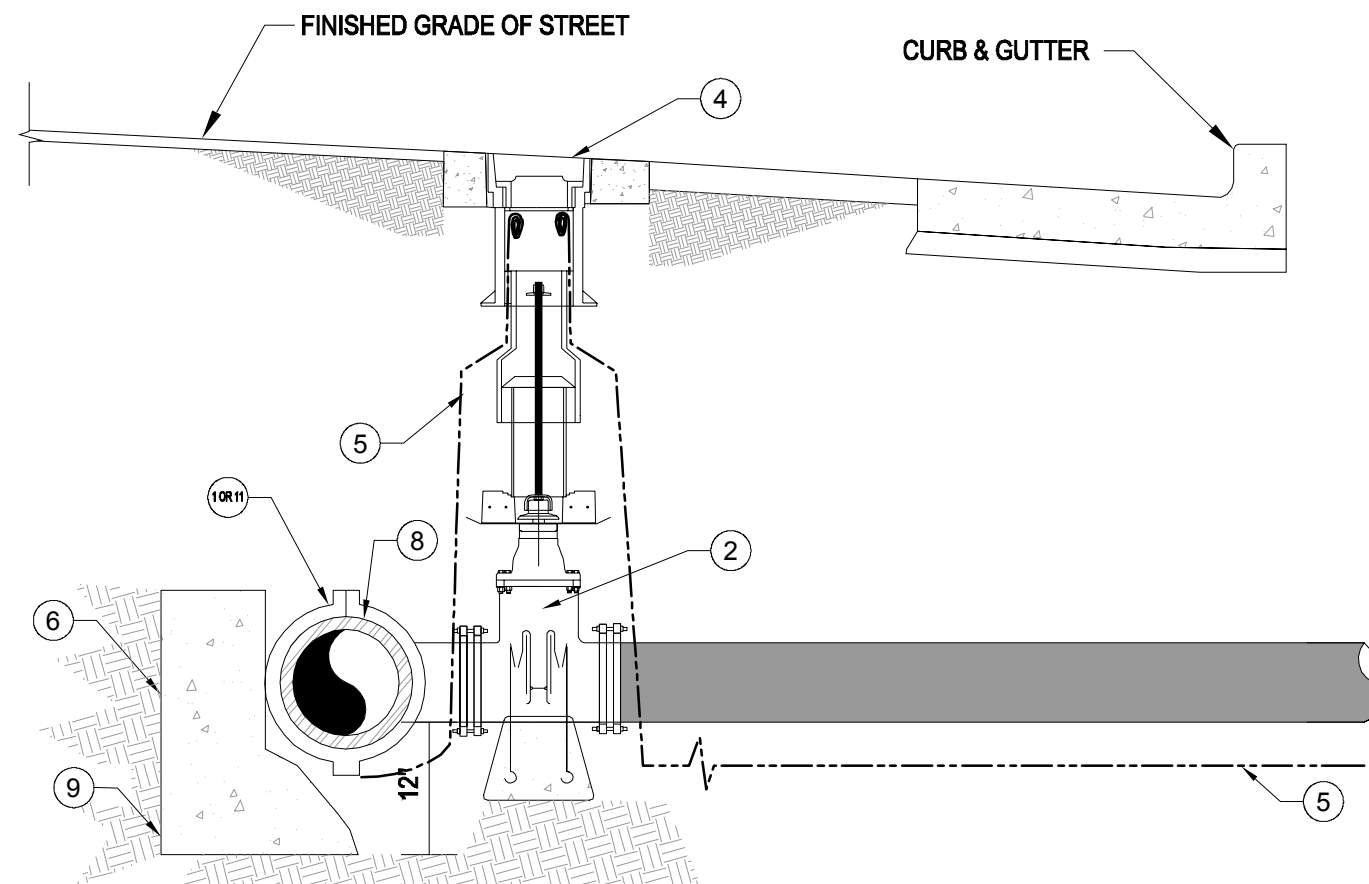
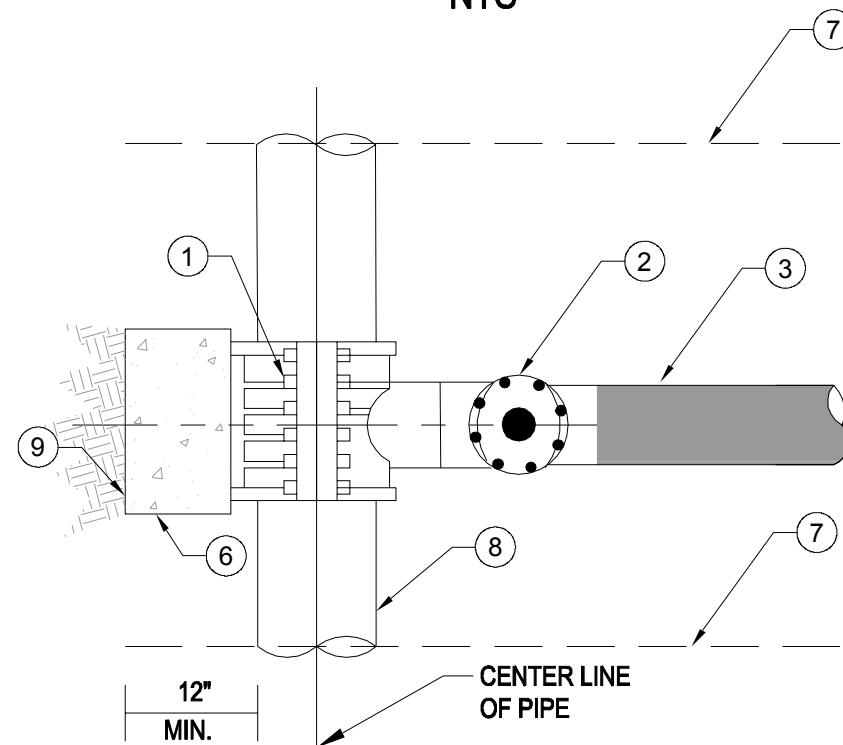
- NOTES:
- A. HYDRANT LOCATION: ON ROADS WITH CURB AND GUTTER, USE EXISTING CLT WATER STANDARD DETAIL FOR FIRE HYDRANTS IN ALL CASES UNLESS OTHERWISE NOTED BY ENGINEER.
  - B. BURIAL TO BE MINIMUM 3-FOOT 6-INCHES UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
  - C. EXTENSIONS REQUIRED AS DETERMINED BY THE ENGINEER, HOWEVER NO MORE THAN ONE HYDRANT EXTENSION IS ALLOWED. IF EXTENSION IS USED, NO NOT CAST HYDRANT COLLAR ON EXTENSION JOINT.
  - D. ON ROADS WITHOUT SIDE DITCH OR CURB, HYDRANT SHALL BE LOCATED 1 FOOT INSIDE THE ROAD RIGHT OF WAY
  - E. ON ROADS WITH SIDE DITCH, FIRE HYDRANT SHALL BE LOCATED A MINIMUM OF 4-FEET BACK OF SIDE DITCH.

NO SCALE			HYDRANT CONNECTION FOR HDPE PIPE	
CHARLOTTE WATER	CHARLOTTE WATER		STANDARD NO.	
	STANDARD DETAILS		HD7	
	HDPE - WATER		VERSION NO.	VERSION DATE
			1.0	2016-05-12

4"-12" MAIN  
NTS



14"-32" MAIN  
NTS



NO. DESCRIPTION

1. ELECTROFUSION TAPPING SADDLE OR STAINLESS STEEL TAPPING SLEEVE WITH OUTLET SEAL GASKET.
2. FLxMJ TAPPING VALVE. REFER TO STANDARD DETAIL HD10 AND HD11.
3. HDPE PIPE
4. STANDARD VALVE BOX ASSEMBLY
5. AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH BLUE 30 MIL HDPE INSULATION.
6. CONCRETE THRUST BLOCK (SEE TABLE FOR SIZING)
7. TRENCH LIMITS
8. EXISTING HDPE WATER MAIN
9. UNDISTURBED NATIVE SOIL
10. HDPE PIPE BUTT FUSION JOINT
11. BUTT FUSED BRANCH SADDLE

NOTES:

- A. BRANCH LARGER THAN THE EXISTING MAIN IS NOT ALLOWED.
- B. FOR EXISTING HDPE MAIN, USE ELECTROFUSION TAPPING SADDLE OR BUTT FUSED BRANCH SADDLE.

THRUST BLOCK TABLE	
TYPE OF FITTING	TEE OR DEAD END
TAP SIZE (INCHES)	TOTAL REQUIRED BEARING AREA (FT <sup>2</sup> )
4	1.3
6	2.9
8	5.1
10	7.9
12	11.4
14	15.7
16	20.1
18	25.8
20	31.4
24	45.3
30	70.7
32	80.4

THRUST BLOCK NOTES:

- A. THRUST BLOCKS TO BE 3,600 PSI CONCRETE.
- B. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
- C. JOINTS TO BE KEPT FREE OF CONCRETE. ALLOW WORKING ROOM AROUND NUTS AND BOLTS. WRAP FITTING WITH 2 LAYERS HDPE FILM (HDCLPE PER AWWA C-105). EACH LAYER MINIMUM 4 MILS THICK.
- D. AREAS GIVEN ARE FOR DR 9 PIPE AT TEST PRESSURE OF 200 PSI IN SOIL WITH 2,000 PSI BEARING CAPACITY. CHANGES SUBJECT TO FIELD CONDITIONS AND APPROVAL OF THE ENGINEER.
- E. TAPPING SLEEVES SHALL HAVE THRUST BLOCKS SIZED BASED ON TAP SIZE.

NO SCALE

STANDARD NO.

HD8

VERSION NO.  
1.0

VERSION DATE  
2016-05-12

TAPPING SLEEVE AND VALVE  
FOR HDPE PIPE (4-INCH TO 32-INCH)

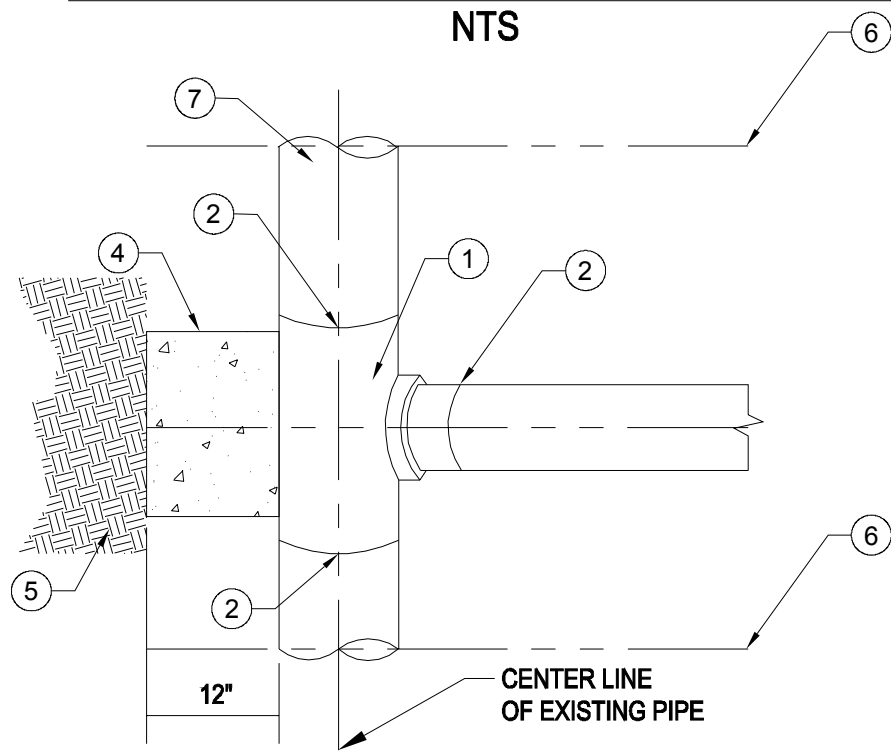
CHARLOTTE WATER

STANDARD DETAILS  
HDPE - WATER

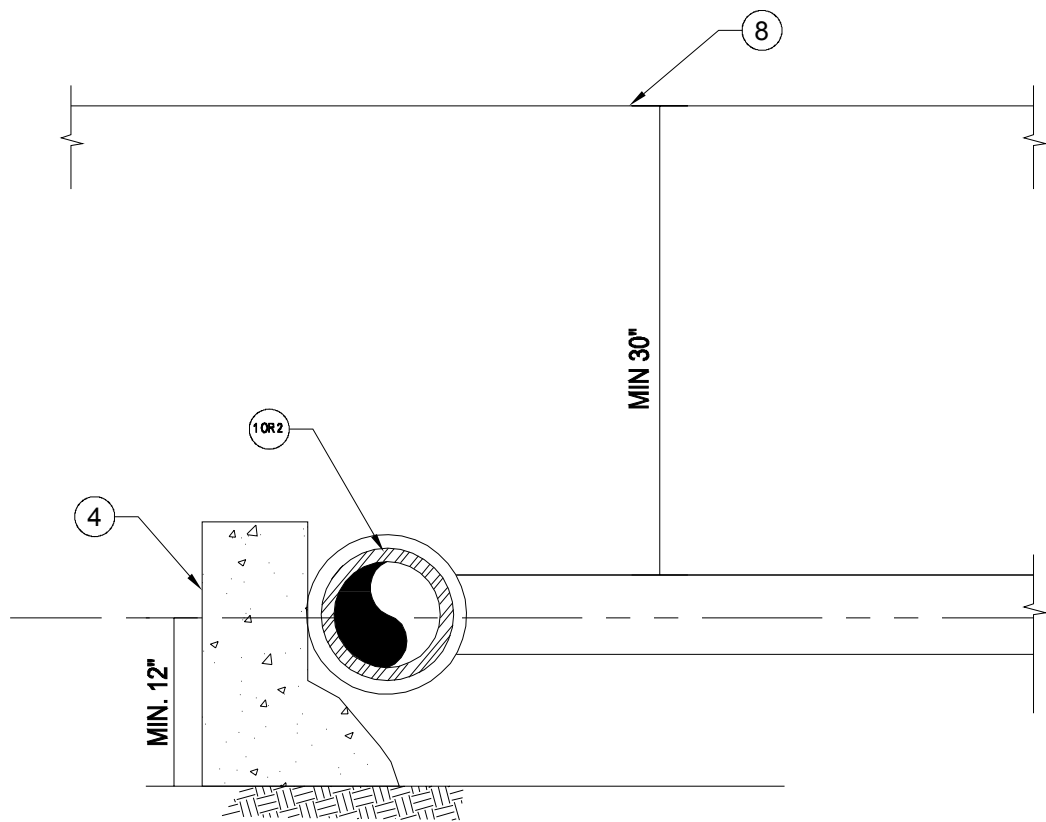
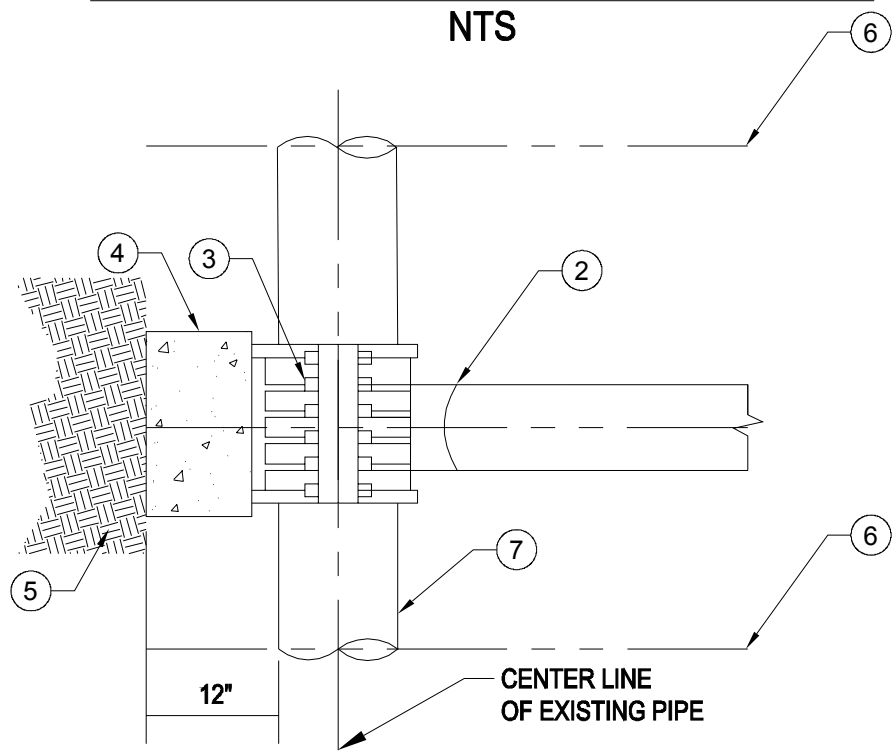
CHARLOTTE  
WATER

A CITY OF ALABAMA WATER TREATMENT

OPTION 1: BUTT FUSION MOLDED TEE PLAN VIEW



OPTION 2: MECHANICAL JOINT TEE PLAN VIEW



NOTES TO DESIGNER

- A. ENGINEER WILL SPECIFY EITHER ROUND BASE BRANCH SADDLE OR MECHANICAL JOINT SADDLE

NO. DESCRIPTION

1. BUTT FUSED BRANCH SADDLE FITTING
2. HDPE PIPE BUTT FUSION JOINT
3. FULL BODY STAINLESS STEEL MJ BRANCH SLEEVE WITH OUTLET SEAL GASKET
4. CONCRETE THRUST BLOCK (SEE TABLE FOR SIZING)
5. UNDISTURBED NATIVE SOIL
6. TRENCH LIMITS
7. EXISTING HDPE WATER MAIN
8. PROPOSED GROUND SURFACE

NOTES:

- A. BRANCH LARGER THAN MAIN IS NOT ALLOWED.
- B. IF COMPLETE SHUT OFF IS POSSIBLE ON EXISTING HDPE MAIN, USE BUTT FUSION MOLDED TEE. IF SHUT OFF IS NOT POSSIBLE, CONFIRM WITH CHARLOTTE WATER INSPECTOR THAT MECHANICAL JOINT TEE OPTION IS ALLOWED.

THRUST BLOCK TABLE	
TYPE OF FITTING	TEE OR DEAD END
TYPICAL PLAN VIEW	
MAIN SIZE (INCHES)	TOTAL REQUIRED BEARING AREA (FT²)
4	2
6	2.5
8	4.5
10	7
12	10
14	14
16	18
18	22
20	27

THRUST BLOCK NOTES:

- A. THRUST BLOCKS TO BE 3,600 PSI CONCRETE.
- B. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
- C. JOINTS TO BE KEPT FREE OF CONCRETE. ALLOW WORKING ROOM AROUND NUTS AND BOLTS. WRAP FITTING WITH 2 LAYERS HDPE FILE (HDCLPE PER AWWA C-105). EACH LAYER MINIMUM 4 MILS THICK.
- D. AREAS GIVEN ARE FOR DR 11 PIPE AT TEST PRESSURE OF 200 PSI IN SOIL WITH 2,000 PSI BEARING CAPACITY. CHANGES SUBJECT TO FIELD CONDITIONS AND APPROVAL OF THE ENGINEER.
- E. TAPPING SLEEVES SHALL HAVE THRUST BLOCKS SIZED THE SAME AS TEES.

NO SCALE

STANDARD NO.

HD9

VERSION NO. 1.0

VERSION DATE 2016-05-12

CUT-IN TEE FOR EXISTING HDPE PIPE  
(4-INCH TO 32-INCH)

CHARLOTTE WATER

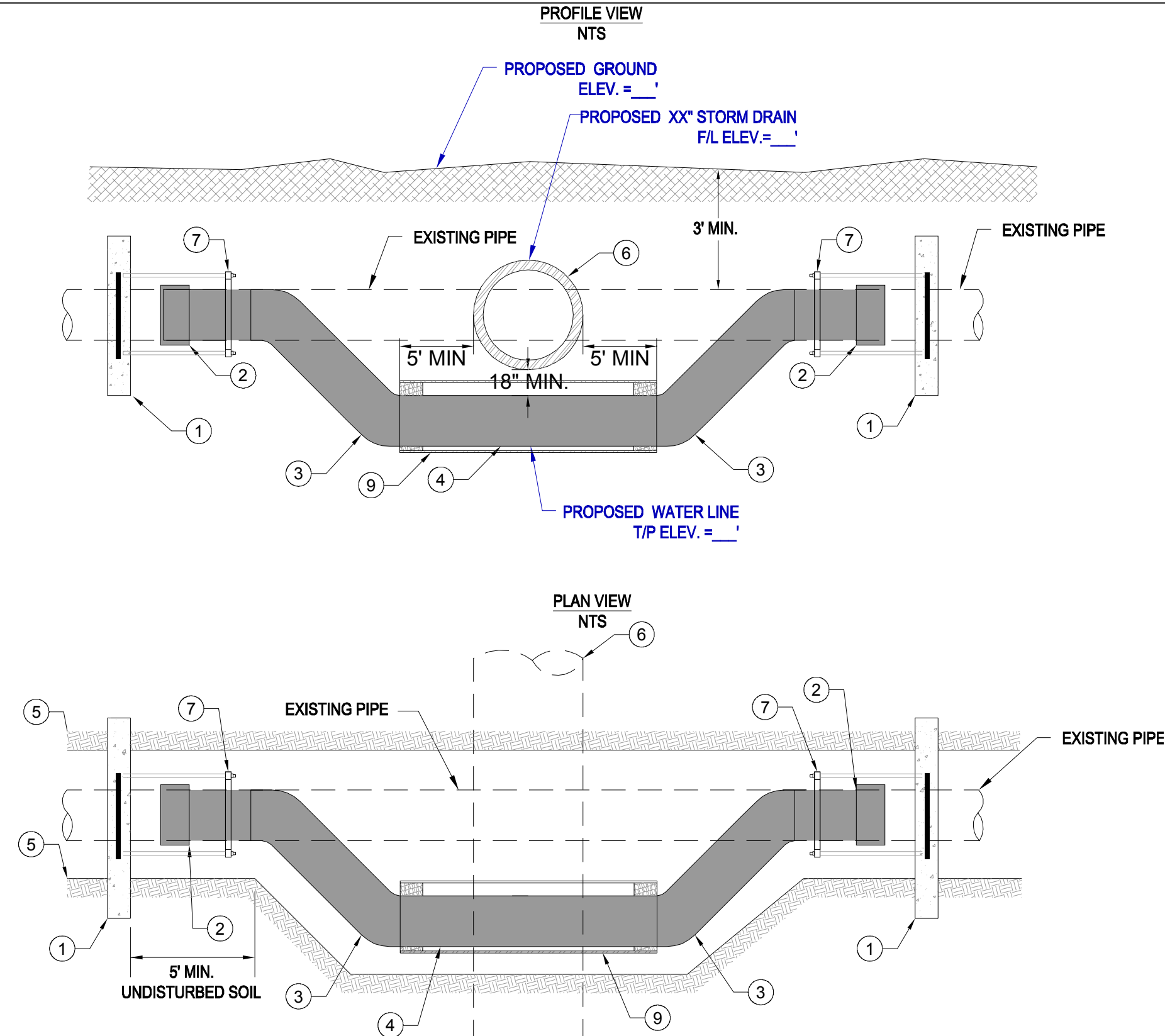
STANDARD DETAILS

HDPE

CHARLOTTE  
WATER

A CITY OF ALABAMA WATER TREATMENT





NOTES TO DESIGNER

- A. ENGINEER SHALL CONFIRM WATER LINE SEPARATION IS IN ACCORDANCE WITH STATE REGULATIONS. MODIFY DETAIL ACCORDINGLY.
- B. ALL BLUE LEADERS AND DIMENSIONS SHOULD BE FILLED IN ACCORDING TO PROJECT PARAMETERS AND PLACED ON A NON-COLOR PLOTTING LAYER.
- C. THIS DETAIL SHOULD BE MODIFIED FOR EACH SPECIFIC APPLICATION. IF THERE ARE MULTIPLE WATER LINE LOWERINGS REQUIRED, MULTIPLE DETAILS SHOULD BE PREPARED.

NO. DESCRIPTION

1. CONCRETE WALL BLOCKING (REFER TO STANDARD DETAIL HD4)
2. TRANSITION COUPLING IF REQUIRED (REFER TO STANDARD DETAIL HD1)
3. TO PREVENT THE OVER-BENDING OF HDPE, A MIN. 1.50 TIMES THE MANUFACTURER SPECIFIED BEND RADIUS IS ALLOWED. IF BEND RADIUS REQUIREMENTS CANNOT BE MET, THEN BUTT FUSED LONG RADIUS BEND FITTINGS ARE ALLOWED.
4. NEW HDPE PIPE - MINIMUM LENGTH IS 10 FEET PLUS DIAMETER OF STORM PIPE OF STRAIGHT RUN OF PIPE AND CENTERED UNDER STORM DRAIN PIPE.
5. TRENCH LIMITS
6. STORM DRAIN (OR PROPOSED CONFLICT)
7. ROD BEND TO WALL BLOCK IF TRANSITION IS NOT SELF-RESTRAINED. ROD MATERIAL MUST BE CORROSION-RESISTANT AND COVERED IN CORROSION INHIBITING SUBSTANCE.
8. TIE ROD - THE CONNECTING TIE RODS THAT JOIN THE TWO RINGS SHALL BE MADE OF LOW ALLOY STEEL THAT CONFORMS TO ANSI/AWWA C111/A21.11.
9. STEEL CASING PIPE - REQUIRED IF STORM PIPE IS 72-INCHES DIAMETER OR LARGER OR IF REQUIRED IF STORM CONFLICT IS A BOX CULVERT. REFER TO STEEL CASING FOR HDPE PIPE STANDARD DETAIL.

NOTES

- A. ALL HDPE PIPE SHALL HAVE BUTT FUSED JOINT OR ELECTROFUSED FITTINGS.
- B. EMBEDMENT OF WATER MAIN SHALL BE PER STANDARD DETAIL HD3.
- C. IF THE EXISTING PIPE IS HDPE, CONTRACTOR MAY NOT DEFLECT PIPE AS-IS TO ACHIEVE LOWERING. HDPE FITTINGS OR NEW HDPE PIPE MUST BE INSTALLED TO PROVIDE THE EXTRA PIPE LENGTH NEEDED TO ACCOMMODATE A WATER MAIN LOWERING.
- D. LOWERED PIPE MUST BE NEW MATERIAL. REUSE OF EXISTING PIPE IS NOT ALLOWED.

BEND RADIUS TABLE	
MAIN SIZE (INCHES)	MINIMUM BEND RADIUS (FEET)
4	90
6	133
8	173
10	215
12	255
16	320
20	400
24	480
30	600
32	640

TIE ROD TABLE	
MAIN SIZE (INCHES)	TIE ROD SIZE (COUNT - INCH)
4	4 - 3/4 X 13
6	6 - 3/4 X 13
8	6 - 3/4 X 13
10	8 - 3/4 X 18
12	8 - 3/4 X 18
16	10 - 3/4 X 18
20	12 - 3/4 X 18
24	14 - 3/4 X 18
30	16 - 1 X 18
32	20 - 1 X 18

NO SCALE

STANDARD NO.

HD10

VERSION NO. 1.0

VERSION DATE 2016-05-12

LOWERING OF 6-INCH TO 12-INCH  
WATER MAIN USING HDPE

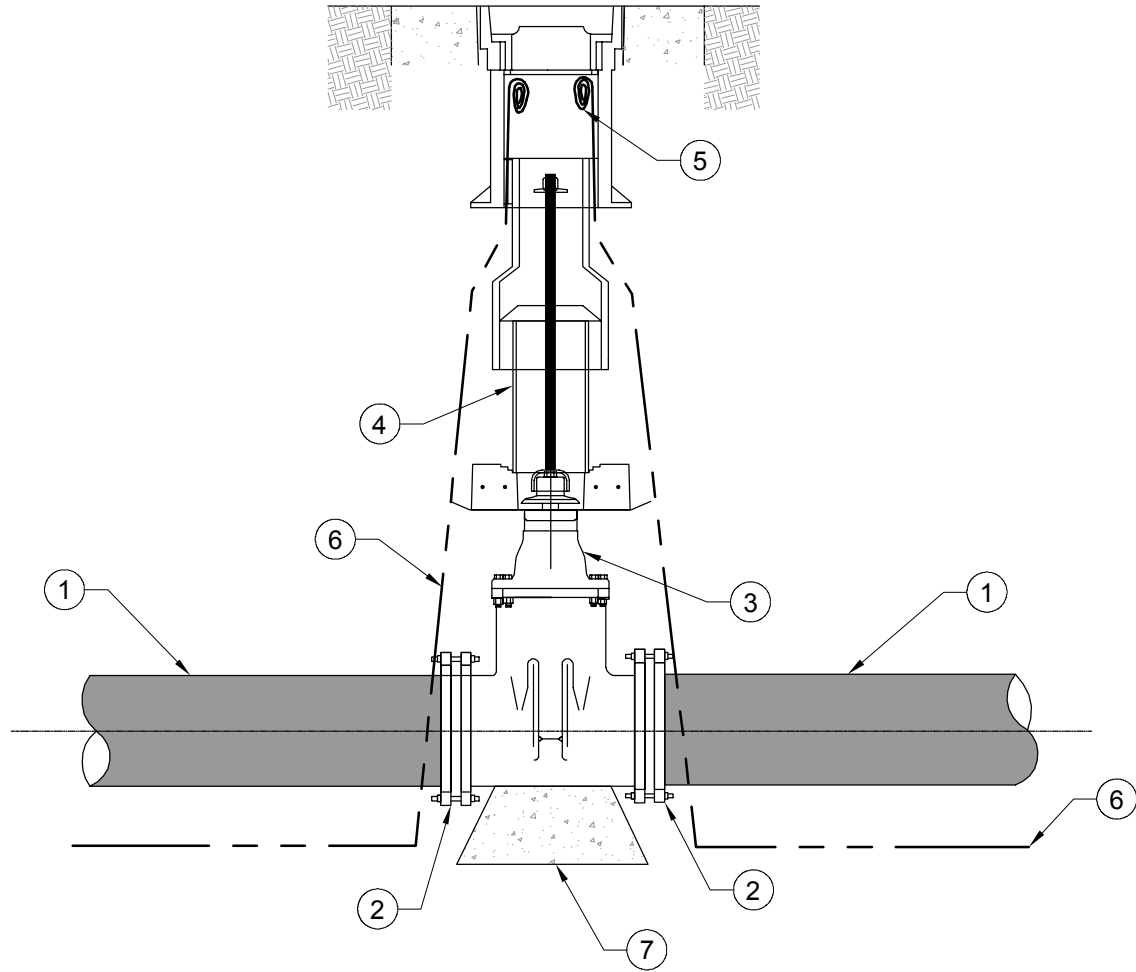
CHARLOTTE WATER

STANDARD DETAILS

HDPE - WATER

CHARLOTTE  
WATER

A CITY OF CHARLOTTE WATER DEPARTMENT



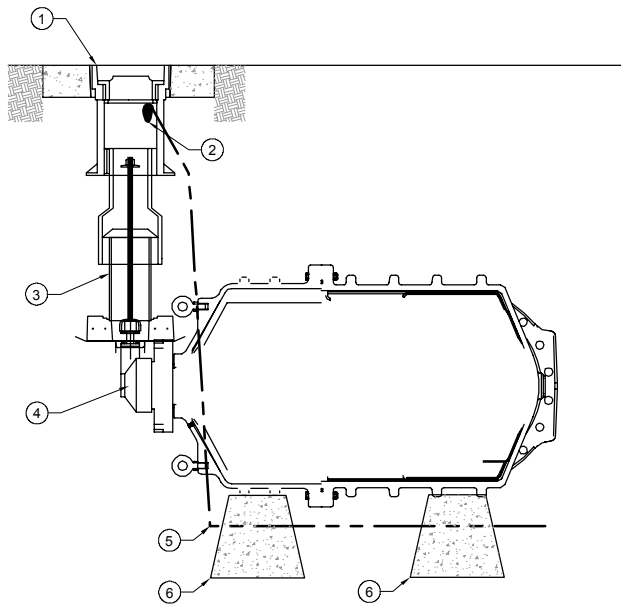
- | NO. | DESCRIPTION  |
|-----|--|
| 1.  | HDPE WATER MAIN  |
| 2.  | BUTT FUSED JOINT OR RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.   |
| 3.  | GATE VALVE.  |
| 4.  | VALVE BOX ASSEMBLY. SEE STANDARD DETAIL.   |
| 5.  | TRACER WIRE TERMINATION.   |
| 6.  | TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION  |
| 7.  | CONCRETE BEARING BLOCK FOR 10-INCH AND LARGER GATE VALVES. POLYETHYLENE WRAP BARRIER SHALL BE PRESENT BETWEEN BEARING BLOCK AND VALVE. WRAP SHALL BE TWO LAYERS OF 4 MIL THICK HDCLPE. |

- NOTES:
- A. MJ ADAPTER KIT SHALL INCLUDE BOLTS AND NUTS, GRADE 3 OR HIGHER AND LONG ENOUGH TO ACCOMMODATE THE ADDED LENGTH OF HDPE FITTING TO ATTACH TO VALVES.
  - B. CHARLOTTE WATER ALLOWS THE INSTALLATION OF DIFFERENT PIPE MATERIALS ON EITHER SIDE OF THE GATE VALVE. INSTALL TRANSITIONS PER STANDARD DETAIL HD1 FOR HDPE.
  - C. IF VALVE OPERATING NUT IS MORE THAN 3 FEET BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STANDARD 2-INCH SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX. SEE STANDARD DETAIL.

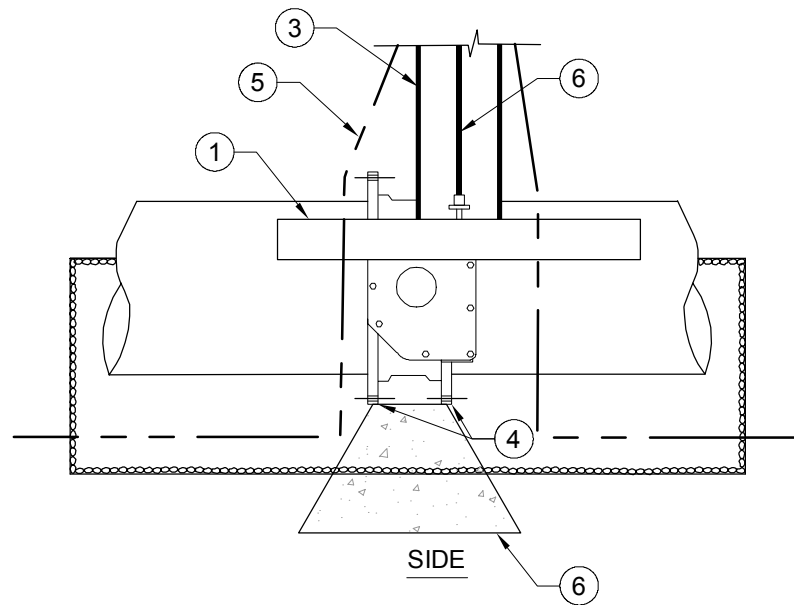
- NOTES TO DESIGNER
- A. ENGINEER IS RESPONSIBLE FOR DESIGN OF PAVEMENT REPAIR AND FOR A DESIGN THAT DOES NOT ALLOW LOADING TRANSFER TO VALVE.
  - B. ENGINEER TO SPECIFY SIZE OF BEARING PAD BASED ON GEOTECHNICAL REPORT OF SOIL CONDITIONS.

NO SCALE			GATE VALVE FOR HDPE PIPE (3-INCH TO 12-INCH)	
CHARLOTTE WATER	CHARLOTTE WATER STANDARD DETAILS HDPE - WATER	STANDARD NO. HD11		
		VERSION NO. 1.0	VERSION DATE 2016-05-12	

PROFILE VIEW



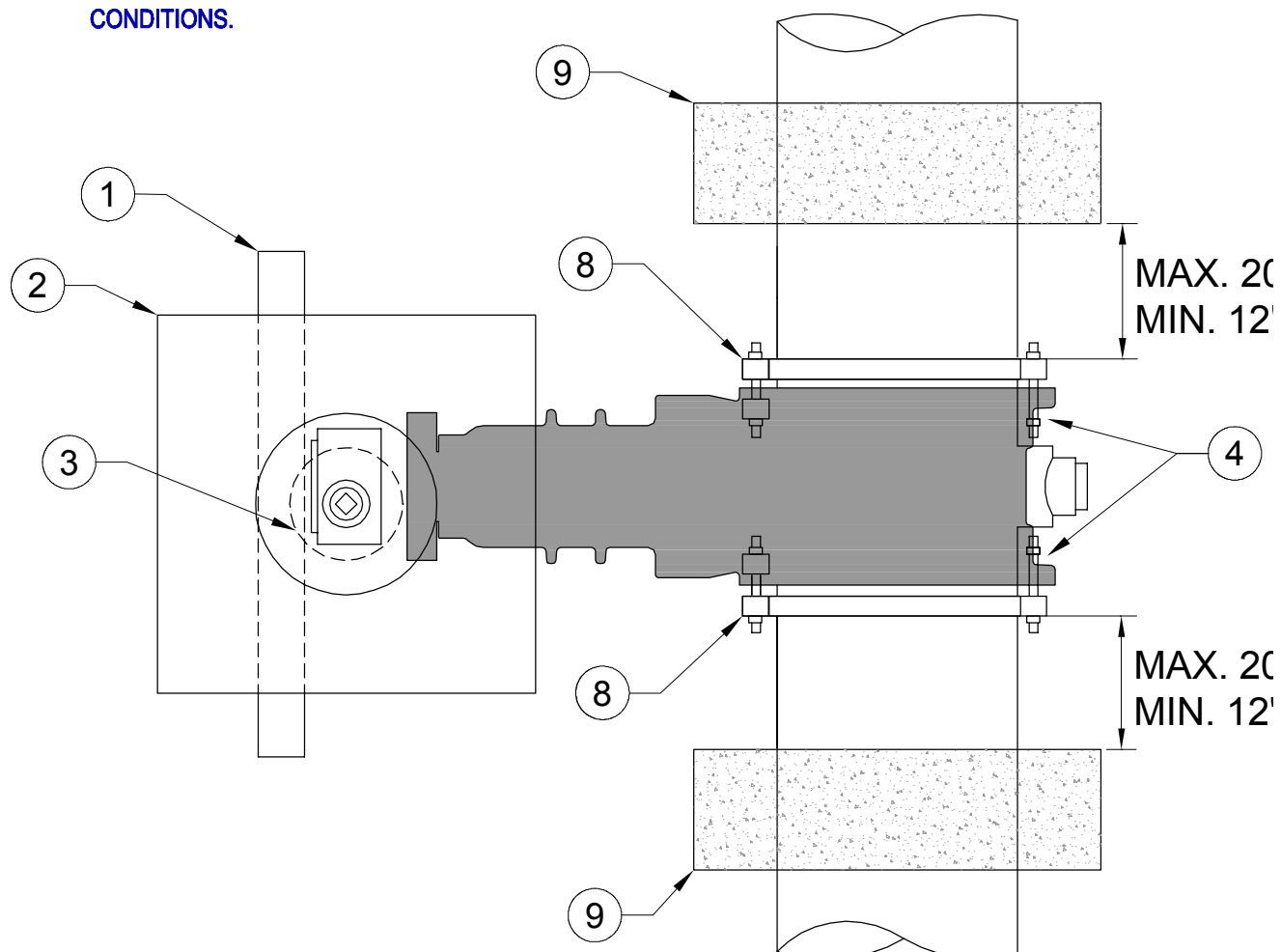
SIDE VIEW



NOTES TO DESIGNER

- ENGINEER IS RESPONSIBLE FOR DEPTH REQUIREMENTS.
- ENGINEER TO SPECIFY SIZE OF BEARING PAD BASED ON GEOTECHNICAL REPORT OF SOIL CONDITIONS.

PLAN VIEW



NO. DESCRIPTION

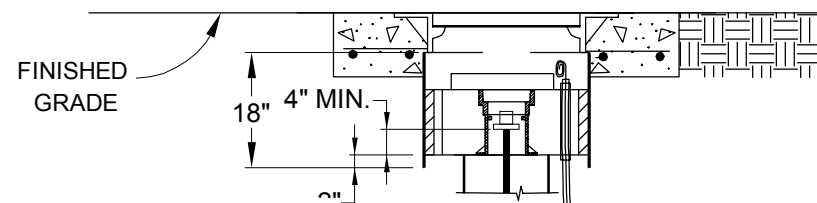
- FRAME AND COVER ASSEMBLY. SEE STANDARD DETAIL.
- TRACER WIRE TERMINATION.
- VALVE BOX ASSEMBLY. SEE CLT WATER STANDARD DETAIL.
- GATE VALVE.
- TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION
- CONCRETE BEARING BLOCK FOR 10-INCH AND LARGER GATE VALVES. POLYETHYLENE WRAP BARRIER SHALL BE PRESENT BETWEEN BEARING BLOCK AND VALVE. WRAP SHALL BE TWO LAYERS OF 4 MIL THICK HDCLPE.
- CONE BEARING BLOCKS.
- RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT.
- THRUST BLOCK. REFER TO STANDARD DETAIL.

NOTES:

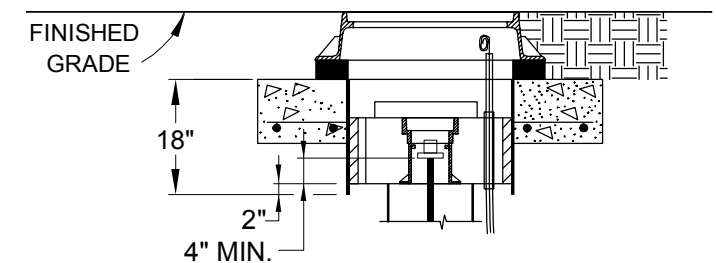
- CONNECT VALVE TO HDPE LINE WITH RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
- MJ ADAPTER KIT SHALL INCLUDE BOLTS AND NUTS, GRADE 3 OR HIGHER AND LONG ENOUGH TO ACCOMMODATE THE ADDED LENGTH OF HDPE FITTING TO ATTACH TO VALVES.
- CHARLOTTE WATER ALLOWS THE INSTALLATION OF DIFFERENT PIPE MATERIALS ON EITHER SIDE OF THE GATE VALVE. INSTALL TRANSITIONS PER STANDARD DETAIL HD1 FOR HDPE.
- IF VALVE OPERATING NUT IS MORE THAN 3 FEET BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STANDARD 2-INCH SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX. SEE STANDARD DETAIL.
- REFER TO STANDARD DETAIL FOR MANHOLE COVER DETAIL.

ELEVATIONS

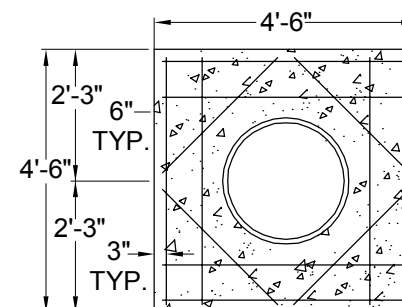
METHOD A



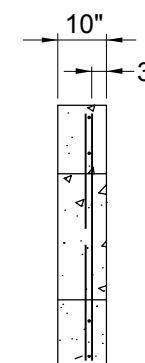
METHOD B



PLAN: PRECAST CONCRETE PAD  
REFER TO STANDARD DETAIL



SECTION



NO SCALE

STANDARD NO. HD12

VERSION NO. 1.0  
VERSION DATE 2016-05-12

HORIZONTAL INSTALLATION OF GATE VALVES  
FOR HDPE PIPE (16-INCH TO 32-INCH)

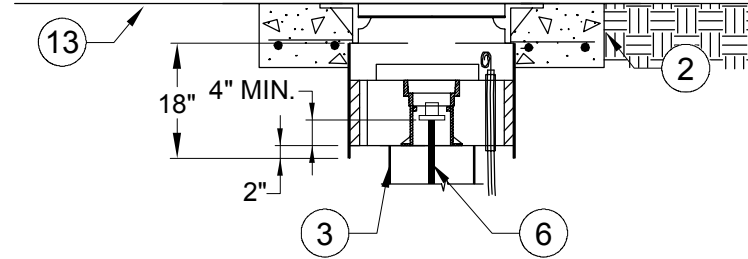
CHARLOTTE WATER  
STANDARD DETAILS  
HDPE - WATER

CHARLOTTE WATER  
A CITY OF ALABAMA WATER TREATMENT

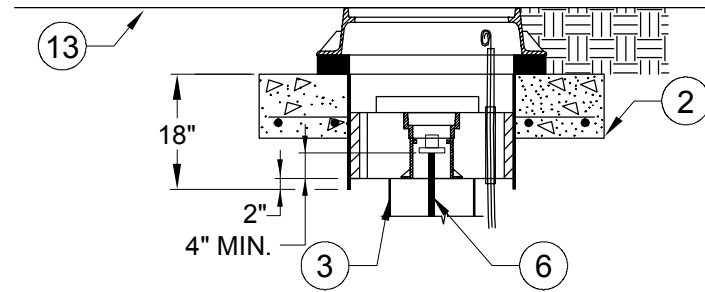


ELEVATIONS

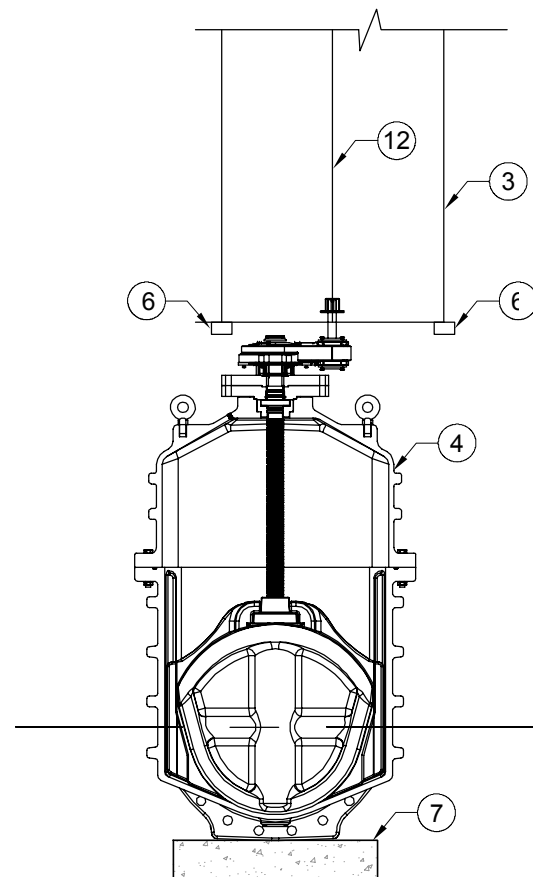
METHOD A - IN SHOULDER



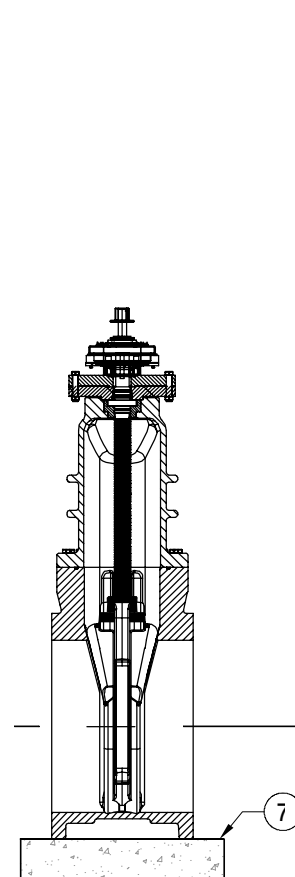
METHOD B - IN PAVEMENT



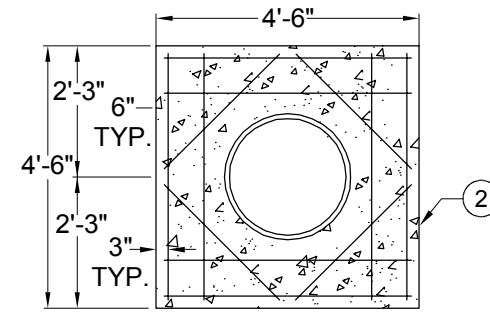
PROFILE VIEW



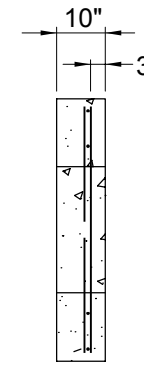
SIDE VIEW



PLAN: PRECAST CONCRETE PAD  
REFER TO STANDARD DETAIL



SECTION



NO. DESCRIPTION

1. FRAME AND COVER ASSEMBLY. SEE STANDARD DETAIL.
2. TRACER WIRE TERMINATION.
3. VALVE BOX ASSEMBLY. SEE STANDARD DETAIL.
4. GATE VALVE - VERTICALLY ORIENTED
5. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION
6. BEARING BAR FOR VALVE BOX. POLYETHYLENE WRAP BARRIER SHALL BE PRESENT BETWEEN BEARING BLOCK AND VALVE.
7. BEARING BLOCK FOR VALVE.
8. PRECAST CONCRETE BEAM (REINFORCED)
9. PRECAST CONCRETE PAD (REINFORCED). SEE STANDARD DETAIL.
10. 12 INCH (MIN.) DIP OR C900 PVC DR18 RISER PIPE 20 INCH MAXIMUM
11. RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
12. EXTENSION STEM ASSEMBLY. REFER TO STANDARD DETAIL.
13. FINISHED GRADE
14. RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT.
15. THRUST BLOCK. REFER TO STANDARD DETAIL.

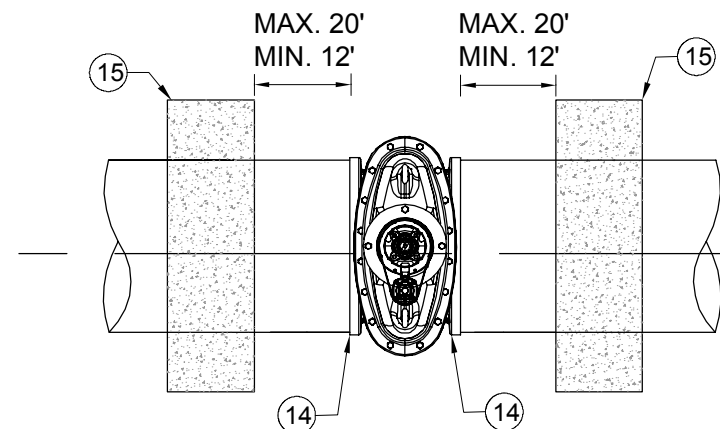
NOTES:

- A. CONNECT VALVE TO HDPE LINE WITH RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
- B. CHARLOTTE WATER ALLOWS THE INSTALLATION OF DIFFERENT PIPE MATERIALS ON EITHER SIDE OF THE GATE VALVE. INSTALL TRANSITIONS PER STANDARD DETAIL HD1 FOR HDPE.
- C. IF VALVE OPERATING NUT IS MORE THAN 3 FEET BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STANDARD 2-INCH SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX. SEE STANDARD DETAIL.
- D. REFER TO STANDARD DETAIL FOR MANHOLE COVER DETAIL.

NOTES TO DESIGNER

- A. ENGINEER IS RESPONSIBLE FOR DEPTH REQUIREMENTS.
- B. ENGINEER IS RESPONSIBLE FOR BEARING BLOCK STRUCTURAL DESIGN.
- C. ENGINEER TO SPECIFY SIZE OF BEARING BLOCK BASED ON GEOTECHNICAL REPORT OF SOIL CONDITIONS.

PLAN VIEW



NO SCALE

STANDARD NO.

HD13

VERSION NO.

1.0

VERSION DATE

2016-05-12

VERTICAL INSTALLATION OF GATE VALVES  
FOR HDPE PIPE (16-INCH TO 32-INCH)

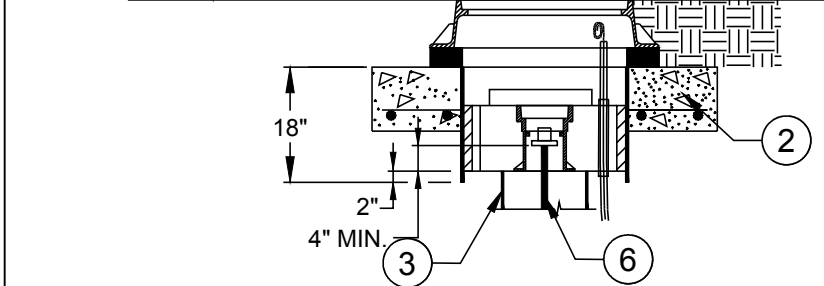
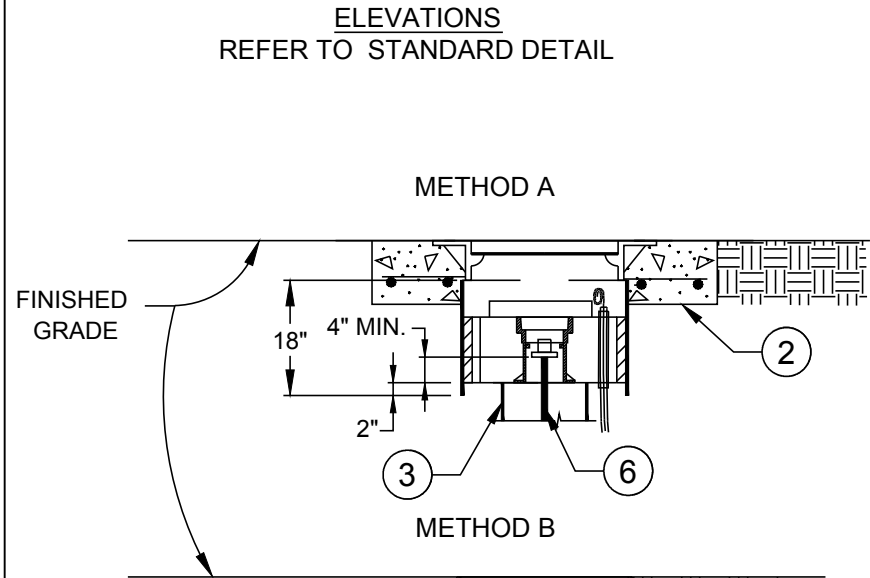
CHARLOTTE WATER

STANDARD DETAILS

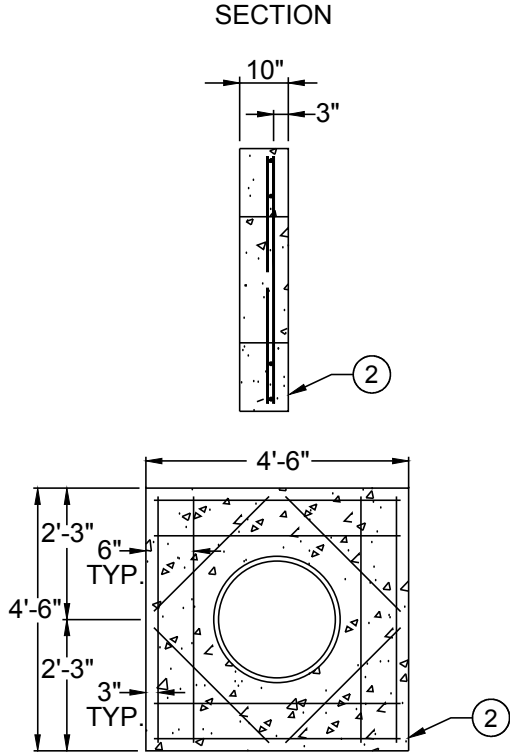
HDPE - WATER

CHARLOTTE  
WATER

A CITY OF ALABAMA WATER REBATEMENT



PRECAST CONCRETE PAD PLAN VIEW  
REFER TO STANDARD DETAIL



NO. DESCRIPTION

1. PRECAST CONCRETE BEAM (REINFORCED)
2. PRECAST CONCRETE PAD (REINFORCED). SEE STANDARD DETAIL.
3. 12 INCH (MIN.) DIP OR C900 PVC DR18 RISER PIPE 20 INCH MAXIMUM
4. RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
5. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION
6. EXTENSION STEM ASSEMBLY. REFER TO STANDARD DETAIL.
7. WASHED #57 OR #67 STONE-MINIMUM 6 FEET ON EACH SIDE OF VALVE.
8. HDPE WATER MAIN.
9. CONCRETE BEARING BLOCK FOR 10-INCH AND LARGER GATE VALVES. POLYETHYLENE WRAP BARRIER SHALL BE PRESENT BETWEEN BEARING BLOCK AND VALVE. WRAP SHALL BE TWO LAYERS OF 4 MIL THICK HDCLPE.
10. MJ X MJ BUTTERFLY VALVE.
11. DIPS MJ ADAPTER
12. DIP SPOOL PIECE WITH RESTRAINT HARNESS.

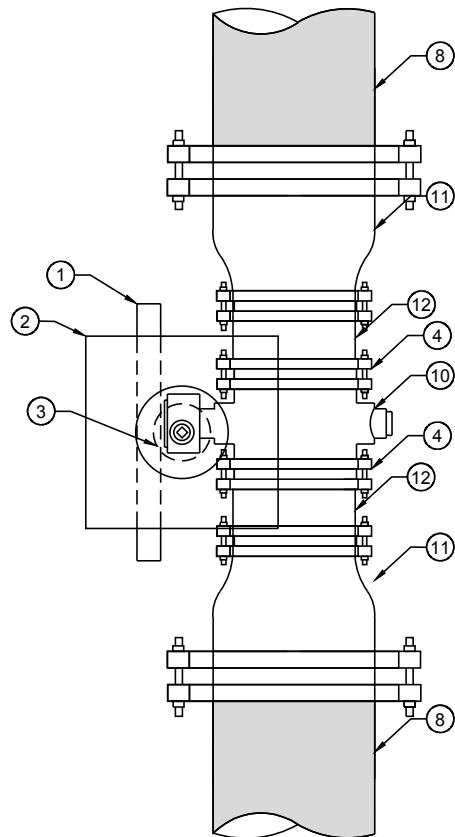
NOTES:

- A. MJ ADAPTER KIT SHALL INCLUDE BOLTS AND NUTS, GRADE 3 OR HIGHER.
- B. PROVIDE REDUCERS PRIOR TO MJ ADAPTER IN NEXT LOWER PIPE SIZE IF IPS PIPE SIZE IS NOT COMPATIBLE WITH AVAILABLE DIPS VALVE SIZES. CHARLOTTE WATER DOES NOT TYPICALLY USE 18-INCH VALVES.
- C. CHARLOTTE WATER ALLOWS THE INSTALLATION OF DIFFERENT PIPE MATERIALS ON EITHER SIDE OF THE BUTTERFLY VALVE. INSTALL TRANSITIONS PER STANDARD DETAIL HD1 FOR HDPE.
- C. IF VALVE OPERATING NUT IS MORE THAN 3 FEET BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STANDARD 2-INCH SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX. SEE STANDARD DETAIL.
- D. REFER TO STANDARD DETAIL FOR MANHOLE COVER DETAIL.

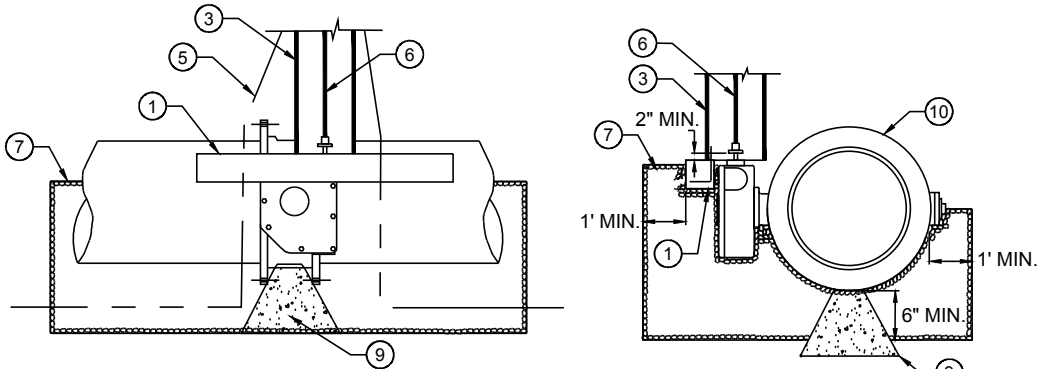
NOTES TO DESIGNER

- A. ENGINEER TO SPECIFY SIZE OF BEARING PAD BASED ON GEOTECHNICAL REPORT OF SOIL CONDITIONS.

PLAN VIEW



SIDE VIEW



VALVE SIZE TABLE

DR 9 IPS HDPE SIZE (INCH)	IPS REDUCER	MJ ADAPTER (IPS X DIPS)	VALVE SIZE (INCH)
8	N/A	8 x 8	8
10	N/A	10 x 10	10
12	N/A	12 x 12	12
14	N/A	14 x 14	14
16	N/A	16 x 16	16
18	18 x 16	16 x 16	16
20	N/A	20 x 20	20
22	22 x 20	20 x 20	20
24	N/A	24 x 24	24
26	26 x 24	24 x 24	24
30	N/A	30 x 30	30
32	32 x 30	30 x 30	30

NO SCALE

STANDARD NO.

HD14

VERSION NO. 1.0

VERSION DATE 2016-05-12

BUTTERFLY VALVE FOR HDPE PIPE  
(16-INCH TO 32-INCH)

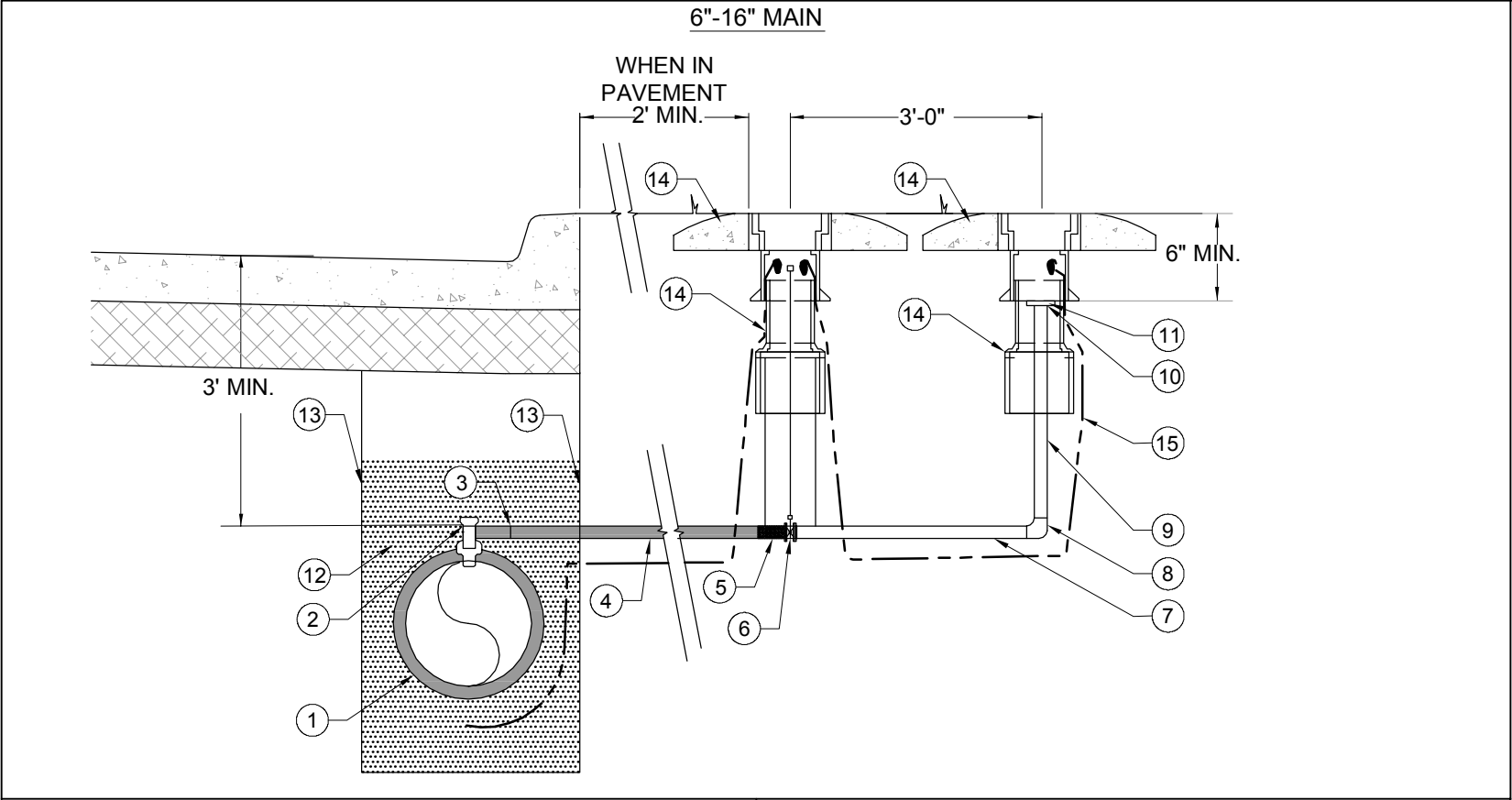
CHARLOTTE WATER

STANDARD DETAILS

HDPE - WATER

CHARLOTTE  
WATER

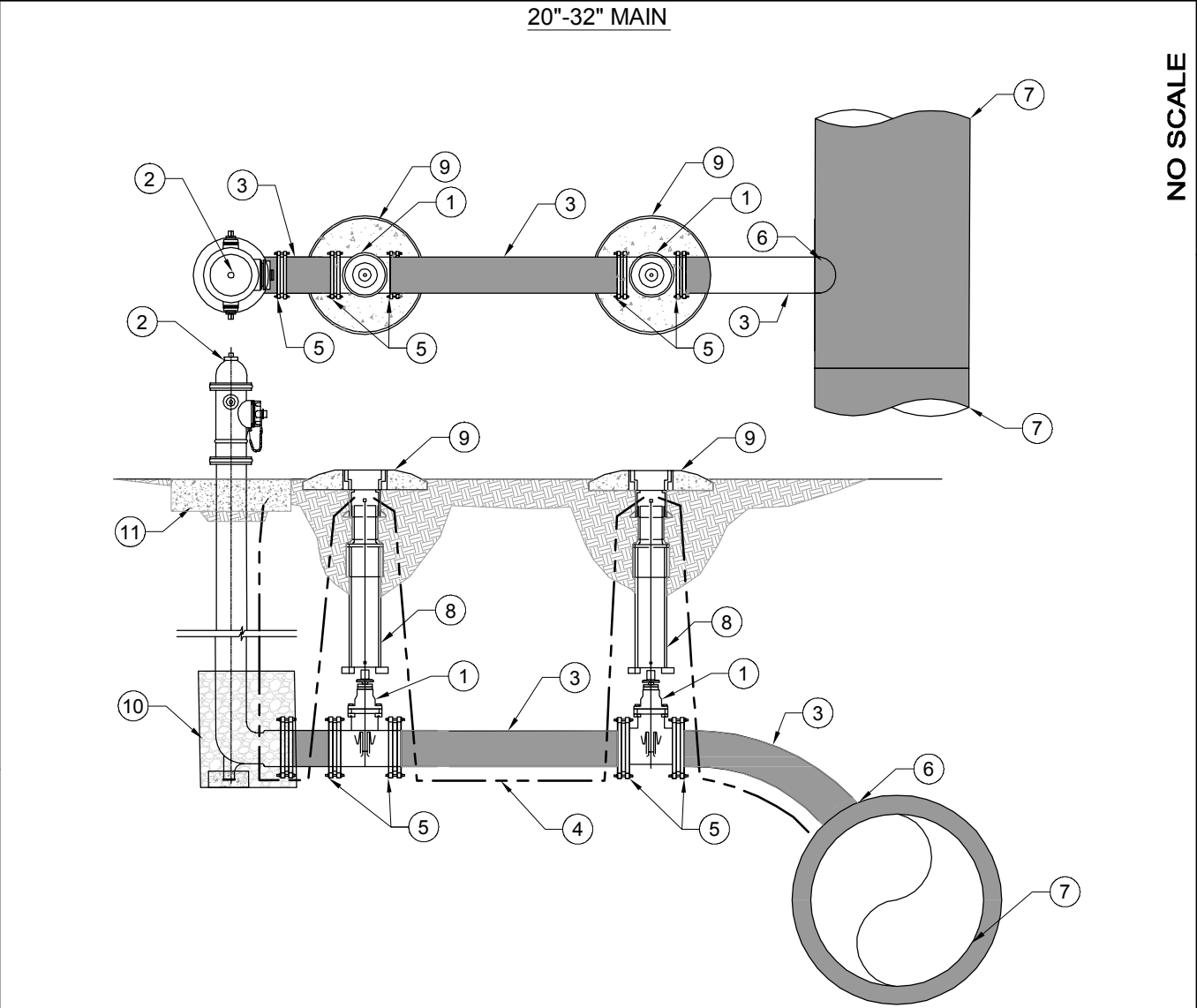
A CITY OF CHARLOTTE DEPARTMENT



ITEM LIST FOR 1-INCH AIR RELEASE	
NO.	DESCRIPTION
1.	HDPE WATER MAIN
2.	1-INCH HDPE TAPPING TEE BY ELECTROFUSION ONLY
3.	HDPE BUTT FUSION JOINT
4.	1-INCH SDR-9 HDPE TUBING (CTS)
5.	1-INCH HDPE PLAIN END x STEEL PLAIN END WELD-ON TRANSITION FITTING FOR WATER
6.	1-INCH BRASS AWWA CURB STOP BALL VALVE (CTS)
7.	1-INCH RED BRASS NIPPLE - SCH 40 - (MNPT X MNPT), MINIMUM 30-INCH LONG
8.	1-INCH RED BRASS 90° BEND (FNPT X FNPT)
9.	1-INCH RED BRASS NIPPLE - SCH 40 - (MNPT X MNPT), LENGTH AS REQUIRED
10.	1-INCH DUCTILE IRON (FUSION BONDED EPOXY COATED) THREADED COUPLING (FNPT)
11.	1-INCH NPT CAP (HAND TIGHT)
12.	HDPE EMBEDMENT MATERIAL
13.	TRENCH LIMITS
14.	VALVE BOX ASSEMBLY - SEE STANDARD DETAIL
15.	TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION

ITEM LIST FOR 2-INCH AIR RELEASE	
NO.	DESCRIPTION
1.	HDPE WATER MAIN
2.	2-INCH HDPE TAPPING TEE BY ELECTROFUSION ONLY
3.	HDPE BUTT FUSION JOINT
4.	2-INCH SDR-9 HDPE TUBING (CTS)
5.	2-INCH HDPE PLAIN END x STEEL THREADED WELD-ON TRANSITION FITTING FOR WATER
6.	2-INCH THREADED GATE VALVE (FNPT X FNPT)
7.	2-INCH RED BRASS NIPPLE - SCH 40 - (MNPT X MNPT), MINIMUM 30-INCH LONG
8.	2-INCH RED BRASS 90° BEND (FNPT X FNPT)
9.	2-INCH RED BRASS NIPPLE - SCH 40 - (MNPT X MNPT), LENGTH AS REQUIRED
10.	2-INCH DUCTILE IRON (FUSION BONDED EPOXY COATED) THREADED COUPLING (FNPT)
11.	2-INCH NPT CAP (HAND TIGHT)
12.	HDPE EMBEDMENT MATERIAL
13.	TRENCH LIMITS
14.	VALVE BOX ASSEMBLY - SEE STANDARD DETAIL
15.	TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION

<b>NOTES:</b> A. AIR RELEASE VALVE ASSEMBLIES FOR MAINS 12-INCHES AND SMALLER SHALL BE 1-INCH IN SIZE. B. AIR RELEASE VALVE ASSEMBLIES FOR 16-INCH MAINS SHALL BE 2-INCHES IN SIZE. C. AIR RELEASE VALVE ASSEMBLIES FOR 20-INCH AND LARGER MAINS SHALL BE 6-INCH. D. 2-INCH BALL VALVES MAY NOT BE SUBSTITUTED FOR GATE VALVES.	
<b>NOTES TO DESIGNER</b> A. INSTALL AIR RELEASE VALVES AT ALL HIGH POINTS AS DIRECTED BY ENGINEER. B. INSTALL AIR RELEASE VALVES ON THE LOW SIDE OF 16-INCH AND LARGER VALVES AS DIRECTED BY ENGINEER. C. VALVE AND B.O. SHALL NOT BE PLACED IN ROAD DITCH.	



ITEM LIST FOR 6-INCH AIR RELEASE	
NO.	DESCRIPTION
1.	6-INCH GATE VALVE. SEE STANDARD DETAIL.
2.	FIRE HYDRANT ASSEMBLY PER STANDARD DETAIL.
3.	6-INCH HDPE PIPE.
4.	TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION.
5.	RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL FOR TRANSITION DETAIL.
6.	HDPE BUTT FUSION TEE
7.	HDPE WATER MAIN
8.	VALVE BOX ASSEMBLY. SEE STANDARD DETAIL.
9.	24-INCH DIAMETER REINFORCED CONCRETE PAD.
10.	#57 OR #68 WASHED STONE-ENCASEMENT
11.	CONCRETE HYDRANT COLLAR. CAST IN PLACE. 3-FEET DIAMETER BY 8-INCH THICK.

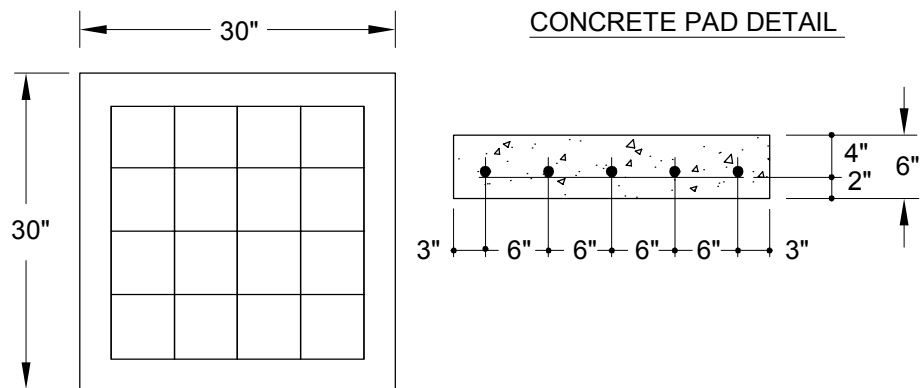
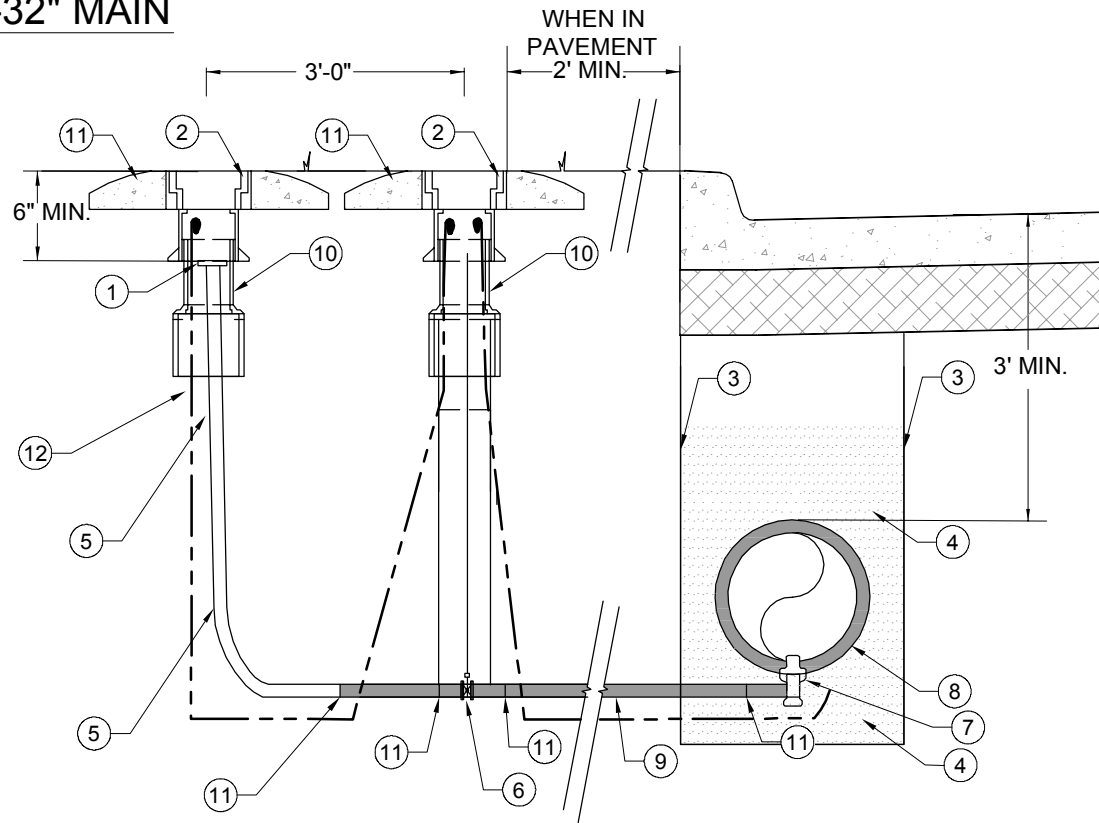
<b>NOTES:</b> A. ALL PIPE, FITTINGS, ETC. SHALL BE RESTRAINED JOINT OR MJ WITH WEDGE ACTION RESTRAINT. BUTT FUSED AND ELECTROFUSED HDPE IS FULLY RESTRAINED. B. ALL HARDWARE (BOLT/WASHER/NUT) SHALL BE TYPE 304 STAINLESS STEEL WITH ANTI-SEIZE COMPOUND C. SEE CONSTRUCTION PLANS FOR EXACT LOCATIONS OF VALVES AND FIRE HYDRANT. D. HYDRANT EXTENSIONS SHALL BE LIMITED TO 1 EACH PER FIRE HYDRANT.	
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<b>NO SCALE</b>	
<b>STANDARD NO.</b> HD15	
<b>VERSION NO.</b> 1.0	
<b>VERSION DATE</b> 2016-05-12	
<b>AIR RELEASE VALVES FOR HDPE PIPE</b>	
<b>CHARLOTTE WATER</b>	<b>STANDARD DETAILS</b>
<b>CHARLOTTE WATER</b>	<b>HDPE</b>



- NO. DESCRIPTION
1. NPT CAP (HAND TIGHT)
  2. VALVE BOX (TOP SECTION) - ASSEMBLY
  3. TRENCH LIMITS
  4. HDPE EMBEDMENT MATERIAL
  5. HDPE TRANSITION RISER
  6. 2-INCH GATE VALVE
  7. HDPE TAPPING TEE BY ELECTROFUSION ONLY
  8. HDPE WATER MAIN
  9. 2-INCH SDR-9 HDPE PIPE (IPS)
  10. VALVE BOX ASSEMBLY. SEE STANDARD DETAIL.
  11. HDPE BUTT FUSION JOINT
  12. TRACER WIRE-CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION.

6"-32" MAIN



CHARLOTTE  
WATER  
ACCESS

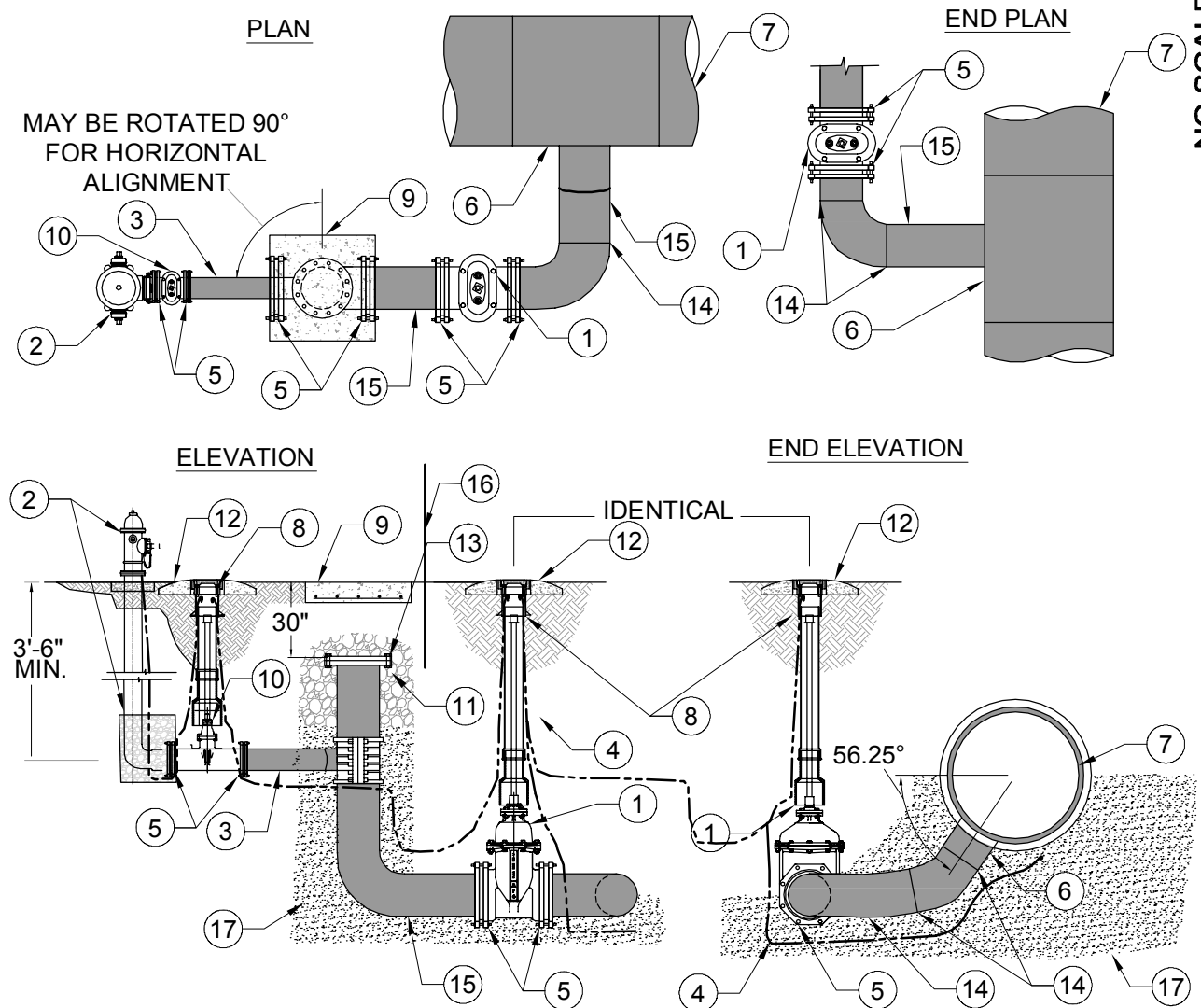
NOTES:

- A. ALL PIPE, FITTINGS, ETC. SHALL BE RESTRAINED JOINT OR MJ WITH WEDGE ACTION RESTRAINT. BUTT FUSED AND ELECTROFUSED HDPE IS FULLY RESTRAINED.
- B. CLT WATER DISTRIBUTION VALVES OPEN RIGHT (CLOCKWISE).
- C. ALL HARDWARE (BOLT/WASHER/NUT) SHALL BE TYPE 304 STAINLESS STEEL WITH ANTI-SEIZE COMPOUND
- D. SEE CONSTRUCTION PLANS FOR EXACT LOCATIONS OF VALVES, CLT WATER ACCESS POINT, AND FIRE HYDRANT.
- E. HYDRANT EXTENSIONS SHALL BE LIMITED TO 1 EACH PER FIRE HYDRANT.

NOTES TO DESIGNER

- A. BLOW OFFS TO BE INSTALLED AT LOW POINTS IF REQUIRED BY ENGINEER.
- B. VALVE AND B.O. SHALL NOT BE PLACED IN ROAD DITCH.

22"-32" MAIN AT CREEK CROSSINGS



NO. DESCRIPTION

1. 12-INCH GATE VALVE. SEE STANDARD DETAIL.
2. FIRE HYDRANT ASSEMBLY PER STANDARD DETAIL.
3. 6-INCH HDPE PIPE.
4. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION.
5. RESTRAINED MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT. SEE STANDARD DETAIL HD1 FOR TRANSITION DETAIL.
6. HDPE TEE
7. HDPE WATER MAIN
8. VALVE BOX ASSEMBLY. SEE STANDARD DETAIL.
9. 30"x 30"x6" REINFORCED CONCRETE VALVE PAD WITH #4 REBAR AT 6 INCH O.C. EACH WAY. SEE CONCRETE PAD DETAIL ON THIS SHEET.
10. 6-INCH GATE VALVE. SEE STANDARD DETAIL HD10.
11. #57 OR #68 WASHED STONE-ENCASEMENT TO 6" ABOVE BLIND FLANGE.
12. 24 INCH DIAMETER REINFORCED CONCRETE PAD.
13. 12" DUCTILE IRON BLIND FLANGE, HDPE FLANGE ADAPTER, AND DUCTILE IRON BACK-UP RING.
14. HDPE FITTING BUTT FUSION JOINT.
15. 12-INCH HDPE PIPE.
16. 72-INCH 3-RAIL MARKER POST, BLUE IN COLOR TO SIGNIFY WATER (RHINO OR APPROVED EQUAL).
17. HDPE EMBEDMENT MATERIAL

NO SCALE

STANDARD NO.

HD16

VERSION NO. 1.0

VERSION DATE 2016-05-12

BLOW OFF ASSEMBLIES  
FOR HDPE PIPE

CHARLOTTE WATER

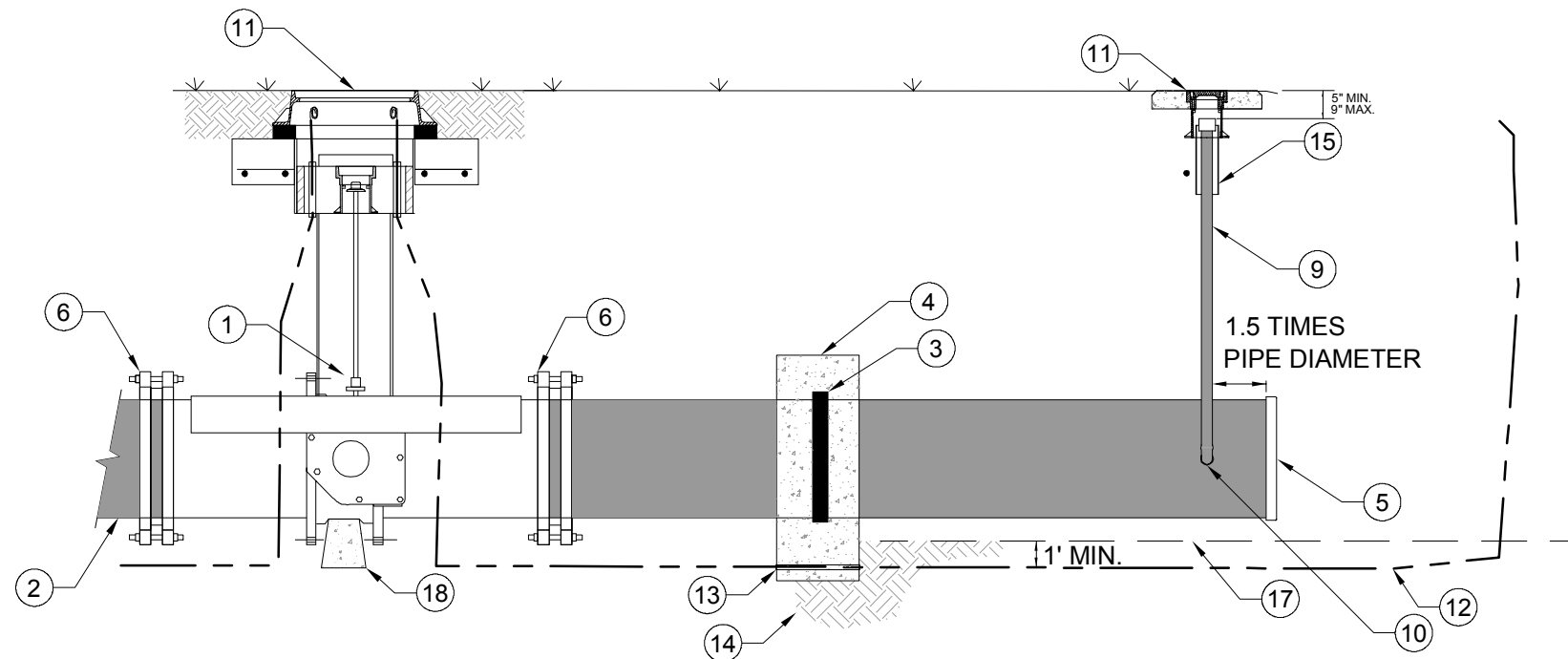
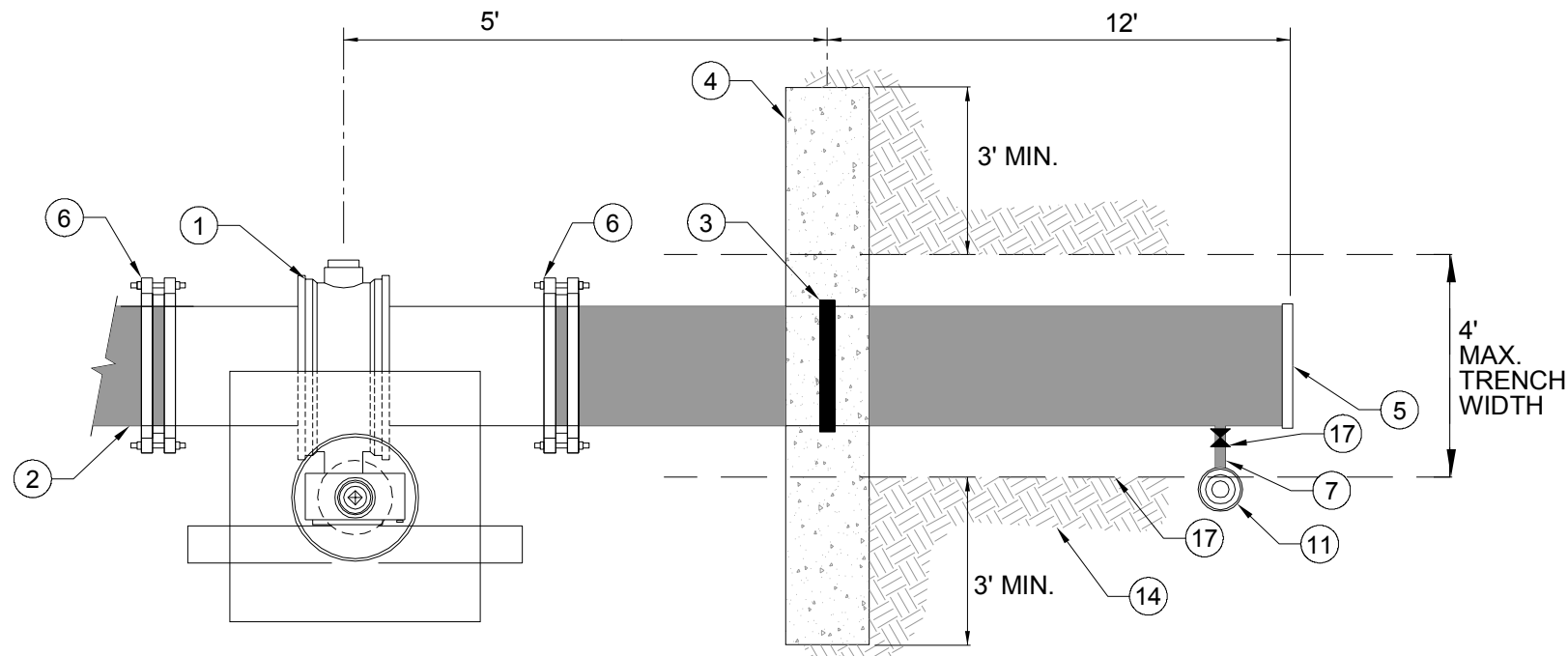
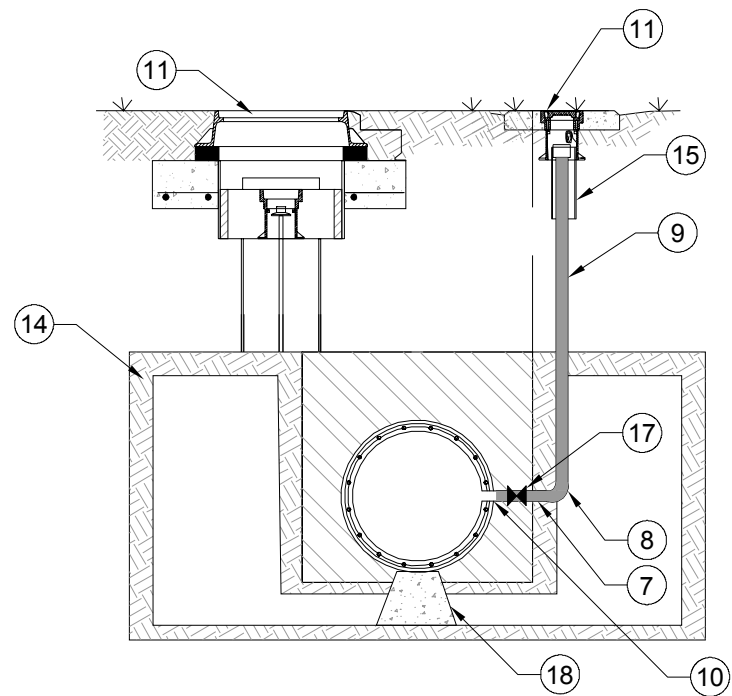
STANDARD DETAILS

HDPE - WATER

CHARLOTTE  
WATER

NO. DESCRIPTION

- 1. END OF LINE VALVE-BUTTERFLY OR GATE VALVE
- 2. HDPE WATER MAIN
- 3. FLEX RESTRAINTS FOR HDPE PIPE. SEE STANDARD DETAIL HD4.
- 4. CONCRETE WALL BLOCKING - F'C = MINIMUM 3,600 PSI. SEE STANDARD DETAIL HD4.
- 5. BUTT FUSED HDPE END CAP
- 6. MJ ADAPTER WITH STAINLESS STEEL STIFFENER AND ACCESSORY KIT OR BUTT FUSION JOINT AS APPROPRIATE TO VALVE.
- 7. 2 INCH HDPE PIPE
- 8. 2 INCH HDPE 90° BEND
- 9. 2 INCH HDPE NIPPLE - LENGTH AS REQUIRED.
- 10. 2-INCH TAPPING TEE OR 4-INCH SADDLE.
- 11. VALVE BOX ASSEMBLY. SEE STANDARD DETAILS HD10, HD11, HD12, AND HD17.
- 12. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION.
- 13. 1 INCH SCH 40 PVC ELECTRICAL CONDUIT. LENGTH AS REQUIRED.
- 14. UNDISTURBED SOIL
- 15. 5 INCH CAST IRON SOIL PIPE, L=15" OR VALVE BOX BOTTOM SECTION.
- 16. TRENCH LIMITS
- 17. CONTROL VALVE
- 18. CONCRETE BEARING BLOCK



OUTLET SIZE TABLE		
MAIN DIAMETER (INCH)	OUTLET NOMINAL DIAMETER (INCH)	CONTROL VALVE
2 to 20	2-INCH	2-INCH GATE VALVE
22 to 32	4-INCH	4-INCH GATE VALVE

- NOTES:
- A. WHEN DIRECTED BY THE ENGINEER,THE CONCRETE WALL BLOCK SIZE MAY BE ADJUSTED, BASED ON ACTUAL SOIL CLASSIFICATION AND PIPE DIAMETER.
  - B. FOR IN-DITCH FUSION, MINIMUM TRENCH WIDTH TO ACCOMMODATE EQUIPMENT ALLOWED.

- NOTES TO DESIGNER
- A. ENGINEER TO CONFIRM ADEQUATE SOIL PRESSURE BEARING CAPACITY FOR THRUST BLOCK
  - B. DESIGNATE IN PLANS THE TYPE OF VALVE FOR ITEM 11.
  - C. FOR 2-INCH TO 12-INCH MAIN, USE GATE VALVE. FOR 14-INCH TO 32-INCH MAIN, USE BUTTERFLY VALVE UNLESS OTHERWISE APPROVED IN WRITING BY CHARLOTTE WATER ENGINEER.
  - D. FLUSHING DEVICE MAY BE REQUIRED.

NO SCALE

STANDARD NO. HD17

VERSION NO. 1.0

VERSION DATE 2016-05-12

DEAD END WALL BLOCKING FOR HDPE PIPE

CHARLOTTE WATER

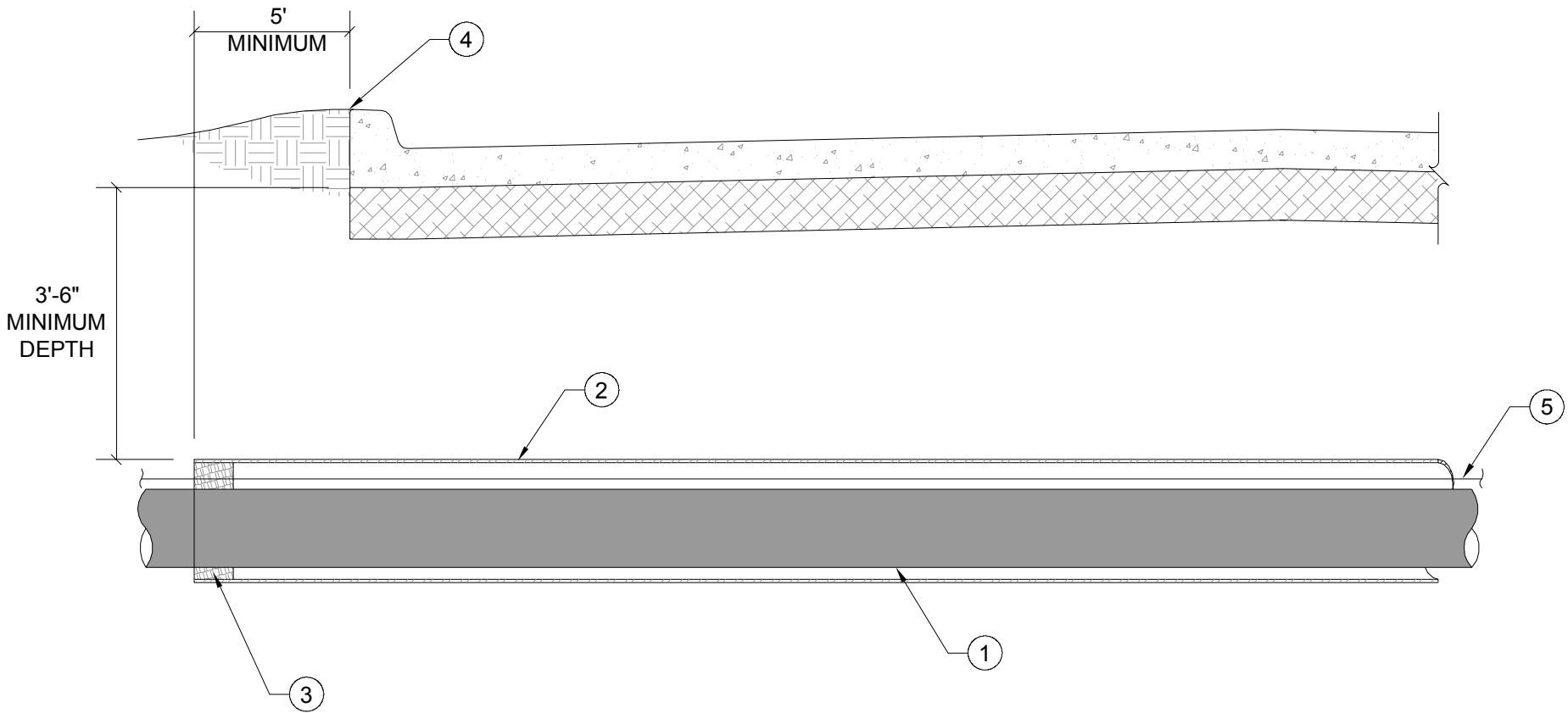
STANDARD DETAILS

HDPE - WATER

CHARLOTTE WATER

WATER

A CITY OF ALABAMA WATER TREATMENT



- NO. DESCRIPTION
- 1. HDPE WATER MAIN CARRIER PIPE
  - 2. STEEL CASING PIPE, MINIMUM 35,000 PSI MINIMUM YIELD STRENGTH STEEL. SEE TABLE FOR THICKNESS.
  - 3. PLUG ENDS OF CASING WITH GROUT (8-INCHES MINIMUM WIDTH).
  - 4. EDGE OF PAVEMENT OR BACK OF CURB.
  - 5. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK COLOR-CODED HDPE INSULATION AT THE BOTTOM OF THE EMBEDMENT LAYER.

- NOTES:
- A. CASING SPACERS ARE NOT ALLOWED FOR USE ON HDPE PIPE IN STEEL CASING.
  - B. SKIDS ARE ALLOWED FOR LONG INSTALLATIONS WITH APPROVAL OF ENGINEER.
  - C. ALLOWABLE TENSILE LOAD FOR PIPE MAY NOT BE EXCEEDED WHEN PULLING CARRIER PIPE THROUGH CASING.
  - D. IF USING UNDER NCDOT ROADWAY, 36-INCH AND 42-INCH CASING IS REQUIRED.

MINIMUM SIZE AND THICKNESS STANDARDS FOR CASING PIPE				
NOMINAL CARRIER PIPE (INCHES)	DOT CASING DIAMETER (INCHES)	DOT CASING THICKNESS (INCHES)	RAILROAD CASING DIAMETER (INCHES)	RAILROAD THICKNESS (INCHES)
2	8	0.250	N/A	N/A
3	8	0.250	N/A	N/A
4	8	0.250	N/A	N/A
6	12.75	0.250	16	0.281
8	16	0.250	18	0.312
10	18	0.250	20	0.344
12	20	0.250	24	0.406
14	20	0.250	30	0.469
16	24	0.250	30	0.469
18	24	0.375	36	0.562
20	36	0.375	36	0.562
22	36	0.375	36	0.562
24	36	0.375	36	0.562
26	42	0.500	48	0.750
30	42	0.500	48	0.750
32	42	0.500	48	0.750

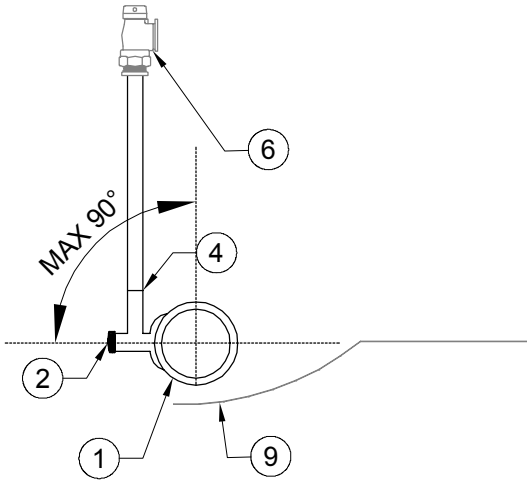
NO. DESCRIPTION

1. HDPE WATER MAIN
2. HDPE SERVICE TAPPING SADDLE WITH CAP AND CUTTER
3. HDPE WATER TUBING (SDR-9 CTS)
4. BUTT FUSION JOINT
5. FINISHED GRADE OF STREET
6. 5/8" X 3/4" ANGLE BALL VALVE WITH LOCK WINGS, YOKE STAR NUT X CTS COMPRESSION
7. WATER METER
8. METER BOX ASSEMBLY. SEE STANDARD DETAIL.
9. TRACER WIRE - CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK BLUE HDPE INSULATION
10. 5/8-INCH X 3/4-INCH BRASS 90° YOKE STAR NUT X CTS COMPRESSION CONNECTOR
11. TYPE K COPPER TUBING OR HDPE SDR-9 (CTS) TUBING WITH INSERT STIFFENERS
12. CURB AND GUTTER

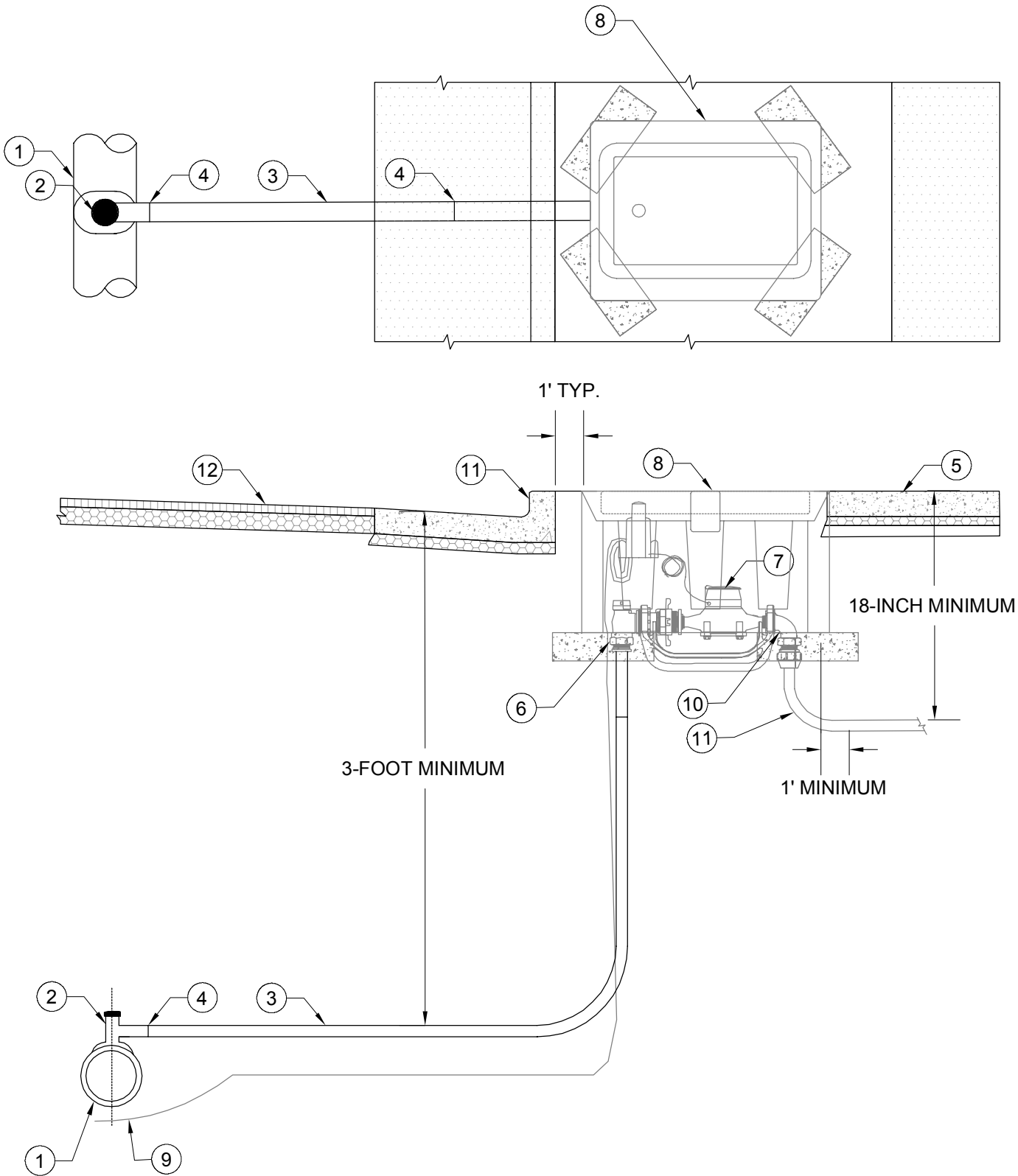
NOTES:

- A. METER LOCATION WHERE SIDEWALK AND CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
- B. ANGLED OPTION IS ONLY ALLOWED WITH CHARLOTTE WATER APPROVAL

OPTION - ANGLED TAPPING SADDLE WITH METER ABOVE MAIN



TAPPING SADDLE WITH CAP AND CUTTER



NO SCALE

STANDARD NO.

HD19

VERSION NO.

1.0

VERSION DATE

2016-05-12

HDPE SERVICE CONNECTION TAP ON  
HDPE PIPE (3/4-INCH TO 1-INCH)

CHARLOTTE WATER

STANDARD DETAILS

HDPE - WATER

CHARLOTTE  
WATER

A CITY OF ALABAMA WATER TREATMENT

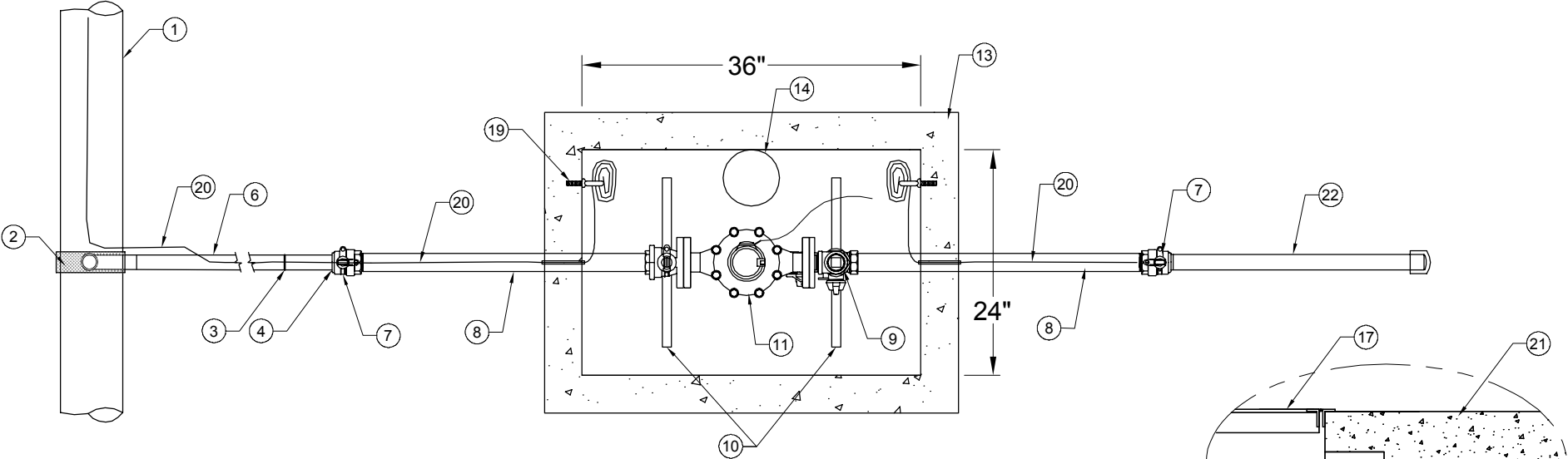
NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- B. ALL PIPE SHALL BE RESTRAINED FROM TAP TO PROPERTY LINE VALVE.
- C. VAULT SHALL BE RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.
- D. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
- E. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE".
- F. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857.

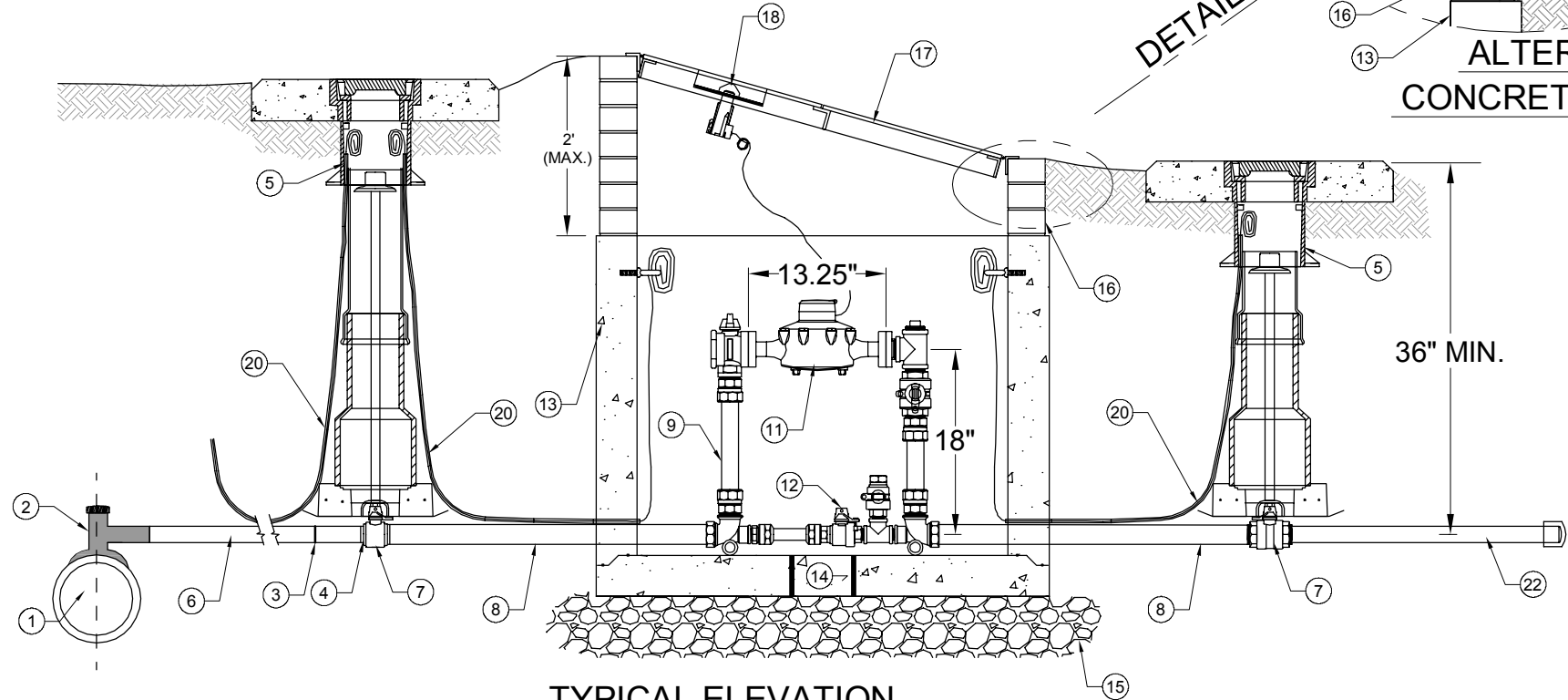
- G. REBARS SHALL BE GRADE 60 PER ASTM A615.
- H. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
- I. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS.
- J. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 4-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL).
- K. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.
- L. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

NO. DESCRIPTION

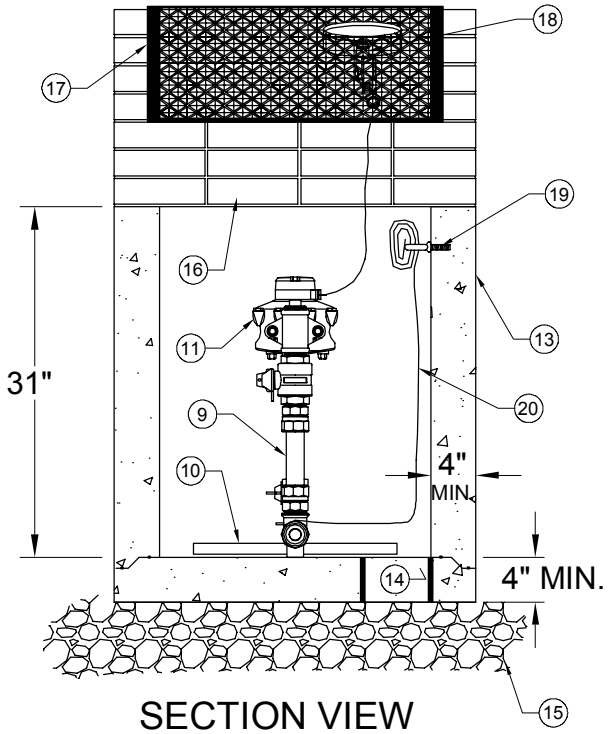
1. HDPE WATER MAIN
2. HDPE SERVICE TAPPING SADDLE WITH CAP AND CUTTER
3. HDPE BUTT FUSION JOINT
4. BUTT FUSION X THREADED (MNPT) ADAPTER
5. STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES (OMIT AT CORPORATION STOP ON SHORT SIDE SERVICE)
6. 1 1/2" SDR-9 IPS HDPE PIPE
7. 1 1/2" BRASS BALL VALVE (FNPT x FNPT)
8. 1 1/2" RED BRASS PIPE NIPPLE (L = 30" )
9. 1 1/2" BRASS METER SETTER ASSEMBLY - FORD #VB-76-95311-05, MUELLER #098B 242343, CAMBRIDGE #6020-718F6F6-UUBS OR MCDONALD #720B618WTFF, NO SOLDER JOINTS PERMITTED
10. 3/4" SCH 40 RED BRASS NIPPLE (L=18") x 2 EACH
11. 1 1/2" WATER METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CONTRACTOR)
12. BY PASS BALL VALVE WITH LOCK WINGS - LOCK VALVE IN CLOSED POSITION (SERIAL NUMBERED STUD LOCK - FURNISHED BY CHARLOTTE WATER)
13. PRECAST CONCRETE SERVICE VAULT (36" x 24" x 31")
14. 6" DIAMETER SUMP HOLE
15. 6" COMPACTED #57 OR #67 WASHED STONE
16. MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2 FT.
17. 24" x 36" ACCESS DOOR - SEE STANDARD DETAIL
18. AMR (ERT) TRANSMITTER
19. 3/8" DIAMETER GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
20. AWG #12 GAUGE SOLID COPPER TRACER WIRE 20 MILS HDPE BLUE INSULATION (THWN) - TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYP)
21. CAST IN PLACE CONCRETE SIDEWALK - BRICK WORK SHALL NOT EXTEND TO SURFACE, ACCESS DOOR SHALL REST ON SIDEWALK
22. 1 1/2" TYPE K COPPER TUBING TAIL PIECE - L = 24" MIN. - CAP END



TYPICAL PLAN



TYPICAL ELEVATION



SECTION VIEW

NO SCALE

STANDARD NO.

