



**Development Standards  
For Public Improvements and  
Construction Specifications Manual**

**Final Approved Version 10-19-17**

# Construction Specifications Quick Reference

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## **Purpose of Construction Specifications**

The purpose of this document is to provide engineers, developers, contractors, sub-contractors, and residents with knowledge and a process to complete projects. This is a living document and is subject to change only through adoption by the ERMD board of directors. Adoption by the ERMD board of directors of this document gives the specifications within the following pages legal and binding power for the Edgemont Ranch subdivision and any property owned and maintained by ERMD

Let it be known that any type of work including but not limited to construction, landscaping, drainage easements, utility installation, infrastructure installation or modification, traffic modification, or any activity taking place on or impacting Edgemont Ranch Metro. District property, Rights of Way, utility easements, or any infrastructure will need to go through an approval process. This process will require the entity to pay for permitting through the ERMD. A monetary surety by the entity to ensure the work is completed will be required before any approval of work is granted. Upon abandonment of a project or the unsatisfactory workmanship of the project the surety will be used by the ERMD to complete the project, the return of the surety will be forfeited by the entity. Liability may not be limited to the surety, in the event that remediation of a project costs more than the surety ERMD reserves the right to bill the entity responsible for costs exceeding the surety. As part of the process pre-construction meetings and all the appropriate permits and payments will be the entities responsibility to schedule and complete. Construction meetings may be required at regular intervals; this will be determined at ERMD staff's discretion on a case by case basis. Inspections of public improvements are required and can be accomplished by the developer's hired engineer that is approved by ERMD or by scheduling it with ERMD staff as described in this document. This is a requirement for any work to commence. Any work that happens without these items will be subject to fines, removal of the project at the entities expense, delay of the project by civil service, and/or legal action.

Any specifications not expressly covered in the following document will be brought to ERMD attention so we can provide direction for a solution and modify the standards for the subdivision. The City of Durango or City of Denver codes will be consulted in such an event.

# 1

## **PERMITTING, INSPECTIONS, PARKING, CONSTRUCTION SURETY REQUIREMENTS, INSURANCE REQUIREMENTS, AND GENERAL POLICIES**

### **1-1 General Supervision**

The ERMD, under the direction of the ERMD board of directors, shall have general control of the waterworks and sewers of ERMD, the management thereof and the supervision of such system.

### **1-2 Adoption of Standard Specifications for Construction and Specification Drawings**

These specifications include material specifications and construction requirements, for underground water, sewer, drainage systems and other utilities installed in ERMD right-of-way and in other areas under ERMD jurisdiction or ownership.

All construction of public improvements within ERMD shall be completed in accordance with the Standard Specifications for Construction of Waterlines, Sanitary Sewers and Storm Drainage Facilities (May, 1984); Standard Specifications for Construction of Streets and Road (May, 1984), including compliance with the Specification Drawings which are an appendix thereto (here-in after collectively referred to as “Standard Specifications for Construction”). The Standard Specifications for Construction shall be subject to modification from time to time upon recommendation of ERMD, the adoption of a resolution by ERMD implementing and adopting such changes and modifications as may be recommended by the ERMD engineer. A copy of ERMD Construction and Specifications can found on the ERMD website. Changes or modifications to Standard Specifications for Construction adopted pursuant to resolution of ERMD shall be incorporated within the standard Specifications for Construction as soon as possible.

### **1-3 Revisions of Standards**

When reference is made to a Standard Specification (AXTM, AWWA, AASHTO, etc.), the specifications referred to shall be understood to mean the latest revision of said specification as amended at the time of the Notice to Bidders.

### **1-4 Contractor Requirements**

All materials to be furnished by the Contractor shall conform to these specifications. The type, size and strength class of pipe, fittings and other materials shall be as shown on the plans or



otherwise specified in the Contract Documents, and are subject to review and or change in the field with approval of the ERMD.

### **1-5 Preconstruction Meetings**

Prior to any work being done on district property or R.O.W for approved utility, infrastructure, or resident driven projects, a pre-construction meeting shall be scheduled. It is the developer, utility company, contractor, or resident's responsibility to make this meeting happen. An overview of the project will be discussed and smaller details required by staff or other entities will be discussed and scheduled. This will ensure that staff understands the scope of the project and that the entity also understands their responsibilities for inspections, permitting, etc.

### **1-6 Applicability**

Where any provisions of this standard impose more stringent requirements, regulations, restrictions or limitations than the minimums imposed or required by any other provision of this Code or the statutes of the state, then the provisions of this standard shall govern.

No public improvements shall be installed nor shall any plated or dedicated street be used or improved except in compliance with this standard. Whenever in this standard, an action of the ERMD or an action of the HOA Architectural Review Board require the sub divider or developer to install water or sanitary sewer mains in the subdivision or developments with an increase in size designed and intended to serve land other than that located within the subdivision or development, an agreement with the sub divider or developer to reimburse ERMD for the cost of the increased size of the water or sanitary sewer mains, may be entered into by sub divider or developer and ERMD.

### **1-7 Enforcement**

The provisions of this article shall be enforced and administered by ERMD.

### **1-8 Guarantee of Improvements-Security Agreements, Collateral Arrangements, Bonds**

An agreement or contract setting forth the construction plan, method of construction, and parties responsible