HD20

VERSION NO. 1.0

VERSION DATE 2016-05-12

HDPE SERVICE CONNECTION TAP  
ON HDPE PIPE (1 1/2-INCH)

CHARLOTTE WATER

STANDARD DETAILS

HDPE - WATER

CHARLOTTE  
WATER

A CITY OF ALABAMA WATER TREATMENT



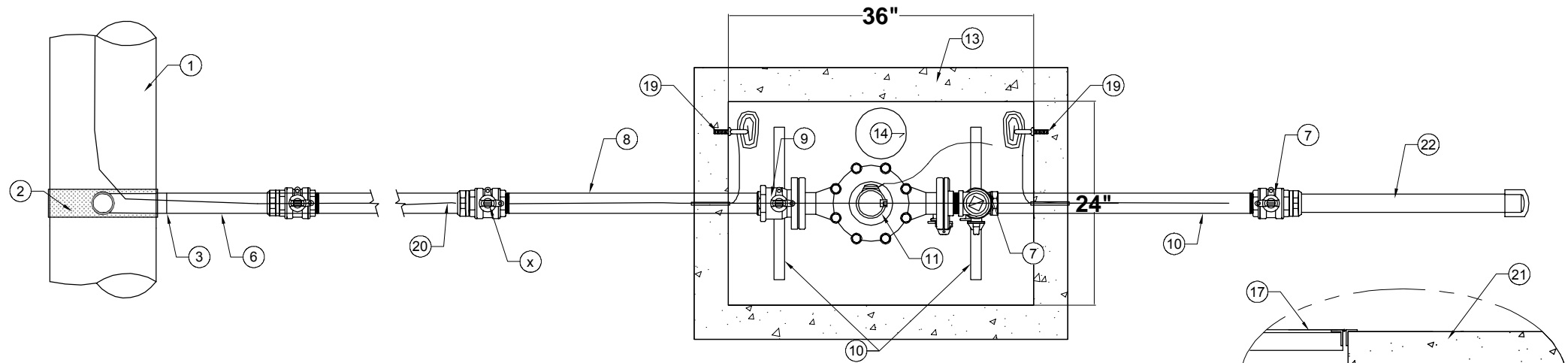
NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- B. ALL PIPE SHALL BE RESTRAINED FROM TAP TO PROPERTY LINE VALVE.
- C. VAULT SHALL BE RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.
- D. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
- E. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE".
- F. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857.

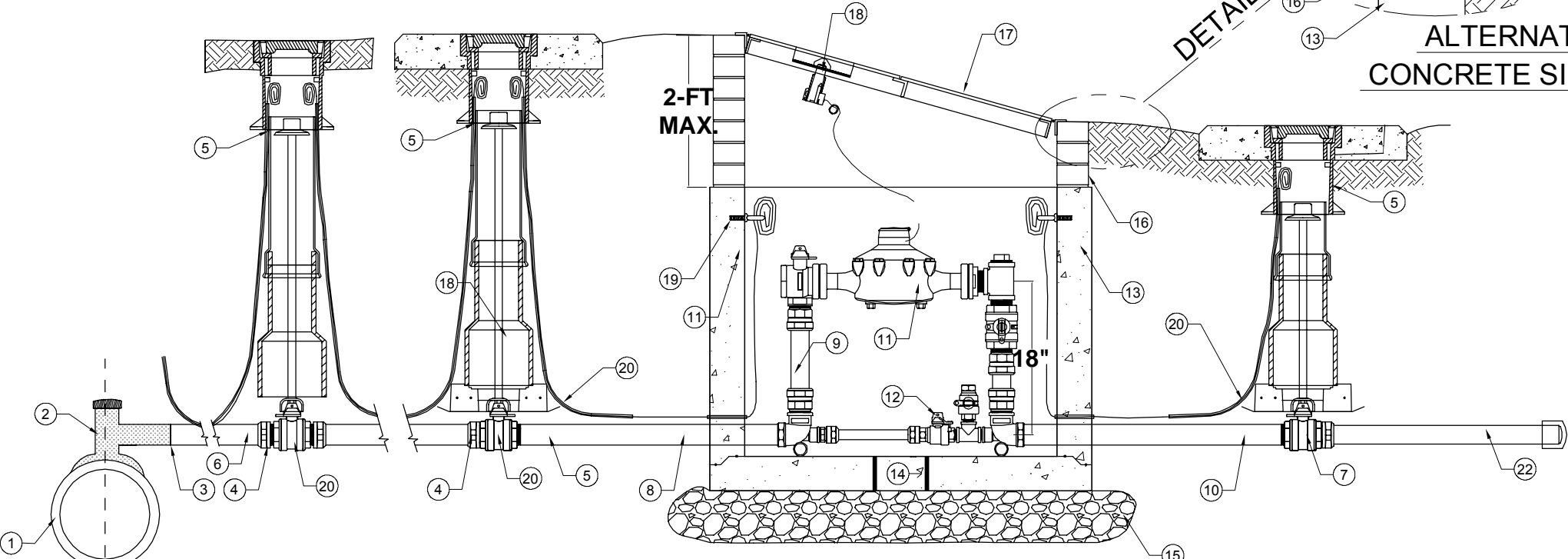
- G. REBARS SHALL BE GRADE 60 PER ASTM A615.
- H. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
- I. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS.
- J. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 4-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL).
- K. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.
- L. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

NO. DESCRIPTION

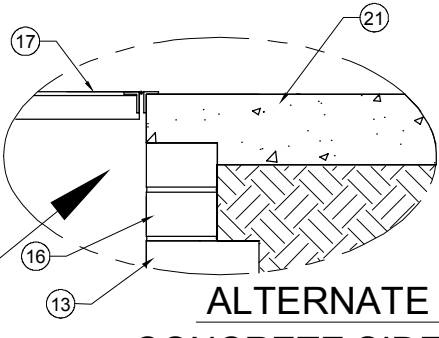
1. HDPE WATER MAIN
2. HDPE SERVICE TAPPING SADDLE WITH CAP AND CUTTER
3. HDPE BUTT FUSION JOINT
4. BUTT FUSION X THREADED (MNPT) ADAPTER
5. STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES (OMIT AT CORPORATION STOP ON SHORT SIDE SERVICE)
6. 2" SDR-9 IPS HDPE PIPE
7. 2" BRASS BALL VALVE (FNPT x FNPT)
8. 2" RED BRASS PIPE NIPPLE (L = 30" )
9. 2" BRASS METER SETTER ASSEMBLY - FORD #VB-76-95311-05, MUELLER #098B 242343, CAMBRIDGE #6020-718F6F6-UUBS OR MCDONALD #720B618WTFF, NO SOLDER JOINTS PERMITTED
10. 3/4" SCH 40 RED BRASS NIPPLE (L=18") x 2 EACH
11. 2" WATER METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CONTRACTOR)
12. BY PASS BALL VALVE WITH LOCK WINGS - LOCK VALVE IN CLOSED POSITION (SERIAL NUMBERED STUD LOCK - FURNISHED BY CHARLOTTE WATER)
13. PRECAST CONCRETE SERVICE VAULT (36" x 24" x 31")
14. 6" DIAMETER SUMP HOLE
15. 6" COMPACTED #57 OR #67 WASHED STONE
16. MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2 FT.
17. 24" x 36" ACCESS DOOR - SEE STANDARD DETAIL
18. AMR (ERT) TRANSMITTER
19. 3/8" DIAMETER GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
20. AWG #12 GAUGE SOLID COPPER TRACER WIRE 20 MILS HDPE BLUE INSULATION (THWN) - TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYP)
21. CAST IN PLACE CONCRETE SIDEWALK - BRICK WORK SHALL NOT EXTEND TO SURFACE, ACCESS DOOR SHALL REST ON SIDEWALK
22. 2" TYPE K COPPER TUBING TAIL PIECE - L = 24" MIN. - CAP END.



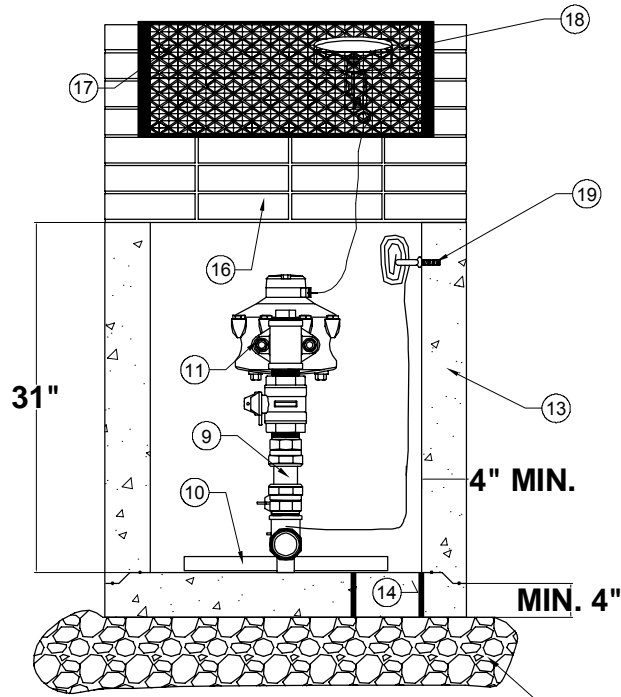
TYPICAL PLAN



TYPICAL ELEVATION



ALTERNATE IN CONCRETE SIDEWALK



SECTION VIEW

NO SCALE

STANDARD NO.

HD21

VERSION NO.

1.0

VERSION DATE

2016-05-12

HDPE SERVICE CONNECTION TAP  
ON HDPE PIPE (2-INCH)

CHARLOTTE WATER

STANDARD DETAILS

HDPE - WATER

CHARLOTTE WATER

WATER

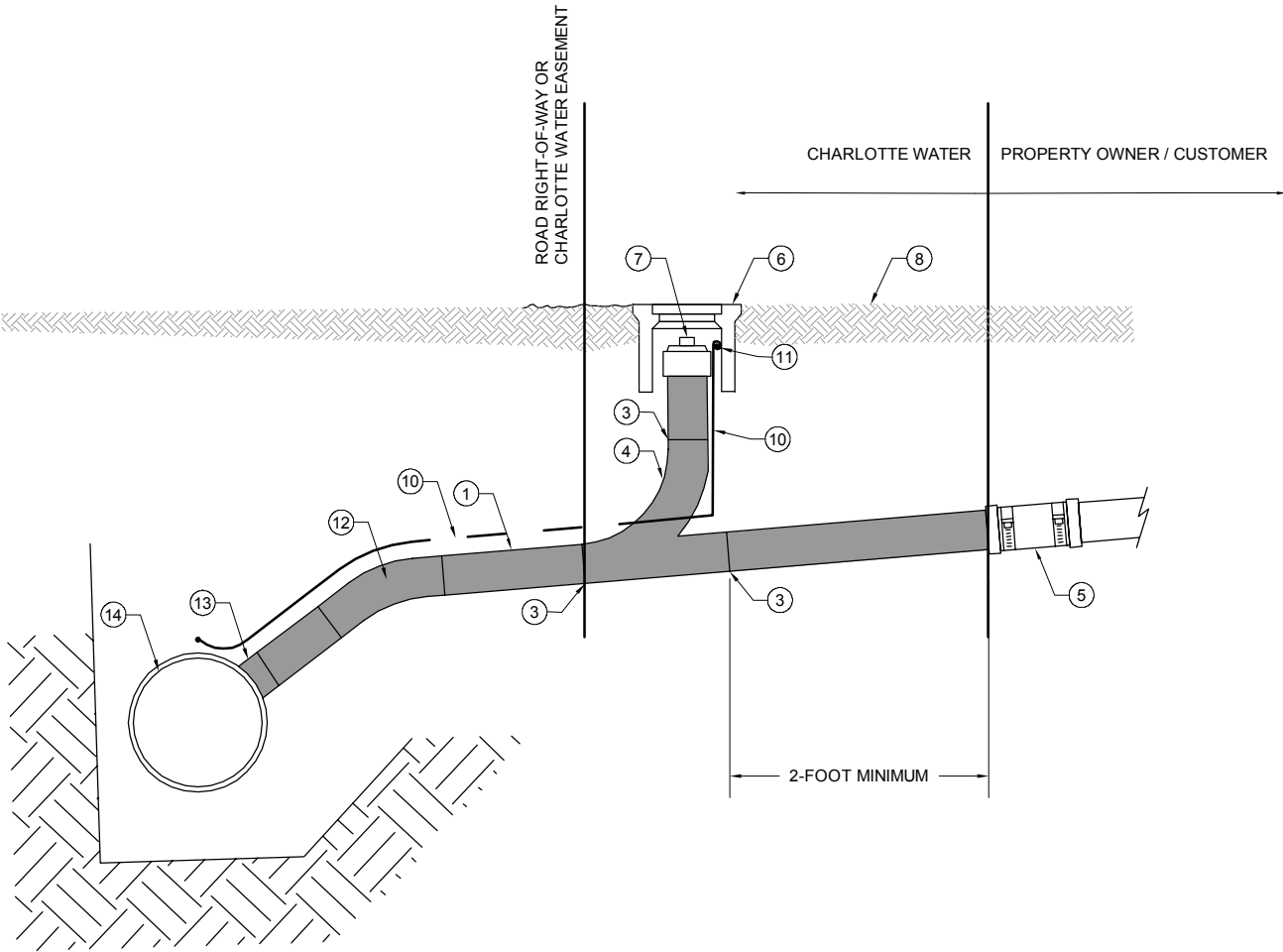
A CITY OF ALABAMA WATER TREATMENT

NO. DESCRIPTION

- 1. HDPE GRAVITY SEWER PIPE - DR17, BUTT FUSED OR ELECTROFUSED
- 2. CUSTOMER SEWER LATERAL
- 3. ELECTROFUSION COUPLING OR BUTT FUSION JOINT
- 4. HDPE LONG RADIUS WYE
- 5. FLEXIBLE, SHIELDED, COUPLING WITH SHEAR BAND
- 6. CAST IRON SEWER VALVE BOX TOP SECTION AND LID
- 7. LID
- 8. FINISH GRADE
- 9. TRACER WIRE-CONTINUOUS AWG NO. 12 GAUGE SOLID COPPER TRACER WIRE WITH 30 MIL THICK GREEN HDPE INSULATION.
- 10. TRACER WIRE TERMINATION. SEE STANDARD DETAIL.
- 12. BEND - 22.5-DEGREE OR 45-DEGREE
- 13. ELECTROFUSION SADDLE TEE
- 14. HDPE SEWER MAIN INSTALLED BY PIPE BURSTING

NOTES:

- A. MINIMUM LATERAL SLOPE SHALL BE 1.0%.
- B. BASED ON SITE CONDITIONS, CHARLOTTE WATER MAY APPROVE THE CLEANOUT INSIDE THE ROAD RIGHT-OF-WAY.
- C. SEWER MAIN, SADDLE TEE, AND BEND SHALL BE COMPLETELY EMBEDDED WITH #57 OR #67 WASHED STONE.



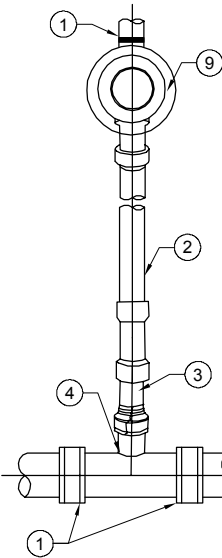
NO. DESCRIPTION

- 1. RUBBER COUPLING
- 2. NEW HDPE SEWER LATERAL (DR 17)
- 3. TRANSITION COUPLING
- 4. EPOXY SADDLE
- 5. ELECTROFUSION SADDLE
- 6. STRAPPED RUBBER SADDLE (PVC HUB, RUBBER SADDLE, AND SS BAND)
- 7. FABRICATED HDPE TEE
- 8. EXISTING SEWER LATERAL
- 9. CLEAN OUT

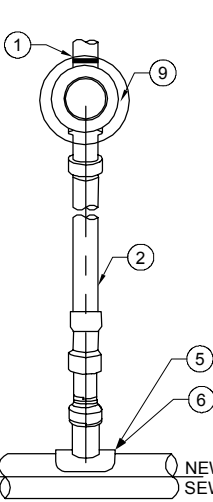
NOTES:

- A. RUBBER COUPLINGS SHALL BE SHIELDED TYPE WITH STAINLESS STEEL SERIES 300 BANDSCREW AND HOUSING WITH SHEAR BAND.
- B. RUBBER SADDLES SHALL BE SEALED WITH AN ELASTOMERIC SEALANT. SEE SPECIFICATIONS.
- C. CHANGES IN PIPE TYPE AND CONNECTIONS ARE NOTED ON THE DRAWINGS
- D. IF ADDITIONAL COUPLINGS ARE NEEDED TO MAKE A CONNECTION, THE CONTRACTOR SHALL USE ELECTROFUSION COUPLINGS
- E. ELECTROFUSION SADDLES SHALL CONSIST OF A FUSION SADDLE WITH AN INTEGRAL FUSION COUPLER AT ITS OUTLET.

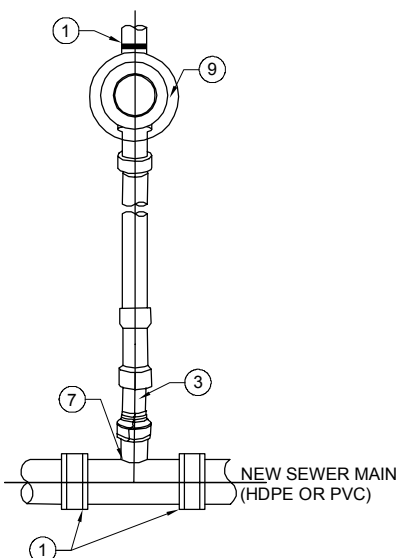
NEW HDPE LATERAL INTO EXISTING SEWER



NEW HDPE LATERAL INTO NEW OR EXISTING HDPE SEWER



EXISTING LATERAL INTO NEW HDPE OR PVC SEWER



NO SCALE

STANDARD NO.

HD22

VERSION NO.

1.0

VERSION DATE

2016-05-12

4-INCH TO 6-INCH SEWER CLEANOUT AND LATERAL ON HDPE PIPE BY PIPE BURSTING

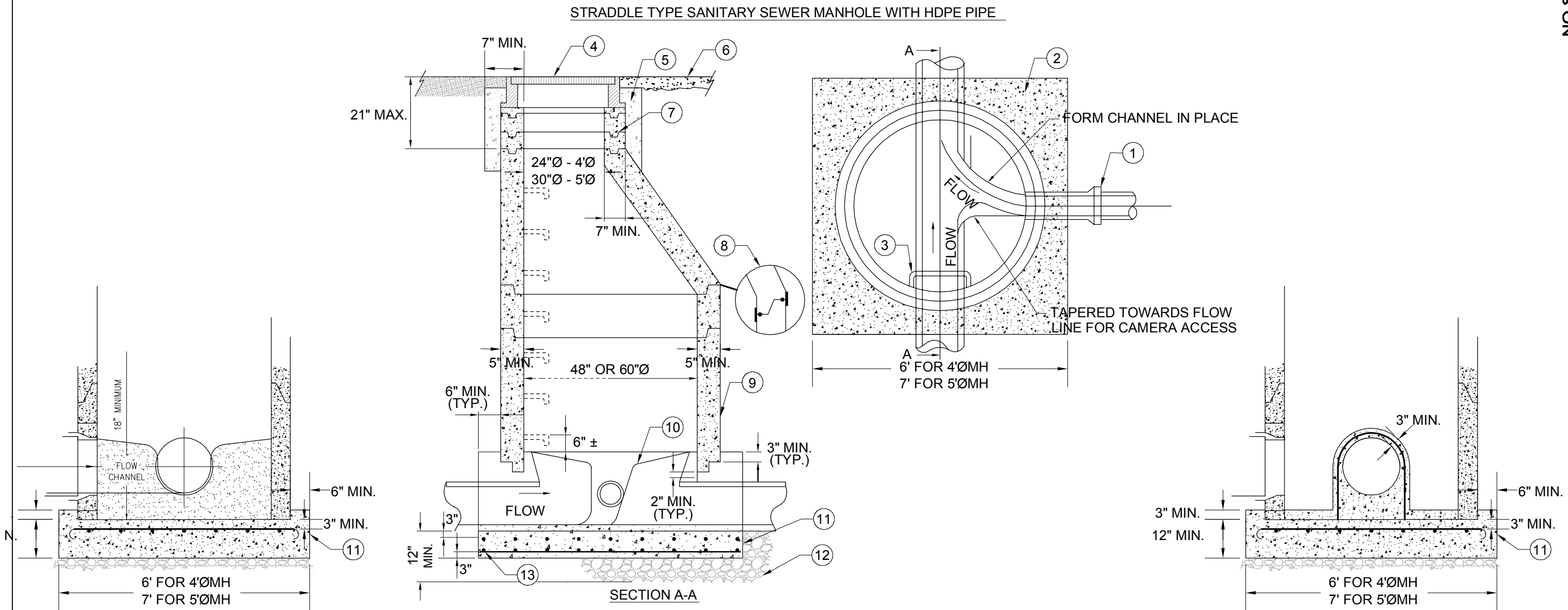
CHARLOTTE WATER

STANDARD DETAILS

HDPE - SEWER

CHARLOTTE WATER

A CITY OF ALABAMA CITY DEPARTMENT

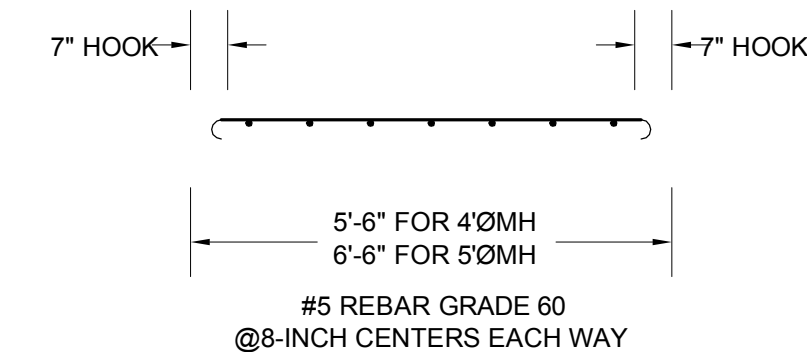


**NO. DESCRIPTION**

1. PIPE JOINT. SEE STANDARD DETAIL FOR NEW PIPE CONNECTION AT MANHOLE
2. POURED IN PLACE CONCRETE BASE - 3600 PSI CONCRETE
3. POLYPROPYLENE SAFETY STEPS INSTALLED ON UPSTREAM SIDE - 4-FOOT Ø MH OVER WIDEST SHELF - 5-FOOT Ø MH
4. MANHOLE FRAME AND COVER. SEE STANDARD DETAIL.
5. CONCRETE COLLAR, POURED IN PLACE. 10-INCH MINIMUM DEPTH (REQUIRED IN ROADWAY)
6. GRADE WITHIN RIGHT-OF-WAY
7. PRECAST CONCRETE GRADE RINGS AS REQUIRED
8. BUTYL RUBBER ROPE BETWEEN ALL JOINTS AND TAPE OUTSIDE OF BARREL SECTIONS AND GRADE RINGS (TYPICAL)
9. PRECAST MANHOLE SECTIONS CONFORMING TO ATSM C-478, AS MODIFIED.
10. MINIMUM SHELF SLOPE OF 1:12
11. CONCRETE BASE, 3,600 PSI CONCRETE
12. COMPACTED #57 OR #67 WASHED STONE UNDER CONCRETE BASE
13. #5 REBAR AT 18" O.C. BOTH WAYS. REBAR SHALL HAVE A MINIMUM CLEARANCE OF 3-INCHES WHEN CONCRETE IS NOT FORMED

**NOTES:**

- A. ALL PIPE OPENINGS SHALL BE NO GREATER THAN 3-INCH LARGER THAN THE OUTSIDE DIAMETER OF THE PIPE.
- B. BASE SECTION SHALL BE REINFORCED WITH A MINIMUM AREA OF 0.20 SQUARE INCHES PER LINEAR FOOT EACH WAY.
- C. ALL PRECAST SECTIONS SHALL BE DESIGNED FOR H-20 LOADING + IMPACT + LIVE LOAD + DEAD LOAD.



**NO SCALE**

**STANDARD NO.**

**HD23**

**VERSION NO.**

**1.0**

**VERSION DATE**

**2016-05-12**

**SADDLE TYPE MANHOLE CONNECTION  
ON HDPE PIPE (8-INCH AND LARGER)**

**CHARLOTTE WATER**

**STANDARD DETAILS**

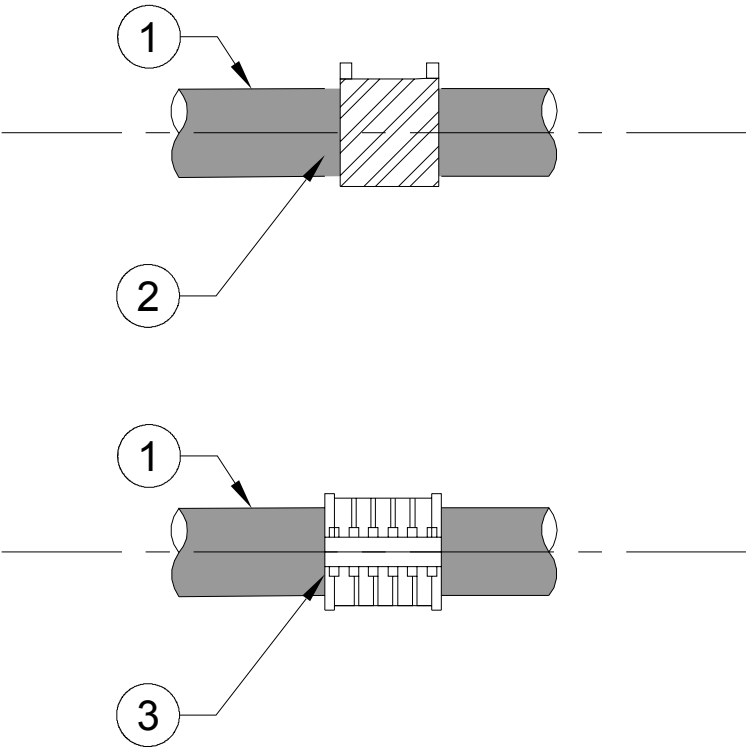
**HDPE - SEWER**

**CHARLOTTE  
WATER**

A CITY OF ALABAMA WATER REBATEMENT

NO.	DESCRIPTION
1.	EXISTING HDPE WATER MAIN
2.	WRAP AROUND REPAIR CLAMP
3.	SOLID RESTRAINED SLEEVE

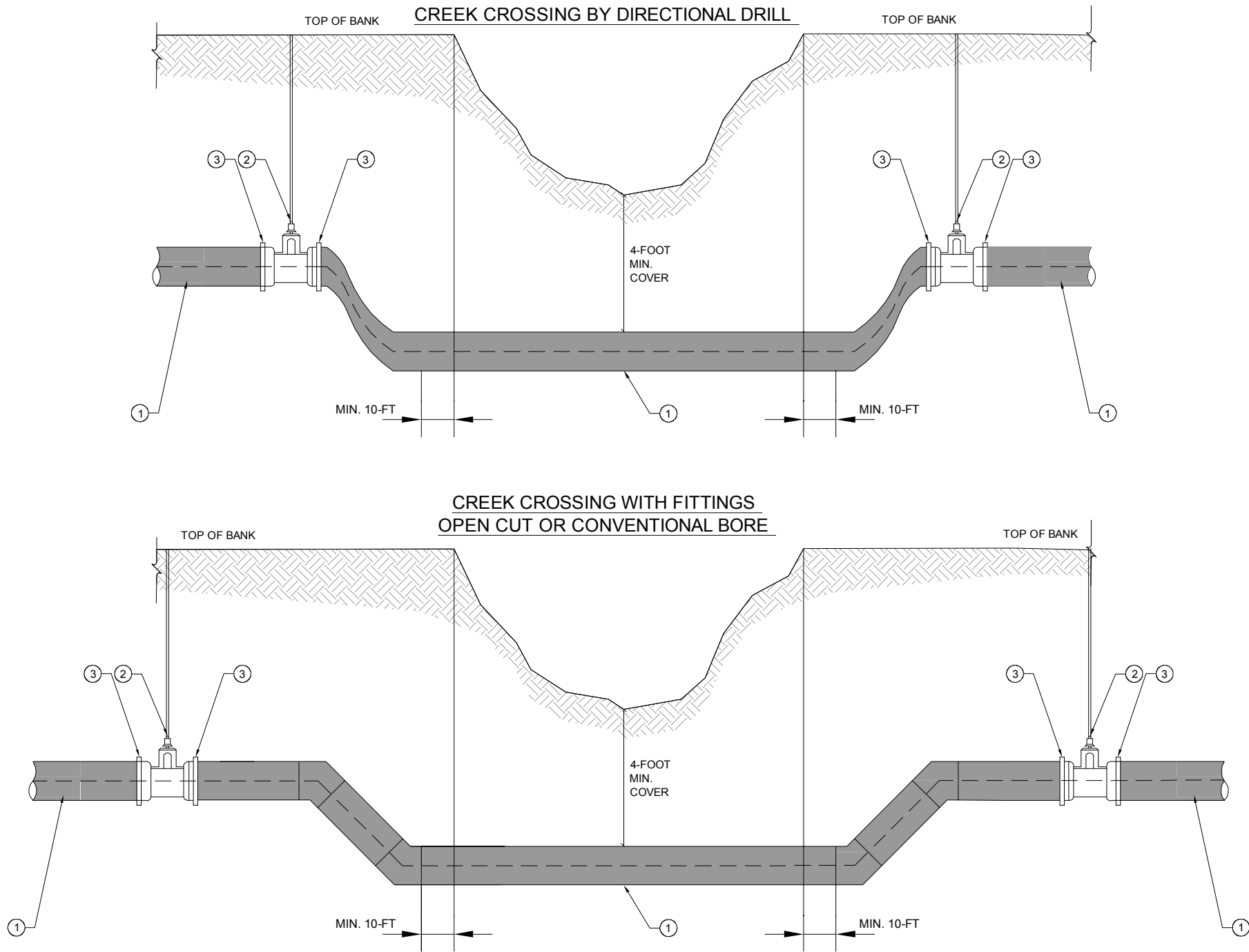
- SMALL PUNCTURE REPAIR NOTES:**
- A. SMALL PUNCTURE DAMAGE IS DEFINED AS ONE INCH OR SMALLER PUNCTURE IN ONE PIPE WALL.
  - B. PREFERRED REPAIR METHOD FOR SMALL PUNCTURE IS ELECTROFUSION PATCH. MECHANICAL COUPLING IS ALLOWED WHEN PIPE CAN NOT BE DRIED, UPON APPROVAL OF CHARLOTTE WATER INSPECTOR.
  - C. BEFORE ADDING FITTING, DRILL SMALL HOLE AT EACH END OF DAMAGE TO PREVENT CRACK PROPAGATING.
  - D. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
  - E. MECHANICAL FITTINGS USED WITH HDPE PIPE SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
  - F. MINIMUM CLAMP WIDTH IS 12-INCHES. MINIMUM CLAMP WIDTH IS 5-INCHES ON EITHER SIDE OF PUNCTURE, FOR 10" NOMINAL DIAMETER PIPE AND LARGER.



**SMALL PUNCTURE REPAIR**

**NOTES TO DESIGNER**  
A. REFER TO PPI TN-34  
(INSTALLATION GUIDELINES  
FOR ELECTROFUSION  
COUPLINGS 14" AND LARGER)

CHARLOTTE <b>WATER</b>	CHARLOTTE WATER STANDARD DETAILS HDPE	EXISTING HDPE PIPE REPAIR (MAINTENANCE REPAIRS ONLY)		NO SCALE
		STANDARD NO.	HD24	VERSION NO. 1.0
			VERSION DATE	2016-05-12



**NO. DESCRIPTION**

- 1. HDPE WATER MAIN CARRIER PIPE
- 2. VALVE
- 3. HDPE RESTRAINED JOINT ADAPTER WITH STEEL PIPE STIFFENER

**NOTES:**

- A. FITTINGS SHALL MEET THE REQUIREMENTS OF AWWA C906.
- B. MECHANICAL FITTINGS USED WITH HDPE PIPE SHALL BE SPECIFICALLY DESIGNED FOR USE WITH HDPE PIPE.
- C. STAINLESS STEEL INTERNAL STIFFENERS SHALL BE INSTALLED IN THE END OF THE HDPE PIPE WHEN HDPE PIPE IS INSERTED INTO THE BELL END OF NON-HDPE PIPE, VALVE, FITTING, OR INTO THE HUB OF A BOLTED COUPLING
- D. ALLOWABLE TENSILE LOAD FOR PIPE MAY NOT BE EXCEEDED WHEN PULLING CARRIER PIPE THROUGH HORIZONTAL DIRECTIONAL DRILL (HDD). PROVIDE SEALED CALCULATIONS.
- E. LOCATE VALVES IN ACCESSIBLE LOCATION AT TOP OF BANK WITHIN 100 TO 1,000 LINEAR FEET OF TOP OF BANK ON BOTH SIDES OF CENTERLINE OF CREEK.

**NOTES TO DESIGNER**

- A. CALL OUT TYPE OF VALVE ON PLANS.
- B. PROVIDE DESIGN CALCULATIONS PER ASTM F1962, STANDARD GUIDE FOR USE OF MAXI-HORIZONTAL DIRECTIONAL DRILLING FOR PLACEMENT OF PE PIPE OR CONDUIT UNDER OBSTACLES, INCLUDING RIVER CROSSINGS. PROVIDE SEALED CALCULATIONS FOR PULLBACK FORCE, TENSILE STRESS, EXTERNAL PRESSURE, BENDING STRESS, THERMAL STRESSES AND STRAINS, AND TORSION STRESS.
- C. PROVIDE SEALED FLOTATION DESIGN CALCULATIONS COMPLYING WITH THE MINIMUM REQUIREMENTS OF CHAPTER 6 SECTION 3 OF "THE HANDBOOK OF POLYETHYLENE PIPE" REVISION 3 OR LATER BY PPI.

NO SCALE

STANDARD NO.

HD25

VERSION NO.

1.0

VERSION DATE

2016-05-12

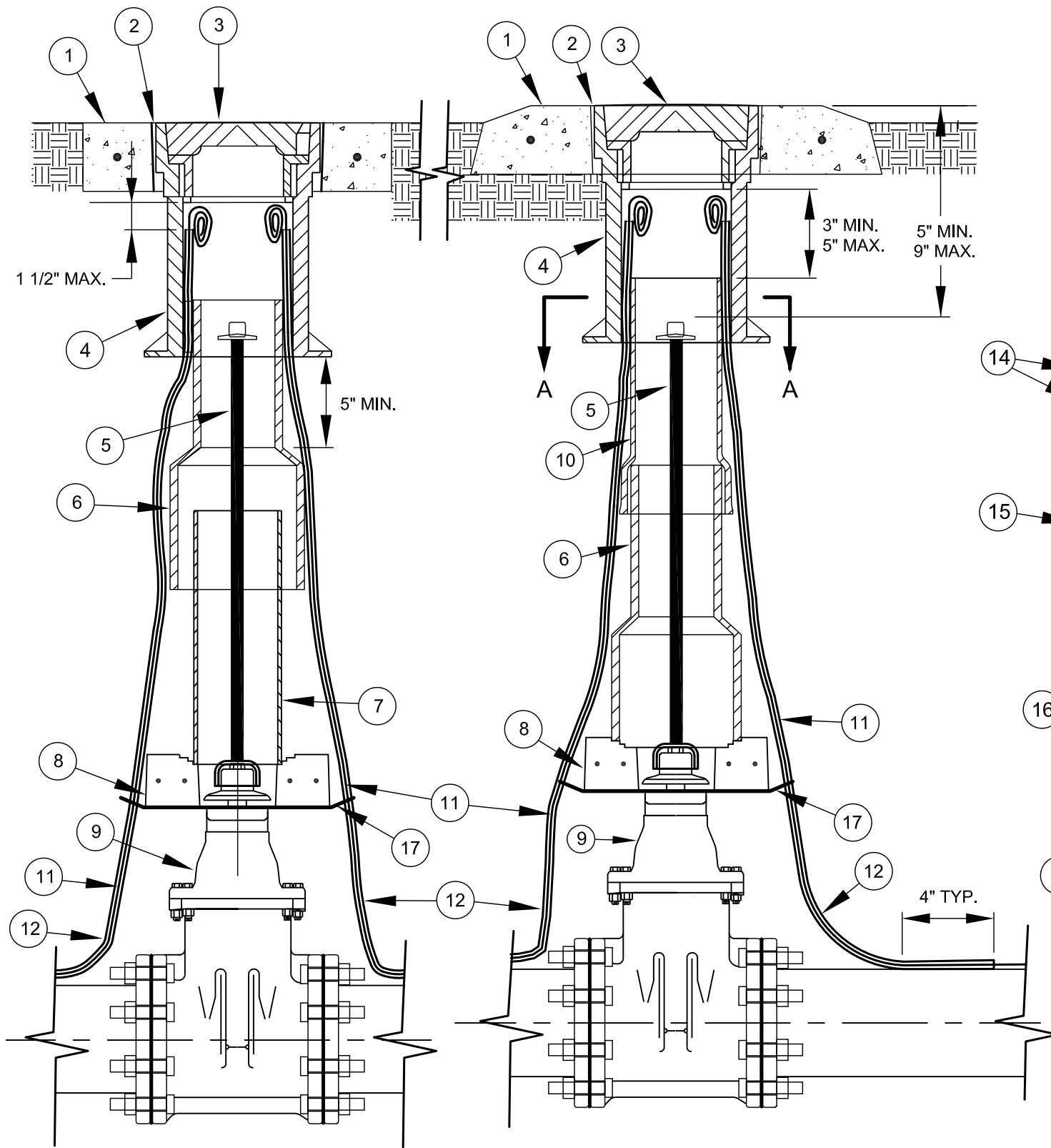
**HDPE CREEK CROSSING**

CHARLOTTE WATER

STANDARD DETAILS

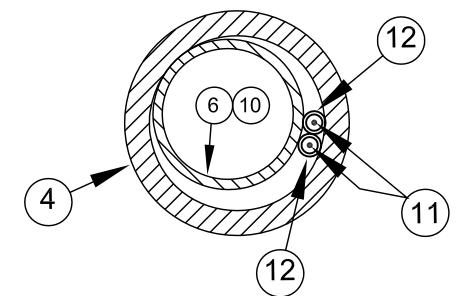
HDPE

CHARLOTTE  
**WATER**

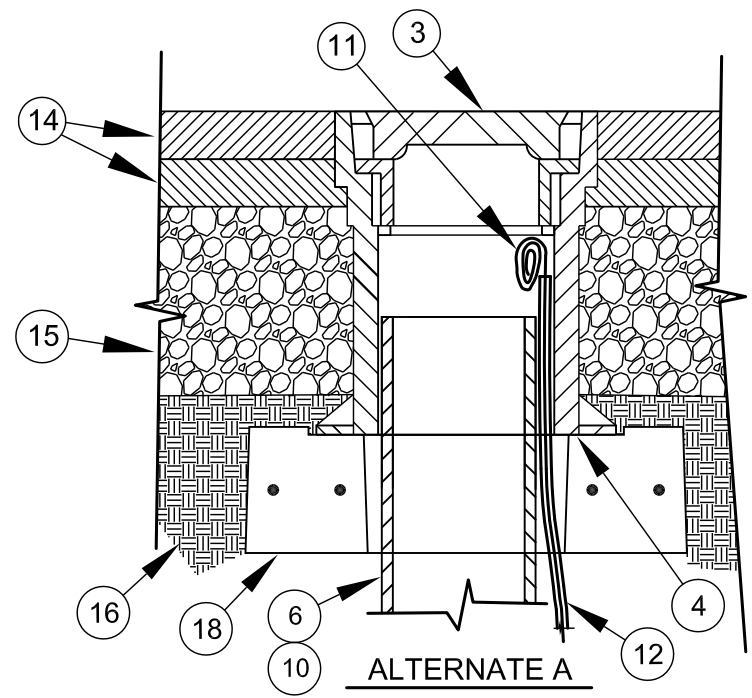


TYPE 1  
USING PVC PIPE

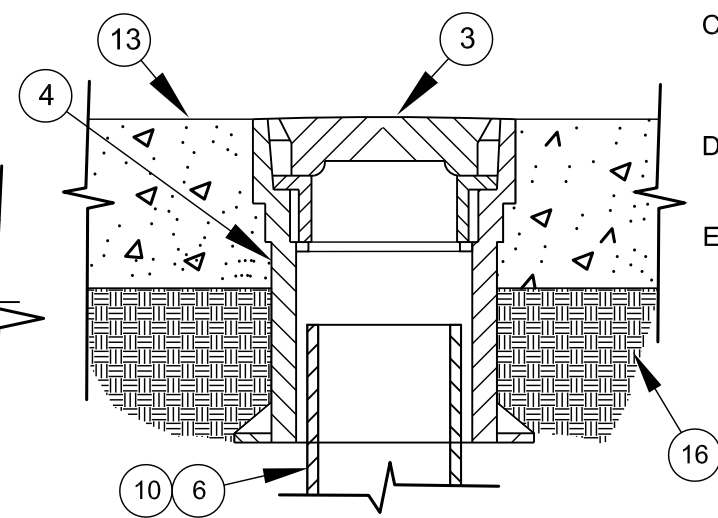
TYPE 2  
USING CAST IRON SOIL PIPE



SECTION A-A



ALTERNATE A  
SET IN ASPHALT




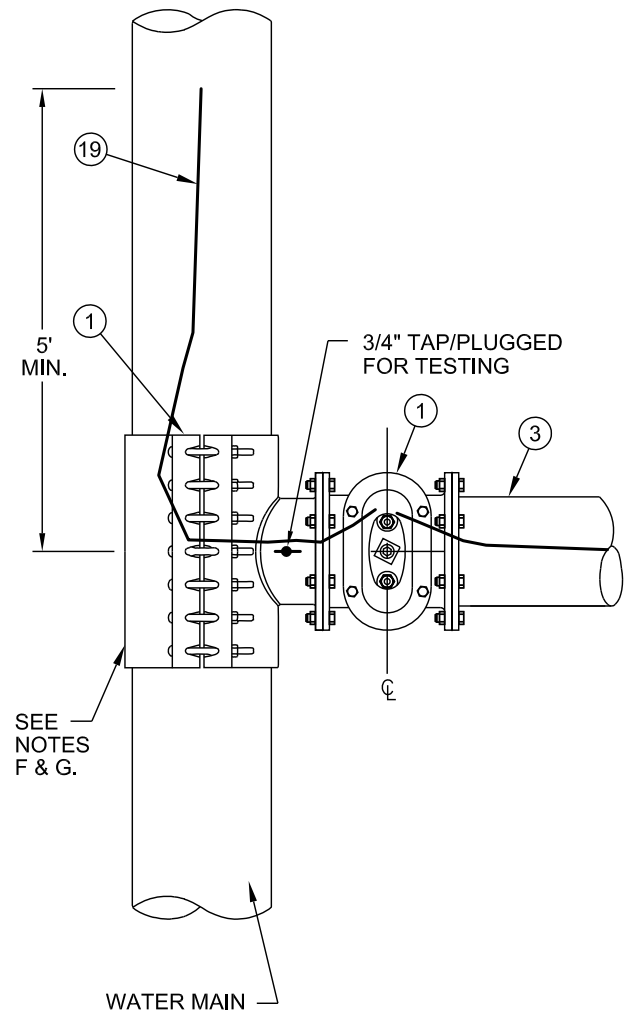
ALTERNATE B  
CAST IN CONCRETE

- | NO. | DESCRIPTION  |
|-----|--|
| 1.  | 18" x 18" PRECAST ( OR CAST IN PLACE ) CON-<br>CRETE PAD OR 24" DIAMETER PRECAST PAD.  |
| 2.  | NON - SHRINK GROUT - IN ANNULAR SPACE.   |
| 3.  | VALVE BOX COVER.   |
| 4.  | TOP SECTION VALVE BOX.   |
| 5.  | EXTENSION STEM AS REQUIRED. SEE NOTES  |
| 6.  | BOTTOM SECTION VALVE BOX.  |
| 7.  | 6" PVC PIPE ( C900 OR SDR 26 ).  |
| 8.  | PRECAST CONCRETE FOOTING - TYPE II - SEE DETAIL.   |
| 9.  | GATE VALVE ( OR BALL VALVE, AS APPLICABLE ).   |
| 10. | 5" DIA. CAST IRON SOIL PIPE - BELL OF PIPE WILL<br>RECEIVE BOTTOM SECTION OF VALVE BOX.  |
| 11. | AWG #12 GAUGE COPPER TRACER WIRE (THWN)<br>WITH BLUE INSULATION, TERMINATE WITH 24 INCH<br>EXCESS WIRE (COILED) AT METER BOX AND<br>VALVE BOX (TYP.) |
| 12. | 1/4" OR 3/8" ID CONDUIT - SDR 9 PEX TUBING -<br>ASTM F 876.  |
| 13. | CONCRETE ( ROADWAY, DRIVEWAY OR SIDEWALK )   |
| 14. | ASPHALT PAVEMENT.  |
| 15. | COMPACTED AGGREGATE BASE COURSE ( CABC )<br>OR ASPHALT BASE COURSE.  |
| 16. | COMPACTED SUBGRADE.  |
| 17. | NONWOVEN GEOTEXTILE FABRIC - 18" x 18" - 2<br>LAYERS - MIRAFI #140N OR CARTHAGE MILLS # FX - 40HS.   |
| 18. | PRECAST CONCRETE FOOTING - TYPE I - SEE DETAIL.  |

- NOTES:
- A. CONCRETE FOOTING TO BE CENTERED OVER VALVE NUT, AND SHALL NOT BEAR ON VALVE BODY.
  - B. PROVIDE CLEARANCE BETWEEN VALVE FOOTING AND THE VALVE.
  - C. WHEN OPERATING NUT DEPTH EXCEEDS 3'-0" BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STANDARD 2" SQUARE OPERATING NUT IN TOP SECTION OF VALVE BOX. SEE STANDARD DETAIL.
  - D. VALVE BOX ASSEMBLY SHALL CONSIST OF NO MORE THAN 3 VERTICAL SECTIONS - 1 TOP SECTION, 1 - BOTTOM SECTION, AND 1 - PIPE RISER SECTION.
  - E. CONCRETE PADS SHALL NOT BE USED IN PAVEMENT ( CONCRETE OR ASPHALT ), SIDEWALKS OR DRIVEWAYS.

NO SCALE

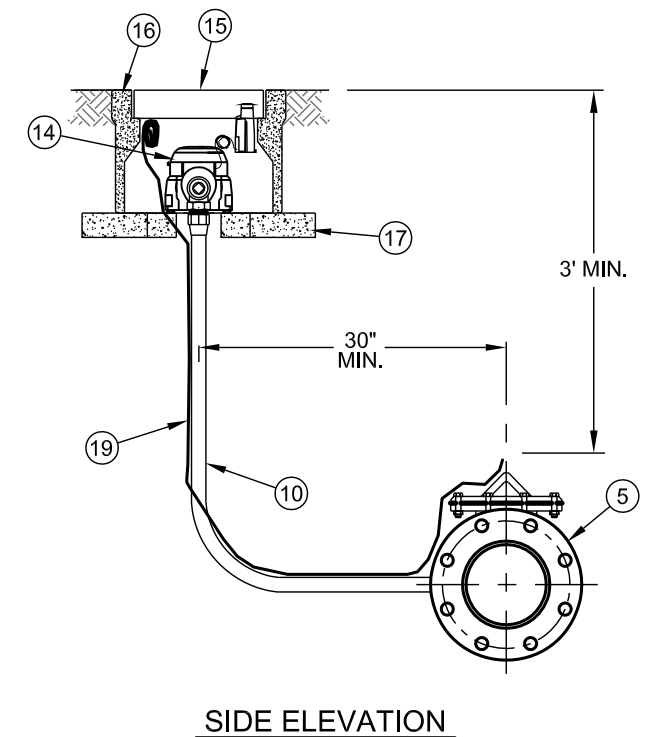
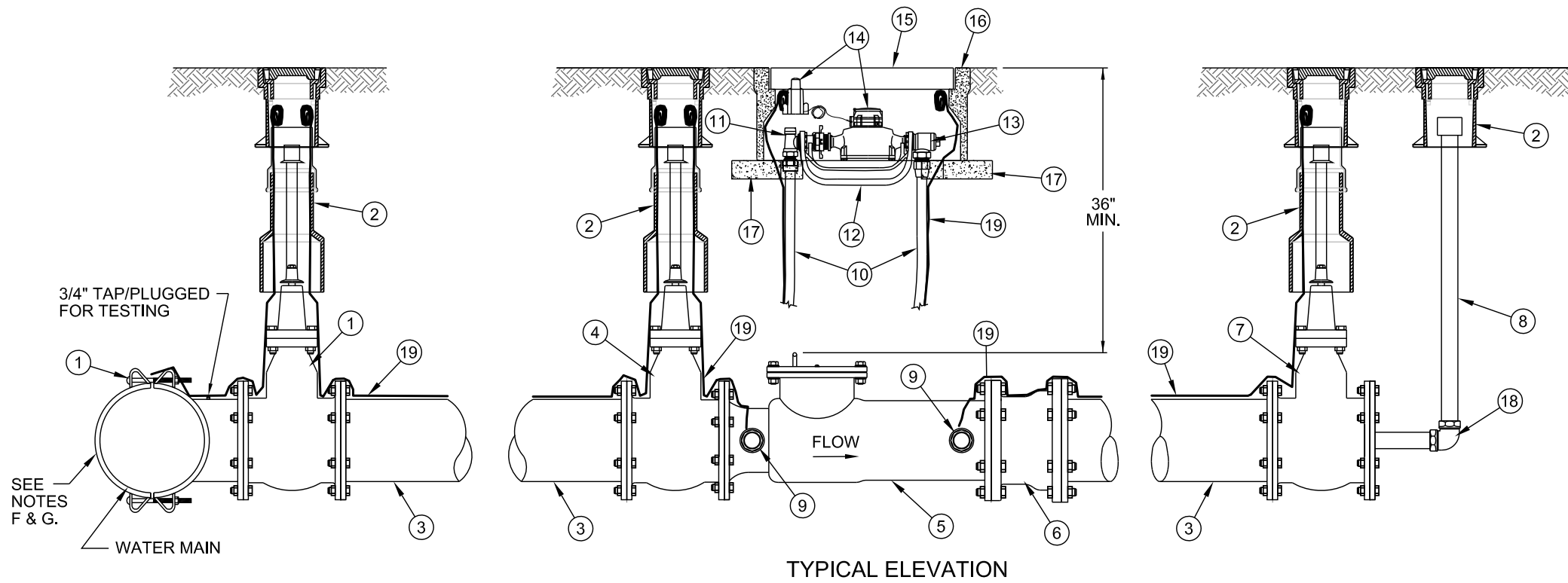
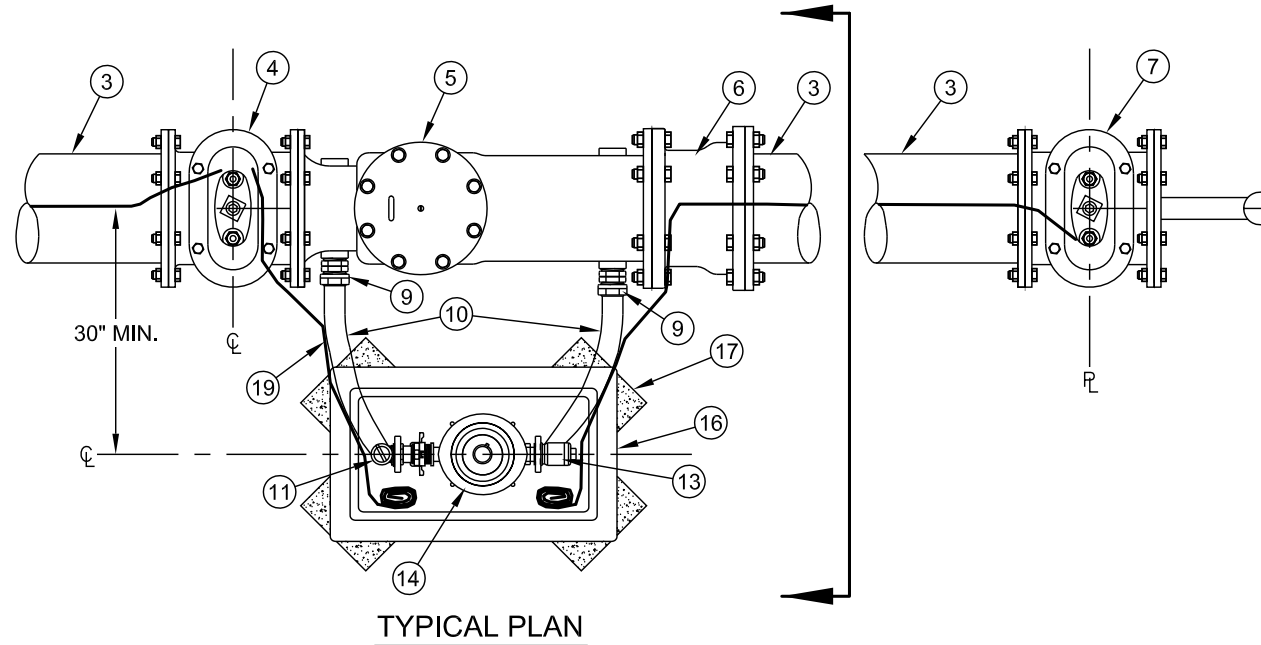
	<b>CHARLOTTE-MECKLENBURG UTILITIES</b>		STANDARD NO. <b>HH</b>
	<b>VALVE BOX ASSEMBLY INSTALLATION - 12" AND SMALLER VALVES</b>		VERSION NO. <b>V1.0</b>
	<b>STANDARD DETAILS</b> WATER		VERSION DATE <b>1.14.2011</b>



FIRE SERVICE SIZE	DETECTOR METER SIZE
4"	1"
6"	1"
8"	1"
10"	1"

NOTES:

- ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.
- METER BOX TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM METER BOX.
- ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. ⑦.
- ONE INCH METER SHALL BE INSTALLED IN STANDARD CONCRETE METER BOX PER STD. DETAIL.
- WRAP TAPPING SLEEVE WITH 2 LAYERS HDPE PLASTIC FILM (HDCLPE PER AWWA C-105) - 4 MILS EACH LAYER - EXTEND HDPE 2 FT. EACH WAY FROM SLEEVE - DUCT TAPE OR ZIP LOCK TIE ENDS.
- CONCRETE THRUST BLOCKING REQUIRED AT TAPPING SLEEVE.
- ANGLE BALL VALVE ⑪ PERMANENT LOCK (WITH CMU SERIAL #) SHALL BE FURNISHED BY CMU.



NO. DESCRIPTION

- TAPPING SLEEVE & FL x MJ TAPPING VALVE ON EXISTING MAIN. MJ TEE AND MJ GATE VALVE ON NEW MAIN
- STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES
- RESTRAINED JOINT DUCTILE IRON PIPE
- FLANGE x MJ GATE VALVE ON LONG SIDE SERVICES. FLANGE x FL ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN)
- DETECTOR CHECK VALVE (FLANGE x FLANGE)
- FLANGE x MJ ADAPTOR (OMIT WHEN PROPERTY LINE VALVE ⑦ IS BOLTED DIRECTLY TO DETECTOR CHECK VALVE ⑤)
- MJ GATE VALVE (RESTRAINED, OPEN LEFT) AT PROPERTY LINE. (FL x MJ GATE VALVE BOLTED DIRECTLY TO DETECTOR CHECK VALVE ⑤)- WHEN APPROVED)
- 2" PIPE GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR 9), OR DUCTILE IRON PIPE, WITH THREADED COUPLING.
- CTS x MNPT BRASS STRAIGHT COUPLING (WITH BRASS HEX REDUCING BUSHING - AS REQUIRED)
- 1" COPPER TUBE - TYPE K OR HDPE (PLOY TUBING) SDR 9
- 1" ANGLE BALL VALVE WITH LOCK WINGS (LOCK OPEN)(CTS COMPRESSION x YOKE STAR NUT)
- 1" METER YOKE BAR
- 1" SINGLE ANGLE CHECK VALVE (YOKE STAR NUT x CTS COMPRESSION)
- 1" METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CMU)
- SOLID POLYETHYLENE (HDPE) METER BOX LID PER STD. DETAIL
- 17" x 28" CONCRETE METER BOX PER STANDARD DETAIL
- SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH
- MALLEABLE IRON (GALV.) 90 ° BEND (FNPT x FNPT)
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.)

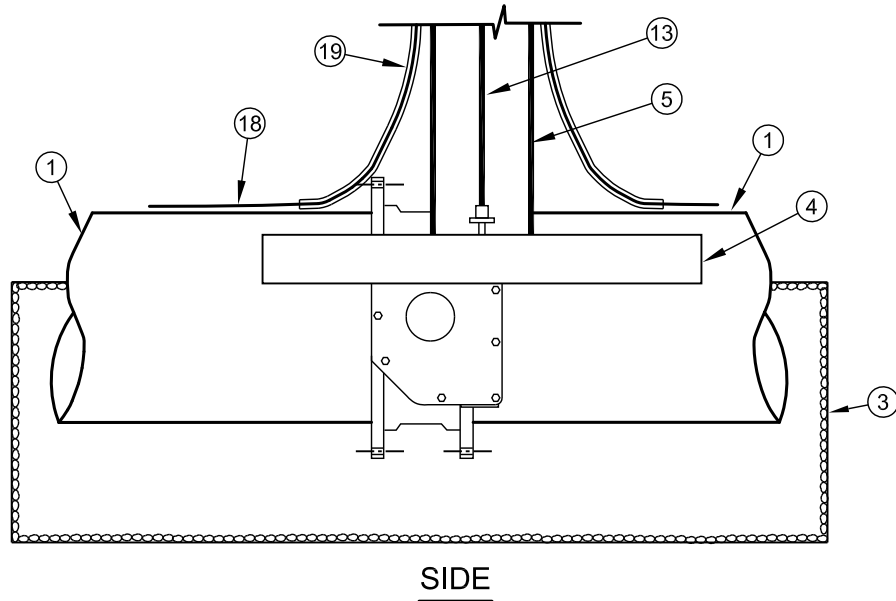
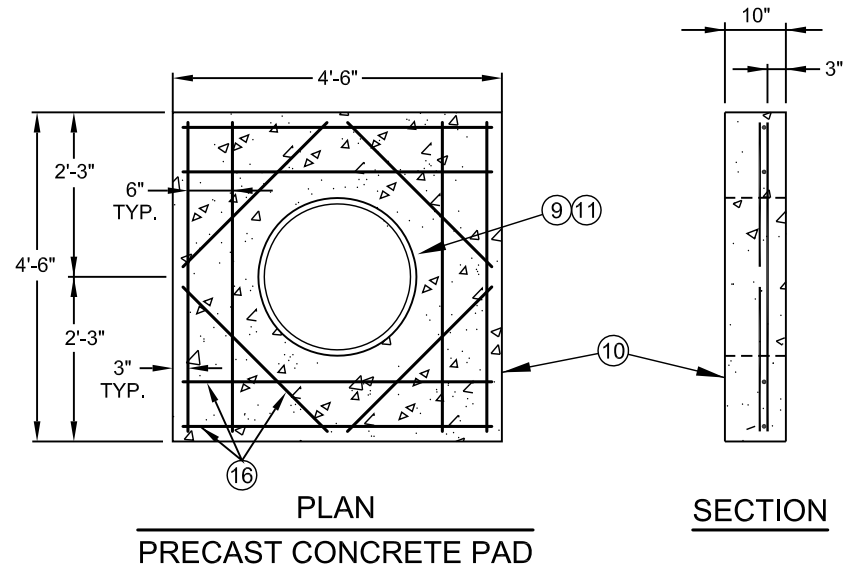
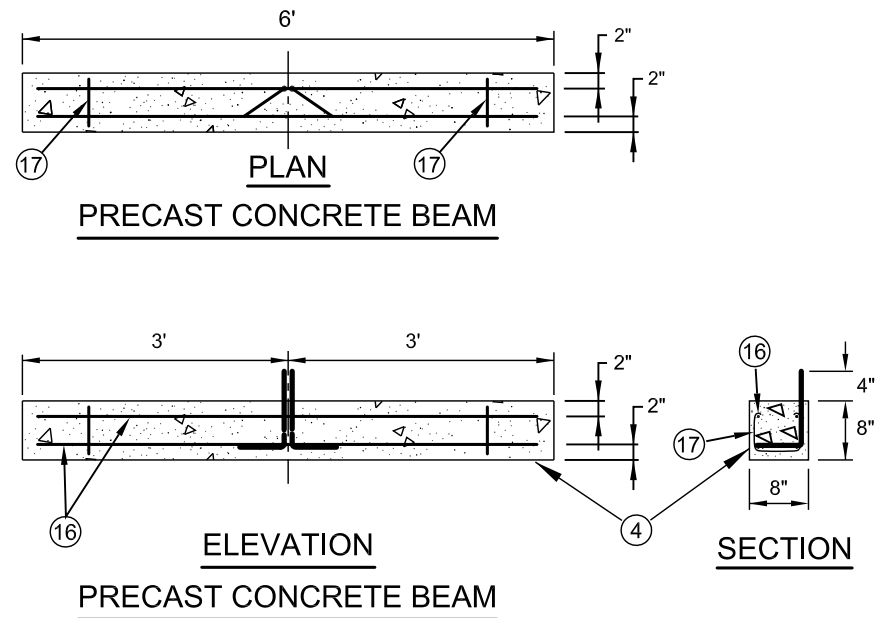
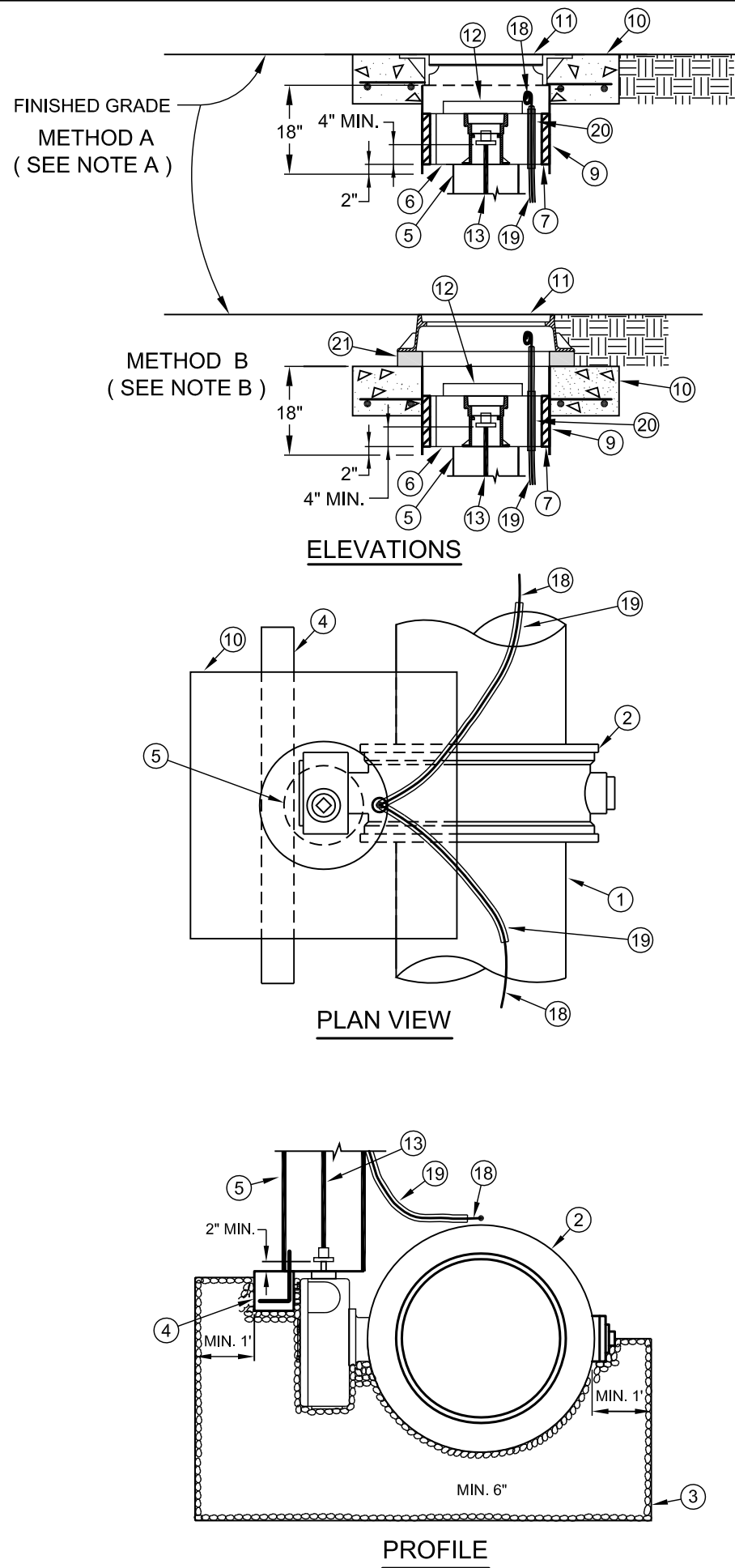
NO SCALE

STANDARD NO.	1
VERSION NO.	1.1
VERSION DATE	02.11.2010

4" - 10" FIRE LINE SERVICE WITH  
DETECTOR METER ASSEMBLY

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER

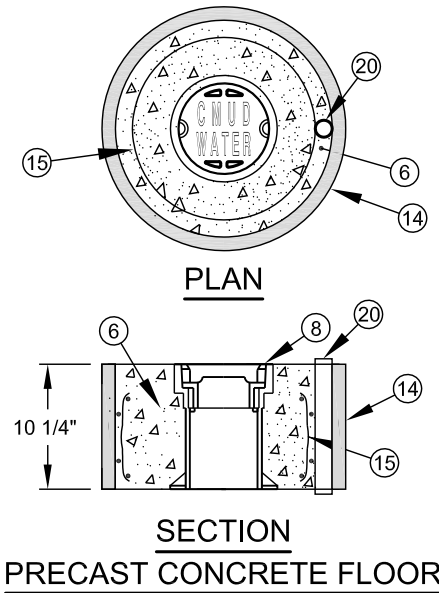




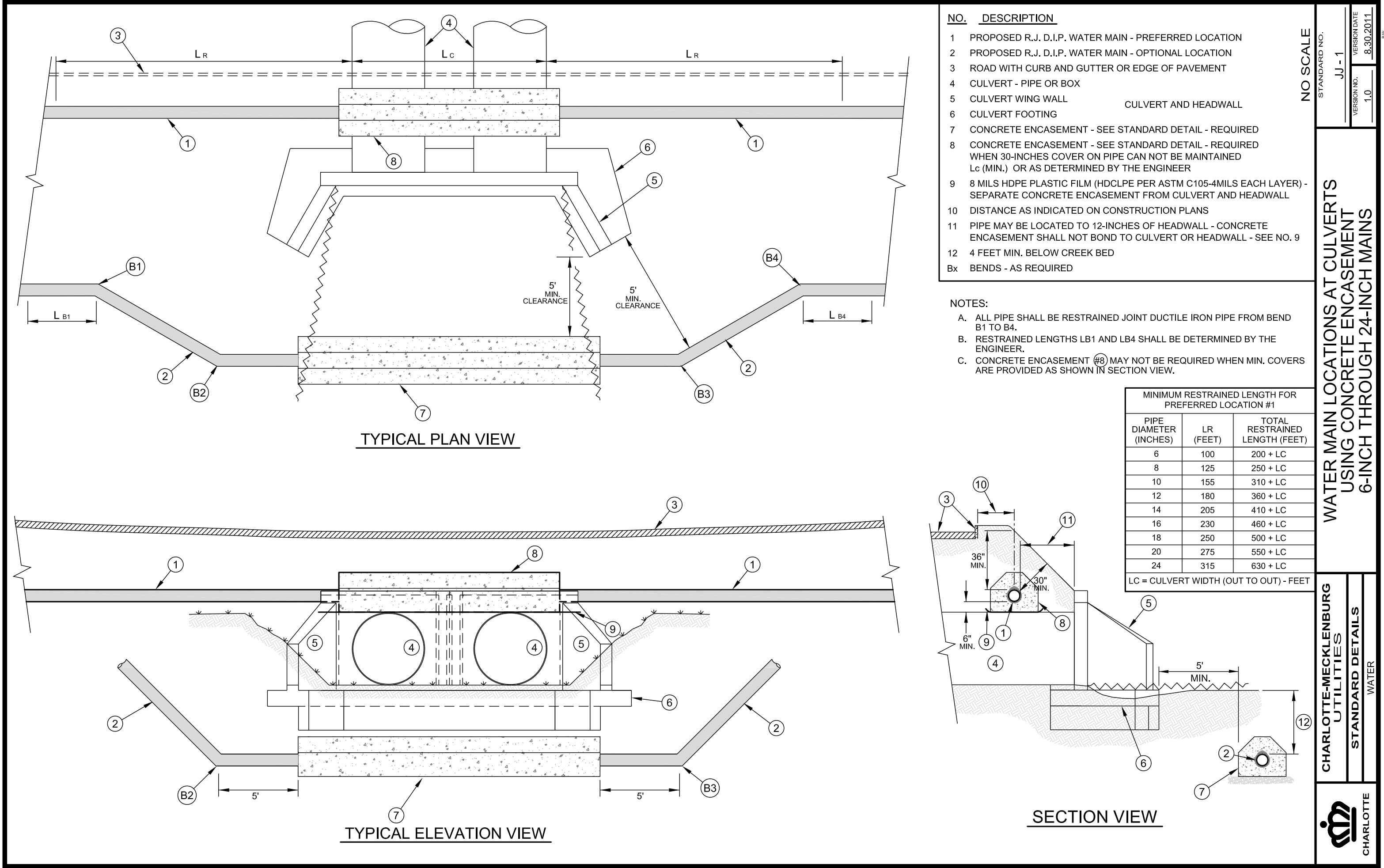
- NO. DESCRIPTION
1. WATER MAIN.
  2. BUTTERFLY VALVE.
  3. WASHED # 57 OR # 67 STONE - MINIMUM 6 FEET EACH SIDE OF VALVE.
  4. PRECAST CONCRETE BEAM. ( REINFORCED )
  5. 12-INCH ( MIN. ) DIP ( OR C900 PVC DR18 ) RISER PIPE 20 INCH MAXIMUM.
  6. PRECAST CONCRETE FLOOR. ( REINFORCED )
  7. 1/2 - INCH EXPANSION MATERIAL ( CONSTRUCTION JOINT )
  8. STANDARD VALVE BOX TOP SECTION ( W/COVER ), CAST IN CONCRETE FLOOR # 6.
  9. 24" PVC PIPE - C905 - DR18, OR DIP - CAST IN.
  10. PRECAST CONCRETE PAD. ( REINFORCED )
  11. FRAME AND COVER - SEE DETAILS.
  12. VALVE LOCKOUT ASSEMBLY - SEE DETAILS.
  13. EXTENSION STEM ASSEMBLY - SEE DETAILS.
  14. 20" PVC PIPE - C905 - DR18, DR21, OR DR25.
  15. WELDED WIRE FABRIC ( WWF ) - 6x6, W2.9/W2.9, 16" DIA., OR 2 EACH # 3 REBARS - 16" DIA.
  16. # 4 REBARS - AS SHOWN.
  17. # 2 OR # 3 REBARS - STIRRUPS - AS SHOWN.
  18. AWG #12 GAUGE COPPER TRACER WIRE ( THWN ) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
  19. 1/4" OR 3/8" ID CONDUIT - SDR 9 PEX TUBING - ASTM F876.
  20. 3/4" DIA. x 12" SCH 40 PVC CONDUIT.
  21. GRADE / SLOPE ADJUSTMENT RING - PRECAST CONCRETE OR RECYCLED RUBBER.

- NOTES:
- A. METHOD A SHALL BE REQUIRED IN WATER MAIN EASEMENTS, OR WHEN VALVE IS BACK OF ROAD DITCH.
  - B. METHOD B SHALL BE REQUIRED WHEN VALVE IS IN MAINTAINED LAWNS, ON ROAD SHOULDER, IN PAVEMENT DRIVEWAYS OR SIDEWALKS.
  - C. DIAMETER OF RISER MAY VARY AS REQUIRED BY VALVE ACTUATOR, AS APPROVED BY CMUD.
  - D. FOR 24" AND SMALLER VALVES - WHEN OPERATING NUT DEPTH EXCEEDS 3'-0" BELOW FINISHED GRADE, PROVIDE EXTENSION STEM WITH STD 2" NUT IN TOP SECTION AS SHOWN. SEE EXTENSION STEM DETAIL.
  - E. FOR 30" AND LARGER VALVES , EXTENSION STEM REQUIRED REGARDLESS OF DEPTH. SEE EXTENSION STEM DETAIL.
  - F. PROVIDE 2" CLEARANCE IN ALL DIRECTIONS BETWEEN RISER AND VALVE/ACTUATOR. ( SEE NOTE C )

- DESIGN REQUIREMENTS:
- a. CONCRETE -  $f'c = 4000$  PSI ( MIN. )
  - b. REBARS - GRADE 60, ASTM A 615
  - c. WELDED WIRE FABRIC - ASTM A 185, A 82







- NO. DESCRIPTION**
- 1 PROPOSED R.J. D.I.P. WATER MAIN - PREFERRED LOCATION
  - 2 PROPOSED R.J. D.I.P. WATER MAIN - OPTIONAL LOCATION
  - 3 ROAD WITH CURB AND GUTTER OR EDGE OF PAVEMENT
  - 4 CULVERT - PIPE OR BOX
  - 5 CULVERT WING WALL
  - 6 CULVERT FOOTING
  - 7 CONCRETE ENCASEMENT - SEE STANDARD DETAIL - REQUIRED
  - 8 CONCRETE ENCASEMENT - SEE STANDARD DETAIL - REQUIRED WHEN 30-INCHES COVER ON PIPE CAN NOT BE MAINTAINED L<sub>c</sub> (MIN.) OR AS DETERMINED BY THE ENGINEER
  - 9 8 MILS HDPE PLASTIC FILM (HDCLPE PER ASTM C105-4MILS EACH LAYER) - SEPARATE CONCRETE ENCASEMENT FROM CULVERT AND HEADWALL
  - 10 DISTANCE AS INDICATED ON CONSTRUCTION PLANS
  - 11 PIPE MAY BE LOCATED TO 12-INCHES OF HEADWALL - CONCRETE ENCASEMENT SHALL NOT BOND TO CULVERT OR HEADWALL - SEE NO. 9
  - 12 4 FEET MIN. BELOW CREEK BED
  - Bx BENDS - AS REQUIRED

- NOTES:**
- A. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON PIPE FROM BEND B1 TO B4.
  - B. RESTRAINED LENGTHS LB1 AND LB4 SHALL BE DETERMINED BY THE ENGINEER.
  - C. CONCRETE ENCASEMENT #8 MAY NOT BE REQUIRED WHEN MIN. COVERS ARE PROVIDED AS SHOWN IN SECTION VIEW.

NO SCALE

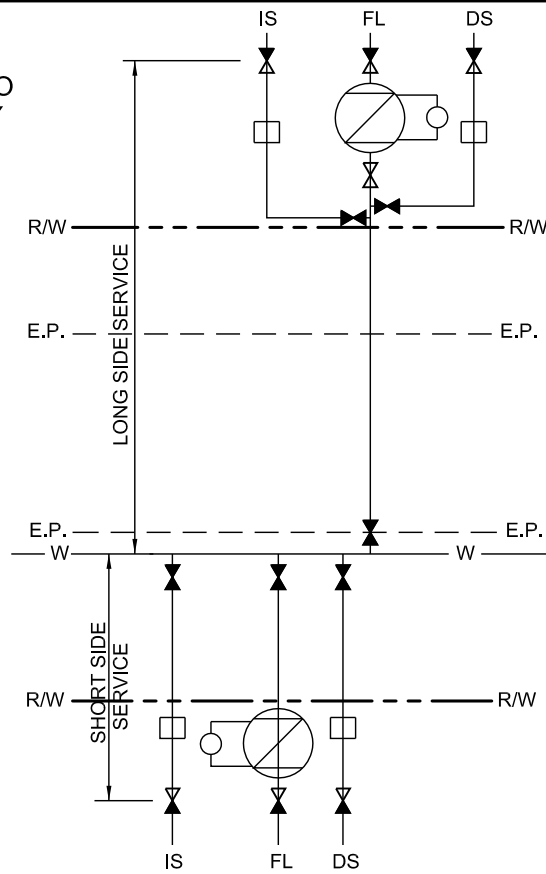
STANDARD NO. JJ - 1  
VERSION NO. 1.0  
VERSION DATE 8.30.2011

WATER MAIN LOCATIONS AT CULVERTS  
USING CONCRETE ENCASEMENT  
6-INCH THROUGH 24-INCH MAINS

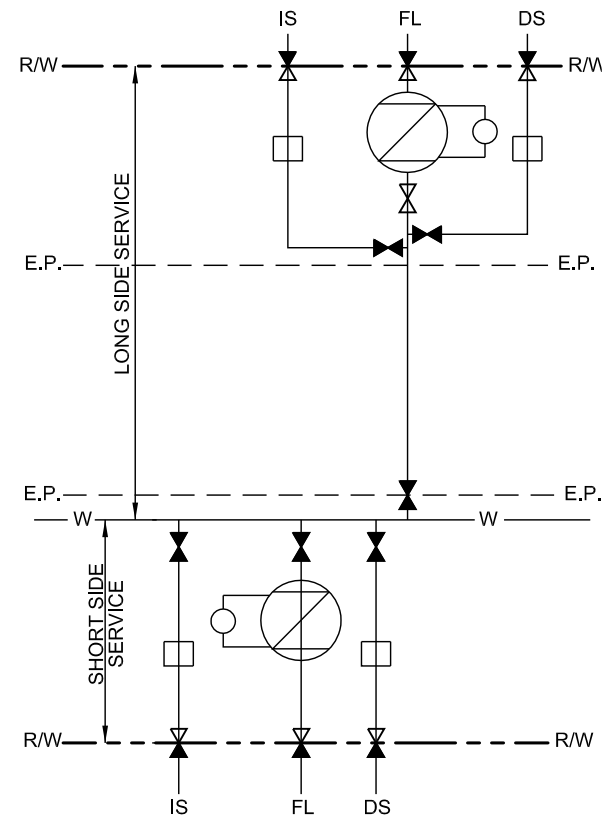
CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



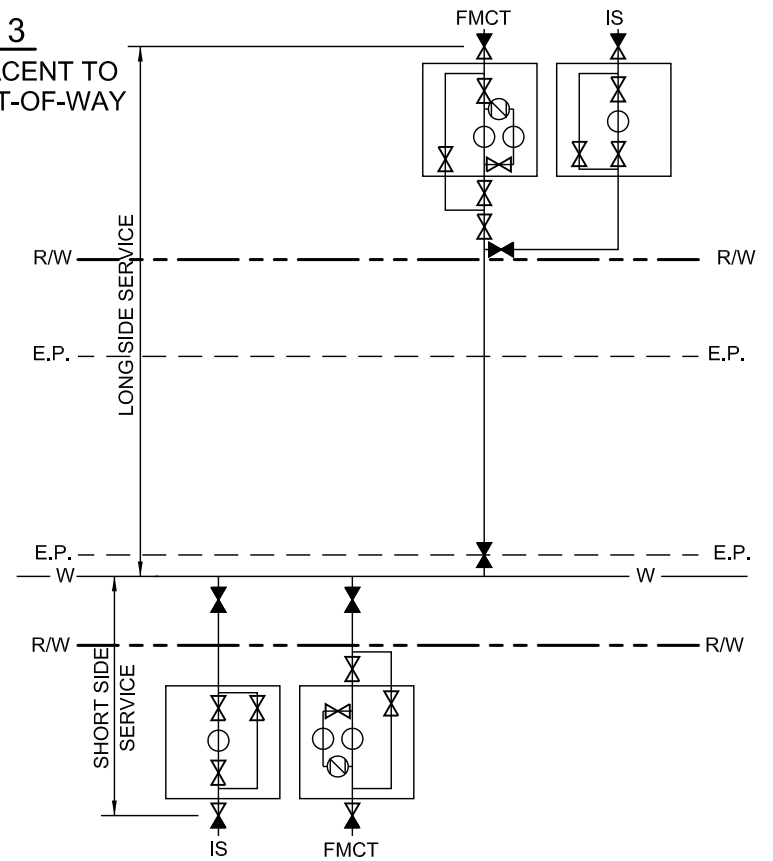
METERS ADJACENT TO  
ROAD RIGHT-OF-WAY



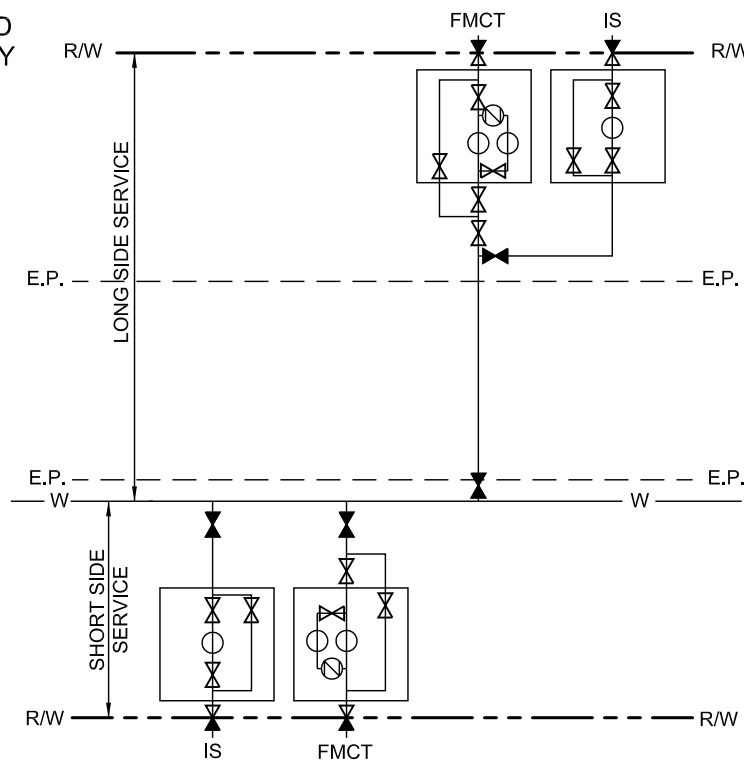
METERS IN ROAD  
RIGHT-OF-WAY



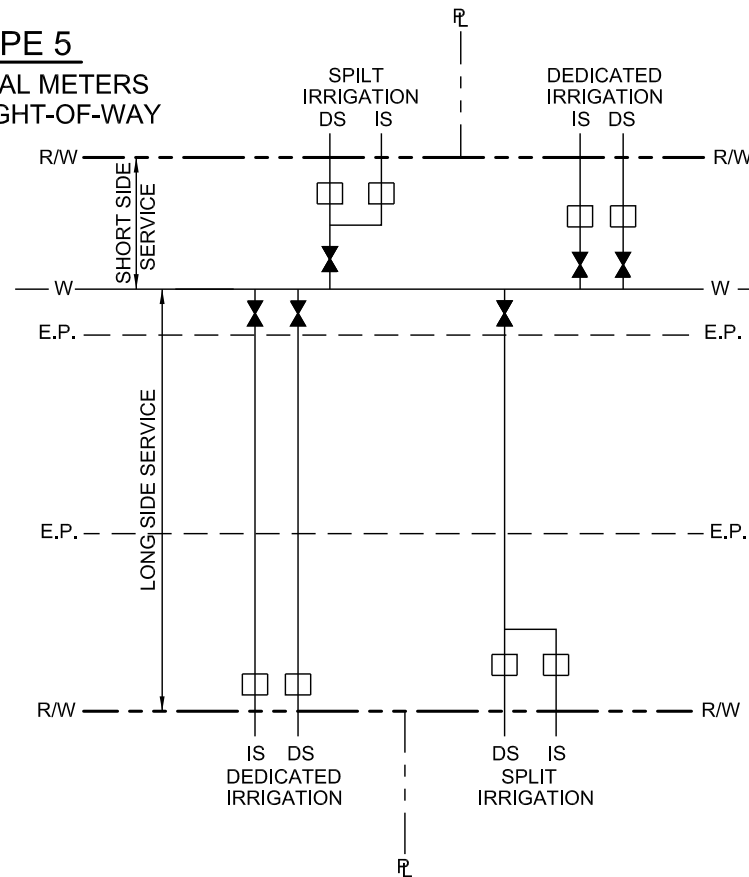
FMCT ADJACENT TO  
ROAD RIGHT-OF-WAY



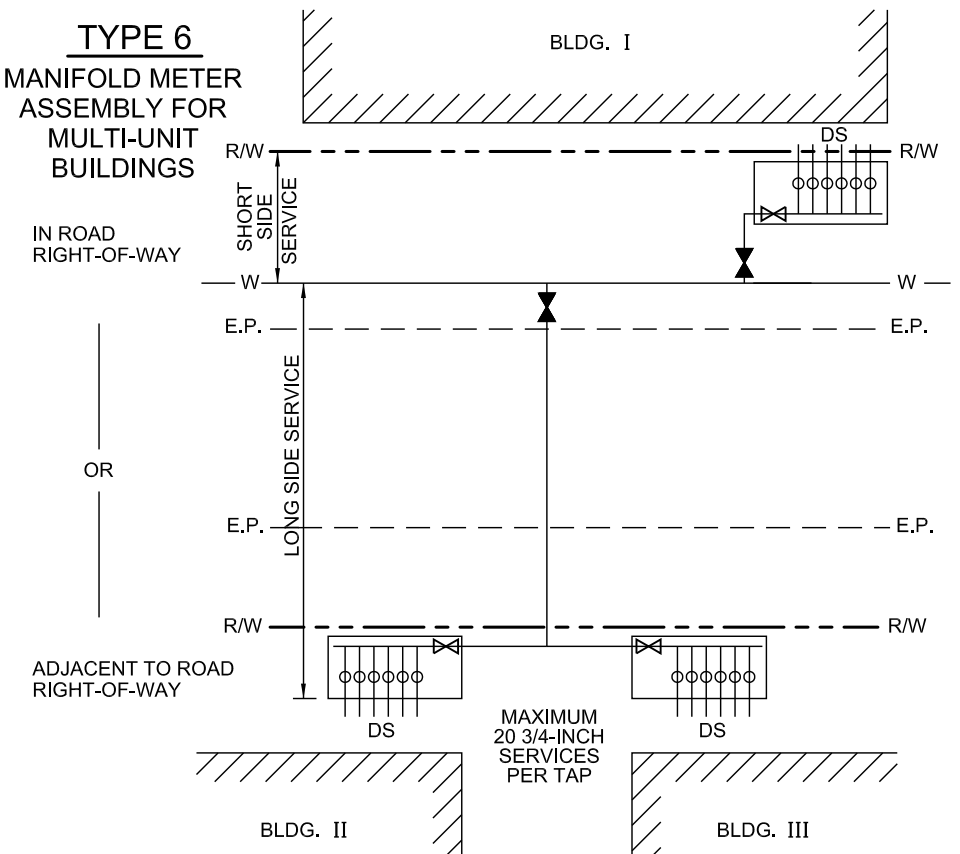
## FMCT IN ROAD RIGHT-OF-WAY






## RESIDENTIAL METERS IN ROAD RIGHT-OF-WAY




MANIFOLD METER  
ASSEMBLY FOR  
MULTI-UNIT  
BUILDINGS



IS	=	LAWN IRRIGATION SERVICE
DS	=	DOMESTIC POTABLE WATER SERVICE
FL	=	FIRE LINE SERVICE WITH DETECTOR METER
FMCT	=	FACTORY MUTUAL COMPOUND TYPE / FIRE MAIN COMPOUND TYPE

-  = FOR 3/4" - 2" SERVICE - TAPPING SADDLE AND BALL CORPORATION STOP-CC (TAPER) THREAD.  
 = FOR 3" - 12" SERVICE - TAPPING SLEEVE AND TAPPING GATE VALVE (FL x MJ) FOR EXISTING WATER MAINS OR TEE AND GATE VALVE (RESTRAINED) FOR NEW MAINS.  
 = GATE VALVE OR BALL VALVE - SEE METER DETAILS

-  = PROPERTY LINE VALVE - FOR 3/4"-1" - NOT REQUIRED, FOR 1 1/2"-2" - BALL VALVE CURB STOP, OR FOR 3"-12" - OPEN LEFT MJ GATE VALVE (RESTRAINED).  
 ALL PIPE SHALL BE RESTRAINED FROM MAIN TO PROPERTY LINE VALVE - 3/4"-2" SHALL BE TYPE K COPPER , 3"-12" SHALL BE DUCTILE IRON.  
 SEE INDIVIDUAL METER STD DETAILS FOR SPECIFIC COMPONENT REQUIREMENTS.

VERSION NO. J

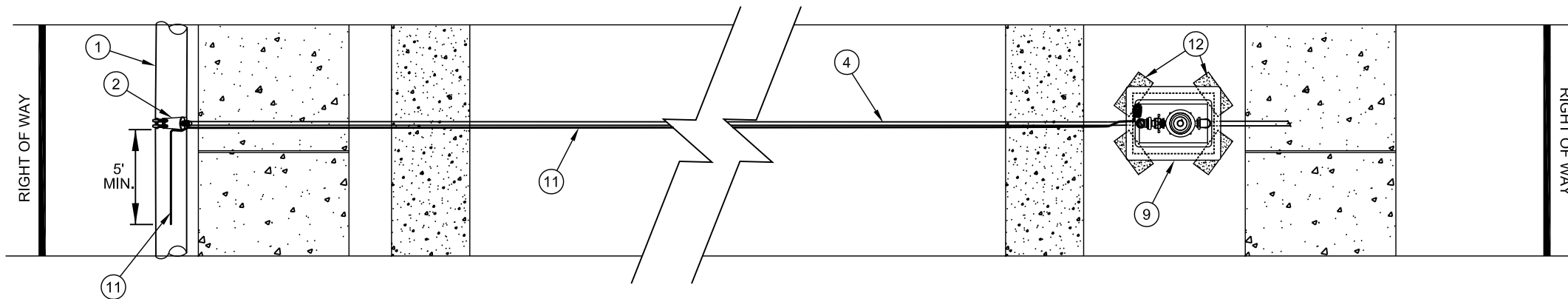
## MULTIPLE WATER SERVICES - SCHEMATIC

## CHARLOTTE-MECKLENBURG UTILITIES

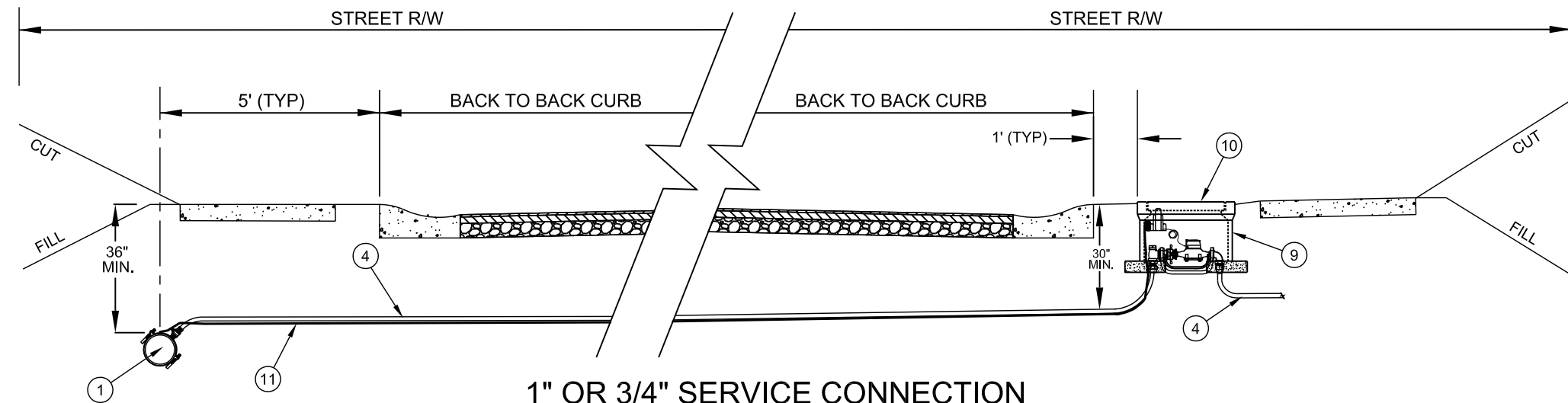
WATER



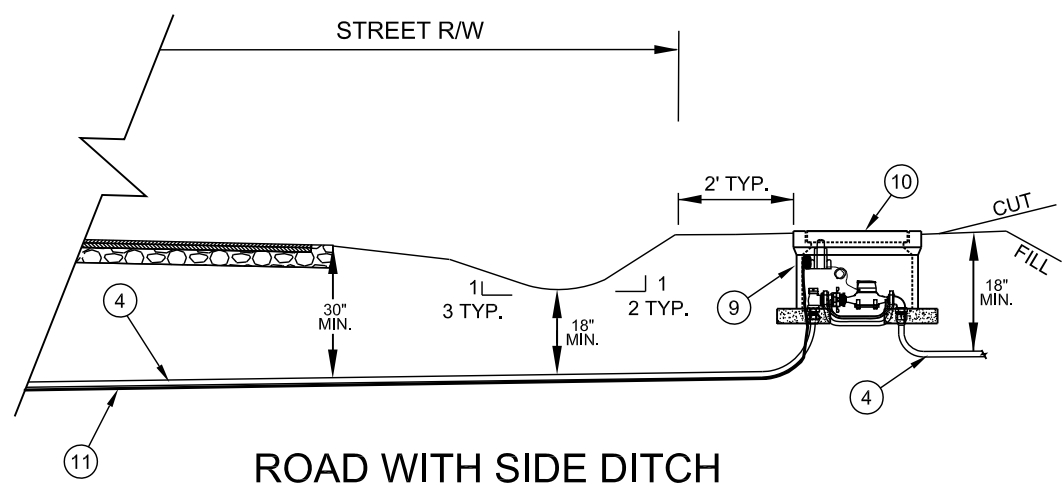
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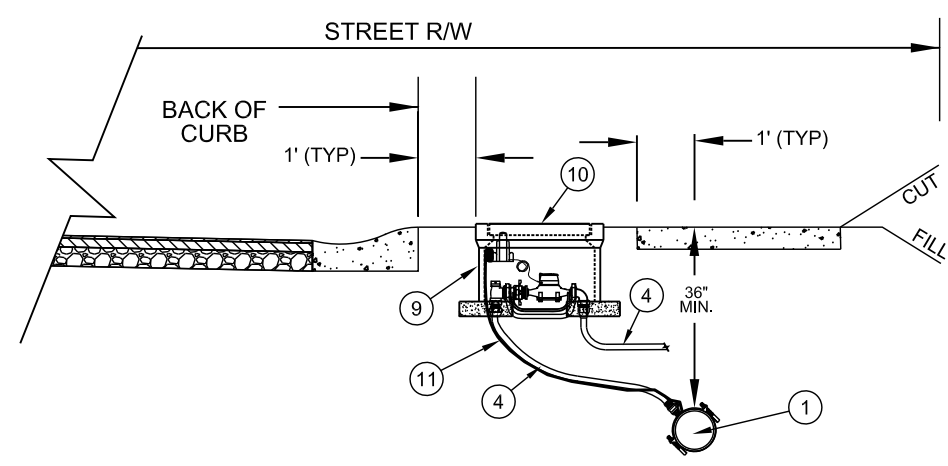
**1" OR 3/4" SERVICE CONNECTION**  
(LONG SIDE - PLAN VIEW)



**1" OR 3/4" SERVICE CONNECTION**  
(LONG SIDE - PROFILE VIEW)

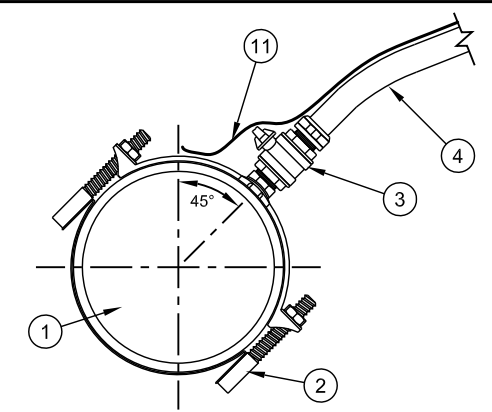


**ROAD WITH SIDE DITCH**

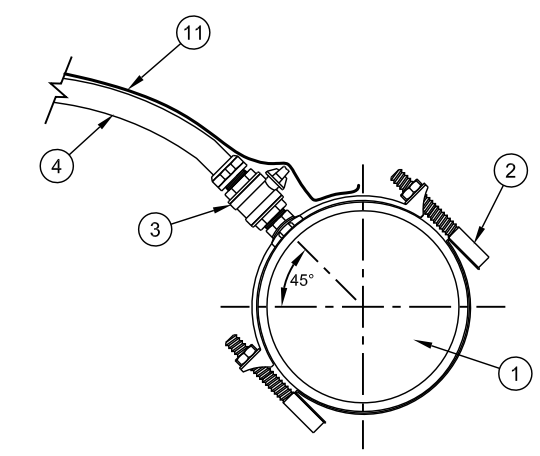


**1" OR 3/4" SERVICE CONNECTION**  
(SHORT SIDE)

NO.	DESCRIPTION
1	WATER MAIN
2	DOUBLE STRAP SERVICE SADDLE - CC (TAPER) THREAD OUTLET
3	BALL CORPORATION STOP - CC (TAPER) THREAD x CTS COMPRESSION
4	TYPE K COPPER TUBING OR SDR9 HDPE (POLY) TUBING WITH INSERT STIFFENERS
5	5/8" x 3/4" ANGLE BALL VALVE WITH LOCK WINGS - CTS COMPRESSION x YOKE STAR NUT
6	5/8" DUCTILE IRON YOKE BAR
7	5/8" METER ASSEMBLY (BY CMUD) WITH AMR TRANSMITTER
8	5/8" x 3/4" BRASS 90° YOKE STAR NUT x CTS COMPRESSION CONNECTOR
9	CONCRETE METER BOX - SEE STD. DETAILS
10	HDPE METER BOX LID WITH AMR TRANSMITTER BRACKETS
11	AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED)
12	SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH.



**DETAIL AT MAIN**  
(LONG SIDE)



**DETAIL AT MAIN**  
(SHORT SIDE)

**NOTE:**

- |  |   |  |
|--|---|--|
| <p>A. MIN. DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS OR SPIGOTS SHALL BE 3'-0" AS MEASURED ALONG THE MAIN.</p> <p>B. CENTER ANGLE BALL VALVE - 90° CONNECTOR ((5) - (8)) IN METER BOX.</p> | <p>C. SHOWN AS 3/4" SERVICE, USE 1" COMPONENTS FOR 1" DOMESTIC WATER SERVICE.</p> <p>D. TRACER WIRE IS NOT REQUIRED WITH ALL COPPER TUBING SERVICE.</p> | <p>E. WHEN METER BOX MUST BE PLACED IN CONCRETE, IT SHALL BE COMPLETELY IN, AND CENTERED IN CONCRETE PANEL, PER CDOT / NCDOT REQUIREMENTS.</p> <p>F. CMUD MAINTENANCE ENDS WITH 90° CONNECTOR ((8)).</p> |
|--|---|--|

NO SCALE

STANDARD NO.

K - 1

VERSION NO.

1.1

VERSION DATE

5.13.2011

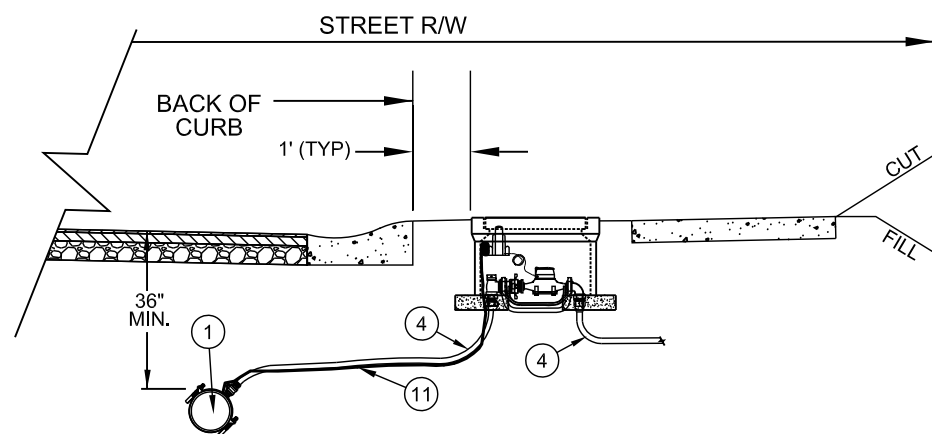
**3/4" AND 1" DOMESTIC WATER  
SERVICE CONNECTION**

CHARLOTTE-MECKLENBURG  
UTILITIES

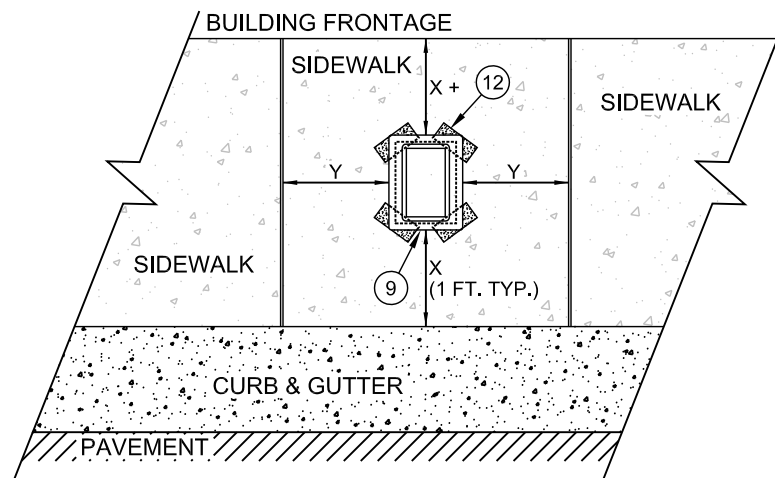
STANDARD DETAILS

WATER





**1" OR 3/4" SERVICE CONNECTION**  
(SHORT SIDE - IN PAVEMENT)



**METER BOX IN SIDEWALK**  
(REQUIRES PRIOR CMU APPROVAL)

NO.	DESCRIPTION
1	WATER MAIN
2	DOUBLE STRAP SERVICE SADDLE - CC (TAPER) THREAD OUTLET
3	BALL CORPORATION STOP - CC (TAPER) THREAD x CTS COMPRESSION
4	TYPE K COPPER TUBING OR SDR9 HDPE (POLY) TUBING WITH INSERT STIFFENERS
5	5/8" x 3/4" ANGLE BALL VALVE WITH LOCK WINGS - CTS COMPRESSION x YOKE STAR NUT
6	5/8" DUCTILE IRON YOKE BAR
7	5/8" METER ASSEMBLY (BY CMUD) WITH AMR TRANSMITTER
8	5/8" x 3/4" BRASS 90° YOKE STAR NUT x CTS COMPRESSION CONNECTOR
9	CONCRETE METER BOX - SEE STD. DETAILS
10	HDPE METER BOX LID WITH AMR TRANSMITTER BRACKET
11	AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED)
12	SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH.

NO SCALE

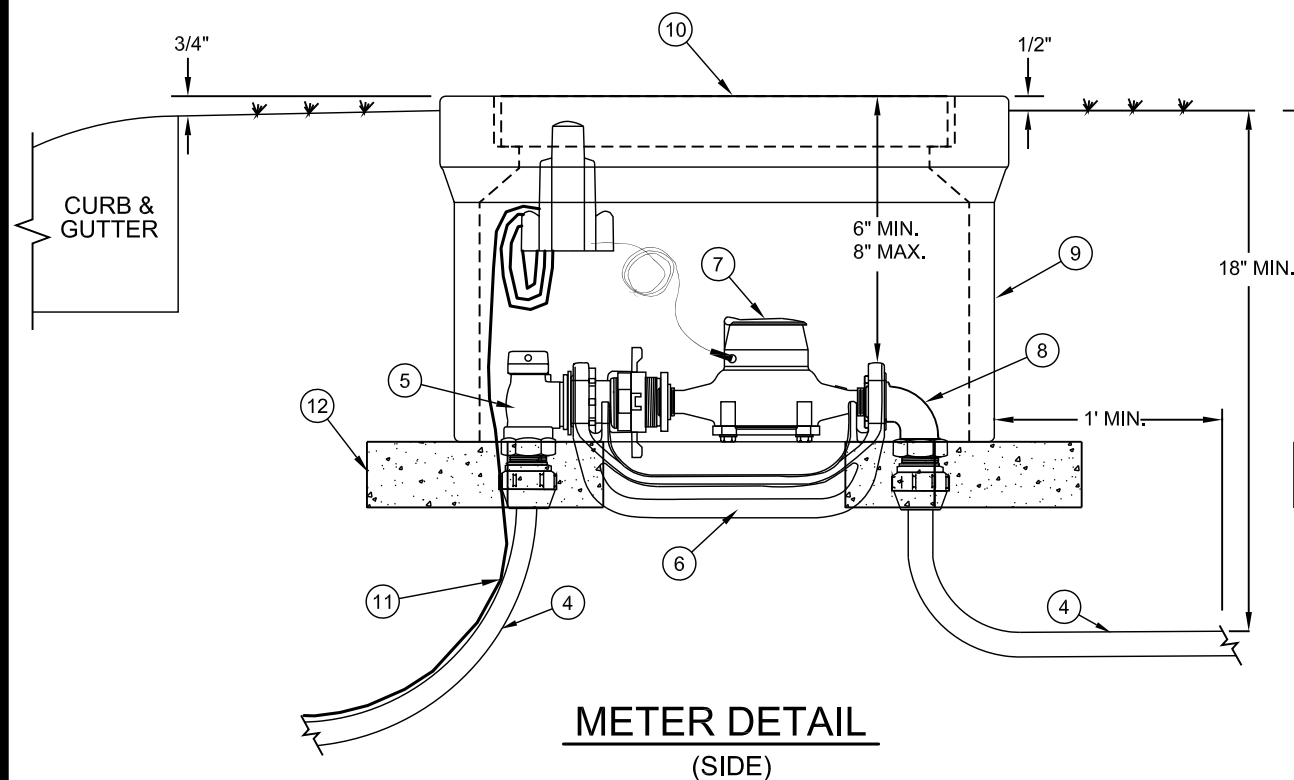
STANDARD NO.

K - 2

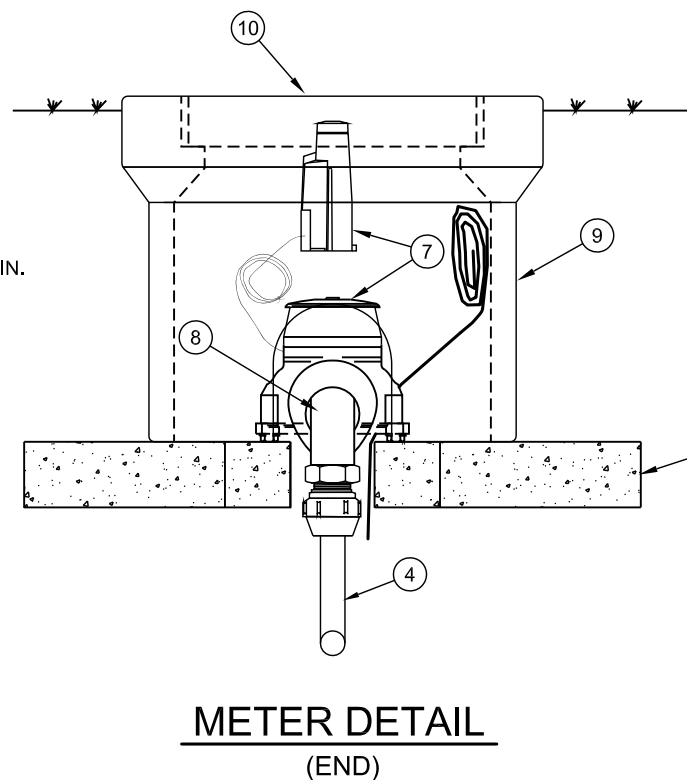
VERSION NO. 1.1

VERSION DATE 5.13.2011

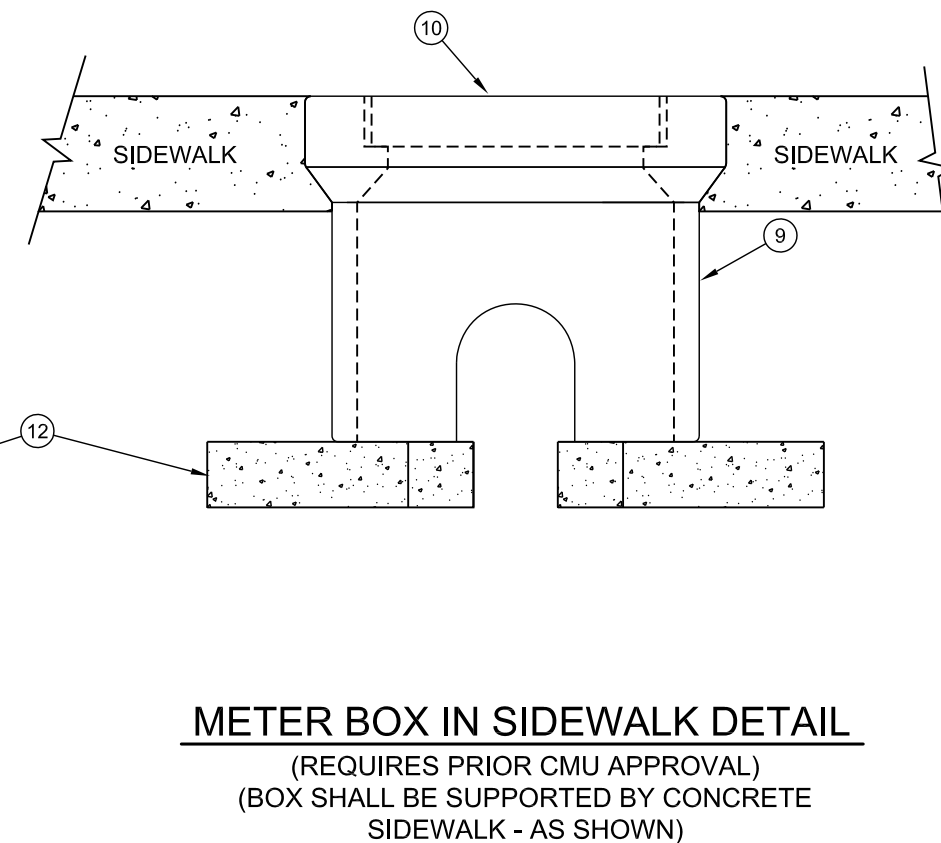
3/4" AND 1" DOMESTIC WATER  
SERVICE CONNECTION



**METER DETAIL**  
(SIDE)



**METER DETAIL**  
(END)



**METER BOX IN SIDEWALK DETAIL**  
(REQUIRES PRIOR CMU APPROVAL)  
(BOX SHALL BE SUPPORTED BY CONCRETE SIDEWALK - AS SHOWN)

**NOTE:**

- A. MIN. DISTANCE CENTER TO CENTER ON SERVICES OR TO BELLS OR SPIGOTS SHALL BE 3'-0" AS MEASURED ALONG THE MAIN.  
B. CENTER ANGLE BALL VALVE - 90° CONNECTOR ((5) - (8)) IN METER BOX.

- C. SHOWN AS 3/4" SERVICE, USE 1" COMPONENTS FOR 1" DOMESTIC SERVICE.  
D. TRACER WIRE IS NOT REQUIRED WITH ALL COPPER TUBING SERVICE.

- E. WHEN METER BOX MUST BE PLACED IN CONCRETE, IT SHALL BE COMPLETELY IN, AND CENTERED IN CONCRETE PANEL, PER CDOT / NCDOT REQUIREMENTS.  
F. CMUD MAINTENANCE ENDS WITH 90° CONNECTOR ((8)).

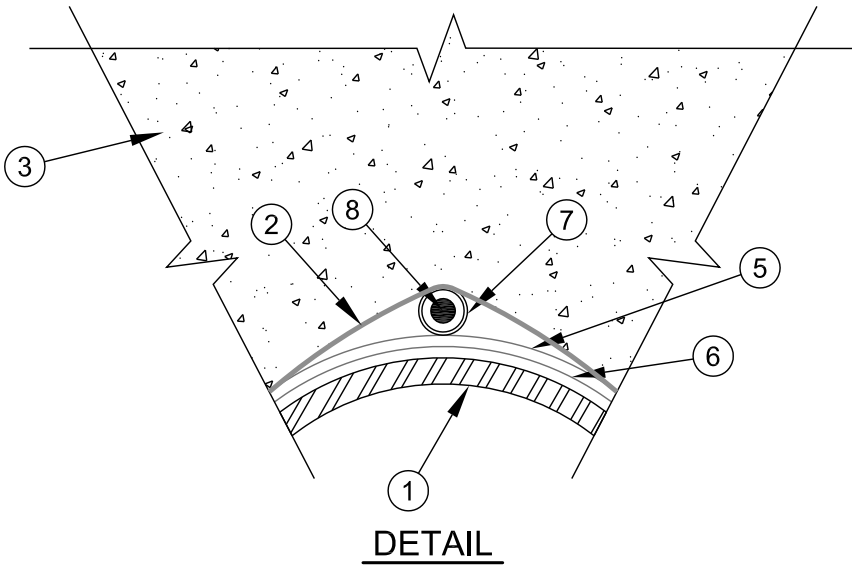
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER

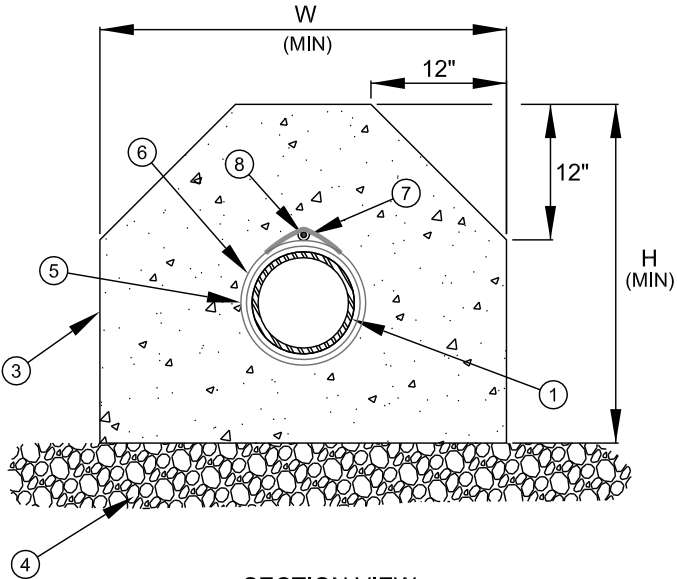
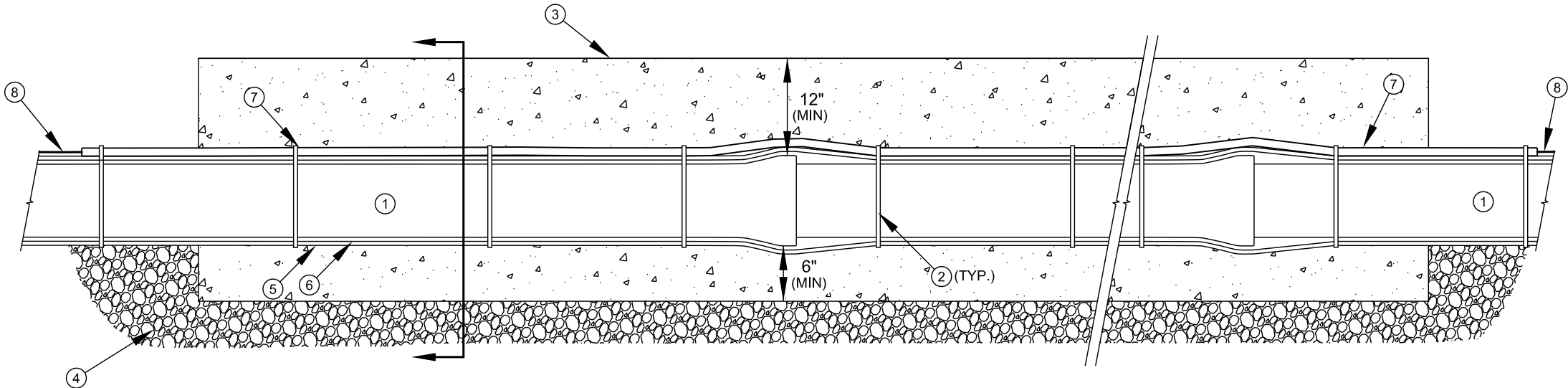
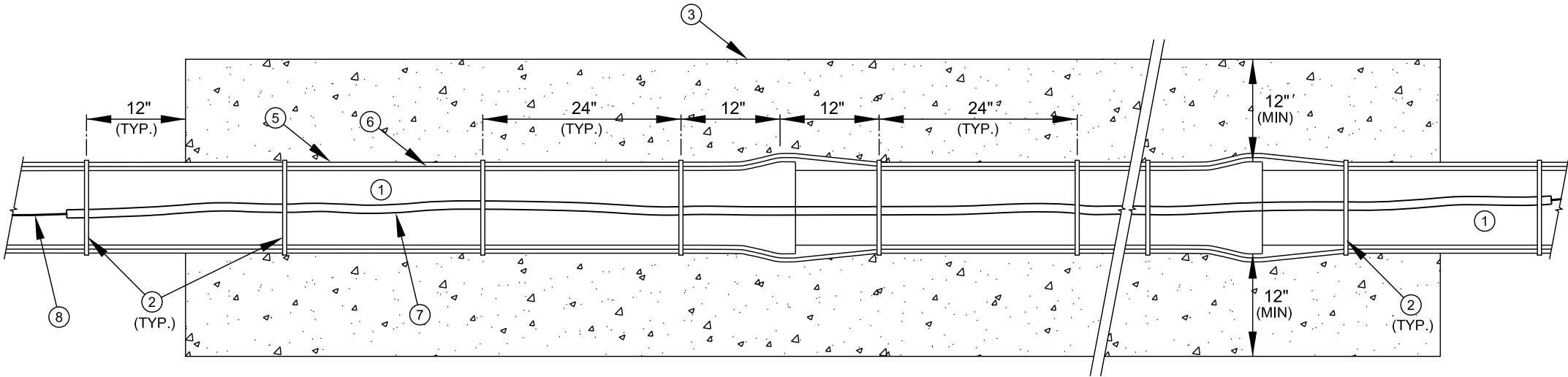


PIPE DIAMETER (INCHES)	WIDTH (W) (MINIMUM) (INCHES)	HEIGHT (H) (MINIMUM) (INCHES)	CONCRETE VOLUME APPROX. PER L.F.	
			FT <sup>3</sup> / LF	CY / LF
4	31	25	4.26	0.16
6	33	27	4.93	0.18
8	36	30	6.05	0.22
10	38	32	6.77	0.25
12	40	34	7.49	0.28
16	44	38	8.96	0.33
20	49	43	11.09	0.41
24	53	47	12.67	0.47
30	60	54	15.91	0.59
36	66	60	18.50	0.69
42	74	68	23.14	0.86
48	80	74	26.04	0.96
54	88	82	31.04	1.15
60	92	86	33.24	1.23
64	96	90	35.48	1.31



- | NO. | DESCRIPTION   |
|-----|---|
| 1   | DUCTILE IRON PIPE   |
| 2   | HDPE ADHESIVE TAPE OR HDPE ZIPLOCK TIE  |
| 3   | CONCRETE ENCASEMENT (f'c = 3600 PSI MIN.)   |
| 4   | STONE STABILIZATION MATERIAL - AS REQUIRED  |
| 5   | HIGH DENSITY CROSS LAMINATED POLYETHYLENE FILM (HDCLPE) - 4 MILS - TUBE - AWWA C105   |
| 6   | HIGH DENSITY CROSS - LAMINATED POLYETHYLENE FILM (HDCLPE) - 4 MILS - TUBE - AWWA C105 |
| 7   | 1-INCH DIA. SCH. 40 PVC ELECTRICAL CONDUIT - SOLVENT WELD JOINTS                      |
| 8   | AWG #12 GAUGE COPPER TRACER WIRE WITH BLUE INSULATION - (30 MIL HDPE)                 |

- NOTES:
- A. CONCRETE ENCASEMENT SHALL ONLY BE INSTALLED WHERE SHOWN ON APPROVED PLANS OR WITH PRIOR APPROVAL BY CMUD ENGINEER.
- B. THIS RESTRICTION IS IN PLACE DUE TO THE INABILITY TO EASILY MAINTAIN / REPAIR OR TAP A MAIN ENCASED IN CONCRETE.



NO SCALE

STANDARD NO. KK

VERSION NO. 1.0

VERSION DATE 8.23.2011

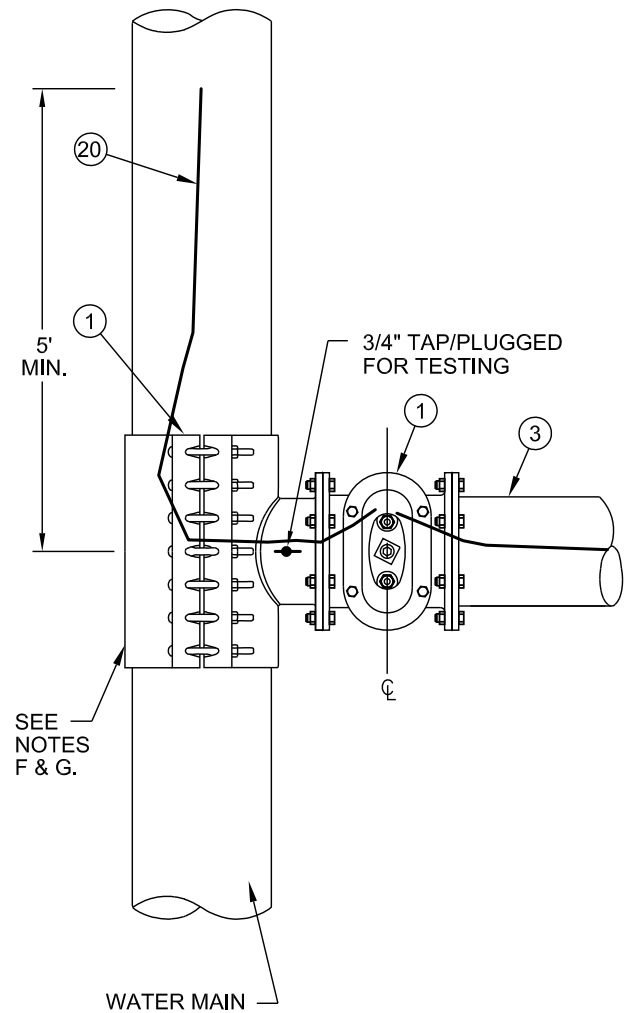
CONCRETE ENCASEMENT  
6-INCH THROUGH 64-INCH MAINS

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER

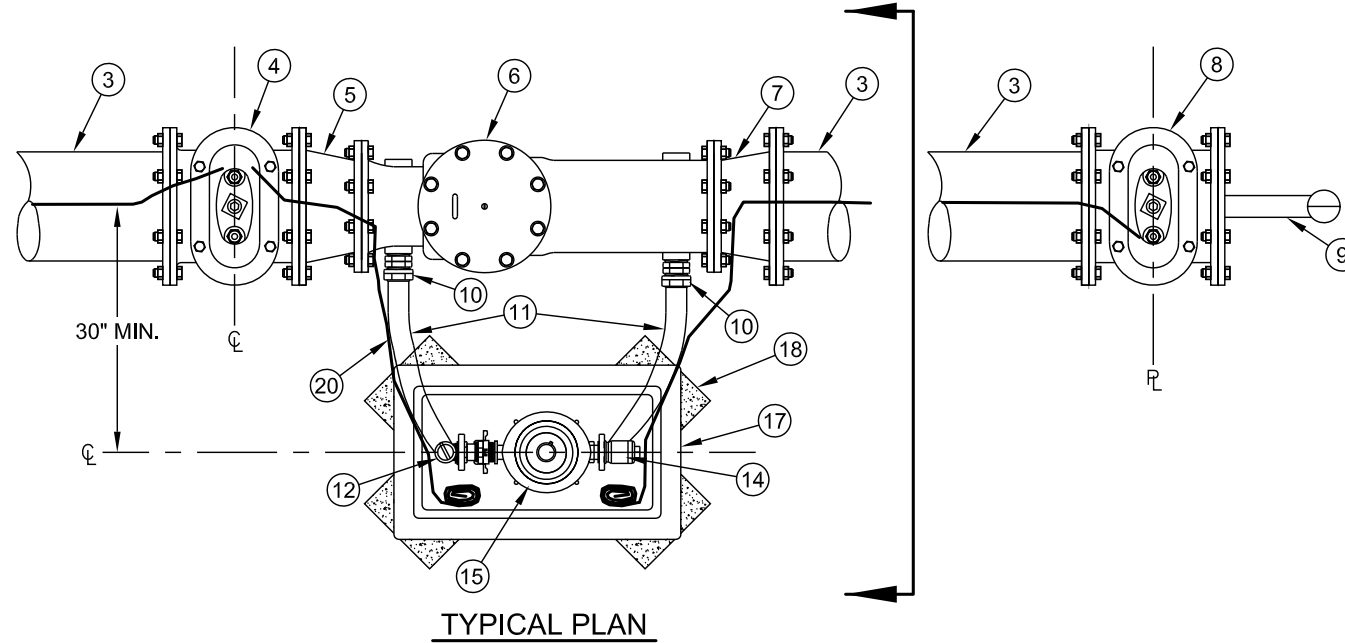
CHARLOTTE



FIRE SERVICE SIZE	DETECTOR METER SIZE
12"	1"

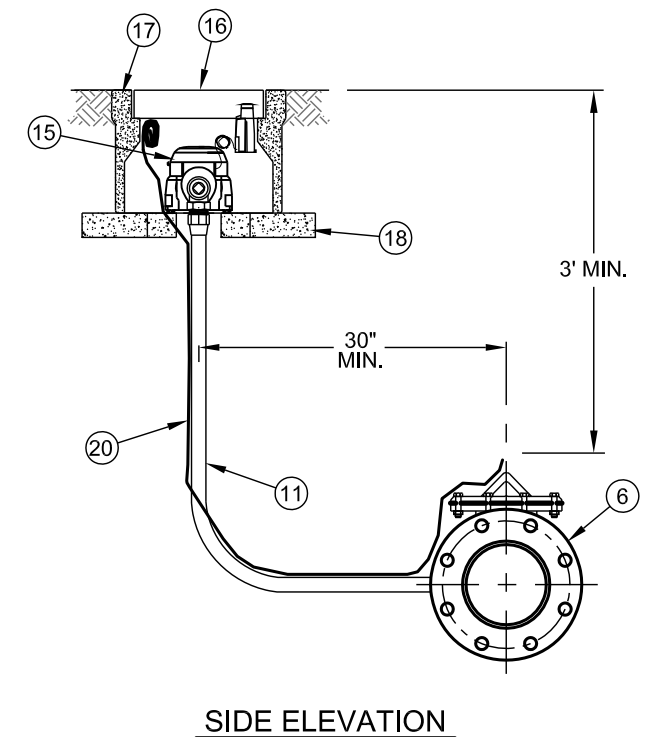
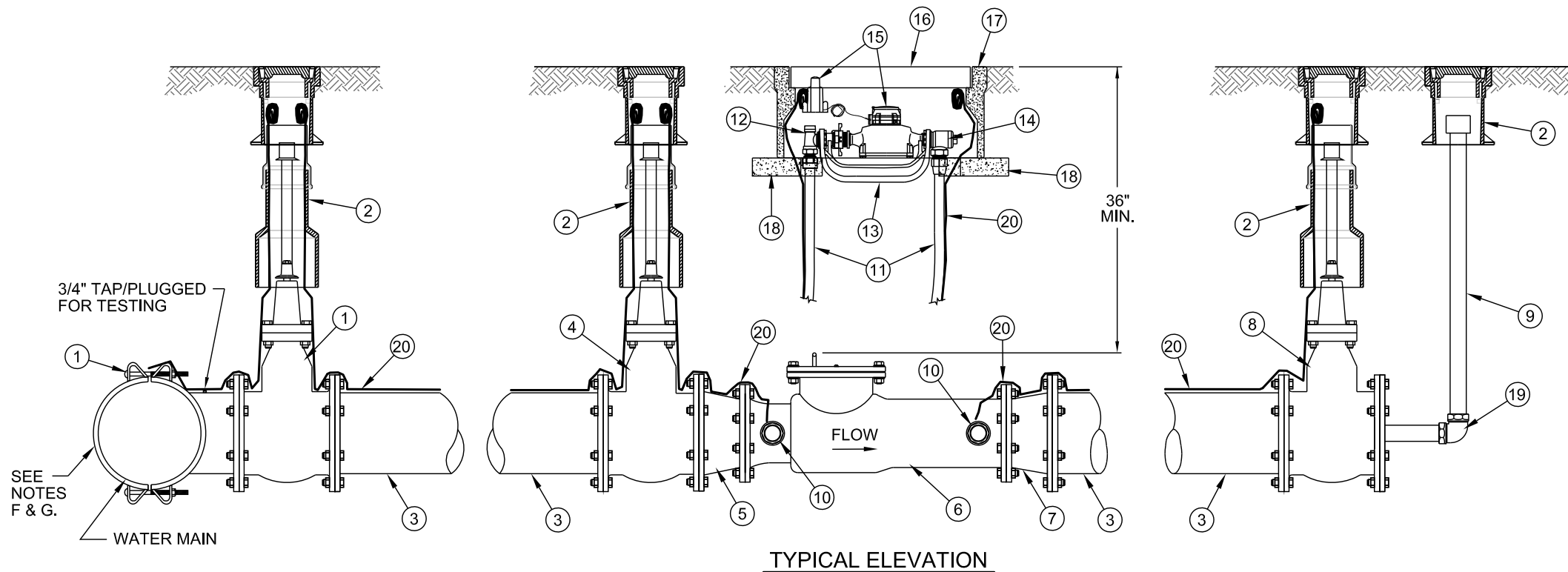
#### NOTES:

- ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.
- METER BOX TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM METER BOX.
- ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. ⑧.
- ONE INCH METER SHALL BE INSTALLED IN STANDARD CONCRETE METER BOX PER STD. DETAIL.
- WRAP TAPPING SLEEVE WITH 2 LAYERS HDPE PLASTIC FILM (HDCLPE PER AWWA C-105) - 4 MILS EACH LAYER - EXTEND HDPE 2 FT. EACH WAY FROM SLEEVE - DUCT TAPE OR ZIP LOCK TIE ENDS.
- CONCRETE THRUST BLOCKING REQUIRED AT TAPPING SLEEVE.
- ANGLE BALL VALVE ⑫ PERMANENT LOCK (WITH CMU SERIAL #) SHALL BE FURNISHED BY CMU.



#### NO. DESCRIPTION

- TAPPING SLEEVE & FL x MJ 12" TAPPING VALVE ON EXISTING MAIN. MJ TEE AND MJ 12" GATE VALVE ON NEW MAIN
- STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES
- RESTRAINED JOINT DUCTILE IRON PIPE - 12" DIAMETER
- 12" MJ GATE VALVE ON LONG SIDE SERVICES. OMIT ON SHORT SIDE SERVICE (NOT SHOWN)
- 12" x 10" REDUCER - MJ x FLANGE
- 10" DETECTOR CHECK VALVE (FLANGE x FLANGE)
- 10" x 12" REDUCER - FLANGE x MJ
- MJ GATE VALVE (RESTRAINED, OPEN LEFT) AT PROPERTY LINE. (FL x MJ GATE VALVE BOLTED DIRECTLY TO 10" x 12" REDUCER ⑦ - WHEN APPROVED)
- 2" PIPE GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR 9), OR DUCTILE IRON PIPE, WITH THREADED COUPLING.
- CTS x MNPT BRASS STRAIGHT COUPLING (WITH BRASS HEX REDUCING BUSHING - AS REQUIRED)
- 1" COPPER TUBE - TYPE K OR HDPE (PLOY TUBING) SDR 9
- 1" ANGLE BALL VALVE WITH LOCK WINGS (LOCK OPEN)(CTS COMPRESSION x YOKE STAR NUT)
- 1" METER YOKE BAR
- 1" SINGLE ANGLE CHECK VALVE (YOKE STAR NUT x CTS COMPRESSION)
- 1" METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CMU)
- SOLID POLYETHYLENE (HDPE) METER BOX LID PER STD. DETAIL
- 17" x 28" CONCRETE METER BOX PER STANDARD DETAIL
- SOLID STANDARD CONCRETE BRICKS - DIAGONAL AT CORNERS - 4 EACH
- MALLEABLE IRON (GALV.) 90 ° BEND (FNPT x FNPT)
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.)



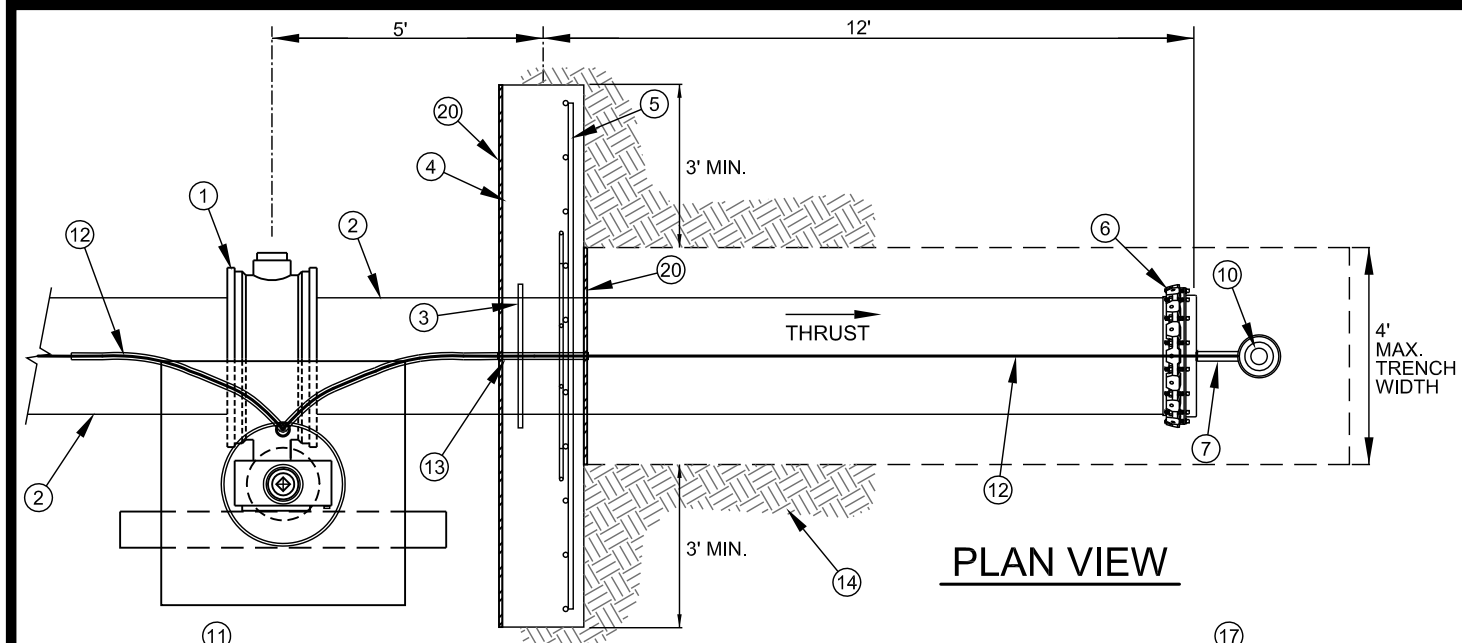
NO SCALE

STANDARD NO.	L
VERSION NO.	1.0
VERSION DATE	02.26.2010

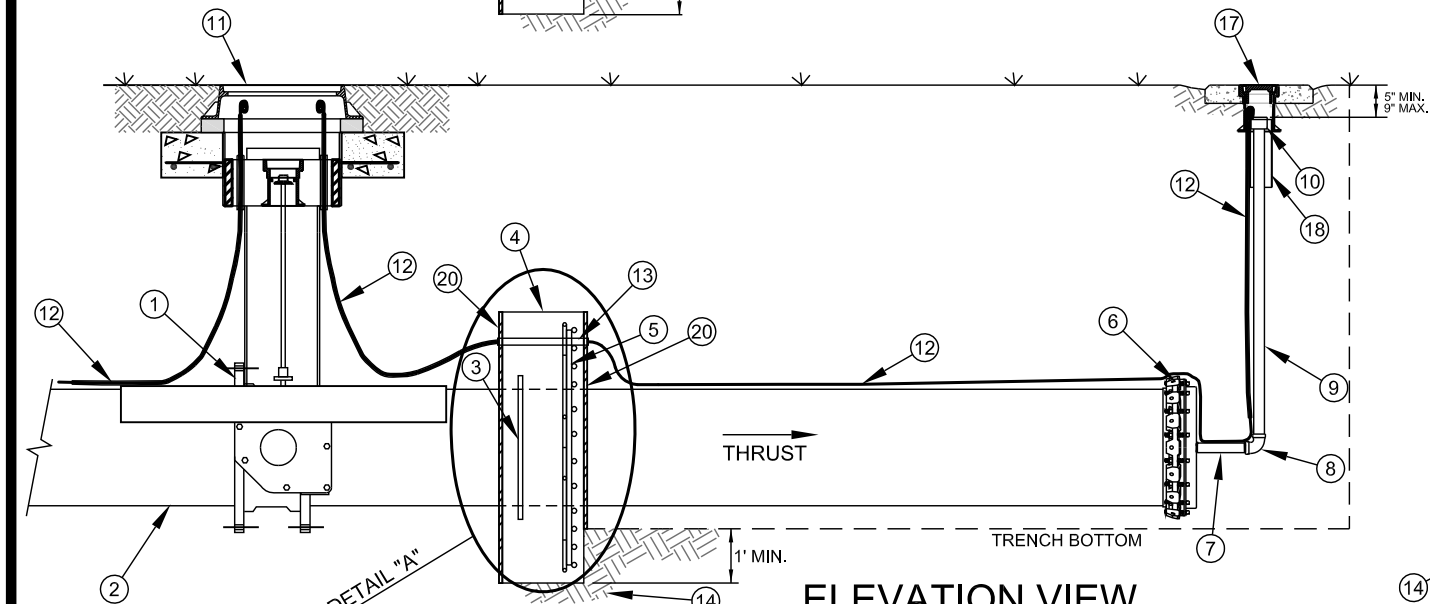
## 12" FIRE LINE SERVICE WITH DETECTOR METER ASSEMBLY

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER

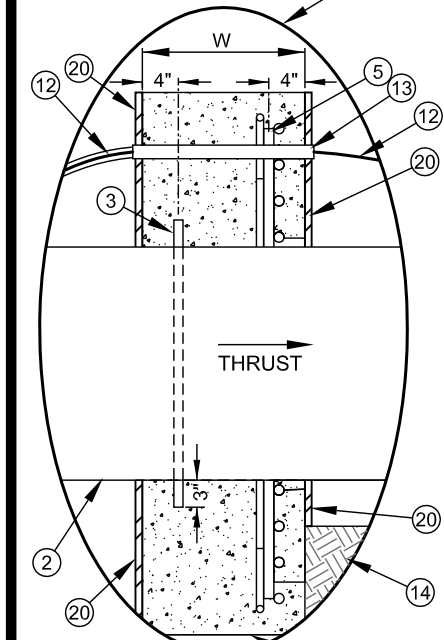




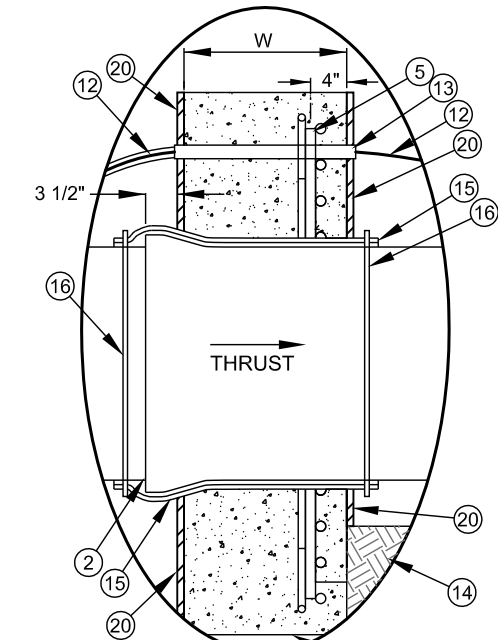
PLAN VIEW



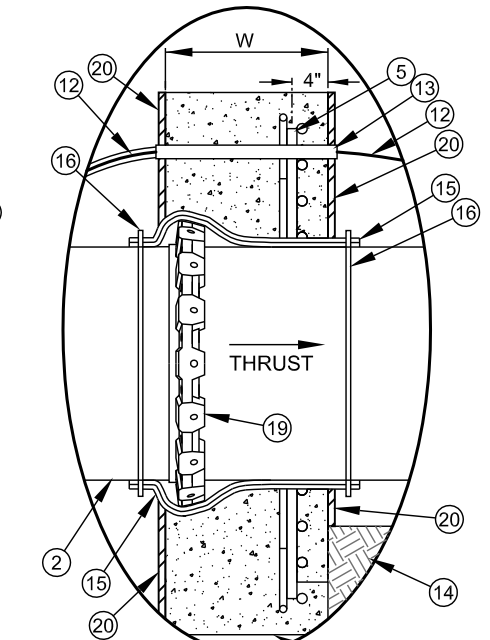
ELEVATION VIEW



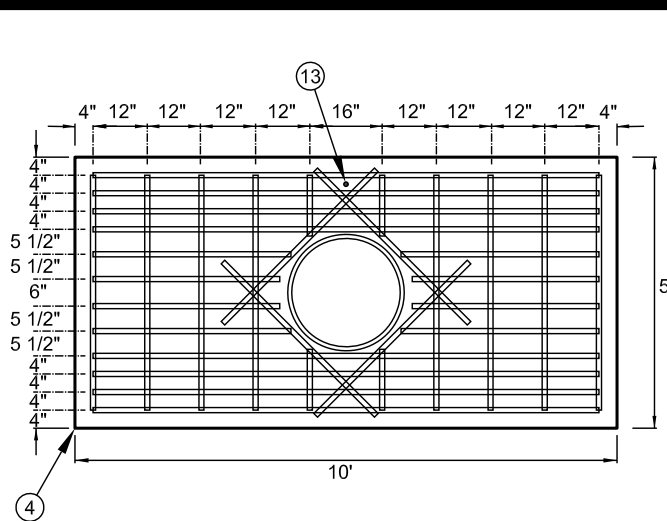
DETAIL "A"



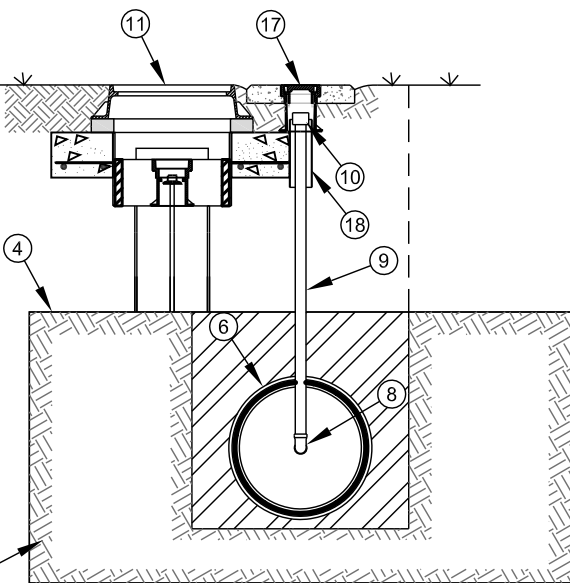
DETAIL "B" (ALT)



DETAIL "C" (ALT)



REBAR DETAIL



END VIEW

NO. DESCRIPTION

- 1 END OF LINE VALVE - BUTTERFLY OR GATE VALVE (MJ X MJ)
- 2 DIP - (PE x PE) - REMOVE BELL - LENGTH = 17 FT~ 19 FT
- 3 1" THICK x 3" WIDE STEEL THRUST RING - FACTORY WELDED TO PIPE
- 4 CONCRETE WALL BLOCK (F<sub>c</sub> = 3600 PSI MIN) 10 FT x 5 FT x WIDTH (W)
- 5 REBARS - GRADE 60 PER ASTM A615 - SEE REBAR SCHEDULES, CUT WHEN REQUIRED
- 6 MJ CAP - WITH WEDGE ACTION RESTRAINT GLAND, TAP 2" THREADED OUTLET (FNPT)
- 7 2" RED BRASS NIPPLE SCH 40 (MNPT x MNPT) - LENGTH = 12 INCH
- 8 2" RED BRASS 90° BEND (FNPT x FNPT)
- 9 2" RED BRASS NIPPLE SCH 40 ( MNPT x MNPT) - LENGTH AS REQUIRED
- 10 2" GALVANIZED MALLEABLE IRON COUPLING (FNPT x FNPT)
- 11 BUTTERFLY/GATE VALVE BOX ASSEMBLY (16" + VALVES) - SEE DETAIL
- 12 AWG #12 GAUGE COPPER TRACER WIRE - WITH BLUE INSULATION (30 MIL HDPE) TERMINATE WITH 24-INCH EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
- 13 1" SCH 40 PVC ELECTRICAL CONDUIT - LENGTH AS REQUIRED
- 14 UNDISTURBED SOIL
- 15 HIGH DENSITY CROSS LAMINATED POLYETHYLENE FILM TUBE (HDCLPE) AWWA C105 - 4 MILS EACH x 2 LAYER - 8 MILS TOTAL
- 16 HDPE ADHESIVE TAPE OR HDPE ZIP LOCK TIES
- 17 STANDARD VALVE BOX ASSEMBLY - SEE DETAIL
- 18 5" CAST IRON SOIL PIPE - L=15" OR VALVE BOX BOTTOM SECTION
- 19 WEDGE ACTION THRUST RESTRAINT GLAND
- 20 PLYWOOD FORM

NOTES:

- A. WHEN DIRECTED BY THE ENGINEER, THE CONCRETE WALL BLOCK SIZE MAY BE ADJUSTED, BASED ON ACTUAL SOIL CLASSIFICATION AND PIPE DIAMETER.
- B. FULLY RESTRAINED JOINT PIPE MAY BE USED IN LIEU OF THIS DETAIL - SEE RESTRAINED JOINT PIPE DETAILS.
- C. ALTERNATE DETAIL "B" (USING A REVERSED BELL) MAY BE USED IN LIEU OF DETAIL "A".
- D. ALTERNATE DETAIL "C" (USING WEDGE ACTION RESTRAINT GLAND) MAY BE USED IN LIEU OF DETAIL "A".

NO. ALTERNATE DESCRIPTION

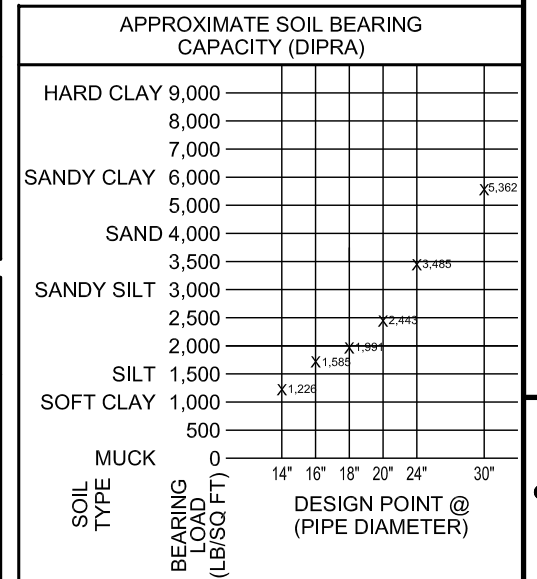
WHEN USING 2-INCH HDPE (IPS) BLOW-OFF PIPE WITH STAINLESS STEEL, BRASS OR BRONZE MNPT ENDS, USE THE FOLLOWING PRODUCTS:

- 7 2" SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - LENGTH AS REQUIRED - 12 - INCH MINIMUM.
- 9 2" SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - LENGTH AS REQUIRED.

APPROX. DEAD END THRUST (DIPRA) AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA	APPROX. SOIL PRESSURE	W (WIDTH) (MINIMUM)	CONCRETE VOLUME (APPROXIMATE)	
PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)	SQUARE FEET	BEARING LOAD (LB/SQ FT)	INCHES	FT <sup>3</sup>	CY
14	36,770	30	1,226	14	28	1.04
16	47,558	30	1,585	16	32	1.19
18	59,730	30	1,991	16	32	1.19
20	73,288	30	2,443	18	36	1.33
24	104,558	30	3,485	18	36	1.33
30	160,850	30	5,362	20	40	1.48

REBAR SCHEDULE		
TYPE	LENGTH (INCHES)	NUMBER REQUIRED
VERTICAL	52	6
VERTICAL	20	4
HORIZONTAL	112	10
HORIZONTAL	48	4
DIAGONAL	48	4

REBAR DIAMETER SCHEDULE			
PIPE DIAMETER	BAR SIZE	TOTAL REBAR LENGTH (FT)	TOTAL REBAR WEIGHT (LB)
14"	#9	158	537
16"	#10	158	680
18"	#10	158	680
20"	#10	158	680
24"	#10	158	680
30"	#11	158	839



NO SCALE

STANDARD NO.

LL

VERSION NO. 1.0

VERSION DATE 8.23.2011

DEAD END THRUST - WALL BLOCKING  
AND 2-INCH BLOW-OFF ASSEMBLY  
14-INCH THROUGH 30-INCH MAINS

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER



NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- B. ALL PIPE SHALL BE RESTRAINED FROM TAP TO PROPERTY LINE VALVE.
- C. VAULT SHALL BE RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.
- D. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
- E. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- F. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857
- G. REBARS SHALL BE GRADE 60 PER ASTM A615
- H. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185
- I. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS
- J. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 4-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

- K. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.
- L. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

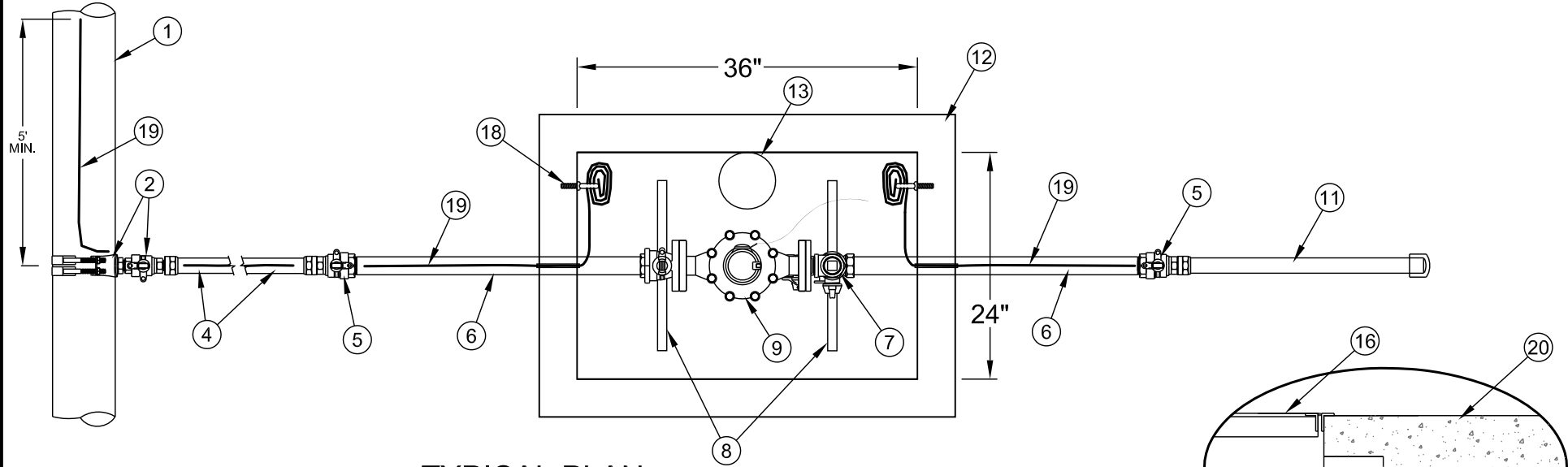
NO. ALTERNATE DESCRIPTION

WHEN USING SDR9 HDPE (IPS) WITH STAINLESS STEEL, BRASS, OR BRONZE MNPT ENDS, USE THE FOLLOWING PRODUCTS:

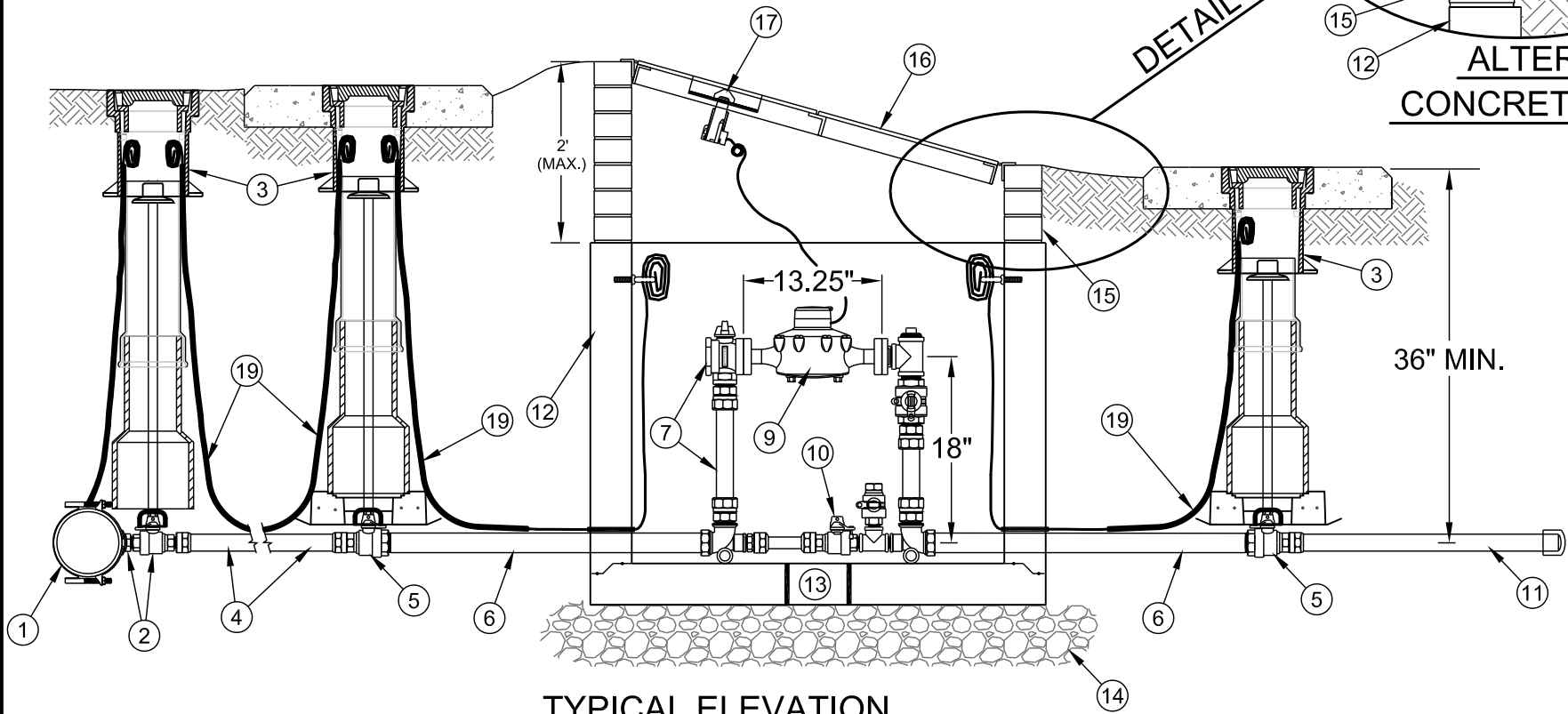
- 2 1 1/2" BALL CORPORATION STOP (CC TAPER THREAD x FNPT)
- 4 1 1/2" SDR9 HDPE (POLY) - IPS PIPE (MNPT x MNPT)
- 5 1 1/2" BALL VALVE (FNPT x FNPT)
- 11 1 1/2" SDR9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - CAP END

NO. DESCRIPTION

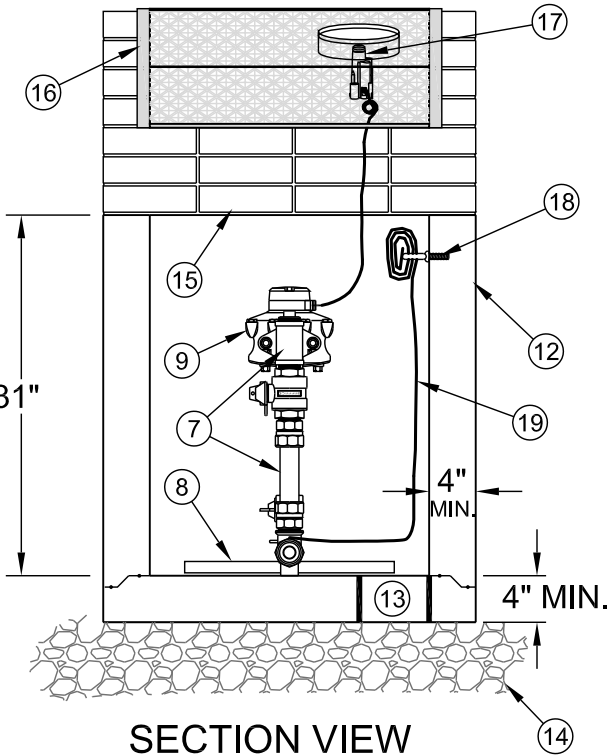
- 1 EXISTING OR PROPOSED WATER MAIN
- 2 TAPPING SADDLE AND 1 1/2" BALL CORPORATION STOP (CC TAPER THREAD x CTS COMPRESSION)
- 3 STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES (OMIT AT CORPORATION STOP ON SHORT SIDE SERVICE)
- 4 1 1/2" TYPE K COPPER TUBING
- 5 1 1/2" BALL VALVE (CTS COMPRESSION x FNPT)
- 6 1 1/2" RED BRASS PIPE NIPPLE (L = 30" OR 36")
- 7 1 1/2" BRASS METER SETTER ASSEMBLY - FORD #VB-76-95311-05, MUELLER #098B 242343, CAMBRIDGE #6020-718F6F6-UUBS OR McDONALD #720B618WTFF, NO SOLDER JOINTS PERMITTED
- 8 3/4" SCH 40 RED BRASS NIPPLE (L=18") x 2 EACH
- 9 1 1/2" WATER METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CONTRACTOR)
- 10 BY PASS BALL VALVE WITH LOCK WINGS - LOCK VALVE IN CLOSED POSITION (SERIAL NUMBERED STUD LOCK - FURNISHED BY CMUD)
- 11 1 1/2" TYPE K COPPER TUBING TAIL PIECE - L = 24" MIN. - CAP END
- 12 PRECAST CONCRETE SERVICE VAULT (36" x 24" x 31")
- 13 6" DIAMETER SUMP HOLE
- 14 6" COMPACTED #57 OR #67 WASHED STONE
- 15 MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2 FT.
- 16 24" x 36" ACCESS DOOR - SEE STANDARD DETAIL
- 17 AMR (ERT) TRANSMITTER
- 18 3/8" DIAMETER GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
- 19 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYP)
- 20 CAST IN PLACE CONCRETE SIDEWALK - BRICK WORK SHALL NOT EXTEND TO SURFACE, ACCESS DOOR SHALL REST ON SIDEWALK



TYPICAL PLAN



TYPICAL ELEVATION



SECTION VIEW

NO SCALE

STANDARD NO.

M

VERSION NO. 1.0

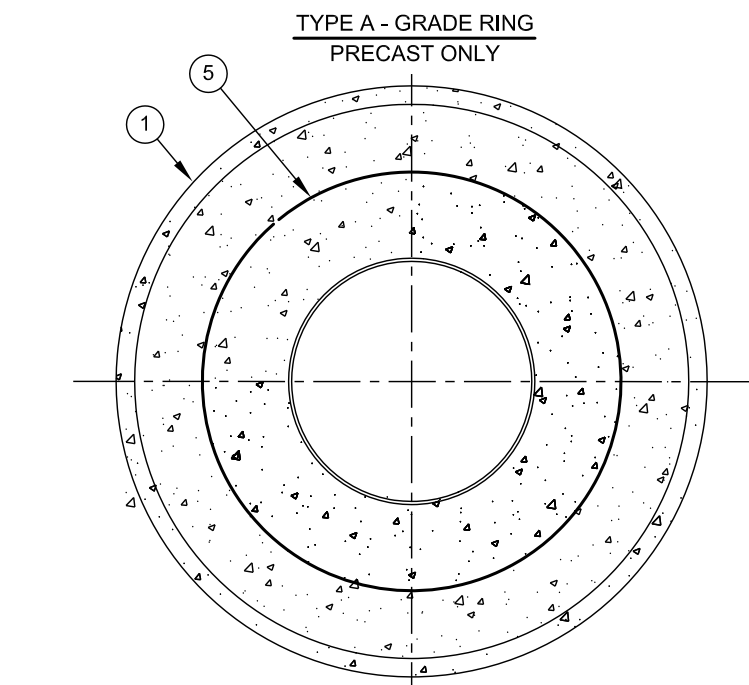
VERSION DATE 5.05.2011

1 1/2 INCH WATER METER SERVICE  
CONNECTION AND VAULT

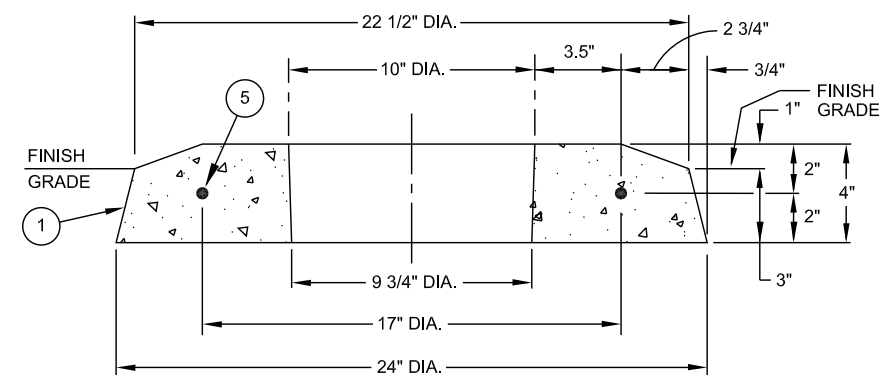
CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



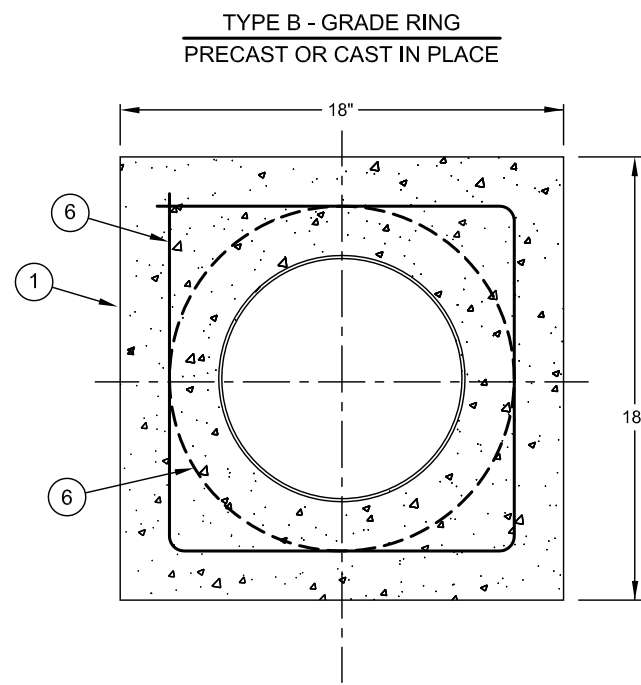




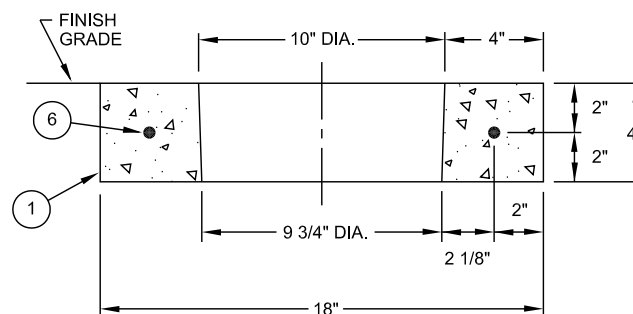
PLAN



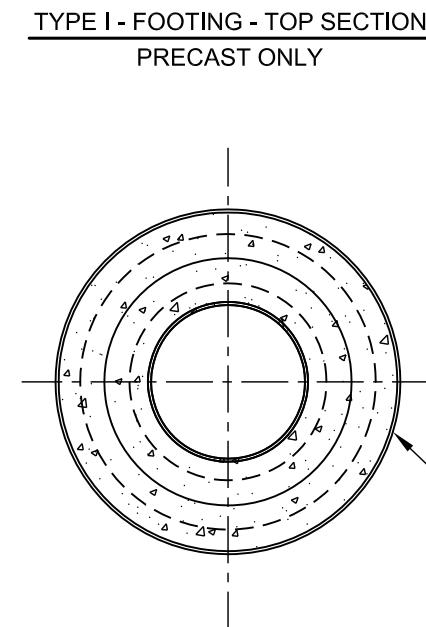
SECTION



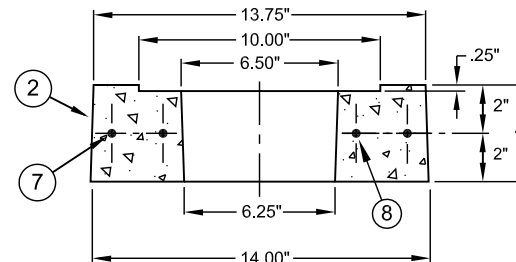
PLAN



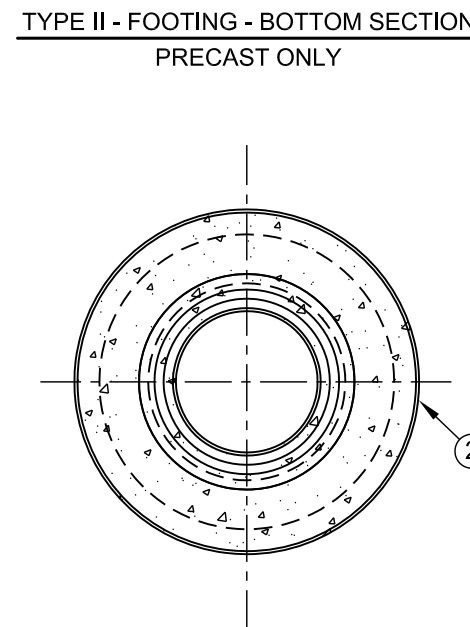
SECTION



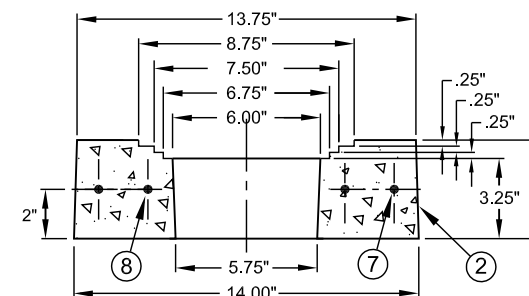
PLAN



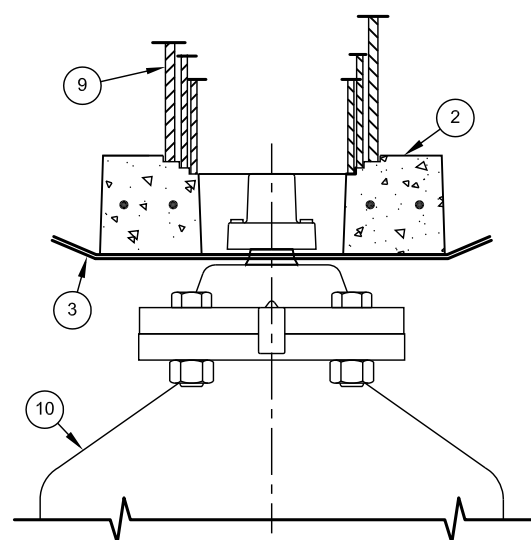
SECTION VIEW



PLAN



SECTION VIEW



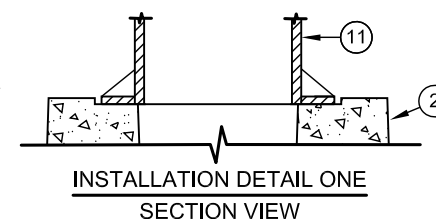
INSTALLATION DETAIL TWO  
SECTION VIEW

#### NO. DESCRIPTION

1. CONCRETE GRADE RING.
2. CONCRETE FOOTING.
3. NON WOVEN GEOTEXTILE FABRIC X 2 EACH.
4. SLIT IN FABRIC – 6 INCHES LONG, ROTATE 90 DEGREES IN SECOND LAYER OF FABRIC.
5. #4 REBAR – 17-INCH DIAMETER.
6. #4 REBAR – LENGTH = 56 INCHES, OR (ALTERNATE - 14-INCH DIAMETER).
7. #4 REBAR – 12-INCH DIAMETER.
8. #4 REBAR – 8-INCH DIAMETER.
9. VALVE BOX ASSEMBLY – (SHOWN LEFT TO RIGHT) – VALVE BOX BOTTOM SECTION, OR 6-INCH DIAMETER C900 PVC PIPE, OR 6-INCH DIAMETER SDR 26 PVC PIPE.
10. VALVE – 12-INCH OR SMALLER.
11. TOP SECTION OF VALVE BOX.

#### DESIGN REQUIREMENTS

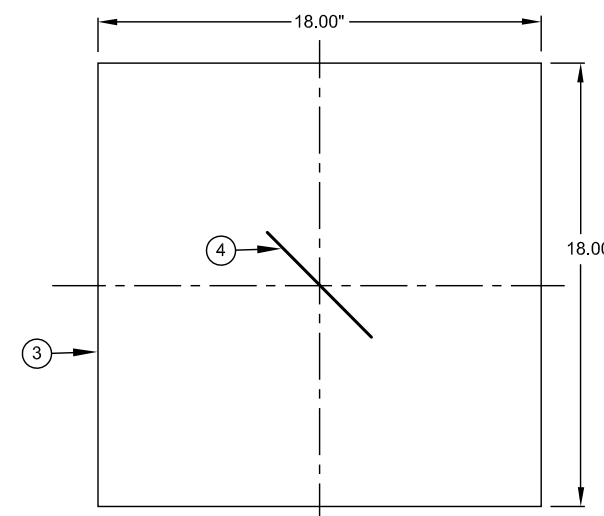
- a. CONCRETE –  $f'_c = 4000$  PSI (PRECAST), OR 3600 PSI (CAST-IN-PLACE).
- b. STEEL REINFORCEMENT – REBARS – GRADE 60 (60,000 PSI) – ASTM A-615, OR WELDED WIRE FABRIC – ASTM A-185.
- c. NON WOVEN GEOTEXTILE FABRIC – CARTHAGE MILLS #FX-40HS, MIRAFI #140N, OR APPROVED EQUAL.



INSTALLATION DETAIL ONE  
SECTION VIEW

#### NOTES:

- A. FOR PRECAST GRADE RINGS – FILL VOID BETWEEN GRADE RING AND CAST IRON VALVE BOX TOP SECTION WITH NON-SHRINK GROUT.
- B. FOR CAST-IN-PLACE GRADE RINGS – TOP SECTION OF CAST IRON VALVE BOX SHALL BE CAST IN THE CONCRETE.
- C. TYPE A GRADE RINGS SHALL BE REQUIRED ON ROAD SHOULDERS WITHOUT CURB.
- D. TYPE I FOOTINGS SHALL BE REQUIRED IN NEW CONSTRUCTION WHEN THE CAST IRON VALVE BOX IS LOCATED DIRECTLY IN THE ASPHALT.
- E. TYPE II FOOTINGS SHALL BE REQUIRED AT ALL VALVE INSTALLATIONS.
- F. FOR INSTALLATION DETAIL TWO – ONLY ONE VALVE BOX ASSEMBLY (PART #9) SHALL BE REQUIRED. FOOTINGS SHALL NOT REST ON THE VALVE, AND SHALL BE CENTERED ON THE VALVE OPERATING NUT AS SHOWN.



NON WOVEN GEOTEXTILE FABRIC x 2 EACH

NO SCALE

STANDARD NO.

MM

VERSION NO. V1.0

VERSION DATE 11.2.2010

VALVE BOX - CONCRETE GRADE RINGS AND  
FOOTINGS ( 12" AND SMALLER VALVES - ONLY )

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER/SEWER/RECLAIM/CP



CHARLOTTE

NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH / WIDTH MAY VARY DUE TO BRAND - VERIFY DIMENSIONS TO DETERMINE MINIMUM VAULT SIZE.

D. VAULT SHALL BE SIZED AS NEEDED FOR MINIMUM CLEARANCE AS SHOWN AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

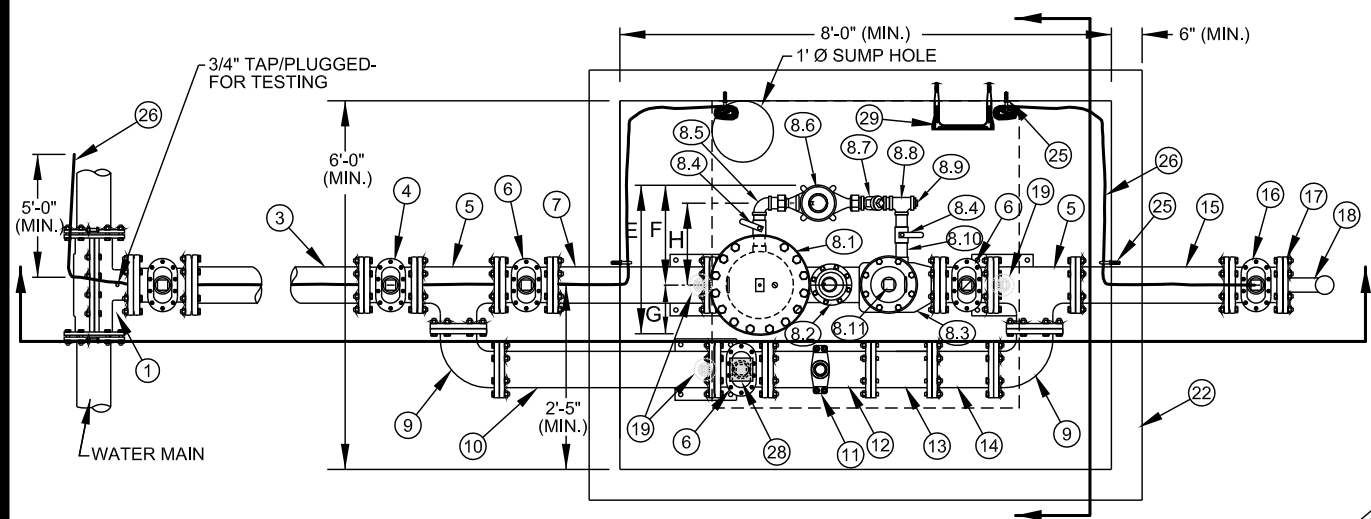
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

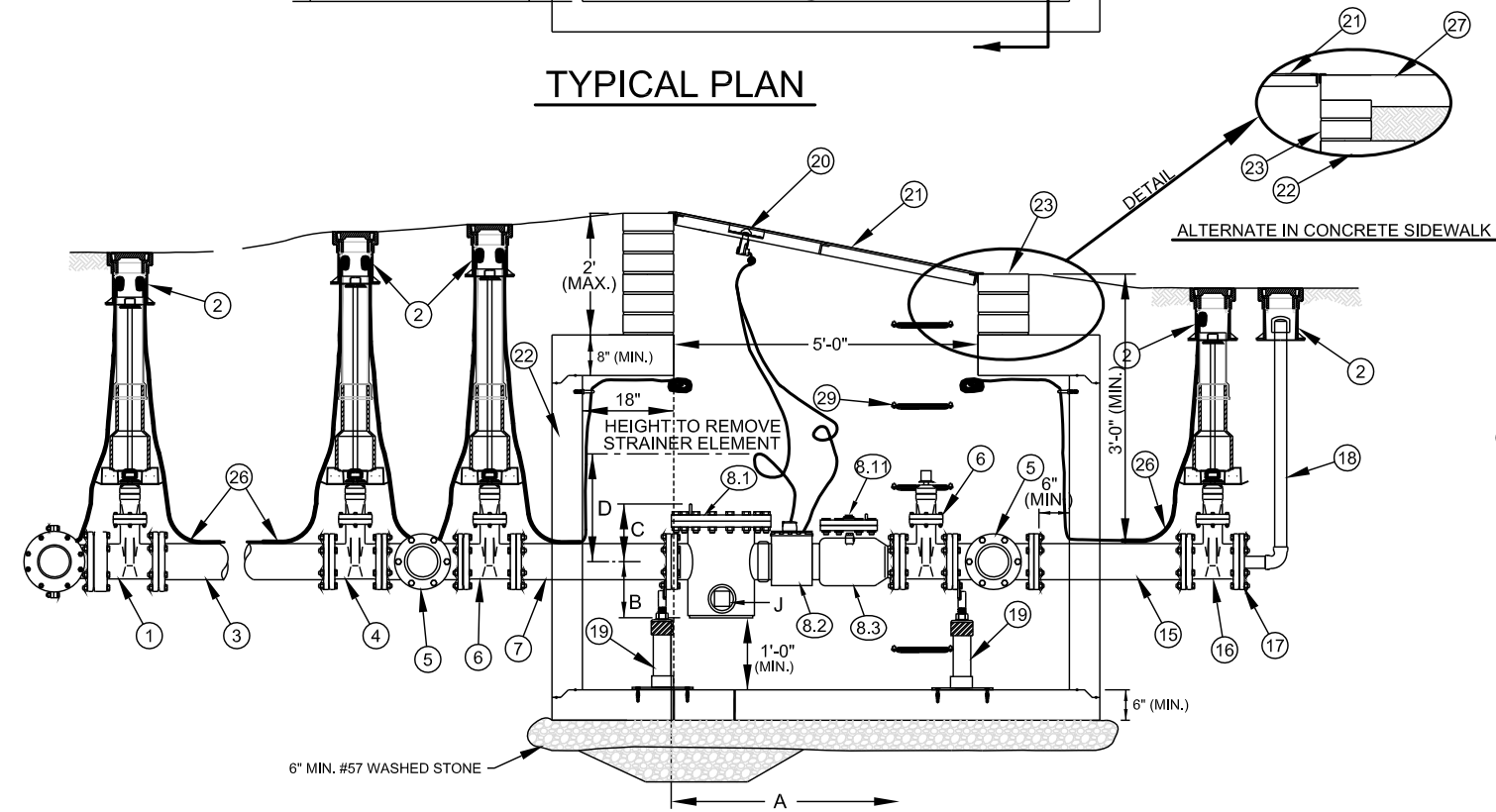
L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 16



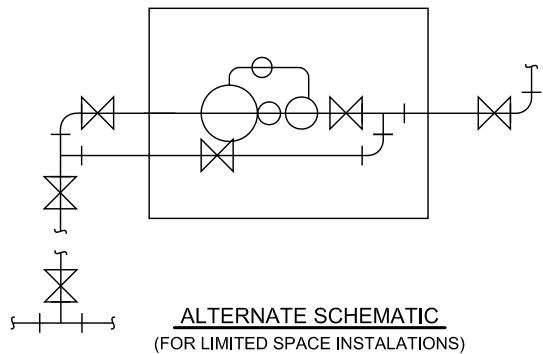
TYPICAL PLAN



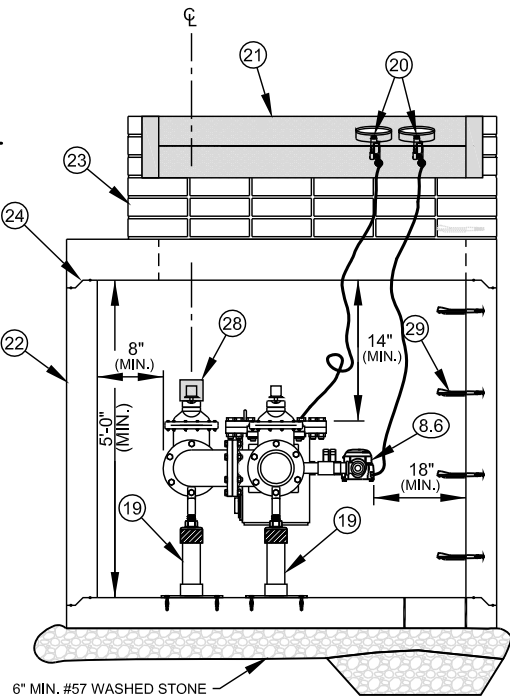
TYPICAL ELEVATION

DIMENSION B - H VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER.

METER SIZE	A	B	C	D	E	F	G	H	8.11	J
6"	45"	11 1/16"	11 3/8"	21 1/4"	29"	19 1/2"	9 1/2"	16"	2"	3"



ALTERNATE SCHEMATIC  
(FOR LIMITED SPACE INSTALLATIONS)



SECTION VIEW

NO. DESCRIPTION

- 1 6" - TAPPING SLEEVE AND 6" FL x MJ TAPPING VALVE ON EXISTING MAIN. 6" MECHANICAL JOINT OUTLET TEE AND 6" MJ GATE VALVE ON NEW MAIN

2 STANDARD VALVE BOX ASSEMBLY (TYPICAL) - ALL VALVES

3 6" DUCTILE IRON PIPE - RESTRAINED

4 6" MJ x FL DUCTILE IRON ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN), 6" MJ x FL GATE VALVE ON LONG SIDE SERVICE (SHOWN)

5 6" ALL FLANGE DUCTILE IRON TEE

6 6" ALL FLANGE GATE VALVE

7 6" ALL FLANGE DUCTILE IRON PIPE SPOOL - L = 30" (MIN.) (SPECIAL CLASS 53)

8 6" FMCT METER ASSEMBLY (FLANGE x FLANGE) - SHOWN AS 6" x 2", MAY ALSO BE 6" x 1 1/2" - AS DETERMINED BY MANUFACTURER.
- 8.1 STRAINER

8.2 METER WITH AMR / TRANSMITTER

8.3 CHECK VALVE

8.4 2" BRASS BALL VALVE WITH HANDLE (FNPT x FNPT)

8.5 2" BRASS 90° BEND (FNPT x FNPT)

8.6 2" METER (2 BOLT METER FL - EACH END) WITH AMR / TRANSMITTER

8.7 2" BRONZE CHECK VALVE (FNPT x FNPT)

8.8 2" BRONZE TEE (FNPT x FNPT x FNPT)

8.9 2" BRONZE PLUG (MNPT)

8.10 2" RED BRASS PIPE NIPPLES (TYP - AS READ) - ( MNPT x MNPT)

8.11 2" (MIN.) SQUARE HEAD BRASS PLUG (MNPT)
- 9 6" DUCTILE IRON 90° BEND FLANGE x FLANGE

10 6" DUCTILE IRON PIPE - FLANGE x FLANGE SPOOL - L = 42" (MIN.) (SPECIAL CLASS 53)

11 6" x 1 1/2" SERVICE SADDLE WITH 1 1/2" BALL CORPORATION STOP - CC - TAPER TREAD

12 6" DUCTILE IRON PIPE - FLANGE x PE - L = 24" (MIN.) (SPECIAL CLASS 53)

13 6" MECHANICAL JOINT DUCTILE IRON LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINT

14 6" DUCTILE IRON PIPE - FLANGE x PE - L = 18" (MIN.) (SPECIAL CLASS 53)

15 6" DUCTILE IRON PIPE - FLANGE x PE - L = 30" (MIN.) (SPECIAL CLASS 53)

16 6" MECHANICAL JOINT (RJ) GATE VALVE - OPEN LEFT AT PROPERTY LINE

17 6" MECHANICAL JOINT PLUG WITH 2" TAP (FNPT)

18 2" TEMPORARY BLOW OFF ASSEMBLY (GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR9) OR DIP - END WITH THREADED COUPLING)

19 GALV. STEEL OR S.S. ADJUSTABLE FLANGE PIPE SUPPORTS (NUMBER REQ'D = 3) (WITH STAINLESS STEEL ADHESIVE ANCHORS)

20 AMR TRANSMITTERS (ERT)

21 5 FT x 5 FT ACCESS DOOR - SEE STD. DETAIL

22 PRECAST REINFORCED CONCRETE VAULT - 8 FT x 6 FT x 5 FT (MIN.) SEE NOTES C AND D.

23 MINIMUM OF (3) STD. SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME - MAX. 2 FT.

24 JOINT REQUIRED AT FLAT TOP SECTION

25 3/8" DIA. GALV. STEEL EYE BOLT (EPOXY ADHESIVE ANCHOR) - TYPICAL

26 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYPICAL)

27 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

28 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED.

29 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING.

NO SCALE

STANDARD NO.

N

VERSION NO.

1.0

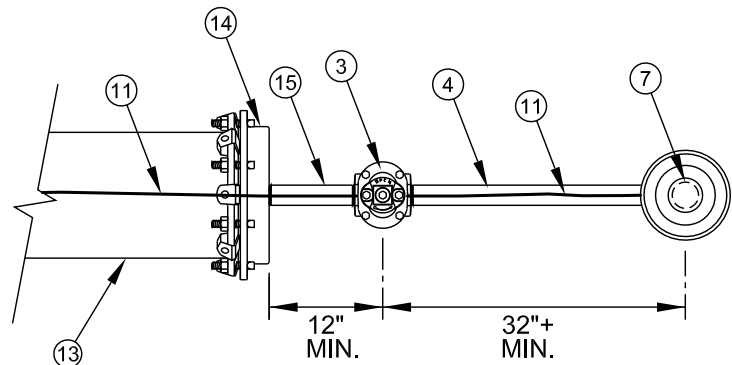
1.13.2011

6-INCH FIRE METER COMPOUND TYPE (FMCT)  
WATER METER AND PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



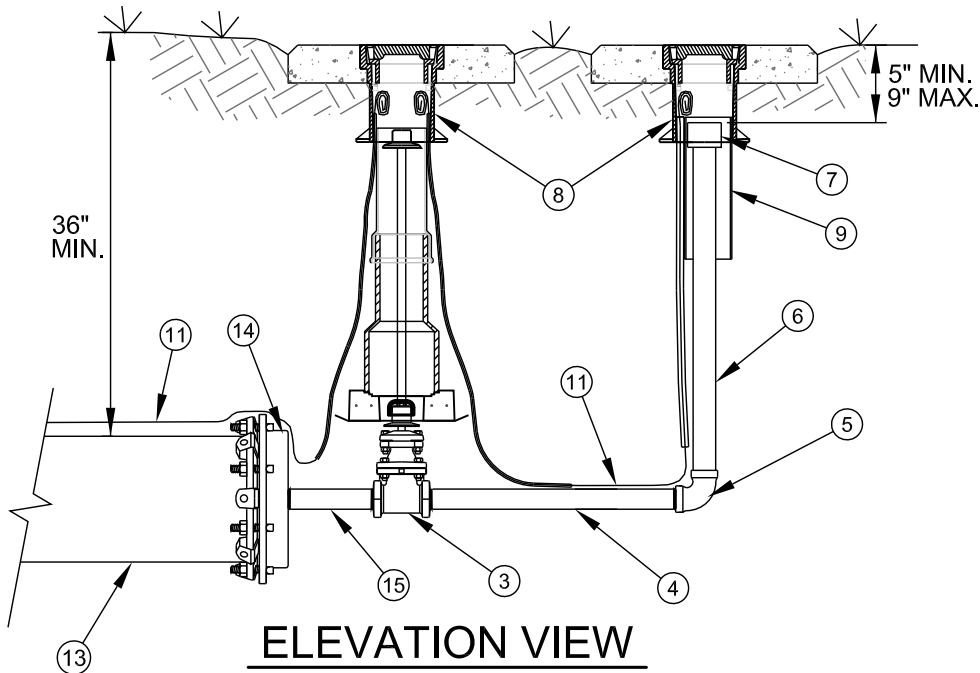
6-INCH THROUGH 12-INCH  
WATER MAINS



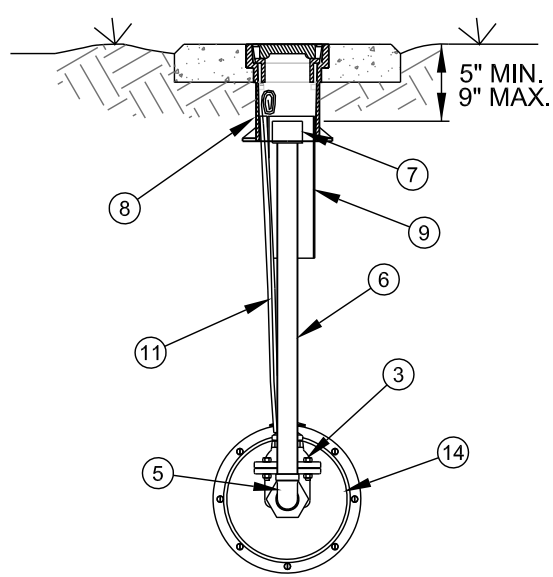
PLAN VIEW

RESTRAINED PIPE LENGTH REQUIREMENTS:		
PIPE DIAMETER (INCHES)	REQUIRED RESTRAINED LENGTH:	
	BARE DIP (FEET)	POLYWRAPPED DIP (FEET)
6	169	242
8	219	312
10	264	377
12	309	441

DESIGN BASIS:  
DIPRA "THRUST RESTRAINT DESIGN FOR DIP"  
VERSION 3.3 DATED 05/09/2003  
LAYING CONDITION: TYPE 2  
SOIL DESIGNATION: SILT 1  
DEPTH OF COVER: 3.0 FT. MINIMUM  
DESIGN PRESSURE: 200 PSI  
SAFETY FACTOR: 2.0

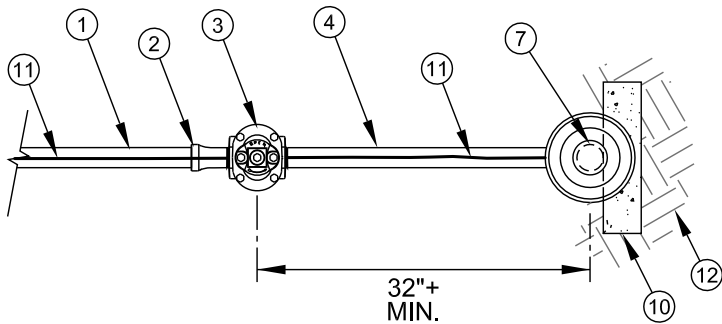


ELEVATION VIEW



END VIEW

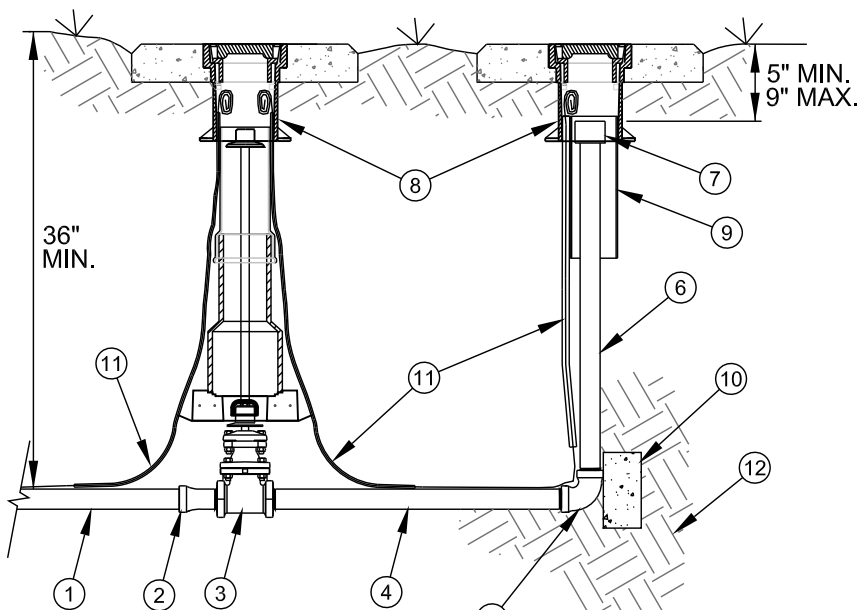
2-INCH WATER MAINS



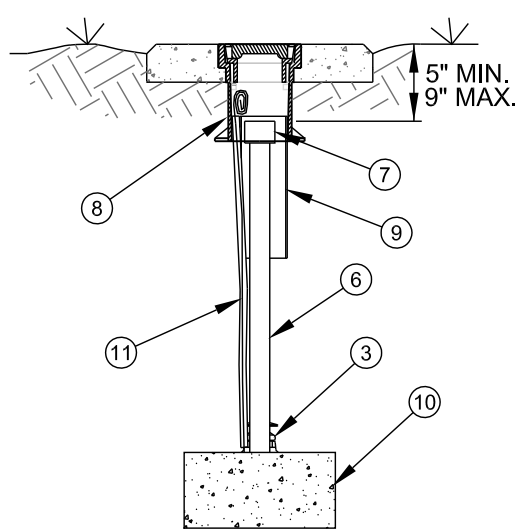
PLAN VIEW

APPROX. DEAD END THRUST (DIPRA) AT 200 PSI WATER PRESSURE		UNDISTURBED SOIL BEARING AREA	APPROX. SOIL PRESSURE
PIPE DIAMETER (INCHES)	TOTAL THRUST (POUNDS)	SQUARE FEET	BEARING LOAD (LB/SQ. FT.)
2	724	0.89	813

APPROXIMATE SOIL BEARING CAPACITY (DIPRA)		
HARD CLAY	9,000	
SANDY CLAY	6,000	
SAND	4,000	
SANDY SILT	3,000	
	2,000	
SILT	1,500	
	1,250	
SOFT CLAY	1,000	
	750	
	500	
	250	
MUCK	0	
SOIL TYPE	BEARING LOAD (LB/SQ. FT.)	DESIGN POINT @ (PIPE DIAMETER)



ELEVATION VIEW



END VIEW

NO. DESCRIPTION

- 1 2-INCH DR 13.5 PVC WATER MAIN (IPS)
- 2 2-INCH D.I. PC 350 ADAPTOR (BELL x MNPT) - FUSION BONDED EPOXY - HARCO OR APPROVED EQUAL.
- 3 2-INCH GATE VALVE (FNPT x FNPT)
- 4 2-INCH RED BRASS NIPPLE - SCH 40 - (MNPT x MNPT), L = 30-INCH (MIN)
- 5 2-INCH RED BRASS 90° BEND (FNPT x FNPT)
- 6 2-INCH RED BRASS NIPPLE - SCH 40 - (MNPT x MNPT) - LENGTH AS REQUIRED
- 7 2-INCH THREADED COUPLING (FNPT x FNPT) - GALV. MALLEABLE IRON OR DUCTILE IRON (F.B.E.)
- 8 STANDARD VALVE BOX ASSEMBLY - SEE DETAIL
- 9 5-INCH CAST IRON SOIL PIPE, L = 15-INCHES, OR VALVE BOX BOTTOM SECTION
- 10 PRECAST CONCRETE SOLID BLOCK (16" x 8" x 4")

- 11 AWG #12 GAUGE COPPER TRACER WIRE WITH BLUE INSULATION (30MIL HDPE) - TERMINATE WITH 24-INCH EXCESS WIRE (COILED) IN VALVE BOX (TYP.)
- 12 UNDISTURBED OR COMPACTED SOIL - 100% STANDARD PROCTOR
- 13 DUCTILE IRON PIPE - RESTRAINED - LENGTH AS REQUIRED - SEE DETAIL
- 14 MJ CAP WITH WEDGE ACTION RESTRAINT GLAND, TAP 2-INCH THREADED OUTLET (FNPT)
- 15 2-INCH RED BRASS NIPPLE - SCH 40 (MNPT x MNPT), L = 12-INCH (MIN)

NO. ALTERNATE DESCRIPTION

- WHEN USING 2-INCH SDR 9 HDPE (IPS) BLOW-OFF PIPE WITH STAINLESS STEEL, BRASS OR BRONZE MNPT ENDS, USE THE FOLLOWING PRODUCTS:
- 4 2-INCH SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - L = 30-INCH (MIN)
- 6 2-INCH SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - LENGTH AS REQ'D.
- 15 2-INCH SDR 9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - L = 12-INCH (MIN)

NO SCALE

STANDARD NO. **11**

VERSION NO. **1.0**

VERSION DATE **8.23.2011**

2-INCH BLOW OFF ASSEMBLY (DEAD END OF MAIN) WITH 2-INCH GATE VALVE

2-INCH THROUGH 12-INCH MAINS

CHARLOTTE-MECKLENBURG UTILITIES

STANDARD DETAILS

WATER

NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH / WIDTH MAY VARY DUE TO BRAND - VERIFY DIMENSIONS TO DETERMINE MINIMUM VAULT SIZE.

D. VAULT SHALL BE SIZED AS NEEDED FOR MINIMUM CLEARANCE AS SHOWN AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

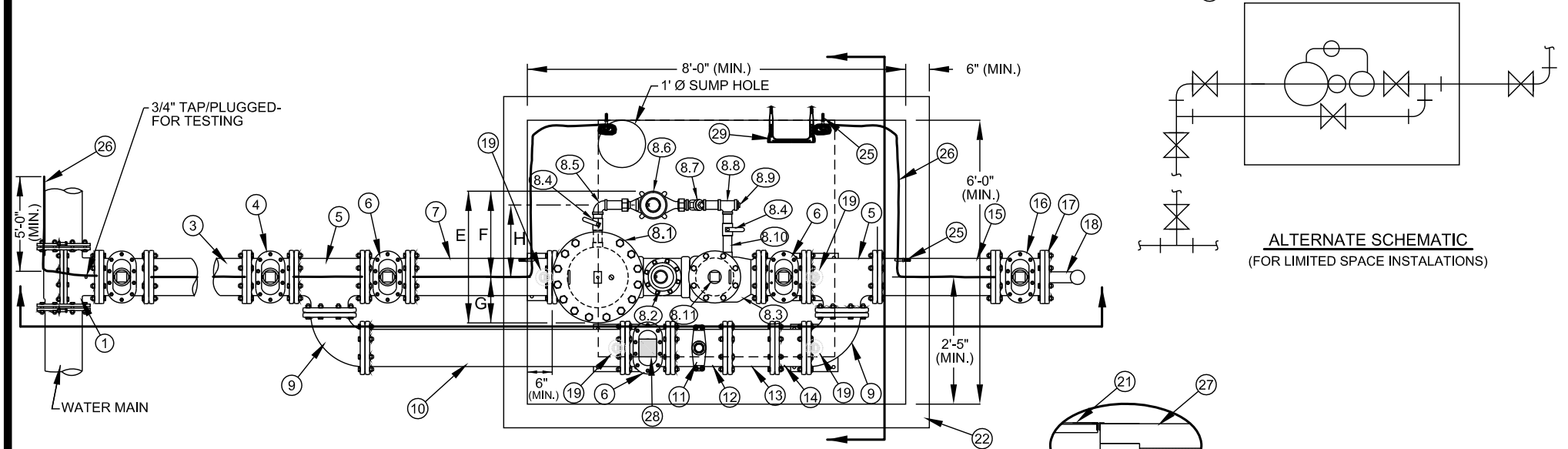
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

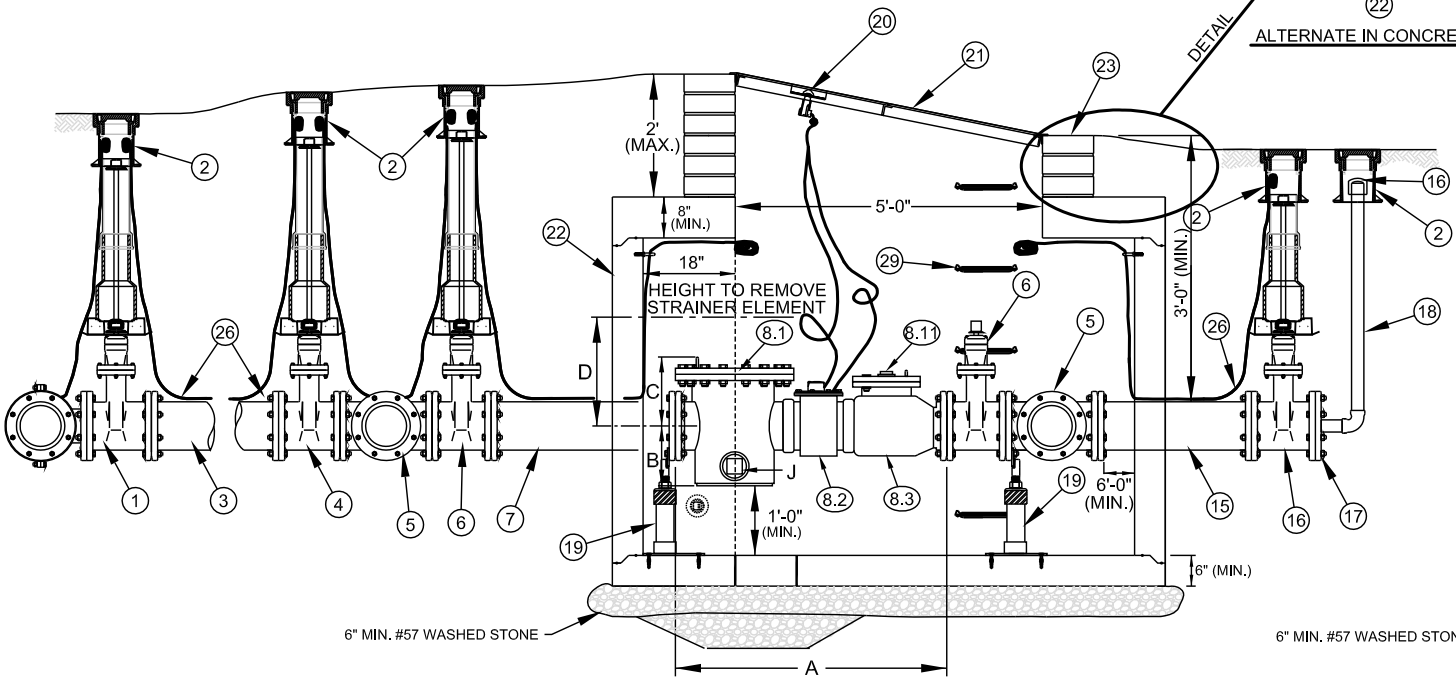
L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 16

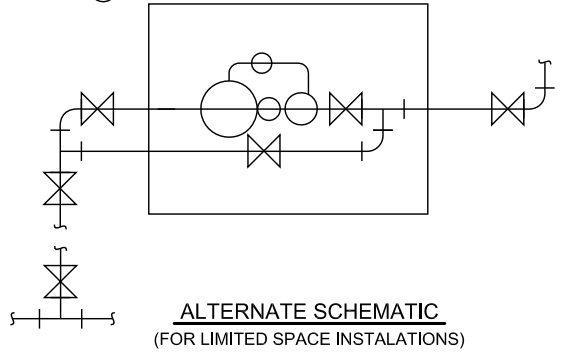


TYPICAL PLAN

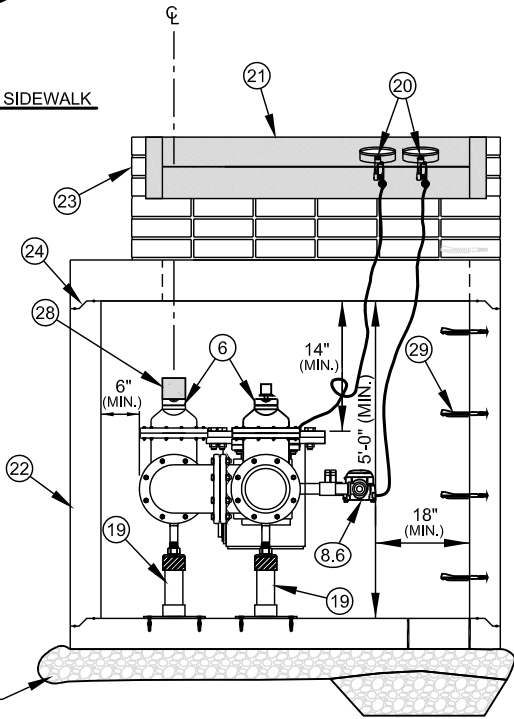


TYPICAL ELEVATION

ALTERNATE IN CONCRETE SIDEWALK



ALTERNATE SCHEMATIC  
(FOR LIMITED SPACE INSTALLATIONS)



SECTION VIEW

NO. DESCRIPTION

- 1 8" OUTLET TAPPING SLEEVE AND 8" FL x MJ TAPPING VALVE ON EXISTING MAIN. 8" MECHANICAL JOINT OUTLET TEE AND 8" MJ GATE VALVE ON NEW MAIN

2 STANDARD VALVE BOX ASSEMBLY (TYPICAL) - ALL VALVES

3 8" DUCTILE IRON PIPE - RESTRAINED

4 8" MJ x FL DUCTILE IRON ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN), 8" MJ x FL GATE VALVE ON LONG SIDE SERVICE (SHOWN)

5 8" ALL FLANGE DUCTILE IRON TEE

6 8" ALL FLANGE GATE VALVE

7 8" ALL FLANGE DUCTILE IRON PIPE SPOOL - L = 36" (MIN.) (SPECIAL CLASS 53)

8 8" FMCT METER ASSEMBLY (FLANGE x FLANGE)

8.1 STRAINER

8.2 METER WITH AMR / TRANSMITTER

8.3 CHECK VALVE

8.4 2" BRASS BALL VALVE WITH HANDLE (FNPT x FNPT)

8.5 2" BRASS 90° BEND (FNPT x FNPT)

8.6 2" METER (2 BOLT METER FL - EACH END) WITH AMR / TRANSMITTER

8.7 2" BRONZE CHECK VALVE (FNPT x FNPT)

8.8 2" BRONZE TEE (FNPT x FNPT x FNPT)

8.9 2" BRONZE PLUG (MNPT)

8.10 2" RED BRASS PIPE NIPPLES (TYP - AS READ) - ( MNPT x MNPT)

8.11 2" (MIN.) SQUARE HEAD BRASS PLUG (MNPT)
- 9 8" DUCTILE IRON 90° BEND FLANGE x FLANGE

10 8" DUCTILE IRON PIPE - FLANGE x FLANGE SPOOL - L = 66" (MIN.) (SPECIAL CLASS 53)

11 8" x 1 1/2" SERVICE SADDLE WITH 1 1/2" BALL CORPORATION STOP - CC - TAPER TREAD

12 8" DUCTILE IRON PIPE - FLANGE x PE - L = 20" (MIN.) (SPECIAL CLASS 53)

13 8" MECHANICAL JOINT DUCTILE IRON LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINT

14 8" DUCTILE IRON PIPE - FLANGE x PE - L = 14" (MIN.) (SPECIAL CLASS 53)

15 8" DUCTILE IRON PIPE - FLANGE x PE - L = 30" (MIN.) (SPECIAL CLASS 53)

16 8" MECHANICAL JOINT (RJ) GATE VALVE - OPEN LEFT AT PROPERTY LINE

17 8" MECHANICAL JOINT PLUG WITH 2" TAP (FNPT)

18 2" TEMPORARY BLOW OFF ASSEMBLY (GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR9) OR DIP - END WITH THREADED COUPLING)

19 GALV. STEEL OR S.S. ADJUSTABLE FLANGE PIPE SUPPORT (NUMBER REQ'D = 4) (WITH STAINLESS STEEL ADHESIVE ANCHORS)

20 AMR TRANSMITTERS (ERT)

21 5 FT x 5 FT ACCESS DOOR - SEE STD. DETAIL

22 PRECAST REINFORCED CONCRETE VAULT - 8 FT x 6 FT x 5 FT (MIN.) SEE NOTES C AND D.

23 MINIMUM OF (3) STD. SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME - MAX. 2 FT.

24 JOINT REQUIRED AT FLAT TOP SECTION

25 3/8" DIA. GALV. STEEL EYE BOLT (EPOXY ADHESIVE ANCHOR) - TYPICAL

26 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYPICAL)

27 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

28 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED.

29 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING.

NO SCALE

STANDARD NO.

0

VERSION NO.

1.0

VERSION DATE

2.02.2011

8-INCH FIRE METER COMPOUND TYPE (FMCT)  
WATER METER AND PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



DIMENSION B - H VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER.

METER SIZE	A	B	C	D	E	F	G	H	8.11	J
8"	53"	11 13/16"	13 29/64"	25 7/8"	34 1/4"	21 3/4"	12 1/2"	17"	3"	3"

Technical drawing of a rectangular component with rounded corners. The overall width is 23.32" and the overall height is 17.83". The drawing shows a cross-section with a central rectangular cavity. The component has a thick outer shell and a thinner inner layer. The section lines are labeled A-A (vertical), B-B (horizontal), and C-C (diagonal). The component is shown in a perspective view, with the section lines indicating the locations of the cross-sections.

Technical drawing of a tapered shaft. The drawing shows a shaft with a tapered section. The dimensions are: 0.43 inch (top diameter), 2.61 inch (height of the tapered section), and 0.25 inch (bottom diameter).

Technical drawing of a mechanical part with dimensions in inches. The part has a total width of 13.88 inches and a total height of 12.00 inches. It features a central raised section with a 10-degree angle and a radius of 1.50 inches. The base has a 1.00 inch thick section. The top has a 0.43 inch thick section. The drawing includes various other dimensions such as 0.81, 10.19, 8.56, 1.24, 1.56, 4.00, 3.71, and 0.25.

A 3D perspective diagram of a rectangular plastic lid. The top surface is covered in a dense, wavy, cross-hatched pattern. On the lid, there is a rectangular label with the text "CHARLES LITTLE" and "METER" (partially visible). Below the lid, three vertical lines represent reinforcement bars, labeled "REBARs" with arrows pointing to them. The entire assembly is labeled "PLASTIC LID" at the bottom.

Technical drawing of a rectangular metal mesh cover. The overall dimensions are 15.31" in width and 10.06" in height. A 3.03" dimension is shown for the right side of the cover. The cover features a diamond-shaped mesh pattern. The text "METER" is printed in large, bold, capital letters on the left side, and "WATER" is printed in large, bold, capital letters on the right side. A vertical label on the right side reads "CHAR-MECK UTILITIES". A circular hole is located on the right side, with a dimension of 0.69" DIA. PICK HOLE indicated below it.



CHARLOTTE-MECKLENBURG SCHOOLS

NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH / WIDTH MAY VARY DUE TO BRAND - VERIFY DIMENSIONS TO DETERMINE MINIMUM VAULT SIZE.

D. VAULT SHALL BE SIZED AS NEEDED FOR MINIMUM CLEARANCE AS SHOWN AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

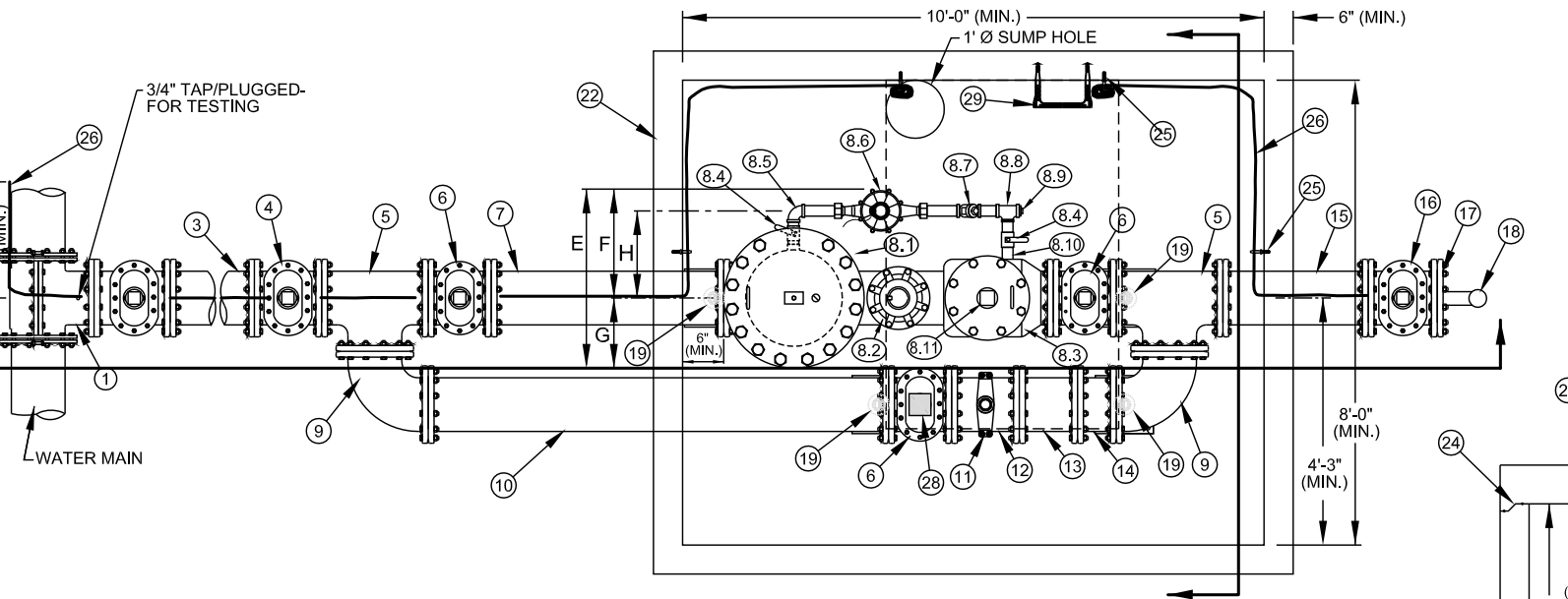
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

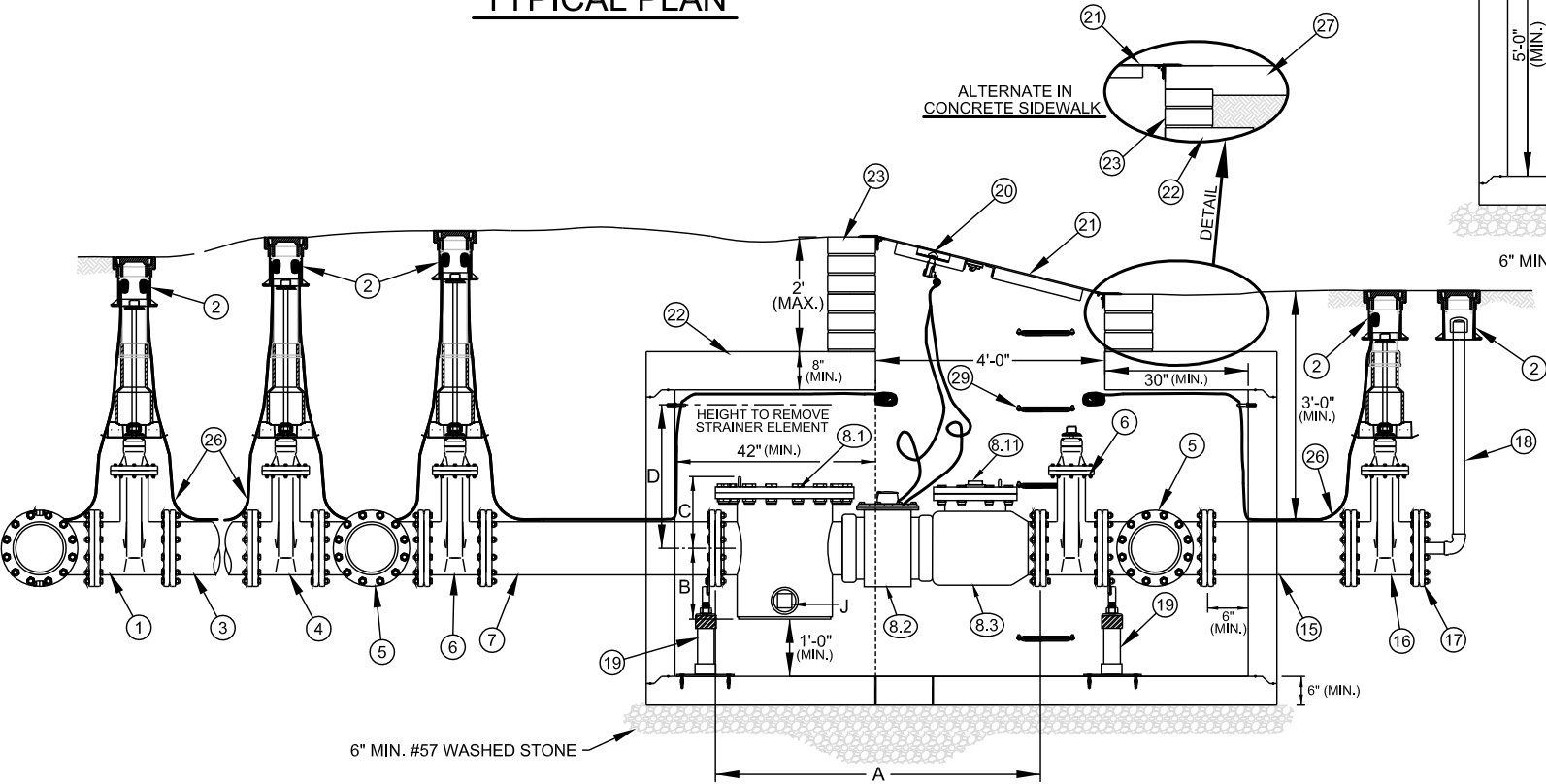
L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 16



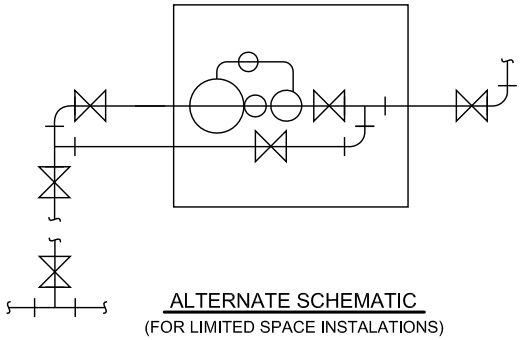
TYPICAL PLAN



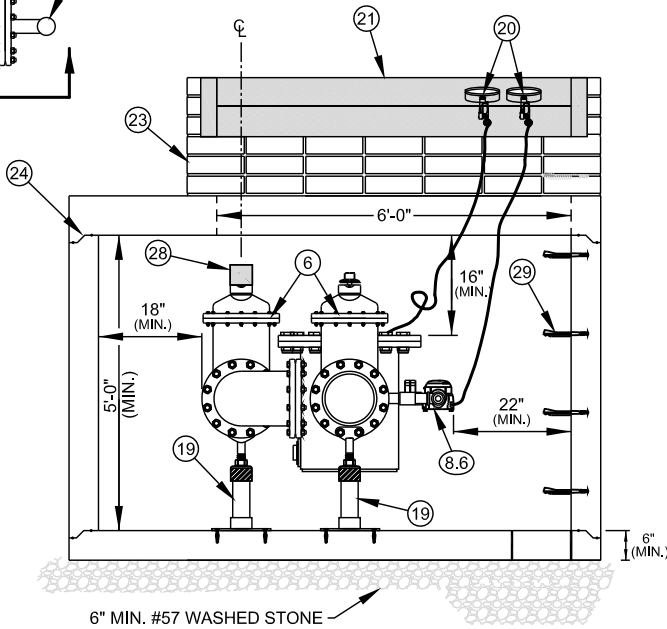
TYPICAL ELEVATION

DIMENSION B - H VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER.

METER SIZE	A	B	C	D	E	F	G	H	8.11	J
10"	68"	14 13/16"	15"	30 1/16"	36 1/4"	22 1/2"	13 3/4"	18"	3"	3"



ALTERNATE SCHEMATIC  
(FOR LIMITED SPACE INSTALLATIONS)



SECTION VIEW

NO. DESCRIPTION

- 1 10" OUTLET TAPPING SLEEVE AND 10" FL x MJ TAPPING VALVE ON EXISTING MAIN. 10" MECHANICAL JOINT OUTLET TEE AND 10" MJ GATE VALVE ON NEW MAIN

2 STANDARD VALVE BOX ASSEMBLY (TYPICAL) - ALL VALVES

3 10" DUCTILE IRON PIPE - RESTRAINED

4 10" MJ x FL DUCTILE IRON ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN), 10" MJ x FL GATE VALVE ON LONG SIDE SERVICE (SHOWN)

5 10" ALL FLANGE DUCTILE IRON TEE

6 10" ALL FLANGE GATE VALVE

7 10" ALL FLANGE DUCTILE IRON PIPE SPOOL - L = 48" (MIN.) (SPECIAL CLASS 53)

8 10" FMCT METER ASSEMBLY (FLANGE x FLANGE)

8.1 STRAINER

8.2 METER WITH AMR / TRANSMITTER

8.3 CHECK VALVE

8.4 2" BRASS BALL VALVE WITH HANDLE (FNPT x FNPT)

8.5 2" BRASS 90° BEND (FNPT x FNPT)

8.6 2" METER (2 BOLT METER FL - EACH END) WITH AMR / TRANSMITTER

8.7 2" BRONZE CHECK VALVE (FNPT x FNPT)

8.8 2" BRONZE TEE (FNPT x FNPT x FNPT)

8.9 2" SQUARE HEAD BRONZE PLUG (MNPT)

8.10 2" RED BRASS PIPE NIPPLES (TYP - AS READ) - ( MNPT x MNPT)

8.11 2" (MIN.) SQUARE HEAD BRASS PLUG (MNPT)

9 10" DUCTILE IRON 90° BEND FLANGE x FLANGE

10 10" DUCTILE IRON PIPE - FLANGE x FLANGE SPOOL - L = 95" (MIN.) (SPECIAL CLASS 53)

11 10" x 1 1/2" SERVICE SADDLE WITH 1 1/2" BALL CORPORATION STOP - CC - TAPER TREAD

12 10" DUCTILE IRON PIPE - FLANGE x PE - L = 20" (MIN.) (SPECIAL CLASS 53)

13 10" MECHANICAL JOINT DUCTILE IRON LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINT

14 10" DUCTILE IRON PIPE - FLANGE x PE - L = 14" (MIN.) (SPECIAL CLASS 53)

15 10" DUCTILE IRON PIPE - FLANGE x PE - L = 30" (MIN.) (SPECIAL CLASS 53)

16 10" MECHANICAL JOINT (RJ) GATE VALVE - OPEN LEFT AT PROPERTY LINE

17 10" MECHANICAL JOINT PLUG WITH 2" TAP (FNPT)

18 2" TEMPORARY BLOW OFF ASSEMBLY (GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR9) OR DIP - END WITH THREADED COUPLING)

19 GALV. STEEL OR S.S. ADJUSTABLE FLANGE PIPE SUPPORT (NUMBER REQ'D = 4) (WITH STAINLESS STEEL ADHESIVE ANCHORS)

20 AMR TRANSMITTERS (ERT)

21 4 FT x 6 FT ACCESS DOOR - SEE STD. DETAIL

22 PRECAST REINFORCED CONCRETE VAULT - 8 FT x 10 FT x 5 FT (MIN.) SEE NOTES C AND D.

23 MINIMUM OF (3) STD. SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME - MAX. 2 FT.

24 JOINT REQUIRED AT FLAT TOP SECTION

25 3/8" DIA. GALV. STEEL EYE BOLT (EPOXY ADHESIVE ANCHOR) - TYPICAL

26 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION-TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYPICAL)

27 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

28 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED.

29 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING.

NO SCALE

STANDARD NO.

P

VERSION NO. 1.0  
VERSION DATE 02.02.2011

10-INCH FIRE METER COMPOUND TYPE (FMCT)  
WATER METER AND PRECAST CONCRETE VAULT

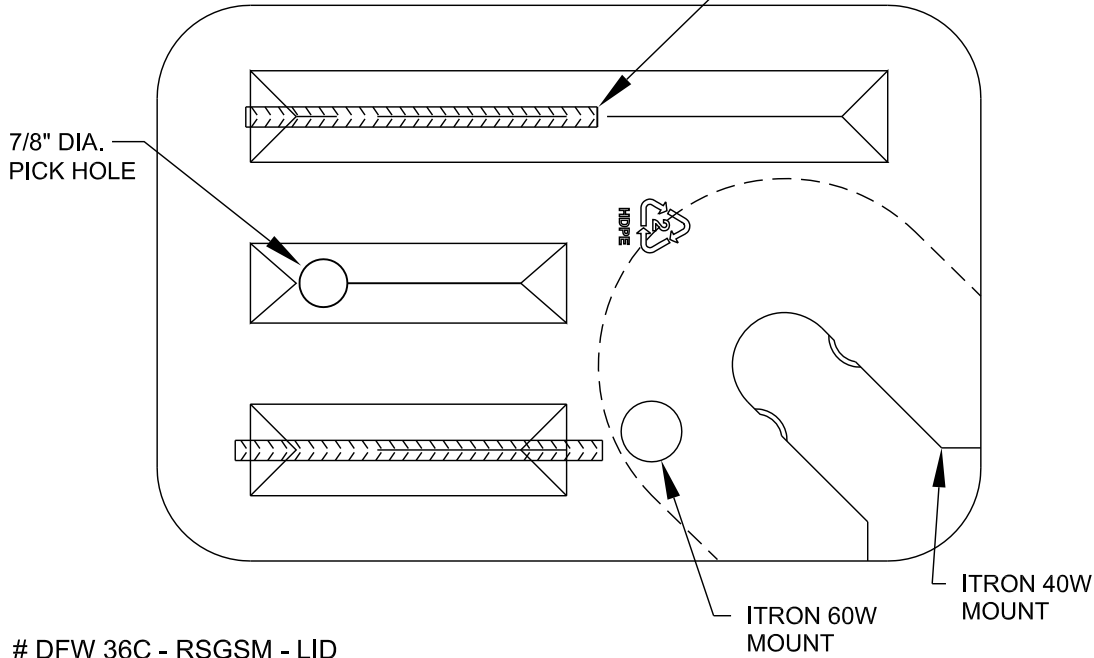
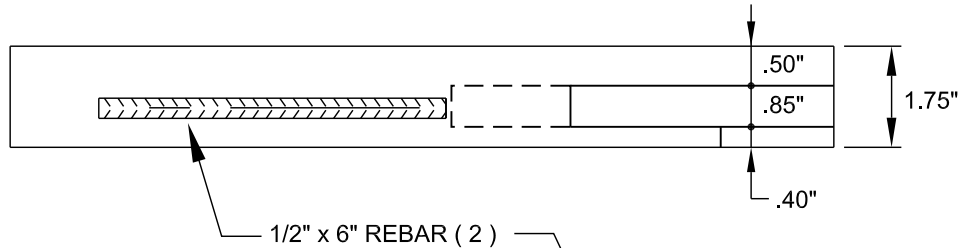
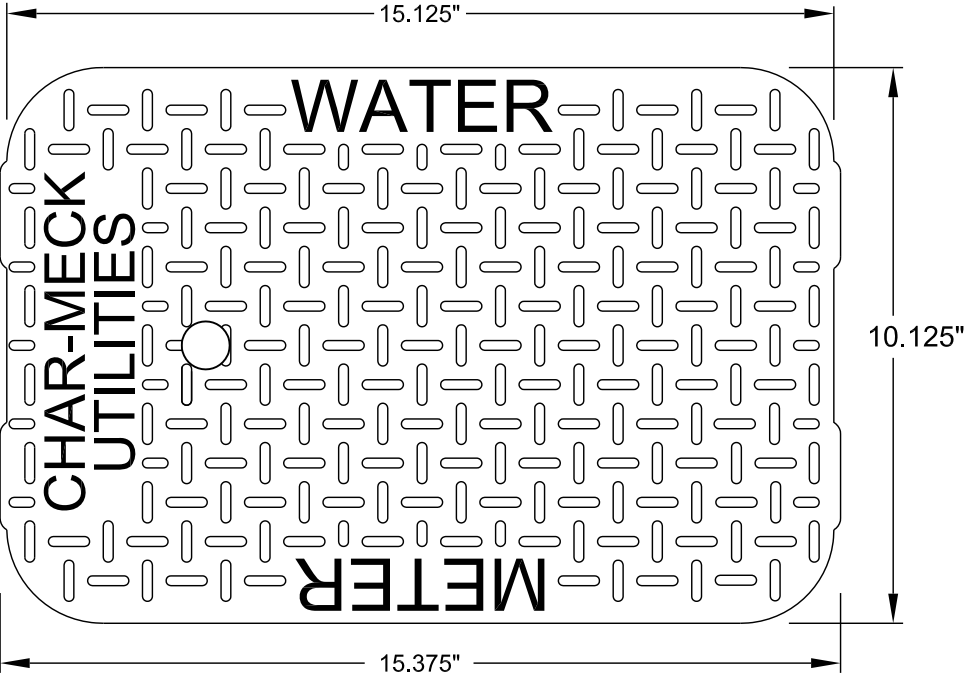
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER

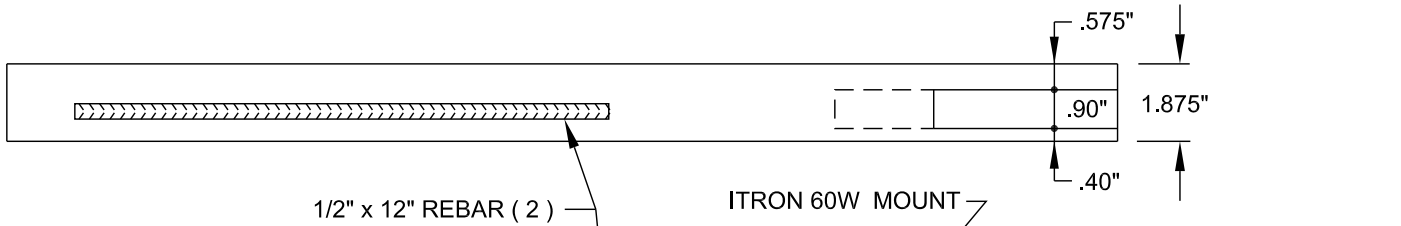
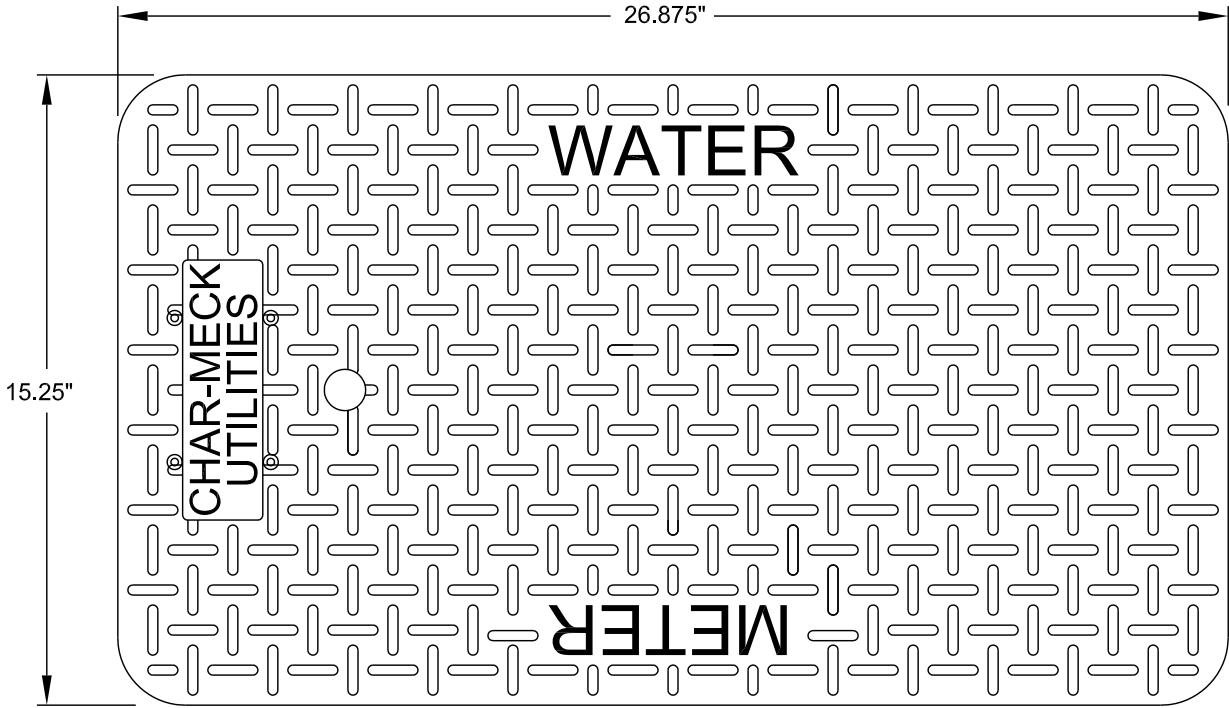


3/4 - INCH SERVICE LID

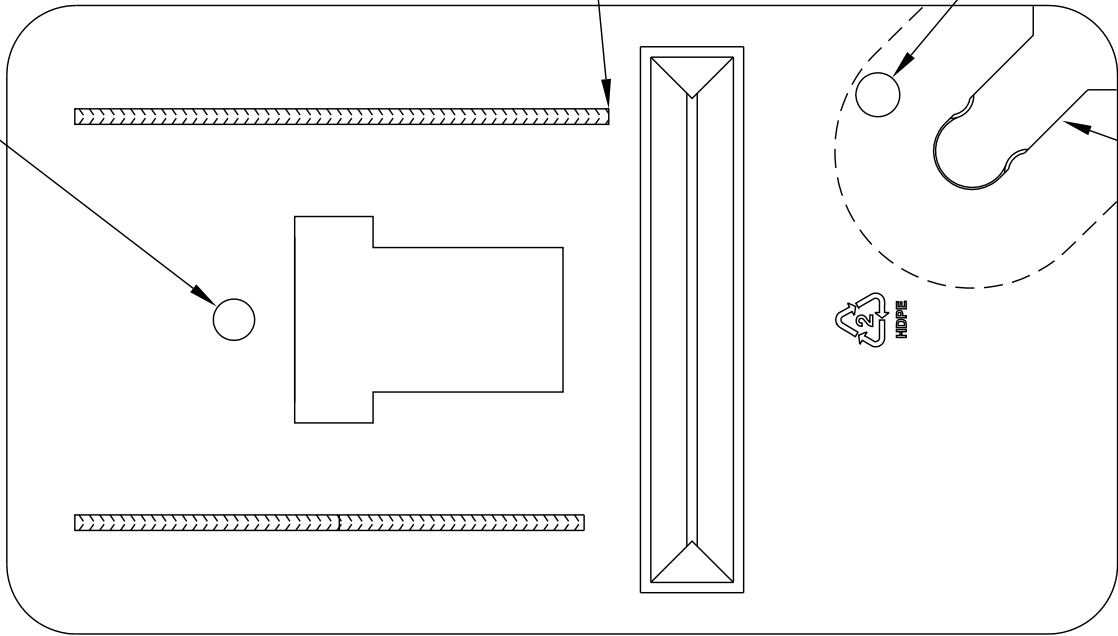


# DFW 36C - RSGSM - LID  
WEIGHT - INCLUDING REBARS - 6.50 LBS.

1 - INCH SERVICE LID



1" DIA.  
PICK HOLE



# DFW 65C - RSGSM - LID  
WEIGHT - INCLUDING REBARS - 23.50 LBS.

NOTES: • MATERIAL - HIGH DENSITY POLYETHYLENE ( HDPE ) - RECYCLED  
• COLOR - CHARLOTTE GREY  
• LOAD RATING - HEAVY DUTY  
• MANUFACTURER - DFW PLASTICS INC. OR APPROVED EQUAL

NO SCALE

STANDARD NO.	
PP	
VERSION NO.	VERSION DATE
V1.0	7.14.2011

WATER METER BOX - PLASTIC LID  
FOR 3/4 - INCH AND 1 - INCH WATER SERVICES

CHARLOTTE-MECKLENBURG UTILITIES	STANDARD DETAILS
	WATER





NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH / WIDTH MAY VARY DUE TO BRAND - VERIFY DIMENSIONS TO DETERMINE MINIMUM VAULT SIZE.

D. VAULT SHALL BE SIZED AS NEEDED FOR MINIMUM CLEARANCE AS SHOWN AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

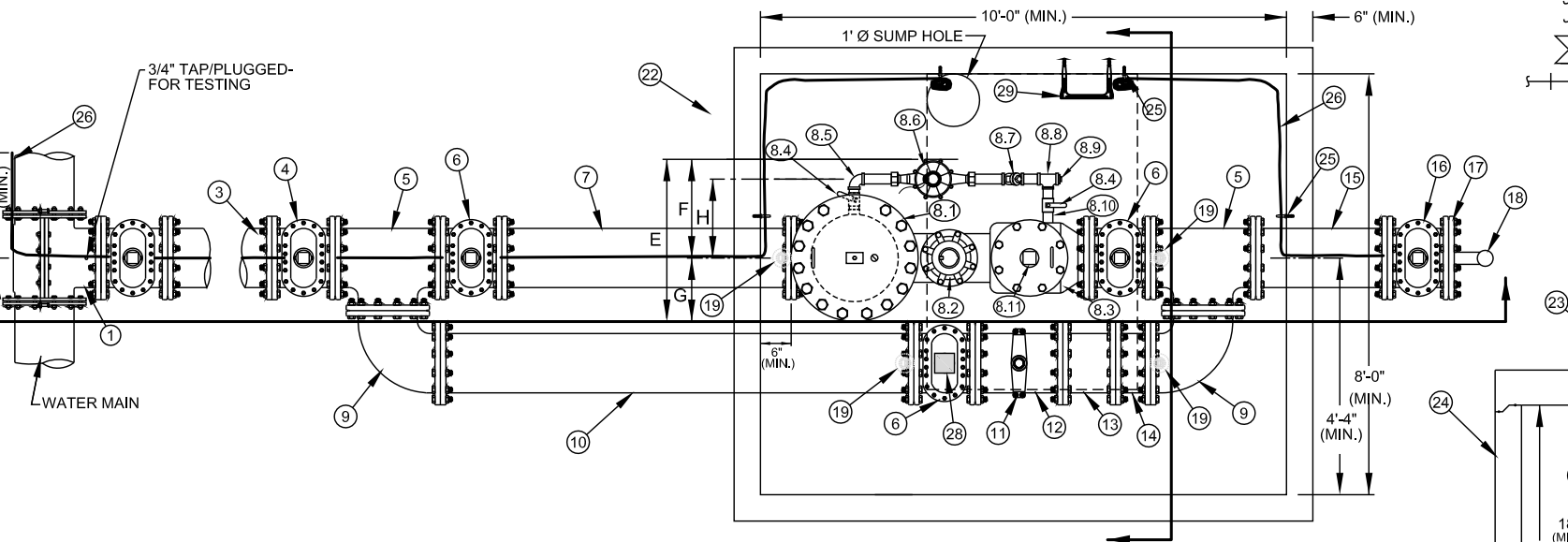
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

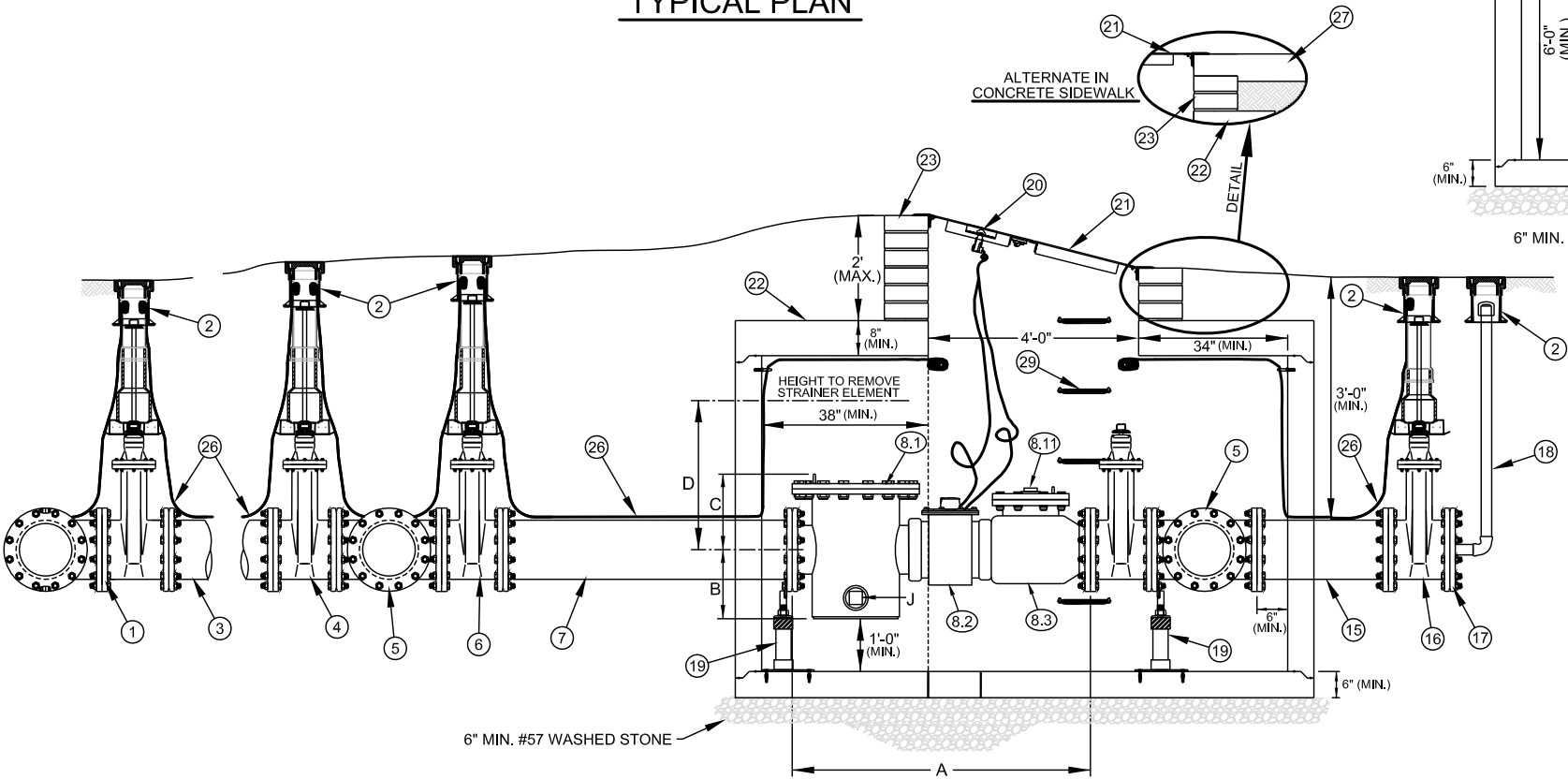
L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 16



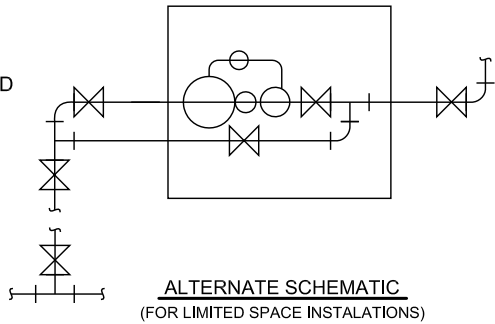
TYPICAL PLAN



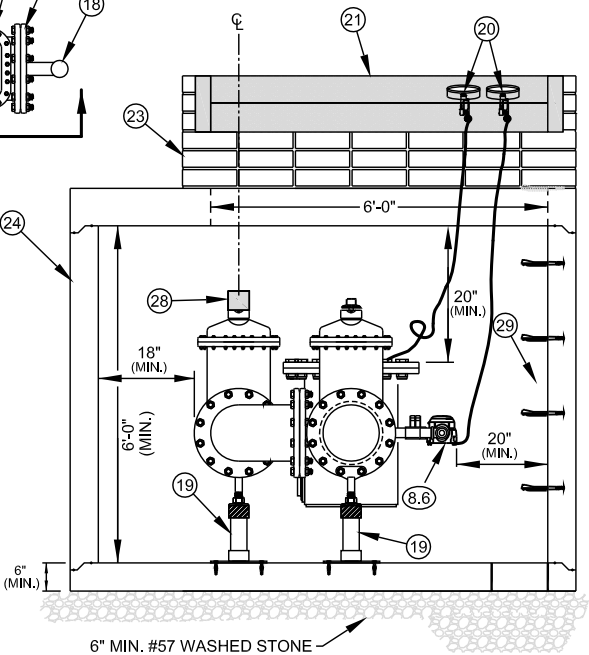
TYPICAL ELEVATION

DIMENSION B - H VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER.

METER SIZE	A	B	C	D	E	F	G	H	8.11	J
12"	68"	15 3/4"	17 1/4"	34 1/16"	36 1/4"	22 1/2"	13 3/4"	18"	3"	3"



ALTERNATE SCHEMATIC  
(FOR LIMITED SPACE INSTALLATIONS)



SECTION VIEW

NO. DESCRIPTION

- 1 12" OUTLET TAPPING SLEEVE AND 12" FL x MJ TAPPING VALVE ON EXISTING MAIN. 12" MECHANICAL JOINT OUTLET TEE AND 10" MJ GATE VALVE ON NEW MAIN

2 STANDARD VALVE BOX ASSEMBLY (TYPICAL) - ALL VALVES

3 12" DUCTILE IRON PIPE - RESTRAINED

4 12" MJ x FL DUCTILE IRON ADAPTER ON SHORT SIDE SERVICE (NOT SHOWN), 12" MJ x FL GATE VALVE ON LONG SIDE SERVICE (SHOWN)

5 12" ALL FLANGE DUCTILE IRON TEE

6 12" ALL FLANGE GATE VALVE

7 12" ALL FLANGE DUCTILE IRON PIPE SPOOL - L = 66" (MIN.) (SPECIAL CLASS 53)

8 12" FMCT METER ASSEMBLY (FLANGE x FLANGE)

8.1 STRAINER

8.2 METER WITH AMR / TRANSMITTER

8.3 CHECK VALVE

8.4 2" BRASS BALL VALVE WITH HANDLE (FNPT x FNPT)

8.5 2" BRASS 90° BEND (FNPT x FNPT)

8.6 2" METER (2 BOLT METER FL - EACH END) WITH AMR / TRANSMITTER

8.7 2" BRONZE CHECK VALVE (FNPT x FNPT)

8.8 2" BRONZE TEE (FNPT x FNPT x FNPT)

8.9 2" SQUARE HEAD BRONZE PLUG (MNPT)

8.10 2" RED BRASS PIPE NIPPLES (TYP - AS READ) - ( MNPT x MNPT)

8.11 2" (MIN.) SQUARE HEAD BRASS PLUG (MNPT)

9 12" DUCTILE IRON 90° BEND FLANGE x FLANGE

10 12" DUCTILE IRON PIPE - FLANGE x FLANGE SPOOL - L = 108" (MIN.) (SPECIAL CLASS 53)

11 12" x 1 1/2" SERVICE SADDLE WITH 1 1/2" BALL CORPORATION STOP - CC - TAPER TREAD

12 12" DUCTILE IRON PIPE - FLANGE x PE - L = 26" (MIN.) (SPECIAL CLASS 53)

13 12" MECHANICAL JOINT DUCTILE IRON LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINT

14 12" DUCTILE IRON PIPE - FLANGE x PE - L = 14" (MIN.) (SPECIAL CLASS 53)

15 12" DUCTILE IRON PIPE - FLANGE x PE - L = 30" (MIN.) (SPECIAL CLASS 53)

16 12" MECHANICAL JOINT (RJ) GATE VALVE - OPEN LEFT AT PROPERTY LINE

17 12" MECHANICAL JOINT PLUG WITH 2" TAP (FNPT)

18 2" TEMPORARY BLOW OFF ASSEMBLY (GALV. STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR9) OR DIP - END WITH THREADED COUPLING)

19 GALV. STEEL OR S.S. ADJUSTABLE FLANGE PIPE SUPPORT (NUMBER REQ'D = 4) (WITH STAINLESS STEEL ADHESIVE ANCHORS)

20 AMR TRANSMITTERS (ERT)

21 4 FT x 6 FT ACCESS DOOR - SEE STD. DETAIL

22 PRECAST REINFORCED CONCRETE VAULT - 8 FT x 10 FT x 6 FT (MIN.) SEE NOTES C AND D.

23 MINIMUM OF (3) STD. SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME - MAX. 2 FT.

24 JOINT REQUIRED AT FLAT TOP SECTION

25 3/8" DIA. GALV. STEEL EYE BOLT (EPOXY ADHESIVE ANCHOR) - TYPICAL

26 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION-TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYPICAL)

27 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

28 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED.

29 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING.

NO SCALE

STANDARD NO.

Q

VERSION NO. 1.0

VERSION DATE 02.02.2011

12-INCH FIRE METER COMPOUND TYPE (FMCT)  
WATER METER AND PRECAST CONCRETE VAULT

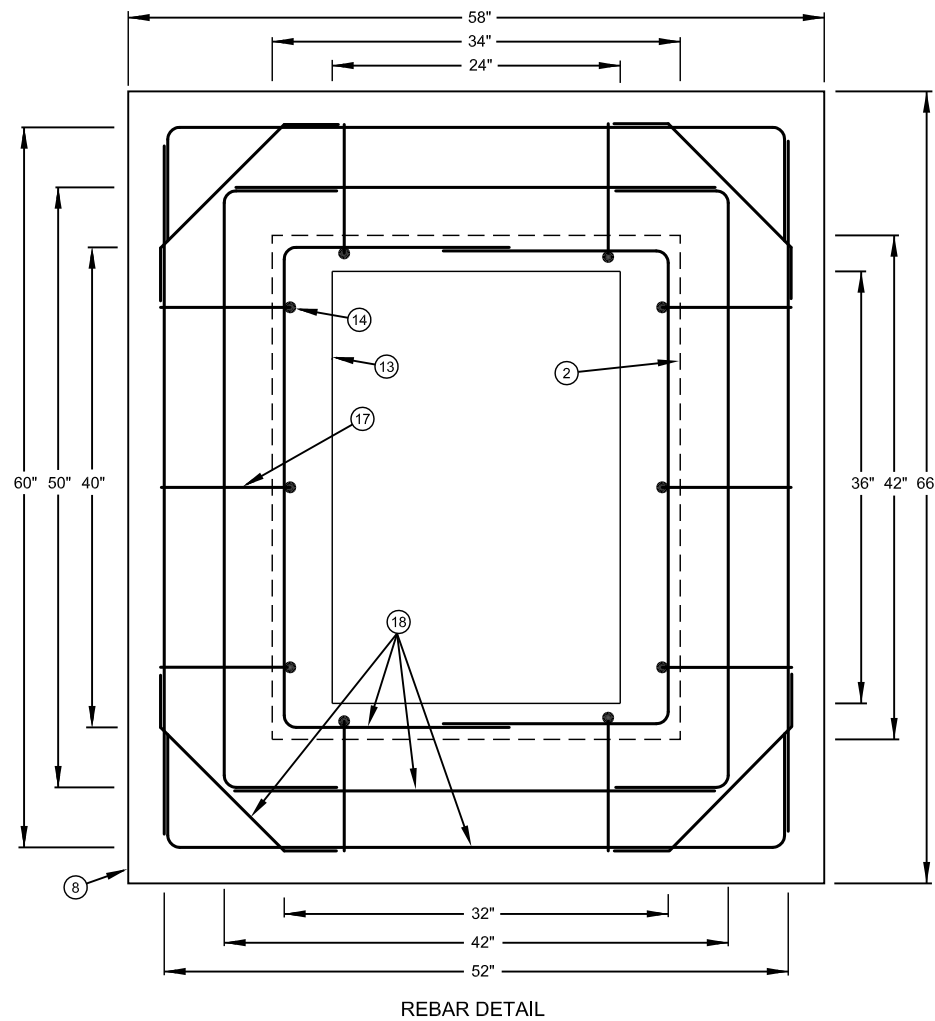
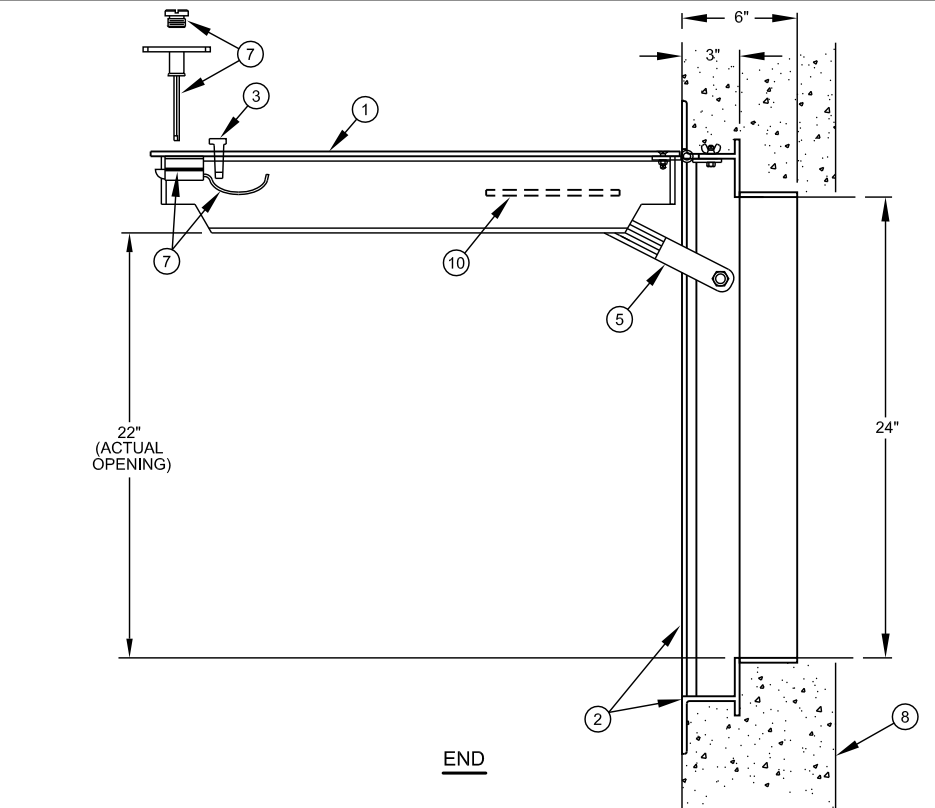
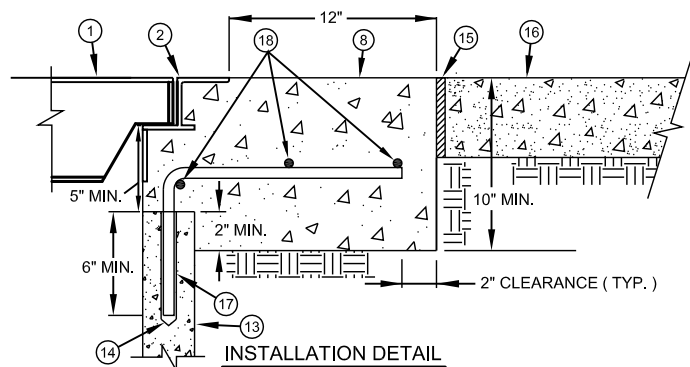
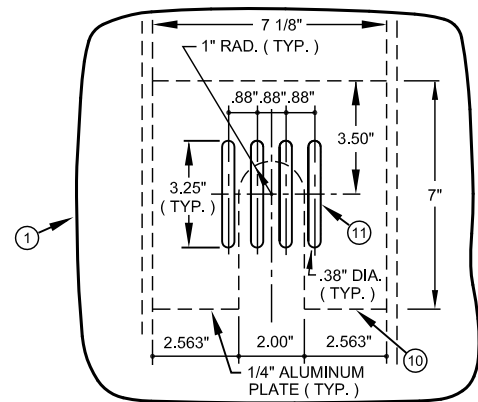
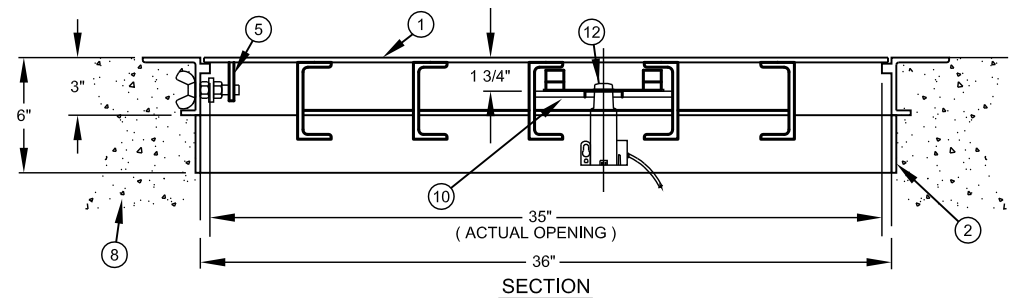
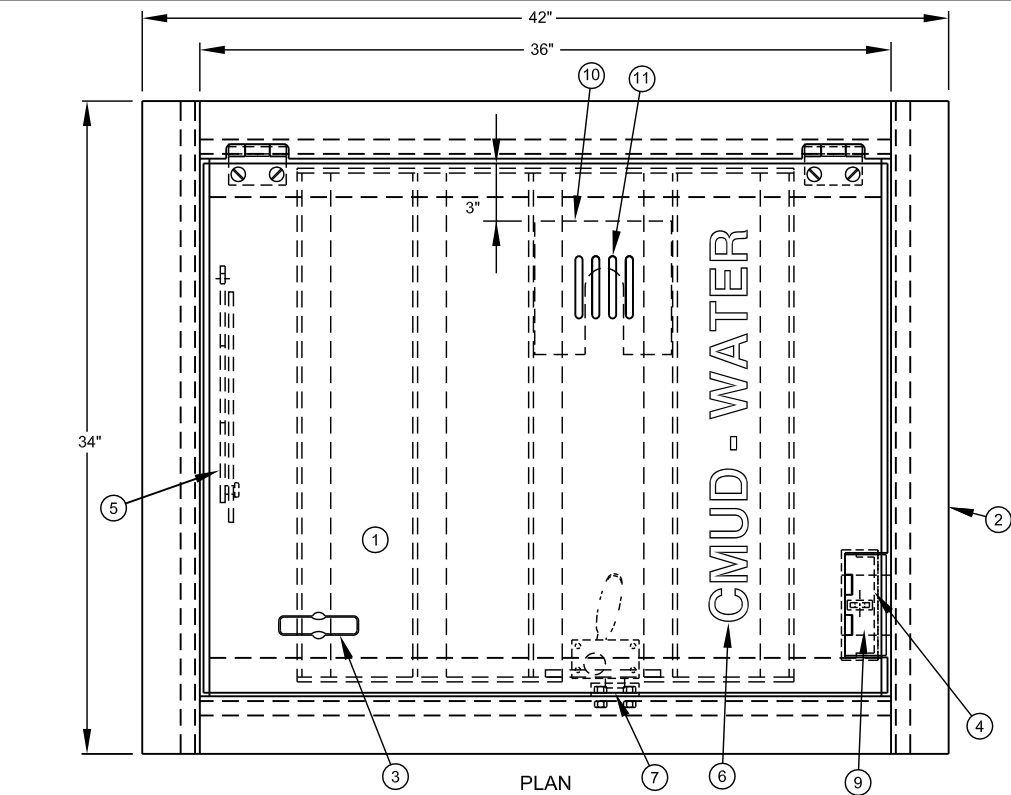
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER







## NO. DESCRIPTION

1. SINGLE DOOR LEAF - REINFORCED.
2. CAST - IN ALUMINUM DOOR FRAME W/3" SKIRT.
3. FLUSH DROP HANDLE.
4. RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAINLESS STEEL STAPLE / SPRING LOADED HINGED LID.
5. AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.
6. 2 - INCH LETTERING MILLED INTO DOOR LEAF.
7. SLAM LOCK/THREADED PLUG / REMOVABLE KEY / INSIDE HANDLE.
8. CONCRETE FRAME - CAST IN PLACE.
9. PADLOCK TO BE FURNISHED BY CMUD.
10. ERT TRANSMITTER SUPPORT BRACKET.
11. ERT TRANSMITTER SLOT.
12. ERT TRANSMITTER.
13. PRECAST CONCRETE VAULT WALL.
14. DRILLED OR CAST HOLE - EPOXY ADHESIVE.
15. 1/2 - INCH EXPANSION MATERIAL. ( CONSTRUCTION JOINT )
16. CONCRETE/ASPHALT HARDSCAPE.
17. # 5 REBAR ANCHOR.
18. # 4 REBAR

## DESIGN REQUIREMENTS

- A. MATERIAL - ALUMINUM - ALLOY ASTM B209 AND B221, EXCEPT AS NOTED.
- B. LIVE LOAD - AASHTO H - 20 - 44 WHEEL LOAD. (16,000# +30% IMPACT OVER 10" x 20" AREA.
- C. DOOR LEAF - 1/4 - INCH THICK ALUMINUM DIAMOND PLATE.
- D. FINISH - SHOT BLAST DULL GRAY-SLIP RESISTANT MEETING ADA REQUIREMENTS.
- E. HINGE / LOCKNUTS / BOLTS - STAINLESS STEEL - TYPE 316.
- F. SLAM LOCK / HOLD OPEN ARM - STAINLESS STEEL - TYPE 316.
- G. ACCESS DOOR SHALL BE MODEL AHS, AS MANUFACTURED BY U.S.F. FABRICATION, OR APPROVED EQUAL.
- H. BITUMINOUS PAINT SHALL BE APPLIED TO FRAME IN CONTACT AREA WITH CONCRETE.
- I. REBARS SHALL BE ASTM A615 - GRADE 60.
- J. REBAR SPLICE LENGTH SHALL BE 12 - INCH MINIMUM.
- K. CONCRETE - f'c = 3600 PSI MINIMUM.

## WARNING NOTE:

THIS DOOR IS NOT TO BE USED IN ROADWAYS OR DRIVEWAYS. IT MAY BE USED IN OFF STREET LOCATIONS WHICH MAY OCCASIONALLY BE SUBJECT TO H-20 WHEEL LOADS.

APPROXIMATE WEIGHT = 98 LBS.

NO SCALE

STANDARD NO.

QQ

VERSION NO. V1.0

VERSION DATE 3.3.2011

ALUMINUM SINGLE LEAF ACCESS DOOR - 2 FT x 3 FT  
OFF STREET H-20 WHEEL LOADING ( OCCASIONAL -  
NON - TRAFFIC ) FOR 1 1/2 & 2 - INCH WATER METER VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS  
WATER

CHARLOTTE

NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.
- B. ALL PIPE SHALL BE RESTRAINED FROM TAP TO PROPERTY LINE VALVE.
- C. VAULT SHALL BE RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.
- D. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
- E. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- F. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857
- G. REBARS SHALL BE GRADE 60 PER ASTM A615
- H. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185
- I. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS
- J. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH 4-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

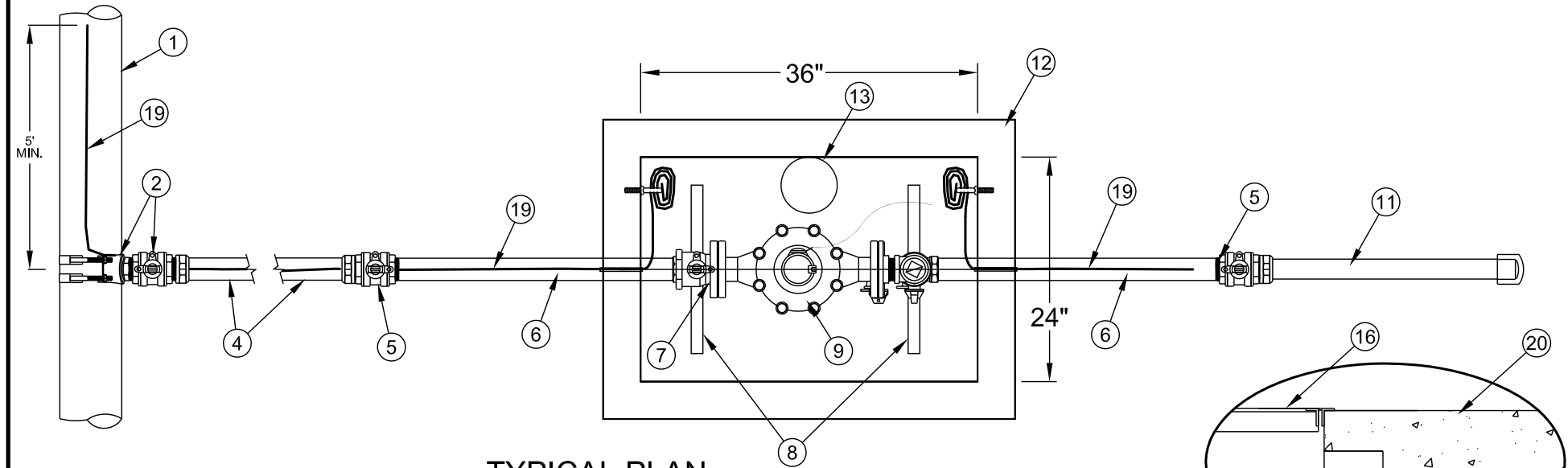
- K. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.
- L. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

NO. ALTERNATE DESCRIPTION

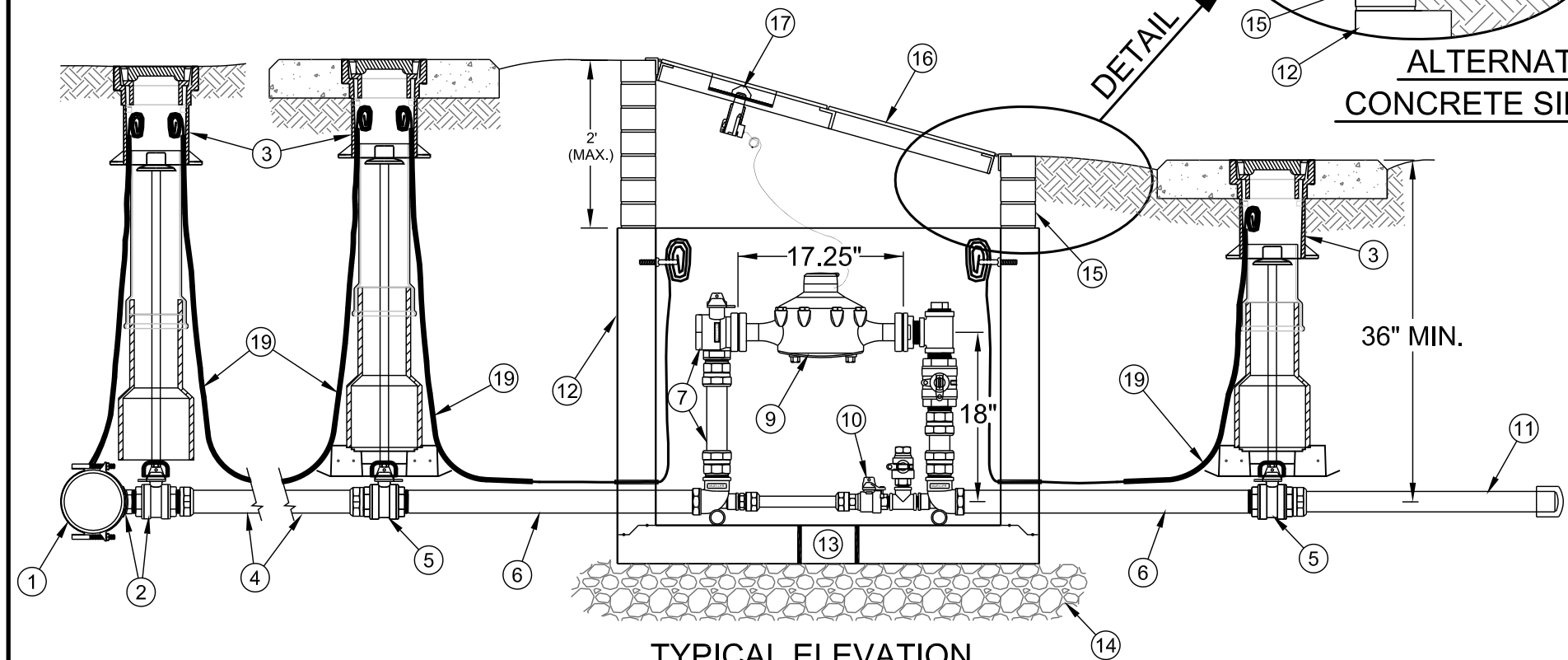
- WHEN USING SDR9 HDPE (IPS) WITH STAINLESS STEEL, BRASS, OR BRONZE MNPT ENDS, USE THE FOLLOWING PRODUCTS:
- 2 2" BALL CORPORATION STOP (CC TAPER THREAD x FNPT)
- 4 2" SDR9 HDPE (POLY) - IPS PIPE (MNPT x MNPT)
- 5 2" BALL VALVE (FNPT x FNPT)
- 11 2" SDR9 HDPE (POLY) - IPS PIPE (MNPT x MNPT) - CAP END

NO. DESCRIPTION

- 1 EXISTING OR PROPOSED WATER MAIN
- 2 TAPPING SADDLE AND 2" BALL CORPORATION STOP (CC TAPER THREAD x CTS COMPRESSION)
- 3 STANDARD VALVE BOX ASSEMBLY (TYP) - ALL VALVES (OMIT AT CORPORATION STOP ON SHORT SIDE SERVICE)
- 4 2" TYPE K COPPER TUBING
- 5 2" BALL VALVE (CTS COMPRESSION x FNPT)
- 6 2" RED BRASS PIPE NIPPLE (L = 30" OR 36")
- 7 2" BRASS METER SETTER ASSEMBLY - FORD #VB-77-95311-02, MUELLER #106B 242343, CAMBRIDGE #6020-718F7F7 - UUBS OR MCDONALD #720B718WTFF, NO SOLDER JOINTS PERMITTED
- 8 3/4" SCH 40 RED BRASS NIPPLE (L=18") x 2 EACH
- 9 2" WATER METER ASSEMBLY WITH AMR ERT TRANSMITTER (BY CONTRACTOR)
- 10 1" BY PASS BALL VALVE WITH LOCK WINGS - LOCK VALVE IN CLOSED POSITION (PERMANENT STUD LOCK - FURNISHED BY CMUD)
- 11 2" TYPE K COPPER TUBING TAIL PIECE - L = 24" MIN. - CAP END
- 12 PRECAST CONCRETE SERVICE VAULT - (36" x 24" x 31")
- 13 6" DIAMETER SUMP HOLE
- 14 6" COMPACTED #57 OR #67 WASHED STONE
- 15 MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2 FT.
- 16 24" x 36" ACCESS DOOR - SEE STANDARD DETAIL
- 17 AMR (ERT) TRANSMITTER
- 18 3/8" DIAMETER GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
- 19 AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION TERMINATE WITH 24" EXCESS WIRE (COILED) AT EYE BOLT AND VALVE BOX (TYP)
- 20 CAST IN PLACE CONCRETE SIDEWALK - BRICK WORK SHALL NOT EXTEND TO SURFACE, ACCESS DOOR SHALL REST ON SIDEWALK

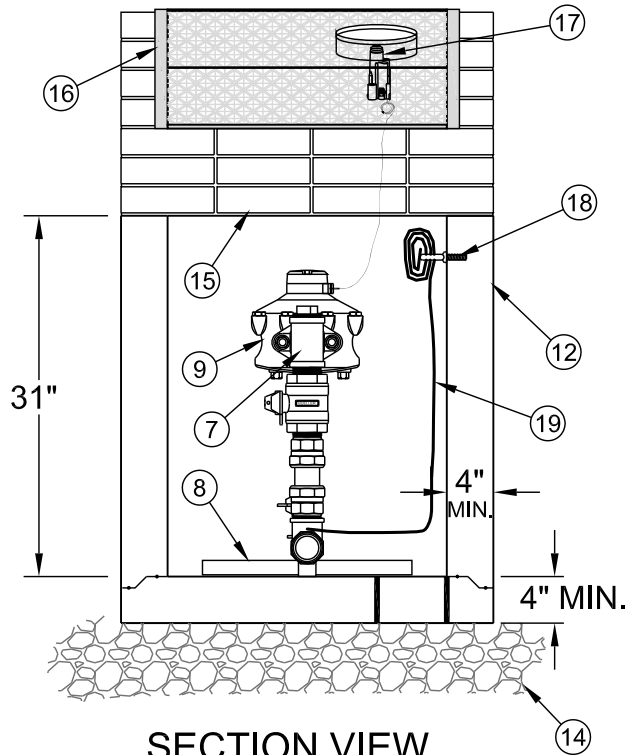


TYPICAL PLAN



TYPICAL ELEVATION

DETAIL  
ALTERNATE IN  
CONCRETE SIDEWALK



SECTION VIEW

NO SCALE

STANDARD NO.

R

VERSION NO.

1.0

VERSION DATE

5.05.2011

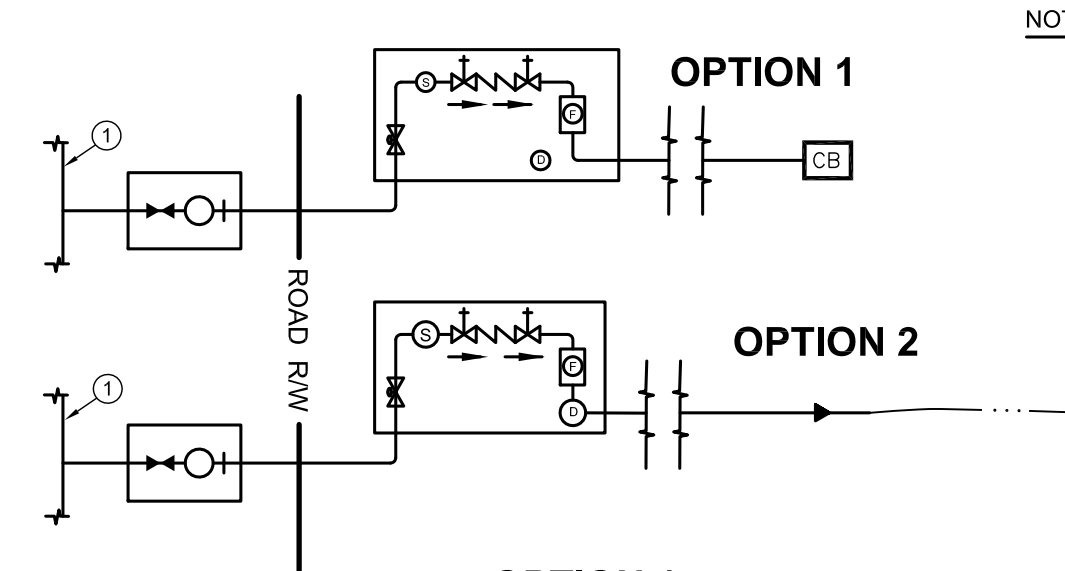
2 INCH WATER METER SERVICE  
CONNECTION AND VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER



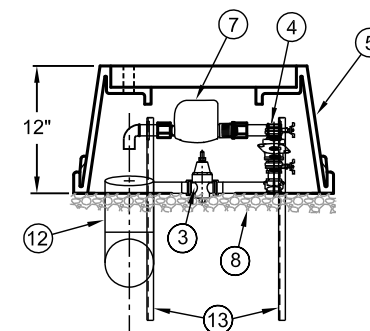
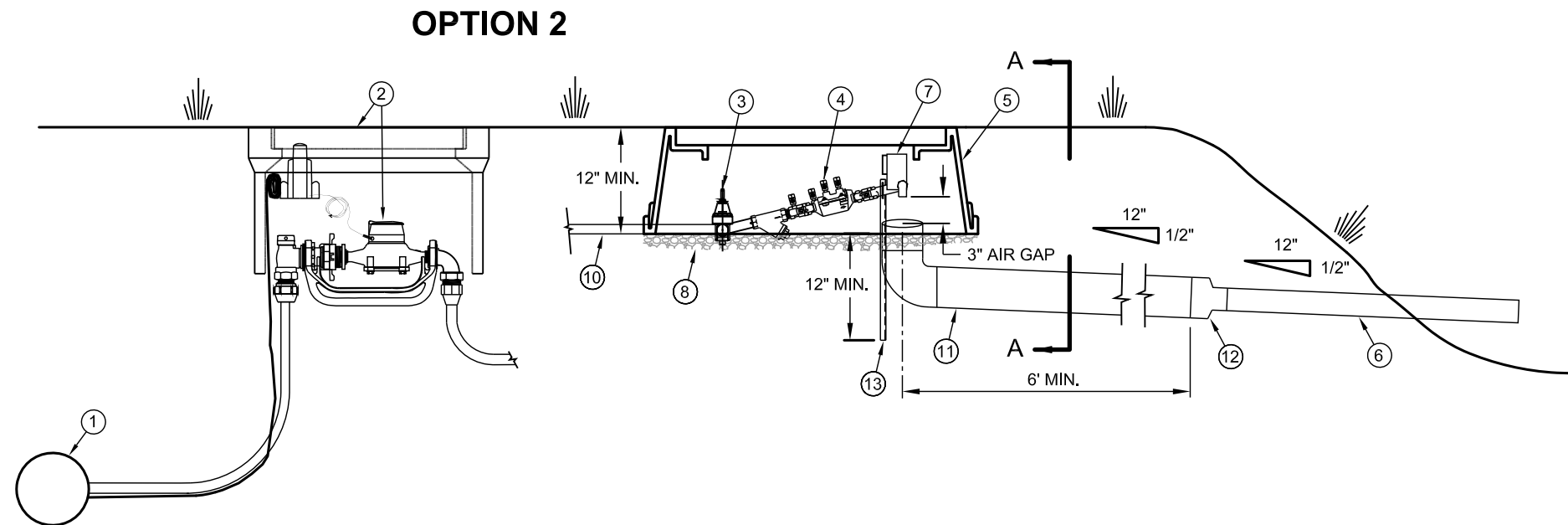
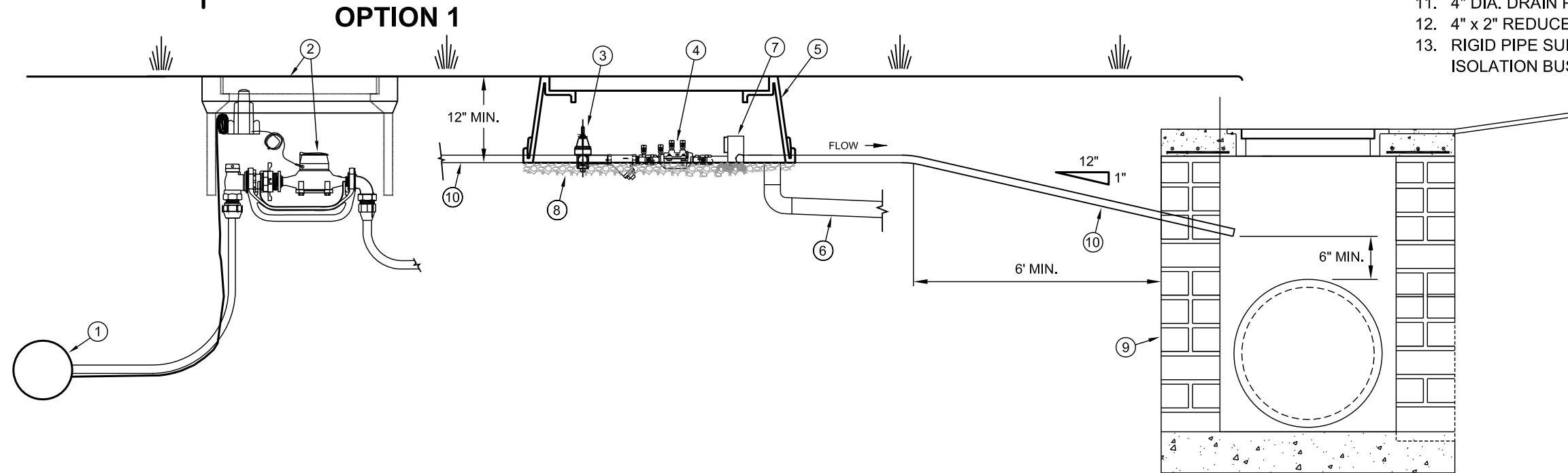


**NOTES:**

- DOUBLE CHECK VALVE BACKFLOW ASSEMBLY SHALL BE TESTED PRIOR TO METER INSTALLATION AND ANNUALLY, PER CMUD BACKFLOW PREVENTION POLICY, AT DEVELOPER'S EXPENSE UNTIL AUTO- FLUSHER IS NO LONGER NEEDED AND REMOVED BY CMUD.
- CAPACITY FEE REQUIRED. REFUNDABLE UPON REQUEST WHEN AUTO FLUSHER IS REMOVED WITHIN 24 MONTHS
- WATER USAGE WILL BE BILLED AT "BULK RATE" BILLING CODE ( WITH NO SEWER CHARGE ).
- CONNECTION TO A PUBLIC CATCH BASIN REQUIRES PRIOR APPROVAL FROM THE APPROPRIATE CONTROLLING AGENCY.
- CHLORINE SHALL BE MAINTAINED AT 0.30 PARTS PER MILLION ( PPM ) OR GREATER.

**NO: DESCRIPTION**

- CMUD WATER MAIN.
- STANDARD CMUD 3/4" WATER SERVICE CONNECTION W/CMUD FURNISHED WATER METER.
- 3/4" PRESSURE REDUCING VALVE ( REQUIRED WHEN CMUD STATIC PRESSURE  $\geq 70$  PSI MAXIMUM. )
- 3/4" DOUBLE CHECK VALVE BACKFLOW ASSEMBLY ( WITH STRAINER ) PER CMUD BACKFLOW STANDARD DETAIL #5 AND STANDARDS.
- IN GROUND 18" x 30" ENCLOSURE PER CMUD STANDARD DETAIL #5 AND LOW PRESSURE SEWER STANDARD DETAIL #3.
- 2" DRAIN TO ATMOSPHERE - PER CMUD STANDARD DETAIL #5.
- 3/4" FLOW CONTROL TIMER ( ORBIT #27729 ) FNPT x FNPT - FURNISHED AND MAINTAINED BY CMUD.
- 4" WASHED STONE.
- CATCH BASIN.
- 3/4" PIPE ( TYPICAL ) UNLESS OTHERWISE SHOWN.
- 4" DIA. DRAIN PIPE.
- 4" x 2" REDUCER.
- RIGID PIPE SUPPORT BRACKETS, AS REQUIRED. RUBBER ISOLATION BUSHING REQUIRED AT PIPE.



NO SCALE

STANDARD NO.

RR

VERSION NO.

V1.0

VERSION DATE

1.18.2011

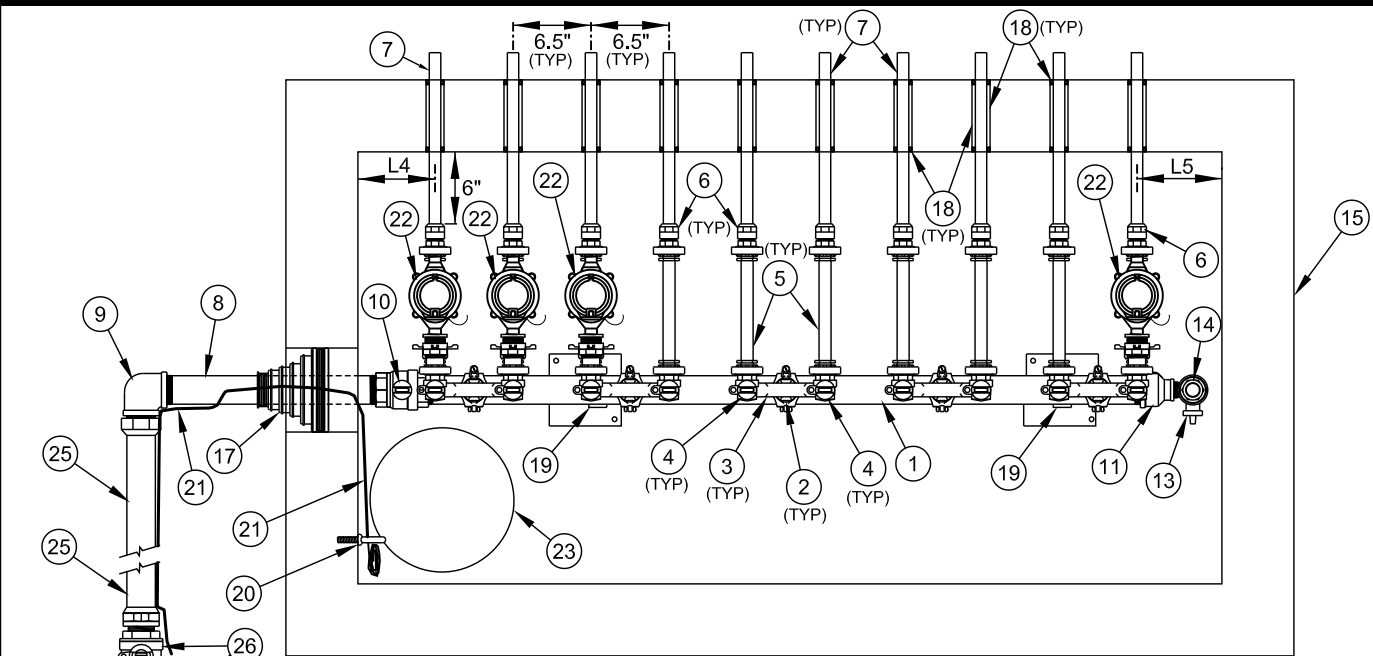
WATER QUALITY AUTO FLUSHER -  
RESIDENTIAL METER BOX TYPE - SCHEMATIC

CHARLOTTE-MECKLENBURG  
UTILITIES

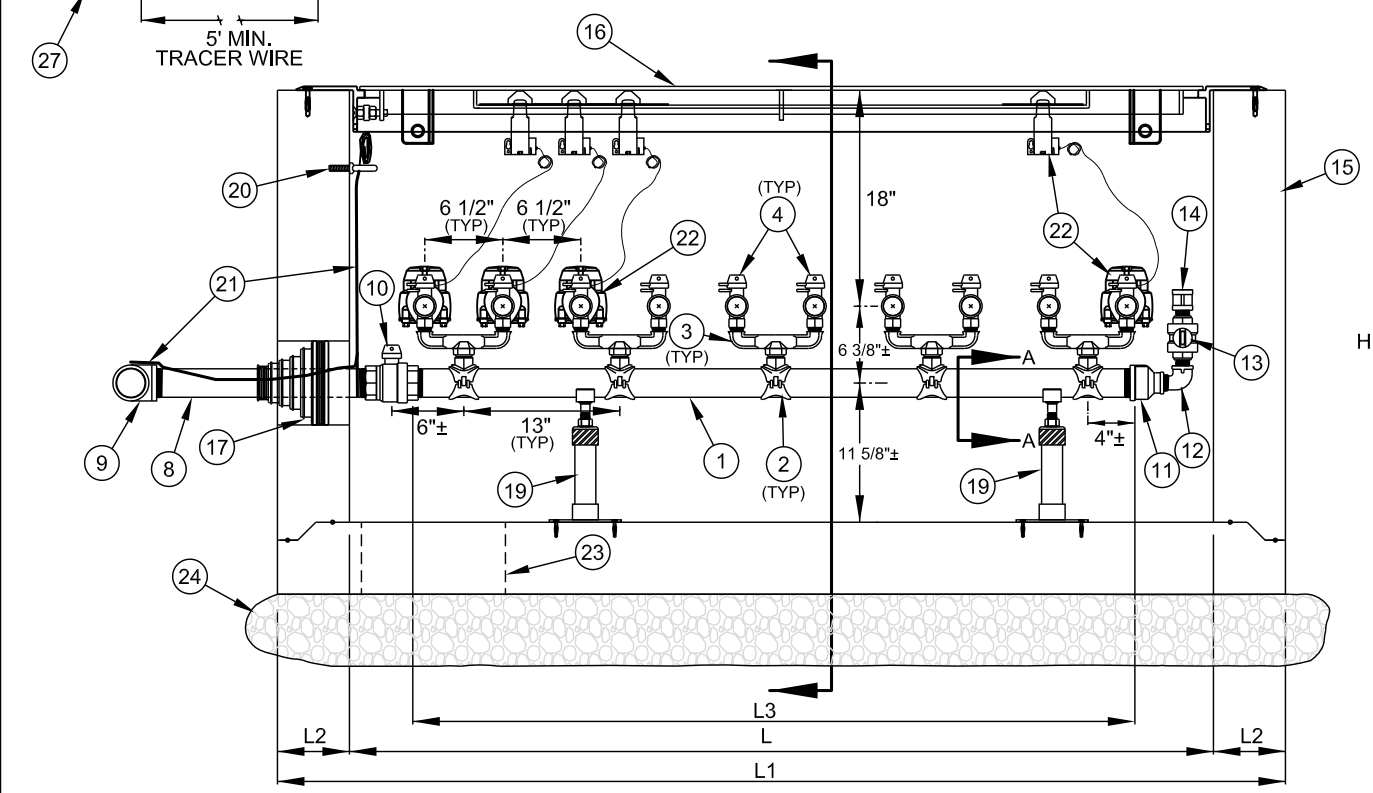
STANDARD DETAILS

WATER



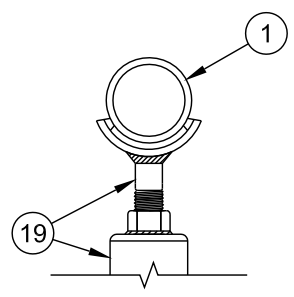


PLAN VIEW

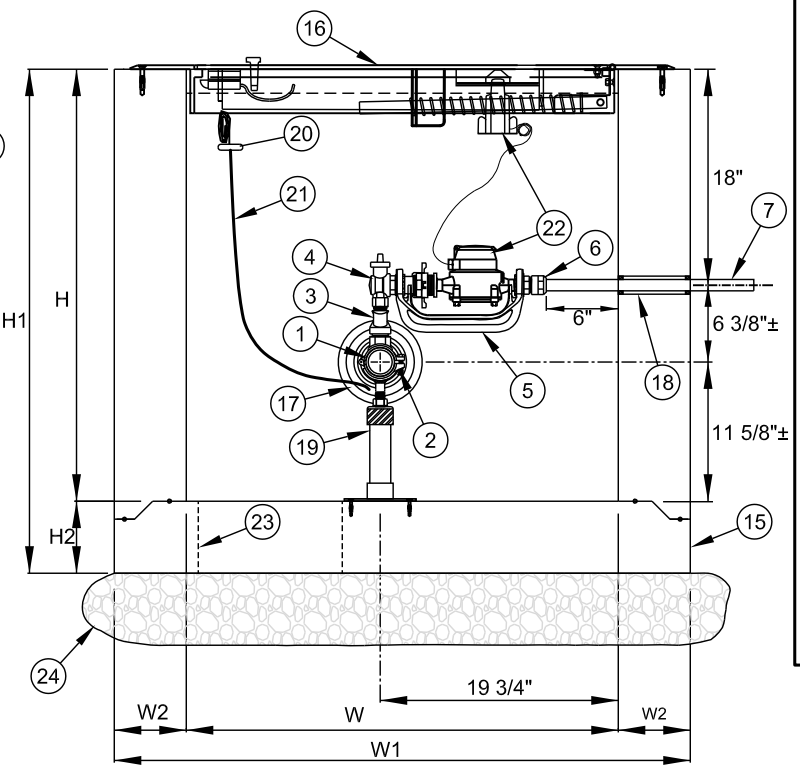


ELEVATION VIEW

- NOTES:
- A. ACCESS DOOR SHALL BE ANCHORED TO VAULT OR SIDEWALK PER ACCESS DOOR STANDARD DETAIL.
  - B. ACCESS DOOR SHALL BE FLUSH WITH GROUND OR SIDEWALK, AND GROUND SHALL SLOPE AWAY FROM VAULT.
  - C. SEE MULTIPLE WATER SERVICES - SCHEMATIC STANDARD DETAIL FOR ADDITIONAL LAYOUT REQUIREMENTS AND OPTIONS.



SECTION AA



SIDE ELEVATION VIEW

NO. DESCRIPTION

- 2" SCH. 40 RED BRASS PIPE MNPT (LENGTH=L3)
- 2" x 1" BRASS SERVICE SADDLE - FNPT OUTLET
- 1" x 3/4" x 3/4" BRASS U-BRANCH - MNPT
- 5/8" X 3/4" ANGLE BALL VALVE WITH LOCK WINGS - FNPT x YOKE STAR NUT
- 5/8" DUCTILE IRON METER YOKE BAR
- 5/8" STRAIGHT CONNECTOR (YOKE STAR NUT x CTS COMPRESSION)
- 3/4" TYPE K COPPER (L = 18")
- 2" SCH. 40 RED BRASS PIPE MNPT (L=24")
- 2" - 90° BRASS BEND - FNPT x CTS COMPRESSION
- 2" BALL VALVE CURB STOP - FNPT x FNPT
- 2" x 1" BRASS REDUCER - FNPT x FNPT
- 1" BRASS 90° STREET ELBOW - MNPT x FNPT
- 1" BALL VALVE CURB STOP - MNPT x MNPT WITH LOCK WINGS (LOCK CLOSED WITH LOCK FURNISHED BY CMUD)
- 1" RED BRASS THREADED COUPLING - FNPT x FNPT
- PRECAST CONCRETE METER VAULT - SEE CHART FOR SIZE
- MANIFOLD ALUMINUM ACCESS DOOR - SEE DETAIL
- 2" FLEXIBLE PIPE CONNECTOR BOOT
- 1 1/2"Ø - SCH 40 PVC SLEEVE (WITH RUBBER ISOLATION BUSHING AT EACH FACE OF VAULT WALL)
- GALV. STEEL OR S.S. ADJUSTABLE SADDLE PIPE SUPPORT (NUMBER REQ'D = N1) WITH 1/4"± THICK NEOPRENE LINER (WITH STAINLESS STEEL ADHESIVE ANCHORS)
- 3/8" DIA. STAINLESS STEEL EYE BOLT (ADHESIVE ANCHOR)
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH BLUE INSULATION - TERMINATE WITH 24" EXCESS WIRE (COILED) @ EYE BOLT AND VALVE BOX (TYPICAL).
- 5/8" WATER METER WITH AMR ERT TRANSMITTER (FURNISHED BY CMUD)
- 12" DIAMETER SUMP HOLE
- 6" #57 OR #67 WASHED STONE
- 2" TYPE K COPPER OR SDR9 HDPE (POLY) TUBING (WITH INSERT STIFFENERS)
- FOR EXISTING MAINS - TAPPING SADDLE AND 2" BALL CORPORATION STOP - CC (TAPER TREAD) x CTS COMPRESSION (WITH STANDARD VALVE BOX ASSEMBLY), OR; FOR NEW MAINS - MJ TEE, MJ PLUG - TAP - 2", 2" x 6" SCH 40 RED BRASS NIPPLE, 2" GATE VALVE (FNPT) (WITH STANDARD VALVE BOX ASSEMBLY), BRASS STRAIGHT CONNECTOR (MNPT x CTS COMPRESSION) MUELLER #H-15428, FORD #C84-77GJ, McDONALD #24753T
- 6" OR LARGER WATER MAIN

DESIGN REQUIREMENTS

- A. VAULT SHALL BE RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWING / CALCULATIONS / P.E. SEALED FOR REVIEW.
- B. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
- C. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- D. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857
- E. REBARS SHALL BE GRADE 60 PER ASTM A615
- F. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185
- G. PIPE PENETRATIONS SHALL BE ISOLATED FROM PIPE WITH FLEXIBLE CONNECTERS (MANHOLE BOOTS) OR WITH RUBBER ISOLATION BUSHINGS

DIMENSIONS ( INCHES )

VAULT (INSIDE)			VAULT (OVERALL-MIN.)			WALL THICKNESS (MIN.)	FLOOR THICKNESS (MIN.)	NUMBER OF METERS (MAX.)	L3 2" RED BRASS PIPE LENGTH ①	N1 REQ'D NO. OF PIPE SUPPORTS ⑨		
L	W	H	L1	W1	H1	W2 / L2	H2				L4	L5
72	36	36	84	48	42	6	6	10	60	2	6.5	7
60	36	36	72	48	42	6	6	8	48	2	7	7.5
48	36	36	60	48	42	6	6	6	36	2	7.5	8
36	36	36	44	44	40	4	4	4	24	1	8	8.5

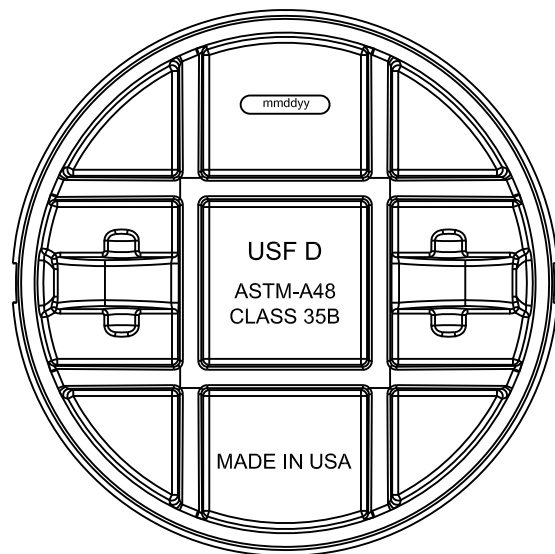
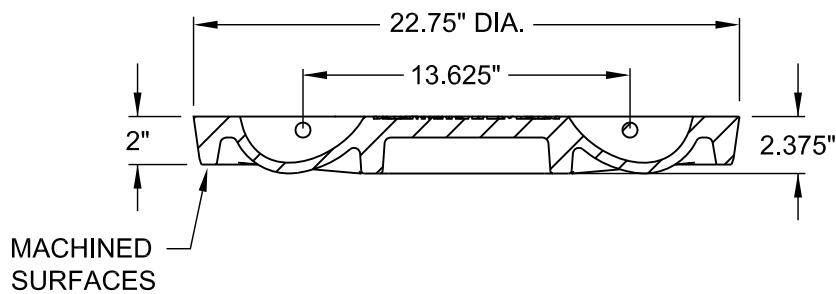
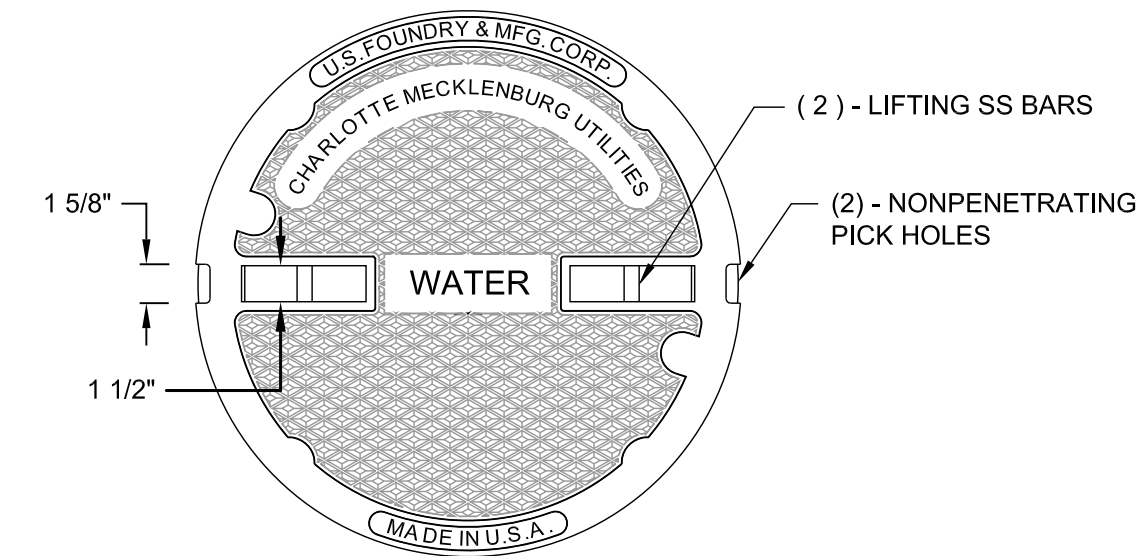
NO SCALE

STANDARD NO.	S
VERSION NO.	1.0
VERSION DATE	09.30.2010

3/4-INCH MANIFOLD WATER METER ASSEMBLY AND PRECAST CONCRETE VAULT

CHARLOTTE-MECKLENBURG UTILITIES  
STANDARD DETAILS  
WATER

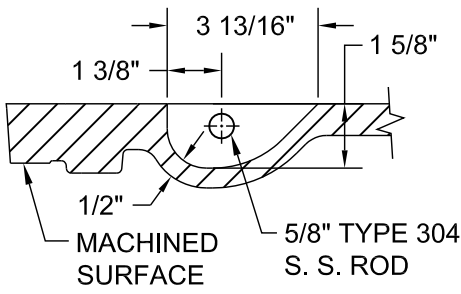
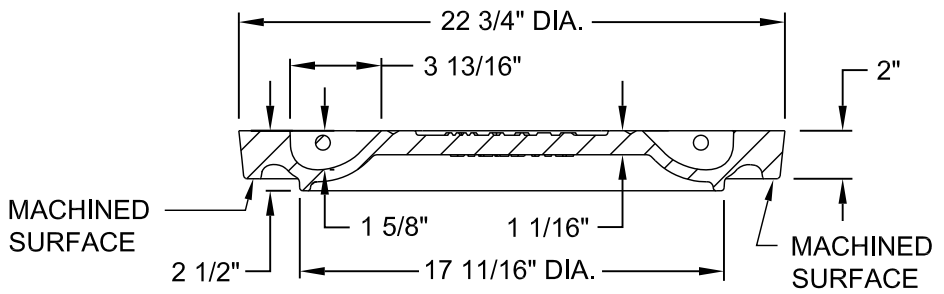
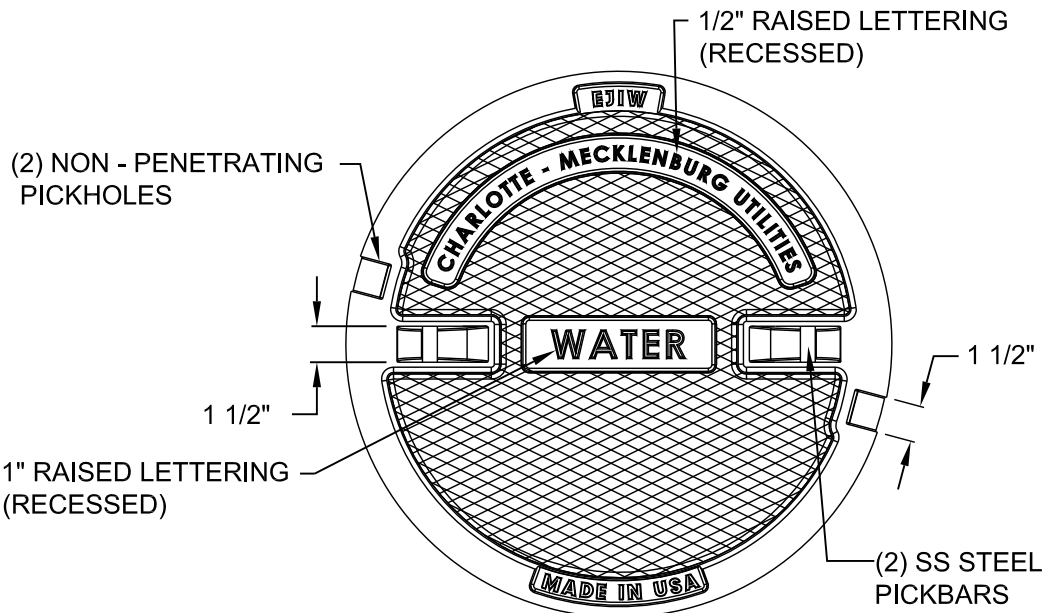




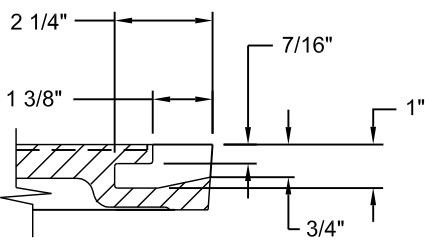
WEIGHT - 130 LB. MIN. , 0% MINUS TOLERANCE

**NOTES:**

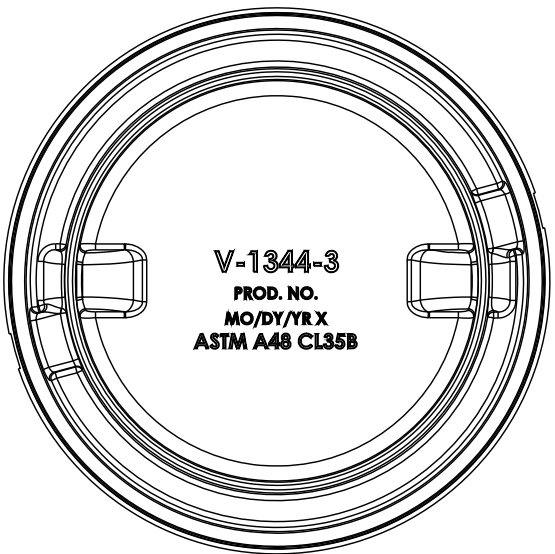
LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED



**PICK BAR DETAIL**



**PICK HOLE DETAIL**



WEIGHT - 130 LB. MIN. , 0% MINUS TOLERANCE

NO SCALE

STANDARD NO.

SS

VERSION NO.

V1.0

VERSION DATE

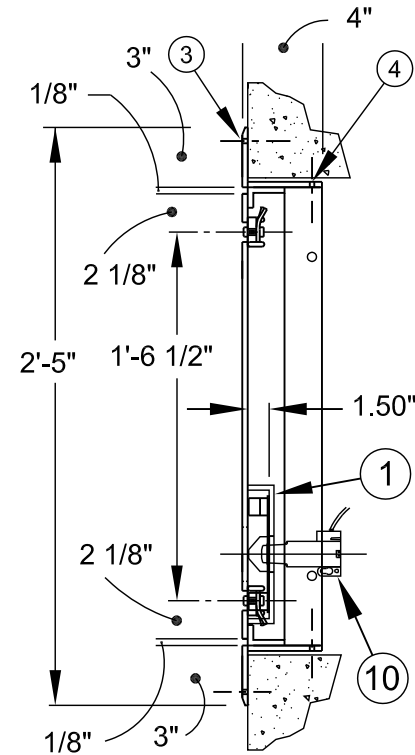
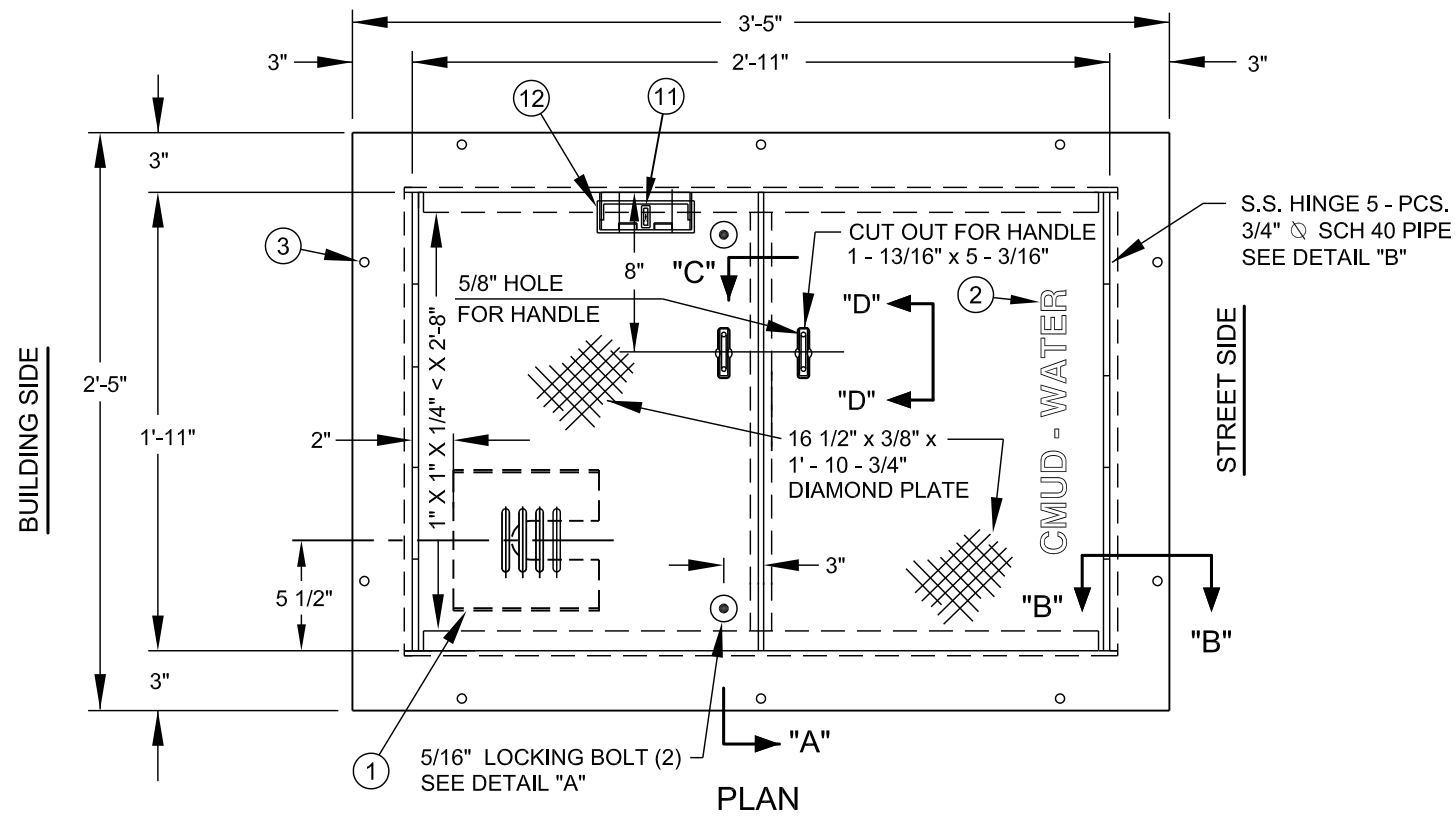
8.3.2011

**TYPE 6 MANHOLE COVER ( CLEAR OPENING )**  
**20.5 - INCH DIAMETER ( CLEAR OPENING )**  
**USE WITH 16 - INCH AND LARGER VALVES**

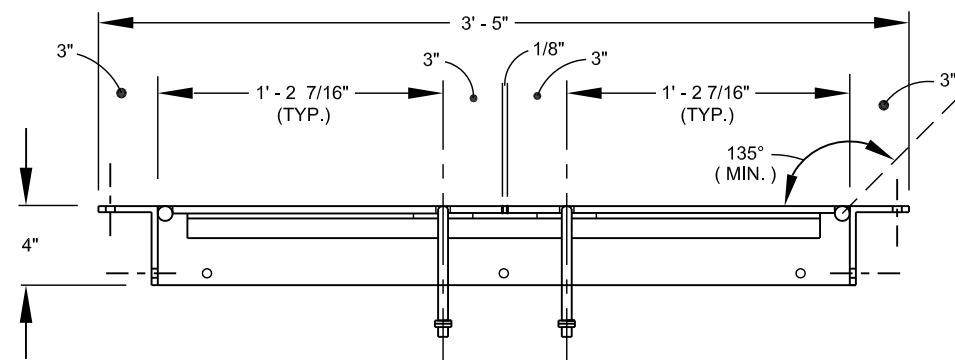
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS  
WATER

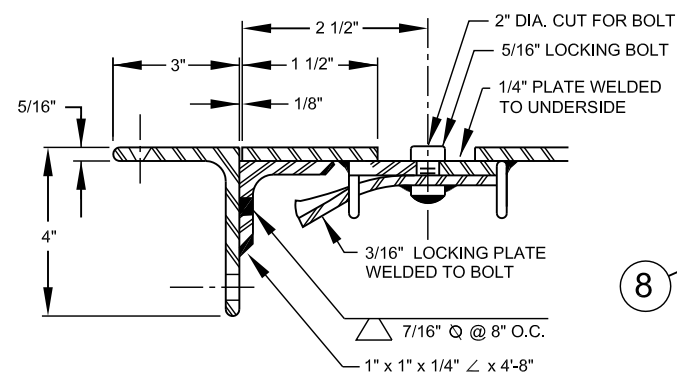




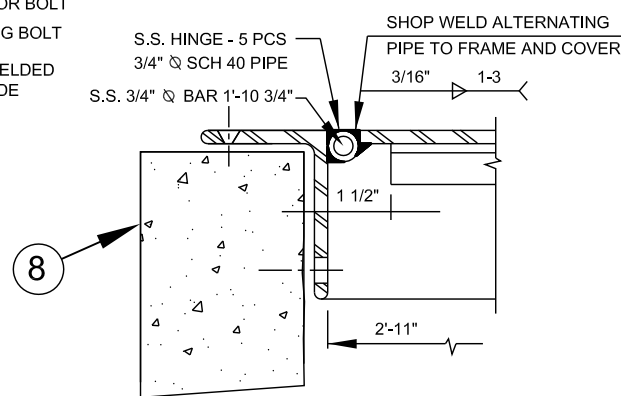
SECTION SIDE



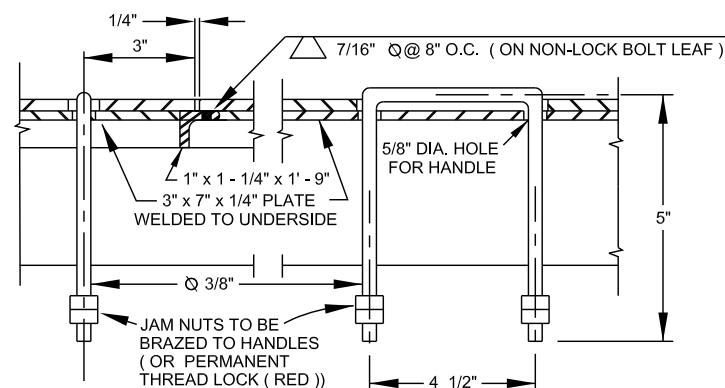
SECTION FRONT



DETAIL A - LOCKING BOLT (2)

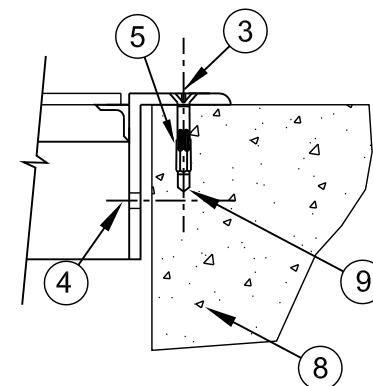


DETAIL B HINGE

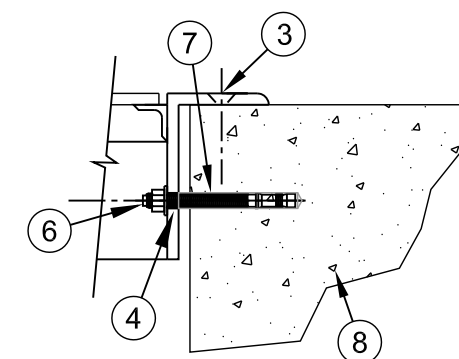


DETAIL C HANDLE (2)

DETAIL D HANDLE



ANCHOR DETAIL  
OPTION 1



ANCHOR DETAIL  
OPTION 2

## NO. DESCRIPTION

- ERT TRANSMITTER SUPPORT BRACKET. ( SEE STANDARD DETAIL )
- 2 - INCH LETTERING MILLED INTO DOOR LEAF.
- 7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) 10 EACH
- 9/16 - INCH DIAMETER DRILLED HOLE ( 10 EACH )
- 3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL )
- 1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )
- 1/2 - INCH DIAMETER DRILLED HOLE IN CONCRETE.
- CONCRETE VAULT OR PEDESTRIAN SIDEWALK.
- 3/8 - INCH DIA. DRILLED HOLE - IN CONCRETE.
- WATER METER ERT TRANSMITTER.
- RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAPLE/SPRING LOADED HINGED LID.
- PADLOCK TO BE FURNISHED BY CMUD.

## DESIGN REQUIREMENTS

- MATERIAL - STRUCTURAL STEEL - ASTM A-36.
- LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 TH. OF SPAN.
- DOOR LEAF - 3/8 - INCH THICK DIAMOND PLATE.
- HINGES SHALL BE SET SO DOORS OPEN 135° TO 180° BEYOND FULL CLOSE.
- HINGE ( PIPE AND BAR ) - TYPE 304 STAINLESS STEEL.

## NOTE:

- FRAME SHALL BE FURNISHED WITH ANCHOR HOLES NO. 3 AND NO. 4.
- CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 3 OR NO. 4 - AS APPROVED. ( OPTION ONE OR OPTION TWO )
- FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND ONE BLACK ENAMEL. FIELD APPLY ONE COAT OF COMPATIBLE BLACK ENAMEL AT FINAL INSPECTION.
- FRAME DIMENSIONS SHALL ALLOW FOR CLOSE FIT INSIDE VAULT AS SHOWN AT TOP OF VAULT WALLS.

## WARNING NOTE:

THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.

NO SCALE

STANDARD NO.

T

VERSION NO. V1.3

VERSION DATE 8.24.2011

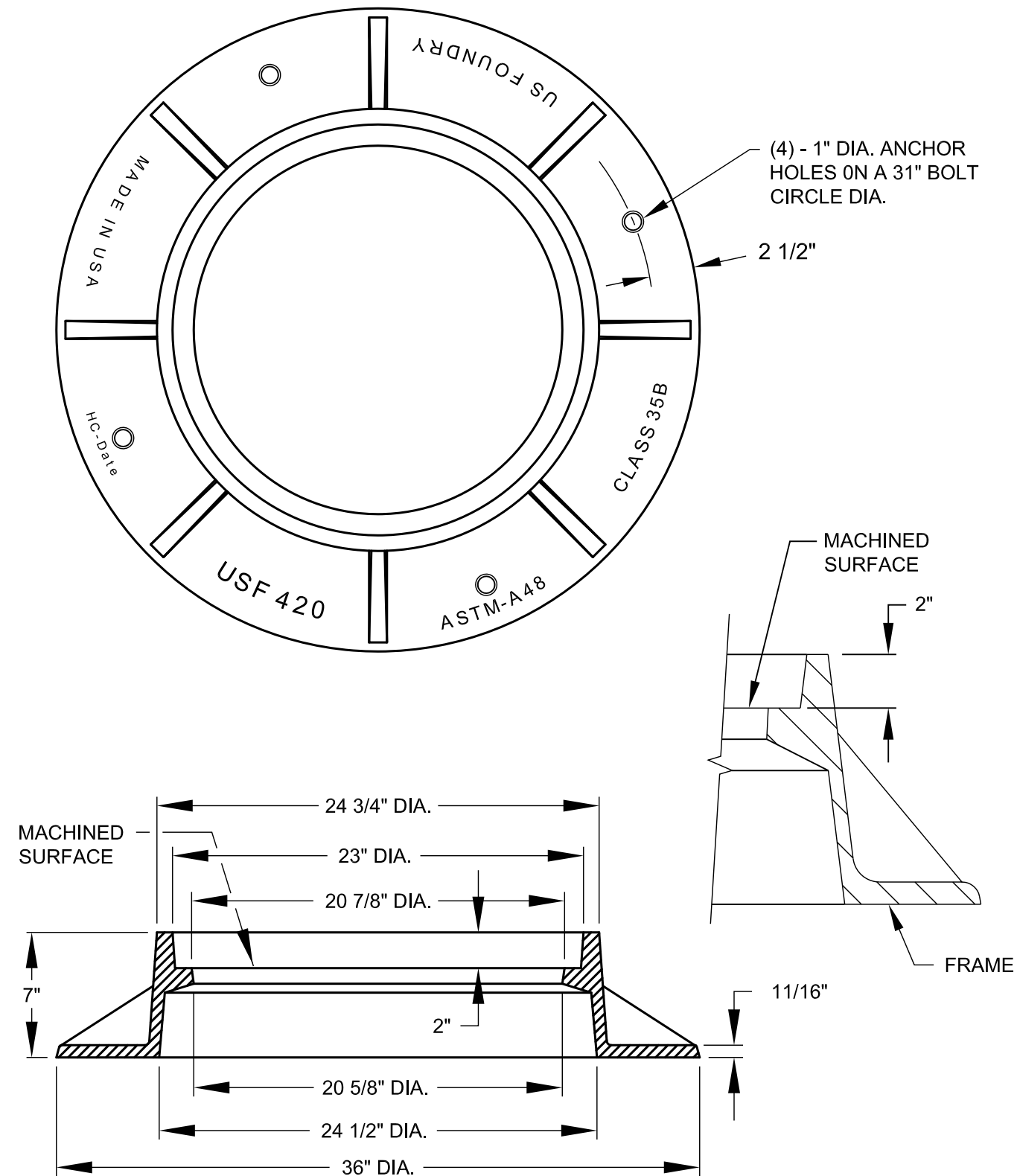
STEEL DOUBLE LEAF ACCESS DOOR - 2' x 3'  
PEDESTRIAN LOADING ( 300 PSF ) FOR  
1 1/2" AND 2-INCH WATER METER VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER

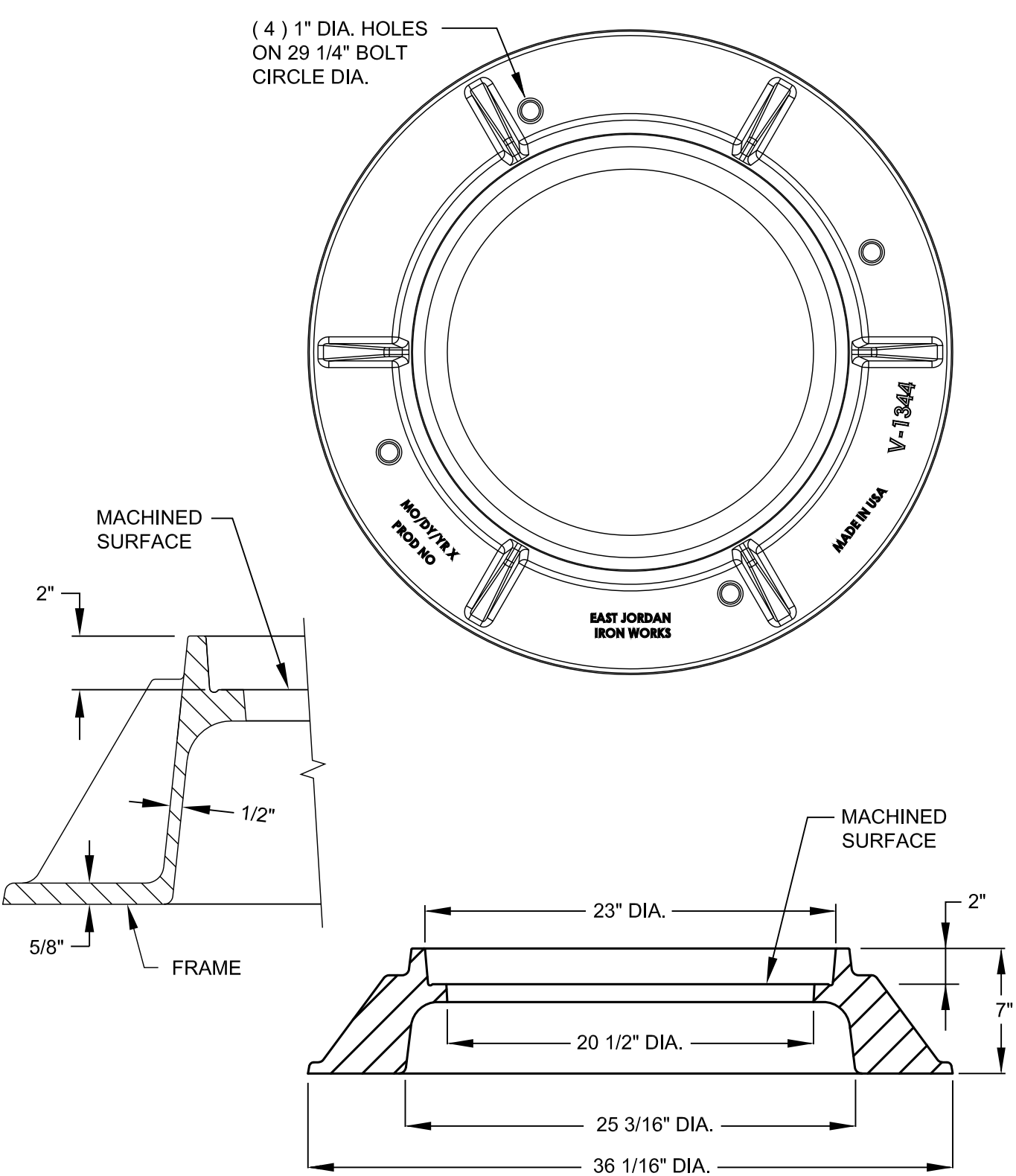
CHARLOTTE



WEIGHT - 240 LB. MIN. , 0% MINUS TOLERANCE

**NOTES:**

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED



WEIGHT - 220 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE 6 MANHOLE COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

NO SCALE

STANDARD NO.

TT

VERSION NO.

V1.0

VERSION DATE

7.14.2011

TYPE F MANHOLE FRAME  
20.5 - INCH DIAMETER ( CLEAR OPENING )  
7 - INCH TALL

CHARLOTTE-MECKLENBURG  
UTILITIES

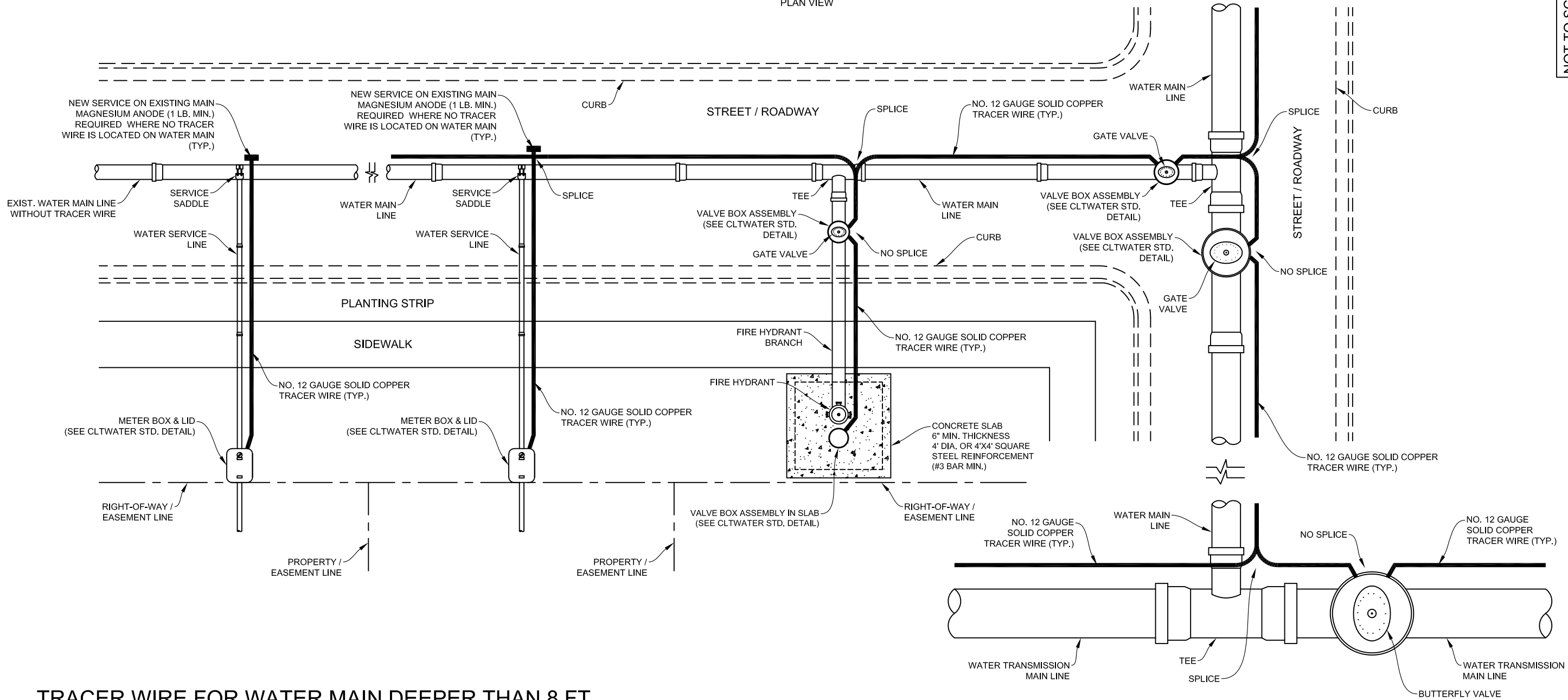
STANDARD DETAILS

WATER



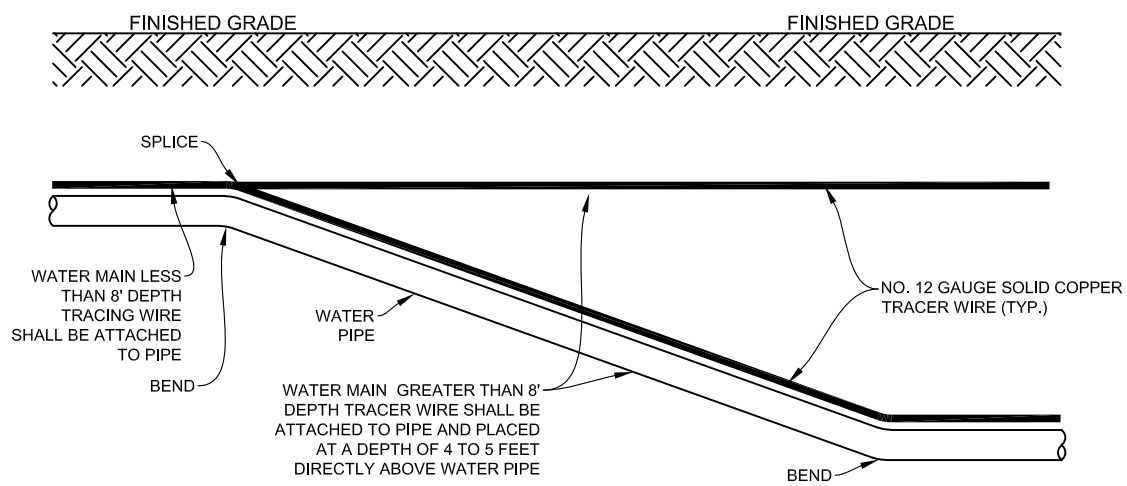
STREET VIEW - WATER MAIN TRACER WIRE

PLAN VIEW



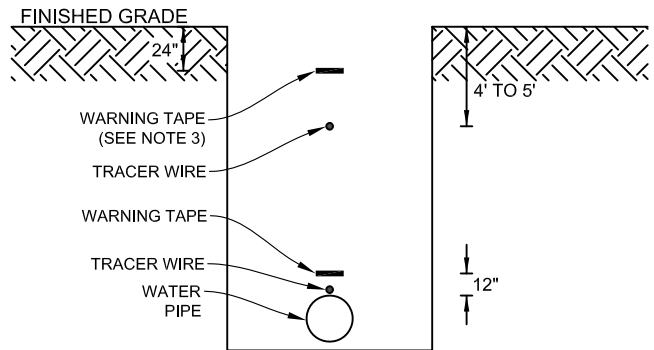
TRACER WIRE FOR WATER MAIN DEEPER THAN 8 FT

SECTION VIEW



TRENCH DETAIL

PROFILE VIEW



NOTES:

1. TRACER WIRE SHOWN AWAY FROM PIPE FOR CLARITY. TRACER WIRE SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE WATER PIPE. TRACER WIRE SHALL BE FASTENED TO THE PIPE WITH ZIP TIES AT 10 FOOT INTERVALS.
2. TRACER WIRE SHALL BE SOLID COPPER NO. 12 WITH 30 MILS BLUE HDPE INSULATION.
3. WARNING TAPE REQUIRED FOR 16 INCH AND LARGER WATER MAINS ONLY.
4. NEED LOCATOR POST FOR 30 INCH AND LARGER DISTRIBUTION MAINS ONLY.

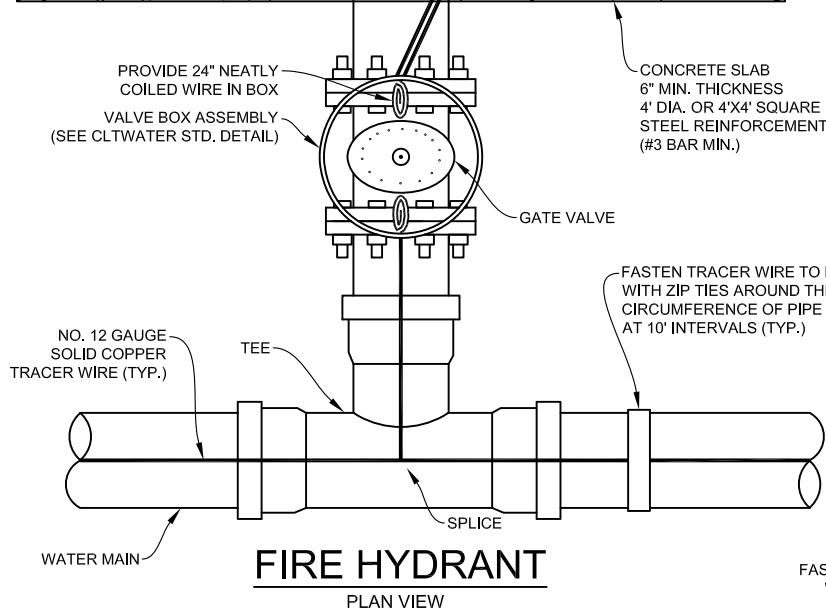
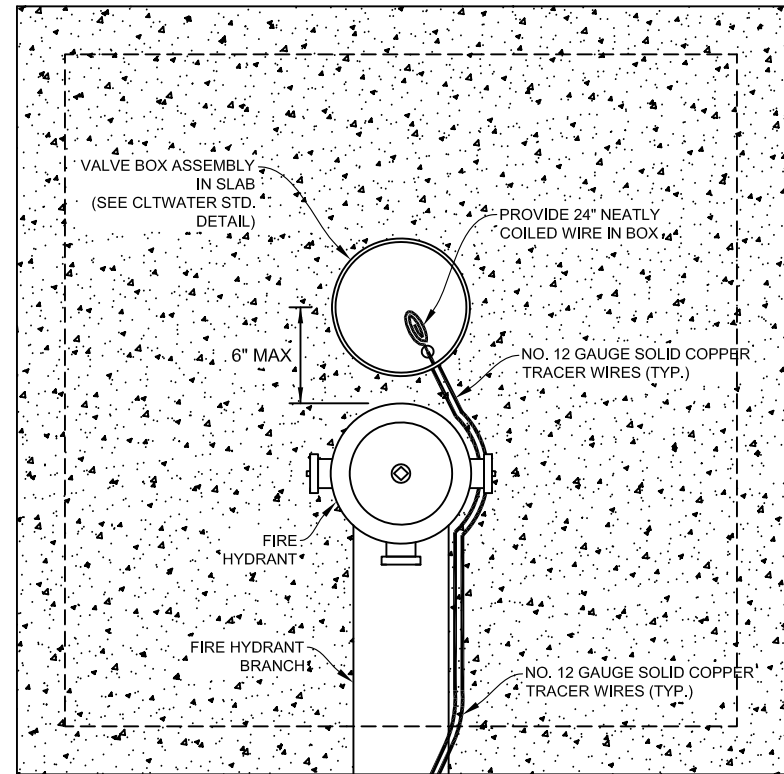
STANDARD NO.	
TW1	
VERSION NO.	1.0
VERSION DATE	7.21.2017

TRACER WIRE - WATER MAIN

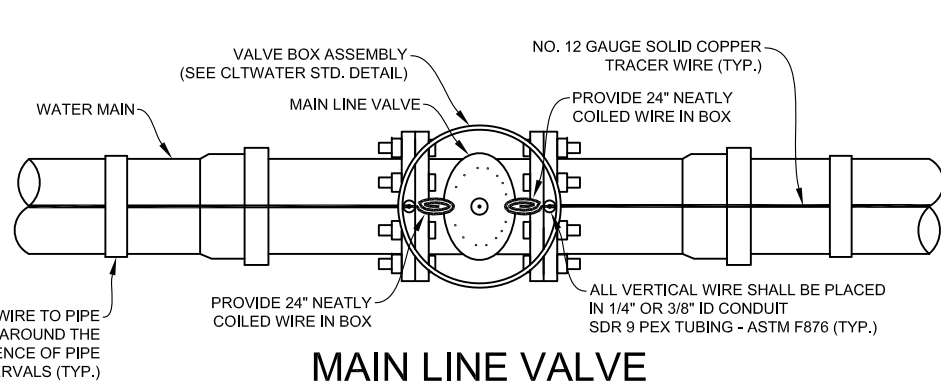
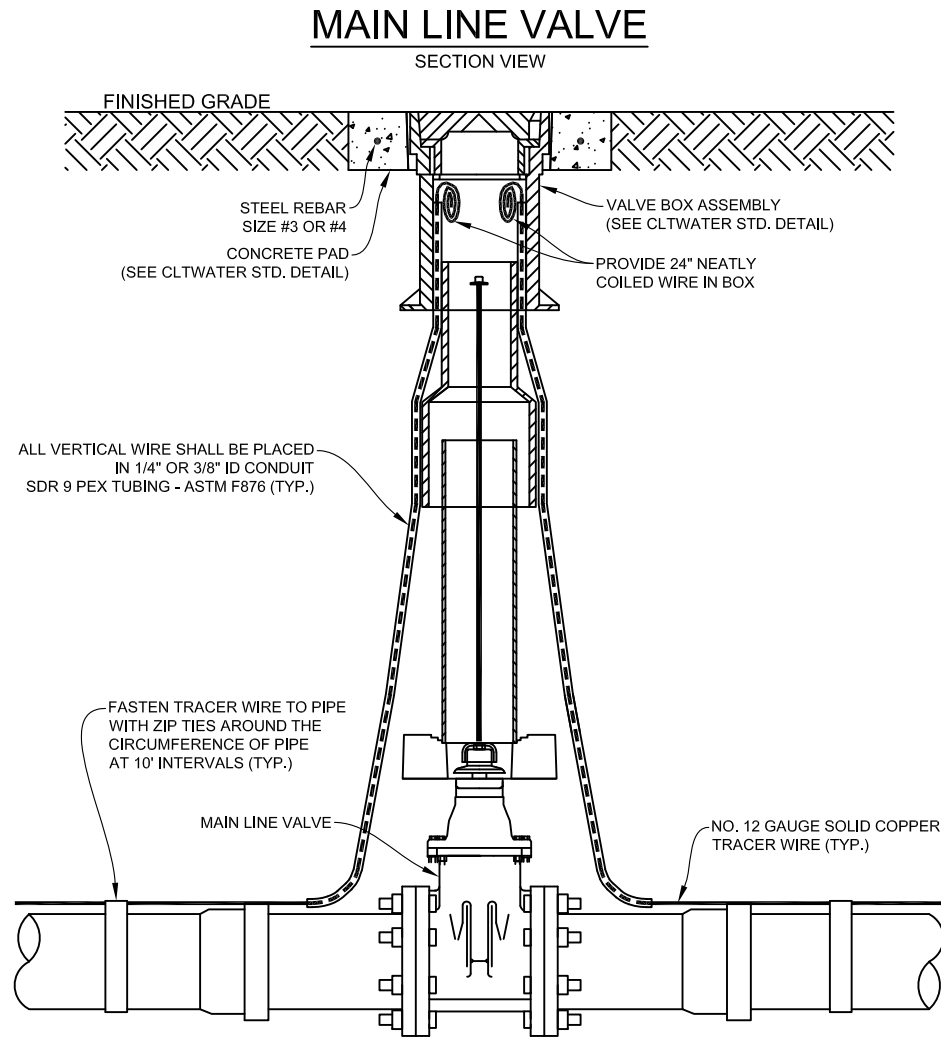
CHARLOTTE WATER	
STANDARD DETAILS	
WATER	



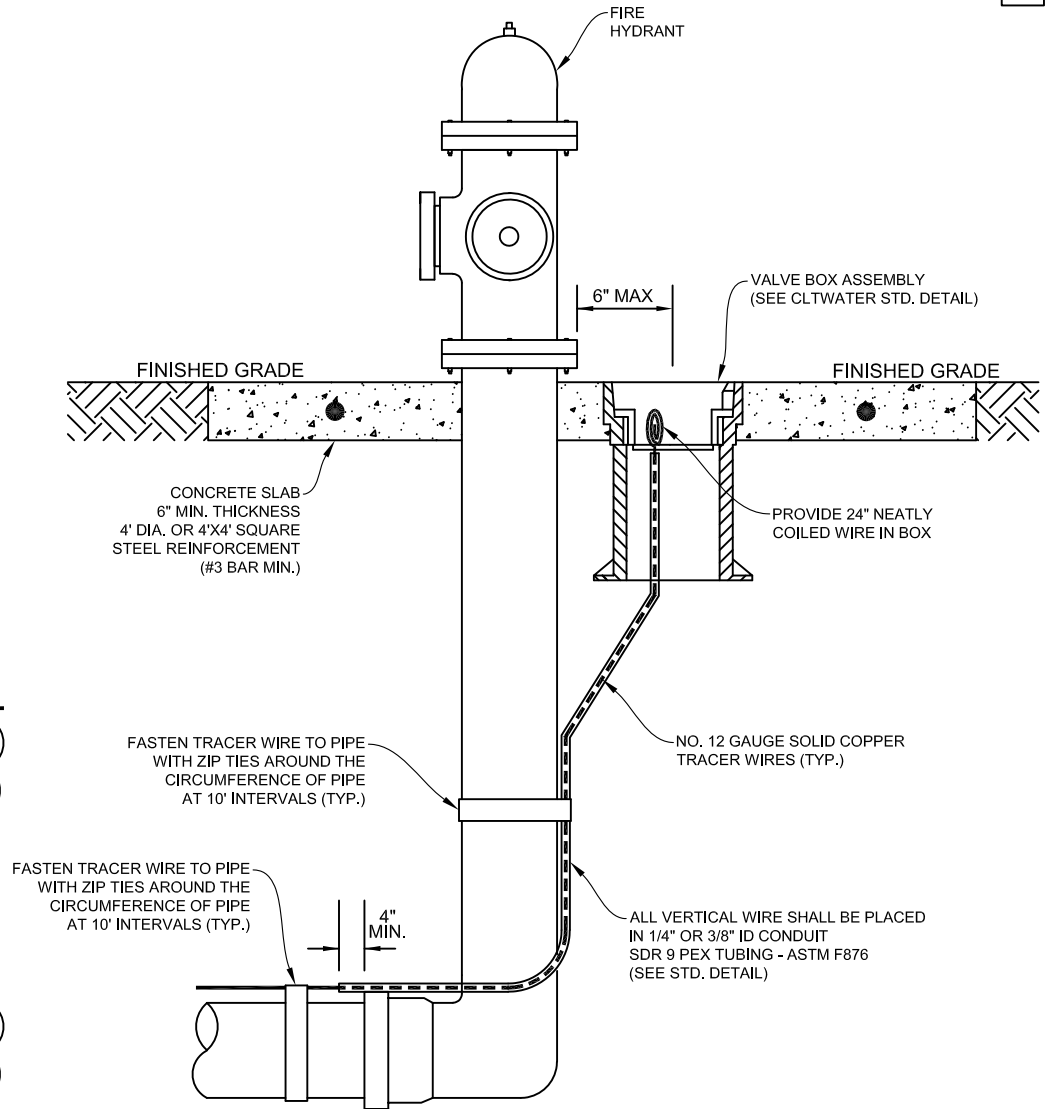




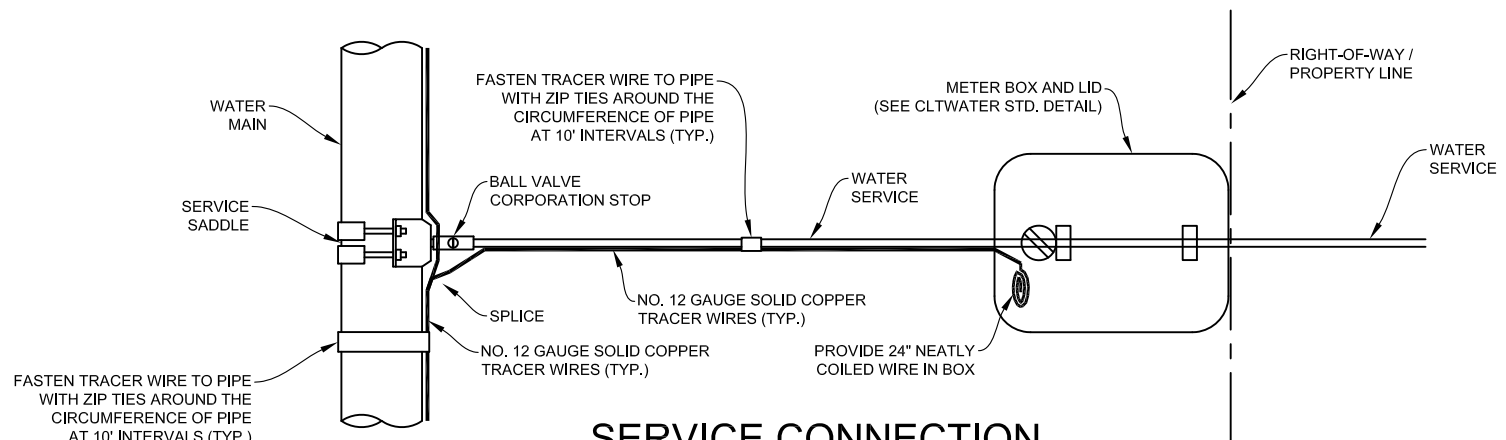
**FIRE HYDRANT**  
PLAN VIEW



**MAIN LINE VALVE**  
PLAN VIEW



**FIRE HYDRANT**  
SECTION VIEW



**SERVICE CONNECTION**  
PLAN VIEW

**NOTES:**

1. TRACER WIRE SHALL BE AWG NO. 12 GUAGE SOLID COPPER WITH 30 MILS BLUE HDPE INSULATION.
2. THE TRACER WIRE SHALL BE CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. WHERE SPLICES ARE NECESSITATED IN THE WIRE, THE SPLICES SHALL BE SECURELY BONDED TOGETHER WITH AN APPROVED INDUSTRIAL CONNECTOR TO PROVIDE ELECTRICAL CONTINUITY. CONNECTOR SHALL BE COPPER AND INSULATION SHALL BE REPAIRED AS DETAILED TO SEAL OUT MOISTURE AND CORROSION AND SHALL BE INSTALLED SO AS TO PREVENT ANY UNINSULATED WIRE EXPOSURE. SEE STANDARD DETAIL TW3.
3. SPICED CONNECTIONS SHALL BE ALLOWED BETWEEN THE MAIN TRACER WIRE AND THE WATER SERVICE TRACER WIRE.
4. TRACER WIRE SHALL BE PROTECTED FROM DAMAGE DURING THE EXECUTION OF THE WORK. NO BREAKS OR CUTS IN THE TRACER WIRE OR INSULATION SHALL BE PERMITTED.
5. PRIOR TO ACCEPTANCE (POST PUNCH LIST) EACH WIRE SEGMENT SHALL PASS A CONDUCTIVITY TEST, WITNESSED BY THE ENGINEER OR ENGINEER'S REPRESENTATIVE.
6. WHERE 2 OR MORE WIRES ENTER A VALVE BOX ASSEMBLY, (PROVIDE 24 INCHES OF NEATLY COILED WIRE) AFTER ACCEPTANCE TESTING, CONNECT ENDS OF ALL WIRES WITH WATER PROOF WIRE CONNECTOR NUT AND 3" BARE #12 PIGTAIL.
7. SPLICES IN THE PRIMARY TRACER WIRE ALONG THE WATER MAIN SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF EACH SPLICE.
8. FOR INSTALLING A NEW SERVICE LINE ON AN EXISTING MAIN WITH TRACER WIRE, ONLY SPLICE TO EXISTING WIRE WITH 3 FEET OF SLACK ON NEW SERVICE LINE.

NOT TO SCALE

STANDARD NO.	TW2
VERSION NO.	1.0
VERSION DATE	7.21.2017

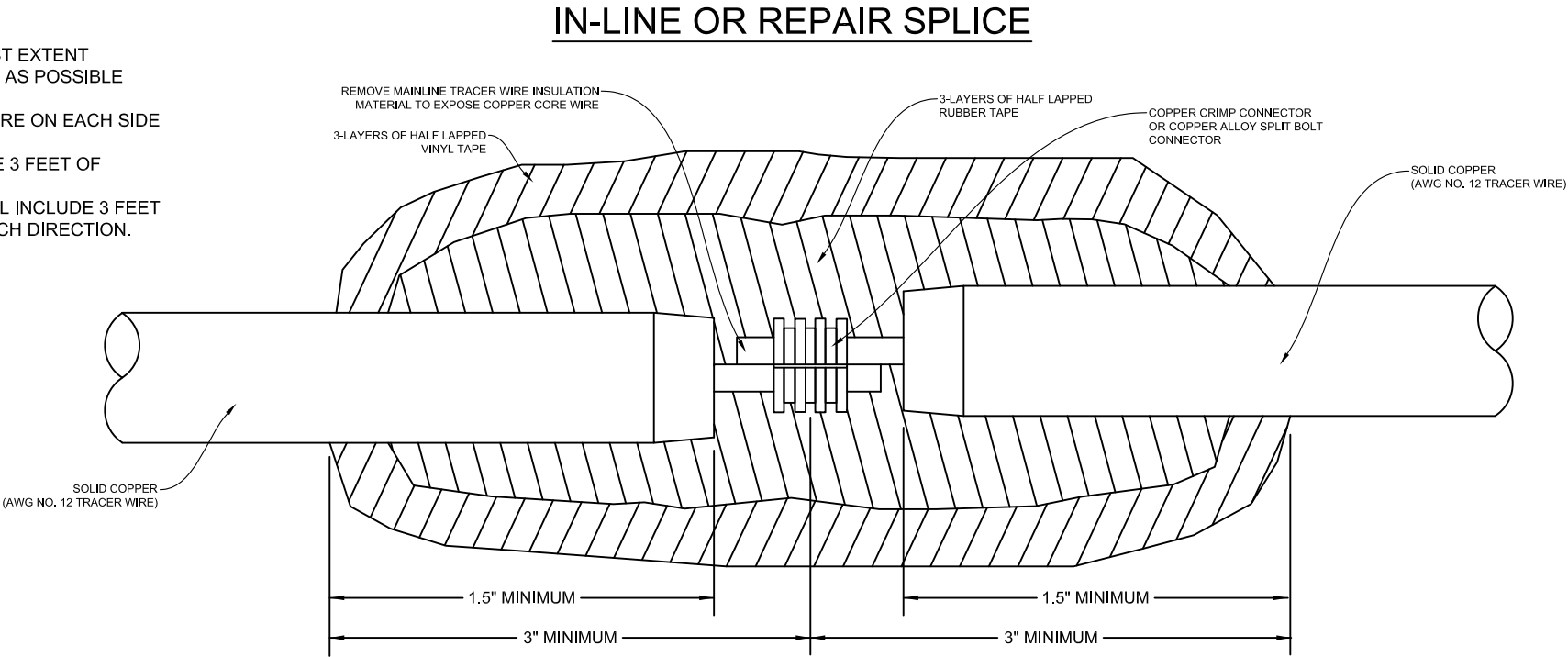
**TRACER WIRE - WATER MAIN**

CHARLOTTE WATER
STANDARD DETAILS
WATER

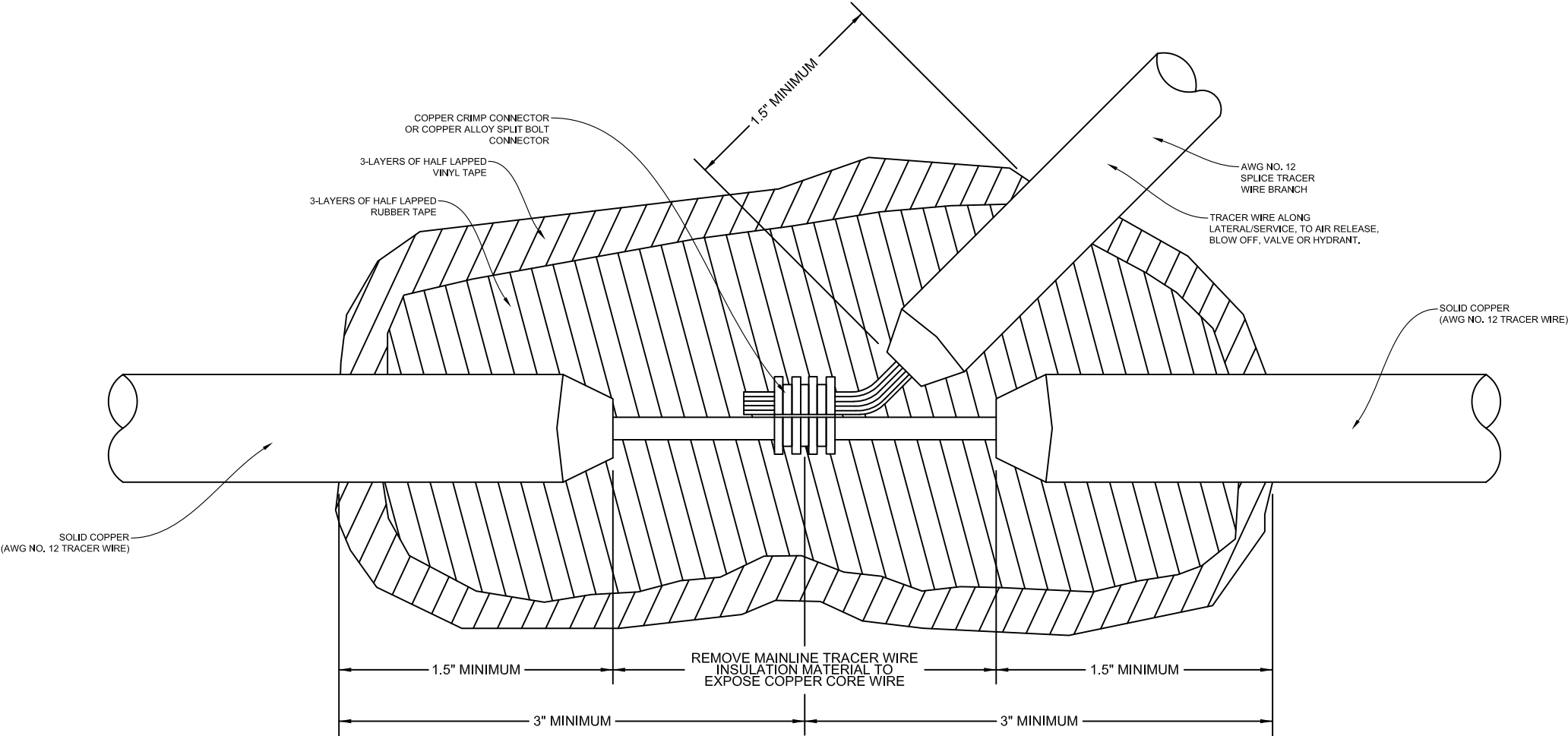


NOTES:

1. IN LINE SPLICES SHALL BE LIMITED TO THE GREATEST EXTENT POSSIBLE. TRACER WIRE SHALL BE AS CONTINUOUS AS POSSIBLE WITHOUT SPLICES.
2. INLINE SPLICES SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF EACH SPLICE.
3. BRANCH SPLICES ON EXISTING WIRE SHALL INCLUDE 3 FEET OF SLACK WIRE ON THE NEW BRANCH WIRE.
4. BRANCH SPLICES ON NEW MAIN INSTALLATION SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF THE SPLICE IN EACH DIRECTION.



**BRANCH IN-LINE SPLICE FOR SERVICE/LATERAL, TEE, CROSS, AIR RELEASE, BLOW OFF, HYDRANT OR VALVE**



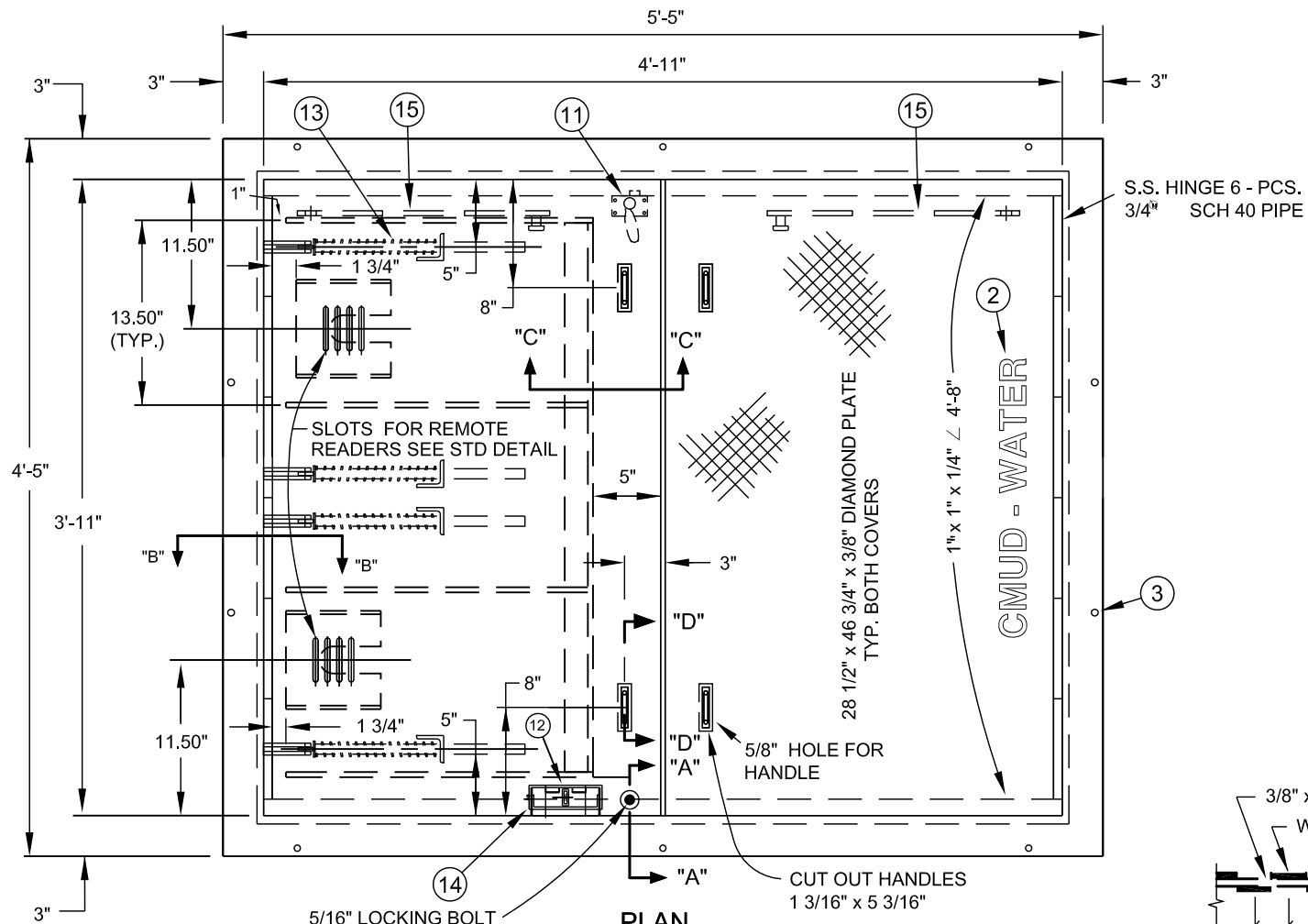
NOT TO SCALE

STANDARD NO.	TW3	
	VERSION NO.	1.0
		VERSION DATE
		7.21.2017

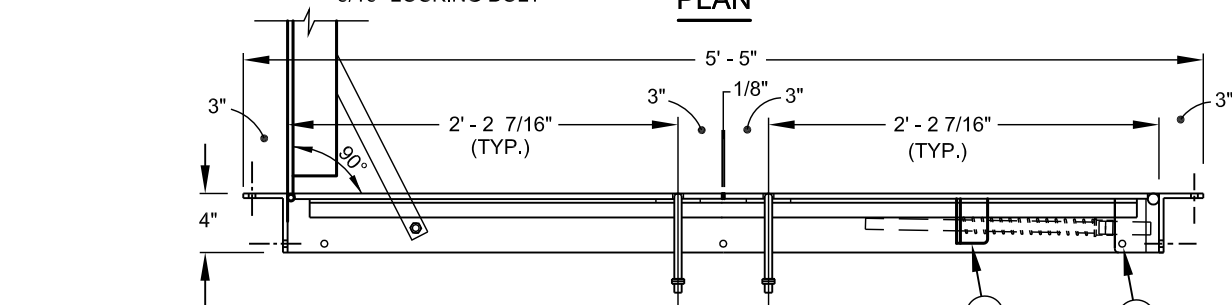
**TRACER WIRE - WATER MAIN - SPLICE**

CHARLOTTE WATER	
STANDARD DETAILS	
WATER	

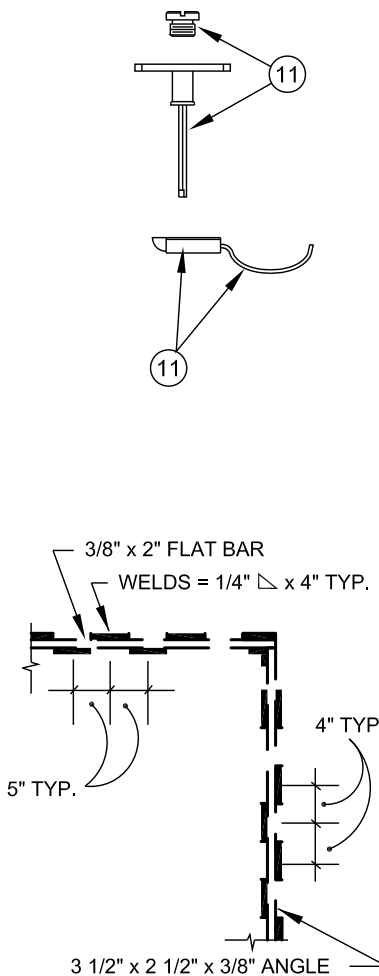




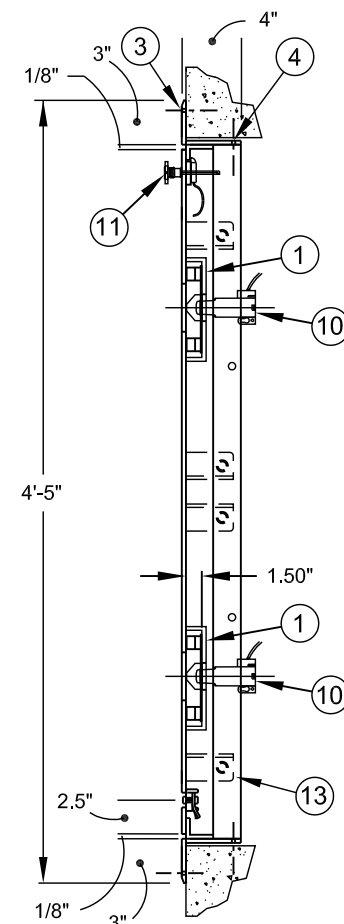
PLAN



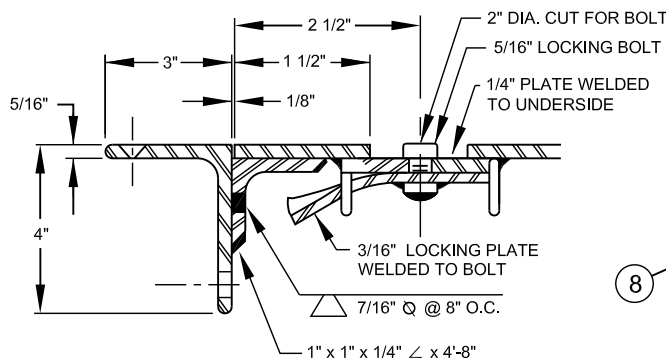
SECTION FRONT



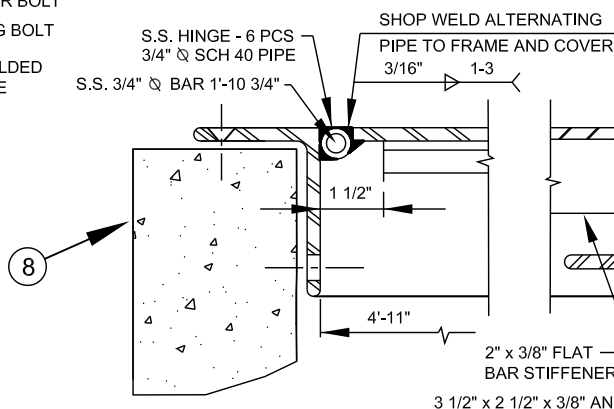
STIFFENER WELD  
DETAIL "F"



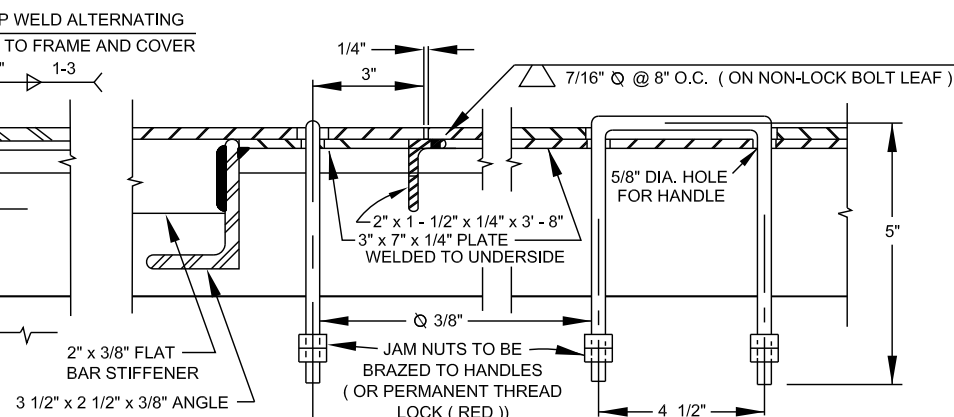
SECTION SIDE



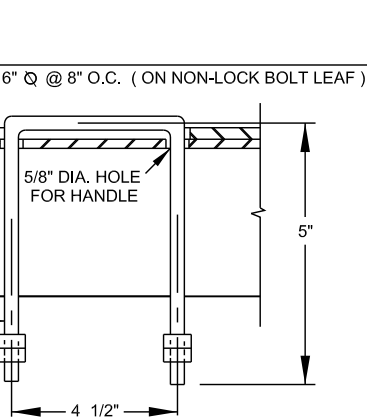
DETAIL A - LOCKING BOLT (1 EA)



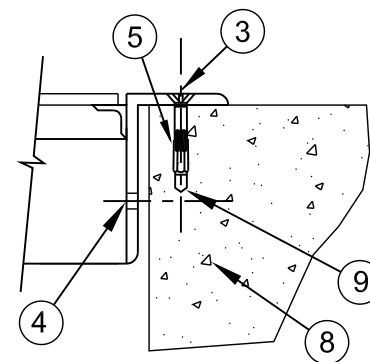
DETAIL B HINGE



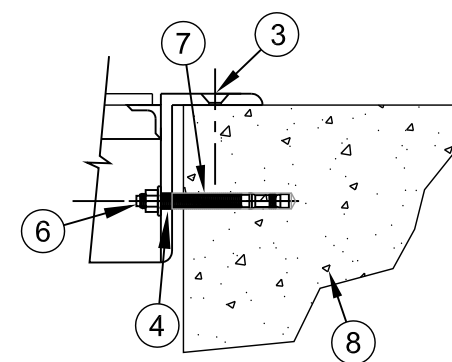
DETAIL C HANDLE (4)



DETAIL D HANDLE



ANCHOR DETAIL  
OPTION 1



ANCHOR DETAIL  
OPTION 2

NO. DESCRIPTION

- ERT TRANSMITTER SUPPORT BRACKET. ( SEE STANDARD DETAIL )
- 2 - INCH LETTERING MILLED INTO DOOR LEAF.
- 7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) 10 EACH
- 9/16 - INCH DIAMETER DRILLED HOLE ( 10 EACH )
- 3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL )
- 1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )
- 1/2 - INCH DIAMETER DRILLED HOLE IN CONCRETE.
- CONCRETE VAULT OR PEDESTRIAN SIDEWALK.
- 3/8 - INCH DIA. DRILLED HOLE - IN CONCRETE.
- WATER METER ERT TRANSMITTER.
- SLAM LOCK/THREADED PLUG / REMOVABLE KEY / INSIDE HANDLE.
- RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAPLE / SPRING LOADED HINGED LID.
- OPEN COMPRESSION SPRING ASSEMBLY ( # AS REQUIRED ) - HORIZONTALLY MOUNTED.
- PADLOCK TO BE FURNISHED BY CMUD.
- AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.

DESIGN REQUIREMENTS

- MATERIAL - STRUCTURAL STEEL - ASTM A-36.
- LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 TH. OF SPAN.
- DOOR LEAF - 3/8 - INCH THICK DIAMOND PLATE.
- COMPRESSION SPRINGS AND HOLD OPEN ARM REQUIRED ON EACH LEAF.
- SLAM LOCK / HOLD OPEN ARM - STAINLESS STEEL - TYPE 300.
- COMPRESSION SPRING ASSEMBLY - STAINLESS STEEL - TYPE 300.
- FORCE REQUIRED TO OPEN LEAF ( W / SPRINGS ) SHALL BE MINUS 5 LBS MINIMUM AND 20 LBS MAXIMUM.
- HINGE ( PIPE AND BAR ) - TYPE 304 STAINLESS STEEL.

NOTE:

- FRAME SHALL BE FURNISHED WITH ANCHOR HOLES NO. 3 AND NO. 4.
- CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 3 OR NO. 4 - AS APPROVED. ( OPTION ONE OR OPTION TWO )
- FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND ONE COAT OF BLACK ENAMEL. FIELD APPLY ONE COAT OF COMPATIBLE BLACK ENAMEL AT FINAL INSPECTION.
- FRAME DIMENSIONS SHALL ALLOW FOR CLOSE FIT INSIDE VAULT AS SHOWN AT TOP OF VAULT WALLS.
- STIFFENER TO BE WELDED TO BACK OF ACCESS DOOR USING WELD PATTERN AS SHOWN.
- COMPRESSION SPRING ASSEMBLY SHALL BE DESIGNED BY MANUFACTURER TO CONFORM TO LIFTING FORCE REQUIREMENTS. - NUMBER OF SPRINGS AS REQUIRED.

WARNING NOTE:

THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.

NO SCALE

STANDARD NO.

U

VERSION NO. V1.2

VERSION DATE 8.24.2011

STEEL DOUBLE LEAF ACCESS DOOR - 4' x 5'  
PEDESTRIAN LOADING ( 300 PSF ) FOR  
WATER METER VAULTS

CHARLOTTE-MECKLENBURG  
UTILITIES

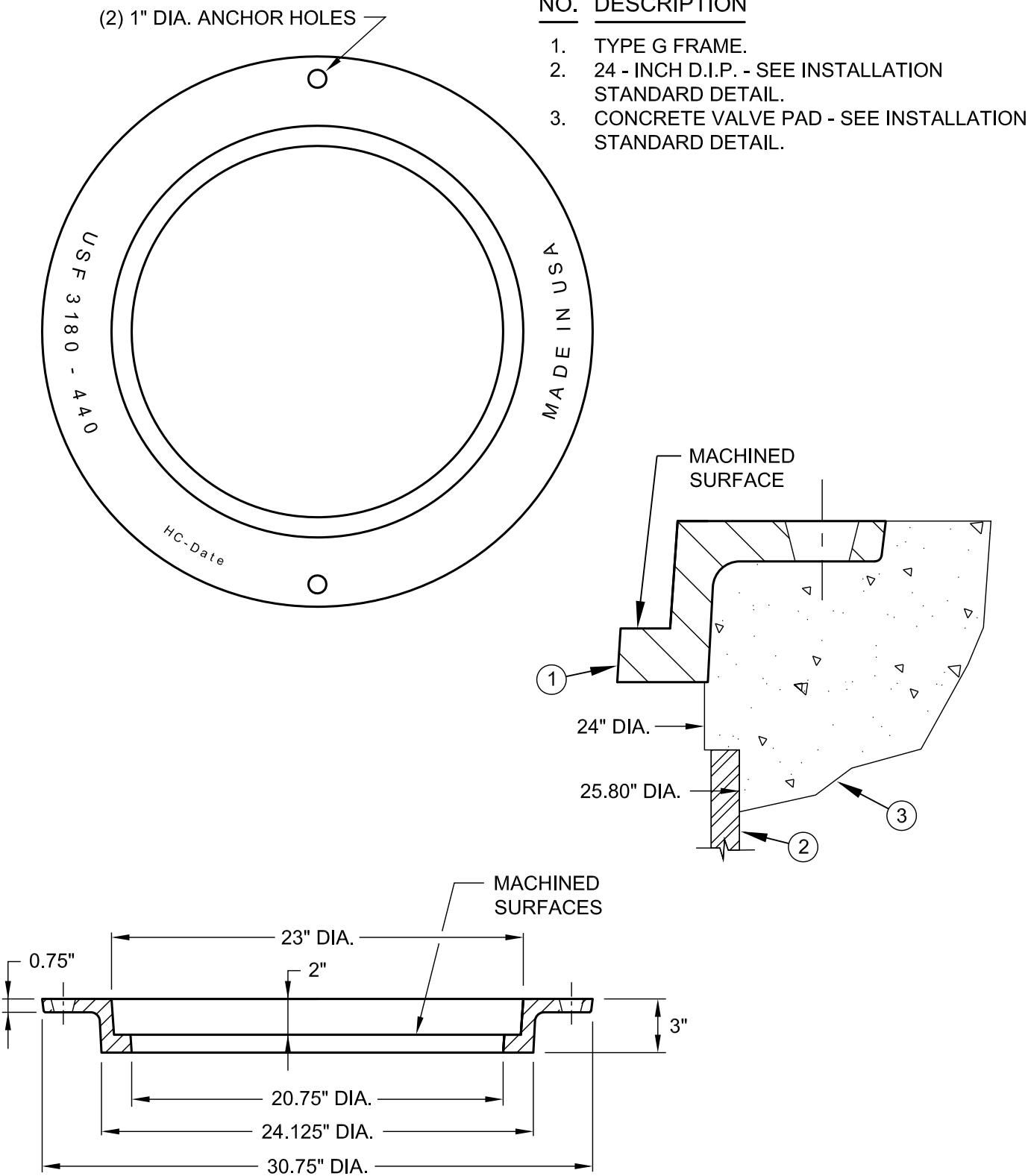
STANDARD DETAILS

WATER



U.S. FOUNDRY & MFG. CORP.

EAST JORDAN IRON WORKS



WEIGHT - 105 LB. MIN. , 0% MINUS TOLERANCE

NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

USE WITH TYPE 6 MANHOLE COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

TO BE DETERMINED

NO SCALE

STANDARD NO.

UU

VERSION NO.

V1.0

VERSION DATE

7.14.2011

TYPE G MANHOLE FRAME

20.5 - INCH DIAMETER ( CLEAR OPENING )

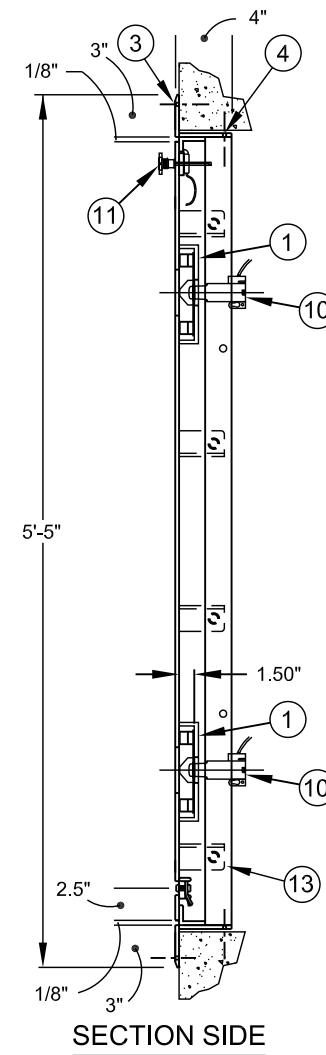
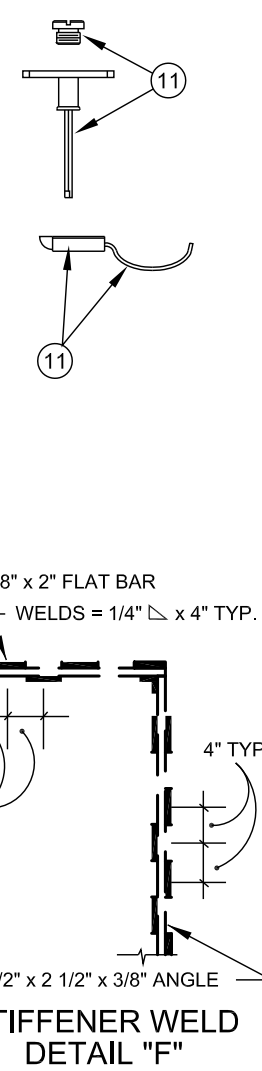
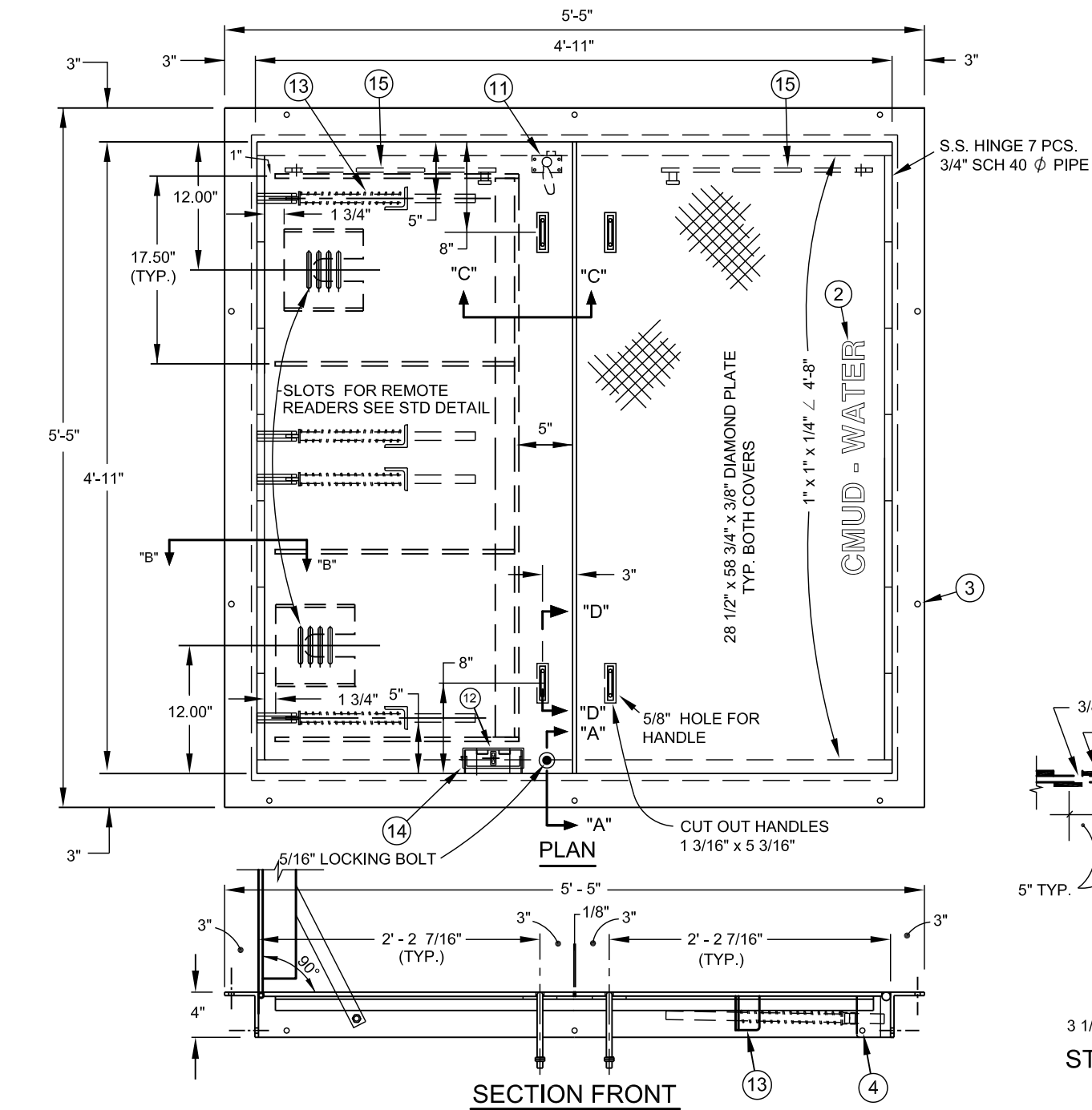
3 - INCH TALL - INVERTED ( CAST - IN - PLACE )

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER





- | NO. | DESCRIPTION   |
|-----|---|
| 1.  | ERT TRANSMITTER SUPPORT BRACKET. ( SEE STANDARD DETAIL )  |
| 2.  | 2 - INCH LETTERING MILLED INTO DOOR LEAF.   |
| 3.  | 7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) 10 EACH   |
| 4.  | 9/16 - INCH DIAMETER DRILLED HOLE ( 10 EACH )   |
| 5.  | 3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL ) |
| 6.  | 1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )   |
| 7.  | 1/2 - INCH DIAMETER DRILLED HOLE IN CONCRETE.   |
| 8.  | CONCRETE VAULT OR PEDESTRIAN SIDEWALK.  |
| 9.  | 3/8 - INCH DIA. DRILLED HOLE - IN CONCRETE.   |
| 10. | WATER METER ERT TRANSMITTER.  |
| 11. | SLAM LOCK/THREADED PLUG / REMOVABLE KEY / INSIDE HANDLE.  |
| 12. | RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAPLE / SPRING LOADED HINGED LID.   |
| 13. | OPEN COMPRESSION SPRING ASSEMBLY ( # AS REQUIRED ) - HORIZONTALLY MOUNTED.  |
| 14. | PADLOCK TO BE FURNISHED BY CMUD.  |
| 15. | AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.  |

#### DESIGN REQUIREMENTS

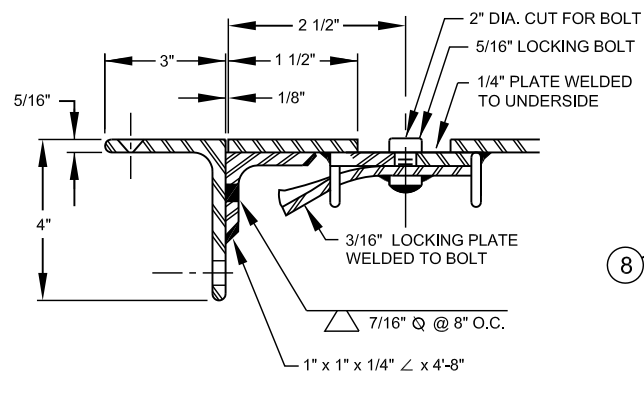
- MATERIAL - STRUCTURAL STEEL - ASTM A-36.
- LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 TH. OF SPAN.
- DOOR LEAF - 3/8 - INCH THICK DIAMOND PLATE.
- COMPRESSION SPRINGS AND HOLD OPEN ARM REQUIRED ON EACH LEAF.
- SLAM LOCK / HOLD OPEN ARM - STAINLESS STEEL - TYPE 300.
- COMPRESSION SPRING ASSEMBLY - STAINLESS STEEL - TYPE 300.
- FORCE REQUIRED TO OPEN LEAF ( W / SPRINGS ) SHALL BE MINUS 5 LBS MINIMUM AND 20 LBS MAXIMUM.
- HINGE ( PIPE AND BAR ) - TYPE 304 STAINLESS STEEL.

#### NOTE:

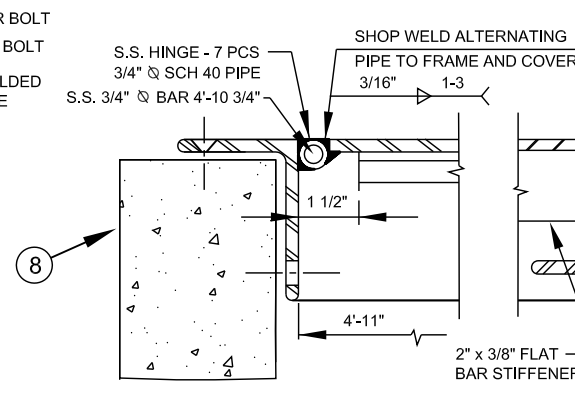
- FRAME SHALL BE FURNISHED WITH ANCHOR HOLES NO. 3 AND NO. 4.
- CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 3 OR NO. 4 - AS APPROVED. ( OPTION ONE OR OPTION TWO )
- FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND ONE COAT OF BLACK ENAMEL. FIELD APPLY ONE COAT OF COMPATIBLE BLACK ENAMEL AT FINAL INSPECTION.
- FRAME DIMENSIONS SHALL ALLOW FOR CLOSE FIT INSIDE VAULT AS SHOWN AT TOP OF VAULT WALLS.
- STIFFENER TO BE WELDED TO BACK OF ACCESS DOOR USING WELD PATTERN AS SHOWN.
- COMPRESSION SPRING ASSEMBLY SHALL BE DESIGNED BY MANUFACTURER TO CONFORM TO LIFTING FORCE REQUIREMENTS. - NUMBER OF SPRINGS AS REQUIRED.

#### WARNING NOTE:

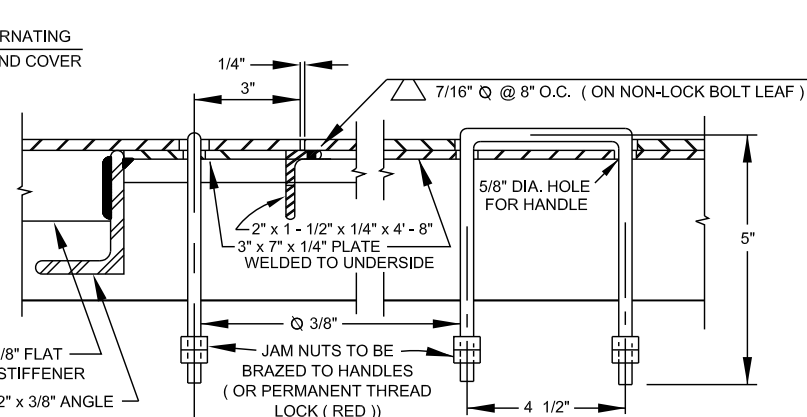
THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.



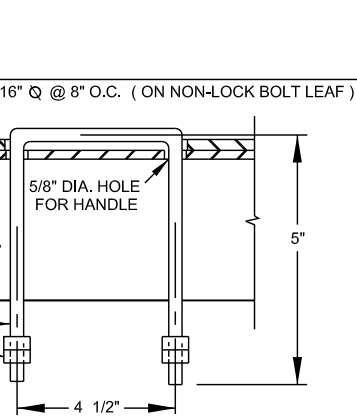
DETAIL A - LOCKING BOLT (1 EA)



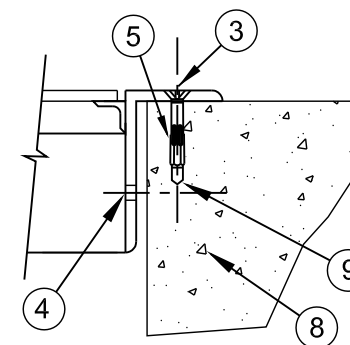
DETAIL B HINGE



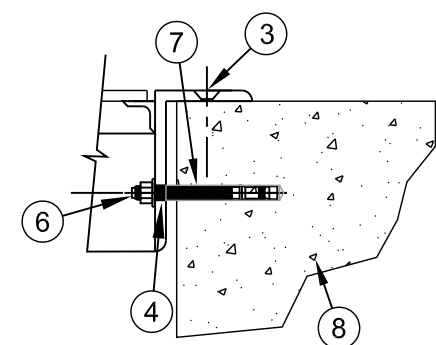
DETAIL C HANDLE (4)



DETAIL D HANDLE



ANCHOR DETAIL  
OPTION 1



ANCHOR DETAIL  
OPTION 2

NO SCALE

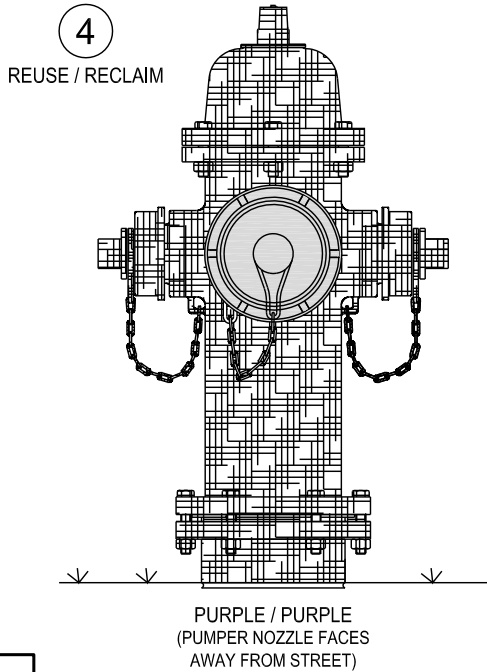
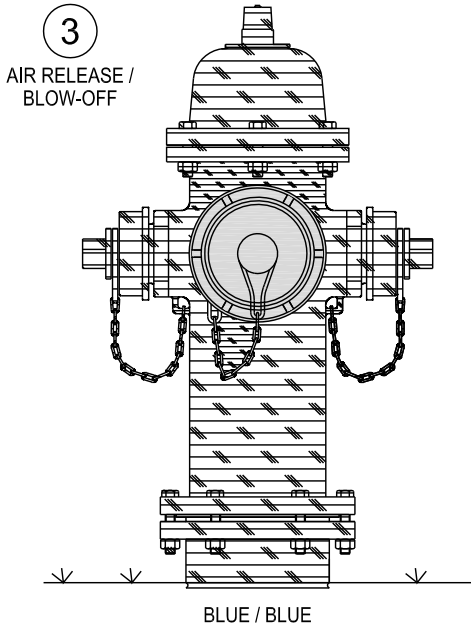
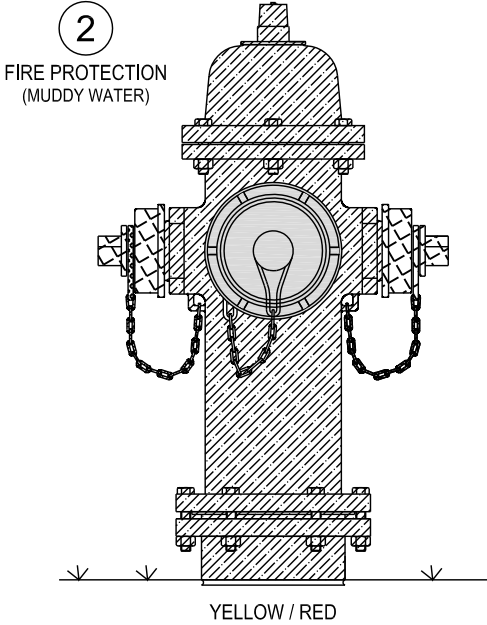
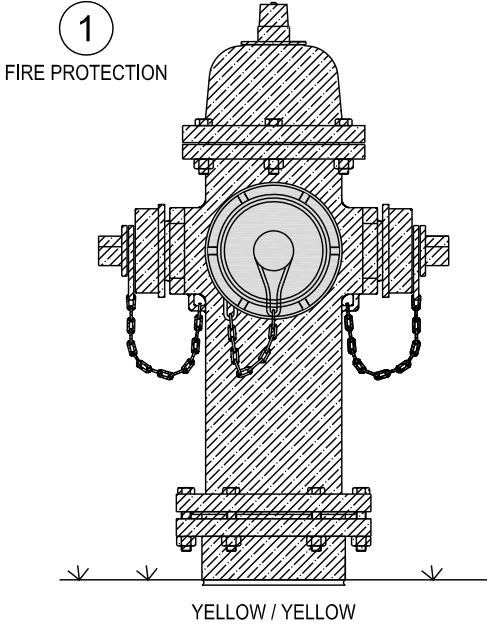
STANDARD NO.	V
VERSION NO.	V1.2
VERSION DATE	8.24.2011

STEEL DOUBLE LEAF ACCESS DOOR - 5' x 5'  
PEDESTRIAN LOADING ( 300 PSF ) FOR  
WATER METER VAULTS

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER

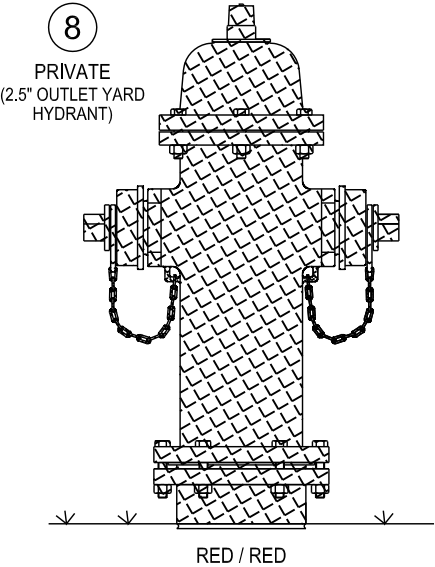
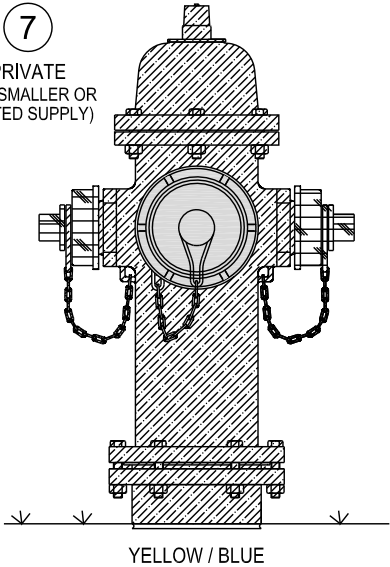
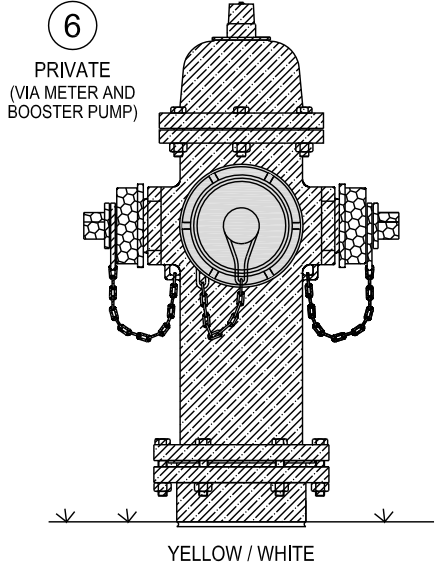
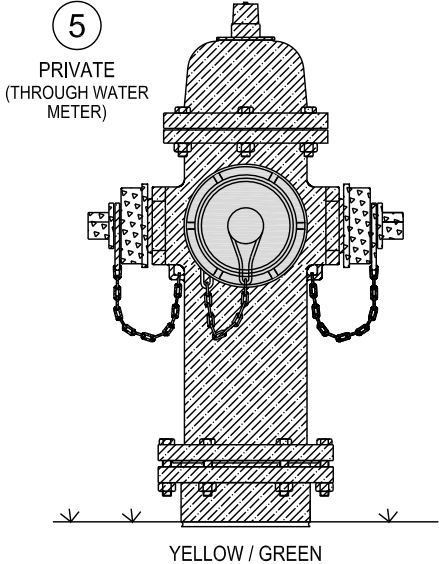


CMUD PUBLIC FIRE HYDRANTS



CMUD / CFD COLOR LEGEND	
COLOR:	HATCH TYPE:
OSHA SAFETY YELLOW	
OSHA SAFETY BLUE	
OSHA SAFETY PURPLE	
OSHA SAFETY RED	
OSHA SAFETY GREEN	
OSHA SAFETY WHITE	

PRIVATE FIRE HYDRANTS



- NOTES:
- A. PUBLIC FIRE HYDRANTS ARE (1) CONNECTED DIRECTLY TO CMUD WATER DISTRIBUTION SYSTEM, (2) OWNED AND MAINTAINED BY CMUD, AND (3) LOCATED WITHIN THE ROAD RIGHT-OF-WAY OR CMUD WATER MAIN EASEMENT.
- B. PRIVATE FIRE HYDRANTS ALL NON-PUBLIC FIRE HYDRANTS, INCLUDING HYDRANTS (1) SERVED VIA CMUD WATER METER, (2) SERVED VIA PRIVATE WATER SYSTEM, AND ARE (3) LOCATED OUTSIDE THE ROAD RIGHT-OF-WAYAND (4) PRIVATELY OWNED AND MAINTAINED.

CMUD AND CHARLOTTE FIRE DEPARTMENT STANDARDS  
COLOR SCHEME FOR CMUD PUBLIC FIRE HYDRANTS

FIRE HYDRANT CLASSIFICATION:	BARREL	SQUARE TOP / BONNET	STORZ PUMPER NOZZLE	IRON PUMPER NOZZLE	IRON HOSE NOZZLE
1 - FIRE PROTECTION	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW
2 - FIRE PROTECTION/ MUDDY FLOW	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY RED	OSHA SAFETY RED
3 - AIR RELEASE	OSHA SAFETY BLUE	OSHA SAFETY BLUE	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
3 - BLOW-OFF	OSHA SAFETY BLUE	OSHA SAFETY BLUE	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
4 - REUSE/ RECLAIM	OSHA SAFETY PURPLE	OSHA SAFETY PURPLE	NOT PAINTED	OSHA SAFETY PURPLE	OSHA SAFETY PURPLE

CHARLOTTE FIRE DEPARTMENT STANDARDS  
COLOR SCHEME FOR PRIVATE FIRE HYDRANTS

CLASSIFICATION:	BARREL	TOP / BONNET	STORZ PUMPER NOZZLE	IRON PUMPER NOZZLE	IRON HOSE NOZZLE
5 - PRIVATE THROUGH WATER METER	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY GREEN	OSHA SAFETY GREEN
6 - PRIVATE via METER AND FIRE BOOSTER PUMP	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY WHITE	OSHA SAFETY WHITE
7 - PRIVATE (6-INCH AND SMALLER MAIN OR LIMITED SUPPLY)	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
8 - PRIVATE (2.5-INCH OUTLET YARD HYDRANT)	OSHA SAFETY RED	OSHA SAFETY RED	N / A	N / A	OSHA SAFETY RED

INDUSTRY STANDARD - **NOT** ADOPTED OR USED BY CMUD/CFD  
AWWA C-502 UNIFORM COLOR SCHEME FOR FIRE HYDRANTS  
NFPA 291 RECOMMENDED PRACTICE FOR MARKING FIRE HYDRANTS

CLASSIFICATION:	FLOW CAPACITY (GPM AT 20 PSI RESIDUAL)	BARREL	TOP / BONNET	PUMPER NOZZLE	HOSE NOZZLE
CLASS AA	1500 OR GREATER	CHROME YELLOW	LIGHT BLUE	LIGHT BLUE	LIGHT BLUE
CLASS A	1000 TO 1499	CHROME YELLOW	GREEN	GREEN	GREEN
CLASS B	500 TO 999	CHROME YELLOW	ORANGE	ORANGE	ORANGE
CLASS C	LESS TO 500	CHROME YELLOW	RED	RED	RED

FOR CLARITY, CONSIDER USING STANDARD DETAIL V V - COLOR AND A COLOR PRINTER.  
ALL PAINTED SURFACES ARE SOLID COLORS - HATCHING DEPICTED FOR USE WITH  
BLACK ONLY PRINTERS.

NO SCALE

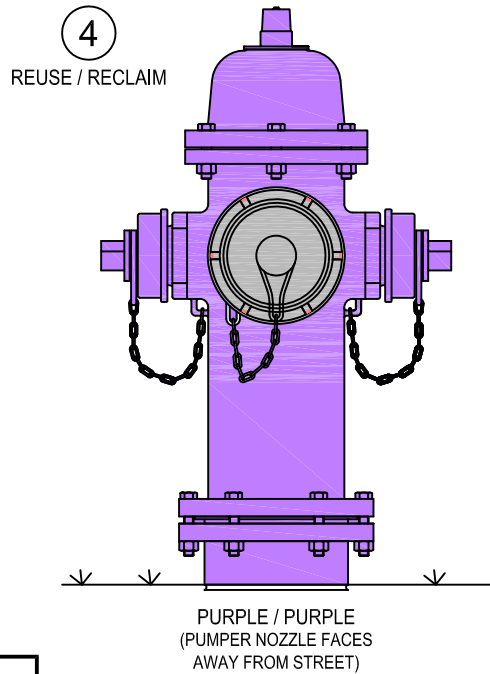
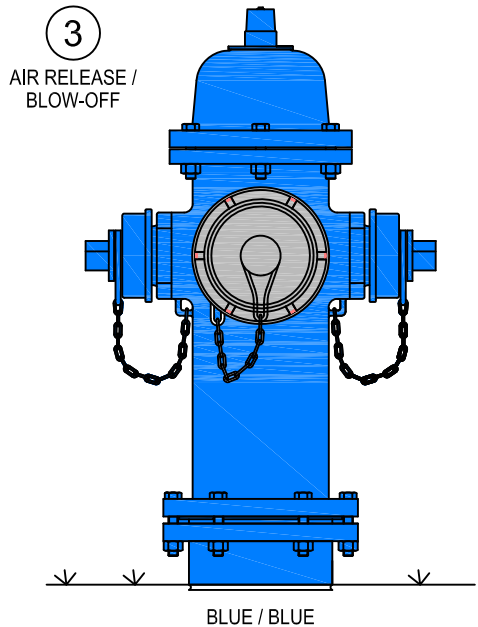
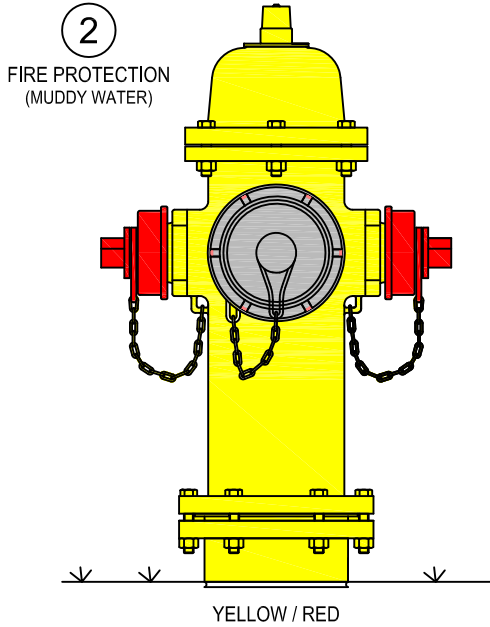
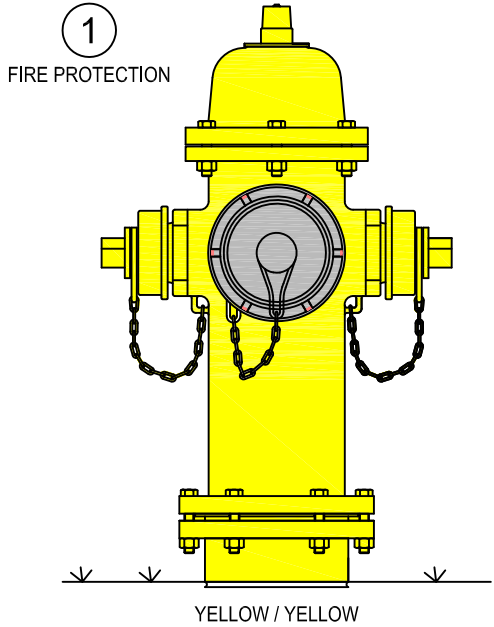
STANDARD NO.	V V - B/W HATCH
VERSION NO.	1.0
VERSION DATE	8.08.2011

FIRE HYDRANT PAINT/COLOR SCHEMES  
CMUD/CHARLOTTE FIRE DEPT. STANDARDS  
PUBLIC AND PRIVATE HYDRANTS



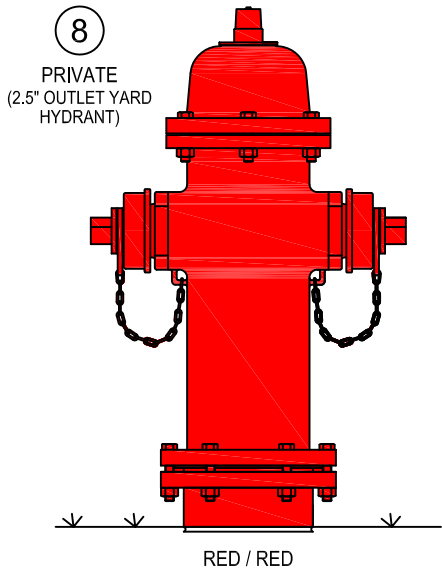
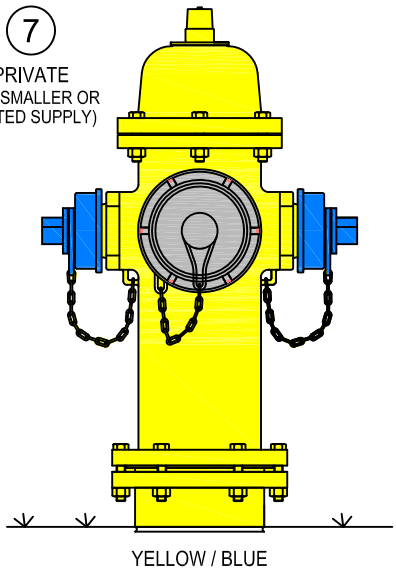
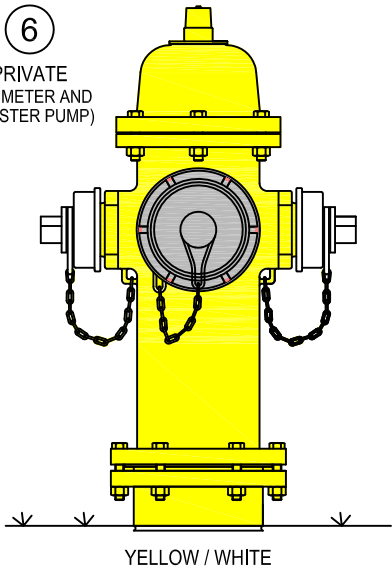
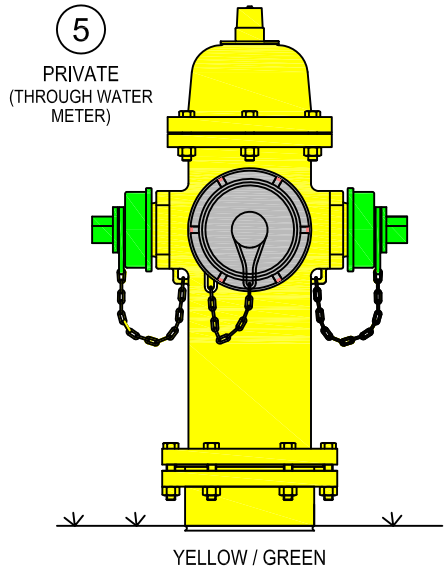


CMUD PUBLIC FIRE HYDRANTS



CMUD / CFD COLOR LEGEND	
COLOR:	SHADE:
OSHA SAFETY YELLOW	
OSHA SAFETY BLUE	
OSHA SAFETY PURPLE	
OSHA SAFETY RED	
OSHA SAFETY GREEN	
OSHA SAFETY WHITE	

PRIVATE FIRE HYDRANTS



- NOTES:
- A. PUBLIC FIRE HYDRANTS ARE (1) CONNECTED DIRECTLY TO CMUD WATER DISTRIBUTION SYSTEM, (2) OWNED AND MAINTAINED BY CMUD, AND (3) LOCATED WITHIN THE ROAD RIGHT-OF-WAY OR CMUD WATER MAIN EASEMENT.
- B. PRIVATE FIRE HYDRANTS ALL NON-PUBLIC FIRE HYDRANTS, INCLUDING HYDRANTS (1) SERVED VIA CMUD WATER METER, (2) SERVED VIA PRIVATE WATER SYSTEM, AND ARE (3) LOCATED OUTSIDE THE ROAD RIGHT-OF-WAYAND (4) PRIVATELY OWNED AND MAINTAINED.

CMUD AND CHARLOTTE FIRE DEPARTMENT STANDARDS  
COLOR SCHEME FOR CMUD PUBLIC FIRE HYDRANTS

FIRE HYDRANT CLASSIFICATION:	BARREL	SQUARE TOP / BONNET	STORZ PUMPER NOZZLE	IRON PUMPER NOZZLE	IRON HOSE NOZZLE
1 - FIRE PROTECTION	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW
2 - FIRE PROTECTION/ MUDDY FLOW	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY RED	OSHA SAFETY RED
3 - AIR RELEASE	OSHA SAFETY BLUE	OSHA SAFETY BLUE	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
3 - BLOW-OFF	OSHA SAFETY BLUE	OSHA SAFETY BLUE	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
4 - REUSE/ RECLAIM	OSHA SAFETY PURPLE	OSHA SAFETY PURPLE	NOT PAINTED	OSHA SAFETY PURPLE	OSHA SAFETY PURPLE

CHARLOTTE FIRE DEPARTMENT STANDARDS  
COLOR SCHEME FOR PRIVATE FIRE HYDRANTS

CLASSIFICATION:	BARREL	TOP / BONNET	STORZ PUMPER NOZZLE	IRON PUMPER NOZZLE	IRON HOSE NOZZLE
5 - PRIVATE THROUGH WATER METER	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY GREEN	OSHA SAFETY GREEN
6 - PRIVATE via METER AND FIRE BOOSTER PUMP	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY WHITE	OSHA SAFETY WHITE
7 - PRIVATE (6-INCH AND SMALLER MAIN OR LIMITED SUPPLY)	OSHA SAFETY YELLOW	OSHA SAFETY YELLOW	NOT PAINTED	OSHA SAFETY BLUE	OSHA SAFETY BLUE
8 - PRIVATE (2.5-INCH OUTLET YARD HYDRANT)	OSHA SAFETY RED	OSHA SAFETY RED	N / A	N / A	OSHA SAFETY RED

INDUSTRY STANDARD - **NOT** ADOPTED OR USED BY CMUD/CFD  
AWWA C-502 UNIFORM COLOR SCHEME FOR FIRE HYDRANTS  
NFPA 291 RECOMMENDED PRACTICE FOR MARKING FIRE HYDRANTS

CLASSIFICATION:	FLOW CAPACITY (GPM AT 20 PSI RESIDUAL)	BARREL	TOP / BONNET	PUMPER NOZZLE	HOSE NOZZLE
CLASS AA	1500 OR GREATER	CHROME YELLOW	LIGHT BLUE	LIGHT BLUE	LIGHT BLUE
CLASS A	1000 TO 1499	CHROME YELLOW	GREEN	GREEN	GREEN
CLASS B	500 TO 999	CHROME YELLOW	ORANGE	ORANGE	ORANGE
CLASS C	LESS TO 500	CHROME YELLOW	RED	RED	RED

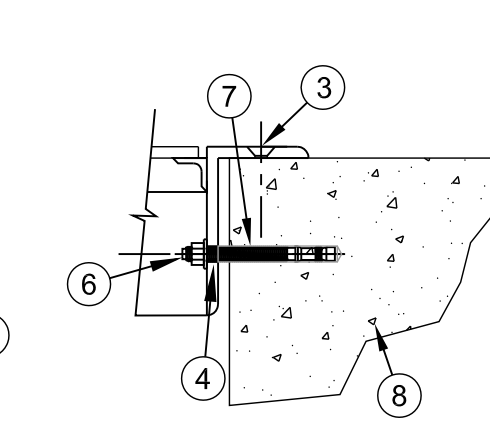
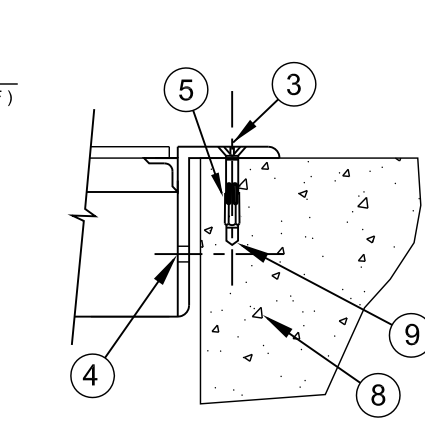
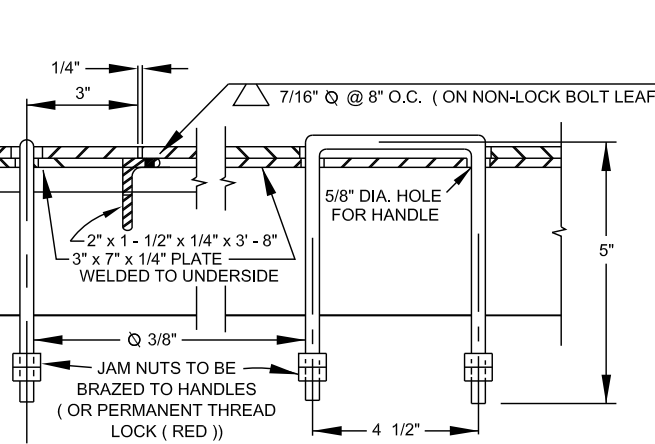
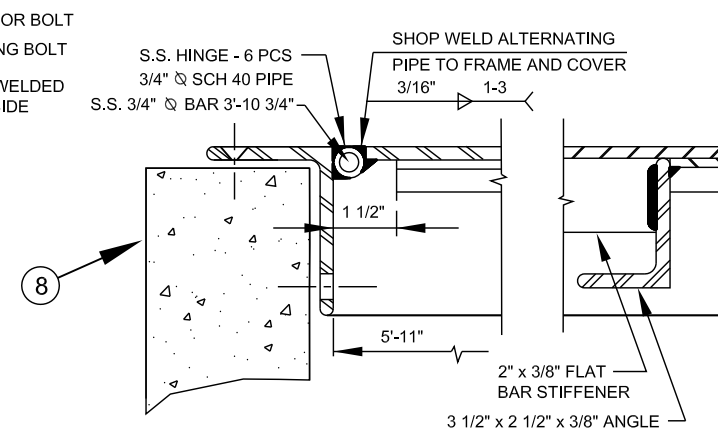
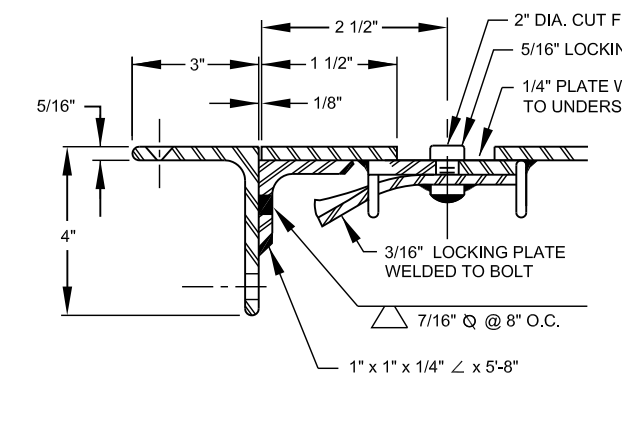
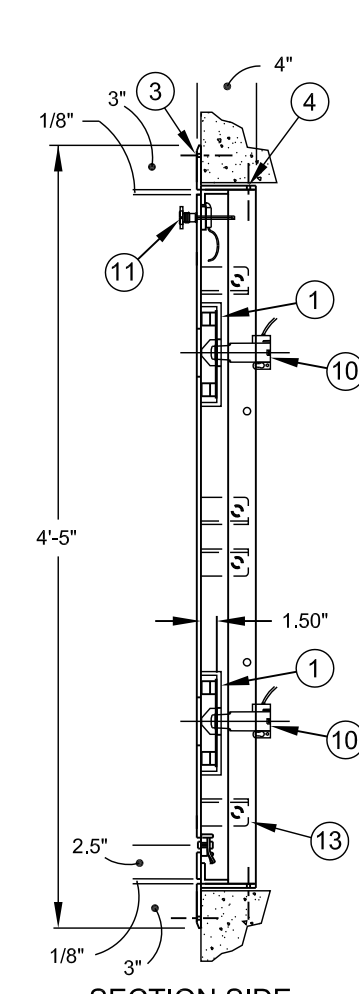
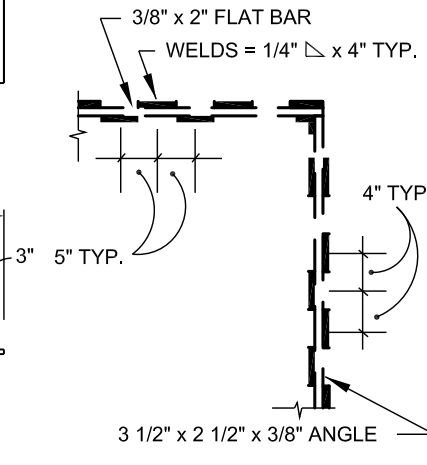
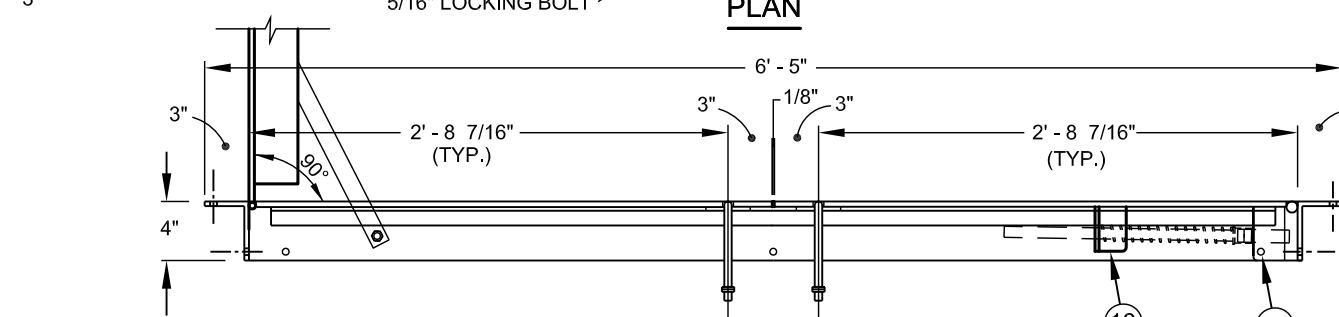
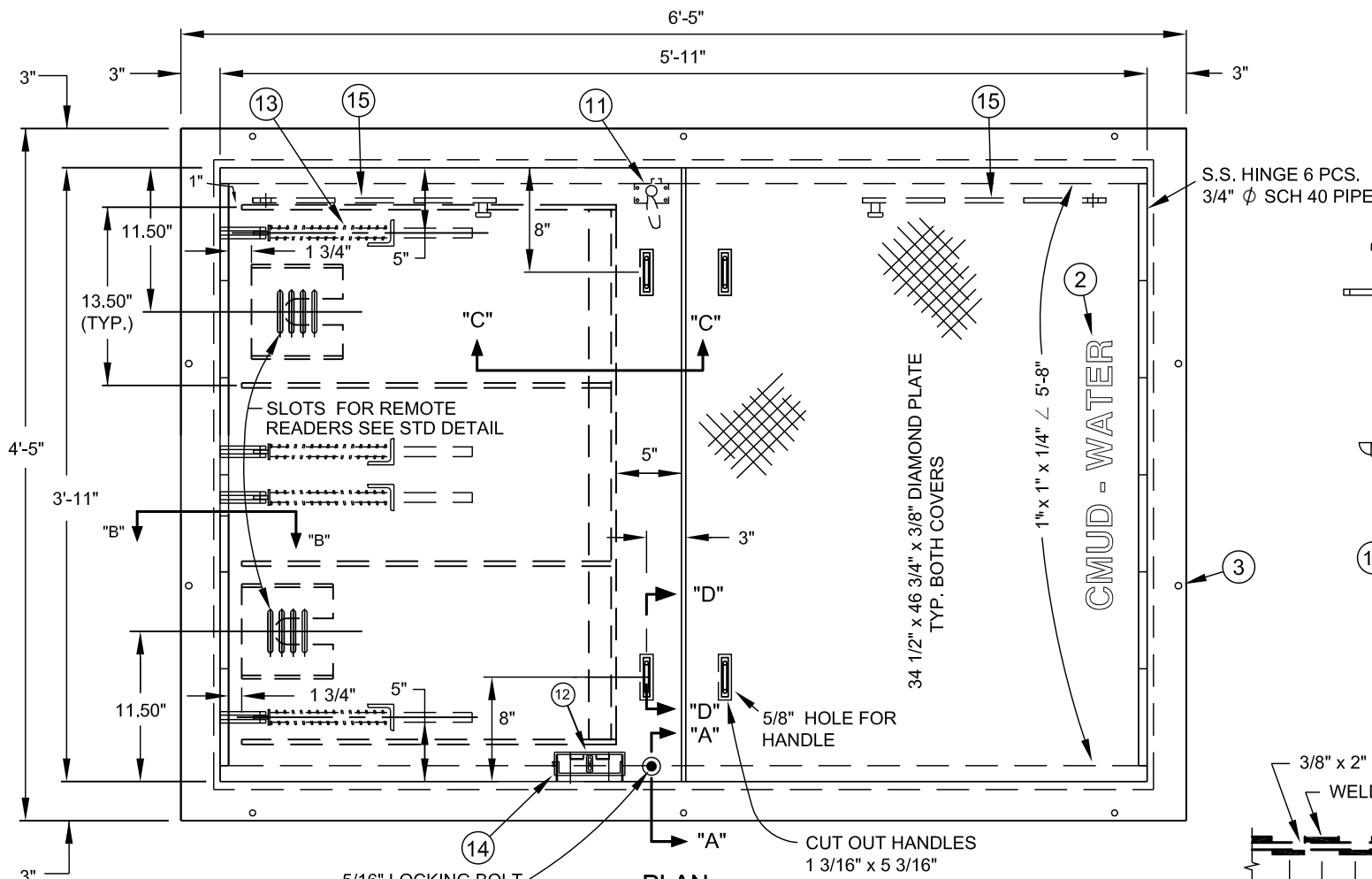
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STANDARD NO.	V V - COLOR
VERSION NO.	1.0
VERSION DATE	8.04.2011

FIRE HYDRANT PAINT/COLOR SCHEMES  
CMUD/CHARLOTTE FIRE DEPT. STANDARDS  
PUBLIC AND PRIVATE HYDRANTS

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER





NO.	DESCRIPTION
1.	ERT TRANSMITTER SUPPORT BRACKET. ( SEE STANDARD DETAIL )
2.	2 - INCH LETTERING MILLED INTO DOOR LEAF.
3.	7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) 10 EACH
4.	9/16 - INCH DIA. DRILLED HOLE ( 10 EACH )
5.	3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL )
6.	1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )
7.	1/2 - INCH DIAMETER DRILLED HOLE IN CONCRETE.
8.	CONCRETE VAULT OR PEDESTRIAN SIDEWALK.
9.	3/8 - INCH DIA. DRILLED HOLE - IN CONCRETE.
10.	WATER METER ERT TRANSMITTER.
11.	SLAM LOCK/THREADED PLUG / REMOVABLE KEY / INSIDE HANDLE.
12.	RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAPLE / SPRING LOADED HINGED LID.
13.	OPEN COMPRESSION SPRING ASSEMBLY ( # AS REQUIRED ) - HORIZONTALLY MOUNTED.
14.	PADLOCK TO BE FURNISHED BY CMUD.
15.	AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.

- DESIGN REQUIREMENTS**
- A. MATERIAL - STRUCTURAL STEEL - ASTM A-36.
  - B. LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 TH. OF SPAN.
  - C. DOOR LEAF - 3/8 - INCH THICK DIAMOND PLATE.
  - D. COMPRESSION SPRINGS AND HOLD OPEN ARM REQUIRED ON EACH LEAF.
  - E. SLAM LOCK / HOLD OPEN ARM - STAINLESS STEEL - TYPE 300.
  - F. COMPRESSION SPRING ASSEMBLY - STAINLESS STEEL - TYPE 300.
  - G. FORCE REQUIRED TO OPEN LEAF ( W / SPRINGS ) SHALL BE MINUS 5 LBS MINIMUM AND 20 LBS MAXIMUM.
  - E. HINGE ( PIPE AND BAR ) - TYPE 304 STAINLESS STEEL.

- NOTE:**
- a. FRAME SHALL BE FURNISHED WITH ANCHOR HOLES NO. 3 AND NO. 4.
  - b. CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 3 OR NO. 4 - AS APPROVED. ( OPTION ONE OR OPTION TWO )
  - c. FRAME AND COVER TO BE SHOP COATED WITH ZINC CHROMATE PRIMER AND ONE COAT OF BLACK ENAMEL. FIELD APPLY ONE COAT OF COMPATIBLE BLACK ENAMEL AT FINAL INSPECTION.
  - d. FRAME DIMENSIONS SHALL ALLOW FOR CLOSE FIT INSIDE VAULT AS SHOWN AT TOP OF VAULT WALLS.
  - e. STIFFENER TO BE WELDED TO BACK OF ACCESS DOOR USING WELD PATTERN AS SHOWN.
  - f. COMPRESSION SPRING ASSEMBLY SHALL BE DESIGNED BY MANUFACTURER TO CONFORM TO LIFTING FORCE REQUIREMENTS. - NUMBER OF SPRINGS AS REQUIRED.

**WARNING NOTE:**  
**THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.**

NO SCALE

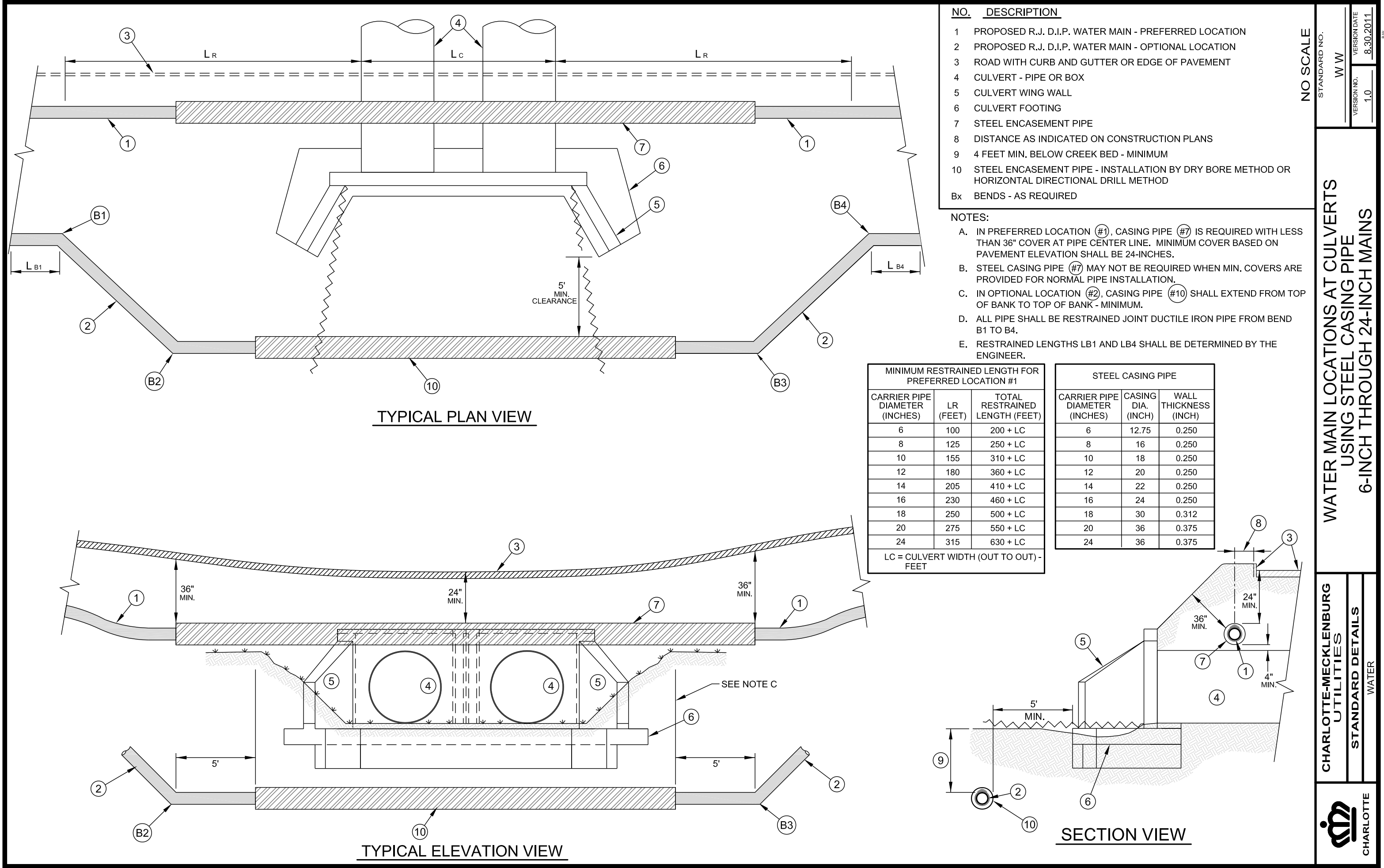
STANDARD NO.	W
VERSION NO.	V1.1
VERSION DATE	8.24.2011

STEEL DOUBLE LEAF ACCESS DOOR - 4' x 6'  
PEDESTRIAN LOADING ( 300 PSF ) FOR  
WATER METER VAULTS

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER





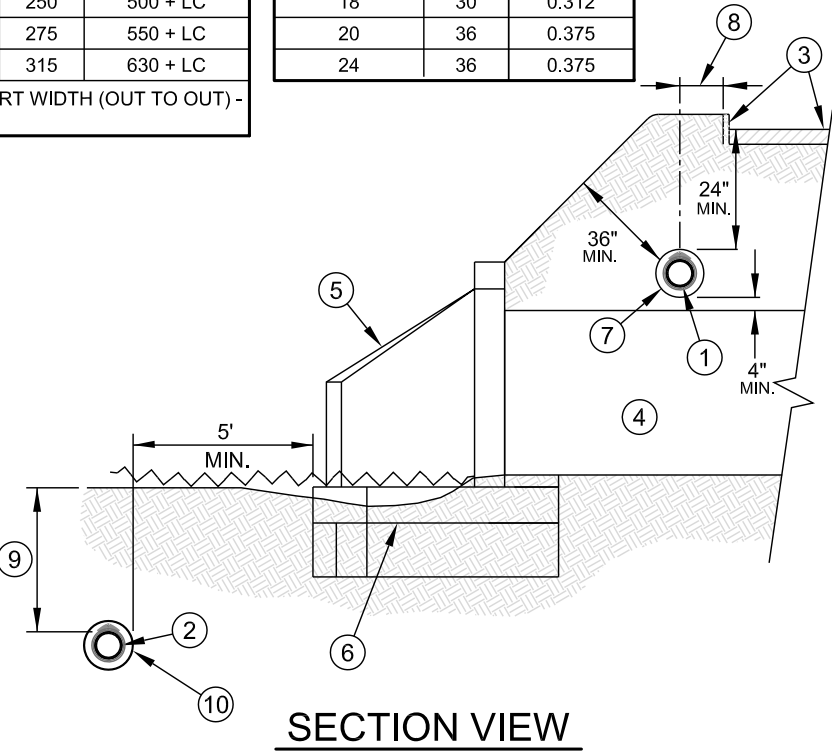


NO.	DESCRIPTION
1	PROPOSED R.J. D.I.P. WATER MAIN - PREFERRED LOCATION
2	PROPOSED R.J. D.I.P. WATER MAIN - OPTIONAL LOCATION
3	ROAD WITH CURB AND GUTTER OR EDGE OF PAVEMENT
4	CULVERT - PIPE OR BOX
5	CULVERT WING WALL
6	CULVERT FOOTING
7	STEEL ENCASUREMENT PIPE
8	DISTANCE AS INDICATED ON CONSTRUCTION PLANS
9	4 FEET MIN. BELOW CREEK BED - MINIMUM
10	STEEL ENCASUREMENT PIPE - INSTALLATION BY DRY BORE METHOD OR HORIZONTAL DIRECTIONAL DRILL METHOD
Bx	BENDS - AS REQUIRED

- NOTES:
- A. IN PREFERRED LOCATION (#1), CASING PIPE (#7) IS REQUIRED WITH LESS THAN 36" COVER AT PIPE CENTER LINE. MINIMUM COVER BASED ON PAVEMENT ELEVATION SHALL BE 24-INCHES.
  - B. STEEL CASING PIPE (#7) MAY NOT BE REQUIRED WHEN MIN. COVERS ARE PROVIDED FOR NORMAL PIPE INSTALLATION.
  - C. IN OPTIONAL LOCATION (#2), CASING PIPE (#10) SHALL EXTEND FROM TOP OF BANK TO TOP OF BANK - MINIMUM.
  - D. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON PIPE FROM BEND B1 TO B4.
  - E. RESTRAINED LENGTHS LB1 AND LB4 SHALL BE DETERMINED BY THE ENGINEER.

MINIMUM RESTRAINED LENGTH FOR PREFERRED LOCATION #1		
CARRIER PIPE DIAMETER (INCHES)	LR (FEET)	TOTAL RESTRAINED LENGTH (FEET)
6	100	200 + LC
8	125	250 + LC
10	155	310 + LC
12	180	360 + LC
14	205	410 + LC
16	230	460 + LC
18	250	500 + LC
20	275	550 + LC
24	315	630 + LC
LC = CULVERT WIDTH (OUT TO OUT) - FEET		

STEEL CASING PIPE		
CARRIER PIPE DIAMETER (INCHES)	CASING DIA. (INCH)	WALL THICKNESS (INCH)
6	12.75	0.250
8	16	0.250
10	18	0.250
12	20	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	36	0.375
24	36	0.375



NO SCALE

STANDARD NO. WW

VERSION NO. 1.0

VERSION DATE 8.30.2011

WATER MAIN LOCATIONS AT CULVERTS

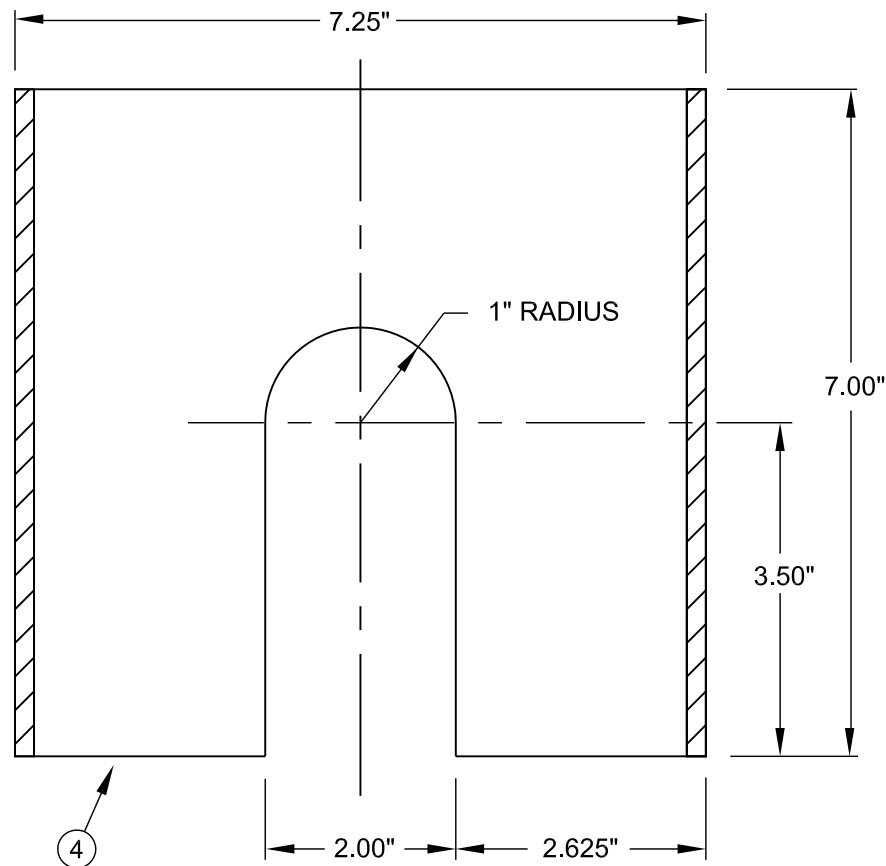
USING STEEL CASING PIPE

6-INCH THROUGH 24-INCH MAINS

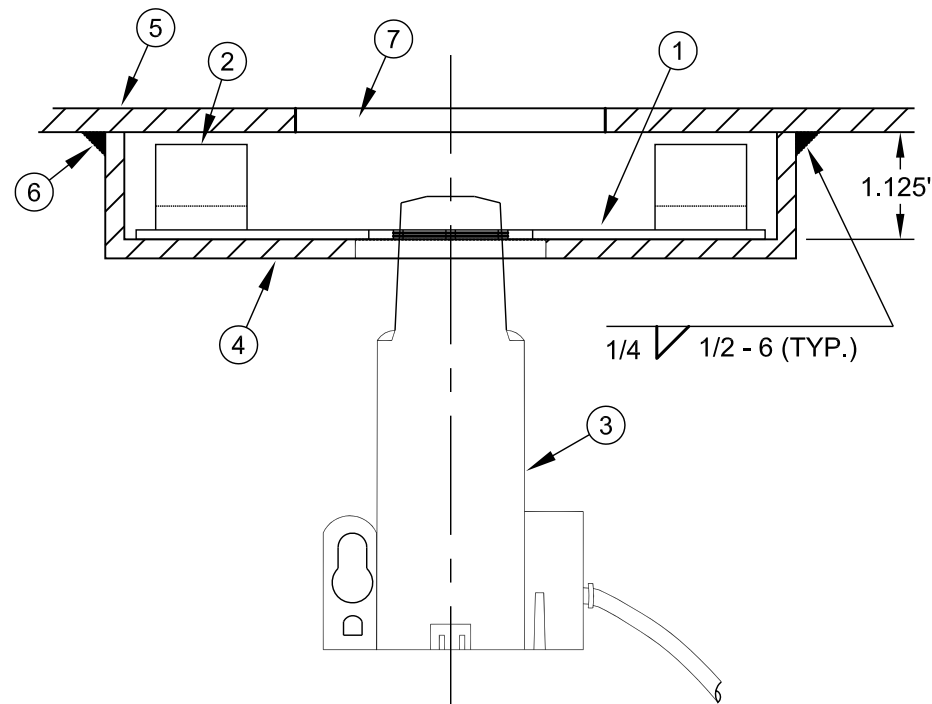
CHARLOTTE-MECKLENBURG UTILITIES

STANDARD DETAILS

WATER



PLAN - SUPPORT BRACKET



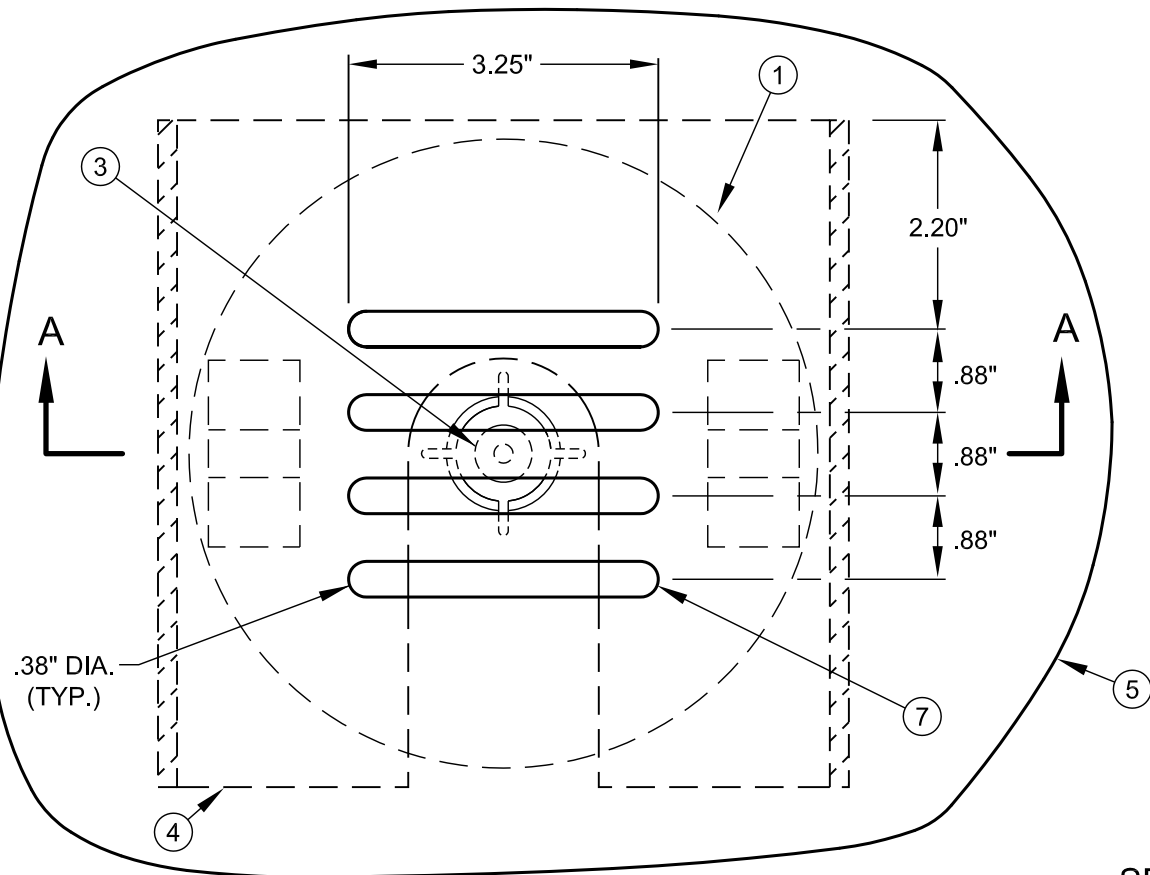
SECTION "A-A" - SUPPORT BRACKET

NO. DESCRIPTION

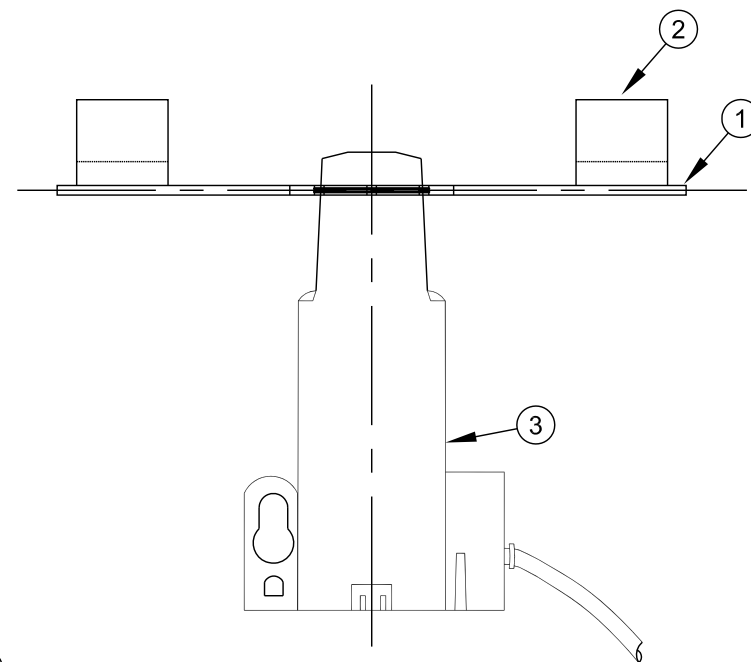
1. ITRON 6.7" DIA. SHELF MOUNT ADAPTOR W/FOAM SPACERS
2. FOAM SPACERS 2 EA. (TYPICAL)
3. ITRON ERT TRANSMITTER
4. SUPPORT BRACKET (1/4" STEEL OR ALUMINUM PLATE)
5. DIAMOND PLATE DOOR LEAF
6. FILLET WELD SUPPORT BRACKET AT CORNERS
7. TRANSMITTER SLOTS - 4 EA. AS SHOWN

NOTES:

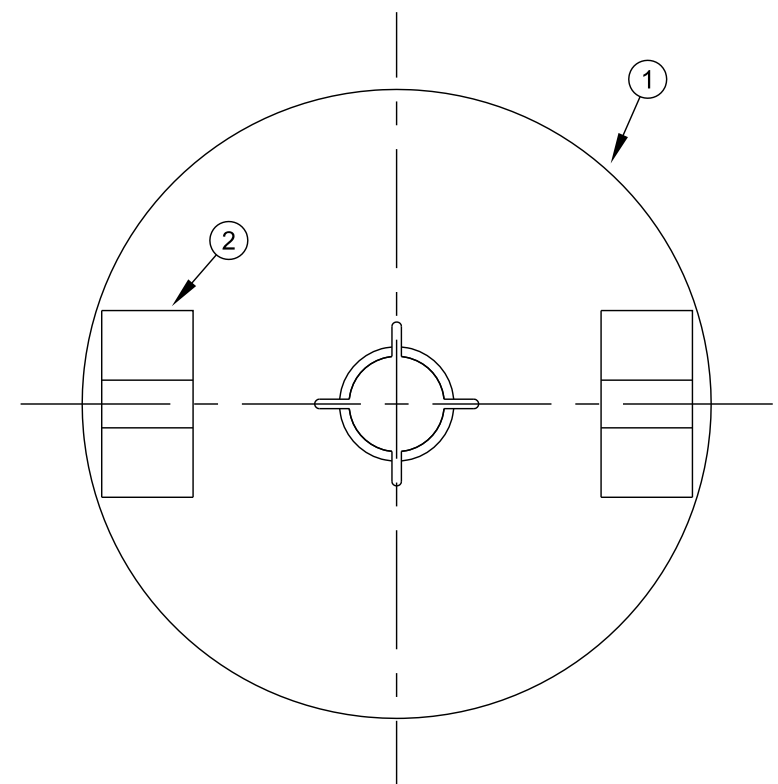
- A. ONE SUPPORT BRACKET REQUIRED FOR EACH METER IN VAULT.
- B. SELF MOUNT ADAPTER SHALL BE SNAPPED ONTO ERT TRANSMITTER.
- C. TRANSMITTER/MOUNT ADAPTER SHALL BE INSERTED INTO SUPPORT BRACKET AS SHOWN.
- D. DOOR LEAF AND SUPPORT BRACKET SHALL BE OF LIKE MATERIALS.
- E. SEE ACCESS DOOR STANDARD DETAILS FOR SUPPORT BRACKET LOCATIONS.



PLAN - TRANSMITTER SLOT DETAIL



SECTION - TRANSMITTER & SELF MOUNT ADAPTER



PLAN - SELF MOUNT ADAPTER

NO SCALE

STANDARD NO.	X
VERSION NO.	V1.0
VERSION DATE	8.27.2010

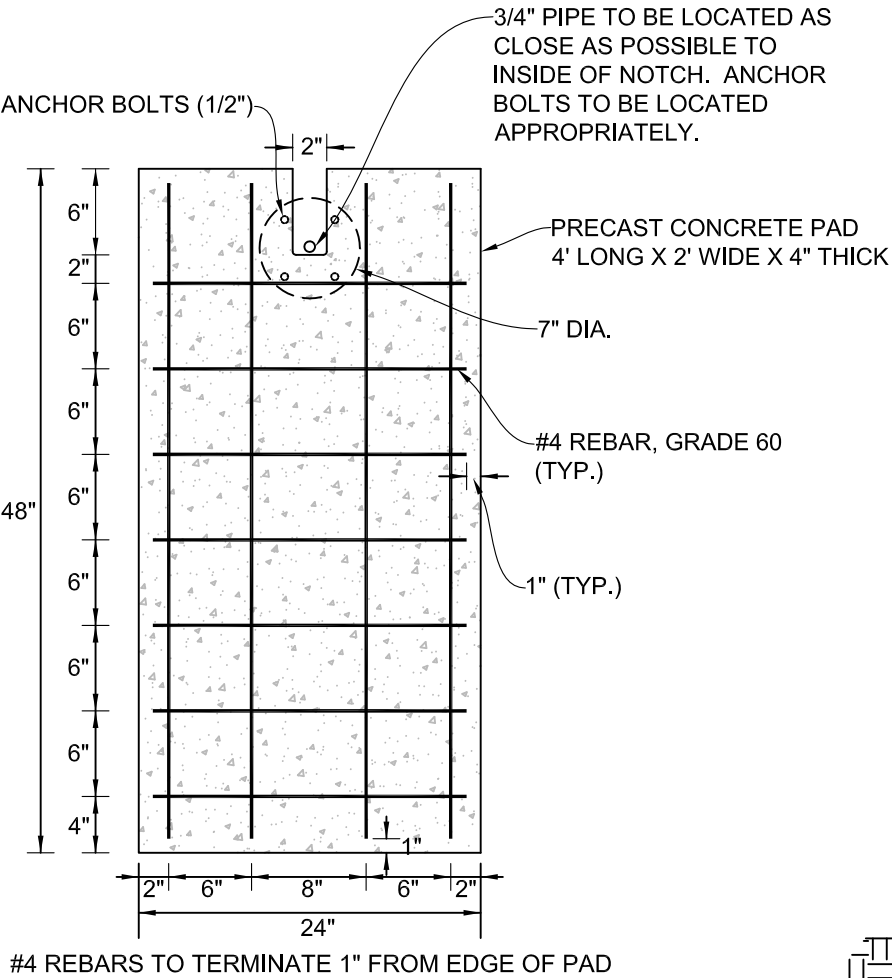
ERT TRANSMITTER SUPPORT BRACKET  
& ERT SELF-MOUNT ADAPTER

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



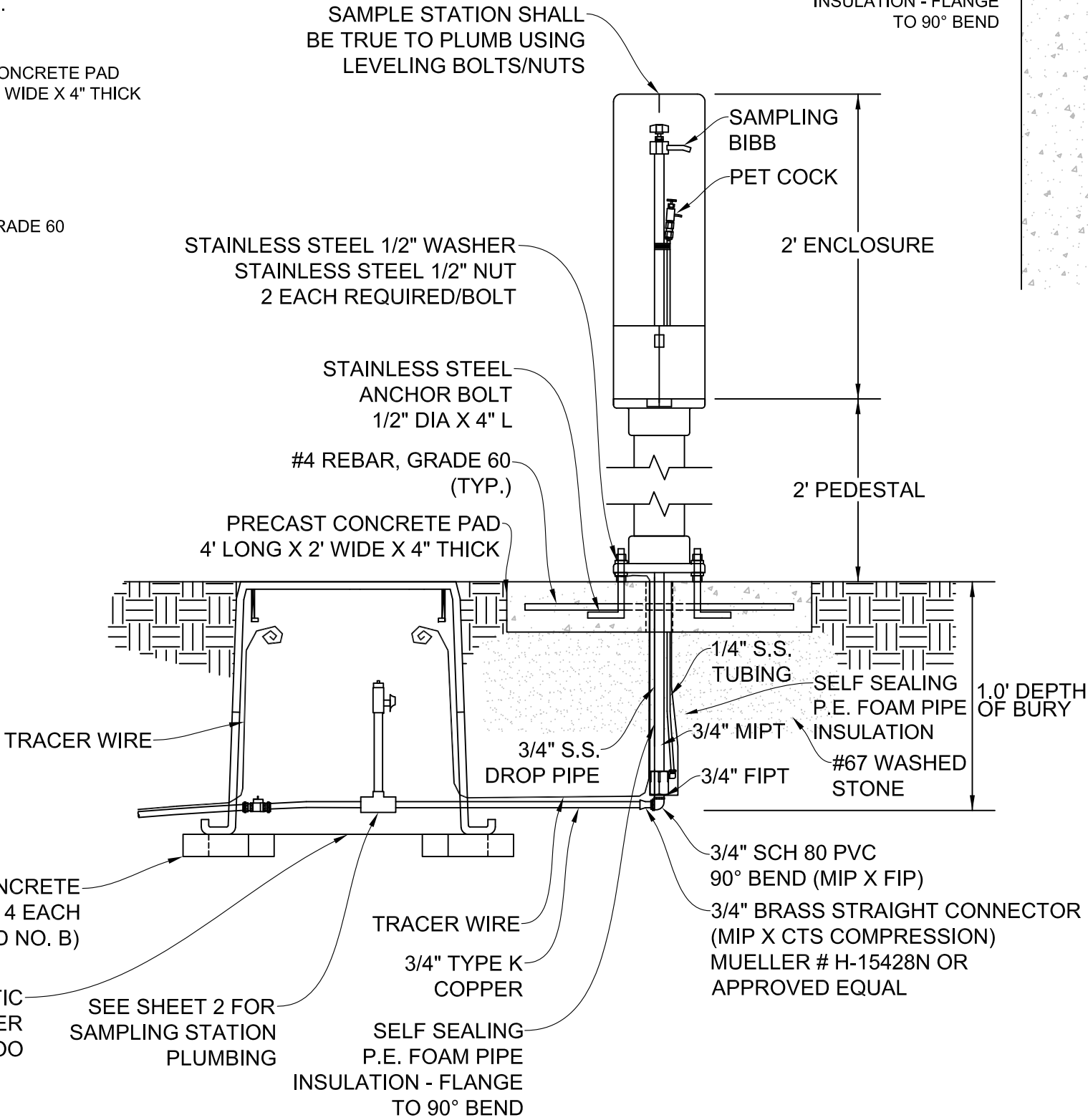
CONCRETE PAD WITH NOTCH

NOT TO SCALE



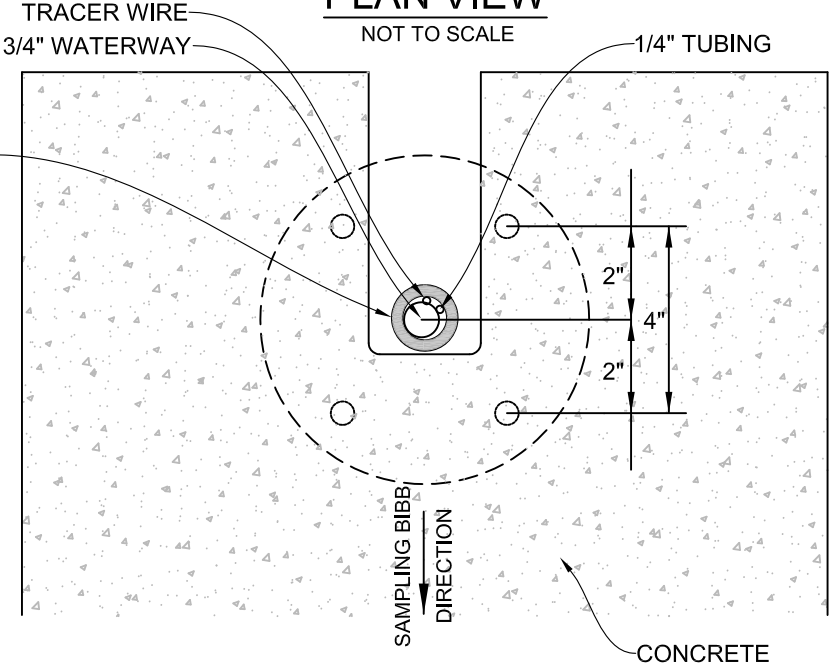
SECTION VIEW

NOT TO SCALE



PLAN VIEW

NOT TO SCALE



NOTES:

1. IN CORROSIVE SOILS, THE BURIED PIPE SHOULD BE PREPARED FOR ADDITIONAL RESISTANCE TO CORROSION. SPRAY ALL UNDERGROUND PIPING AND FITTINGS WITH BITUMINOUS SPRAY TAR, ALLOWING PROPER TIME TO DRY, AND THEN WRAPPING THE PARTS.
2. SAMPLING STATION SHALL BE 1.0' BURY, INSTALLED ON CONCRETE PAD WITH A 3/4" FIPT INLET, AND 7/16" UNTHREADED BLOW OFF AND 1/4" SAMPLING BIBB.
3. STATION SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE ALUMINUM BOX WITH HINGED OPENINGS.
4. WHEN OPEN, THE STATION SHALL REQUIRE NO KEY FOR OPERATION, AND ALL WATER FLOW SHALL PASS THRU AN ALL STAINLESS STEEL WATERWAY.
5. ALL WORKING PARTS SHALL BE OF STAINLESS STEEL AND SERVICEABLE FROM ABOVE GROUND WITH NO DIGGING OR REPLACEMENT NEEDED.
6. A STAINLESS STEEL PETCOCK VALVE WILL BE LOCATED BELOW THE SAMPLING BIBB TO ALLOW PUMPING OF ANY WATER REMAINING INSIDE THE STATION TO ENSURE NON-FREEZING.
7. CONCRETE PAD SHALL DRAIN AWAY FROM SAMPLE STATION AND SHALL BE FLUSH WITH FINISHED GRADE #67 STONE BASE TO A DEPTH OF 8" UNDER PAD.
8. THE STATION SHALL BE MODEL #88-SS WITH 2' STEEL PEDESTAL AND EPOXY COATING WITHIN BOX FOR CORROSION PROTECTION AS MANUFACTURED BY THE KUPFERLE FOUNDRY, OR APPROVED EQUAL.
9. ANCHOR BOLTS - 304 STAINLESS STEEL, WITH NUTS AND WASHERS - 316 STAINLESS STEEL.
10. AWG #12 GAUGE SOLID COPPER TRACER WIRE-WITH 30 MILS BLUE HDPE INSULATION-TERMINATE IN METER BOX WITH 24" EXCESS WIRE (COILED), AND TERMINATE AT ANCHOR BOLT.

\*TAP SHALL ONLY BE CONNECTED DIRECTLY TO A CHARLOTTE WATER PUBLIC MAIN AND MAY NOT BE CONNECTED TO WATER SERVICE PIPING, FIRE HYDRANT FEEDER LEG, AIR RELEASE OR BLOW-OFF PIPING.

STANDARD NO.

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VERSION NO.

1.1

VERSION DATE

8.21.2015

WATER QUALITY SAMPLING STATION (1 OF 2)

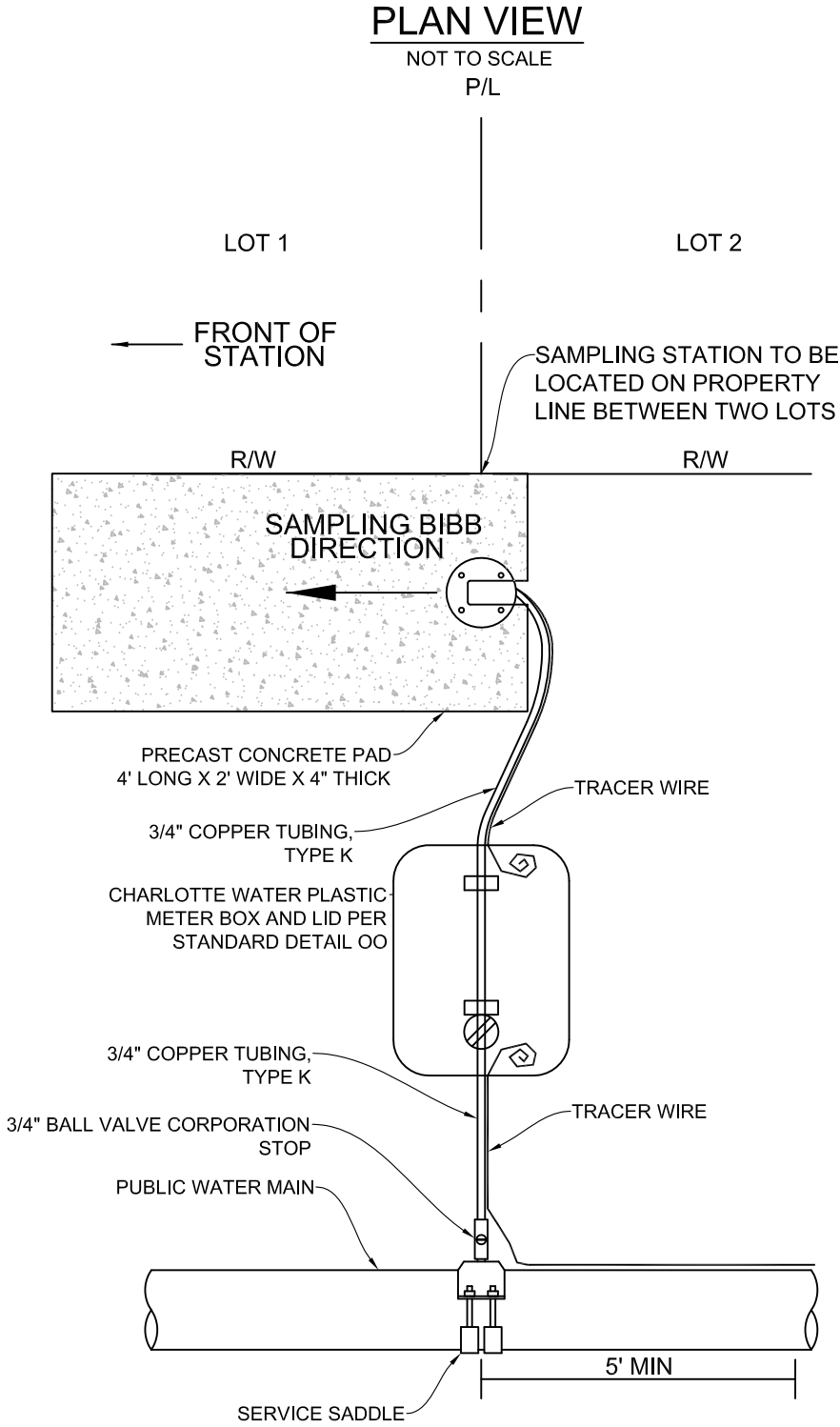
CHARLOTTE-MECKLENBURG UTILITIES

STANDARD DETAILS

WATER

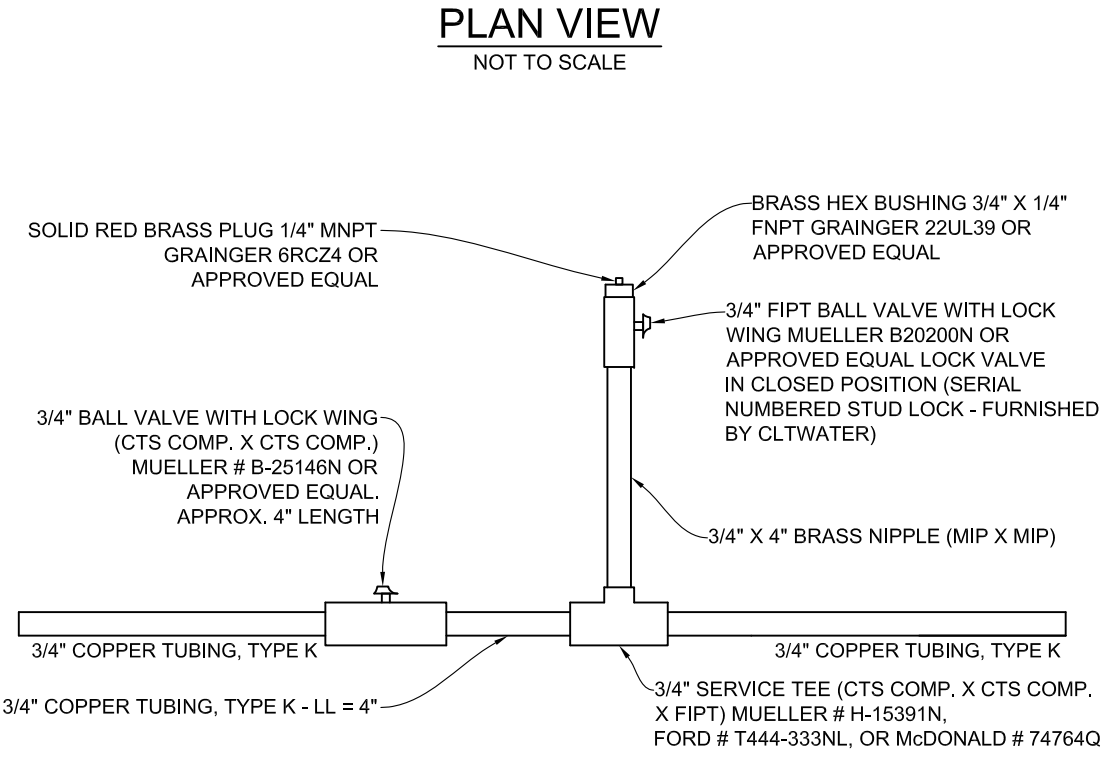
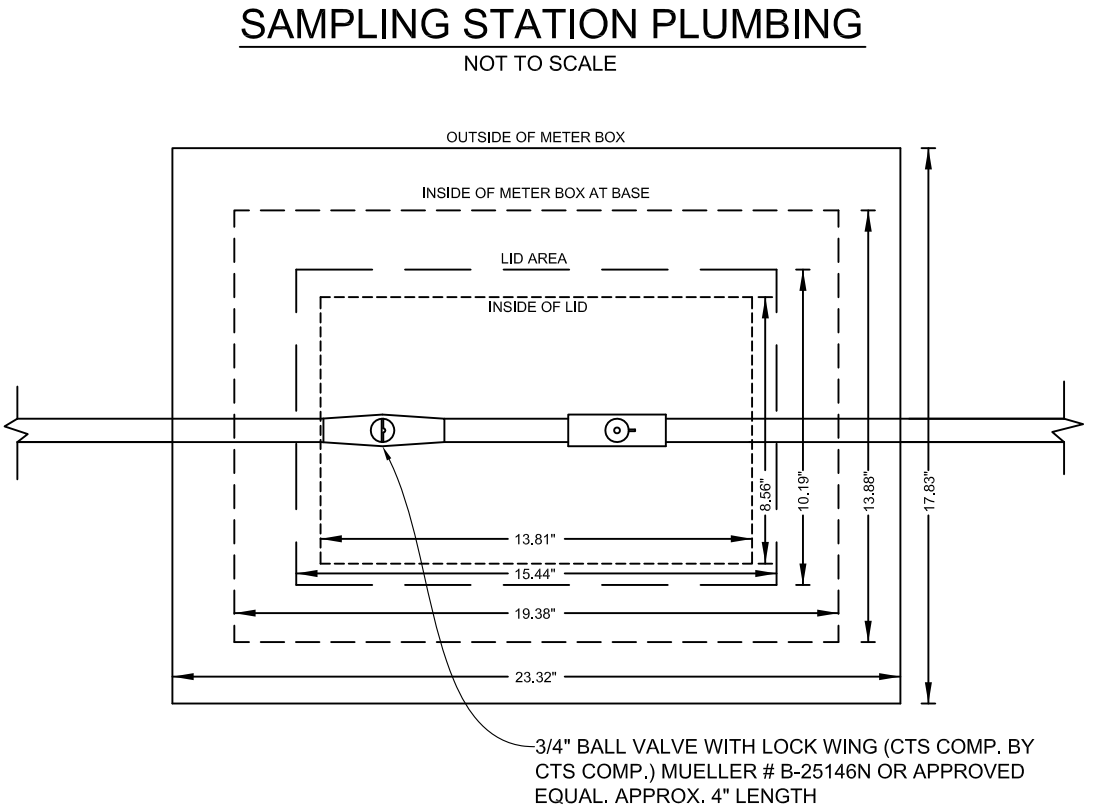


# WATER MAIN CONNECTIONS



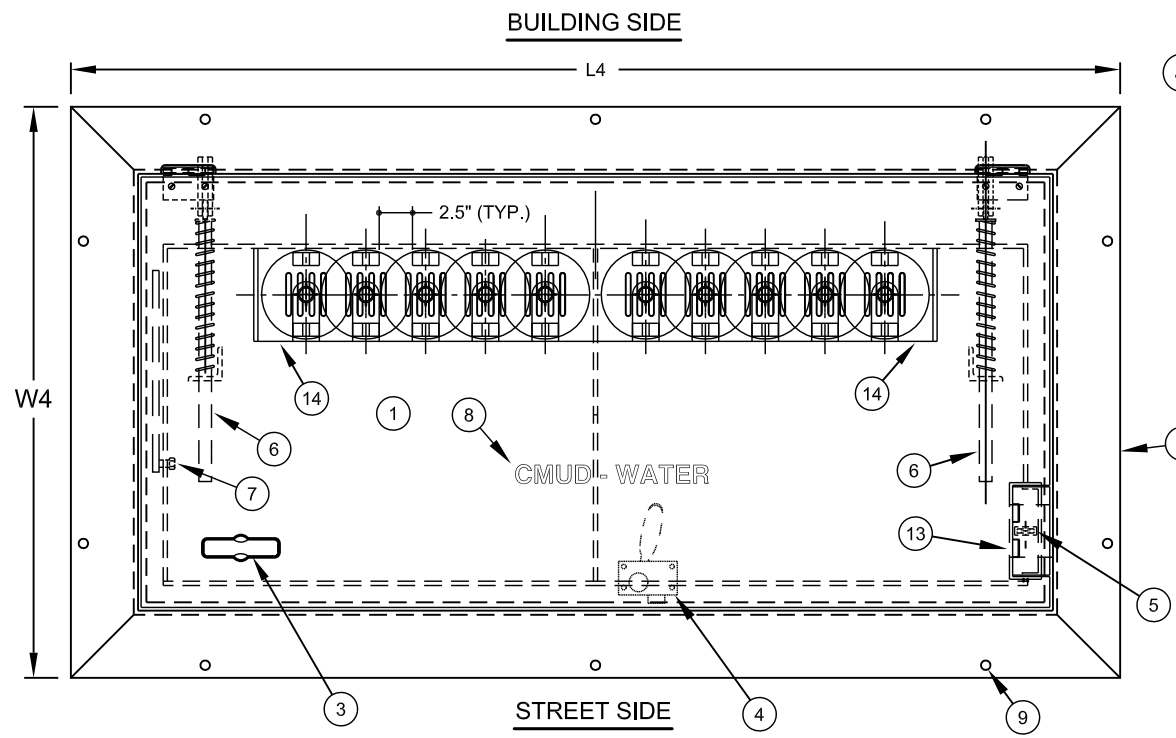
**PRIMARY**

\*TAP SHALL ONLY BE CONNECTED DIRECTLY TO A CHARLOTTE WATER PUBLIC MAIN AND MAY NOT BE CONNECTED TO WATER SERVICE PIPING, FIRE HYDRANT FEEDER LEG, AIR RELEASE OR BLOW-OFF PIPING.

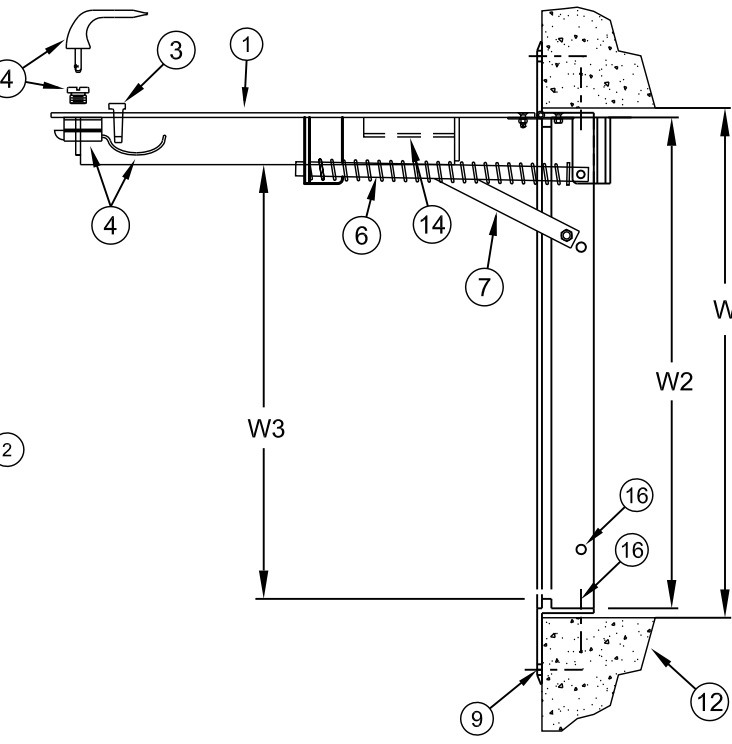


**ELEVATION VIEW**

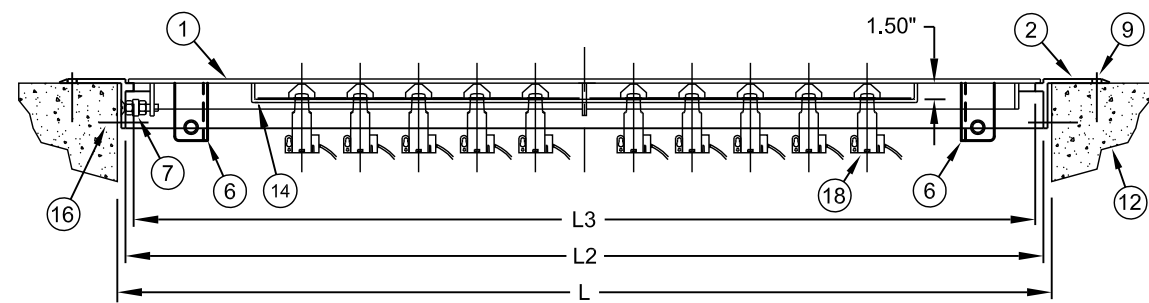
NOT TO SCALE



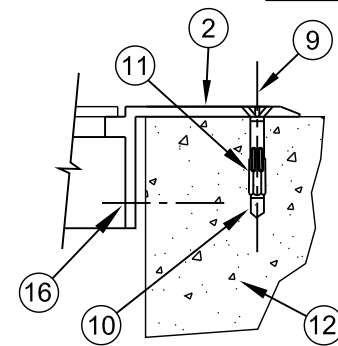
PLAN VIEW



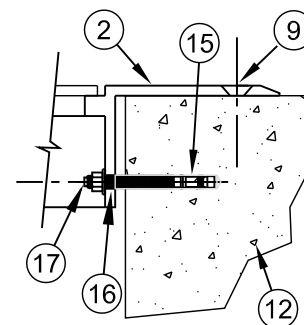
SECTION VIEW SIDE



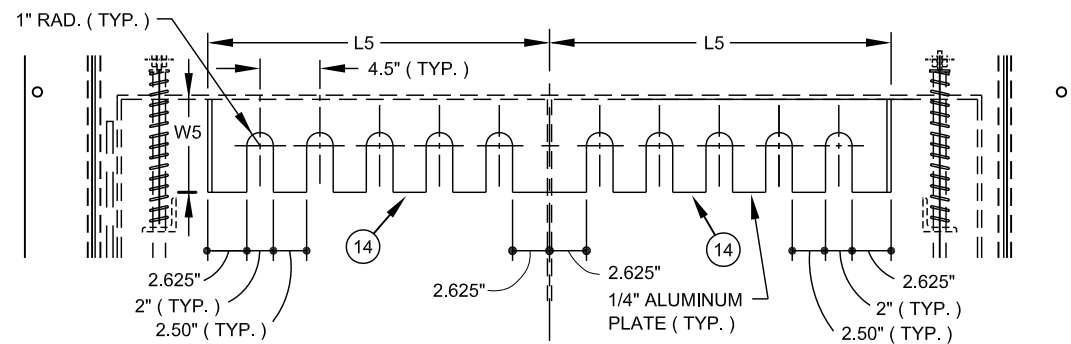
SECTION VIEW FRONT



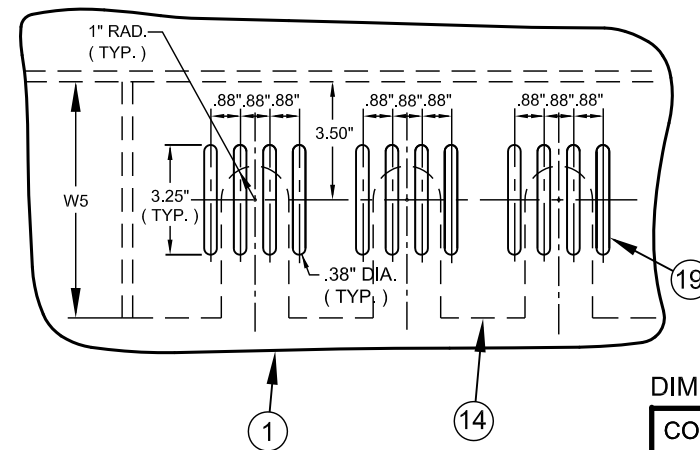
ANCHOR DETAIL  
OPTION 1



ANCHOR DETAIL  
OPTION 2



ERT TRANSMITTER SUPPORT BRACKET



ERT TRANSMITTER SLOT DETAIL

NO. DESCRIPTION

1. SINGLE DOOR LEAF - REINFORCED.
2. ANGLE DOOR FRAME.
3. FLUSH DROP HANDLE.
4. SLAM LOCK/THREADED PLUG / REMOVABLE KEY / INSIDE HANDLE.
5. RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAINLESS STEEL STAPLE / SPRING LOADED HINGED LID.
6. OPEN COMPRESSION SPRING ASSEMBLY ( # AS REQUIRED ) - HORIZONTALLY MOUNTED.
7. AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.
8. 2 - INCH LETTERING MILLED INTO DOOR LEAF.
9. 7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) ( # AS REQUIRED )
10. 3/8 - INCH DIA. DRILLED HOLE IN CONCRETE.
11. 3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL )
12. CONCRETE VAULT OR PEDESTRIAN SIDEWALK.
13. PADLOCK TO BE FURNISHED BY CMUD.
14. ERT TRANSMITTER SUPPORT BRACKETS.
15. 1/2 - INCH DIAMETER HOLE IN CONCRETE.
16. 9/16 - INCH - INCH DIAMETER DRILLED HOLE ( # AS REQUIRED )
17. 1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )
18. ERT TRANSMITTER.
19. ERT TRANSMITTER SLOT.

DESIGN REQUIREMENTS

- A. MATERIAL - ALUMINUM - ALLOY TYPE 3004 - H35, ASTM B209 AND B221, EXCEPT AS NOTED.
- B. LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 OF SPAN.
- C. DOOR LEAF - 1/4 - INCH THICK ALUMINUM DIAMOND PLATE.
- D. FINISH - SHOT BLAST DULL GRAY-SLIP RESISTANT MEETING ADA REQUIREMENTS.
- E. HINGE / LOCKNUTS / BOLTS - STAINLESS STEEL - TYPE 316.
- F. SLAM LOCK / HOLD OPEN ARM - STAINLESS STEEL - TYPE 316.
- G. COMPRESSION SPRING ASSEMBLY - STAINLESS STEEL - TYPE 302.
- H. FORCE REQUIRED TO OPEN LEAF ( W / SPRINGS ) SHALL BE MINUS 5 LBS MINIMUM AND 20 LBS MAXIMUM, AND 35 LBS MAXIMUM W/O SPRINGS.
- I. ACCESS DOOR SHALL BE MODEL APS 300 RETROFIT, AS MANUFACTURED BY U.S.F. FABRICATION, OR APPROVED EQUAL.

NOTE:

- A. FRAME SHALL BE FURNISHED ANCHOR HOLES NO. 9 AND NO. 16.
- B. CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 9 OR NO. 16 - AS APPROVED. ( OPTION ONE OR OPTION TWO )

WARNING NOTE:

THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.

DIMENSIONS ( INCHES )

CONC. CLEAR OPENING		FRAME OPENING		CLEAR OPENING		OVERALL FRAME SIZE		BASE WT. W/O OPTIONS	LIFT ASSIST SPRINGS	SLAM LOCK
L	W	L2	W2	L3	W3	L4	W4	POUNDS	REQ'D ?	REQ'D ?
72	36	71	35	70	31	79	43	126	YES	YES
60	36	59	35	58	31	67	43	107	YES	YES
48	36	47	35	46	31	55	43	91	NO	NO
36	36	35	35	34	31	43	43	72	NO	NO

DIMENSIONS ( INCHES )

VAULT		NUMBER OF METERS	METERS PER BRACKET	L5 BRACKET LENGTH	W5 BRACKET WIDTH	NUMBER OF SLOTS PER BRACKET
L	W					
72	36	10	5	25.25	7	20
60	36	8	4	20.75	7	16
48	36	6	3	16.25	7	12
36	36	4	2	11.75	7	8

NO SCALE

STANDARD NO. Y

VERSION NO. V1.1  
VERSION DATE 8.26.2010

ALUMINUM SINGLE LEAF ACCESS DOOR -  
PEDESTRIAN LOADING ( 300 # / SQ. FT. )  
FOR MANIFOLD METER VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS

WATER



NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH MAY VARY DUE TO BRAND - VERIFY LENGTH TO DETERMINE MINIMUM VAULT LENGTH.

D. VAULT SHALL BE SIZED AS NEEDED FOR PIPE (8.5'x4' MINIMUM) AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C657

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

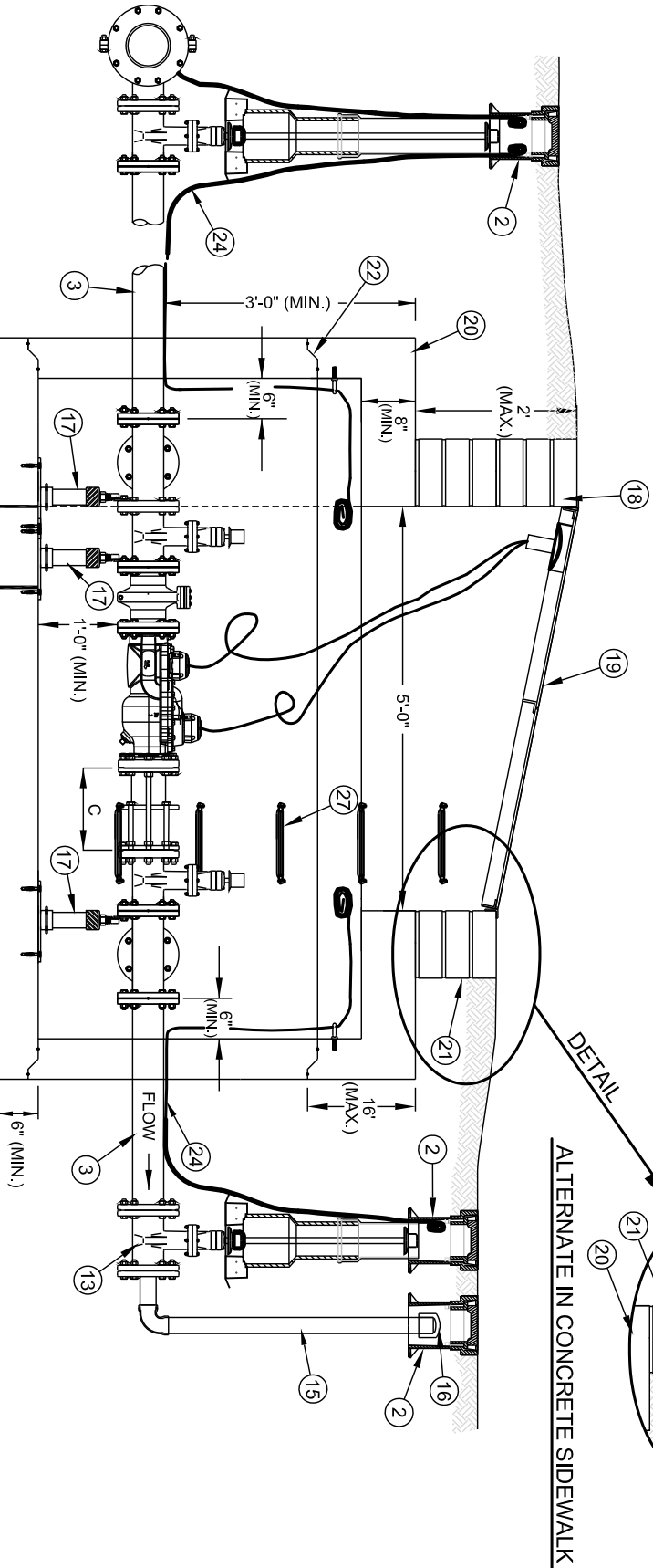
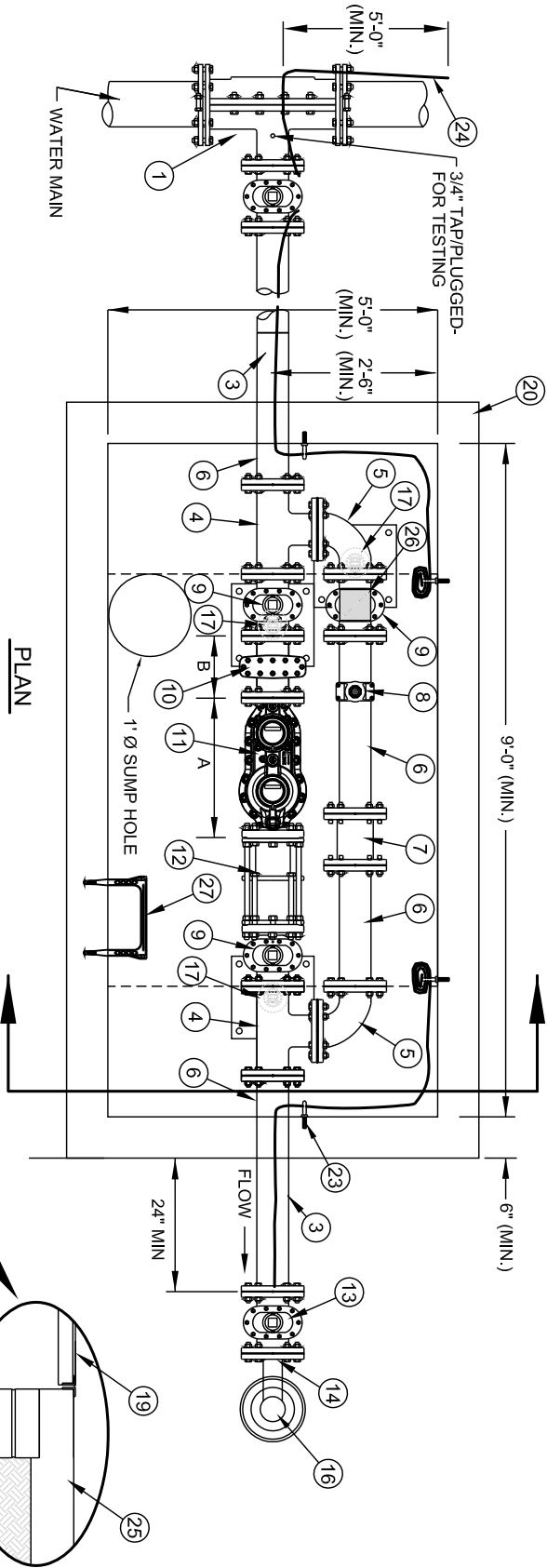
J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. 13



DIMENSION A & B VARY SLIGHTLY - AS DETERMINED BY MANUFACTURER			
METER SIZE	A	B	C
6"	24"	9"	ROMAC = 9" SMITH BLAIR = 10"

NO. DESCRIPTION

- 1 6" TAPPING SLEEVE AND 6" FLANGE x MJ TAPPING VALVE ON EXISTING MAIN. 6" MJ TEE AND 6" MJ GATE VALVE ON NEW MAIN.
- 2 STANDARD VALVE BOX ASSEMBLY (TYP.) - ALL VALVES
- 3 6" RESTRAINED JOINT DUCTILE IRON PIPE.
- 4 FLANGE DUCTILE IRON TEE WITH ADJUSTABLE FLANGE SUPPORT
- 5 FLANGE DUCTILE IRON 90°-BEND
- 6 FLANGE x PLAIN END DUCTILE IRON PIPE (MIN. SPECIAL CLASS 53)
- 7 MJ LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINTS
- 8 2" BALL CORPORATION STOP (THREADED OUTLET) WITH TAPPING SADDLE
- 9 FLANGE GATE VALVE, WITH 2" OPERATING NUT - OPEN RIGHT AND WITH ADJUSTABLE FLANGE SUPPORT ON BYPASS VALVE
- 10 FLANGE STRAINER
- 11 FLANGE COMPOUND METER ASSEMBLY W/AMR TRANSMITTERS. METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.
- 12 DISMANTLING JOINT (EXTENDED) - FL X FL - SMITH BLAIR #975 OR ROMAC #DJ400 WITH STAINLESS STEEL TIE RODS/HARDWARE
- 13 MECHANICAL JOINT (RJ) GATE VALVE-2" OPERATING NUT - OPEN LEFT @ PROPERTY LINE.
- 14 MECHANICAL JOINT PLUG WITH 2" TAP
- 15 2" PIPE GALVANIZED STEEL (SCH 80), RED BRASS (SCH 40), HDPE (DR 9) OR DIP WITH STANDARD VALVE BOX/CONCRETE PAD
- 16 2" THREADED COUPLING
- 17 ADJUSTABLE FLANGE SUPPORTS (3 REQUIRED)
- 18 AMR TRANSMITTERS
- 19 5' x 5' DOUBLE-LEAF ACCESS DOOR. SEE STANDARD DETAIL.
- 20 PRECAST REINFORCED CONCRETE VAULT
- 21 MINIMUM OF (3) SOLID CONCRETE CAP BLOCK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2FT.
- 22 JOINT REQUIRED AT FLAT TOP SECTION.
- 23 3/8" DIA. GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL
- 24 AWG #12 GAUGE SOLID COPPER TRACER WIRE - WITH BLUE INSULATION (30 MILS HDPE) - TERMINATE WITH 24" EXCESS WIRE (COILED) @ EYE BOLT AND VALVE BOX (TYPICAL).
- 25 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.
- 26 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED
- 27 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING

NO SCALE

STANDARD NO.

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VERSION NO.  
1.0

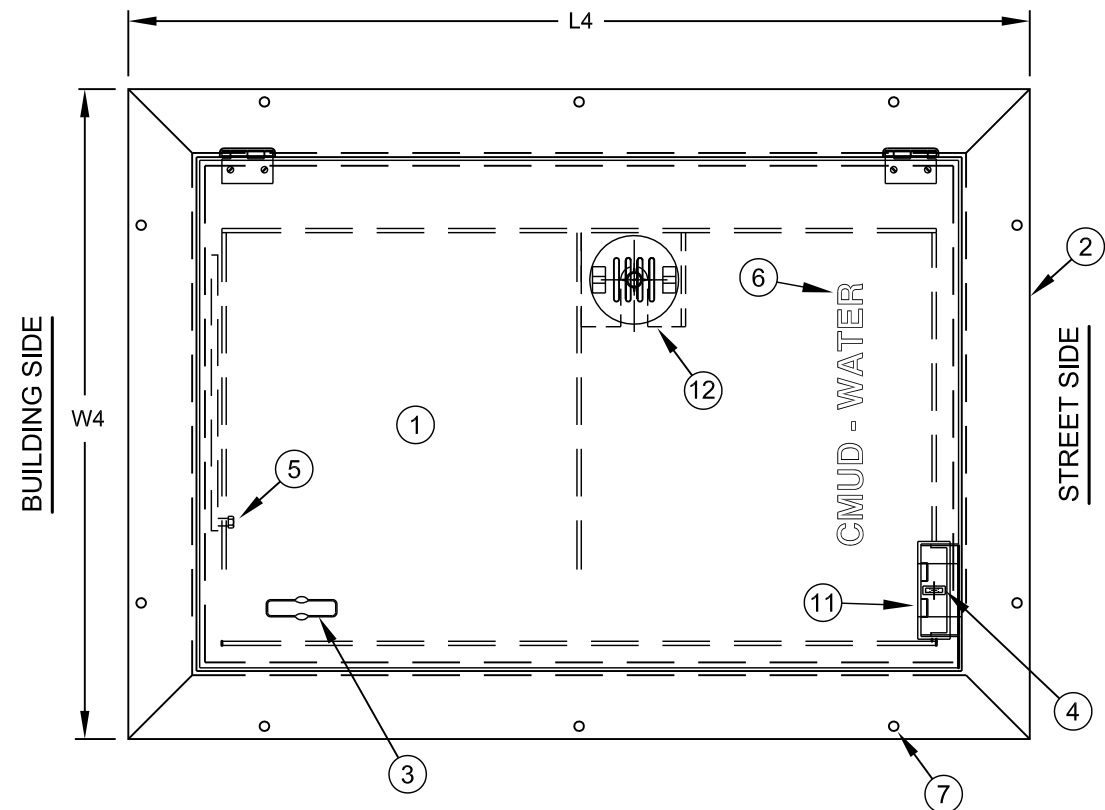
VERSION DATE  
03.02.2018

6 - inch COMPOUND WATER METER AND  
PRECAST CONCRETE VAULT

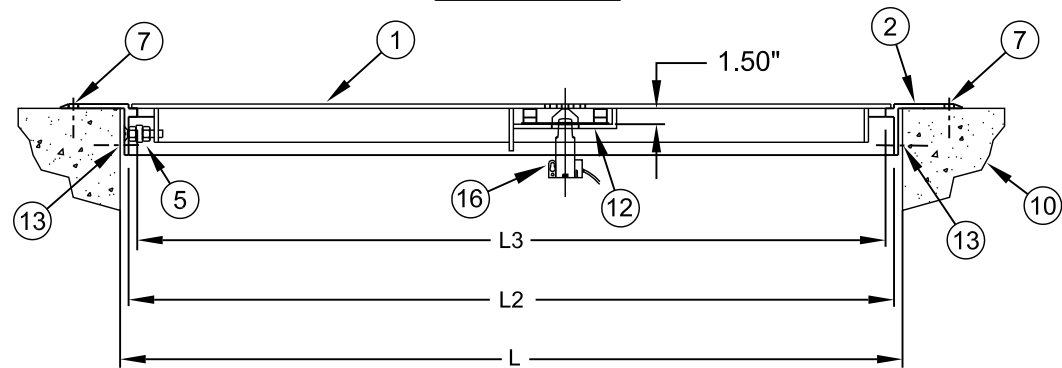
CHARLOTTE WATER  
STANDARD DETAILS  
WATER



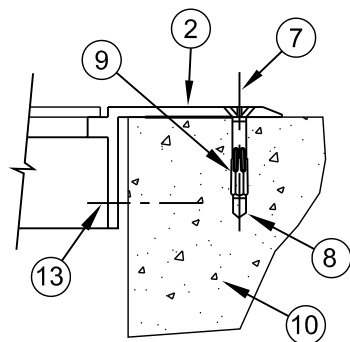




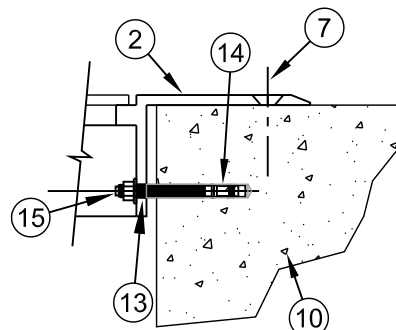
PLAN VIEW



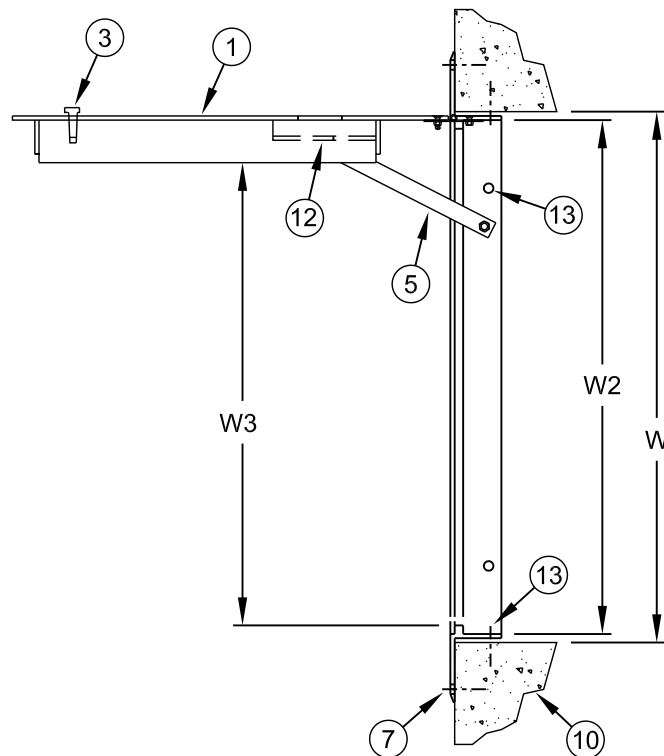
SECTION VIEW FRONT



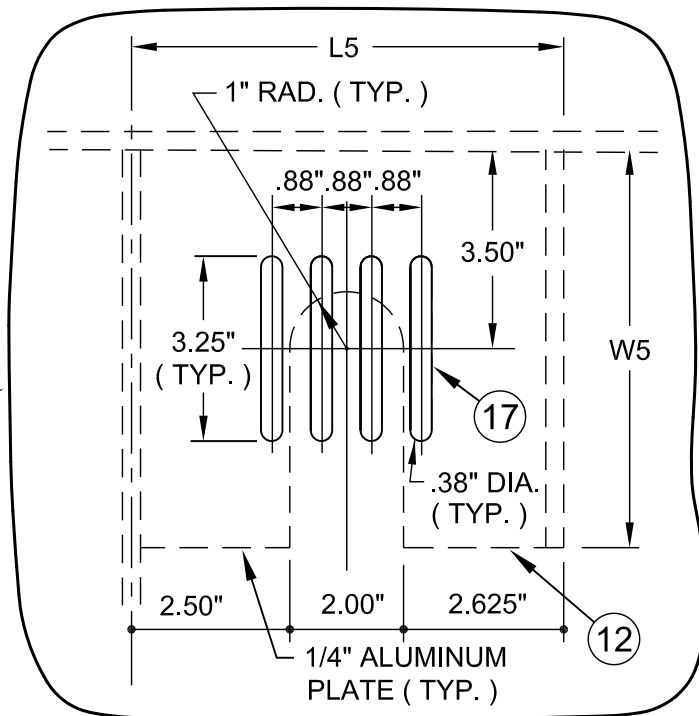
ANCHOR DETAIL  
OPTION 1



ANCHOR DETAIL  
OPTION 2



SECTION VIEW SIDE



ERT TRANSMITTER SLOT DETAIL  
& ERT TRANSMITTER SUPPORT

NO. DESCRIPTION

1. SINGLE DOOR LEAF - REINFORCED.
2. ANGLE DOOR FRAME.
3. FLUSH DROP HANDLE.
4. RECESSED PADLOCK ASSEMBLY ( STANDARD SIZE ) WITH STAINLESS STEEL STAPLE / SPRING LOADED HINGED LID.
5. AUTOMATIC HOLD OPEN ARM WITH VINYL GRIP.
6. 2 - INCH LETTERING MILLED INTO DOOR LEAF.
7. 7/16 - INCH DIA. DRILLED HOLE ( COUNTERSINK ) ( # AS REQUIRED )
8. 3/8 - INCH DIA. DRILLED HOLE - IN CONCRETE.
9. 3/8 - INCH DIA. x 2 - 7/8 INCH STAINLESS STEEL ANCHOR. ( REDHEAD DYNABOLT # SFS - 3826 OR HILTI HLC SLEEVE ANCHOR # HLC - FPH 3/8 - INCH x 2 - 7/8 INCH STAINLESS STEEL OR APPROVED EQUAL )
10. CONCRETE VAULT OR PEDESTRIAN SIDEWALK.
11. PADLOCK TO BE FURNISHED BY CMUD.
12. ERT TRANSMITTER SUPPORT BRACKET.
13. 9/16 - INCH DIAMETER DRILLED HOLE ( # AS REQUIRED )
14. 1/2 - INCH DIAMETER DRILLED HOLE IN CONCRETE.
15. 1/2 - INCH DIAMETER x 4 - 1/2 - INCH DRIVE-IN EXPANSION ANCHOR OR EPOXY ADHESIVE ANCHOR - ( RED HEAD, HILTI OR APPROVED EQUAL )
16. ERT TRANSMITTER.
17. ERT TRANSMITTER SLOT.

DESIGN REQUIREMENTS

- A. MATERIAL - ALUMINUM - ALLOY TYPE 3004 - H35, ASTM B209 AND B221, EXCEPT AS NOTED.
- B. LIVE LOAD - 300 LBS / SQ. FT. - PEDESTRIAN LOADING. MAXIMUM DEFLECTION 1/150 TH. OF SPAN.
- C. DOOR LEAF - 1/4 - INCH THICK ALUMINUM DIAMOND PLATE.
- D. FINISH - SHOT BLAST DULL GRAY-SLIP RESISTANT MEETING ADA REQUIREMENTS.
- E. HINGE / LOCKNUTS / BOLTS - STAINLESS STEEL - TYPE 316.
- F. HOLD OPEN ARM - STAINLESS STEEL - TYPE 316.
- G. FORCE REQUIRED TO OPEN LEAF SHALL BE 35 LBS. MAXIMUM, WITHOUT SPRING ASSIST.
- H. ACCESS DOOR SHALL BE MODEL APS 300 RETROFIT, AS MANUFACTURED BY U.S.F. FABRICATION, OR APPROVED EQUAL.

NOTE:

- A. FRAME SHALL BE FURNISHED WITH ANCHOR HOLES NO. 7 AND NO. 13.
- B. CONTRACTOR SHALL ANCHOR FRAME USING ANCHOR HOLES NO. 7 OR NO. 13 - AS APPROVED. ( OPTION ONE OR OPTION TWO )

WARNING NOTE:

THIS DOOR IS NOT TO BE USED IN OR ADJACENT TO DRIVEWAYS OR ANY AREA SUBJECT TO VEHICLE WHEEL LOADS, OR ANY LOAD GREATER THAN 300 PSF.

DIMENSIONS ( INCHES )

CONC. CLEAR OPENING		FRAME OPENING		CLEAR OPENING		OVERALL FRAME SIZE		BRACKET LENGTH	BRACKET WIDTH	BASE WT. W/O OPTIONS
L	W	L2	W2	L3	W3	L4	W4	L5	W5	POUNDS
36	24	35	23	34	20	43	31	7.125	7	54

NO SCALE

STANDARD NO.

Z

VERSION NO.

V1.1

VERSION DATE

5.17.2011

ALUMINUM SINGLE LEAF ACCESS DOOR -  
PEDESTRIAN LOADING ( 300 # / SQ. FT. )  
FOR 1 1/2 & 2 - INCH WATER METER VAULT

CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS  
WATER



NOTES:

- A. ALL FLANGE HARDWARE (BOLT/WASHER/NUT) SHALL BE STAINLESS STEEL - TYPE 304 WITH ANTI-SEIZE COMPOUND.

B. ALL PIPE SHALL BE RESTRAINED JOINT DUCTILE IRON FROM TAP TO PROPERTY LINE VALVE.

C. METER CONFIGURATION AND LENGTH MAY VARY DUE TO BRAND - VERIFY LENGTH TO DETERMINE MINIMUM VAULT LENGTH.

D. VAULT SHALL BE SIZED AS NEEDED FOR PIPE (8.0' x 4' MINIMUM) AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.

E. ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.

F. DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
- G. STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857

H. REBARS SHALL BE GRADE 60 PER ASTM A615

I. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185

J. DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS

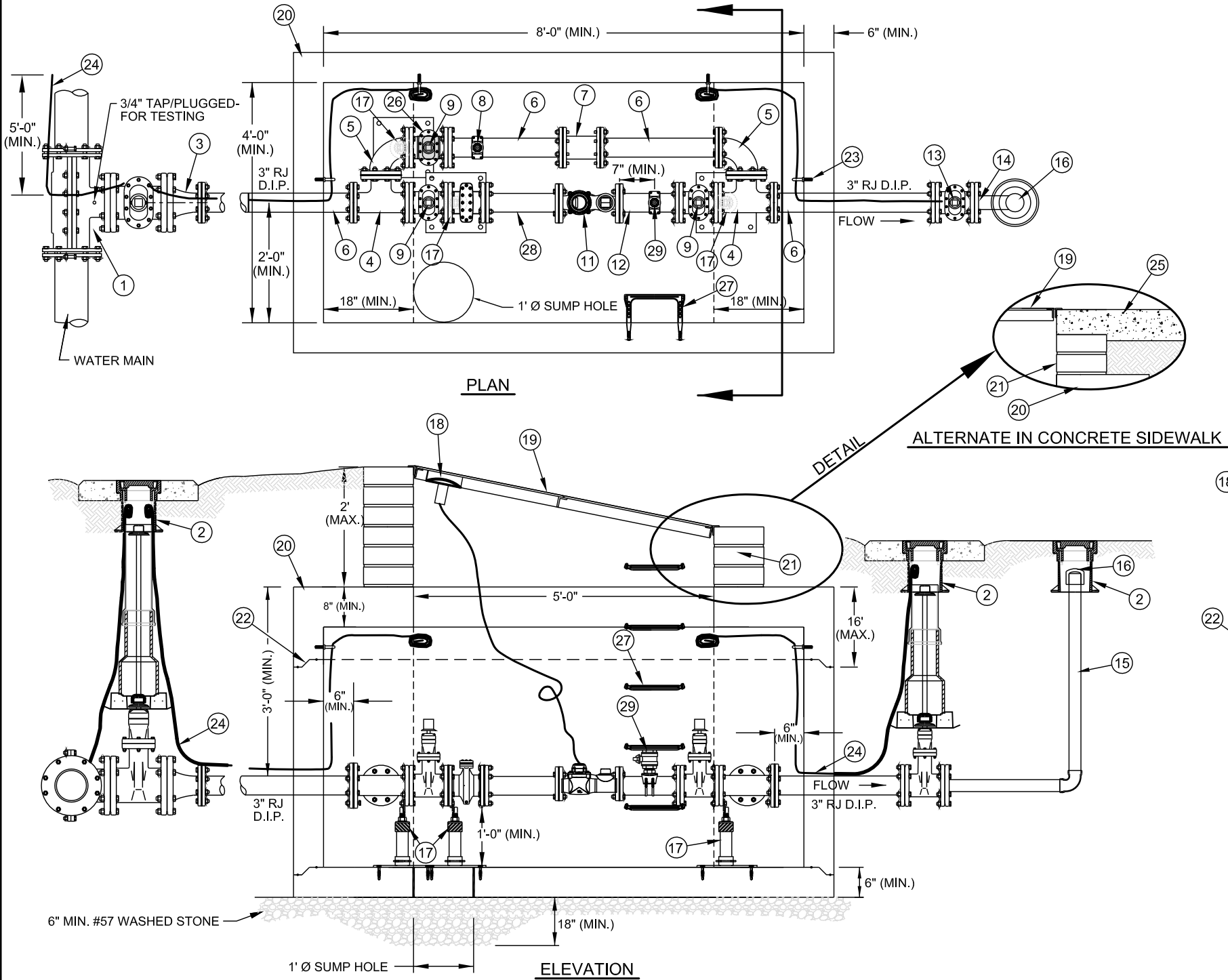
K. PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)

L. FRAME TO BE FLUSH WITH GROUND OR CONCRETE SIDEWALK, GROUND SHALL SLOPE AWAY FROM VAULT.

M. ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC.

N. ALL VALVES SHALL BE OPEN RIGHT - CLOCKWISE, EXCEPT NO. ⑬

O. SERVICE AND VAULT MAY BE ROTATED 90° WHEN NEEDED, DUE TO LIMITED SITE / SPACE RESTRICTIONS.



NO. DESCRIPTION

- 1 4" TAPPING SLEEVE AND 4" FLANGE x MJ TAPPING VALVE ON EXISTING MAIN. 3" MJ TEE AND 3" MJ GATE VALVE ON NEW MAIN.

2 STANDARD VALVE BOX ASSEMBLY (TYP.) - ALL VALVES

3 4" x 3" REDUCER (RJ) REQUIRED ON EXISTING MAIN INSTALLATIONS. (REDUCER NOT REQUIRED ON NEW MAIN INSTALLATIONS)

4 FLANGE DUCTILE IRON TEE WITH ADJUSTABLE FLANGE SUPPORT

5 FLANGE DUCTILE IRON 90°-BEND

6 FLANGE x PLAIN END DUCTILE IRON PIPE (MIN. SPECIAL CLASS 53)

7 MJ LONG PATTERN SOLID SLEEVE WITH RESTRAINED JOINTS

8 3/4" BALL CORPORATION STOP WITH TAPPING SADDLE

9 FLANGE GATE VALVE; WITH 2" OPERATING NUT - OPEN RIGHT AND WITH ADJUSTABLE FLANGE SUPPORT ON BYPASS VALVE

10 FLANGE STRAINER

11 FLANGE TURBINE METER ASSEMBLY W/AMR TRANSMITTERS. METER CONFIGURATION MAY VARY DUE TO BRAND SUPPLIED.

12 DUCTILE IRON PIPE SPOOL (FL x FL) - L = 12" (MIN SPECIAL CL 53)

13 MECHANICAL JOINT (RJ) GATE VALVE-2" OPERATING NUT - OPEN LEFT @ PROPERTY LINE.

14 MECHANICAL JOINT PLUG WITH 2" TAP

15 2" PIPE GALVANIZED STEEL (SCH 80), HDPE (DR 9) WITH STANDARD VALVE BOX/CONCRETE PAD

16 2" THREADED COUPLING (SCH 80 - G.S.F.)

17 ADJUSTABLE FLANGE SUPPORTS (3 REQUIRED)

18 AMR TRANSMITTERS

19 4' x 5' DOUBLE-LEAF ACCESS DOOR. SEE STANDARD DETAIL.

20 PRECAST REINFORCED CONCRETE VAULT - 8.0 FT x 4 FT x 4 FT (MIN)

21 MINIMUM OF (3) STANDARD SOLID CONCRETE BRICK COURSES UNDER ACCESS DOOR FRAME, MAXIMUM 2FT.

22 JOINT REQUIRED AT FLAT TOP SECTION.

23 3/8" DIA. GALV. STEEL EYE BOLT (ADHESIVE ANCHOR) - TYPICAL

24 AWG #12 GAUGE SOLID COPPER TRACER WIRE - WITH BLUE INSULATION (30 MLLS-HDPE) - TERMINATE WITH 24" EXCESS WIRE (COILED) @ EYE BOLT AND VALVE BOX (TYPICAL).

25 CAST IN PLACE CONCRETE SIDEWALK - BRICKWORK SHALL NOT EXTEND TO SURFACE. ACCESS DOOR FRAME SHALL REST ON SIDEWALK.

26 VALVE LOCK (FURNISHED BY CMUD) - LOCK VALVE CLOSED

27 PLASTIC STEP - 12" OR 16" O.C. VERTICAL SPACING

28 DUCTILE IRON PIPE SPOOL (FL x FL) - L = 15" (MIN SPECIAL CL 53)

29 2" BALL CORPORATION STOP (TAPPER THREAD x FNPT) WITH TAP. SADDLE.

- NOTES:
- CUSTOMER / APPLICANT MUST PROVIDE JUSTIFICATION WHEN REQUESTING A TURBINE WATER METER. PRIOR APPROVAL IS REQUIRED FROM THE CUSTOMER SERVICE MANAGER FOR ALL TURBINE METERS. OTHERWISE, A COMPOUND METER IS REQUIRED.

NO SCALE

STANDARD NO.

ZZ

VERSION DATE

11.14.2011

VERSION NO.

1.0

3 - inch TURBINE WATER METER AND  
PRECAST CONCRETE VAULT

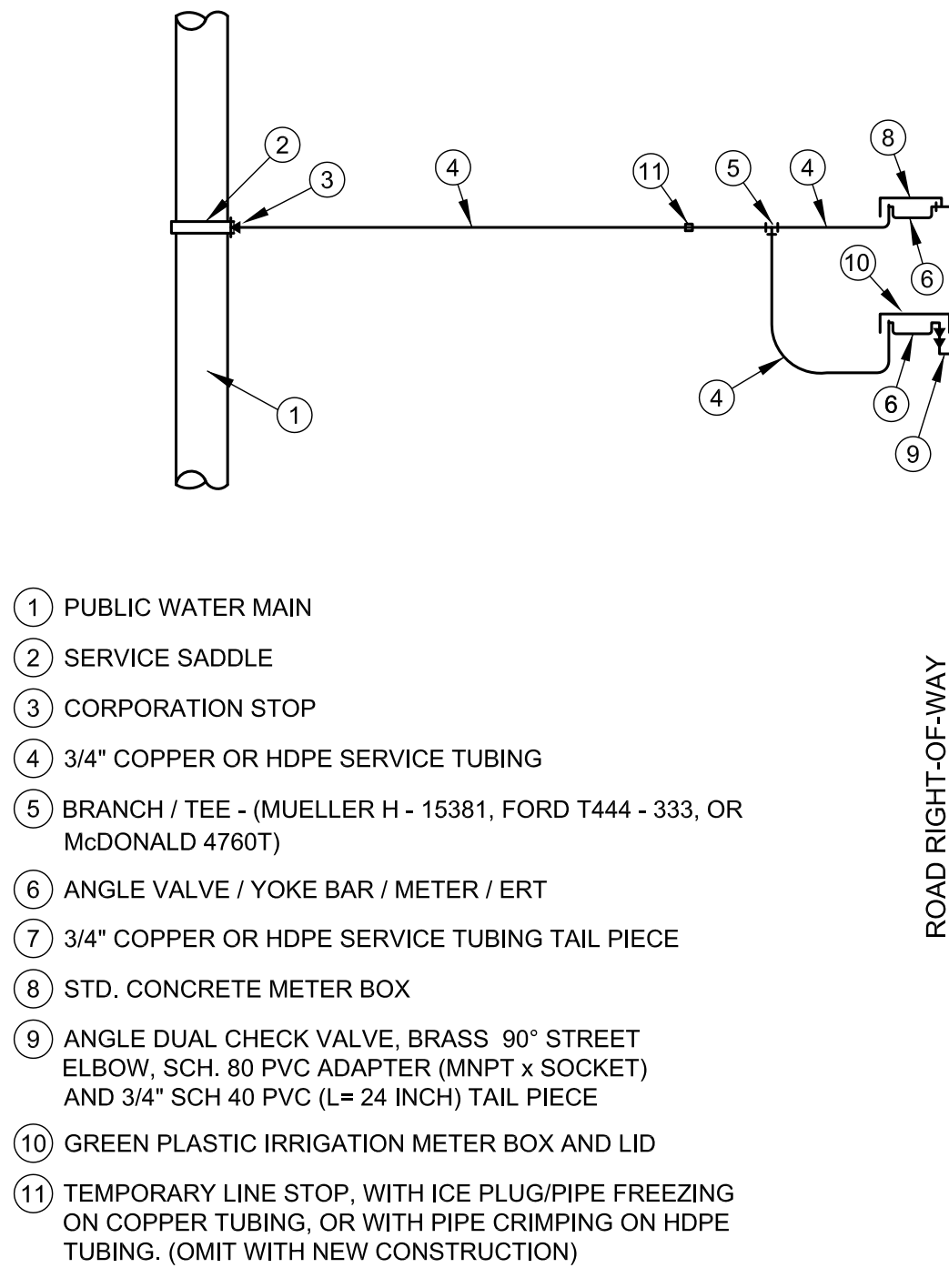
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

WATER







- ① PUBLIC WATER MAIN
- ② SERVICE SADDLE
- ③ CORPORATION STOP
- ④ 3/4" COPPER OR HDPE SERVICE TUBING
- ⑤ BRANCH / TEE - (MUELLER H - 15381, FORD T444 - 333, OR McDONALD 4760T)
- ⑥ ANGLE VALVE / YOKE BAR / METER / ERT
- ⑦ 3/4" COPPER OR HDPE SERVICE TUBING TAIL PIECE
- ⑧ STD. CONCRETE METER BOX
- ⑨ ANGLE DUAL CHECK VALVE, BRASS 90° STREET ELBOW, SCH. 80 PVC ADAPTER (MNPT x SOCKET) AND 3/4" SCH 40 PVC (L= 24 INCH) TAIL PIECE
- ⑩ GREEN PLASTIC IRRIGATION METER BOX AND LID
- ⑪ TEMPORARY LINE STOP, WITH ICE PLUG/PIPE FREEZING ON COPPER TUBING, OR WITH PIPE CRIMPING ON HDPE TUBING. (OMIT WITH NEW CONSTRUCTION)
- ⑫ REDUCED PRESSURE PRINCIPAL BACKFLOW ASSEMBLY (BY OTHERS)
- ⑬ IRRIGATION CONTROL SYSTEM (BY OTHERS)
- ⑭ IRRIGATION PIPE SYSTEM (BY OTHERS)
- ⑮ IRRIGATION SPRINKLER HEAD (BY OTHERS)
- ⑯ BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER ⑩ AND BACKFLOW ASSEMBLY ⑫

#### NOTES:

1. METER LOCATION AND RELATIONSHIP TO ROAD RIGHT-OF-WAY, CURB, SIDEWALK AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CMUD STANDARDS.
2. CMUD MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST BRASS FITTING.
3. DOMESTIC SERVICE SHALL BE ON THE RUN OF THE TEE, AND IRRIGATION SERVICE SHALL BE ON THE BRANCH OF THE TEE, AS SHOWN.
4. METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 2 FT. MIN. AND 5 FT. MAX. CLEARANCE.
5. SOLVENT WELDS ON PVC PIPE / FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.
6. SERVICES SHALL BE ALL COPPER OR HDPE SERVICE TUBING. DO NOT MIX SERVICE TUBING MATERIALS.

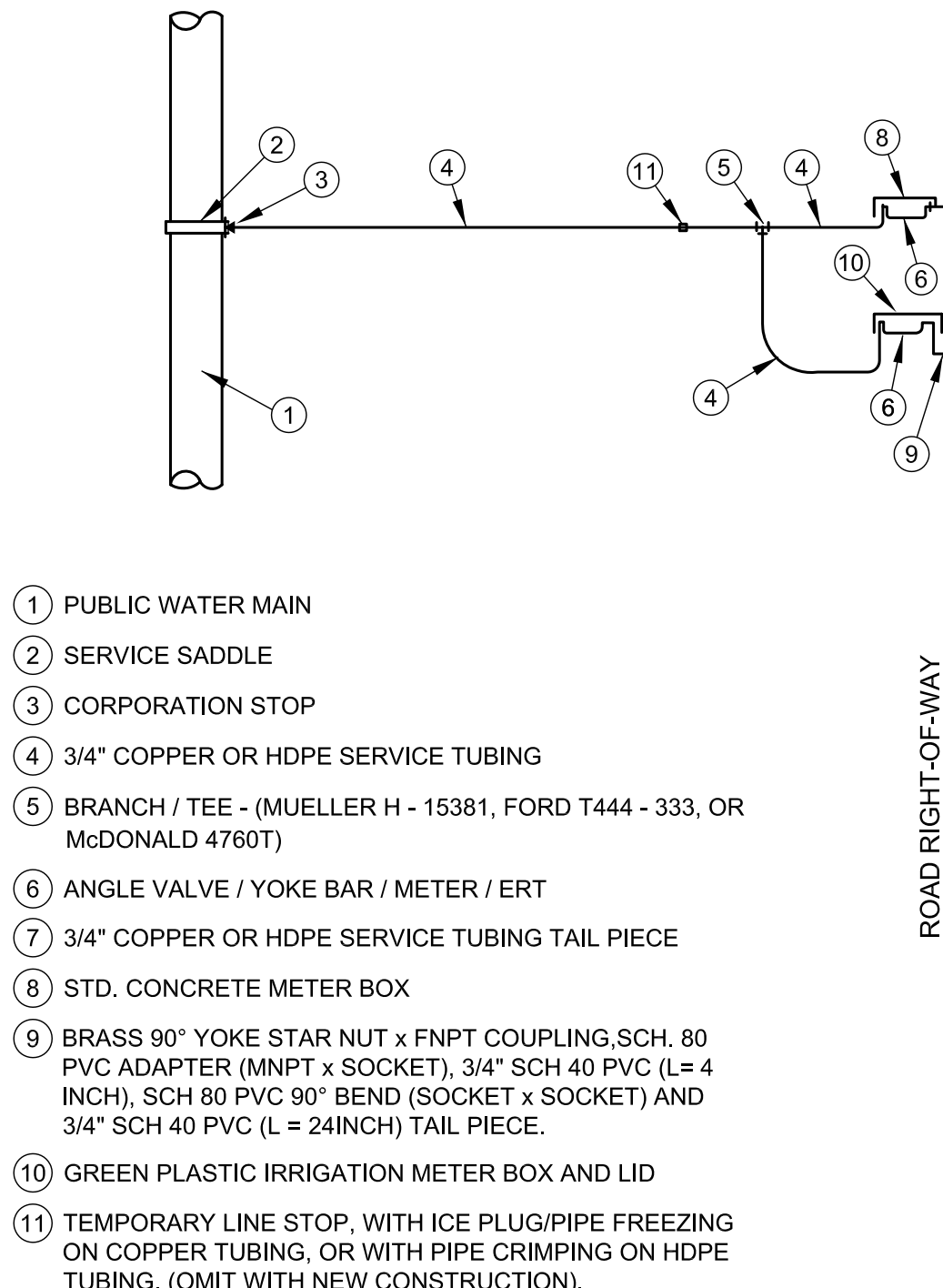
NO SCALE

STANDARD NO.	1
VERSION NO.	V2.2
VERSION DATE	7.21.2009

3/4-INCH DOMESTIC WATER SERVICE WITH SPLIT  
3/4-INCH IRRIGATION SERVICE  
DUAL CHECK AT METER / BACKFLOW AT HOUSE

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER





- ① PUBLIC WATER MAIN
- ② SERVICE SADDLE
- ③ CORPORATION STOP
- ④ 3/4" COPPER OR HDPE SERVICE TUBING
- ⑤ BRANCH / TEE - (MUELLER H - 15381, FORD T444 - 333, OR McDONALD 4760T)
- ⑥ ANGLE VALVE / YOKE BAR / METER / ERT
- ⑦ 3/4" COPPER OR HDPE SERVICE TUBING TAIL PIECE
- ⑧ STD. CONCRETE METER BOX
- ⑨ BRASS 90° YOKE STAR NUT x FNPT COUPLING, SCH. 80 PVC ADAPTER (MNPT x SOCKET), 3/4" SCH 40 PVC (L= 4 INCH), SCH 80 PVC 90° BEND (SOCKET x SOCKET) AND 3/4" SCH 40 PVC (L = 24INCH) TAIL PIECE.
- ⑩ GREEN PLASTIC IRRIGATION METER BOX AND LID
- ⑪ TEMPORARY LINE STOP, WITH ICE PLUG/PIPE FREEZING ON COPPER TUBING, OR WITH PIPE CRIMPING ON HDPE TUBING. (OMIT WITH NEW CONSTRUCTION).
- ⑫ REDUCED PRESSURE PRINCIPAL BACKFLOW ASSEMBLY (BY OTHERS)
- ⑬ IRRIGATION CONTROL SYSTEM (BY OTHERS)
- ⑭ IRRIGATION PIPE SYSTEM (BY OTHERS)
- ⑮ IRRIGATION SPRINKLER HEAD (BY OTHERS)
- ⑯ BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER ⑩ AND BACKFLOW ASSEMBLY ⑫

#### NOTES:

- 1. METER LOCATION AND RELATIONSHIP TO ROAD RIGHT-OF-WAY, CURB, SIDEWALK AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CMUD STANDARDS.
- 2. CMUD MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST BRASS FITTING.
- 3. DOMESTIC SERVICE SHALL BE ON THE RUN OF THE TEE, AND IRRIGATION SERVICE SHALL BE ON THE BRANCH OF THE TEE, AS SHOWN.
- 4. METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 2 FT. MIN. AND 5 FT. MAX. CLEARANCE.
- 5. SOLVENT WELDS ON PVC PIPE / FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.
- 6. SERVICES SHALL BE ALL COPPER OR HDPE SERVICE TUBING. DO NOT MIX SERVICE TUBING MATERIALS.

NO SCALE

STANDARD NO.	2
VERSION NO.	V2.2
VERSION DATE	7.21.2009

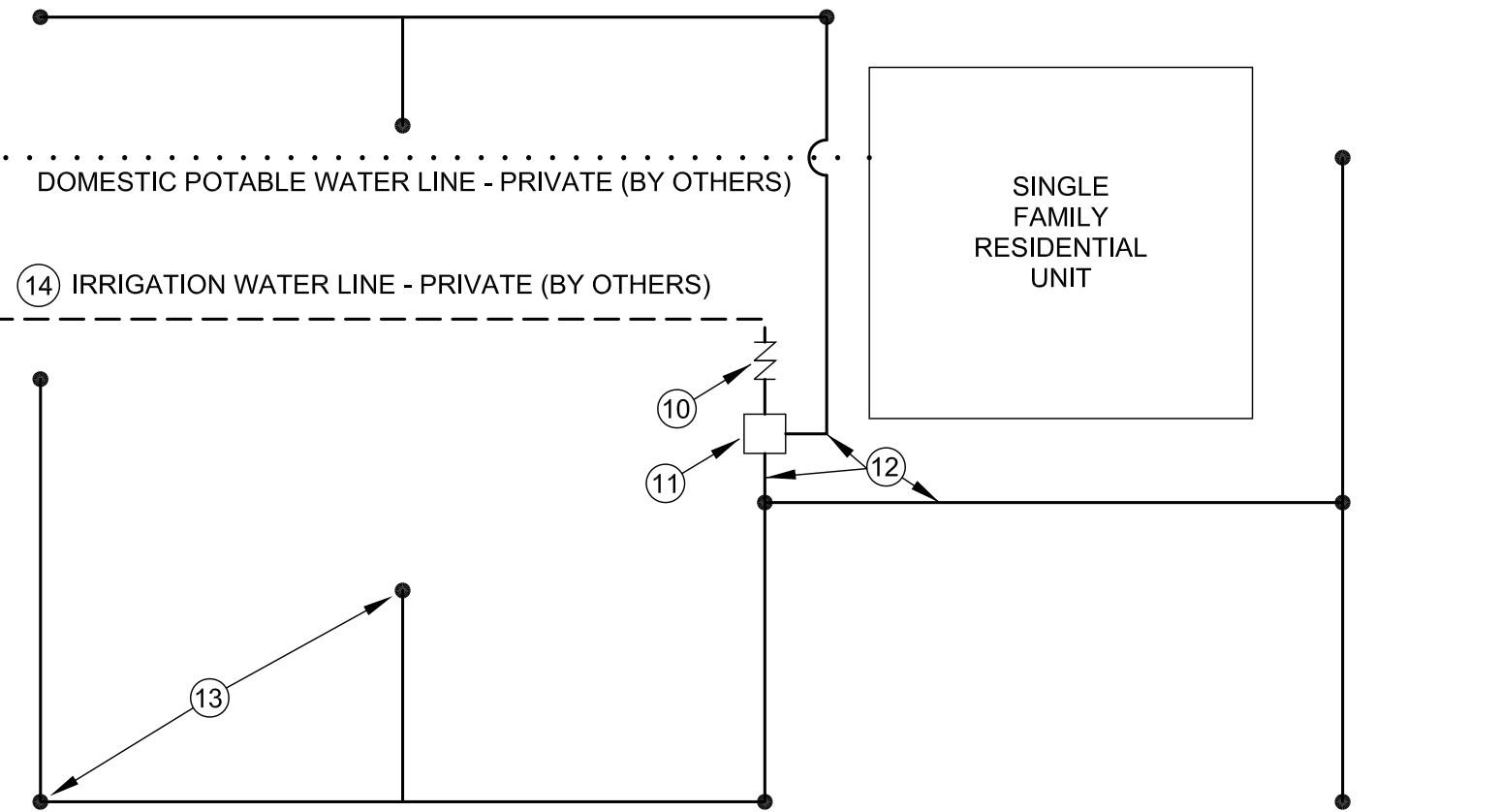
3/4-INCH DOMESTIC WATER SERVICE WITH SPLIT  
3/4-INCH IRRIGATION SERVICE  
BACKFLOW AT ROAD RIGHT-OF-WAY / NO DUAL CHECK AT METER

CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
WATER



- ① PUBLIC WATER MAIN  
 ② SERVICE SADDLE  
 ③ CORPORATION STOP  
 ④ COPPER OR HDPE SERVICE TUBING  
 ⑤ ANGLE VALVE / YOKE BAR / METER / ERT  
 ⑥ COPPER OR HDPE SERVICE TUBING TAIL PIECE  
 ⑦ STD. CONCRETE METER BOX  
 ⑧ ANGLE DUAL CHECK VALVE, BRASS 90° STREET ELBOW, SCH. 80 PVC ADAPTER (MNPT x SOCKET) AND SCH 40 PVC (L= 24 INCH) TAIL PIECE  
 ⑨ GREEN PLASTIC IRRIGATION METER BOX AND LID  
 ⑩ REDUCED PRESSURE PRINCIPAL BACKFLOW ASSEMBLY (BY OTHERS)  
 ⑪ IRRIGATION CONTROL SYSTEM (BY OTHERS)  
 ⑫ IRRIGATION PIPE SYSTEM (BY OTHERS)  
 ⑬ IRRIGATION SPRINKLER HEAD (BY OTHERS)  
 ⑭ BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER ⑩ AND BACKFLOW ASSEMBLY ⑪

ROAD RIGHT-OF-WAY



#### NOTES:

- METER LOCATION AND RELATIONSHIP TO ROAD RIGHT-OF-WAY, CURB, SIDEWALK AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CMUD STANDARDS.
- CMUD MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST BRASS FITTING.
- METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 3 FT. MIN. AND 8 FT. MAX. CLEARANCE.
- SOLVENT WELDS ON PVC PIPE / FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.

NO SCALE

3/4 OR 1 INCH DOMESTIC WATER SERVICE WITH  
 DEDICATED 3/4 OR 1 INCH IRRIGATION SERVICE  
 DUAL CHECK AT METER / BACKFLOW AT HOUSE

CHARLOTTE-MECKLENBURG  
 UTILITIES  
 STANDARD DETAILS  
 WATER



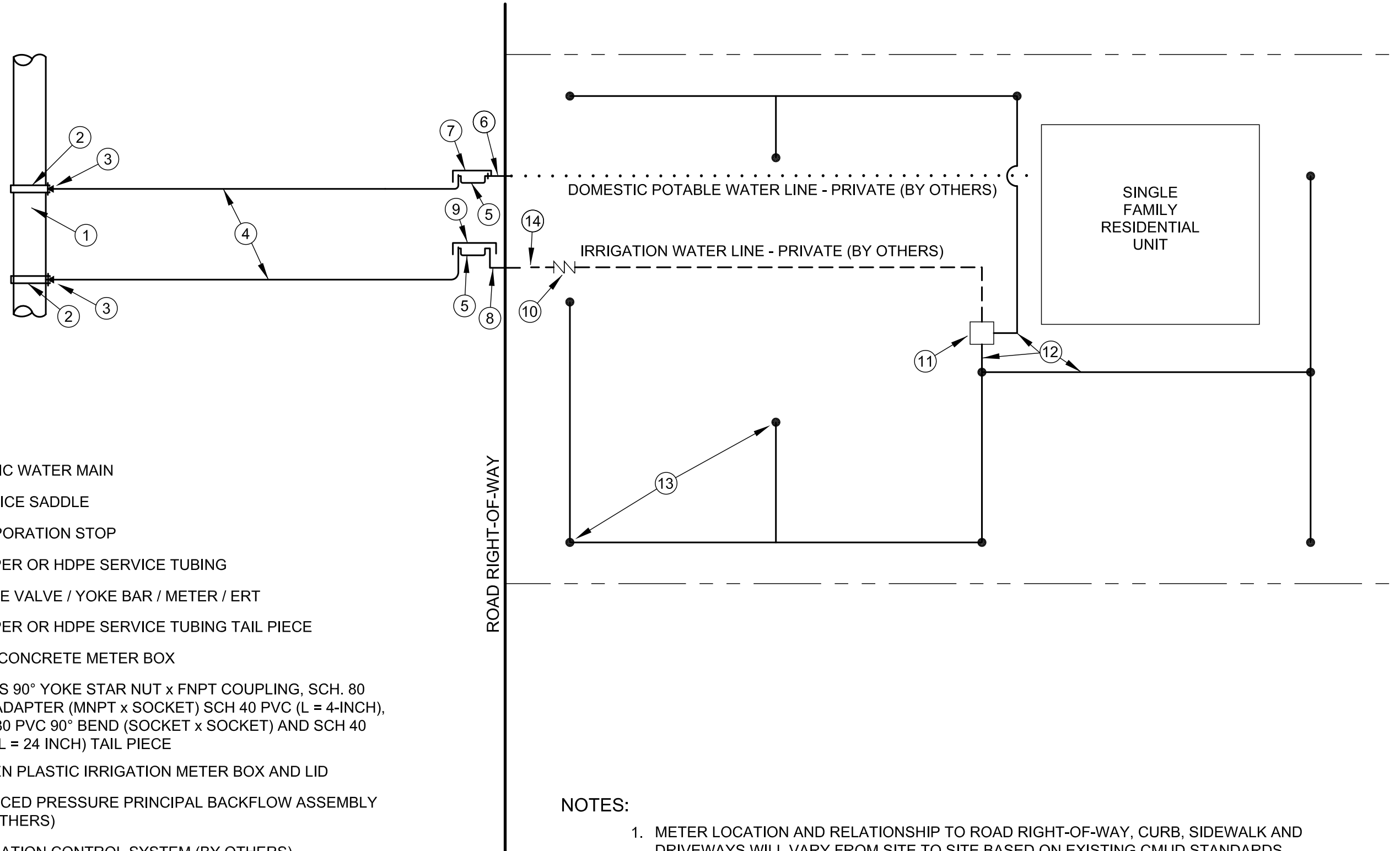
STANDARD NO. 3  
 VERSION NO. V2.1  
 VERSION DATE 6.29.2009

- ① PUBLIC WATER MAIN
- ② SERVICE SADDLE
- ③ CORPORATION STOP
- ④ COPPER OR HDPE SERVICE TUBING
- ⑤ ANGLE VALVE / YOKE BAR / METER / ERT
- ⑥ COPPER OR HDPE SERVICE TUBING TAIL PIECE
- ⑦ STD. CONCRETE METER BOX
- ⑧ BRASS 90° YOKE STAR NUT x FNPT COUPLING, SCH. 80 PVC ADAPTER (MNPT x SOCKET) SCH 40 PVC (L = 4-INCH), SCH 80 PVC 90° BEND (SOCKET x SOCKET) AND SCH 40 PVC (L = 24 INCH) TAIL PIECE
- ⑨ GREEN PLASTIC IRRIGATION METER BOX AND LID
- ⑩ REDUCED PRESSURE PRINCIPAL BACKFLOW ASSEMBLY (BY OTHERS)
- ⑪ IRRIGATION CONTROL SYSTEM (BY OTHERS)
- ⑫ IRRIGATION PIPE SYSTEM (BY OTHERS)
- ⑬ IRRIGATION SPRINKLER HEAD (BY OTHERS)
- ⑭ BRANCHES AND/OR IRRIGATION SPRINKLER HEADS ARE NOT PERMITTED BETWEEN IRRIGATION METER ⑨ AND BACKFLOW ASSEMBLY ⑩

ROAD RIGHT-OF-WAY

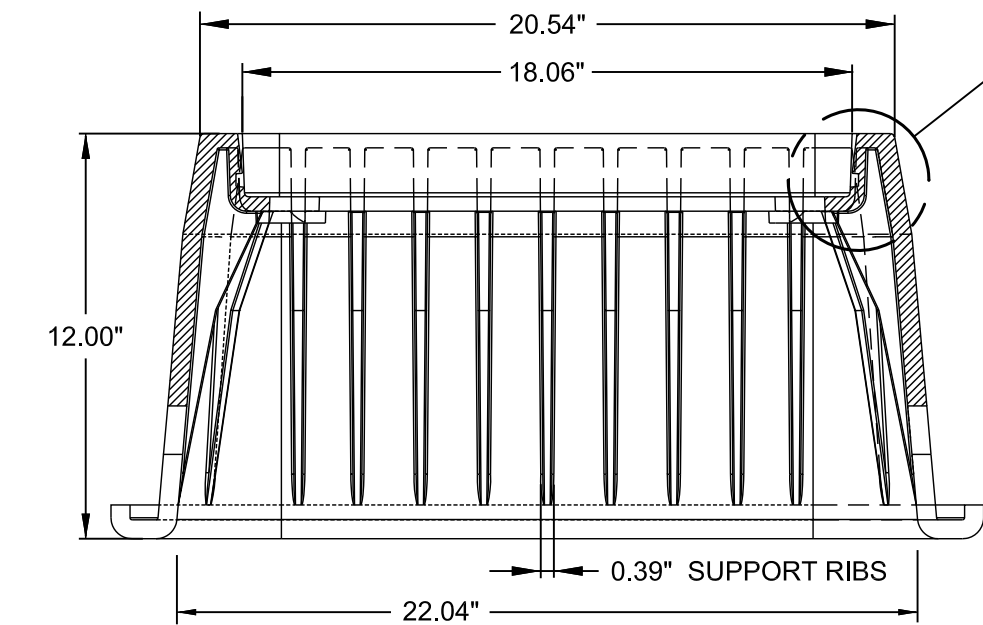
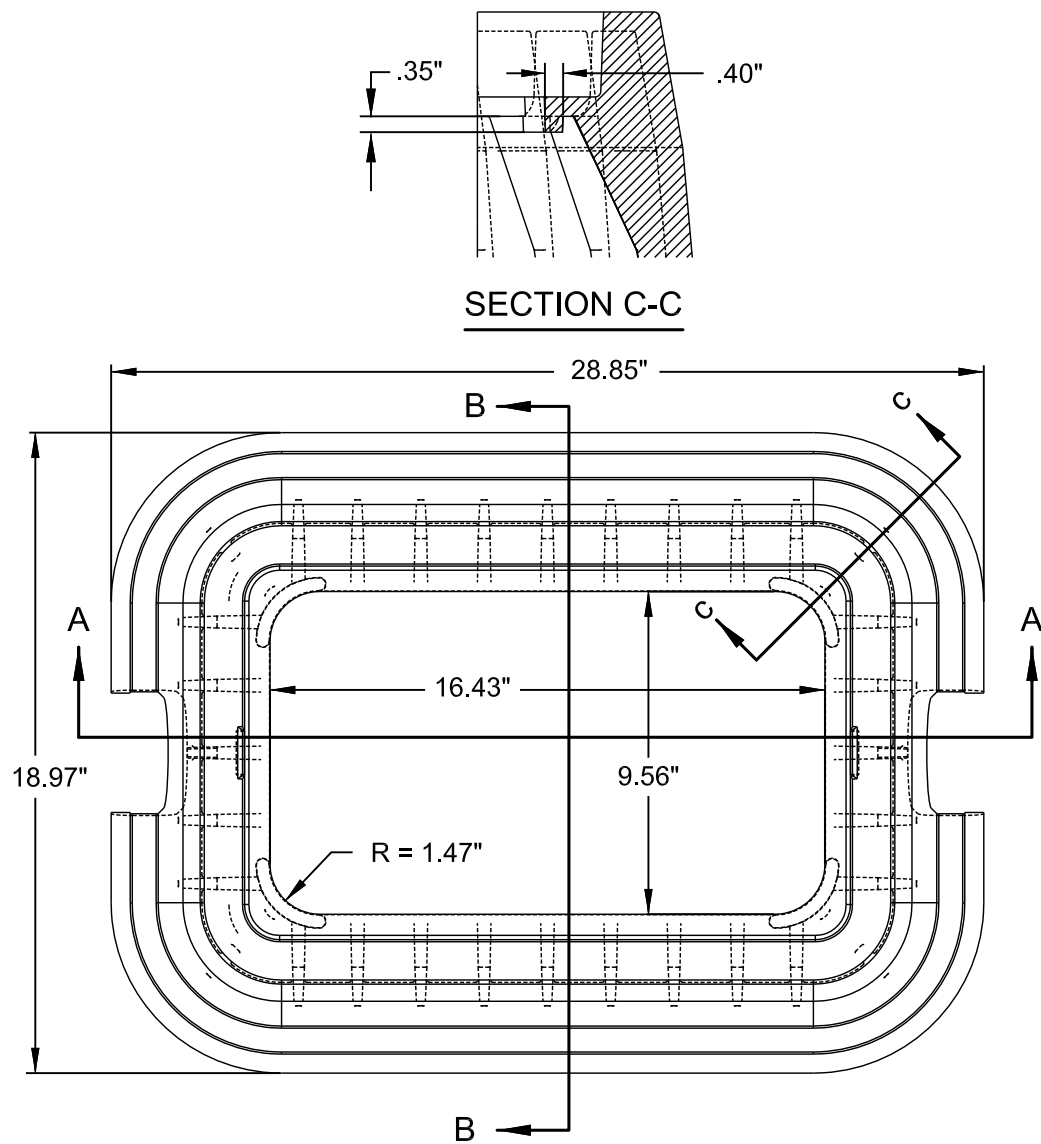
#### NOTES:

1. METER LOCATION AND RELATIONSHIP TO ROAD RIGHT-OF-WAY, CURB, SIDEWALK AND DRIVEWAYS WILL VARY FROM SITE TO SITE BASED ON EXISTING CMUD STANDARDS.
2. CMUD MAINTENANCE ENDS AT THE METER ASSEMBLY, AT THE LAST BRASS FITTING.
3. METER BOXES SHALL BE INSTALLED SIDE BY SIDE, WITH 3 FT. MIN. AND 8 FT. MAX. CLEARANCE.
4. SOLVENT WELDS ON PVC PIPE / FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.



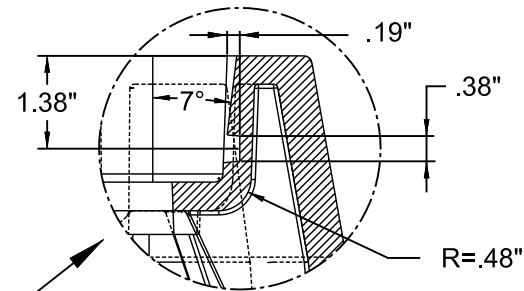
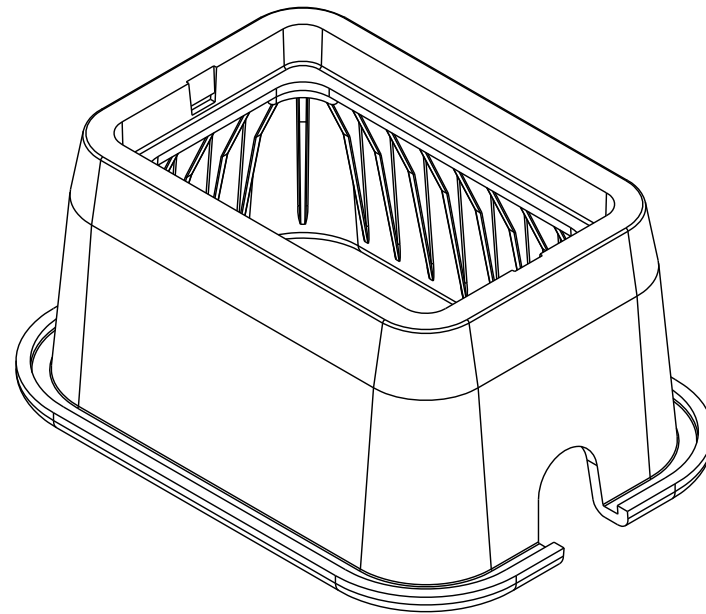
NO SCALE

<div><div>CHARLOTTE</div></div>	CHARLOTTE-MECKLENBURG UTILITIES	
	STANDARD DETAILS	
	WATER	
3/4 OR 1 INCH DOMESTIC WATER SERVICE WITH DEDICATED 3/4 OR 1 INCH IRRIGATION SERVICE BACKFLOW AT ROAD RIGHT-OF-WAY / NO DUAL CHECK AT METER		
STANDARD NO.		4
VERSION NO.	V2.1	
VERSION DATE	6.29.2009	

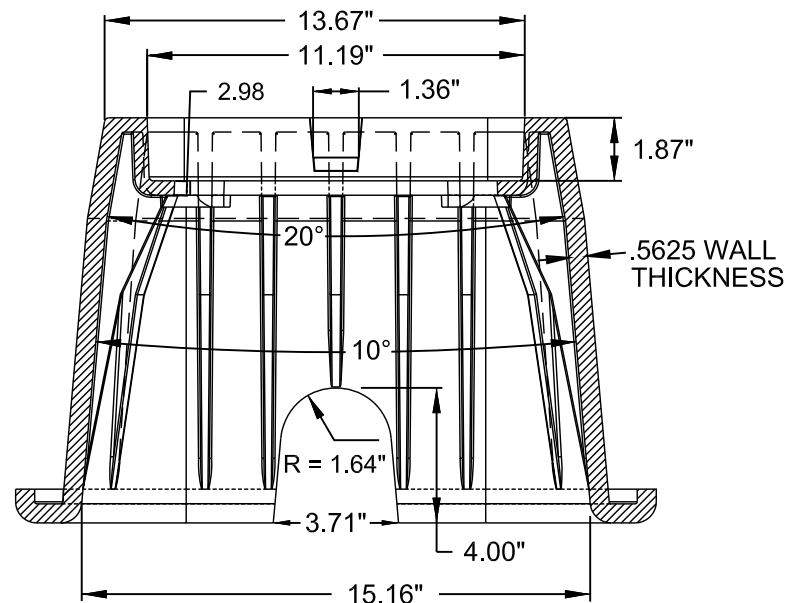


SECTION A-A

BOX WT. - 15.25#



DETAIL A - SNAP SLOT

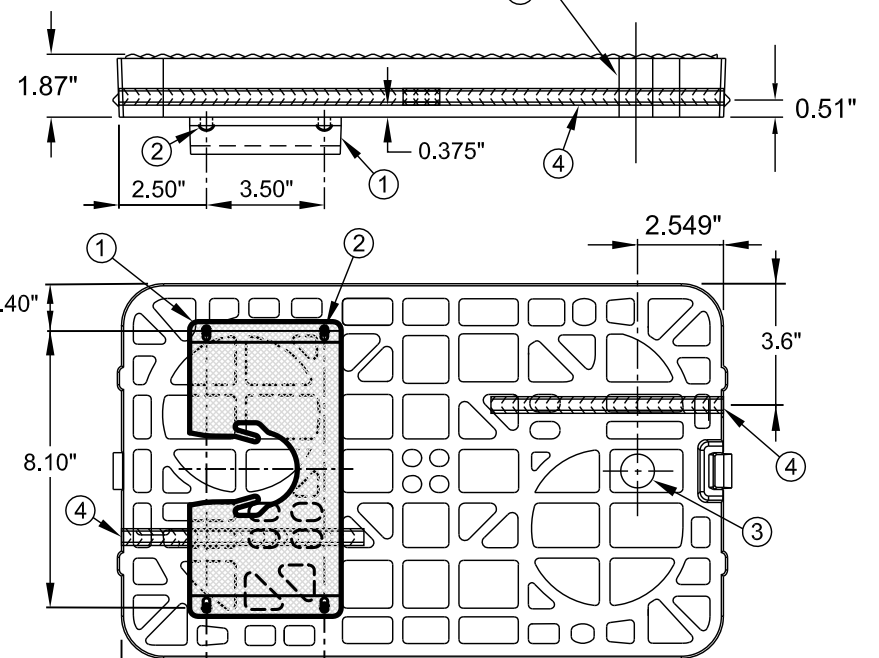
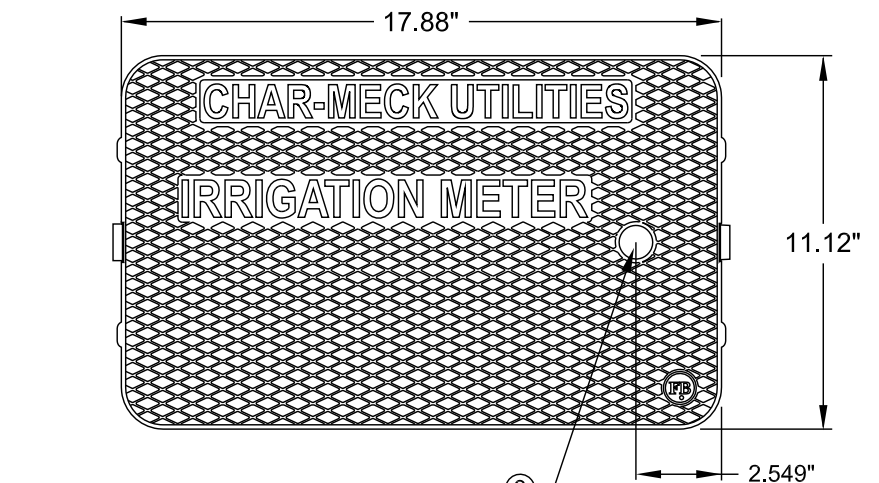
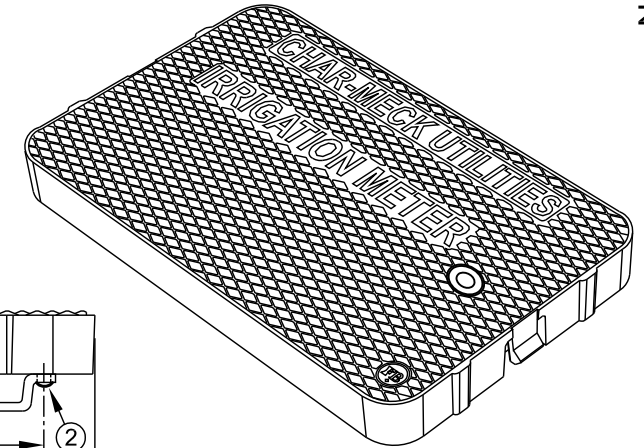
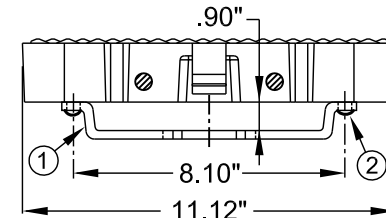


SECTION B-B

NO. DESCRIPTION

1. AMR TRANSMITTER SUPPORT BRACKET
2. # 14 x 3/4 INCH S.S. PAN HEAD SHEET METAL SCREW - 4 EACH
3. 1 INCH DIAMETER PICK HOLE
4. 1/2 INCH DIAMETER REBAR x 2 EACH

LID WT. - 6.0#



BOTTOM VIEW

NO SCALE

STANDARD NO.

A

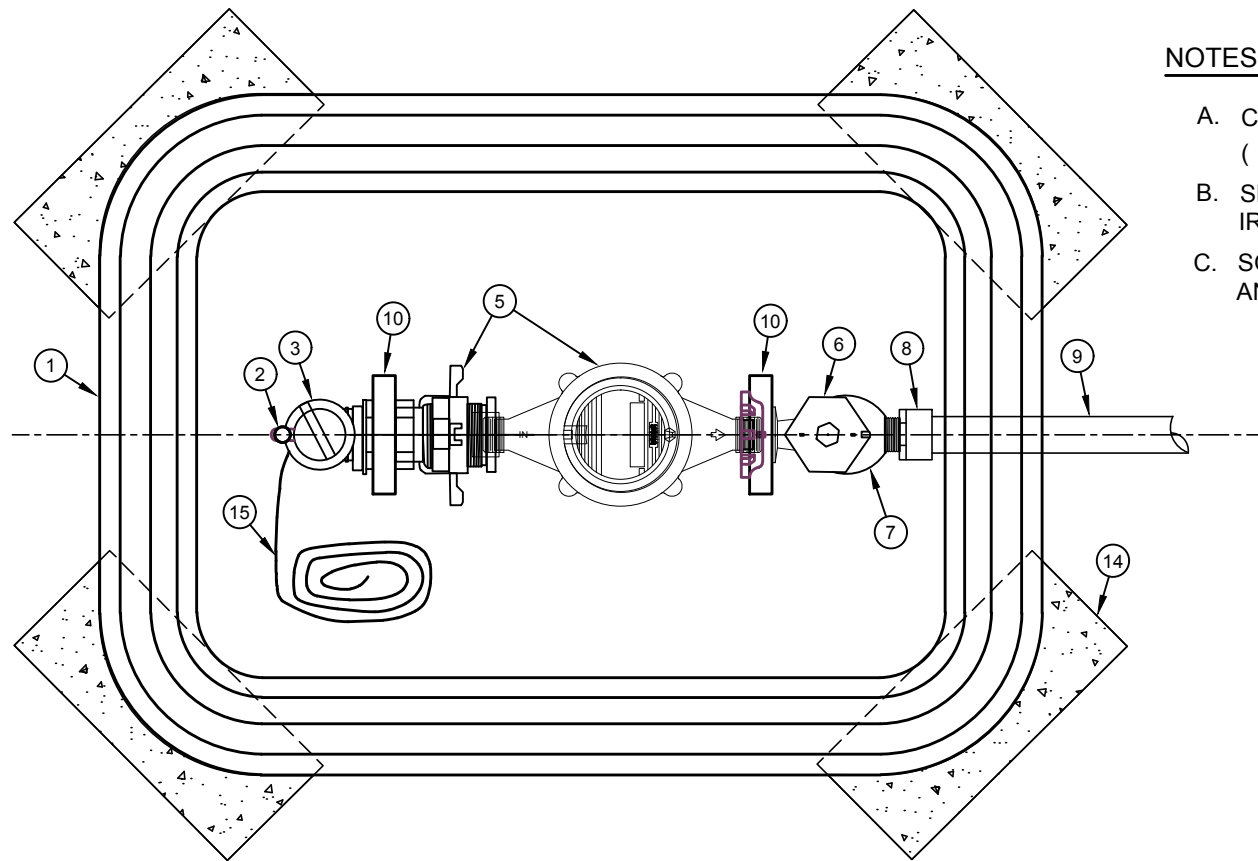
VERSION DATE

6.24.2010

3/4 INCH IRRIGATION WATER SERVICE  
PLASTIC GREEN METER BOX & GREEN LID

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER





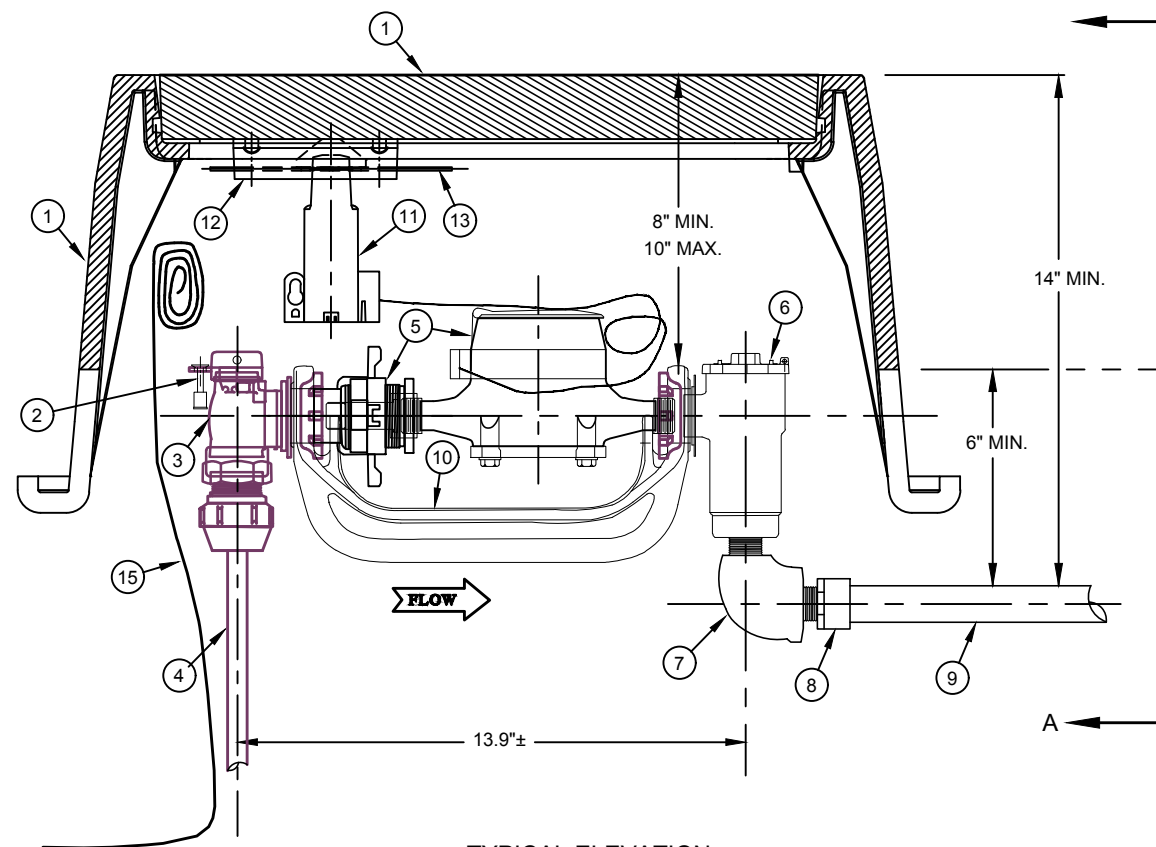
PLAN

NOTES:

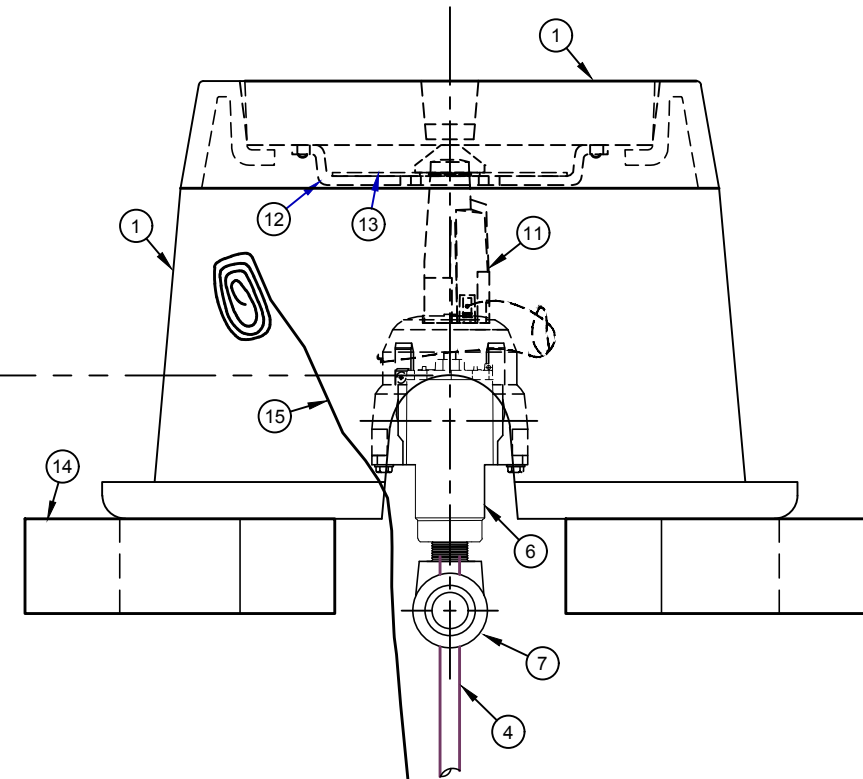
- CENTER ANGLE BALL VALVE/ANGLE DUAL CHECK VALVE ( ③/⑥ ) IN METER BOX.
- SHOWN AS 3/4" SERVICE, USE 1" COMPONENTS FOR 1" IRRIGATION SERVICE.
- SOLVENT WELDS ON PVC PIPE/FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.

NO. DESCRIPTION

- PLASTIC GREEN METER BOX & GREEN LID
- STUD LOCK, FURNISHED BY CMUD
- ANGLE BALL VALVE W/LOCK WINGS (LOCKED-CLOSED)
- 3/4" COPPER TUBING OR 3/4" HDPE-COPPER TUBING SIZE (CTS)
- 5/8" METER ASSEMBLY, WITH ERT AMR, FURNISHED BY CMUD
- ANGLE DUAL CHECK VALVE - (YOKE STAR NUT x FNPT) - (MULLER H - 14464 - A, FORD HHCA91, OR McDONALD 12 - 3YE OR 112 - 3YE)
- BRASS 90° STREET ELBOW - (MNPT x FNPT)
- SCH 80 PVC ADAPTER (MNPT x SOCKET)
- 3/4" SCH 40 PVC TAIL PIPE (L = 24")
- YOKE BAR
- ERT - ELECTRONIC RADIO TRANSMITTER
- ITRON 6.7" DIA. SHELF MOUNT ADAPTER W/FOAM SPACERS
- ERT HANGER FOR 3/4 AND 1 3/4 INCH WATER METER BOX
- SOLID STANDARD CONCRETE BRICK-DIAGONAL AT CORNERS - 4 EACH.
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.)



TYPICAL ELEVATION



VIEW A-A

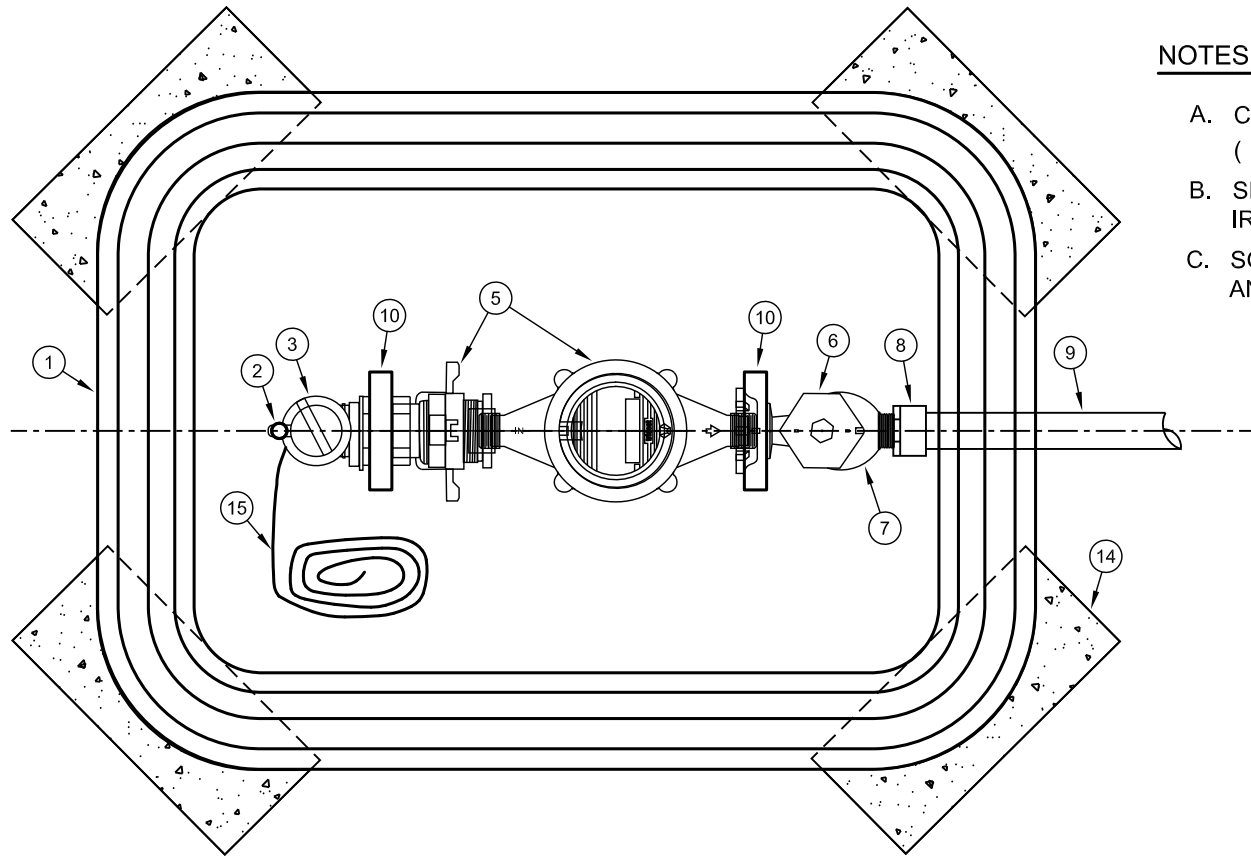
NO SCALE

STANDARD NO.	B	VERSION DATE	8.27.2010
VERSION NO.	V1.3		

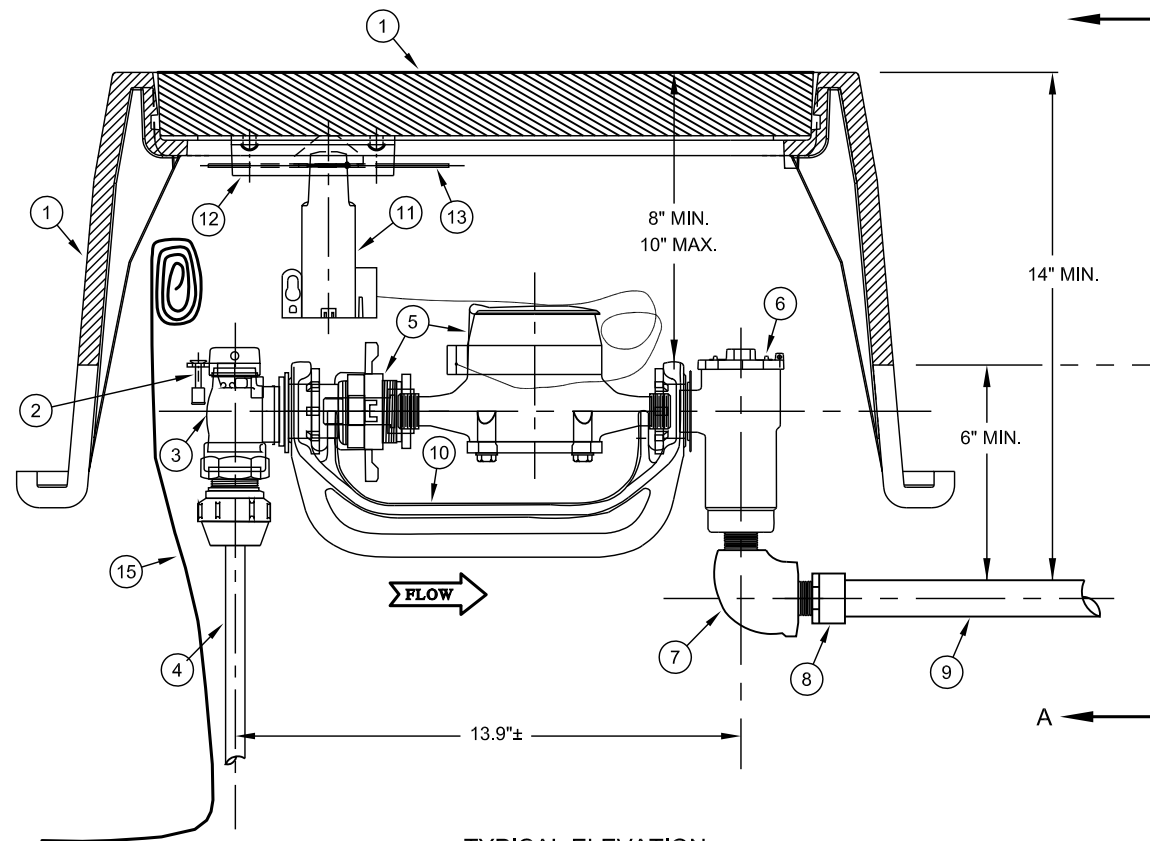
3/4" - 1" IRRIGATION SERVICE DETAIL  
DUAL CHECK AT METER / BACKFLOW AT HOUSE

CHARLOTTE-MECKLENBURG UTILITIES	STANDARD DETAILS	WATER
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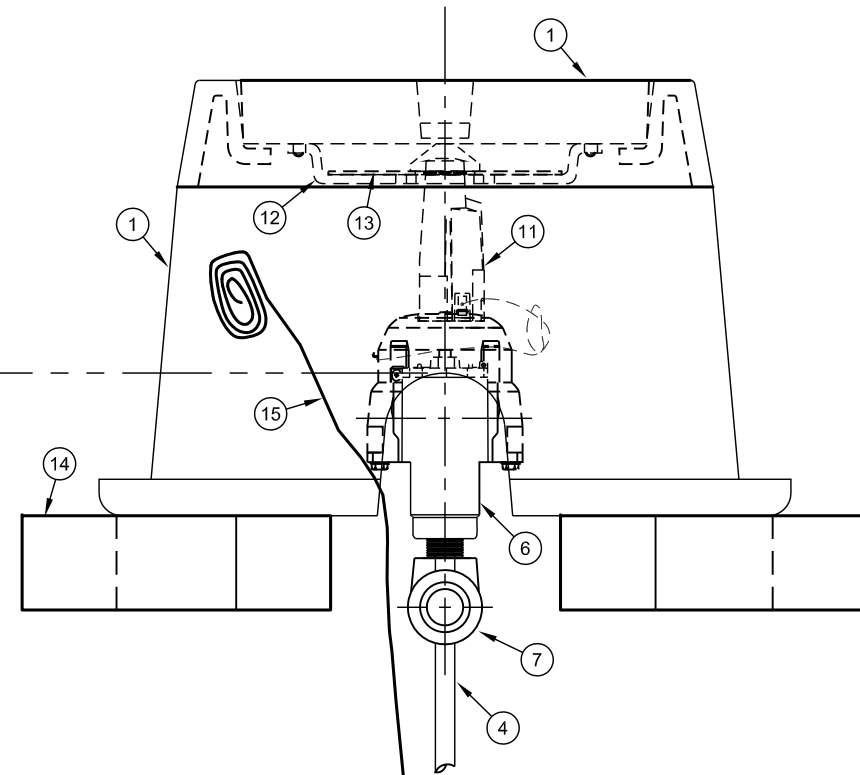




PLAN



TYPICAL ELEVATION



VIEW A-A

NOTES:

- CENTER ANGLE BALL VALVE/ANGLE DUAL CHECK VALVE ( ③/⑥ ) IN METER BOX.
- SHOWN AS 3/4" SERVICE, USE 1" COMPONENTS FOR 1" IRRIGATION SERVICE.
- SOLVENT WELDS ON PVC PIPE/FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.

NO. DESCRIPTION

- PLASTIC GREEN METER BOX & GREEN LID
- STUD LOCK, FURNISHED BY CMUD
- ANGLE BALL VALVE W/LOCK WINGS (LOCKED-CLOSED)
- 3/4" COPPER TUBING OR 3/4" HDPE-COPPER TUBING SIZE (CTS)
- 5/8" METER ASSEMBLY, WITH ERT AMR, FURNISHED BY CMUD
- ANGLE DUAL CHECK VALVE - (YOKE STAR NUT x FNPT) - (MULLER H - 14464 - A, FORD HHCA91, OR McDONALD 12 - 3YE OR 112 - 3YE)
- BRASS 90° STREET ELBOW - (MNPT x FNPT)
- SCH 80 PVC ADAPTER (MNPT x SOCKET)
- 3/4" SCH 40 PVC TAIL PIPE (L = 24")
- YOKE BAR
- ERT - ELECTRONIC RADIO TRANSMITTER
- ITRON 6.7" DIA. SHELF MOUNT ADAPTER W/FOAM SPACERS
- ERT HANGER FOR 3/4 AND 1 3/4 INCH WATER METER BOX
- SOLID STANDARD CONCRETE BRICK-DIAGONAL AT CORNERS - 4 EACH.
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.)

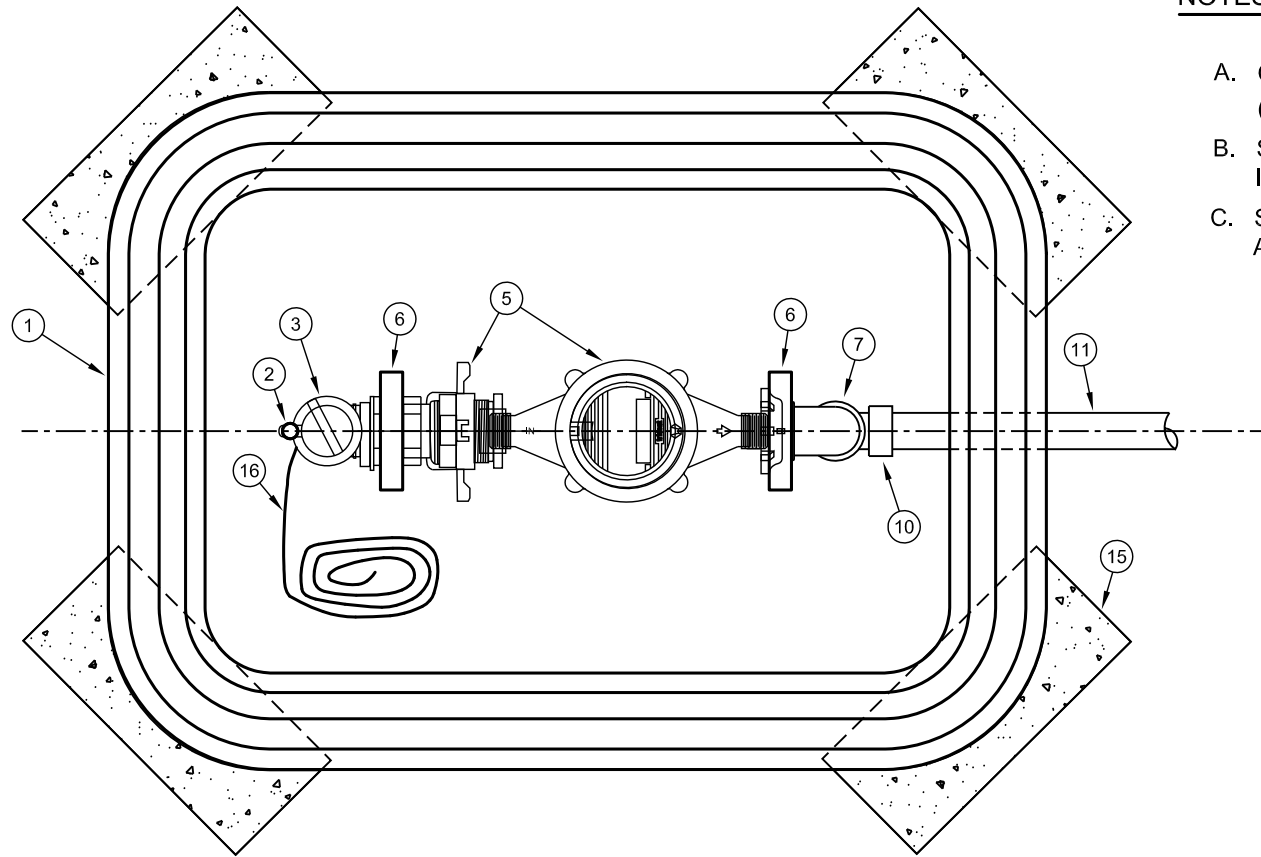
NO SCALE

3/4" - 1" IRRIGATION SERVICE DETAIL  
DUAL CHECK AT METER / BACKFLOW AT HOUSE

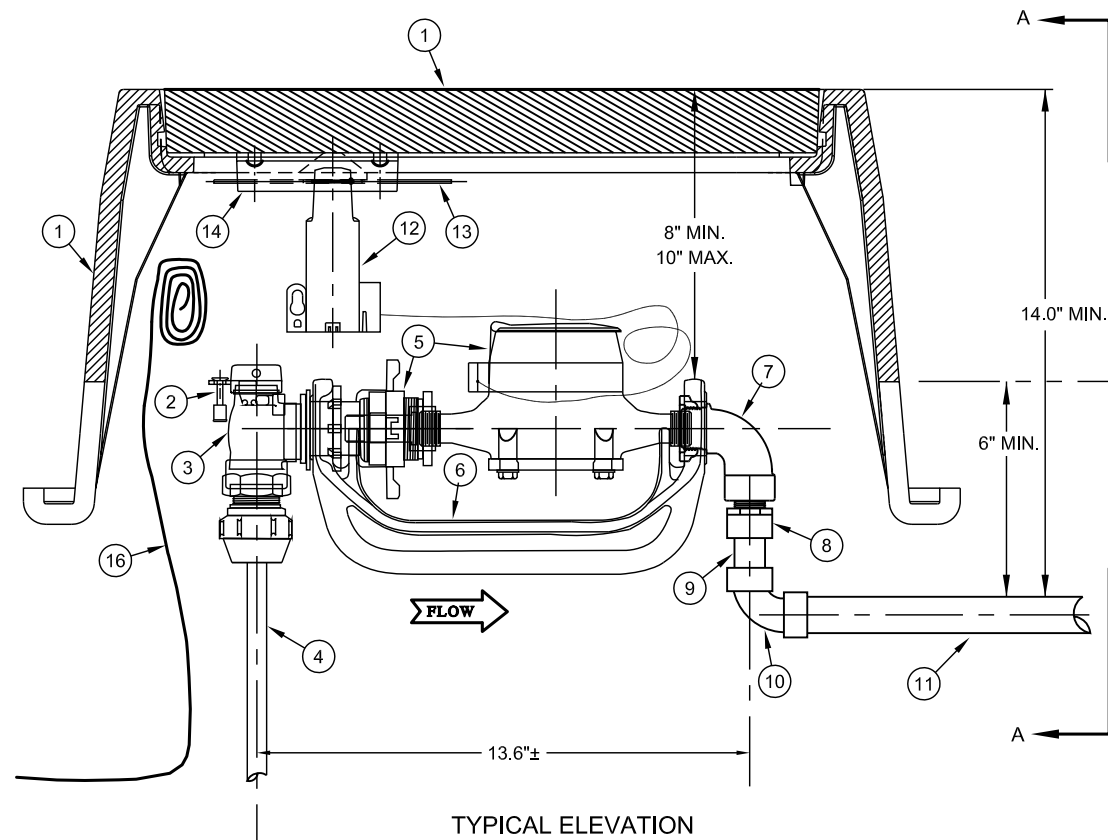
CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
WATER



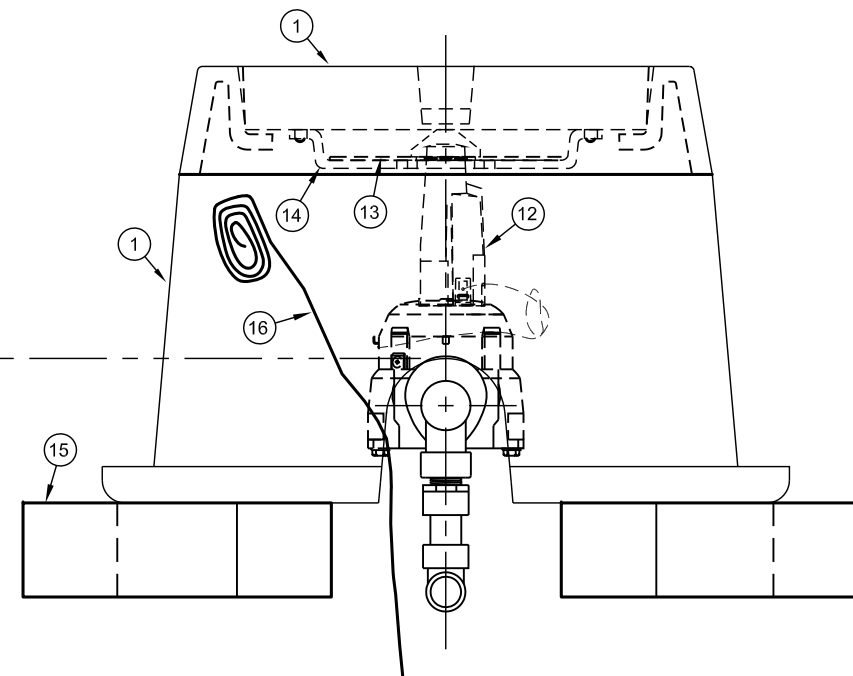
STANDARD NO.	B
VERSION NO.	V1.3
VERSION DATE	8.27.2010



PLAN



TYPICAL ELEVATION



VIEW A-A

NOTES:

- CENTER ANGLE BALL VALVE/90° CONNECTOR ( ③/⑦ ) IN METER BOX.
- SHOWN AS 3/4" SERVICE, USE 1" COMPONENTS FOR 1" IRRIGATION SERVICE.
- SOLVENT WELDS ON PVC PIPE/FITTINGS SHALL BE CLEANED AND PRIMED PRIOR TO APPLYING GLUE.

NO. DESCRIPTION

- PLASTIC GREEN METER BOX & GREEN LID
- STUD LOCK, FURNISHED BY CMUD
- ANGLE BALL VALVE W/LOCK WINGS ( LOCKED-CLOSED )
- 3/4" COPPER TUBING OR 3/4" HDPE-COPPER TUBING SIZE ( CTS )
- 5/8" METER ASSEMBLY, WITH ERT AMR, FURNISHED BY CMUD
- YOKE BAR
- BRASS 90° YOKE STAR NUT x FNPT CONNECTOR - ( MULLER H - 14214, FORD L - 91, OR McDONALD 4779FY )
- SCH 80 PVC ADAPTER ( MNPT x SOCKET )
- 3/4" SCH 40 PVC SHORT PIECE ( L = AS REQUIRED )
- SCH 80 PVC 90° BEND ( SOCKET x SOCKET )
- 3/4" SCH 40 PVC TAIL PIPE ( L = 24" )
- ERT - ELECTRONIC RADIO TRANSMITTER
- ITRON 6.7" DIA. SHELF MOUNT ADAPTER W/FOAM SPACERS
- ERT HANGER
- SOLID STANDARD CONCRETE BRICK-DIAGONAL AT CORNERS - 4 EACH
- AWG #12 GAUGE COPPER TRACER WIRE (THWN) WITH BLUE INSULATION, TERMINATE WITH 24 INCH EXCESS WIRE (COILED) AT METER BOX AND VALVE BOX (TYP.)

NO SCALE

STANDARD NO.	C
VERSION NO.	V1.3
VERSION DATE	8.27.2010

3/4" - 1" IRRIGATION SERVICE DETAIL  
BACKFLOW AT ROAD RIGHT-OF-WAY / NO DUAL CHECK

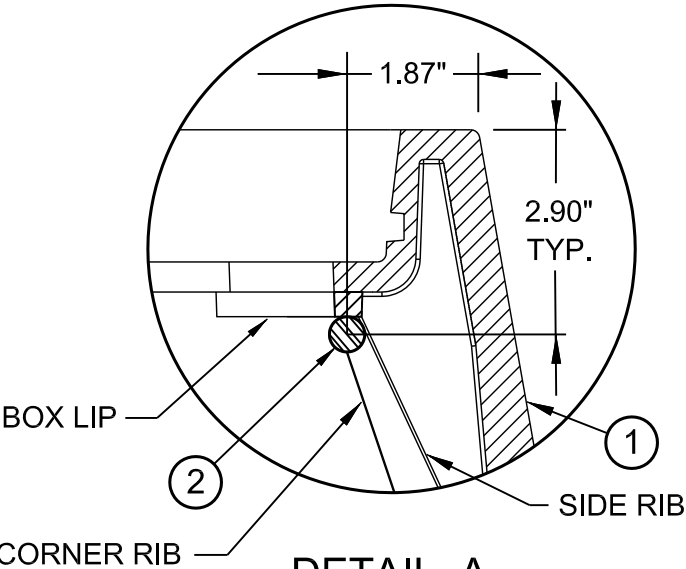
CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
WATER





NO. DESCRIPTION

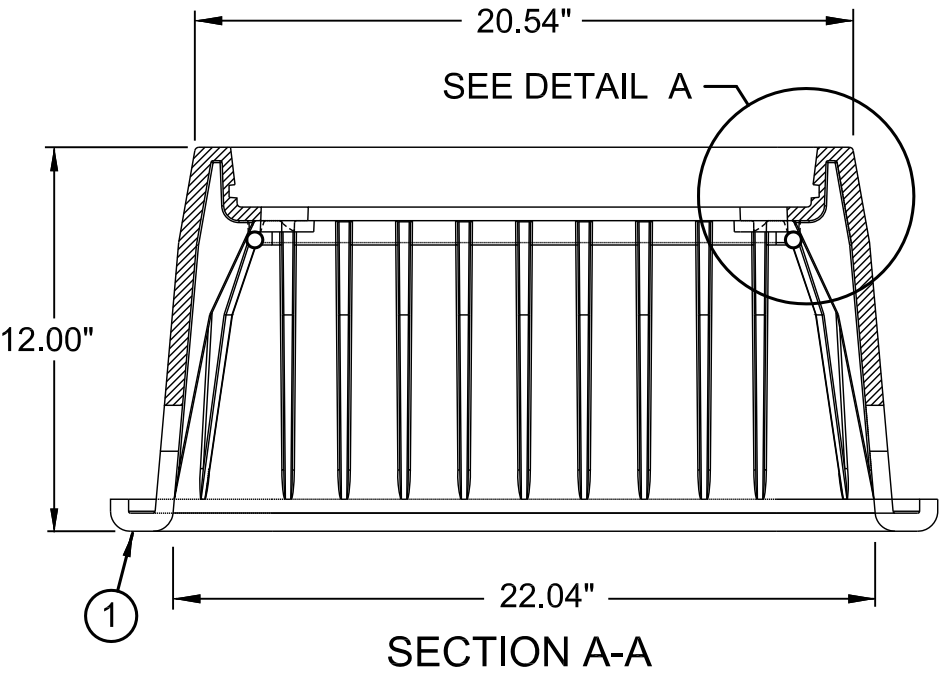
- (1) PLASTIC IRRIGATION WATER SERVICE METERBOX
- (2) 1/2" DIAMETER REBAR x 2, L = 36 INCHES, INSTALLED THROUGH 1/2 INCH  $\phi$  DRILLED HOLES IN METER BOX WALLS AND CORNER RIBS. LOCATE AS SHOWN WITH BOX LIP AND SIDE RIBS RESTING ON REBAR.
- (3) CONCRETE HARDSCAPE,  $f'c = 3600$  PSI, MINIMUM.



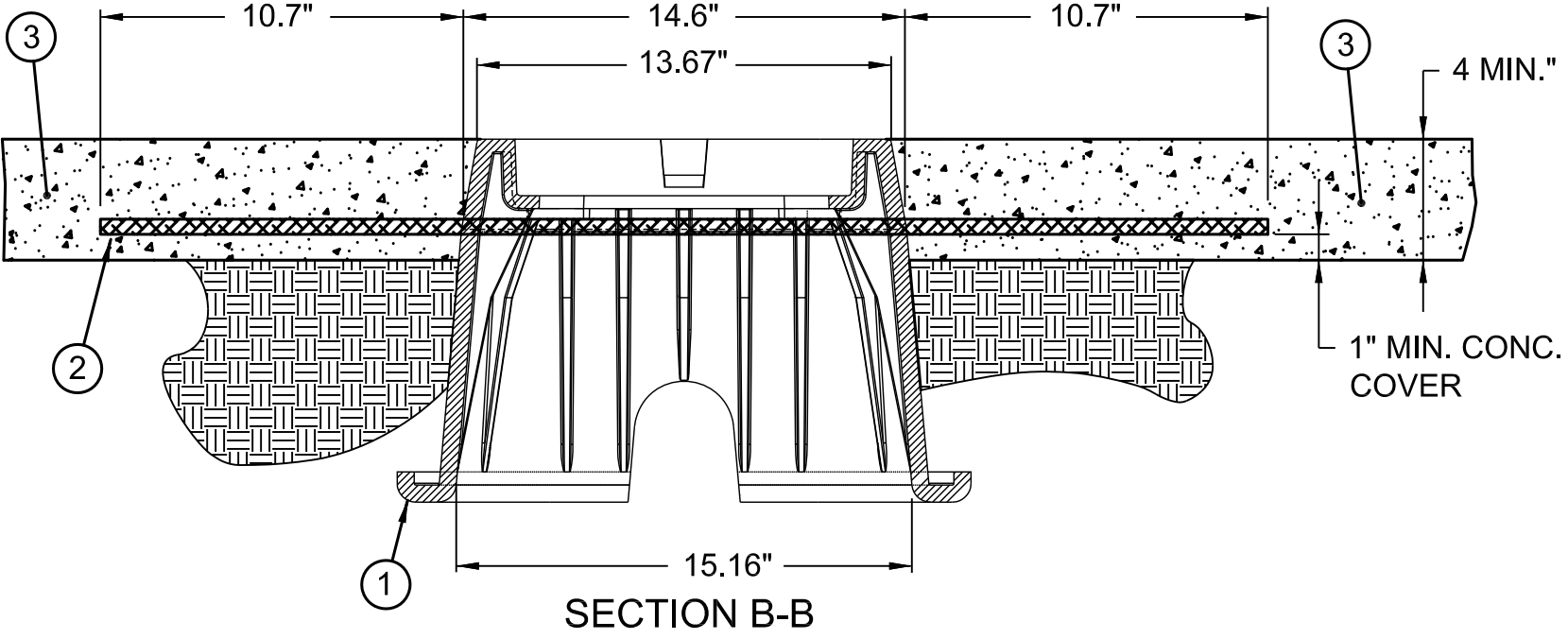
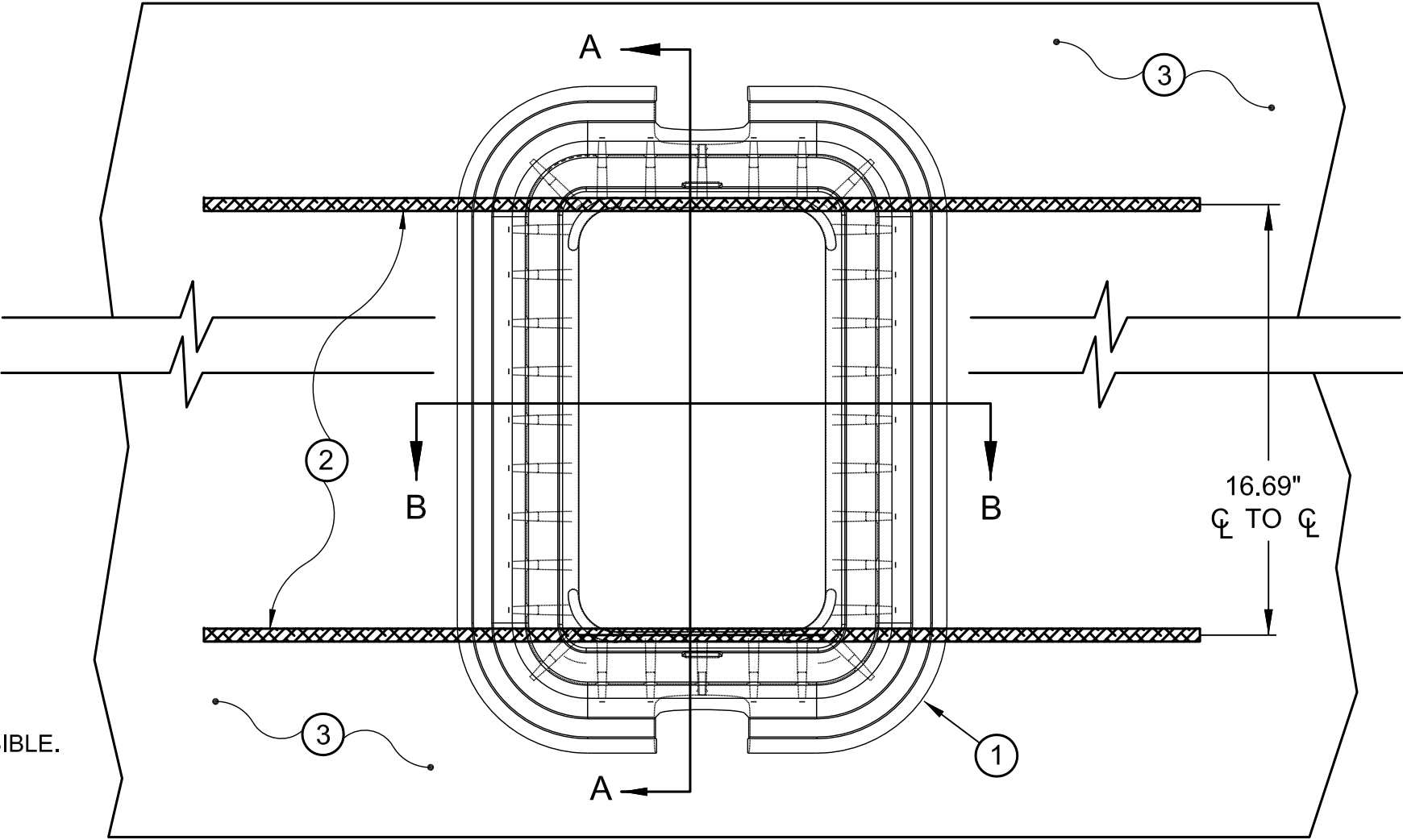
DETAIL A

NOTES:

1. RELOCATE METER BOX OUTSIDE CONCRETE HARDSCAPE WHEN POSSIBLE.
2. RELOCATION AND FINAL LOCATION REQUIRES CMUD APPROVAL.
3. IF RELOCATION IS NOT POSSIBLE, METER BOX MUST BE LOCATED COMPLETELY WITHIN CONCRETE.
4. METER BOX SHALL BE SET FLUSH WITH CONCRETE.



SECTION A-A



SECTION B-B

NO SCALE

STANDARD NO.

E

VERSION NO. V1.0  
VERSION DATE 8.4.2009

3/4 INCH IRRIGATION WATER SERVICE  
METER BOX INSTALLATION IN CONCRETE SIDEWALK

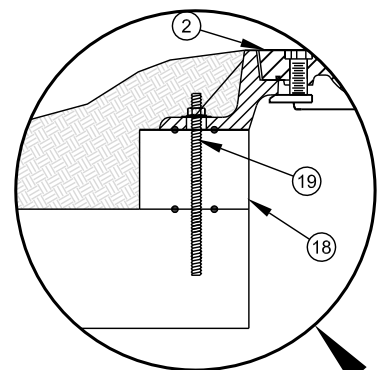
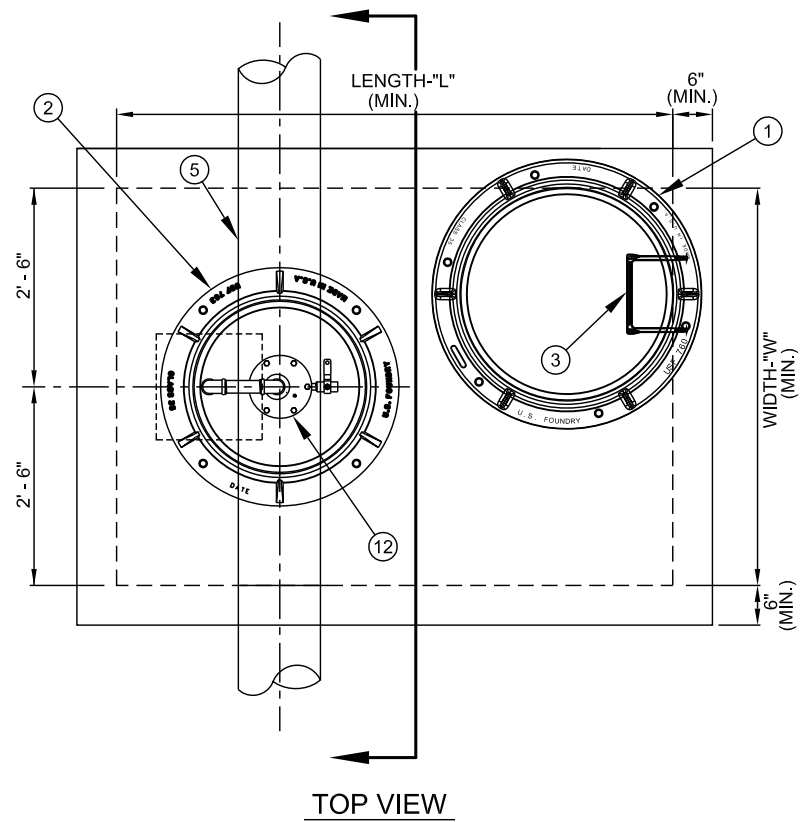
CHARLOTTE-MECKLENBURG  
UTILITIES

STANDARD DETAILS

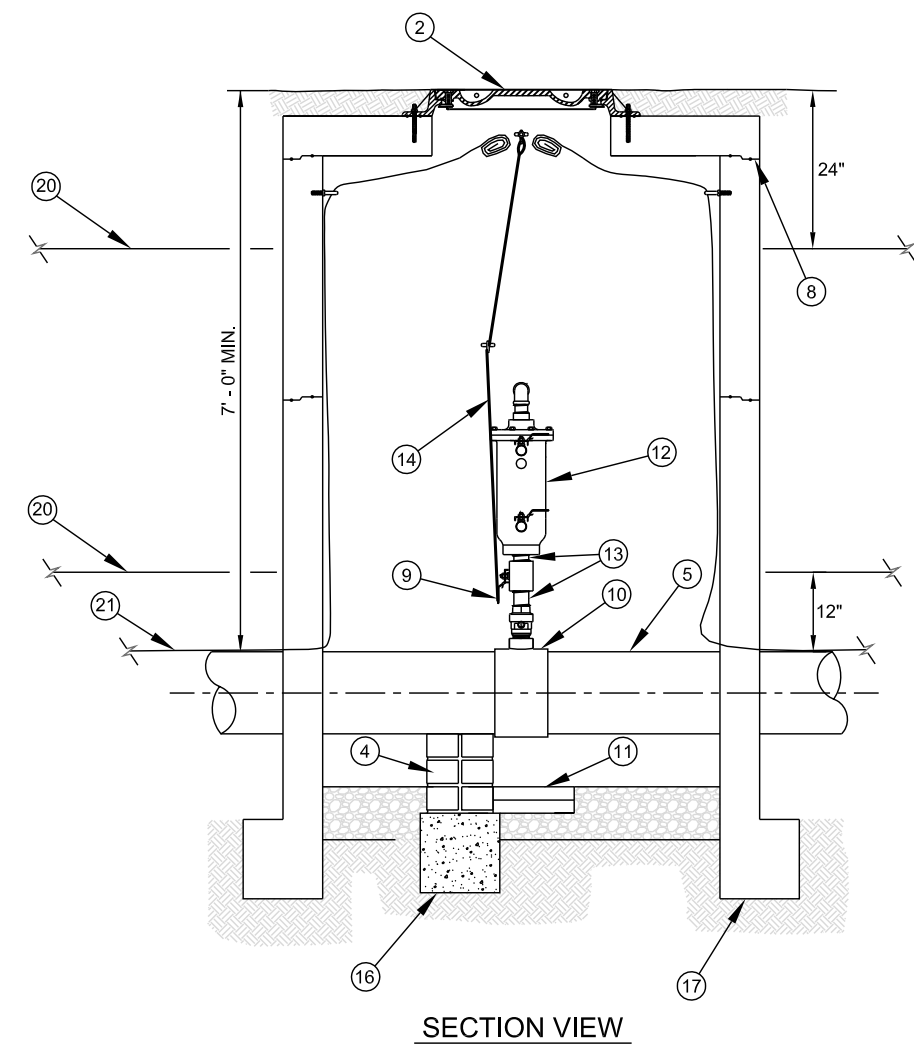
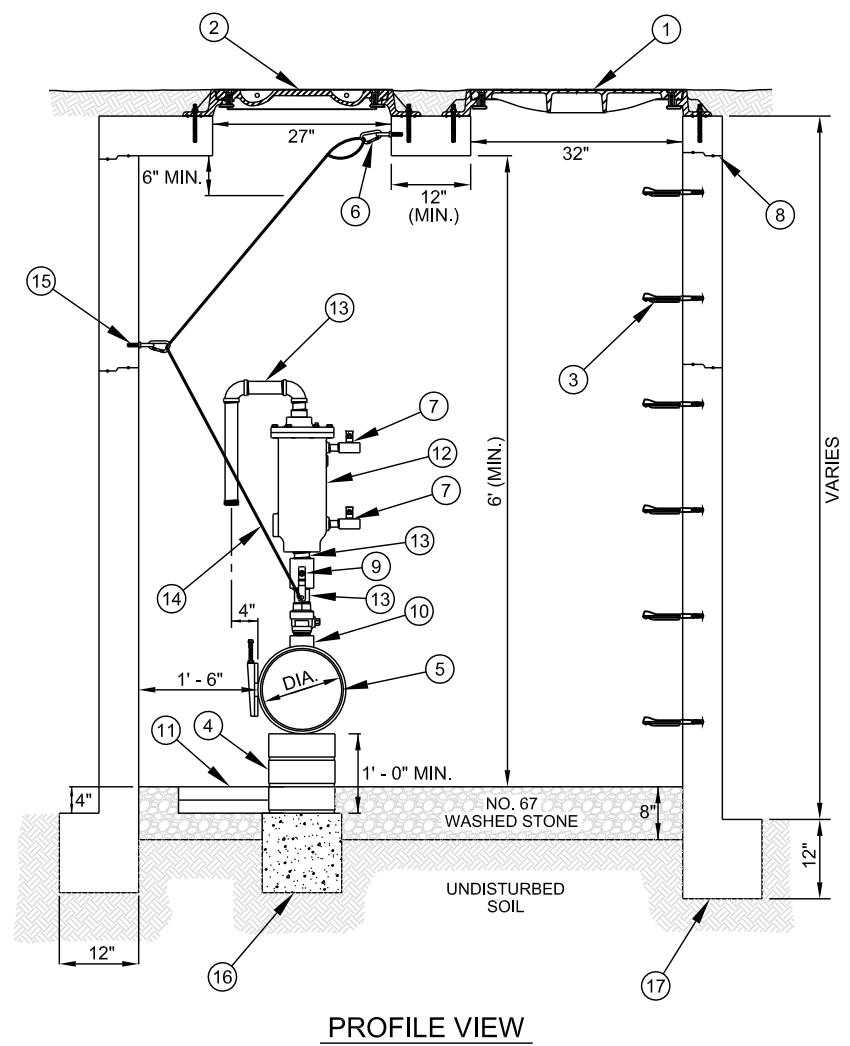
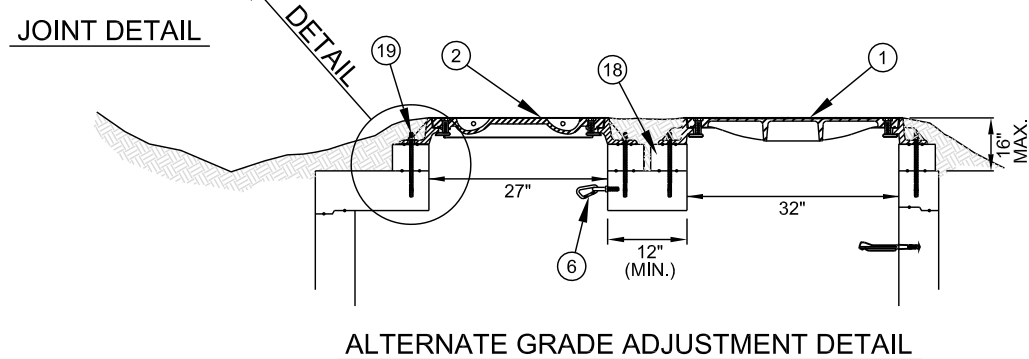
WATER



CHARLOTTE



VAULT DIMENSION REQUIREMENTS		
PIPE DIA. D - (IN.)	LENGTH L - (FT.)	WIDTH W - (FT.)
4 - 6	6.5	5.0
8 - 16	7.0	5.0
18 - 24	7.5	5.0
30 - 36	8.0	5.0
42 - 48	8.5	5.0



- NO. DESCRIPTION
- 30" CAST IRON MANHOLE FRAME AND COVER (MAN ACCESS) PER CMU STANDARDS - TYPE D / 4
  - 24" CAST IRON MANHOLE FRAME AND COVER (EQUIPMENT ACCESS) PER CMU STANDARDS - TYPE B / 1 CENTER OVER AIR / VACUUM VALVE
  - MANHOLE STEPS AT 12" OR 16" O.C. - CENTERED WITH FRAME ①
  - SOLID CONCRETE STANDARD BRICK & MORTAR PIPE SUPPORT
  - DUCTILE IRON PIPE FORCE MAIN
  - 1/2" DIA. TYPE 304 STAINLESS STEEL HOOK (ADHESIVE ANCHOR)
  - STAINLESS STEEL BALL VALVE - 1/4 TURN AND NIPPLE
  - JOINT REQUIRED AT FLAT TOP SECTION
  - STAINLESS STEEL BALL VALVE
  - BRONZE BALL CORPORATION STOP WITH ALL STAINLESS STEEL (TYPE 304) TAPPING SADDLE - FORD FS 303 - ROMAC STYLE 306 OR APPROVED EQUAL
  - 16" x 16" x 2" CONCRETE PAVER (SPLASH PAD) - 2 EACH - STACKED - CENTER UNDER BRASS PIPE DISCHARGE
  - AIR AND VACUUM VALVE - SEE SPECIFICATIONS
  - SCHEDULE 40 RED BRASS PIPING
  - ROUTE 1/8" TYPE 304 STAINLESS STEEL CABLE FROM BALL VALVE HANDLE (MOUNTED ON TOP OF CORP. STOP THROUGH EYELET TO HOOK) LEAVE 6" SECURED LOOP IN CABLE END TO HANG OVER HOOK
  - 1/2" DIA. TYPE 304 STAINLESS STEEL EYE BOLT (ADHESIVE ANCHOR)
  - 12"x12"x12" CONCRETE FOOTING FOR PIPE SUPPORT OFFSET Laterally FROM VALVE
  - CONTINUOUS PRECAST OR CAST IN PLACE FOOTING
  - PRECAST CONCRETE GRADE ADJUSTMENT RING AS NEEDED
  - 1/2" DIA. GALV. ANCHOR BOLTS - FRAME TO VAULT (ADHESIVE ANCHOR)
  - GREEN DETECTABLE PLASTIC LOCATOR TAPE
  - AWG #12 GAUGE COPPER TRACER WIRE (THWN) - WITH GREEN INSULATION - TERMINATE AT HOOK ⑥ WITH 24" EXCESS WIRE (COILED).

- NOTES:
- VAULT SHALL BE SIZED AS NEEDED FOR PIPE (6.5'x5' MINIMUM) AND RATED FOR NCDOT HS-20 LOADING - SUBMIT SHOP DRAWINGS / P.E. SEALED FOR REVIEW.
  - ALL CONCRETE SHALL BE MINIMUM 4000 PSI COMPRESSIVE STRENGTH.
  - DESIGN SHALL CONFORM TO ASTM C858 - SPECIFICATIONS FOR "UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURE"
  - STEEL REINFORCING DESIGN SHALL CONFORM TO ASTM C857
  - REBARS SHALL BE GRADE 60 PER ASTM A615
  - WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185
  - DIAGONAL REINFORCING SHALL BE ADDED AT ALL OPENINGS
  - PIPE PENETRATIONS SHALL BE SEALED WITH FLEXIBLE CONNECTORS (MANHOLE BOOTS) OR WITH 8-INCHES OF BRICK & MORTAR (AND 1/2 INCH THICK CONSTRUCTION EXPANSION MATERIAL)
  - ALL VALVES SHALL OPEN COUNTERCLOCKWISE. (OPEN LEFT)
  - FRAME TO BE FLUSH WITH GROUND IN MAINTAINED ROAD OR YARD R/W AND 2 FEET ABOVE GROUND IN SEWER EASEMENT
  - AIR AND VACUUM VALVE TO BE SHORT BODY TYPE, SIZED PER MANUFACTURER'S RECOMMENDATIONS
  - VALVE TO BE INSTALLED AT MIDPOINT OF A FULL JOINT OF DUCTILE IRON PIPE WHEN INSTALLING PVC FORCE MAIN
  - VAULTS LOCATED IN AREAS SUBJECT TO FLOODING SHALL HAVE SOLID CONCRETE FLOOR AND VENT (PER CMU STANDARD DETAILS) EXTENDING TO 2 FEET ABOVE 100 YEAR FLOOD ELEVATION - FRAME AND COVERS SHALL BE WATERTIGHT TYPE D/5 AND TYPE B/3.
  - ALL JOINTS SHALL BE MADE WATERTIGHT USING 2 RINGS OF BUTYL RUBBER JOINT MASTIC - SEE JOINT DETAIL.

NO SCALE

STANDARD NO. 1

VERSION NO. 1.2

VERSION DATE 10.22.2009

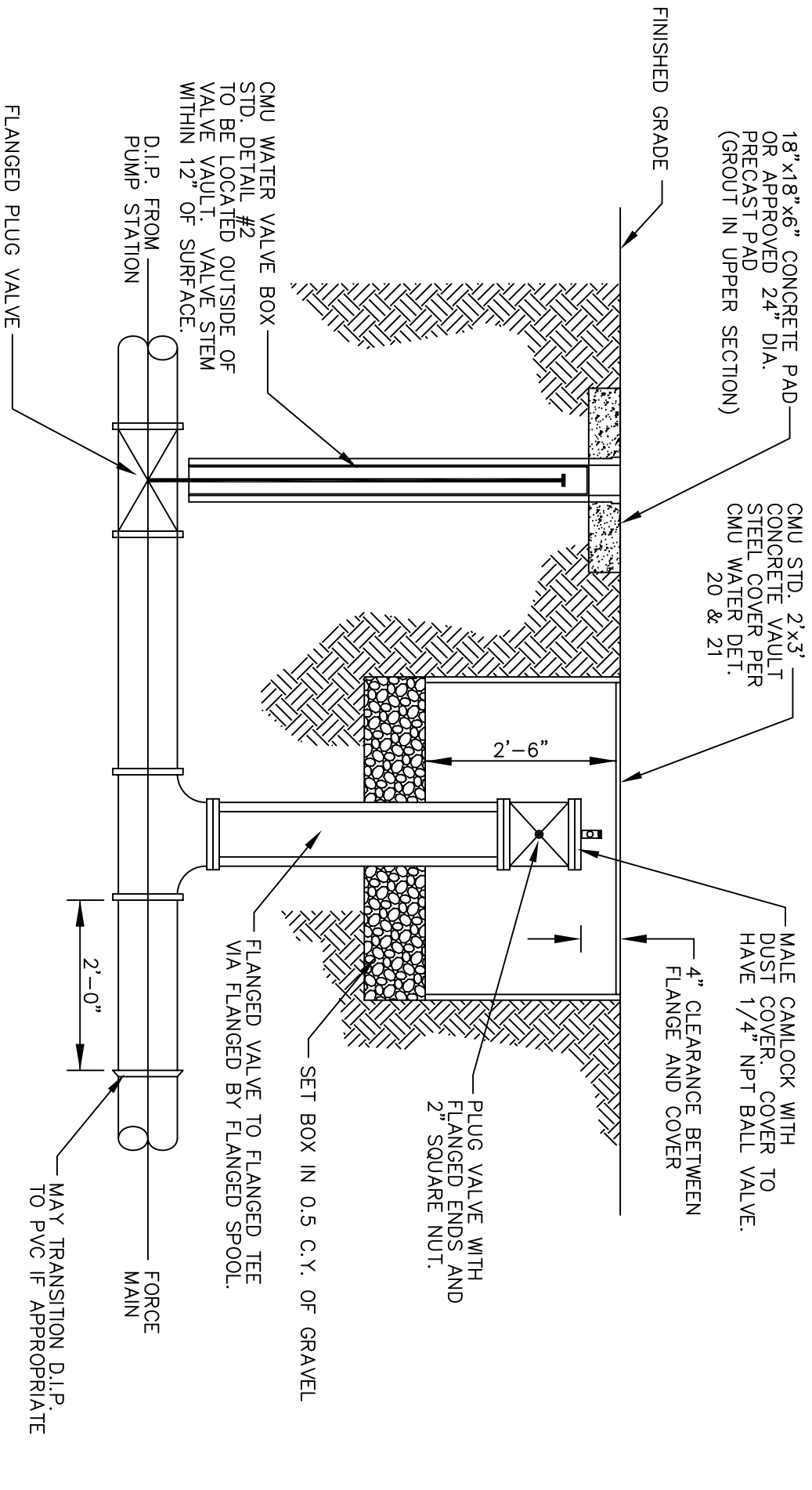
COMBINATION AIR AND VACUUM VALVE FOR SEWER FORCE MAINS

CHARLOTTE-MECKLENBURG UTILITIES

STANDARD DETAILS

SEWER PUMP STATION

CHARLOTTE



- NOTES:
1. CONTRACTOR TO FURNISH "T" - HANDLE VALVE KEY AND WRENCH FOR 2" NUT AS PERMANENT STATION EQUIPMENT.
  2. PUMP CONNECTIONS LARGER THAN 8" SHALL BE HOUSED IN VAULT SIZED AS REQUIRED FOR APPLICATION AS DETERMINED BY CMU.
  3. ALL VALVES OPEN LEFT.

CHARLOTTE-MECKLENBURG  
UTILITIES  
SYSTEM PROTECTION DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. \_\_\_\_\_ File No. \_\_\_\_\_  
Scale \_\_\_\_\_ N.T.S.  
PLAN  
PROFILE  
Hor. \_\_\_\_\_  
Vert. \_\_\_\_\_

As Built \_\_\_\_\_ Date \_\_\_\_\_  
EAB  
Designed By

B.I.W.  
Drawn By

EAB  
Project-Eng

Approved By

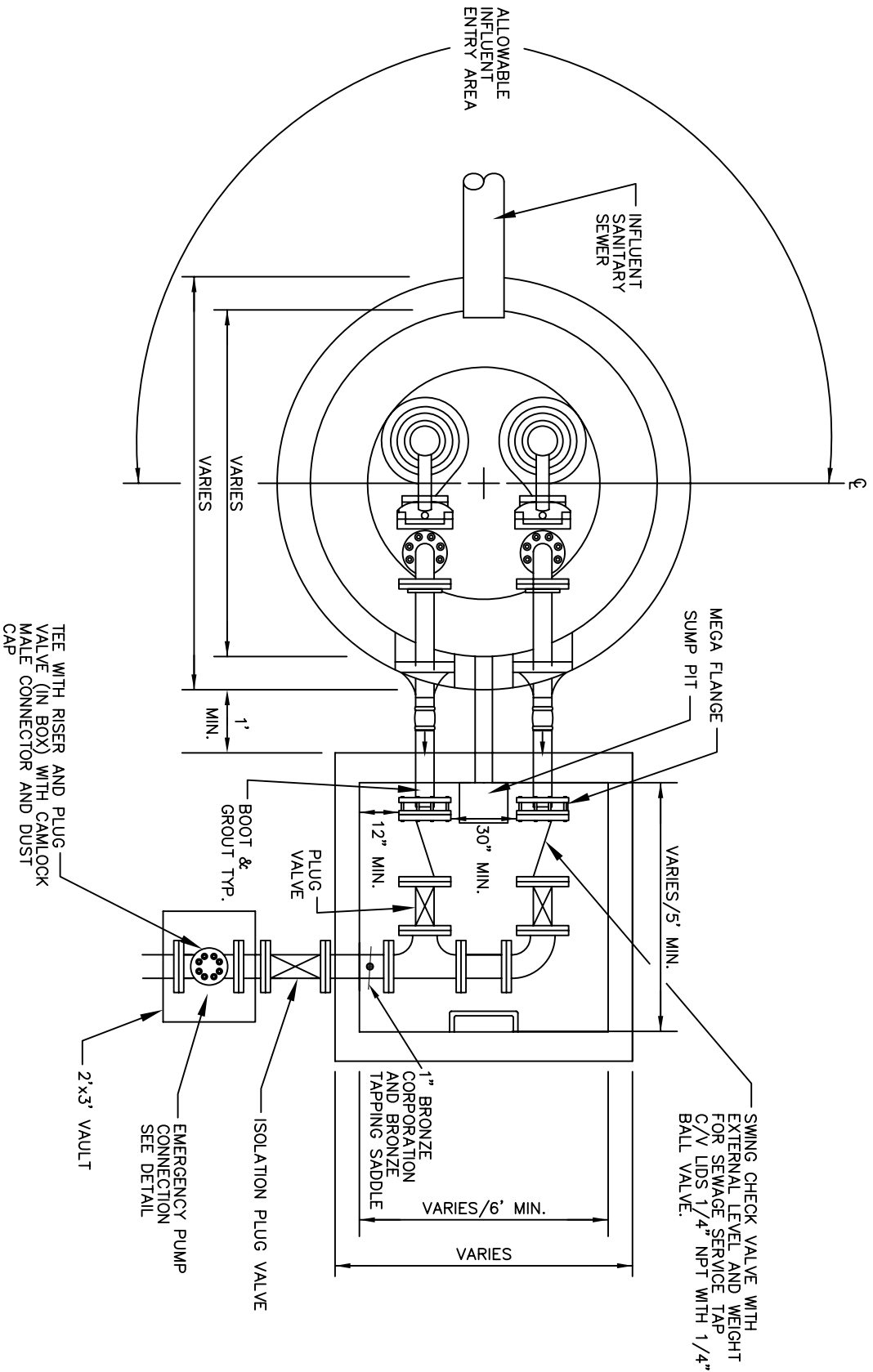
4/2003  
Date

STANDARD DETAIL  
SEWER PUMP STATION

EMERGENCY PUMP  
CONNECTION DETAIL  
UP TO 8-INCH

No.	Date	By	Revision





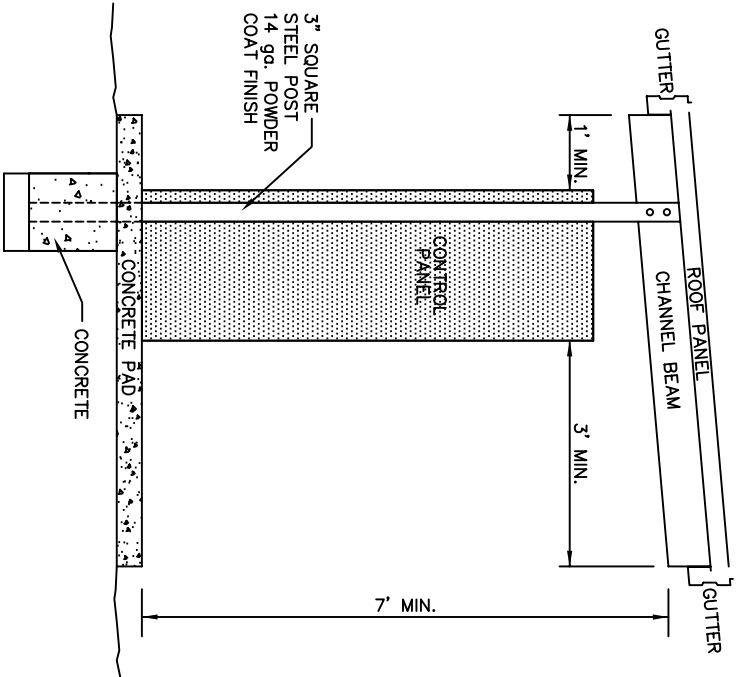
CHARLOTTE-MECKLENBURG  
UTILITIES  
SYSTEM PROTECTION DIVISION  
CHARLOTTE, NORTH CAROLINA

Job No. \_\_\_\_\_ File No. \_\_\_\_\_  
Scales \_\_\_\_\_  
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Hor. \_\_\_\_\_  
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As Built \_\_\_\_\_ Date \_\_\_\_\_

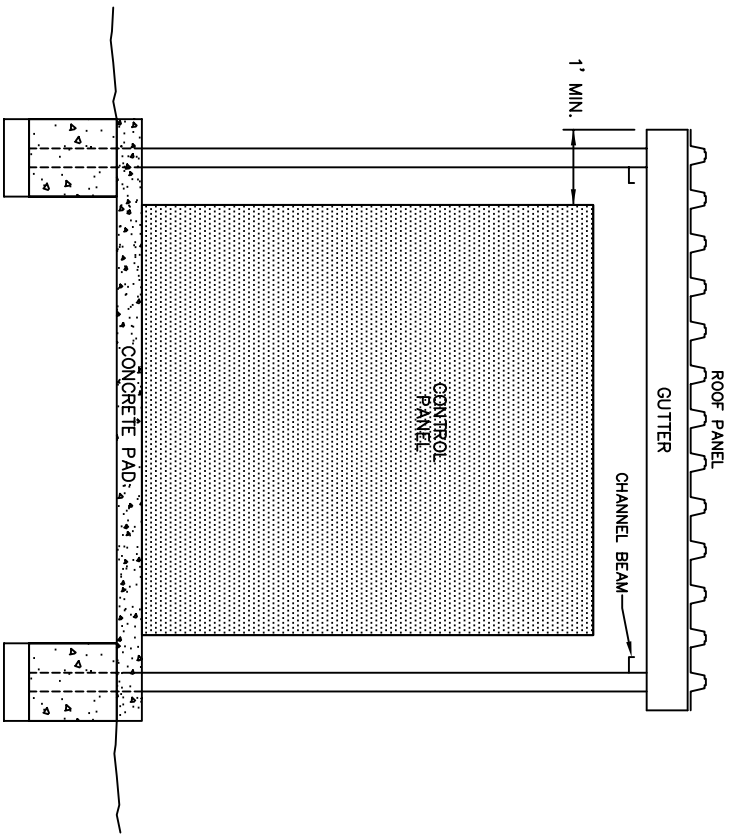
STANDARD DETAIL  
SEWER PUMP STATION  
SUBMERSIBLE STATION  
PLAN VIEW

No.	Date	By	Revision	Surveyed By	Designed By	Drawn By	EAB	Project-Eng'r	Approved By	4/2003	Sheet
						BJW				Date	4





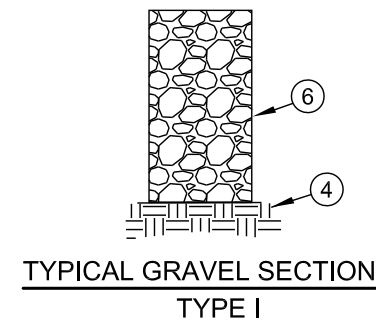
SIDE VIEW



FRONT VIEW

- NOTES:
1. STRUCTURE AND FOOTING SHALL BE DESIGNED TO WITHSTAND 100 MPH WIND LOAD.
  2. ROOF PANEL, CHANNEL BEAM AND GUTTERS SHALL BE OF ALUMINIUM.

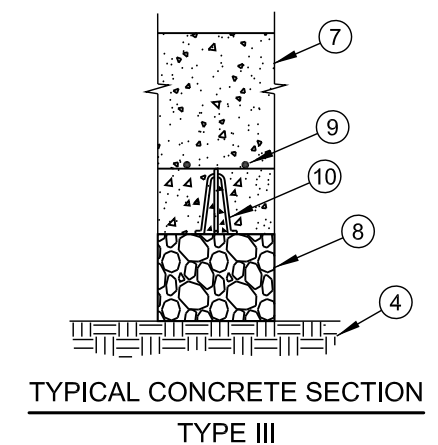
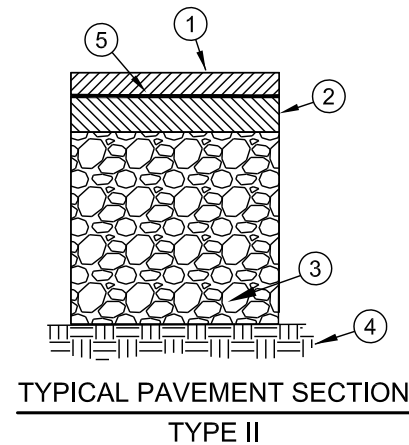
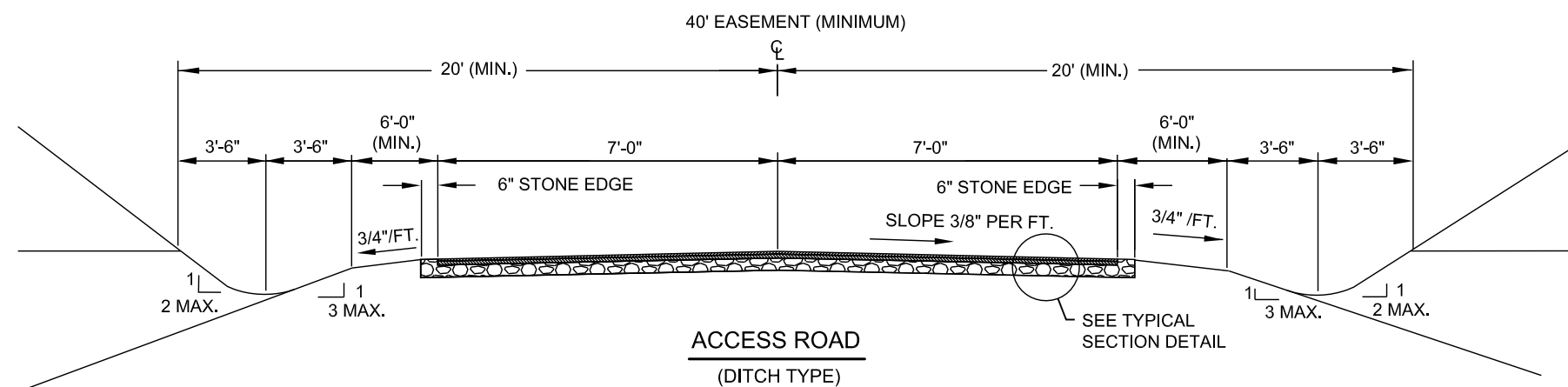
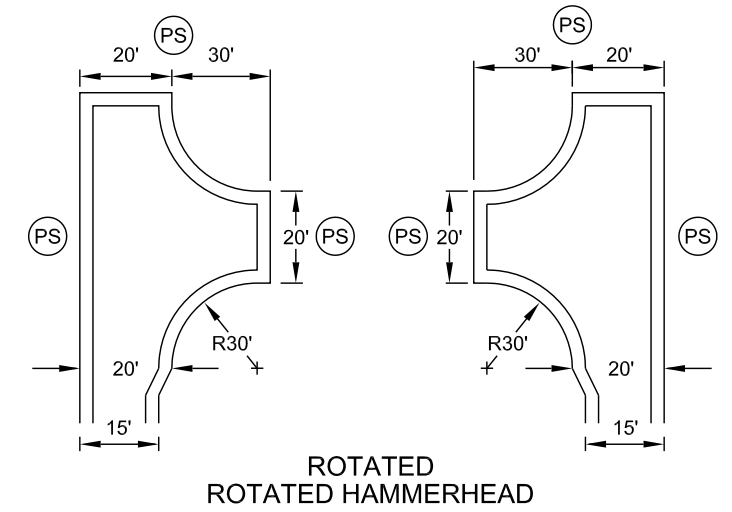
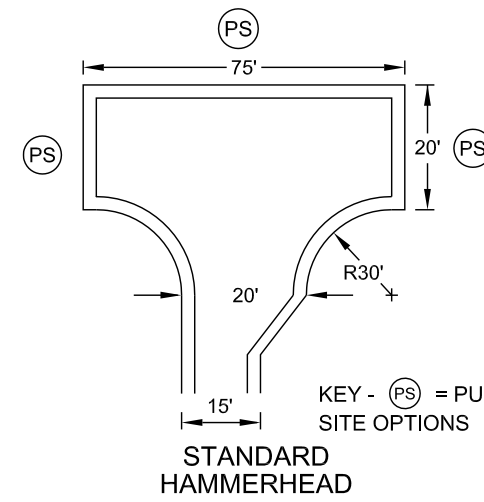
<p>CHARLOTTE-MECKLENBURG UTILITIES SYSTEM PROTECTION DIVISION CHARLOTTE, NORTH CAROLINA</p>									
<p>Job No. _____ File No. _____ Scales _____ PLAN N.T.S. PROFILE _____ Hor. _____ Vert. _____</p>					<p>STANDARD DETAIL SEWER PUMP STATION CONTROL PANEL SHELTER</p>				
As Built _____ Date _____		Surveyed By _____		Designed By _____		Drawn By _____		EAB Project-Eng'r Approved By _____	
						2/2004		Date	
								Sheet 6	



1. SURFACE COURSE 1" SF9.5A : FINAL LIFT TO BE APPLIED AFTER INITIAL PUMP START UP.
2. INTERMEDIATE COURSE: 1 1/2" S9.5B, SF9.5A - INSTALL PRIOR TO INITIAL PUMP START UP.
3. BASE COURSE: 8" COMPACTED AGGREGATE BASE COURSE, OR 4" BCBC TYPE B25.0B.
4. SUBGRADE: COMPACTED SUBGRADE 100% MAX. DRY DENSITY ( STANDARD PROCTOR ) - ASTM D698.
5. TACK COAT.
6. SURFACE COURSE - 8" COMPACTED AGGREGATE BASE COURSE. ( CABC )
7. SURFACE COURSE - 8" CONCRETE - f 'c 3600 PSI MINIMUM.
8. BASE COURSE - 4" COMPACTED AGGREGATE BASE COURSE. ( CABC )
9. WELDED WIRE FABRIC ( WWF ) - 6 x 6, W2.9 x W2.9.
10. 2" CHAIR, PLASTIC OR STEEL, SPACING PER MANUFACTURER'S REQUIREMENTS, OR AS NEEDED.
11. CONCRETE SIDEWALK.
12. GROOVE JOINT. ( TYP.)
13. 1/2" EXPANSION JOINT. ( TYP. )
14. STANDARD 2'-0" VALLEY GUTTER.
15. \* W = WIDTH OF PLANTING STRIP. (VARIES)

NOTES:

- A. SEE PUMP STATION SPECIFICATIONS FOR ADDITIONAL ACCESS ROAD DESIGN STANDARDS/REQUIREMENTS.
- B. TYPE II PAVEMENT SECTION REQUIRED WHEN ACCESS ROAD SLOPE IS BETWEEN 5% AND 10%.
- C. TYPE III CONCRETE SECTION REQUIRED WHEN EXISTING OR PLANNED ADJACENT DRIVEWAYS ARE CONCRETE.
- D. STORM WATER MAY NOT CROSS OVER ROADWAY - PROVIDE DRAINAGE FACILITIES AS NECESSARY.
- E. "A" BREAKOVER SHALL BE 7% OR LESS ( A = ALGEBRAIC DIFFERENCE ).



NO SCALE

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STANDARD NO.

## CONCLUSIONS

5

V10 1122

## ACCESS ROAD STANDARDS AND DETAILS

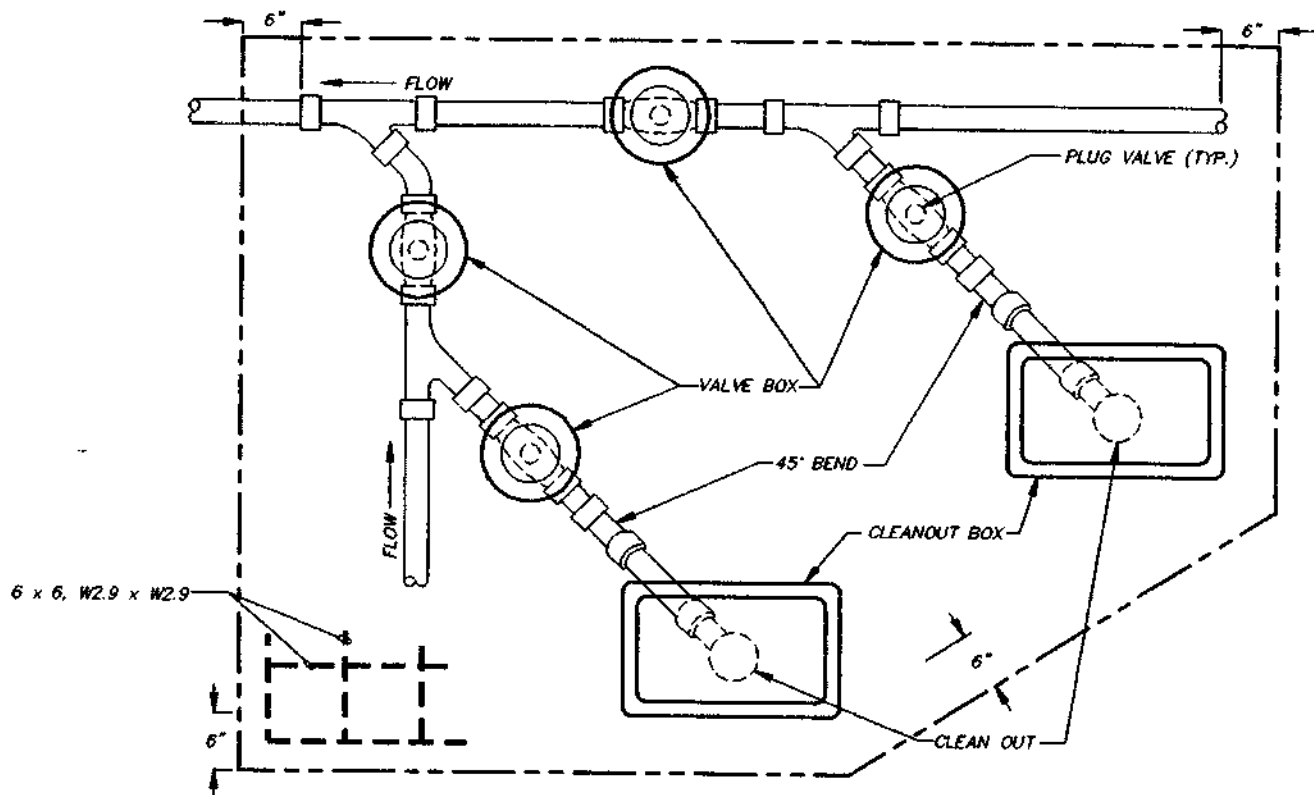
## CHARLOTTE-MECKLENBURG UTILITIES

# THE BIBLE

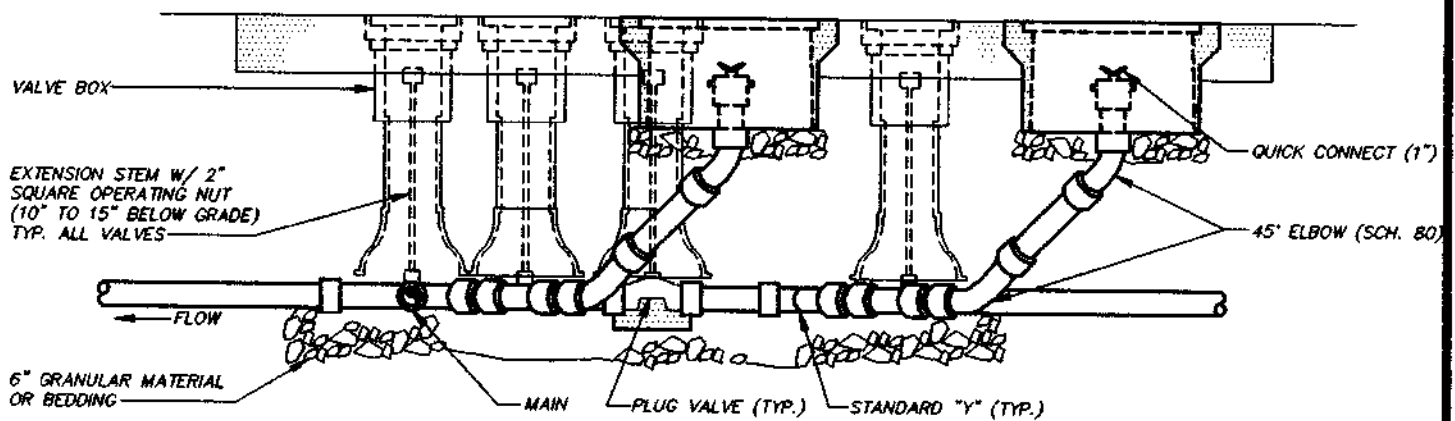


CHARLOTTE-MECKLENBURG SCHOOLS





PLAN VIEW



ELEVATION

**NOTES:**

CONCRETE PAD UNDER AND UP ON SIDES OF ALL VALVES TO PREVENT SETTLEMENT AND TWISTING OF VALVE.

CONCRETE PAD SHALL BE MIN. 6" THICK, 3600 PSI

DELETE CLEANOUTS UNLESS SHOWN IN PROFILE OR REQUIRED AT HIGH POINT FOR AIR RELEASE.

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

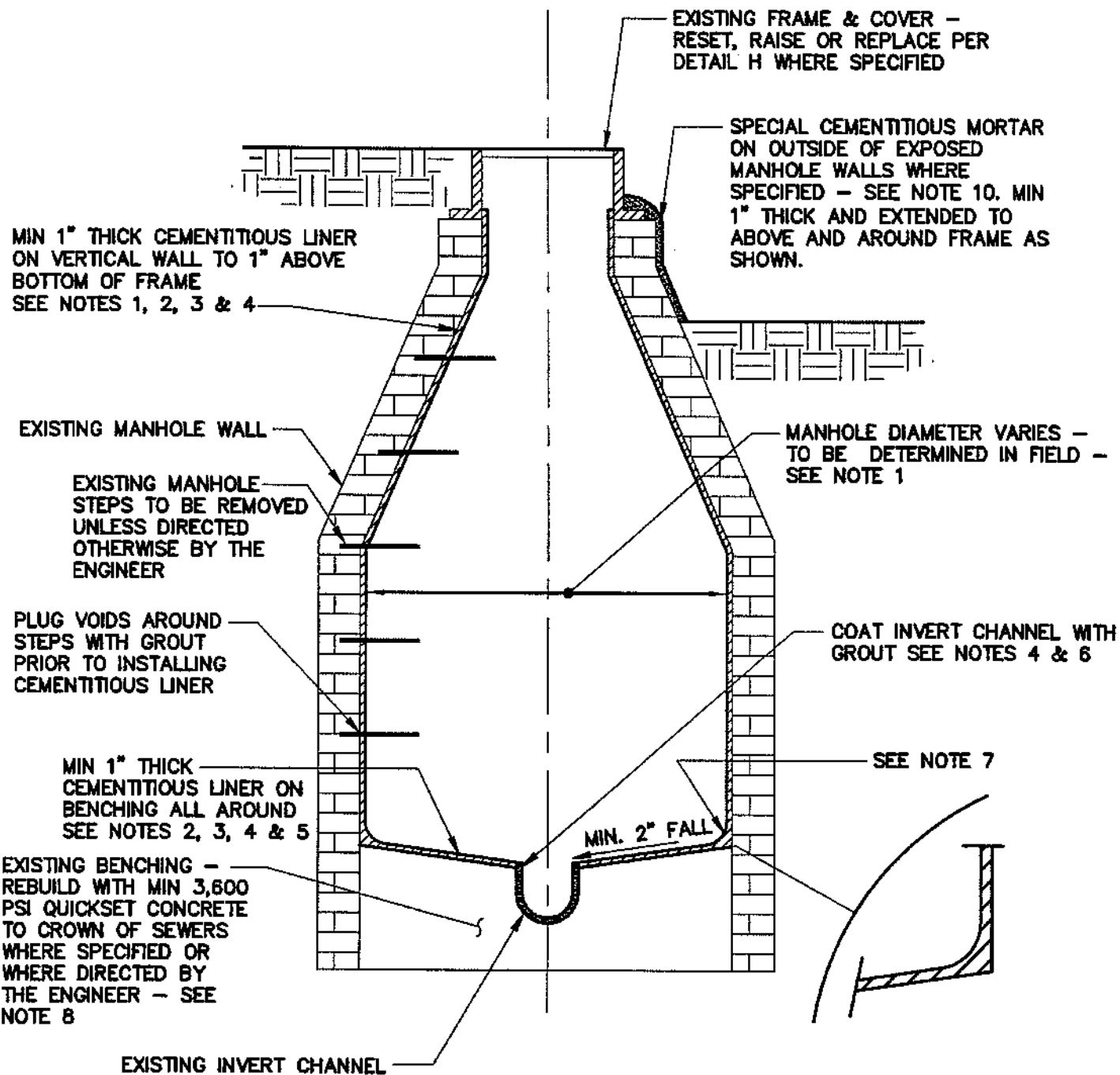
**STANDARD DETAIL  
PRESSURE SEWER**

**VALVE DETAIL  
AT INTERSECTION**

Job No.	File No.
PLAN	Scales NTS
PROFILE	Hor. _____
	Vert. _____
As Built	Date
Surveyed By	Designed By

KHP	Project-Engr	Approved By	Date	Sheet 1 of 1
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No.	Date	By	Revision



CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

REHABILITATION OF EXISTING MANHOLES  
(PAGE 1 OF 2)

No.	Date	By

Revision

NTS  
Scale

Approved By

DETAIL NO.  
A

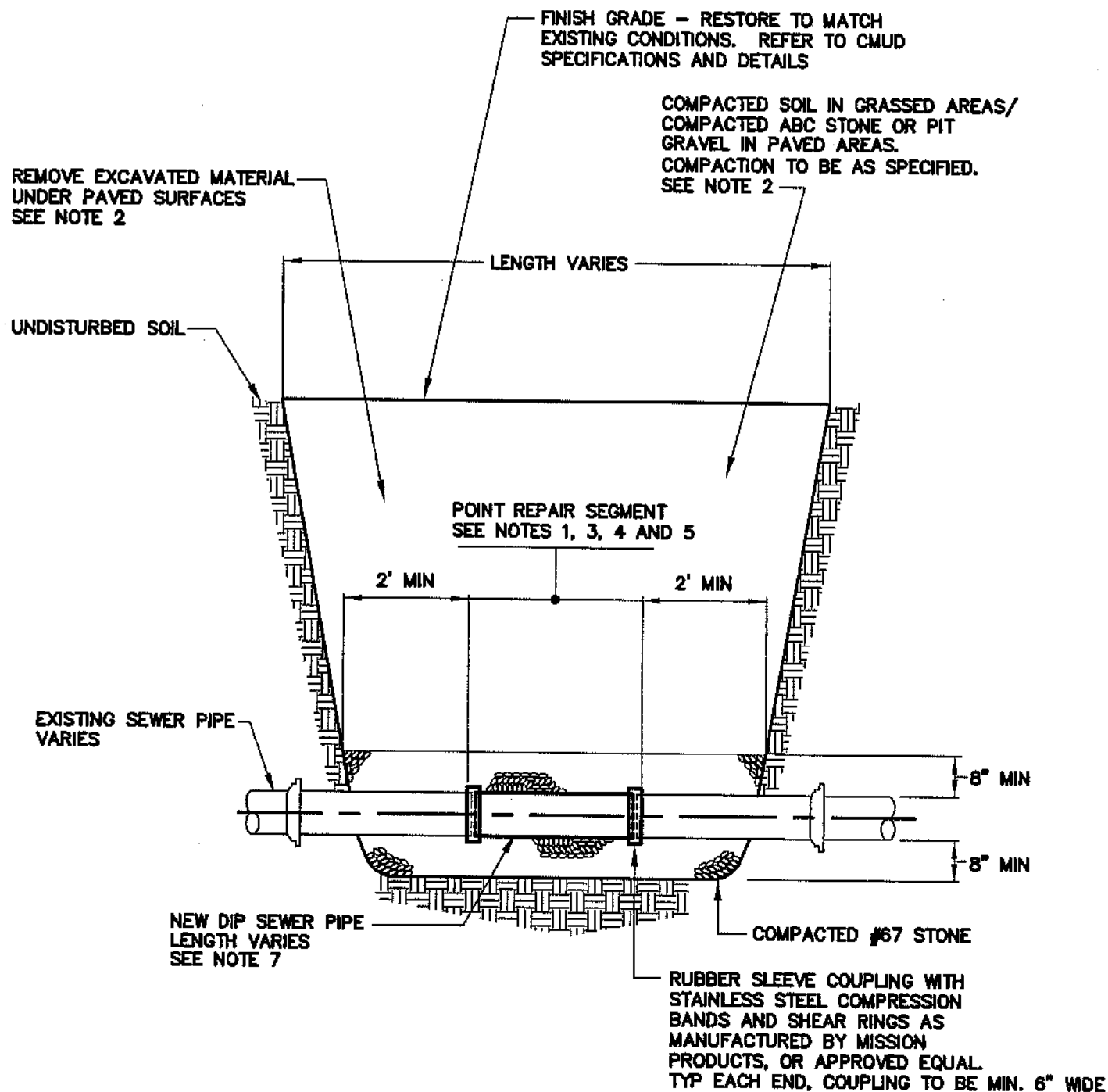
**NOTES:**

1. MANHOLE SHOWN IS A TYPICAL SHAPE. HOWEVER, MANHOLE SHAPES WILL VARY. CONTRACTOR SHALL DETERMINE ACTUAL SHAPE. UNIT PRICES BID SHALL COVER ANY SHAPE.
2. BID ITEMS ARE INCLUDED FOR COATING EXISTING 4-FOOT, 5-FOOT, AND 6-FOOT DIAMETER MANHOLES WITH ANY SPECIFIED MATERIAL AND WITH HYDROGEN-SULFIDE RESISTANT MATERIAL. THE ENGINEER WILL SPECIFY THE REQUIRED MATERIAL FOR EACH MANHOLE.
3. CEMENTITIOUS LINER SHALL NOT BE INSTALLED UNTIL ALL MAIN SEWER, SERVICE LATERAL WORK WITHIN THE MANHOLE, AND OTHER MANHOLE REHABILITATION WORK IS COMPLETED.
4. CONTRACTOR SHALL PROPERLY PREPARE SURFACE PRIOR TO LINING IN STRICT ACCORDANCE WITH THE LINING MANUFACTURER'S RECOMMENDATIONS AND THE SPECIFICATIONS. ALL MATERIAL REMOVED DURING THE PREPARATORY WORK INCLUDING PRESSURE CLEANING SHALL BE REMOVED FROM THE MANHOLE AND DISPOSED OF OFFSITE - NO MATERIAL SHALL BE ALLOWED TO ENTER THE SEWERS. IN ADDITION, NO CHEMICALS USED FOR CLEANING OR OTHER OPERATIONS SHALL BE ALLOWED TO ENTER THE SEWER. CEMENTITIOUS LINING SHALL BE MONOLITHICALLY SPRAY APPLIED IN ONE PASS AND TROWELED SMOOTH AFTER APPLICATION.  
CONTRACTOR SHALL PROVIDE BYPASS PUMPING AS REQUIRED WHILE REHABILITATING MANHOLES. BYPASS PUMPING MUST BE PERFORMED WHEN COATING THE INVERT CHANNELS WITH GROUT. NO MATERIAL SHALL BE ALLOWED TO ENTER THE SEWERS.
5. PROVIDE ADDITIONAL CEMENTITIOUS MATERIAL AS NECESSARY TO PROVIDE A MINIMUM 2" FALL FROM THE MANHOLE WALL TO THE INVERT CHANNEL. ANY AND ALL ADDITIONAL CEMENTITIOUS MATERIAL REQUIRED TO PROVIDE THE 2" FALL SHALL BE INCIDENTAL TO THE WORK AND SHALL BE INCLUDED IN THE UNIT PRICE BID FOR THE CEMENTITIOUS COATING. THE CONTRACTOR IS ADVISED THAT MOST OF THE EXISTING BENCHES ARE FLAT. PROVIDE CHANNEL IN BENCHING FOR SEWERS ENTERING MANHOLES ABOVE BENCHING. CHANNEL TO PROVIDE SMOOTH TRANSITION TO MAIN INVERT CHANNEL.
6. COAT INVERT CHANNELS WITH A QUICKSET NON-SHRINK GROUT TO PROVIDE A CONSTANT SLOPE BETWEEN INLET AND OUTLET SEWERS WHEN SPECIFIED/REQUIRED BY THE ENGINEER. PROVIDE ADDITIONAL MATERIAL AS NECESSARY TO PROVIDE A UNIFORM INVERT CHANNEL THROUGH THE MANHOLE. THE WIDTH OF THE UNIFORM CHANNEL SHALL BE EQUAL TO THE INCOMING AND OUTGOING PIPE DIAMETERS. THE FINISHED CHANNEL SHALL BE SMOOTH AND FREE OF BURRS THAT WILL CATCH TOILET PAPER, DEBRIS, RAGS, ETC. SEE NOTE 8.
7. AT WALL/BENCH INTERFACE, INSTALL ADDITIONAL CEMENTITIOUS MATERIAL TO PROVIDE A SMOOTH TRANSITION FROM THE WALL TO THE BENCH AS SHOWN. MATERIAL SHALL BE MONOLITHICALLY APPLIED WITH THE WALL AND BENCH MATERIAL.
8. THE ENGINEER WILL SPECIFY MANHOLE BENCHES AND INVERT CHANNELS THAT ARE REQUIRED TO BE RE-BUILT. THE ENGINEER WILL DETERMINE SUCH WORK BASED ON MANHOLE INSPECTIONS. RE-BUILDING MAY BE REQUIRED IF THERE IS NO BENCHING, AND NO DEFINED INVERT CHANNEL OR IF THE EXISTING INVERT CHANNEL IS MORE THAN 6 INCHES WIDER THAN THE INCOMING AND OUTGOING PIPE DIAMETERS. EXISTING INVERT CHANNELS THAT ARE LESS THAN 6 INCHES WIDER THAN THE INCOMING/OUTGOING PIPE DIAMETERS SHALL BE NARROWED TO PROVIDE A UNIFORM CHANNEL PER NOTE 8 AS PART OF THE MANHOLE REHABILITATION WORK AND AT NO ADDITIONAL COST. BENCHES AND INVERTS SHALL BE IN ACCORDANCE WITH CMUD STANDARD SPECIFICATIONS AND DETAILS. SEE NOTE 6.
9. ALL REHABILITATED MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH ASTM C-1244 EXCEPT THAT THE MINIMUM TEST TIME SHALL BE 1 MINUTE. VACUUM TESTING SHALL BE PERFORMED AFTER ALL MANHOLE REHABILITATION WORK IS COMPLETE. TESTING SHALL INCLUDE VACUUM TESTING THE FRAME-CHIMNEY INTERFACE. CONTRACTOR TO PERFORM ALL MANHOLE REHABILITATION WORK NECESSARY IN ORDER TO PASS THE VACUUM TEST. THE CONTRACTOR SHALL REPAIR ALL LEAKS AND SHALL RE-TEST MANHOLES THAT FAIL THE VACUUM TEST REGARDLESS OF THE REASON FOR THE FAILURE (INCLUDING LEAKS AT THE FRAME-CHIMNEY SEAL) AT NO ADDITIONAL COST TO THE OWNER.
10. THE ENGINEER WILL SPECIFY MANHOLES TO RECEIVE AN EXTERIOR COATING OF MORTAR. THE MORTAR SHALL BE SPECIALLY DESIGNED FOR INSTALLATION ON VERTICAL, EXPOSED SURFACES AS RECOMMENDED BY THE MORTAR MANUFACTURER. THE MORTAR SHALL BE USED TO REPAIR BROKEN OR CRACKED MORTAR AND TO PATCH HOLES IN EXPOSED WALLS. ALL OLD, CRACKED MORTAR SHALL BE COMPLETELY REMOVED AND THE SUBSTRATE SURFACE SHALL BE CLEAN AND DRY PRIOR TO INSTALLING NEW, 1-INCH THICK MORTAR. MORTAR TO BE HB2 REPAIR MORTAR BY THOROC, SIKATOP 123 BY SIKA CORPORATION OR APPROVED EQUAL.

CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

REHABILITATION OF EXISTING MANHOLES  
(PAGE 2 OF 2)

				NTS			DETAIL NO.
No.	Date	By	Revision	Scale	Approved By		A



CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

TYPICAL POINT REPAIR  
(PAGE 1 OF 2)

No.	Date	By	Revision	NTS Scale	Approved By	DETAIL NO. B

**NOTES:**

1. THE SEQUENCE OF WORK FOR PERFORMING POINT REPAIRS SHALL BE AS FOLLOWS:
  - A. BYPASS PUMP FLOWS AROUND POINT REPAIR SEGMENT.
  - B. EXCAVATE TO 8" BELOW EXISTING SEWER.
  - C. NEATLY CUT EXISTING SEWER AT EACH END OF POINT REPAIR AND REMOVE EXISTING SEWER COMPLETELY.
  - D. INSTALL #67 STONE TO SEWER INVERT ELEVATION AND COMPACT.
  - E. INSTALL NEW DIP SEWER AT A CONSTANT SLOPE BETWEEN THE TWO EXISTING PIPE ENDS. CONNECT THE NEW SEWER TO THE EXISTING WITH RUBBER SLEEVE COUPLINGS. REMOVE STONE BEDDING AS REQUIRED TO INSTALL PIPE AND COUPLINGS AND FILL VOIDS UNDER PIPE WITH STONE.
  - F. RETURN FLOW THROUGH PIPE.
  - G. BACKFILL AND COMPACT AS SHOWN.
2. UNDER PAVED SURFACES ONLY, CONTRACTOR SHALL REMOVE EXCAVATED SOIL AND DISPOSE OF IT OFFSITE. CONTRACTOR SHALL IMPORT ABC STONE OR PIT GRAVEL FOR BACKFILLING FROM TOP OF #67 STONE TO PAVEMENT SUBGRADE. PAYMENT FOR ABC STONE OR PIT GRAVEL SHALL BE BASED ON THE LENGTH OF POINT REPAIR. ALL COSTS OF THIS WORK SHALL BE INCLUDED IN THE UNIT PRICES BID.
3. SERVICE LATERALS LOCATED WITHIN POINT REPAIR SEGMENTS SHALL BE CONNECTED TO NEW SEWER WITH A DIP TEE. REFER TO DETAIL F.
4. LENGTH OF POINT REPAIR WILL BE DETERMINED BY THE CONTRACTOR AND/OR THE ENGINEER AFTER REVIEWING THE TELEVISION INSPECTION TAPES AND LOGS. THE CONTRACTOR SHALL EXTEND POINT REPAIRS IN THE FIELD AS NECESSARY AND APPROVED BY THE ENGINEER TO CONNECT TO SOLID PIPE.
5. THE CONTRACTOR SHALL USE A TRENCH BOX OR SHEETING AND SHORING IN ACCORDANCE WITH OSHA REGULATIONS TO SUPPORT THE TRENCH WALLS DURING THIS WORK. THE CONTRACTOR WILL NOT BE ALLOWED TO SLOPE TRENCH WALLS.
6. REFER TO DETAIL E FOR CONNECTING TO MANHOLES.
7. ALL PIPE USED FOR POINT REPAIRS SHALL BE DUCTILE IRON PIPE (DIP).

CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

TYPICAL POINT REPAIR  
(PAGE 2 OF 2)

				NTS			DETAIL NO.
No.	Date	By	Revision	Scale	Approved By		B

STEEL VENT PIPE WHEN SPECIFIED - HEIGHT TO BE SPECIFIED BY ENGINEER - SEE NOTE 9

VENT PIPE OPENING

FLAT-TOP MANHOLE SECTION  
SEE NOTE 7

24" OR 30" CAM-LOCK WATERTIGHT  
FRAME AND COVER - FRAME CAST  
INTO FLAT-TOP SECTION  
SEE NOTE 8

150# SLIP-ON TYPE  
WELDING FLANGES (TYP)  
SEE NOTE 9

VENT PIPE STUB-OUT  
SEE NOTE 9

3/4" CHAMFER ALL AROUND

GROUT ALL OUTSIDE JOINTS  
ABOVE GRADE WITH  
NON-SHRINK GROUT

SEE NOTE 5

FINISHED GRADE

12" TYP

MAX 24"

12" TYP

NEW RISER SECTIONS - HEIGHT VARIES  
SEE NOTE 5

MIN 8" WIDE BUTYL  
RUBBER SEAL ON ALL  
BELOW-GRADE JOINTS

CONCRETE COLLAR ALL AROUND  
JOINT - SEE NOTE 6

REMOVE EXIST MH  
SEE NOTES 3 AND 4

EXISTING MANHOLE STEPS  
WHERE APPLICABLE

FILL INSIDE JOINT WITH  
NON-SHRINK GROUT  
SEE NOTE 6

EXISTING MANHOLE WALL  
SEE NOTE 2

INSTALL 2 PIECES BUTYL  
RUBBER UNDER RISER  
SECTION WHERE POSSIBLE -  
SEE NOTE 8

EXISTING BENCHING

MANHOLE DIAMETER VARIES  
- CONTRACTOR TO  
DETERMINE IN FIELD SEE  
NOTE 3

CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

REHABILITATION OF MANHOLE WALLS  
AND TOP SECTION  
(PAGE 1 OF 2)

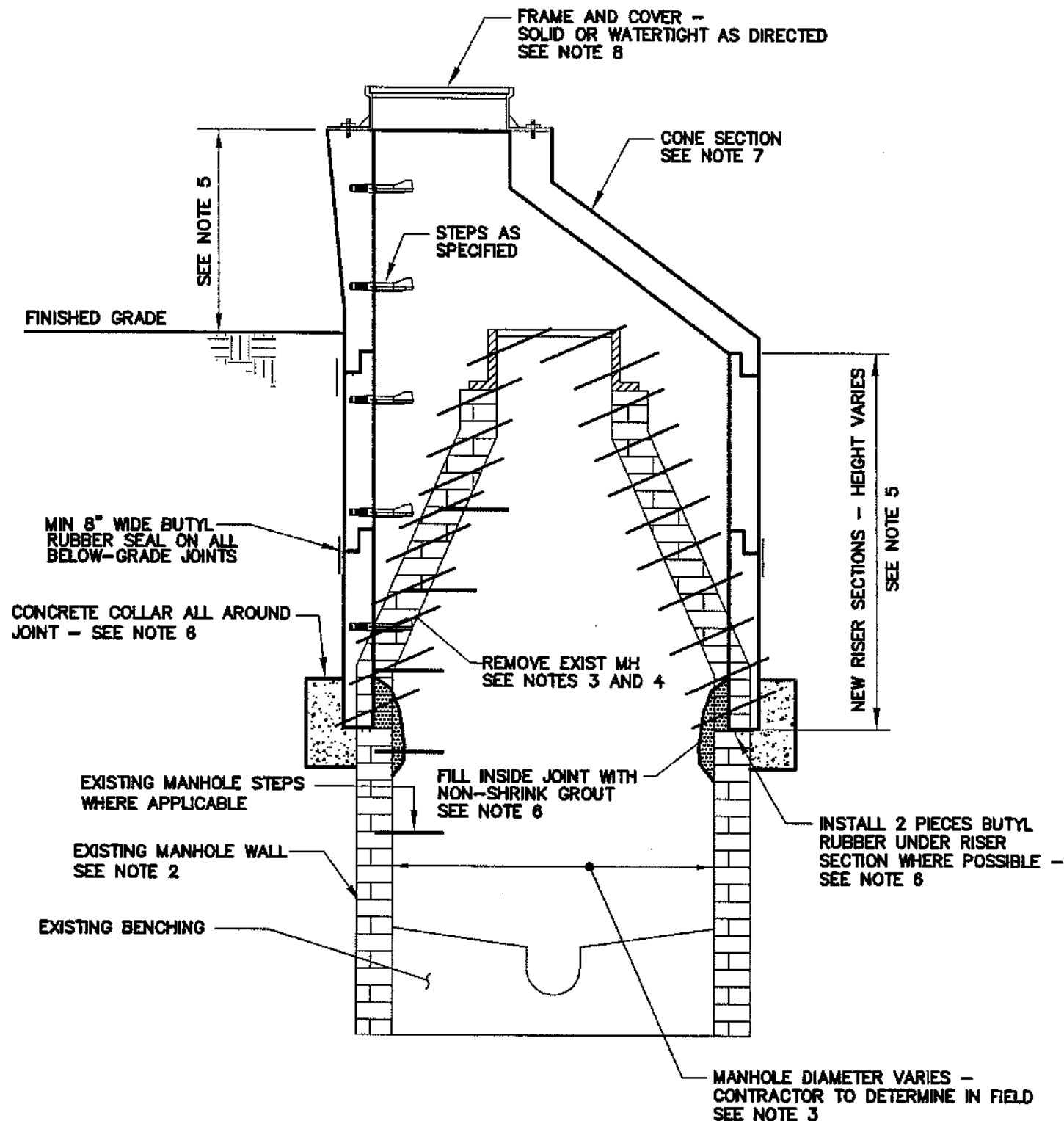
No.	Date	By	Revision

NTS			DETAIL NO.
Scale	Approved By		C

**NOTES:**

1. WORK SPECIFIED IN THIS DETAIL SHALL BE PAID UNDER BID ITEM 6. ALL WORK AND MATERIALS TO BE IN ACCORDANCE WITH CMUD'S STANDARD SPECIFICATIONS AND DETAILS.
2. THIS DETAIL DEPICTS AN EXISTING BRICK MANHOLE WITH A TYPICAL CHIMNEY SECTION. SOME MANHOLES MAY BE PRECAST CONCRETE WITH CONE SECTIONS.
3. CONTRACTOR TO MEASURE THE INSIDE DIAMETER OF EXISTING MANHOLE TO SELECT APPROPRIATE DIAMETER OF NEW RISERS.
4. CONTRACTOR TO REMOVE EXISTING WALLS TO SOLID STRUCTURE (TO AT LEAST BELOW THE CONE OR CHIMNEY SECTION) OR TO THE SPECIFIED LOCATION. THE LIMITS OF REMOVAL SHALL BE APPROVED BY THE ENGINEER IN THE FIELD. CONTRACTOR TO ALSO REMOVE EXISTING FRAMES AND COVERS, VENT PIPES AND ALL APPURTENANCES, STEPS, ETC. CONTRACTOR TO DISPOSE OF ALL MATERIALS OFF-SITE.  
NO DEBRIS SHALL BE DROPPED INTO THE SEWER. IF DEBRIS ENTERS THE SEWER, THE CONTRACTOR WILL BE REQUIRED TO CLEAN THE SEWER AT NO ADDITIONAL COST TO THE OWNER.
5. CONTRACTOR TO INSTALL NEW RISER SECTIONS AS NECESSARY TO EXTEND THE MANHOLE TO THE SPECIFIED/APPROVED ELEVATION. ENGINEER SHALL APPROVE FINAL ELEVATIONS IN THE FIELD. BOTTOM RISER TO BE PROVIDED WITH A FLAT JOINT UNLESS OTHERWISE APPROVED.
6. CONTRACTOR TO SEAL NEW RISER SECTION/EXISTING WALL JOINT TO PROVIDE A LEAK-TIGHT JOINT. THE CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO PROVIDE A LEAK-TIGHT SEAL. WHERE POSSIBLE, BUTYL RUBBER SEALANT SHALL BE PROVIDED UNDER THE NEW RISER SECTION. IN ALL CASES, A CONCRETE COLLAR SHALL BE POURED AROUND THE JOINT. COLLAR TO BE MINIMUM 6 INCHES WIDE AND 12 INCHES HIGH CENTERED ON JOINT ALL AROUND.  
ON THE INSIDE OF THE JOINT, CONTRACTOR TO SEAL JOINT WITH NON-SHRINK GROUT. GROUT TO COMPLETELY FILL JOINT AND SHALL EXTEND AT LEAST 6 INCHES EACH SIDE OF JOINT ALL AROUND. GROUT TO BE TAPERED TO THE EXISTING WALL SECTION BELOW THE JOINT. GROUT TO BE RESISTANT TO HYDROGEN-SULFIDE.
7. NEW FLAT-TOP SECTIONS TO BE INSTALLED ON TOP OF NEW RISER SECTIONS UNLESS SPECIFIED OTHERWISE. FRAMES TO BE CAST INTO FLAT-TOP - SEE NOTE 8. IN SOME INSTANCES, THE ENGINEER MAY SPECIFY THAT A STANDARD CONE SECTION BE INSTALLED INSTEAD OF A FLAT-TOP.
8. FOR FLAT-TOPS, ALL FRAMES SHALL BE CAST INTO THE FLAT-TOP SECTION UNLESS OTHERWISE SPECIFIED. FOR CONE SECTIONS, FRAMES SHALL BE BOLTED TO THE CONE. ALL COVERS SHALL BE CAM-LOCK WATERTIGHT COVERS UNLESS OTHERWISE SPECIFIED/APPROVED.  
24-INCH-DIAMETER FRAMES/COVERS SHALL BE PROVIDED ON MANHOLES FOR SEWERS 24" AND SMALLER. 30-INCH-DIAMETER FRAMES/COVERS SHALL BE PROVIDED ON MANHOLES FOR SEWERS LARGER THAN 24". THE 24" AND 30" CAM-LOCK FRAMES/COVERS SHALL BE AS MANUFACTURED BY EAST JORDAN IRON WORKS, US FOUNDRY, OR APPROVED EQUAL.
9. WHERE SPECIFIED, FLAT TOP SECTIONS SHALL BE FURNISHED WITH THE VENT PIPE CAST INTO THE TOP SECTION. SEE CMU STANDARD SPECIFICATIONS AND DETAILS.  
IF A VENT PIPE IS SPECIFIED, FURNISH VENT PIPE TO THE SPECIFIED HEIGHT (HEIGHT TO VENT OPENING) PER CMU STANDARD SPECIFICATIONS AND DETAILS.

				<b>CHARLOTTE-MECKLENBURG UTILITIES</b> <b>CHARLOTTE, NORTH CAROLINA</b>			
				<b>REHABILITATION OF MANHOLE WALLS</b> <b>AND TOP SECTION</b> (PAGE 2 OF 2)			
				NTS			DETAIL NO.
No.	Date	By	Revision	Scale	Approved By		C



CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

REHABILITATION OF MANHOLE WALLS  
AND TOP SECTION (WITH CONE SECTION)  
(PAGE 1 OF 2)

No.	Date	By	Revision	NTS Scale	Approved By	DETAIL NO. D
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**NOTES:**

1. ALL WORK AND MATERIALS TO BE IN ACCORDANCE WITH CMU's STANDARD SPECIFICATIONS AND DETAILS.
2. THIS DETAIL DEPICTS AN EXISTING BRICK MANHOLE WITH A TYPICAL CHIMNEY SECTION. SOME MANHOLES MAY BE PRECAST CONCRETE WITH CONE SECTIONS.
3. CONTRACTOR TO MEASURE THE INSIDE DIAMETER OF EXISTING MANHOLE TO SELECT APPROPRIATE DIAMETER OF NEW RISERS.

4. CONTRACTOR TO REMOVE EXISTING WALLS TO SOLID STRUCTURE (TO AT LEAST BELOW THE CONE OR CHIMNEY SECTION) OR TO THE SPECIFIED LOCATION. THE LIMITS OF REMOVAL SHALL BE APPROVED BY THE ENGINEER IN THE FIELD. CONTRACTOR TO ALSO REMOVE EXISTING FRAMES AND COVERS, VENT PIPES AND ALL APPURTENANCES, STEPS, ETC. CONTRACTOR TO DISPOSE OF ALL MATERIALS OFF--SITE.

NO DEBRIS SHALL BE DROPPED INTO THE SEWER. IF DEBRIS ENTERS THE SEWER, THE CONTRACTOR WILL BE REQUIRED TO CLEAN THE SEWER AT NO ADDITIONAL COST TO THE OWNER.

5. CONTRACTOR TO INSTALL NEW RISER AND CONE SECTIONS AS NECESSARY TO EXTEND THE MANHOLE TO THE SPECIFIED/APPROVED ELEVATION. THE FINAL ELEVATION MAY BE HIGHER THAN, LOWER THAN OR EQUAL TO THE EXISTING ELEVATION. THIS DETAIL ILLUSTRATES A HIGHER ELEVATION. THE CONTRACTOR SHALL DETERMINE THE REQUIRED RISER AND CONE HEIGHTS TO MEET THE SPECIFIED ELEVATION. ENGINEER SHALL APPROVE FINAL ELEVATIONS IN THE FIELD. BOTTOM RISER TO BE PROVIDED WITH A FLAT JOINT UNLESS OTHERWISE APPROVED.

6. CONTRACTOR TO SEAL NEW RISER SECTION/EXISTING WALL JOINT TO PROVIDE A LEAK--TIGHT JOINT. THE CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO PROVIDE A LEAK--TIGHT SEAL. WHERE POSSIBLE, BUTYL RUBBER SEALANT SHALL BE PROVIDED UNDER THE NEW RISER SECTION. IN ALL CASES, A CONCRETE COLLAR SHALL BE POURED AROUND THE JOINT. COLLAR TO BE MINIMUM 6 INCHES WIDE AND 12 INCHES HIGH CENTERED ON JOINT ALL AROUND.

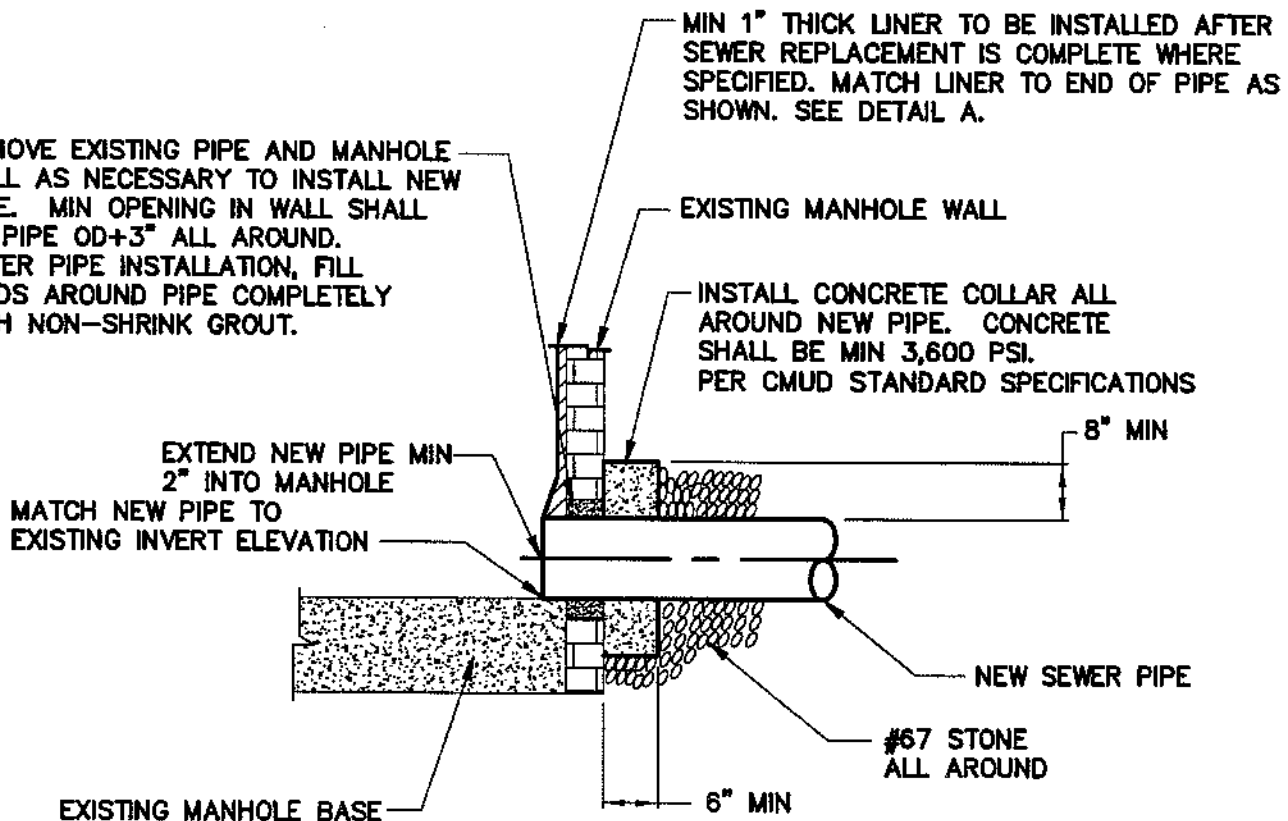
ON THE INSIDE OF THE JOINT, CONTRACTOR TO SEAL JOINT WITH NON--SHRINK GROUT. GROUT TO COMPLETELY FILL JOINT AND SHALL EXTEND AT LEAST 6 INCHES EACH SIDE OF JOINT ALL AROUND. GROUT TO BE TAPERED TO THE EXISTING WALL SECTION BELOW THE JOINT. GROUT TO BE RESISTANT TO HYDROGEN--SULFIDE.

7. NEW CONE SECTIONS TO BE INSTALLED ON TOP OF NEW RISER SECTIONS UNLESS SPECIFIED OTHERWISE. FRAMES TO BE BOLTED ONTO CONE SECTIONS PER CMU's STANDARD DETAILS AND DETAIL G. REFER TO DETAIL G FOR ALL WORK IN PAVED AREAS. SEE NOTE 8.

8. COVERS SHALL BE CAM--LOCK WATERTIGHT COVERS OR SOLID COVERS AS DIRECTED BY THE ENGINEER. CAM--LOCK WATERTIGHT FRAMES/COVERS SHALL BE AS MANUFACTURED BY EAST JORDAN IRON WORKS, US FOUNDRY, OR APPROVED EQUAL.

				<b>CHARLOTTE--MECKLENBURG UTILITIES</b> <b>CHARLOTTE, NORTH CAROLINA</b>			
				<b>REHABILITATION OF MANHOLE WALLS</b> <b>AND TOP SECTION (WITH CONE SECTION)</b> (PAGE 2 OF 2)			
				NTS			DETAIL NO.
No.	Date	By	Revision	Scale	Approved By		<b>D</b>

REMOVE EXISTING PIPE AND MANHOLE WALL AS NECESSARY TO INSTALL NEW PIPE. MIN OPENING IN WALL SHALL BE PIPE OD+3" ALL AROUND. AFTER PIPE INSTALLATION, FILL VOIDS AROUND PIPE COMPLETELY WITH NON-SHRINK GROUT.



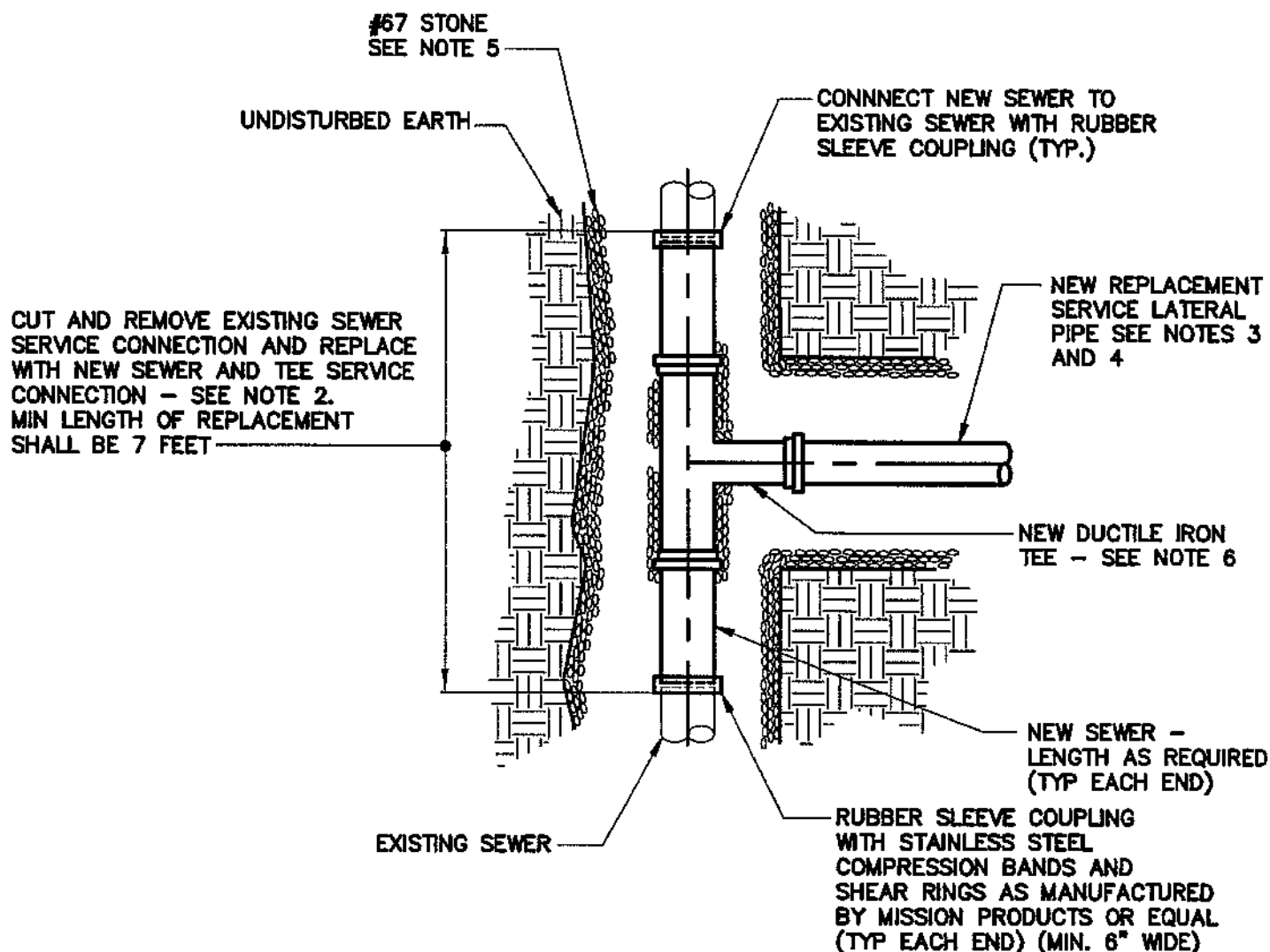
**NOTES:**

1. CONTRACTOR SHALL REFER TO THIS DETAIL WHEN CONNECTING NEW SEWER PIPES TO EXISTING OR NEW MANHOLES. THE NEW PIPES MAY BE INSTALLED FOR A POINT REPAIR, PIPE REPLACEMENT, PIPE BURSTING, OR SERVICE LATERAL REPLACEMENT.

No.	Date	By

Revision

CHARLOTTE-MECKLENBURG UTILITIES CHARLOTTE, NORTH CAROLINA			
NEW PIPE CONNECTION AT MANHOLE			
NTS			DETAIL NO.
Scale	Approved By		E



CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

SERVICE LATERAL REPLACEMENT  
(PAGE 1 OF 2)

No.	Date	By

Revision

NTS  
Scale

Approved By

DETAIL NO.  
F

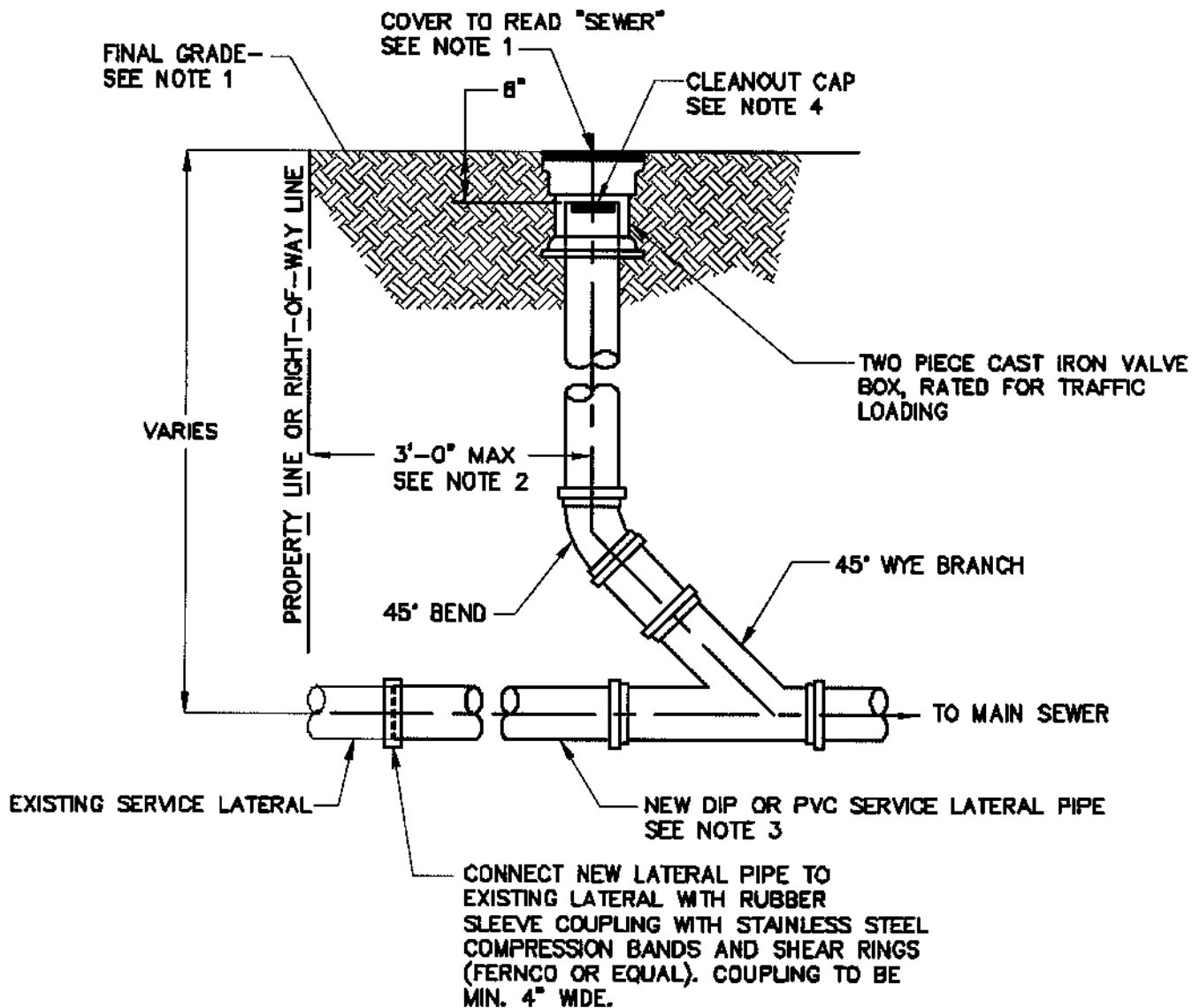
**NOTES:**

1. REPLACE EXISTING SERVICE LATERALS WHERE SPECIFIED BY THE ENGINEER. REPLACEMENT TO INCLUDE THE TEE AND 6 FEET OF SERVICE LATERAL TO RECONNECT TO THE EXISTING LATERAL OR ADDITIONAL LATERAL TO INSTALL THE NEW LATERAL ALL THE WAY TO THE EDGE OF THE PROPERTY LINE OR ROAD R/W. INSTALL A CLEANOUT AT THE END OF THE NEW LATERAL PER DETAIL F WHEN DIRECTED BY THE ENGINEER. THE ENGINEER WILL DETERMINE WHICH SERVICES TO REPLACE FROM REVIEW OF TELEVISION INSPECTIONS.
2. INSTALL THE NEW SEWER AT A CONSTANT SLOPE BETWEEN THE TWO EXISTING PIPE ENDS.
3. INSTALL FITTINGS, ADAPTERS AND RUBBER SLEEVE COUPLINGS AS NECESSARY TO CONNECT NEW TEE AND SERVICE LATERAL. NEW SERVICE LATERALS SHALL BE DUCTILE IRON PIPE (DIP) OR PVC. NEW LATERALS AND TEE BRANCHES SHALL BE THE SAME SIZE AS THE EXISTING LATERAL.
4. NEW SERVICE LATERAL SHALL BE INSTALLED AT THE EXISTING LATERAL SLOPE AND IN THE EXISTING LATERAL LOCATION. CONNECT NEW LATERAL TO EXISTING LATERAL WITH RUBBER SLEEVE COUPLINGS WITH STAINLESS STEEL COMPRESSION BANDS AND SHEAR RINGS AS MANUFACTURED BY MISSION PRODUCTS OR APPROVED EQUAL. BYPASS FLOWS FROM THE LATERAL DURING CONSTRUCTION TO MAINTAIN SEWER SERVICE. DISPOSE OF EXISTING LATERAL PIPE MATERIAL OFFSITE.
5. INSTALL AND COMPACT #67 CRUSHED STONE TO A MIN OF 1 FOOT ABOVE THE TOP OF THE NEW SEWER PIPE, TEE, FITTINGS AND SERVICE LATERAL PIPES (COMPLETE TO CLEANOUT). IN PAVED AREAS, INSTALL AND COMPACT IMPORTED ABC STONE OR PIT GRAVEL FROM TOP OF STONE TO PAVEMENT SUBGRADE. PAYMENT FOR ABC STONE OR PIT GRAVEL SHALL BE BASED ON THE LENGTH OF POINT REPAIR. IN UNPAVED AREAS, INSTALL AND COMPACT COMMON FILL FROM TOP OF STONE TO FINISHED GRADE. RESTORE SURFACE TO MATCH EXISTING CONDITIONS.
6. TEES SHALL BE ROTATED 22 1/2 DEGREES PER CMUD STANDARDS. INSTALL FITTINGS AS NECESSARY TO RETURN THE NEW LATERAL TO THE EXISTING LATERAL ELEVATION. ALL TEES SHALL BE DUCTILE IRON.

CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

SERVICE LATERAL REPLACEMENT  
(PAGE 2 OF 2)

				NTS			DETAIL NO.
No.	Date	By	Revision	Scale	Approved By		F



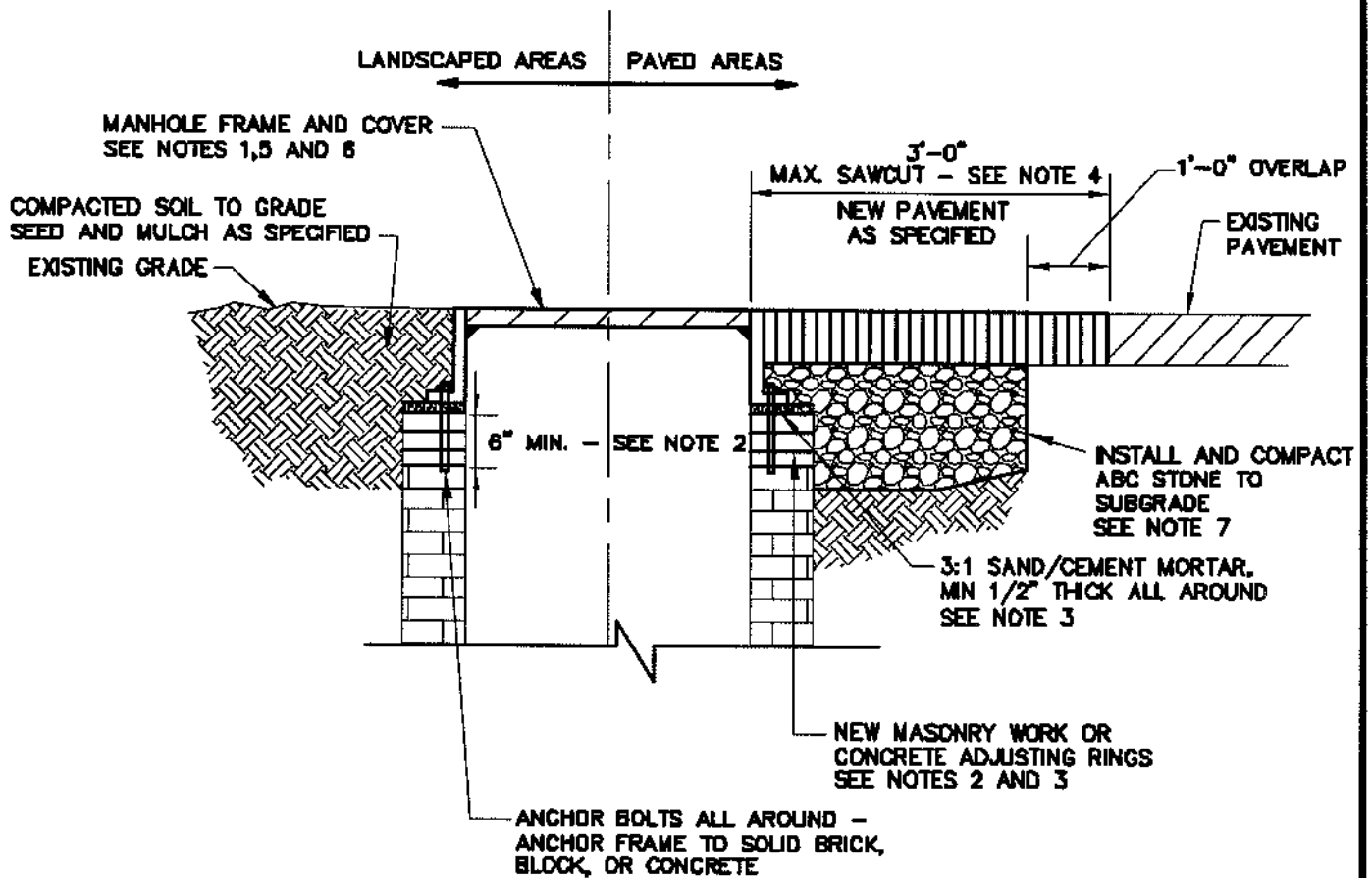
**NOTES:**

1. CLEANOUT COVER TO BE FLUSH WITH THE FINAL GRADE. RESTORE SURFACE TO MATCH EXISTING CONDITIONS IN ACCORDANCE WITH CMUD STANDARD SPECIFICATIONS AND DETAILS.
2. LOCATION OF CLEANOUT SHALL BE AS DIRECTED BY ENGINEER.
3. NEW SERVICE LATERAL PIPE, CLEANOUT PIPING AND FITTINGS SHALL BE DUCTILE IRON PIPE (DIP) OR PVC. NEW SERVICE LATERALS SHALL BE INSTALLED TO MATCH THE EXISTING SLOPES AND CONFIGURATIONS UNLESS NOTED OTHERWISE. REFER TO DETAIL F.
4. CLEANOUT CAP SHALL BE PLASTIC GRIPPER PLUG, END OF PIPE MODEL, BY CHERNE INDUSTRIES OR APPROVED EQUAL.
5. FOR MEASUREMENT AND PAYMENT, CLEANOUT TO BEGIN AT WYE FITTING.

CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

TYPICAL CLEANOUT

No.	Date	By	Revision	NTS	Approved By	DETAIL NO.
				Scale		
						G



CHARLOTTE-MECKLENBURG UTILITIES  
CHARLOTTE, NORTH CAROLINA

REHABILITATION OF MANHOLE FRAME  
AND COVER  
(PAGE 1 OF 2)

No.	Date	By	Revision	NTS Scale	Approved By	DETAIL NO. H
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NOTES:

1. CONTRACTOR SHALL REFER TO THIS DETAIL WHEN RAISING MANHOLES AND WHEN RESETTING OR REPLACING EXISTING FRAMES AND COVERS. ALL REHABILITATION OF FRAMES AND COVERS SHALL BE COMPLETED PRIOR TO OTHER MANHOLE REHABILITATION WORK. THIS DETAIL ILLUSTRATES MANHOLES AT GRADE. FOR FRAME AND COVERS ABOVE GRADE, WORK SHALL BE IN ACCORDANCE WITH THIS DETAIL AND ALL OTHER REQUIREMENTS IN CMUD'S STANDARD SPECIFICATIONS AND DETAILS. SEE NOTE B.
2. CONTRACTOR TO REMOVE AT LEAST 6" OF EXISTING BRICK AND/OR MATERIAL PRIOR TO INSTALLING NEW MASONRY OR CONCRETE ADJUSTING RINGS, TO PROVIDE A NEW SOLID SURFACE FOR SEATING THE FRAME AND TO PROVIDE A LEAK-TIGHT SEAL.
3. REMOVE ALL LOOSE BRICKS AND MORTAR AND PROVIDE A SMOOTH LEVEL SURFACE PRIOR TO INSTALLING MASONRY OR CONCRETE ADJUSTING RINGS. BRUSH SURFACE WITH STIFF WIRE BRUSH PRIOR TO PLACING MORTAR.
4. IN PAVED AREAS, PAVEMENT SHALL BE SAW-CUT NEATLY IN A SQUARE AROUND EXISTING MANHOLES.
5. MANHOLE COVER TO BE FLUSH WITH EXISTING GRADE UNLESS NOTED OTHERWISE.
6. ALL NEW FRAME AND COVERS (WHERE REQUIRED) SHALL BE SOLID OR WATERTIGHT AS SPECIFIED BY THE ENGINEER.
7. FOR COVERS IN PAVED AREAS, FILL AROUND FRAME AND EXPOSED MANHOLE WALL COMPLETELY WITH ABC STONE. ABC STONE TO EXTEND TO EXISTING PAVEMENT - NEW PAVEMENT (MIN 2", MAX 8") TO BE INSTALLED FROM TOP OF ABC STONE TO TOP OF FRAME. THE COST FOR THE ABC STONE, ANCHOR BOLTS, AND PAVEMENT RESTORATION SHALL BE INCLUDED IN THE UNIT PRICES BID.
8. A STREET CUT PERMIT IS REQUIRED TO PERFORM EXCAVATION WORK IN CDOT ROADS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE OWNER WITH THE REQUIRED INFORMATION ASSOCIATED WITH EACH STREET CUT IN ORDER TO PROPERLY OBTAIN A VALID STREET CUT PERMIT FROM CDOT. THE CONTRACTOR'S PROJECT MANAGER, SUPERINTENDENTS AND/OR FOREMEN MUST BE CERTIFIED BY CDOT TO PERFORM ANY EXCAVATION WORK IN CDOT ROADS. CDOT PROVIDES THE CERTIFICATION THROUGH PERIODIC CERTIFICATION COURSES. THE CONTRACTOR AND ALL SUBCONTRACTORS (AS NECESSARY) SHALL OBTAIN THE CERTIFICATION PRIOR TO PERFORMING ANY EXCAVATION IN CDOT ROADS.

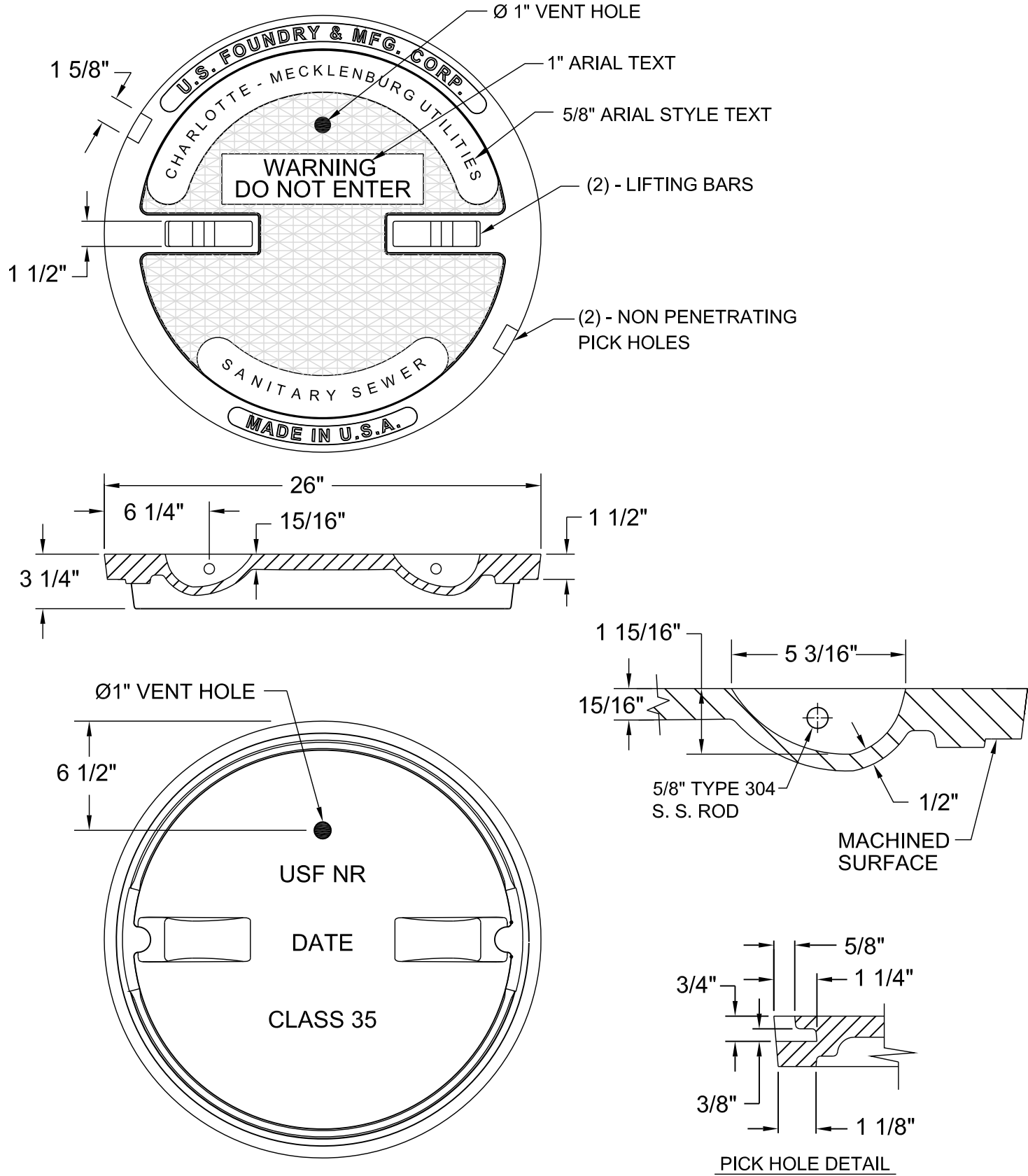
				CHARLOTTE-MECKLENBURG UTILITIES CHARLOTTE, NORTH CAROLINA			
				REHABILITATION OF MANHOLE FRAME AND COVER (PAGE 2 OF 2)			
				NTS		DETAIL NO.	
No.	Date	By	Revision	Scale	Approved By		H



<b>CHARLOTTE-MECKLENBURG UTILITIES</b> <b>CHARLOTTE, NORTH CAROLINA</b>			
<b>SERVICE LATERAL CONNECTING TO</b> <b>CURED-IN-PLACE PIPE LINING (CIPP)</b>			
NTS Scale	Approved By	_____	DETAIL NO. 1



U.S. FOUNDRY & MFG. CORP.

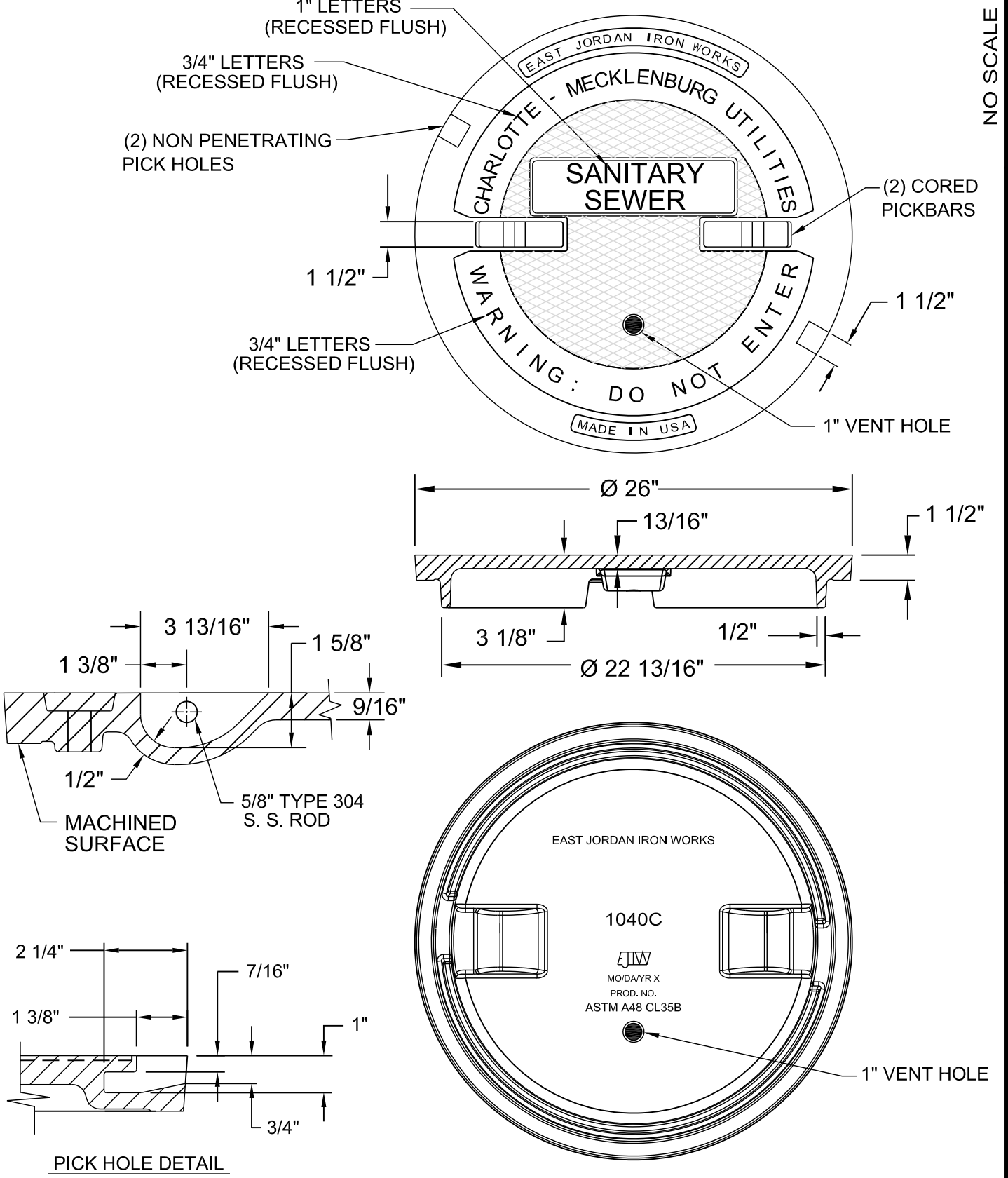


WEIGHT - 150 LB. MIN. , 0% MINUS TOLERANCE

NOTES:


LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS

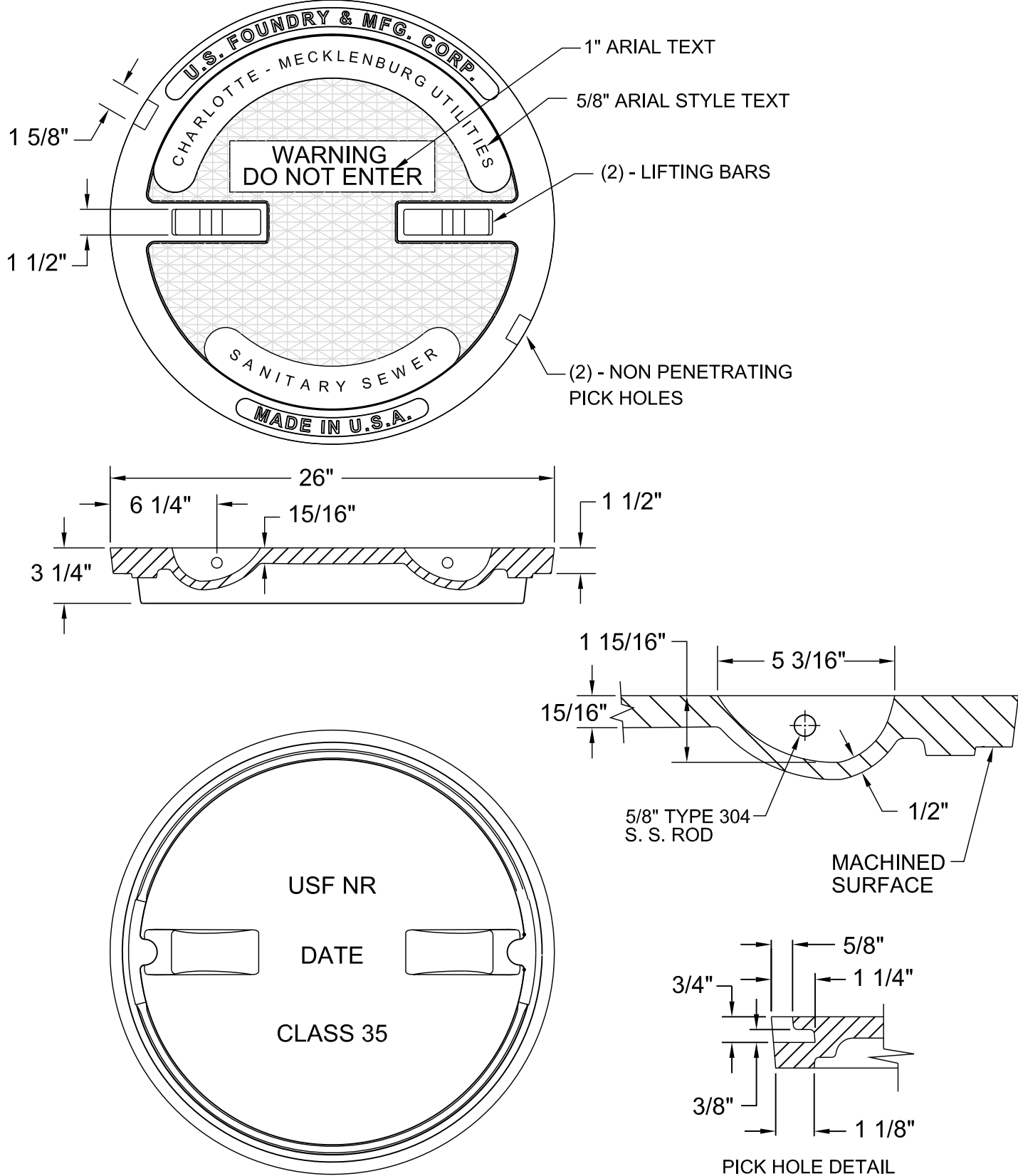


WEIGHT - 145 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE A, B, OR C FRAME  
COVER SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
COVER SHALL NOT BE OUT OF ROUND.

 CHARLOTTE	CHARLOTTE-MECKLENBURG UTILITIES	TYPE 1 MANHOLE COVER  24-INCHES DIAMETER (CLEAR OPENING)  VENTED - ONE VENT HOLE, NO GASKET, NO CAM LOCK	NO SCALE	
			STANDARD NO. A	
			VERSION NO. V1.2	VERSION DATE 9.23.2009

U.S. FOUNDRY & MFG. CORP.

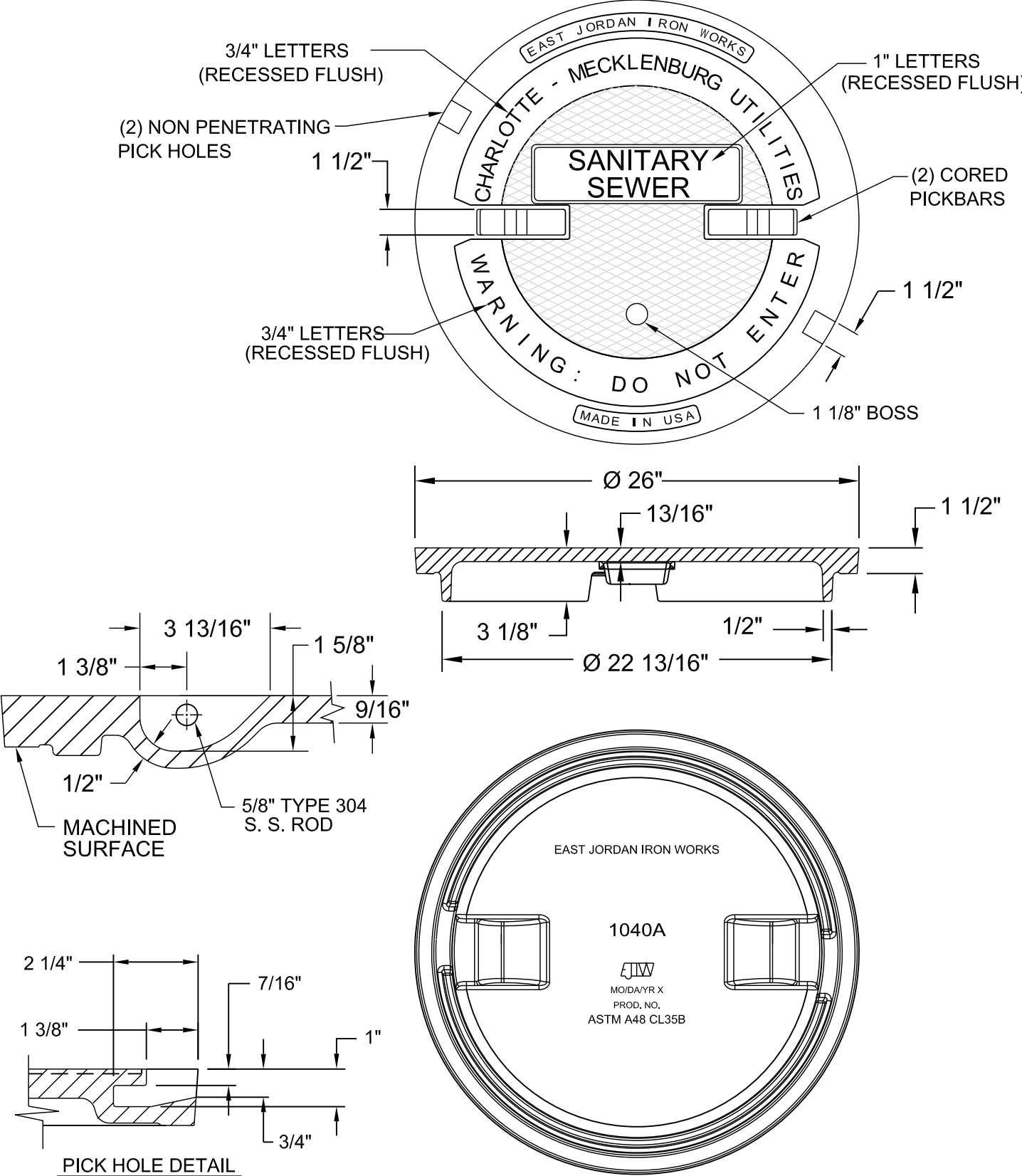


WEIGHT - 150 LB. MIN. , 0% MINUS TOLERANCE

NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS



WEIGHT - 145 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE A, B, OR C FRAME  
COVER SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
COVER SHALL NOT BE OUT OF ROUND.

NO SCALE

STANDARD NO.

B

VERSION NO.

V1.2

TYPE 2 MANHOLE COVER  
24-INCHES DIAMETER (CLEAR OPENING)  
SOLID - NO VENT HOLE, NO GASKET, NO CAM LOCK

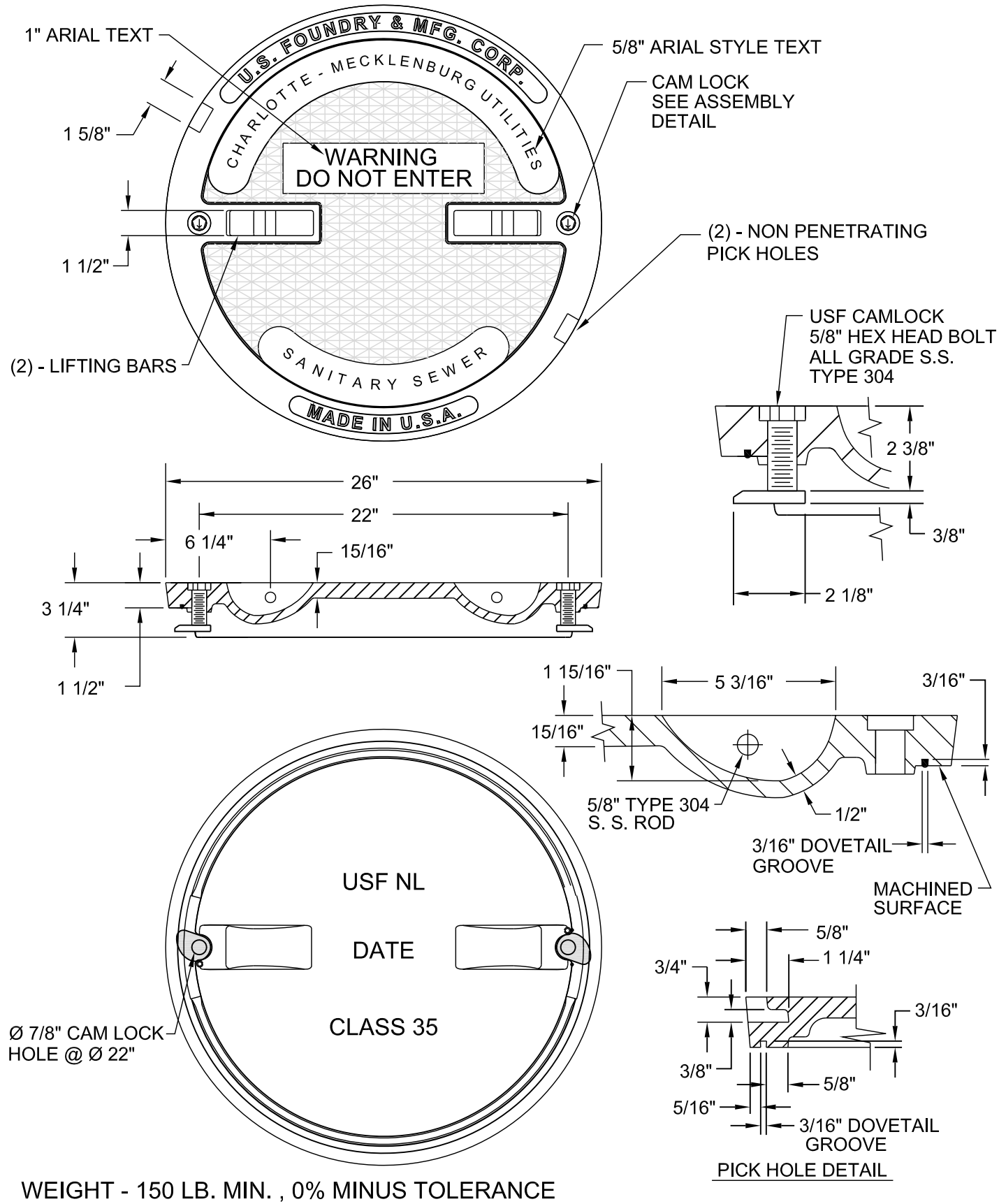
CHARLOTTE-MECKLENBURG UTILITIES

STANDARD DETAILS

GRAVITY SEWER

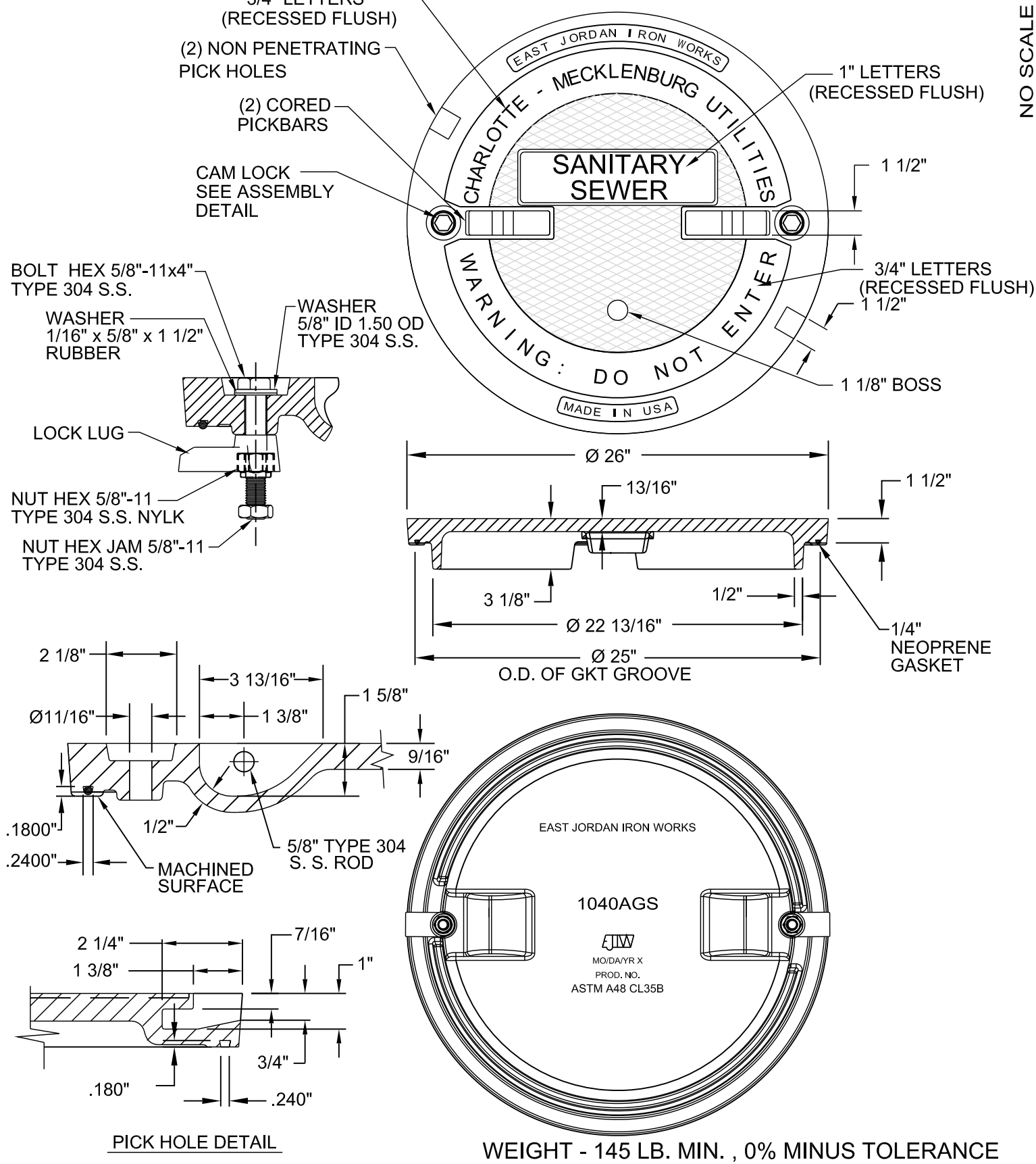


U.S. FOUNDRY & MFG. CORP.




**NOTES:**  
LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

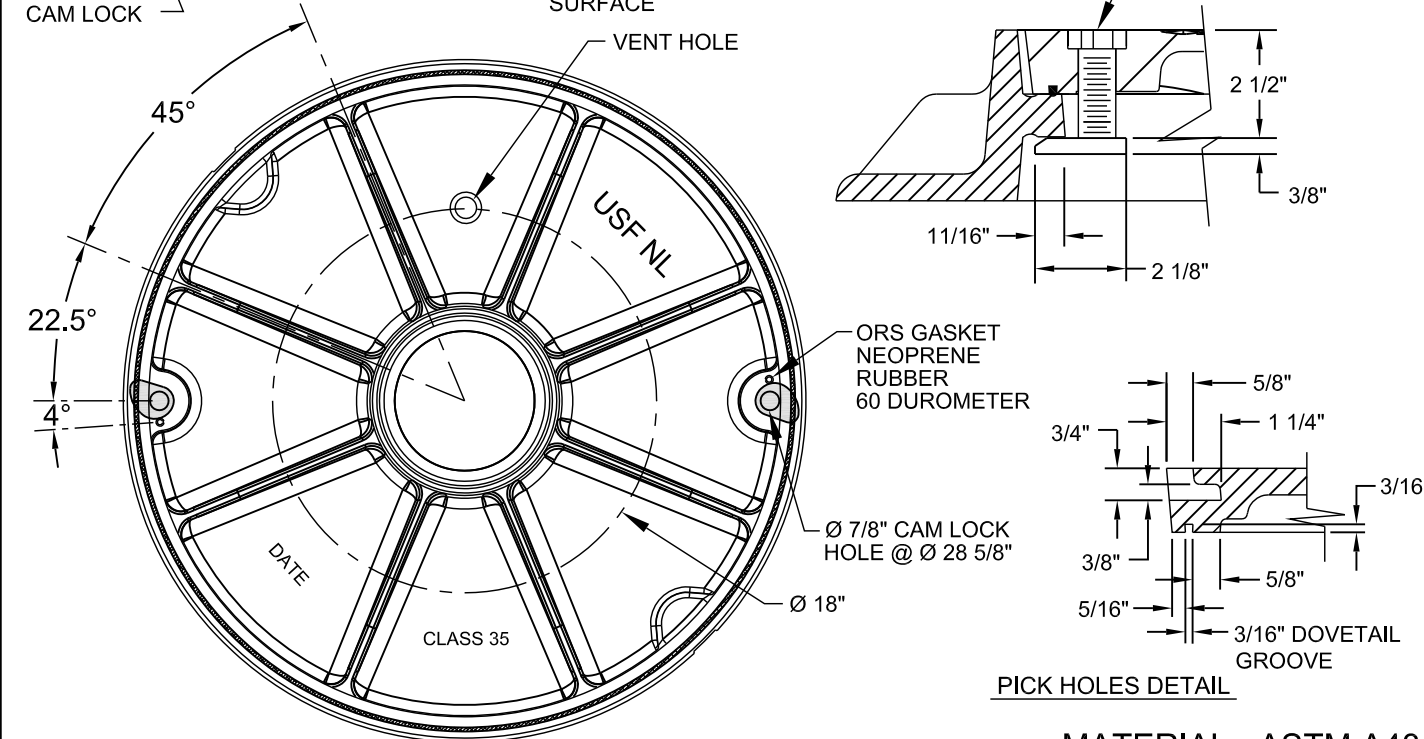
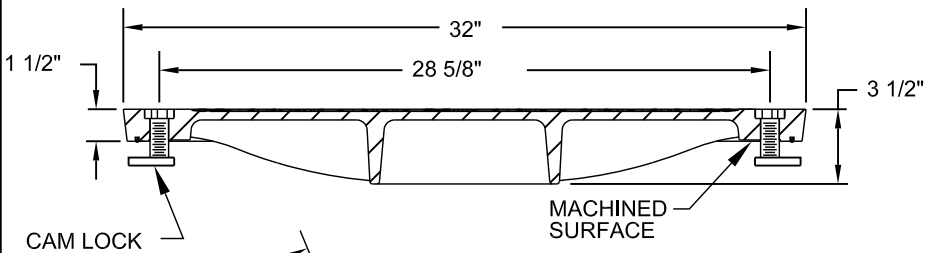
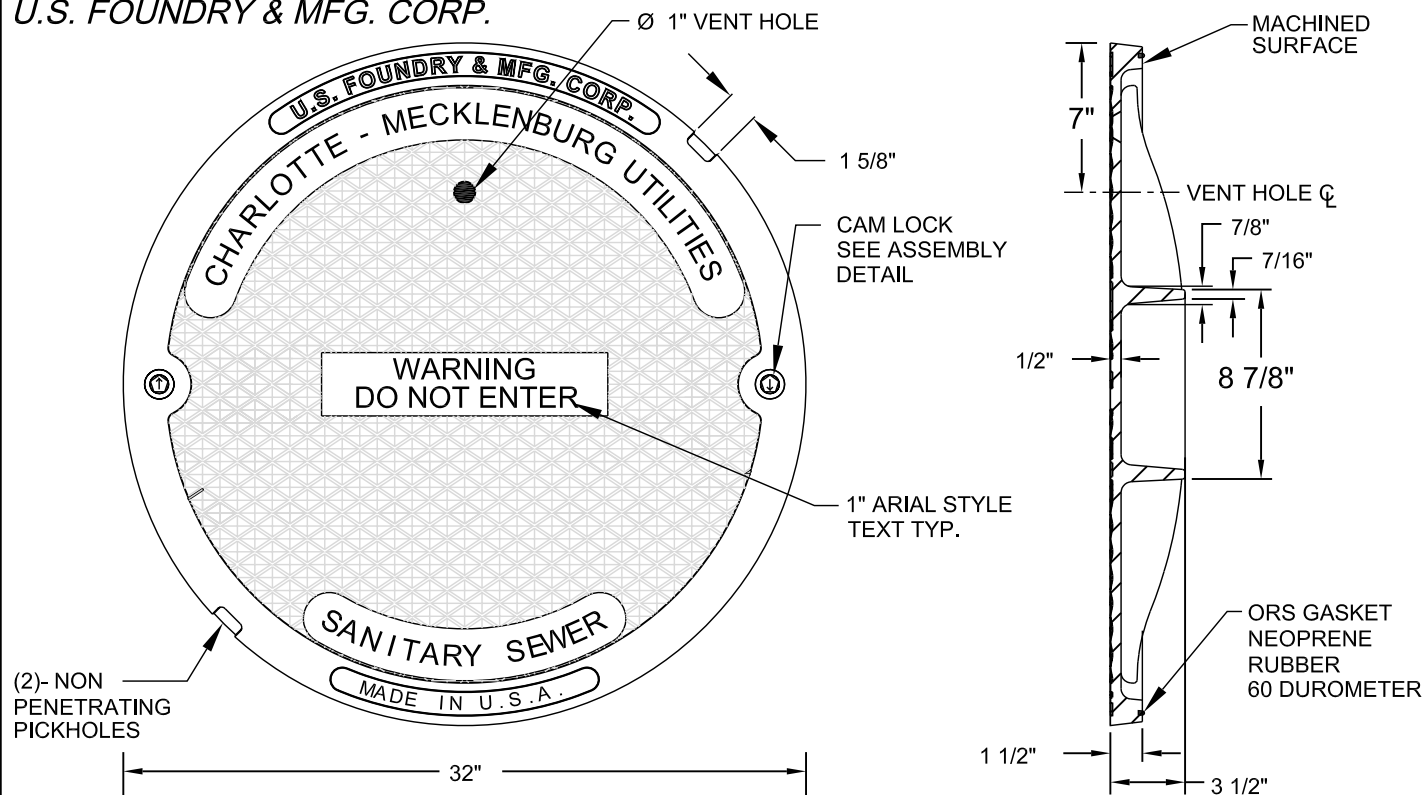
EAST JORDAN IRON WORKS



USE WITH TYPE A, B, OR C FRAME  
COVER SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
COVER SHALL NOT BE OUT OF ROUND.

NO SCALE	STANDARD NO.	C
	VERSION NO.	V1.2
	VERSION DATE	9.23.2009
TYPE 3 MANHOLE COVER		
24-INCHES DIAMETER (CLEAR OPENING)		
WATERTIGHT - NO VENT HOLE, GASKET, CAM LOCK		
CHARLOTTE-MECKLENBURG UTILITIES	STANDARD DETAILS	GRAVITY SEWER
		

U.S. FOUNDRY & MFG. CORP.

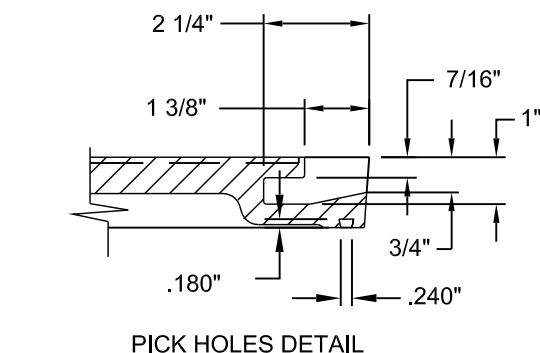
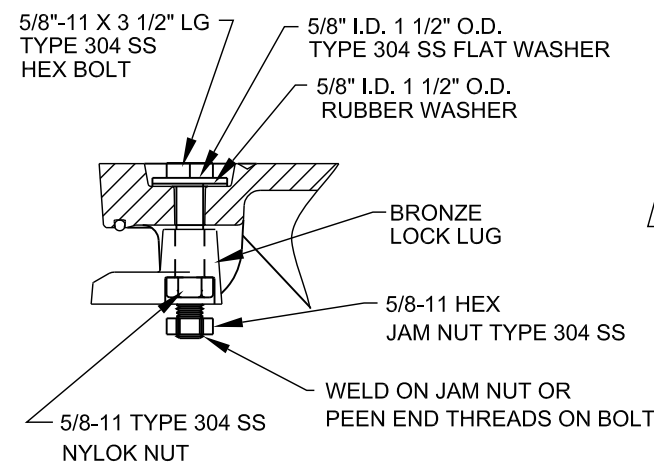
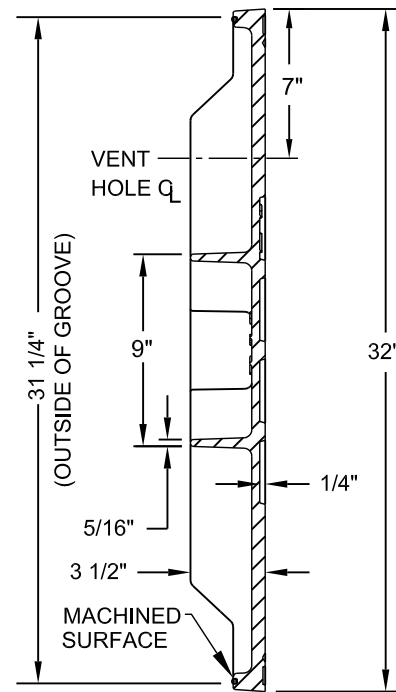


WEIGHT - 165 LB. MIN. , 0% MINUS TOLERANCE

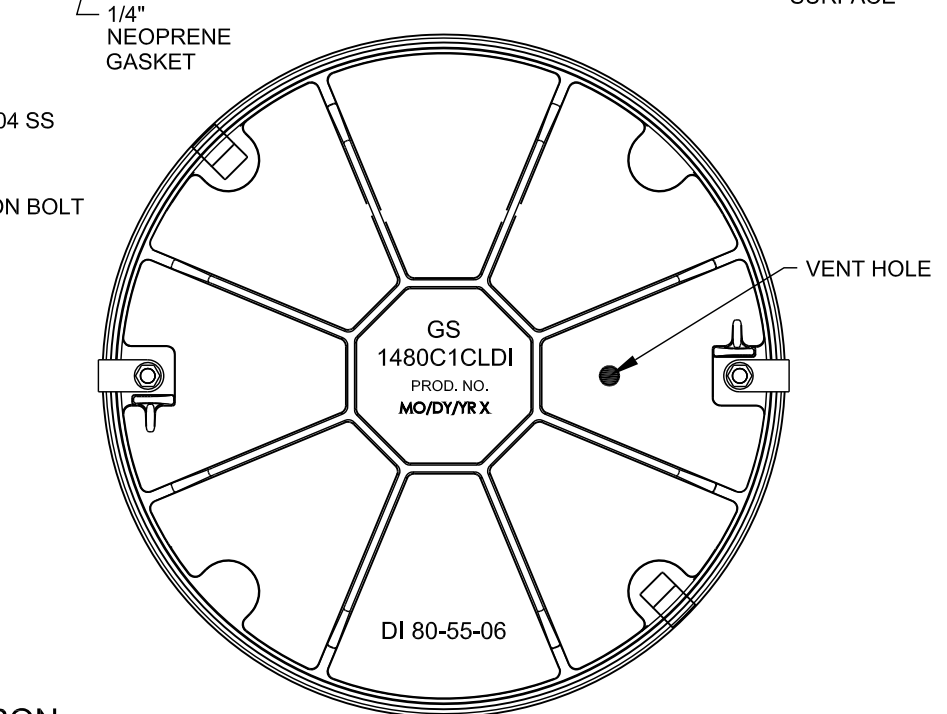
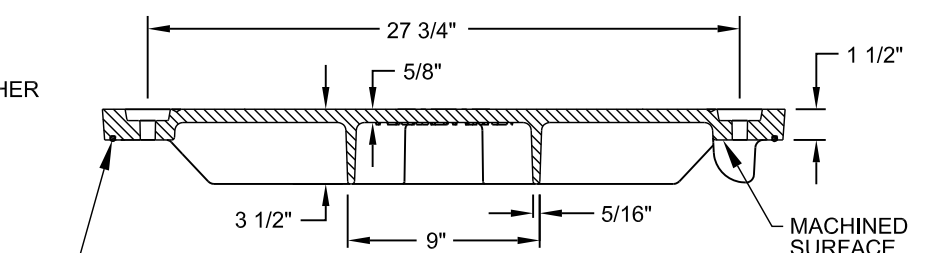
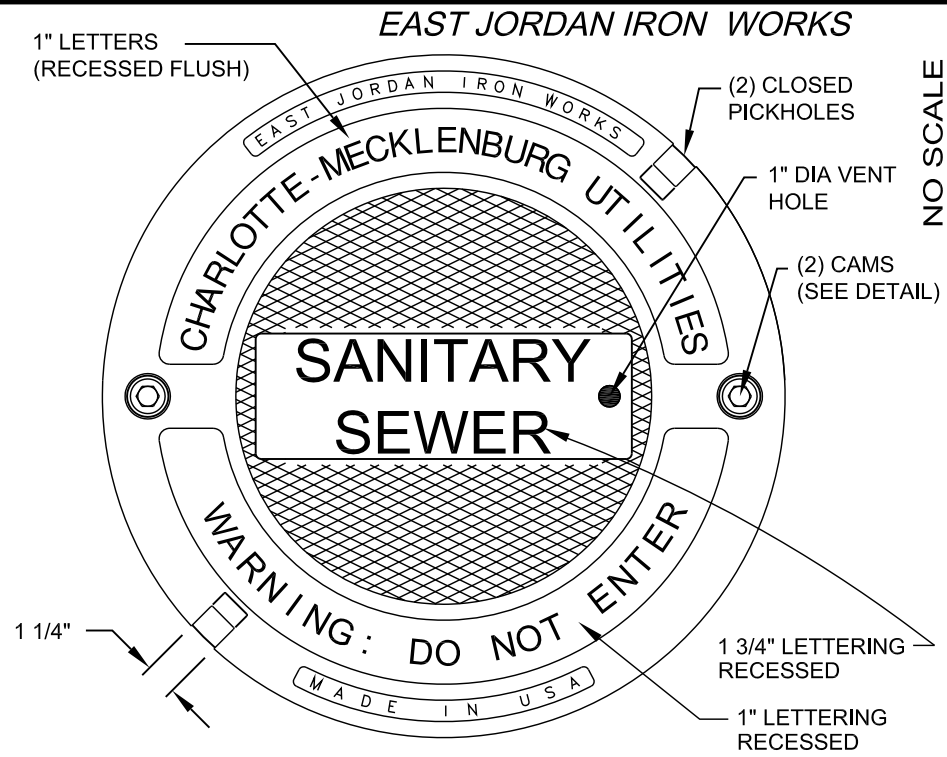
MATERIAL - ASTM A48  
CLASS 35

**NOTES:**

LOAD RATING - HEAVY DUTY  
MATERIAL - DUCTILE OR CAST IRON AS INDICATED ABOVE  
COATING - UNDIPPED



MATERIAL - ASTM A536 DUCTILE IRON -  
GRADE 80-55-06



WEIGHT - 150 LB. MIN. , 0% MINUS TOLERANCE

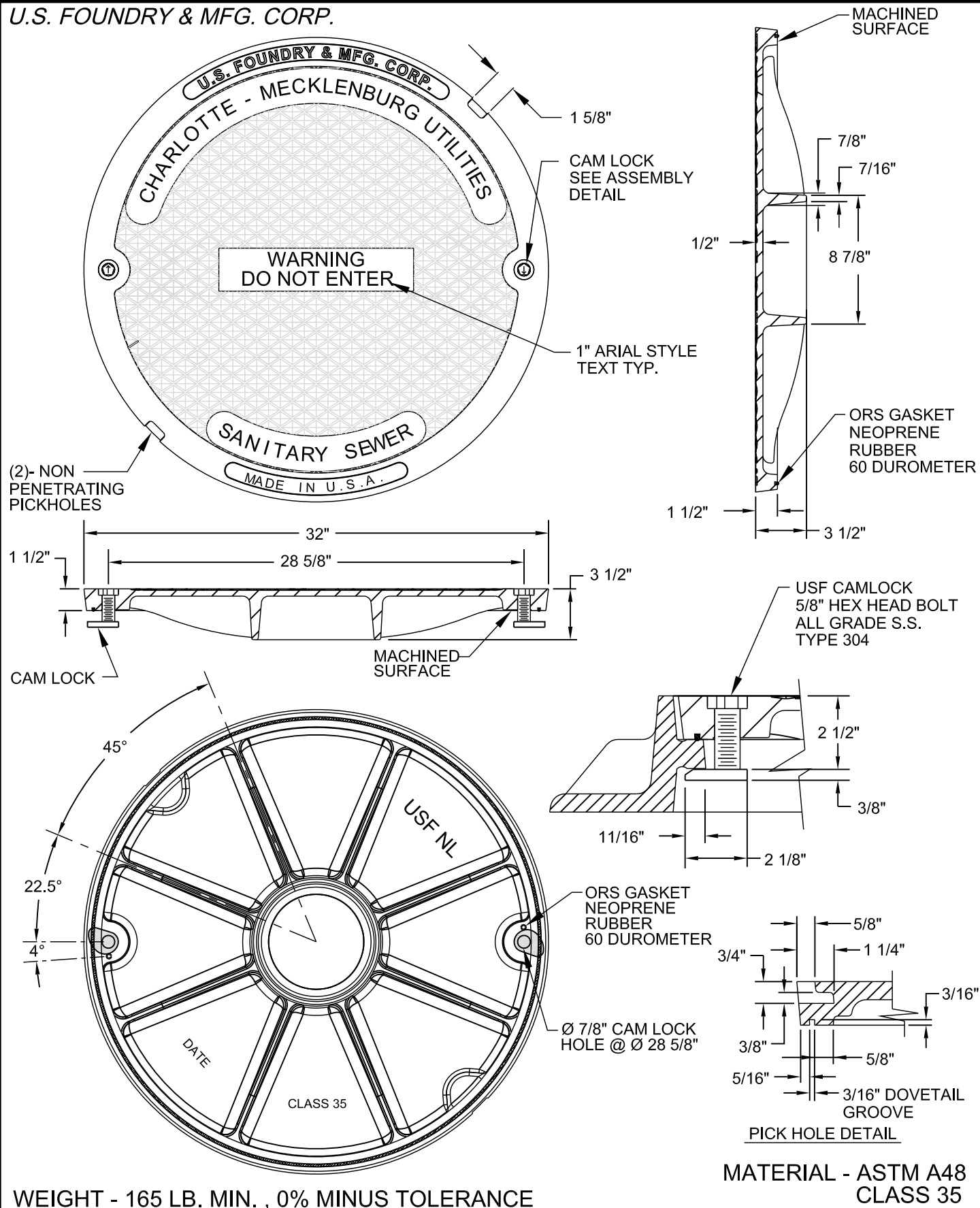
STANDARD NO.	D	VERSION DATE	9.23.2009
VERSION NO.	V1.2		

TYPE 4 MANHOLE COVER  
30-INCHES DIAMETER (CLEAR OPENING)  
VENTED - ONE VENT HOLE, GASKET, CAM LOCK

CHARLOTTE-MECKLENBURG UTILITIES	STANDARD DETAILS	GRAVITY SEWER
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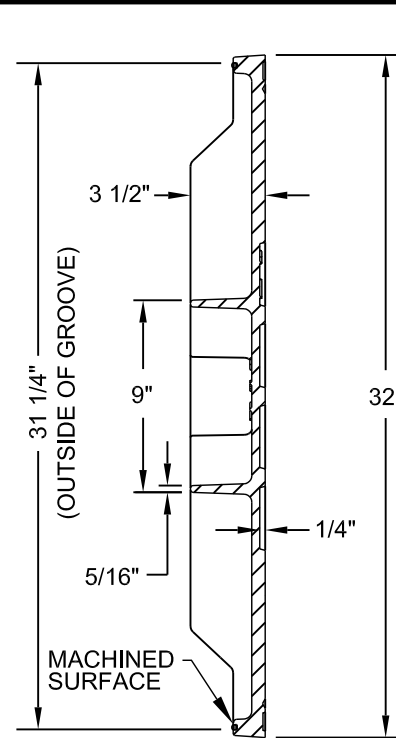


U.S. FOUNDRY & MFG. CORP.




NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - DUCTILE OR CAST IRON AS INDICATED ABOVE  
COATING - UNDIPPED



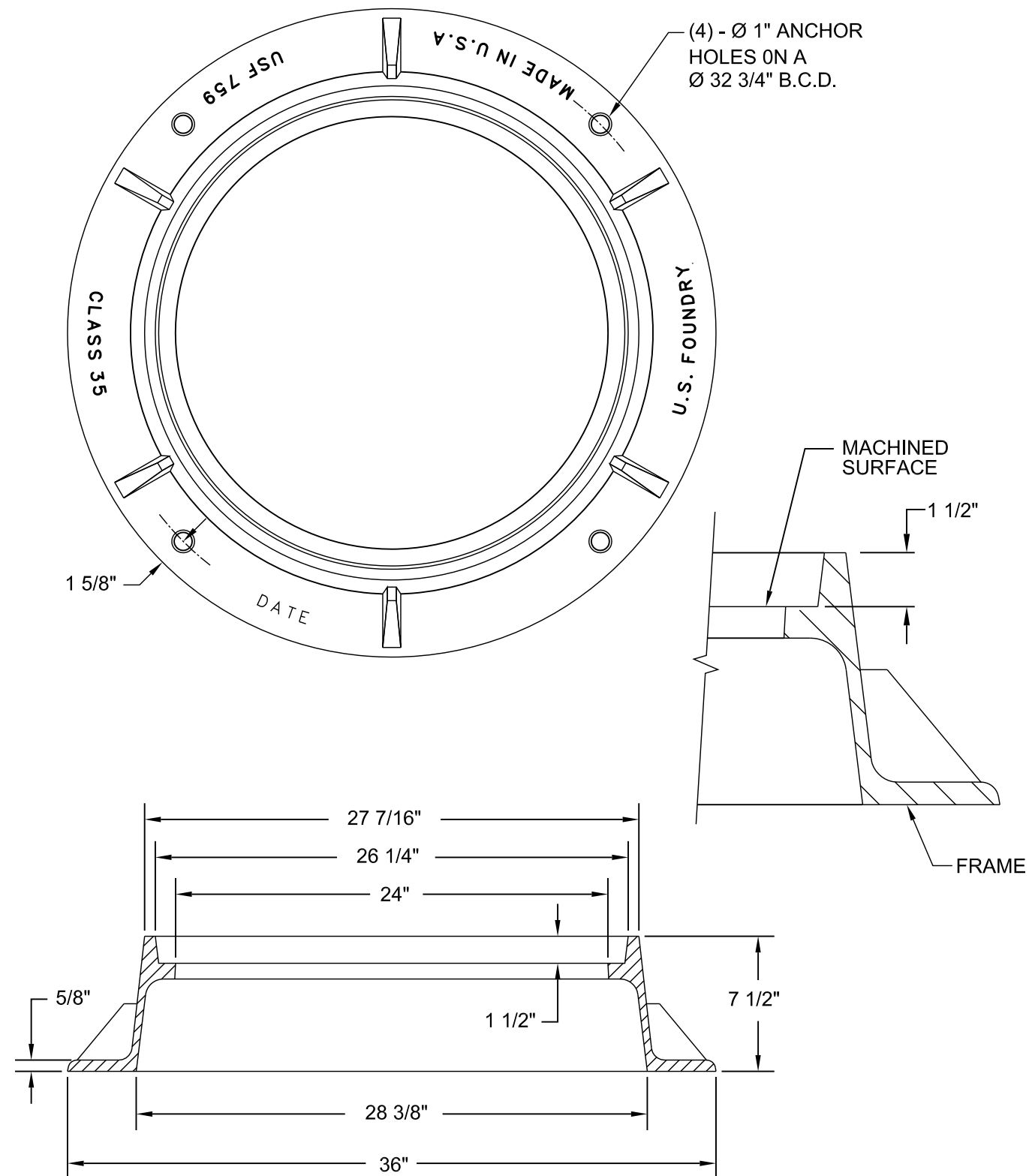
MATERIAL - ASTM A536 DUCTILE IRON - GRADE 80-55-06

WEIGHT - 150 LB. MIN. , 0% MINUS TOLERANCE

 CHARLOTTE	CHARLOTTE-MECKLENBURG UTILITIES	TYPE 5 MANHOLE COVER		STANDARD NO. E
	STANDARD DETAILS	30-INCHES DIAMETER (CLEAR OPENING)		
	GRAVITY SEWER	WATERTIGHT - NO VENT HOLE, GASKET, CAM LOCK		
		VERSION NO. V1.2	VERSION DATE 9.23.2009	



*U.S. FOUNDRY & MFG. CORP.*

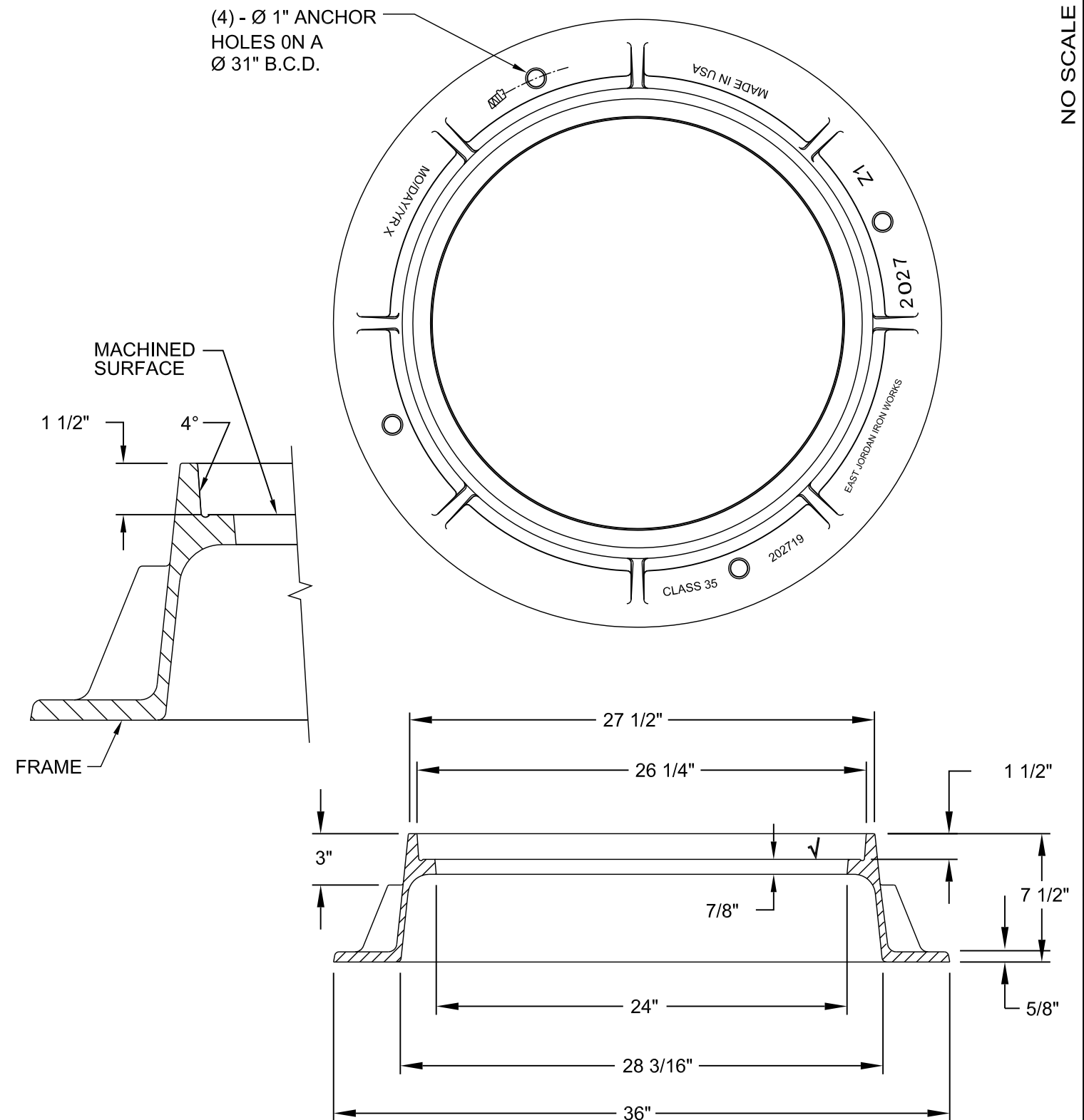


WEIGHT - 170 LB. MIN. , 0% MINUS TOLERANCE

NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

*EAST JORDAN IRON WORKS*



## FRAME SECTION

WEIGHT - 173 LB. MIN. , 0% MINUS TOLERANCE

NO SCALE

---

STANDARD NO.

ONLINE

111

VERSION

TYPE A MANHOLE FRAME  
24-INCHES DIAMETER (CLEAR OPENING)  
7 1/2-INCHES TALL

**CHARLOTTE-MECKLENBURG  
UTILITIES**

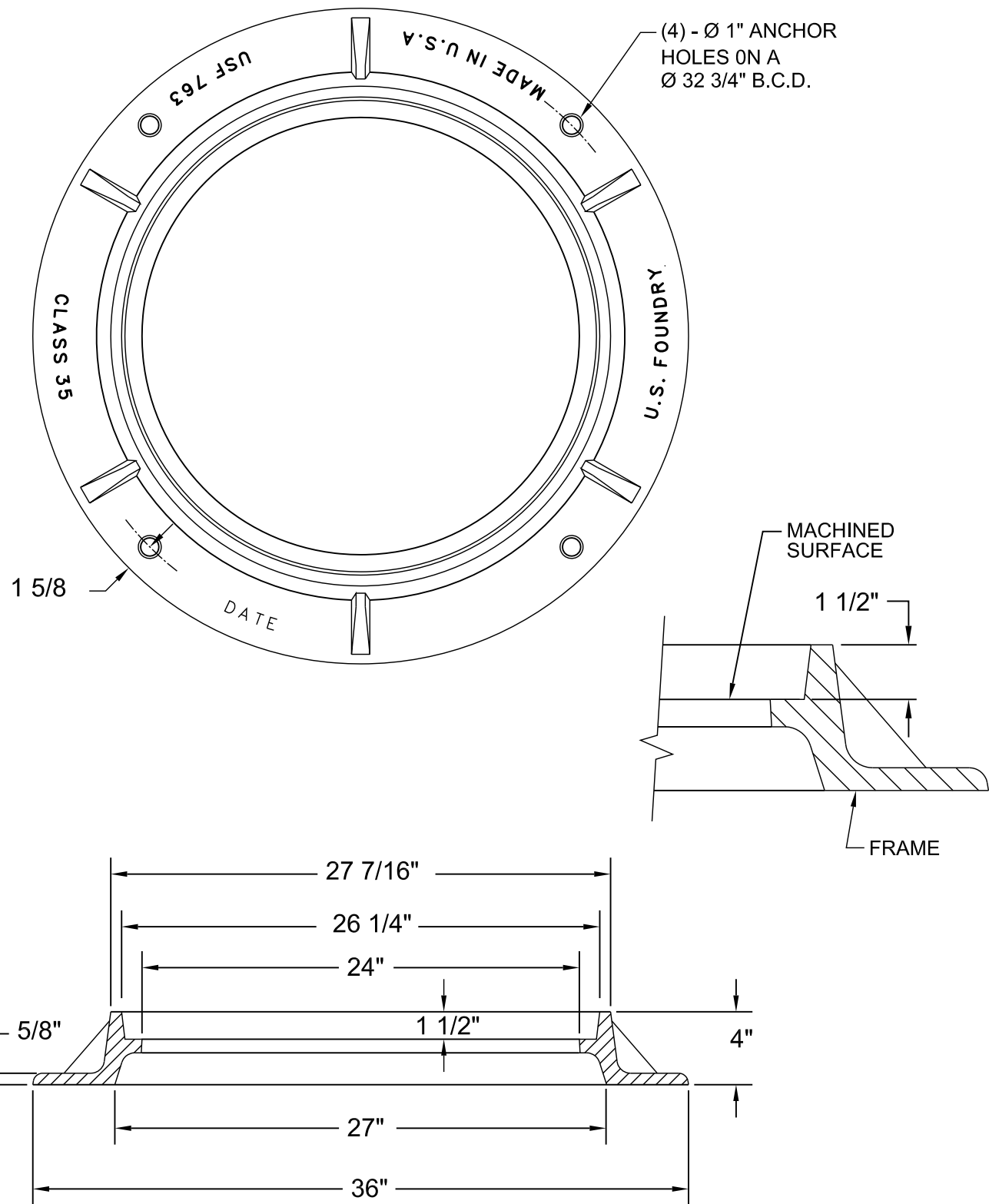
## STANDARD DETAILS

## GRAVITY SEWER



**CHARLOTTE**

U.S. FOUNDRY & MFG. CORP.

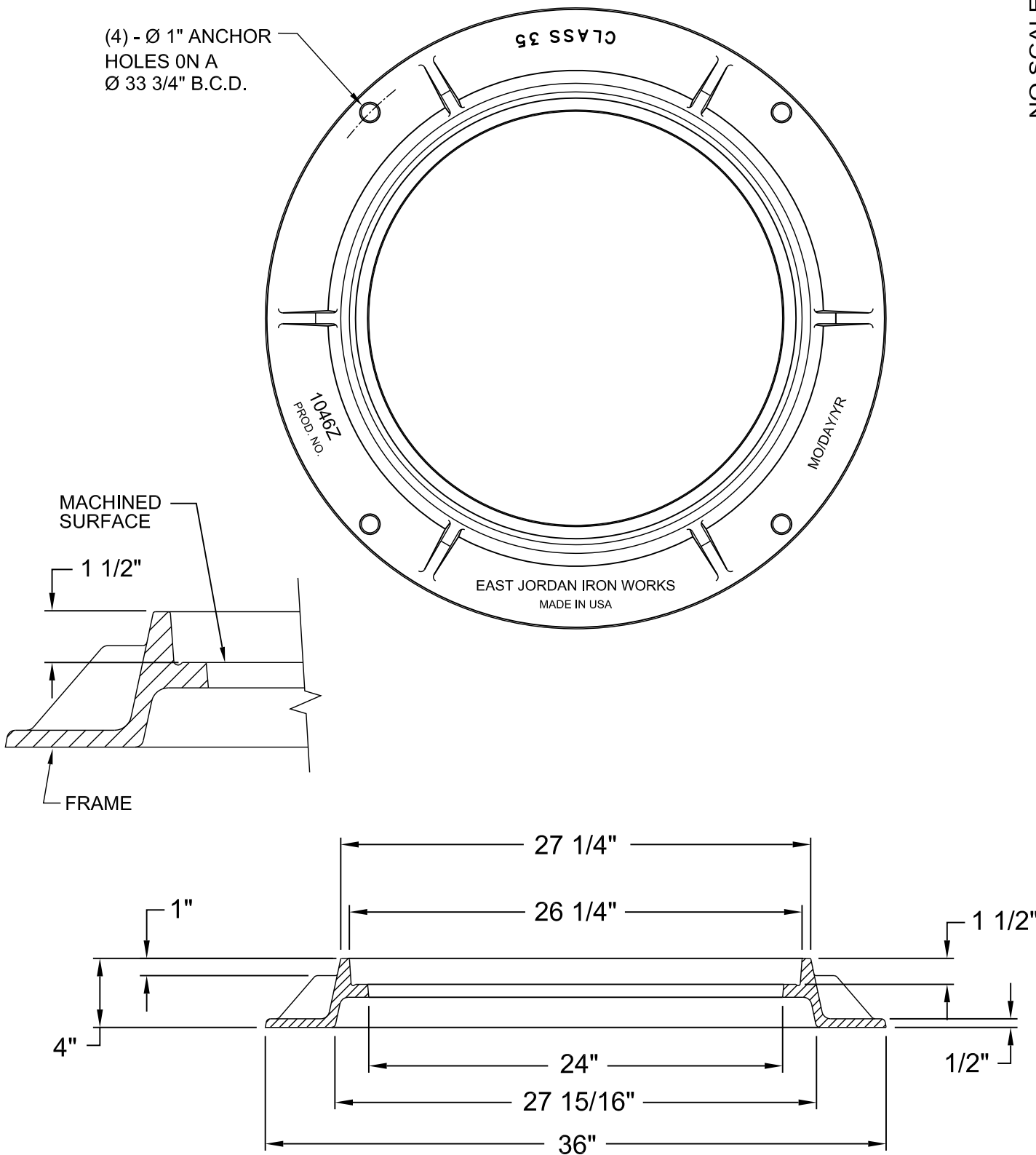


WEIGHT - 155 LB. MIN. , 0% MINUS TOLERANCE

NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS



WEIGHT - 135 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE 1, 2, OR 3 COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

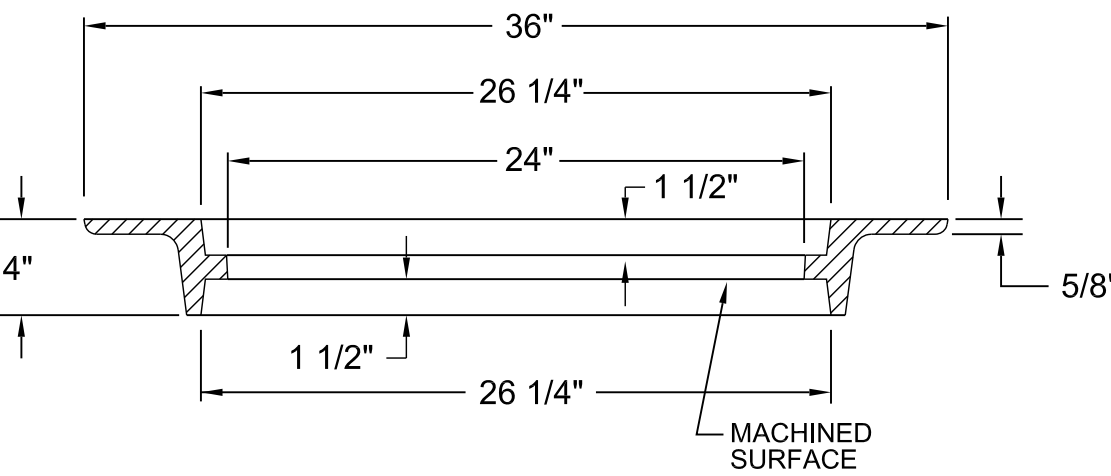
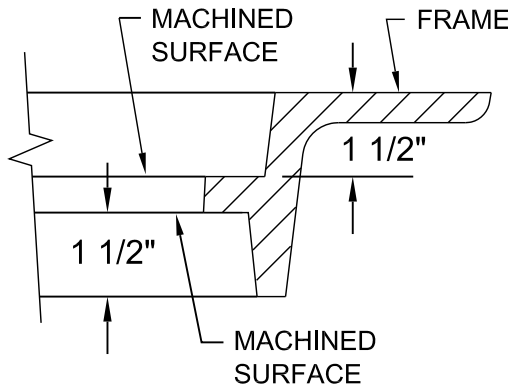
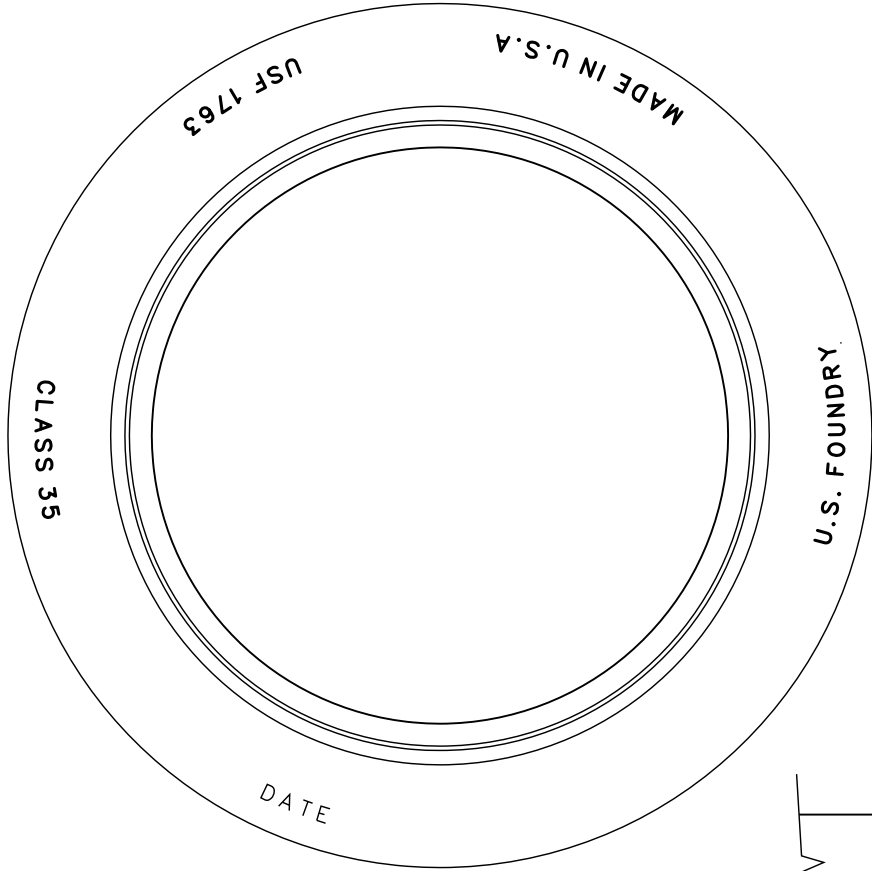
NO SCALE  
STANDARD NO. G  
VERSION NO. V1.1  
VERSION DATE 8.18.2009

TYPE B MANHOLE FRAME  
24-INCHES DIAMETER (CLEAR OPENING)  
4-INCHES TALL

CHARLOTTE-MECKLENBURG  
UTILITIES  
STANDARD DETAILS  
GRAVITY SEWER



U.S. FOUNDRY & MFG. CORP.

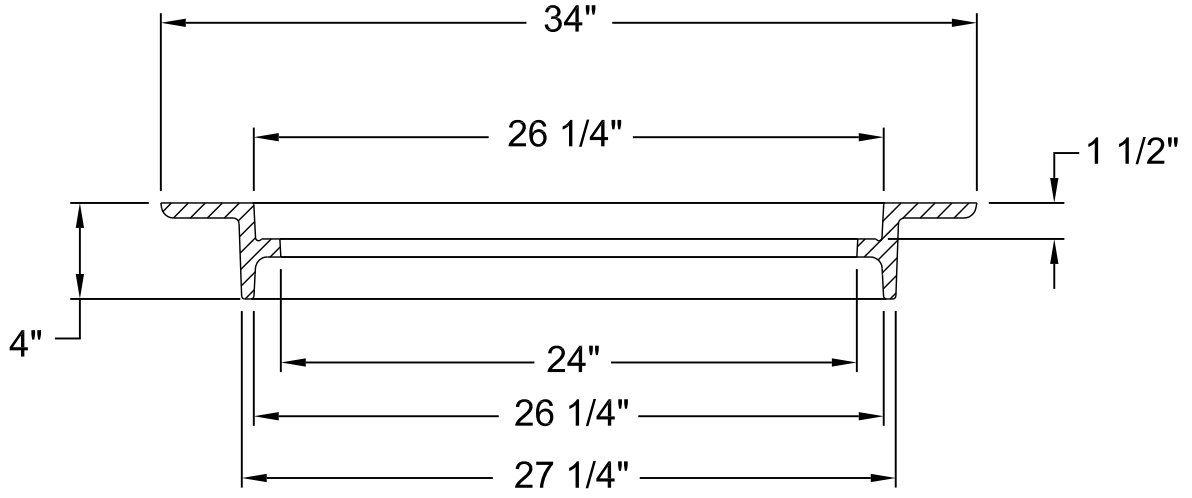
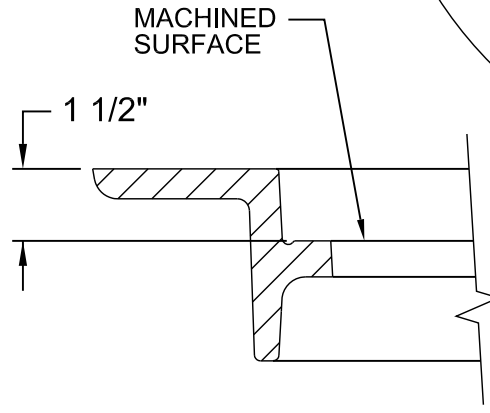
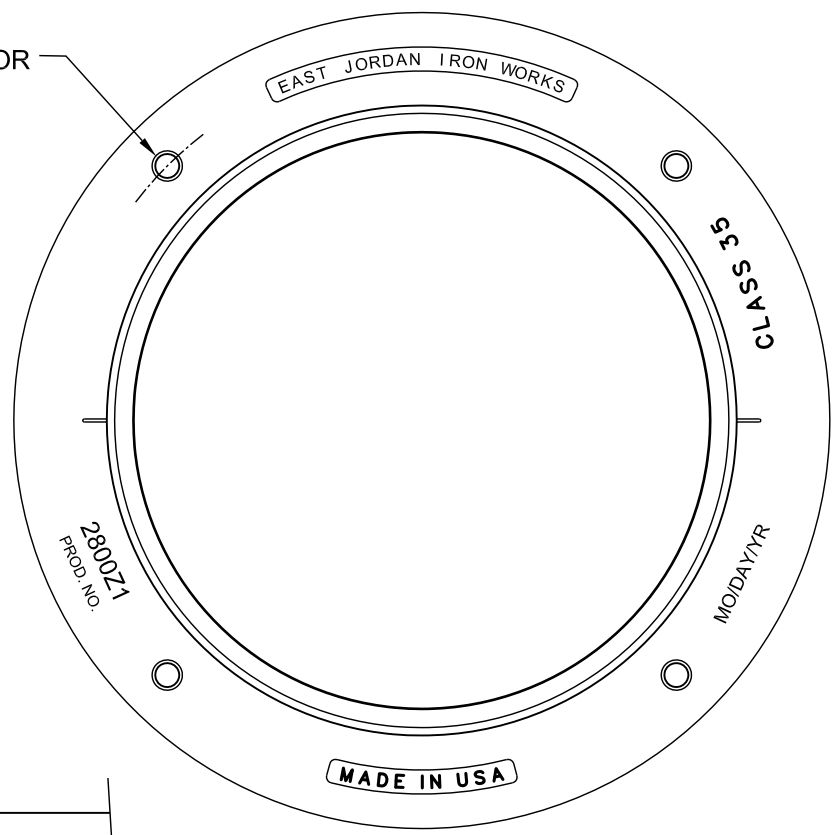


WEIGHT - 150 LB. MIN. , 0% MINUS TOLERANCE

**NOTES:**  
LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS

(4) - Ø 1" ANCHOR HOLES ON A Ø 31" B.C.D.



WEIGHT- 121 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE 1, 2, OR 3 COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

NO SCALE

STANDARD NO.

H

VERSION NO.

V1.1

VERSION DATE

8.19.2009

TYPE C MANHOLE FRAME  
24-INCHES DIAMETER (CLEAR OPENING)  
4-INCHES TALL - INVERTED/REVERSIBLE (CAST IN)

CHARLOTTE-MECKLENBURG UTILITIES

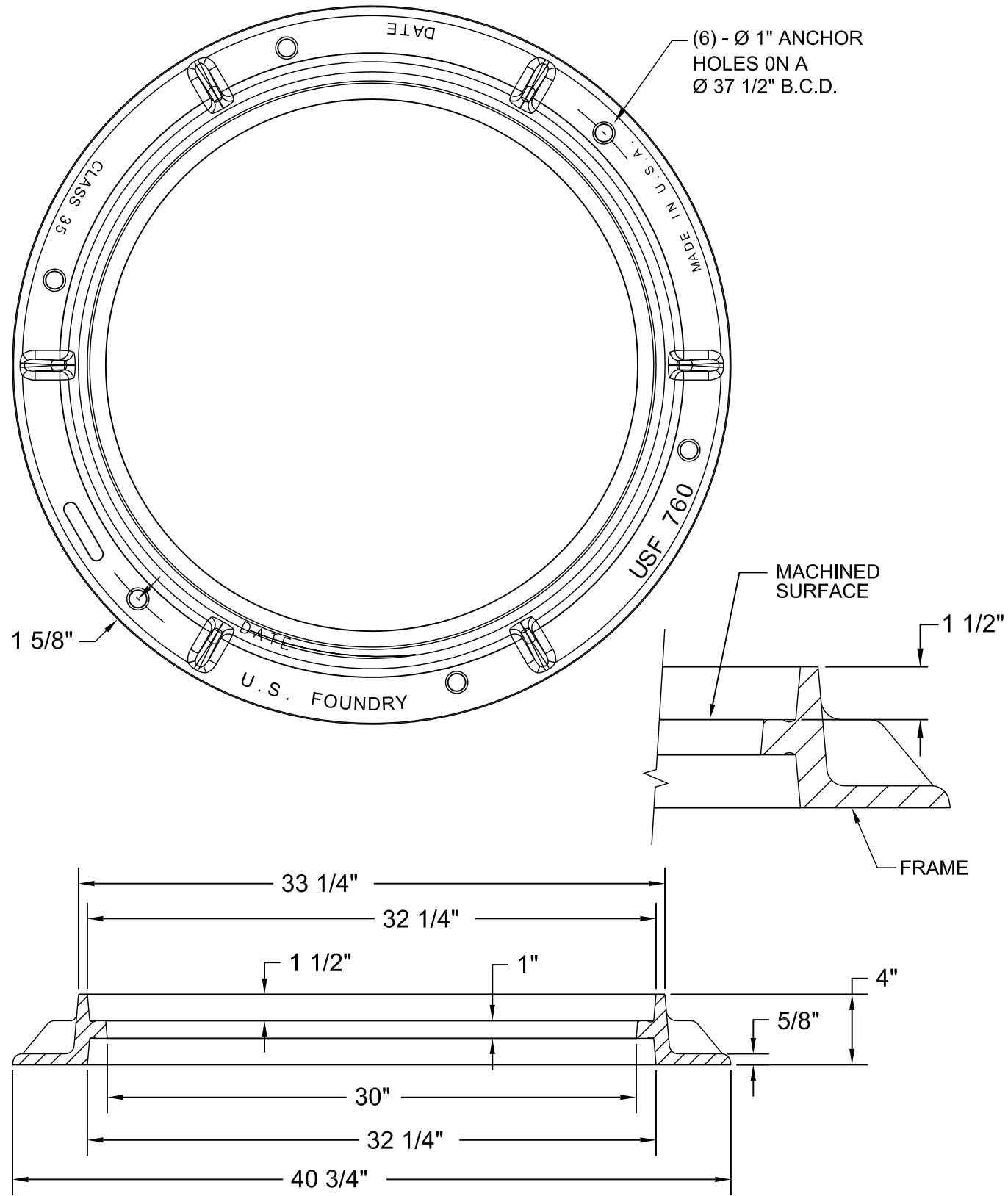
STANDARD DETAILS

GRAVITY SEWER





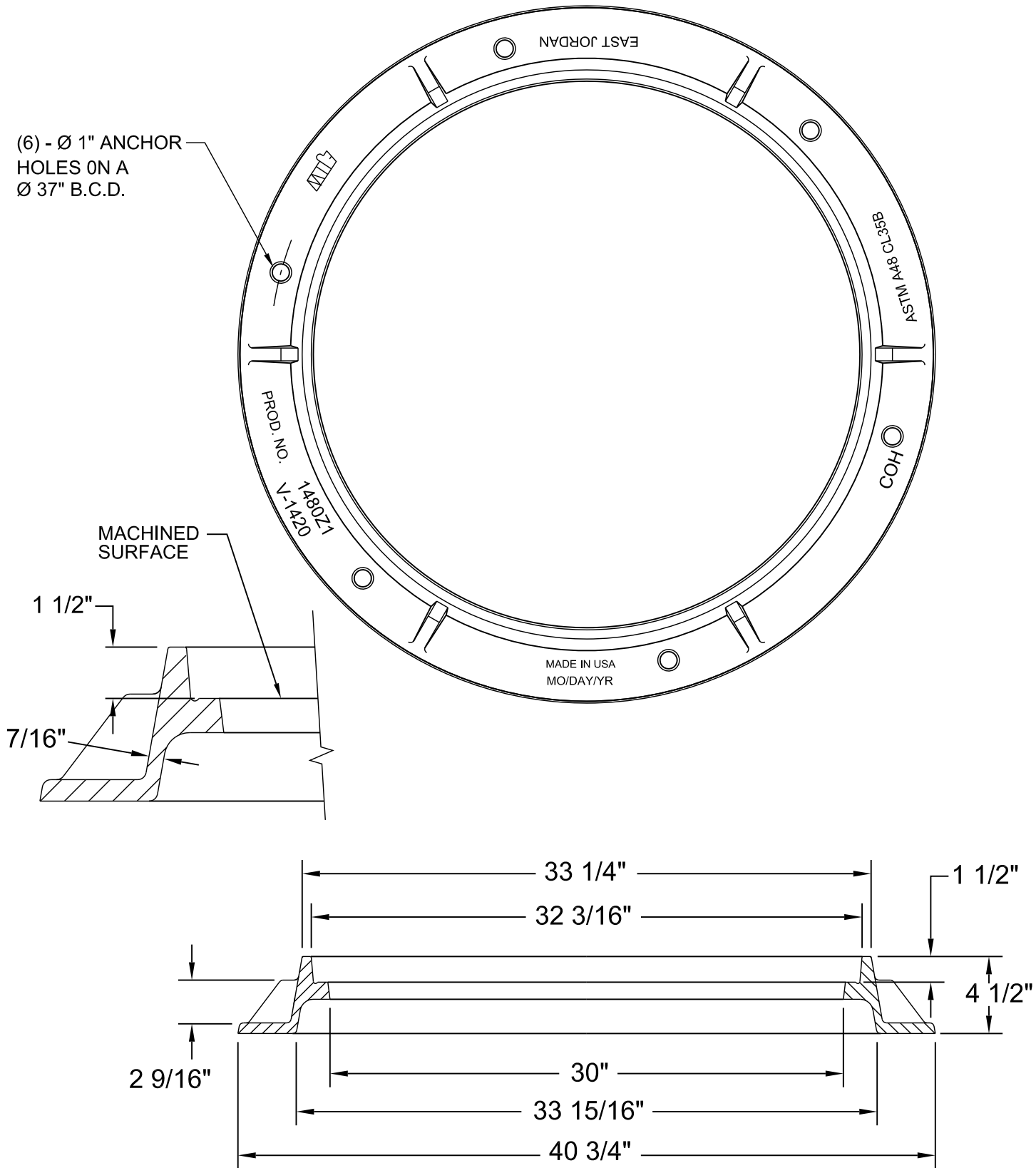
U.S. FOUNDRY & MFG. CORP.



WEIGHT - 175 LB. MIN. , 0% MINUS TOLERANCE

**NOTES:**  
LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS

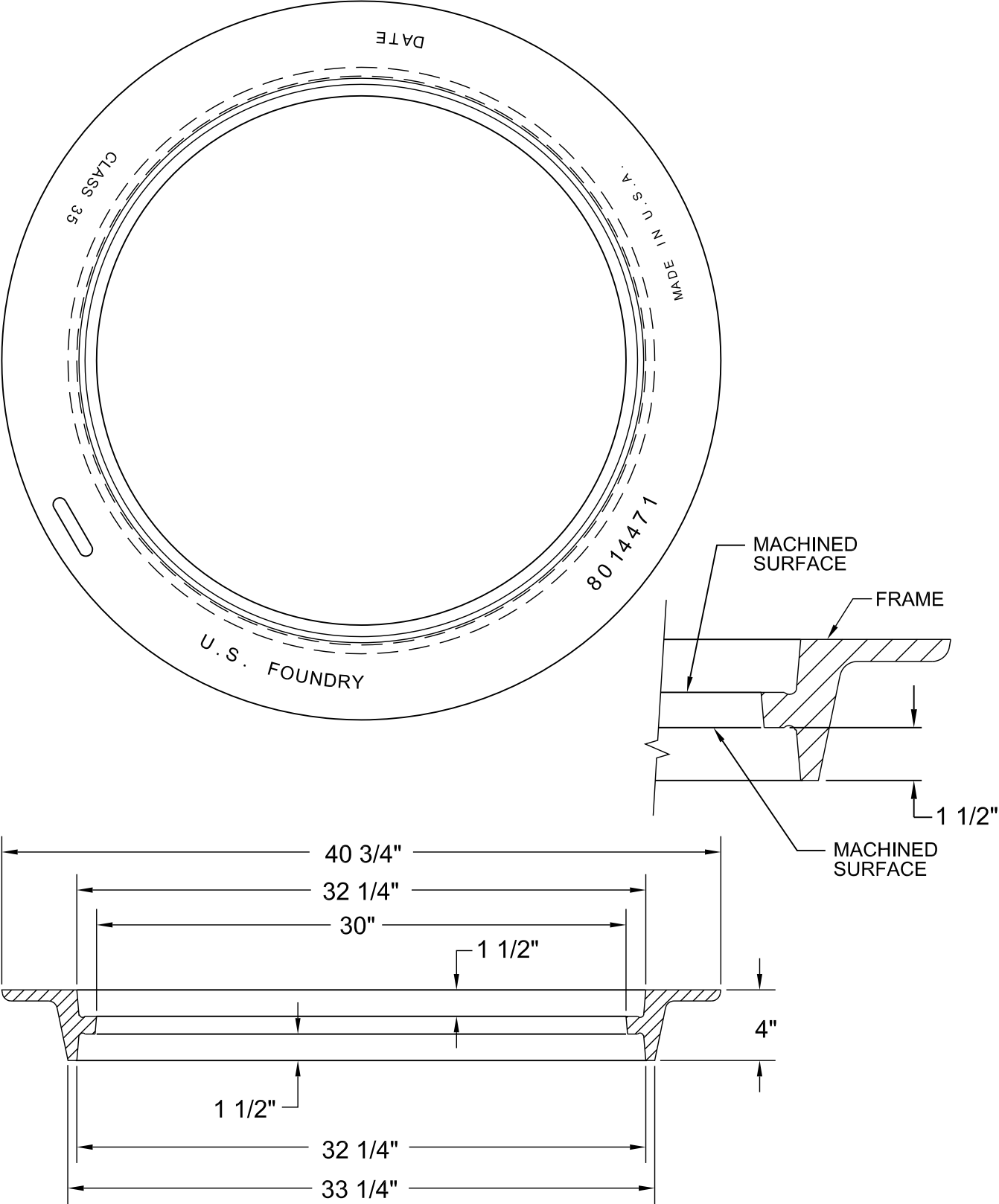


WEIGHT - 170 LB. MIN. , 0% MINUS TOLERANCE

USE WITH TYPE 4 OR 5 COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

NO SCALE	STANDARD NO.	J
	VERSION NO.	V1.1
	VERSION DATE	8.19.2009
TYPE D MANHOLE FRAME		
30-INCHES DIAMETER (CLEAR OPENING)		
4-INCHES TALL		
CHARLOTTE-MECKLENBURG UTILITIES	STANDARD DETAILS	
GRAVITY SEWER		
CHARLOTTE		

U.S. FOUNDRY & MFG. CORP.

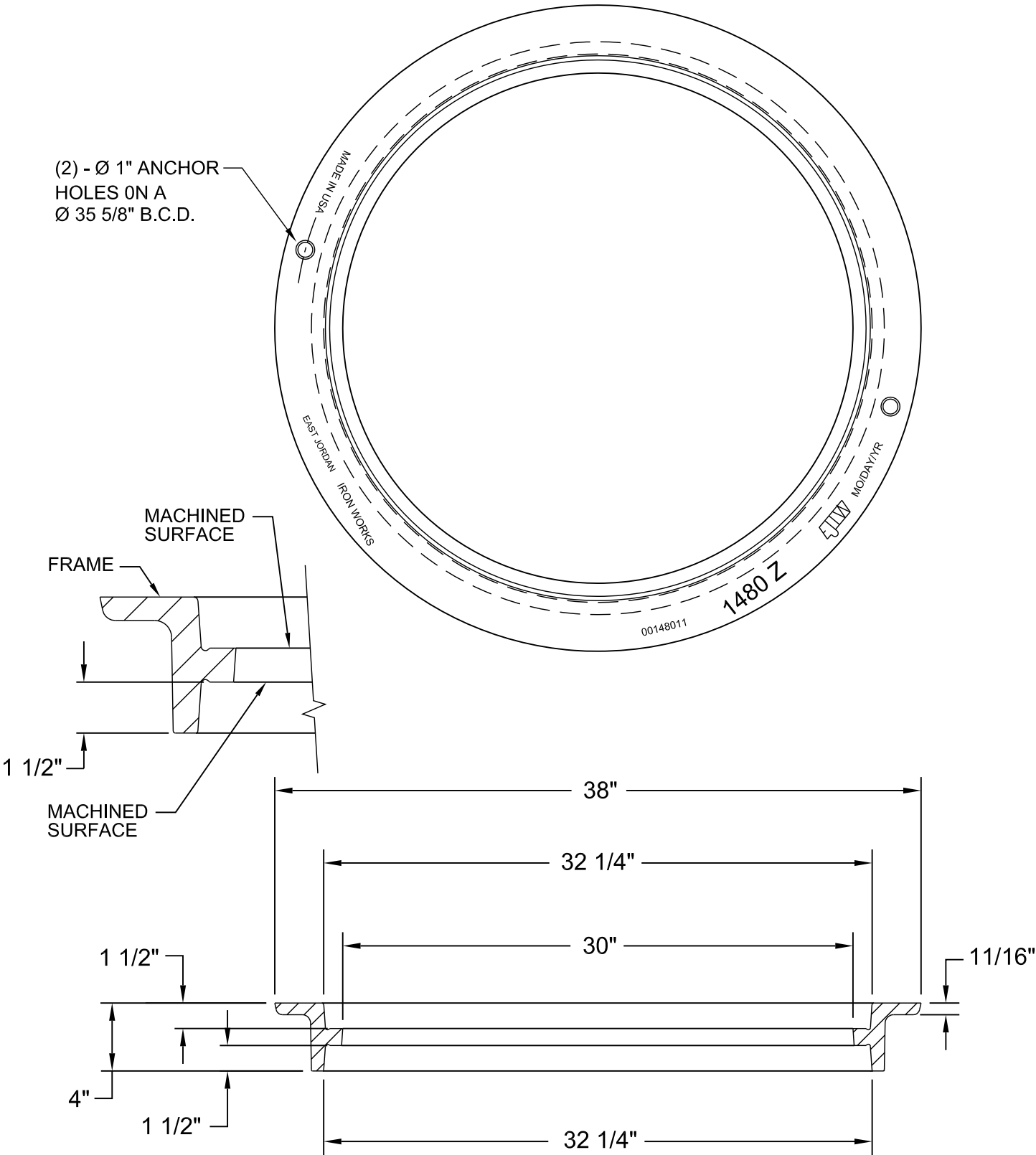


WEIGHT - 175 LB. MIN. , 0% MINUS TOLERANCE

NOTES:

LOAD RATING - HEAVY DUTY  
MATERIAL - ASTM A48 - CLASS 35 GRAY IRON  
COATING - UNDIPPED

EAST JORDAN IRON WORKS



WEIGHT - 154 LB. MIN. , 0% MINUS TOLERANCE

NO SCALE
STANDARD NO. K
VERSION NO. V1.1
VERSION DATE 8.19.2009

TYPE E MANHOLE FRAME  
30-INCHES DIAMETER (CLEAR OPENING)  
4-INCHES TALL - INVERTED/REVERSIBLE (CAST IN)

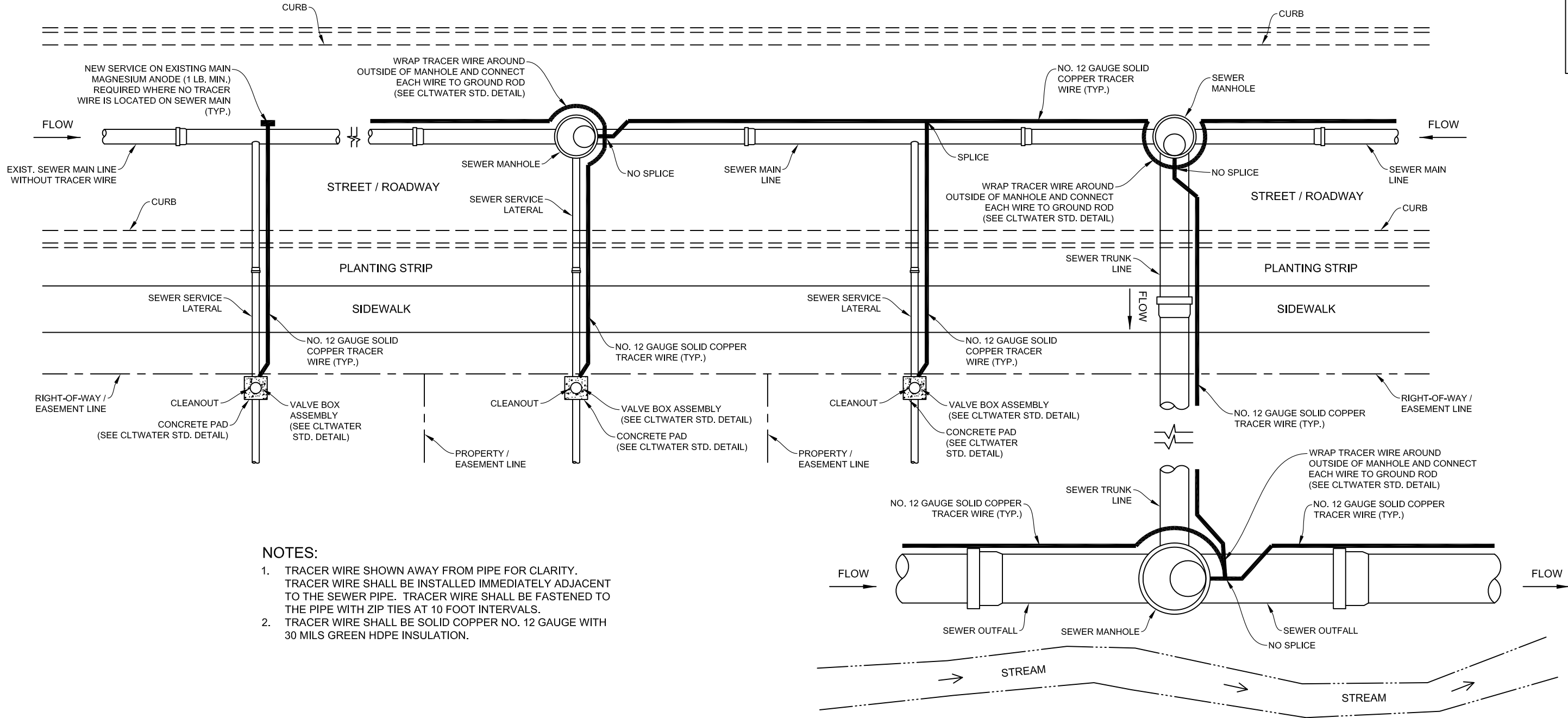
CHARLOTTE-MECKLENBURG UTILITIES
STANDARD DETAILS
GRAVITY SEWER



USE WITH TYPE 4 OR 5 COVER  
FRAME SHALL CONFORM TO DIMENSION AND WEIGHT REQUIREMENTS.  
FRAME SHALL NOT BE OUT OF ROUND.

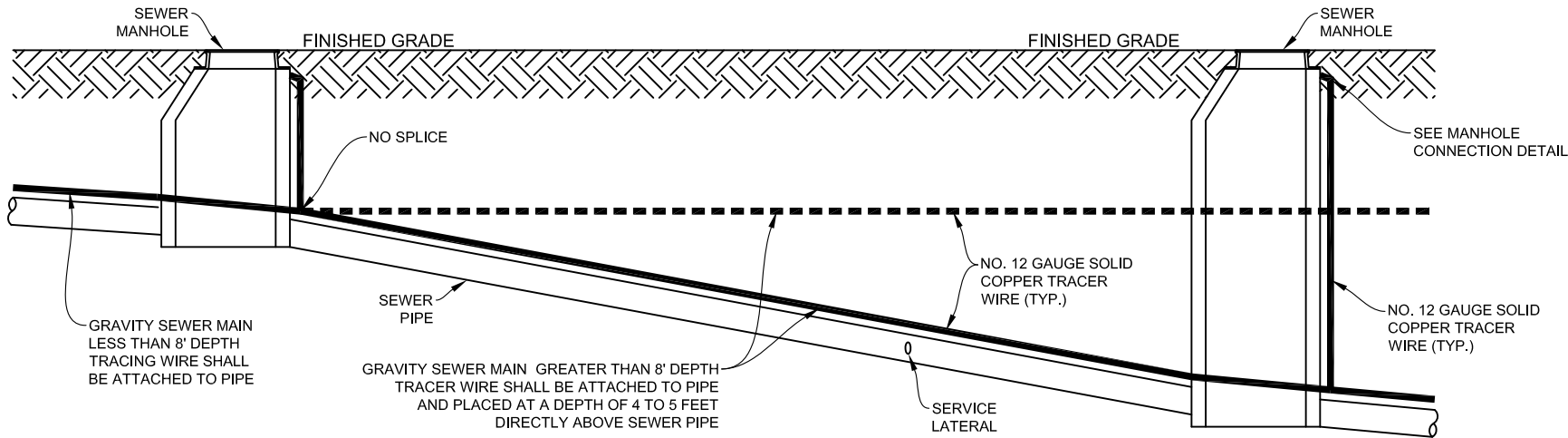
STREET VIEW - GRAVITY SEWER TRACER WIRE

PLAN VIEW



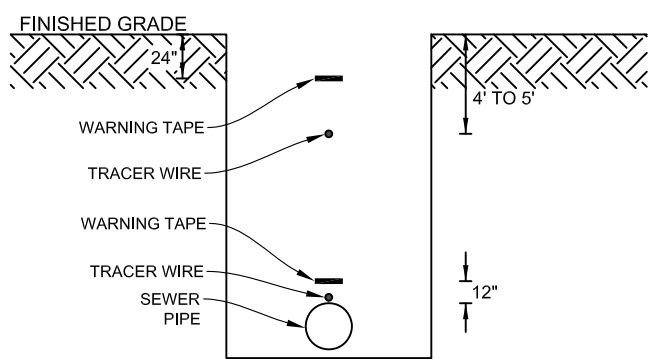
TRACER WIRE FOR GRAVITY SEWER DEEPER THAN 8 FT

SECTION VIEW



TRENCH DETAIL

PROFILE VIEW



NOT TO SCALE

STANDARD NO.	TS1
VERSION NO.	1.0
VERSION DATE	7.21.2017

TRACER WIRE - GRAVITY SEWER

CHARLOTTE WATER
STANDARD DETAILS
SEWER



### SECTION VIEW



- [illegible]

### SECTION VIEW



- ### PLAN VIEW

### SECTION VIEW



TCS

VERSION NO:	1.0	VERSION DATE	7.21.2017
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## IRACER WIRE - GRAVITY SEWER DETAILS

CHARLOTTE WATER

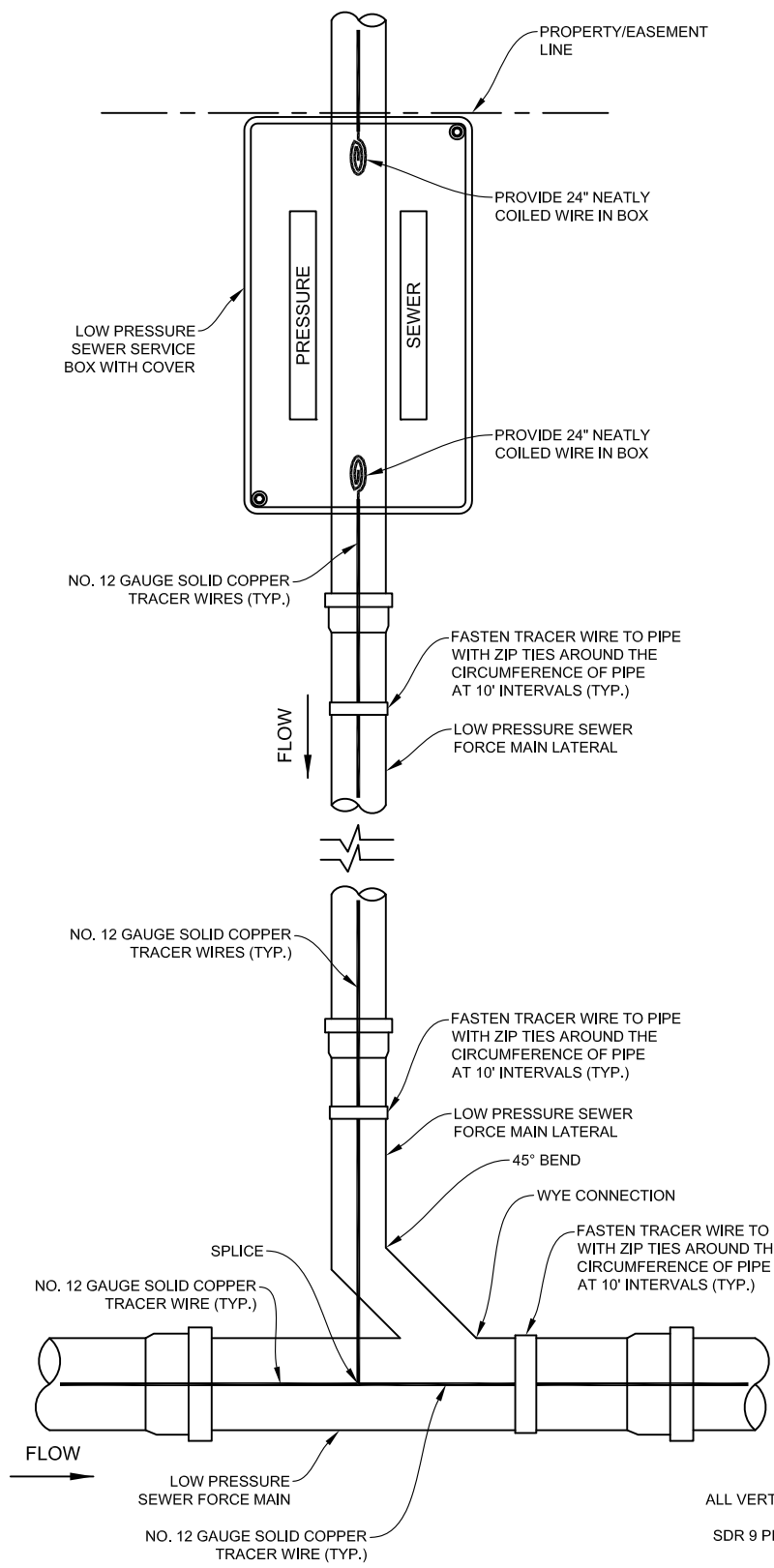
SEWER

1110

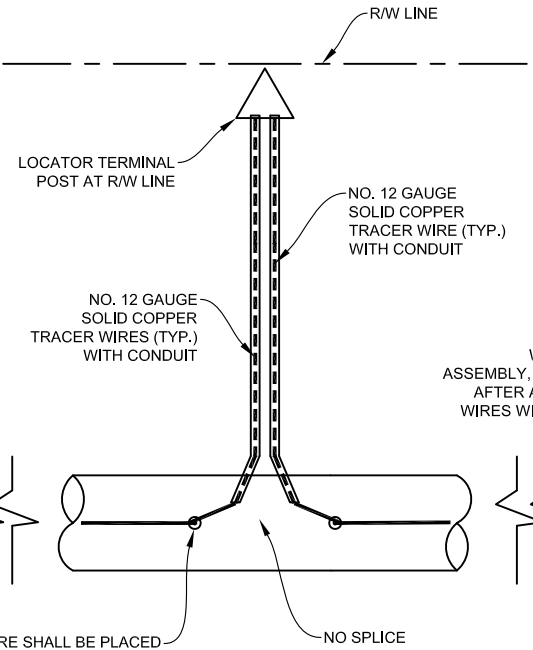


SERVICE CONNECTION

PLAN VIEW



- LOCATOR TERMINAL POST
1. SHALL BE A GREEN TRIANGULAR TRACER WIRE TERMINAL POST, 54 INCHES TALL, WITH CLT WATER APPROVED DECAL.
  2. POST SHALL BE "RHINO ULTIMATE LOCATE POST" AS MANUFACTURED BY RHINO MARKING AND PROTECTION SYSTEMS OR APPROVED EQUAL.
  3. TRACER WIRES FROM MAIN TO LOCATOR POST SHALL BE INSTALLED IN 1" PVC CONDUITS.
  4. PROVIDE LOCATOR POST EVERY 750 FT WHERE NO VALVE OR SERVICE CONNECTION OCCURS.

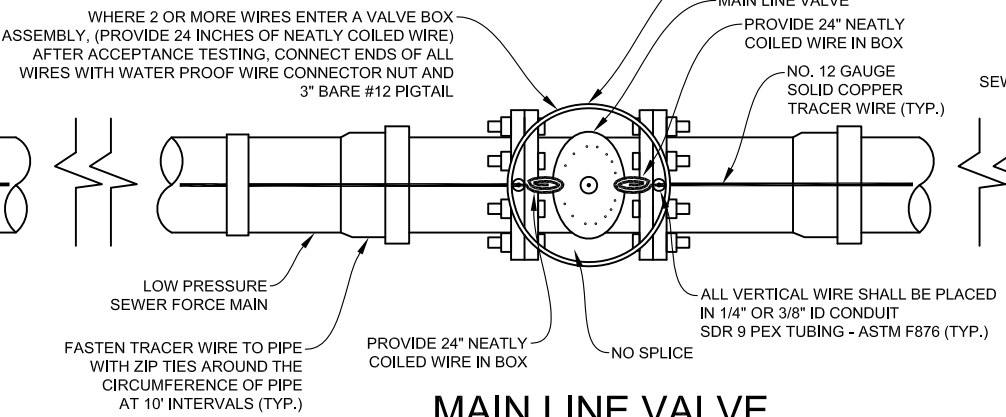
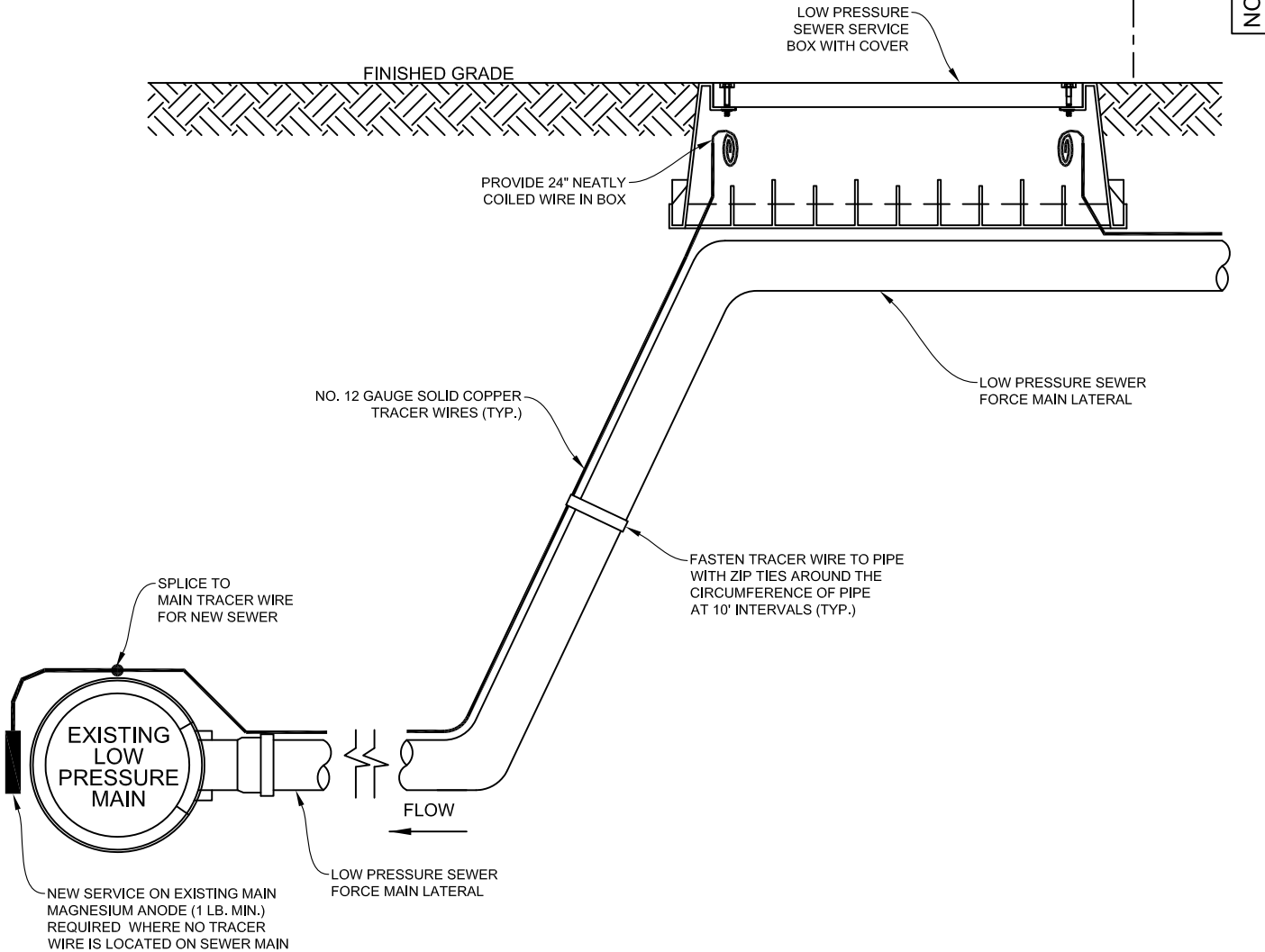


LOCATOR POST

PLAN VIEW

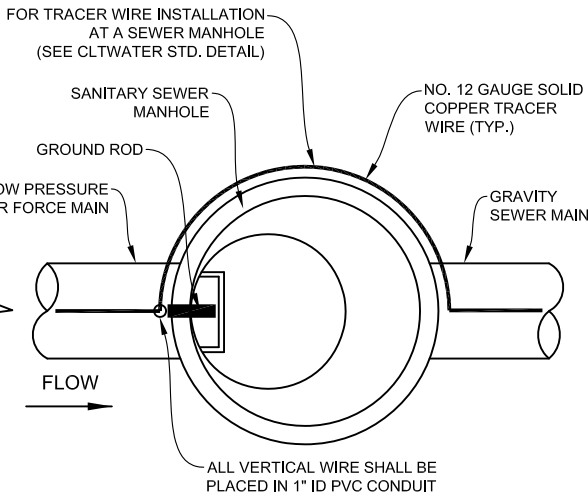
SERVICE CONNECTION

SECTION VIEW



MAIN LINE VALVE

PLAN VIEW



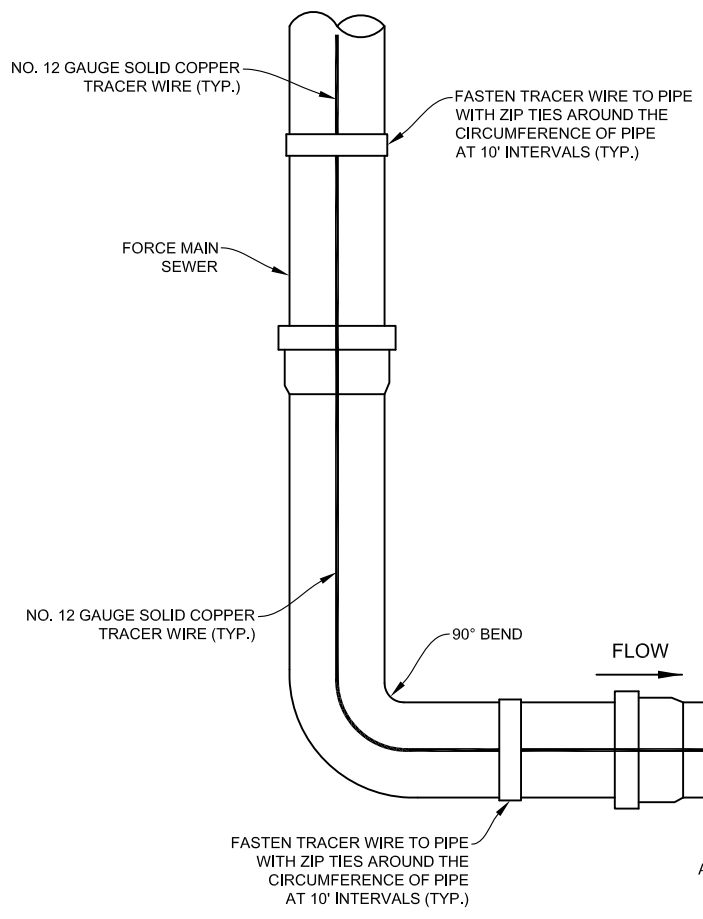
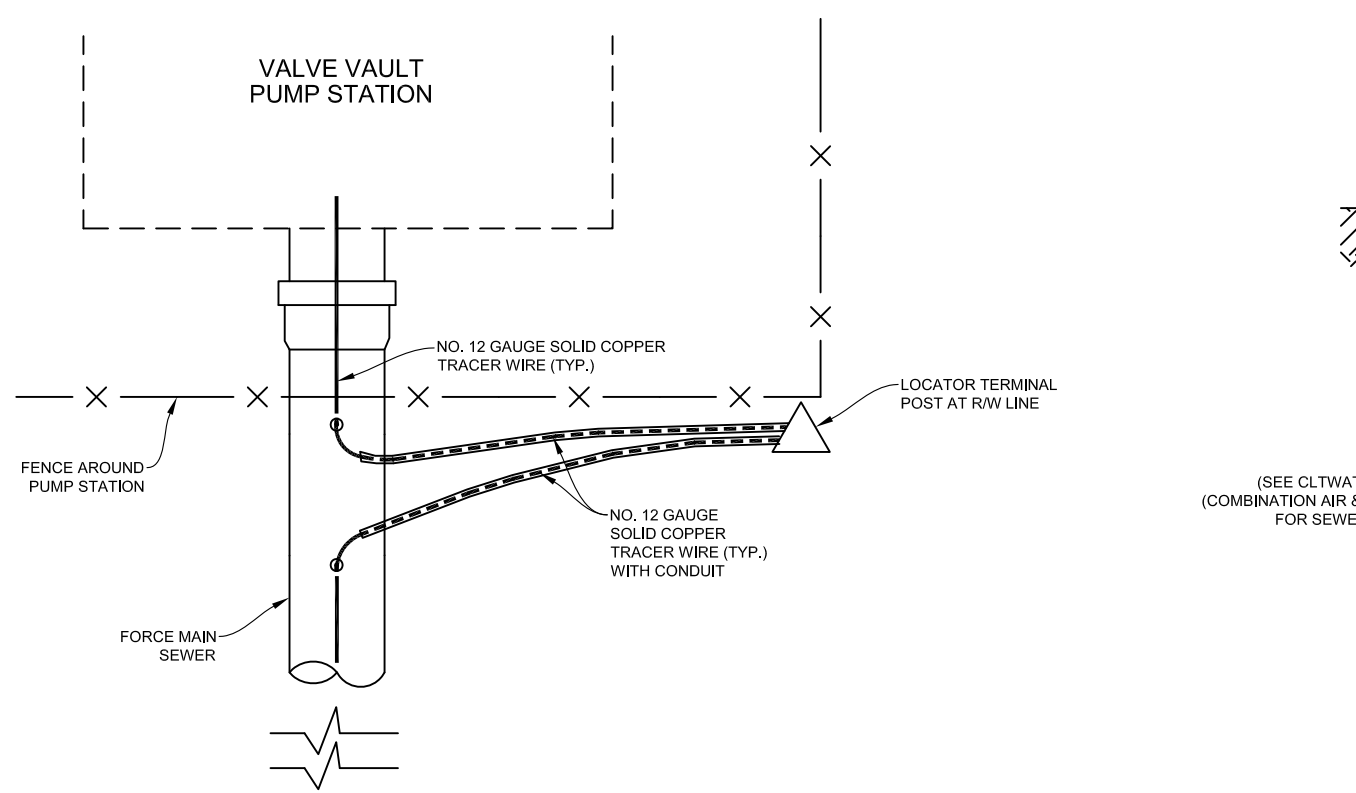
TERMINATION AT MANHOLE

PLAN VIEW

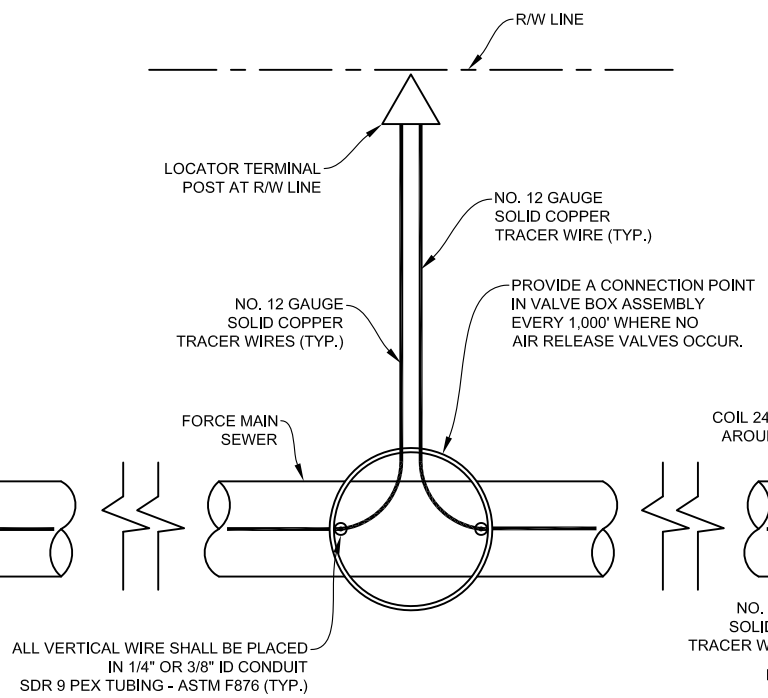
NOT TO SCALE

STANDARD NO.	TS3
VERSION NO.	1.0
VERSION DATE	7.21.2017

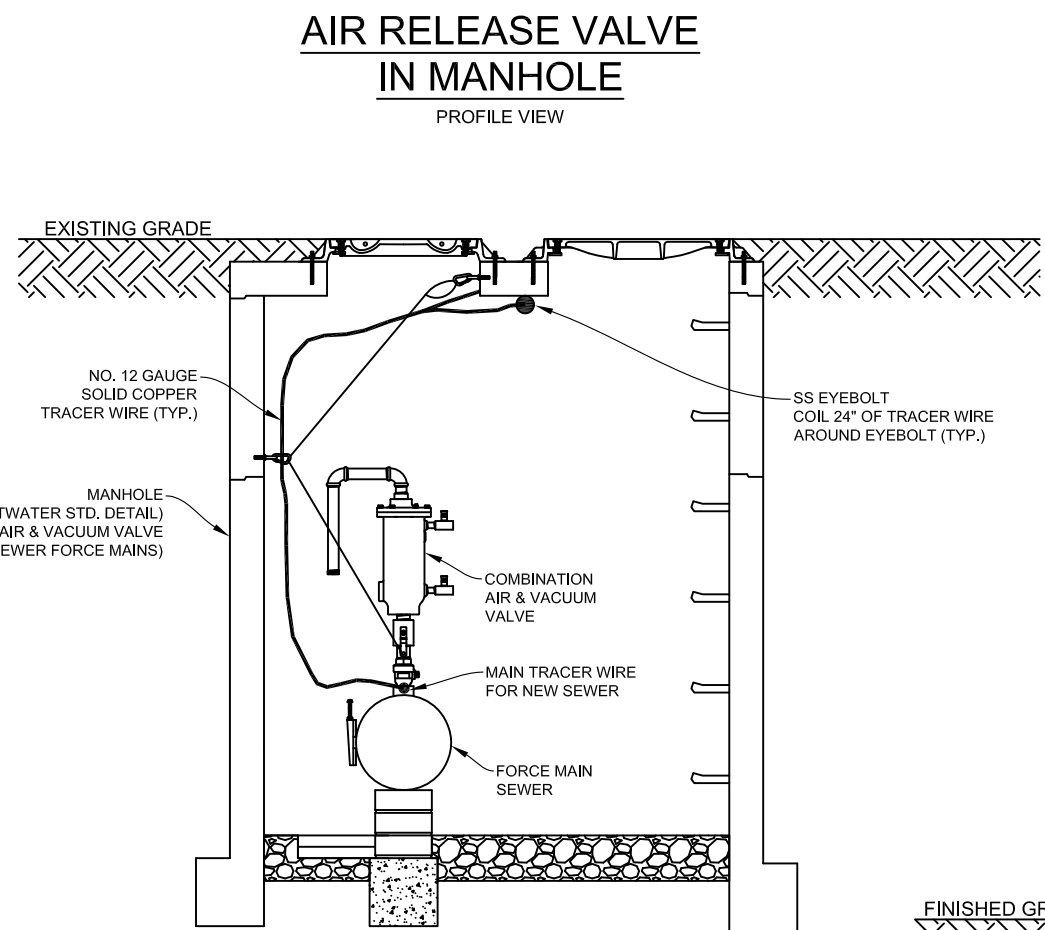
TRACER WIRE - LOW PRESSURE SEWER



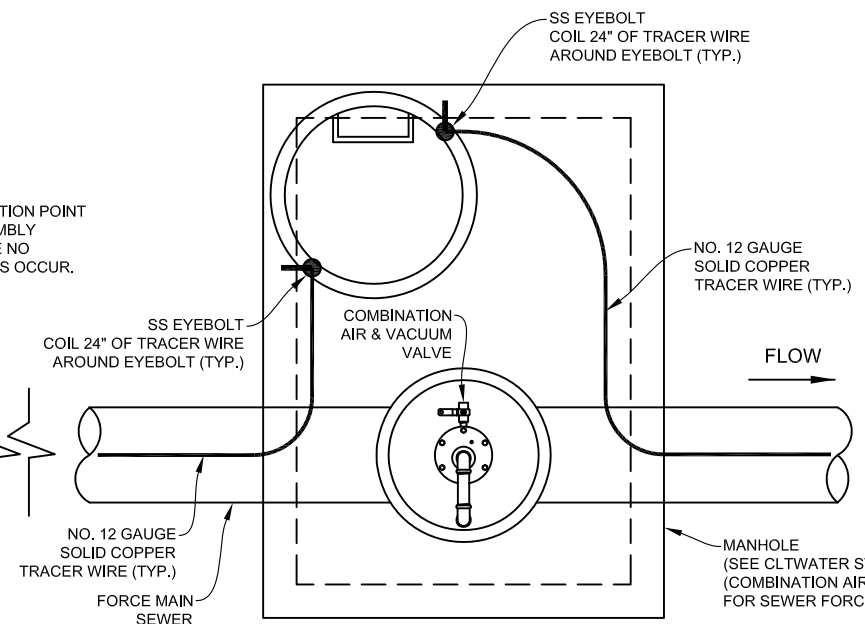
**TERMINATION AT PUMP STATION**  
PLAN VIEW



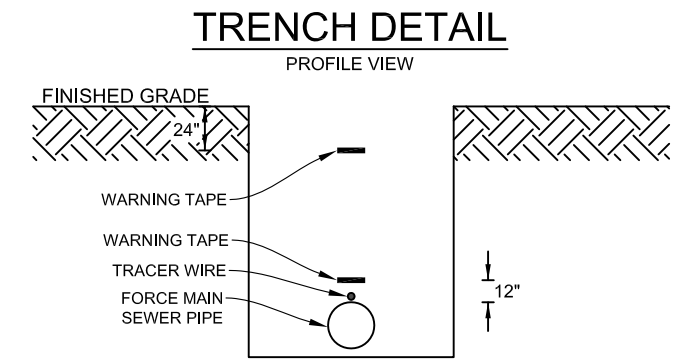
**LOCATOR POST**  
PLAN VIEW



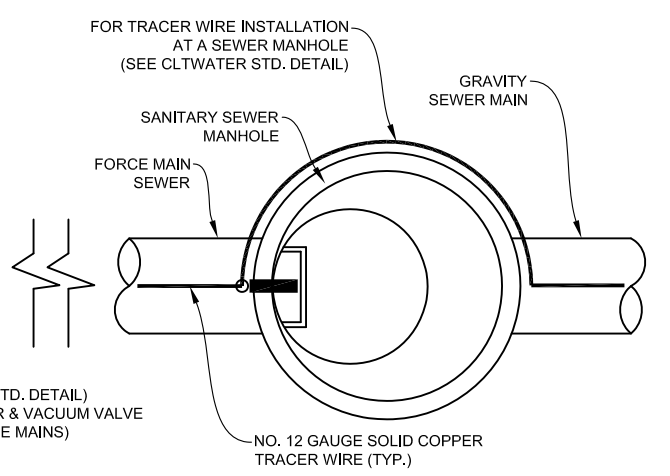
**AIR RELEASE VALVE IN MANHOLE**  
PROFILE VIEW



**AIR RELEASE VALVE IN MANHOLE**  
PLAN VIEW



**TRENCH DETAIL**  
PROFILE VIEW



**TERMINATION AT MANHOLE**  
PLAN VIEW

NOT TO SCALE	
STANDARD NO.	TS4
VERSION NO.	1.0
VERSION DATE	7.21.2017

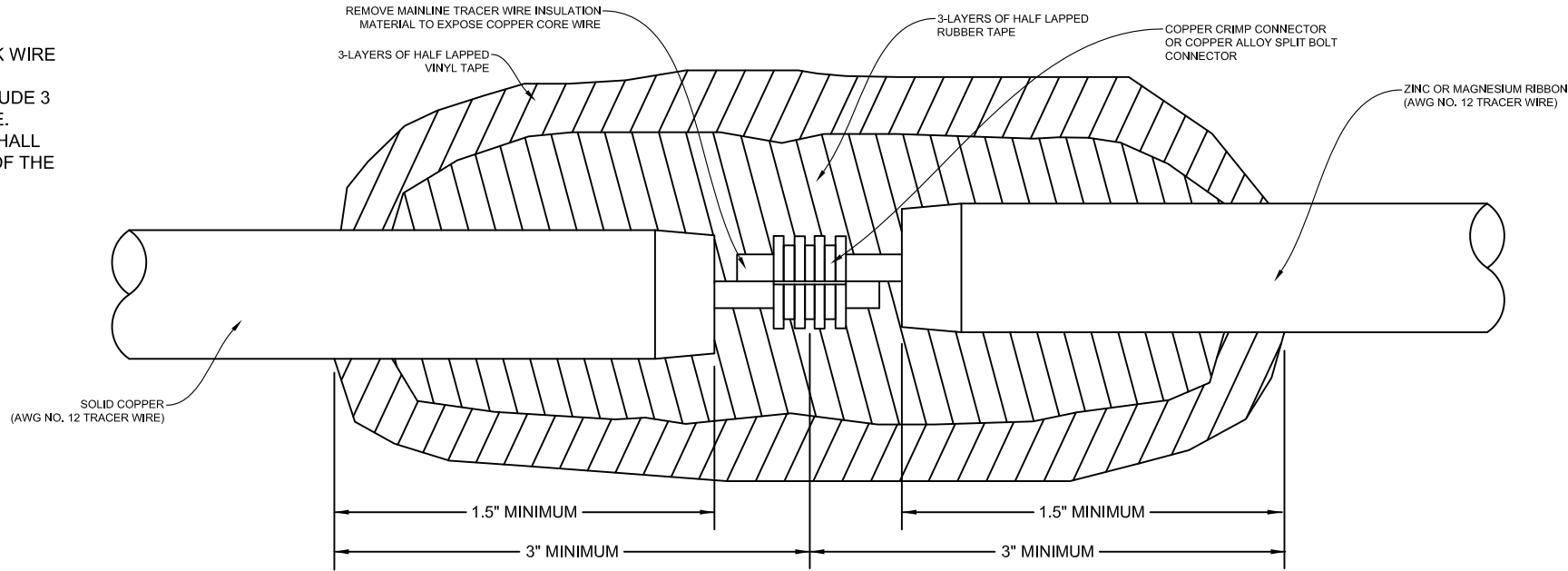
**TRACER WIRE - FORCE MAIN SEWER**

CHARLOTTE WATER	STANDARD DETAILS
	SEWER

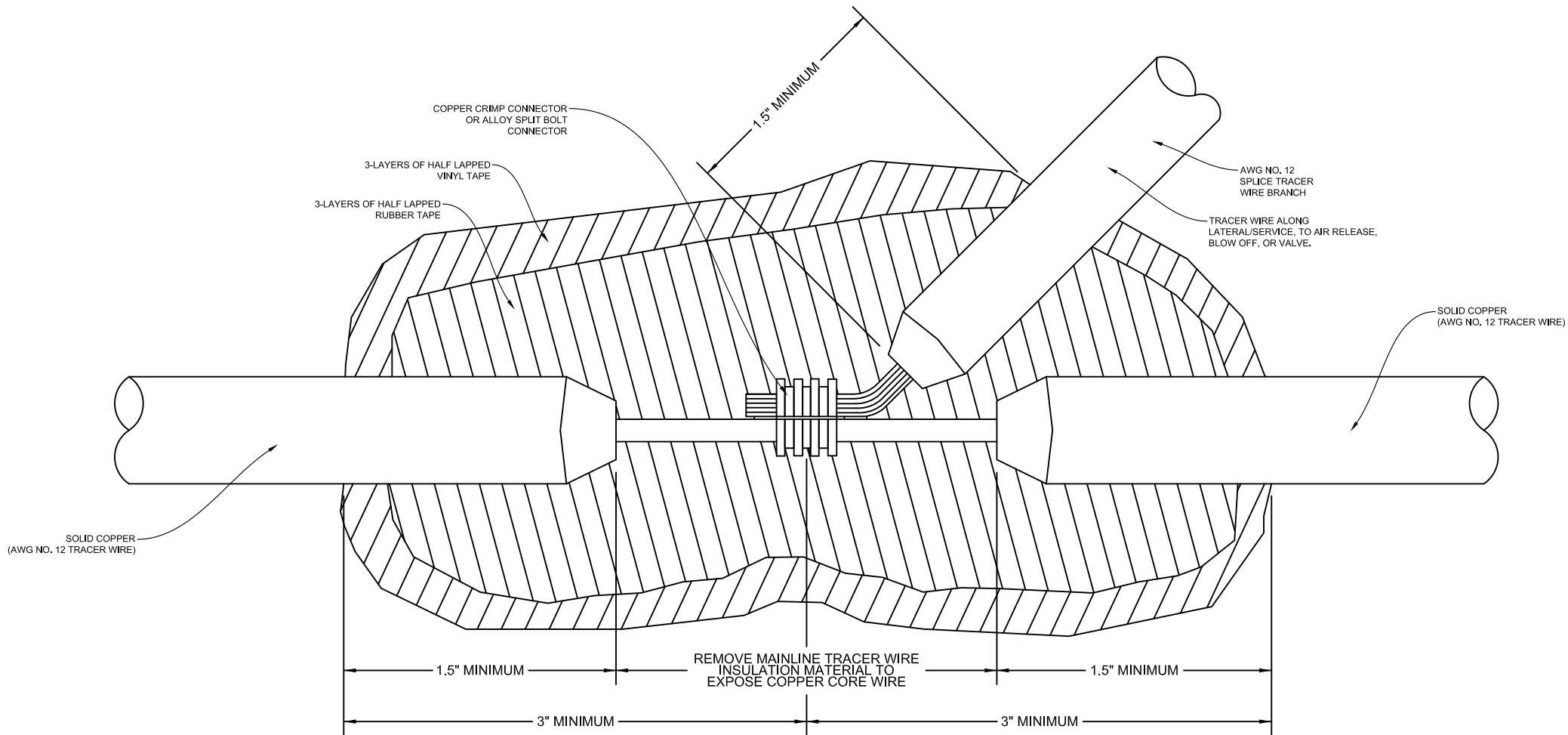
IN-LINE OR REPAIR SPLICE

NOTES:

1. IN LINE SPLICES SHALL BE LIMITED TO THE GREATEST EXTENT POSSIBLE. TRACER WIRE SHALL BE AS CONTINUOUS AS POSSIBLE WITHOUT SPLICES.
2. INLINE SPLICES SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF EACH SPLICE.
3. BRANCH SPLICES ON EXISTING WIRE SHALL INCLUDE 3 FEET OF SLACK WIRE ON THE NEW BRANCH WIRE.
4. BRANCH SPLICES ON NEW MAIN INSTALLATION SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF THE SPLICE IN EACH DIRECTION.



BRANCH IN-LINE SPLICE FOR SERVICE/LATERAL, TEE, CROSS, AIR RELEASE, BLOW OFF, OR VALVE



NOT TO SCALE

STANDARD NO.	TS5
VERSION NO.	1.0
VERSION DATE	7.21.2017

TRACER WIRE - SEWER MAIN - SPLICE

CHARLOTTE WATER
STANDARD DETAILS
SEWER

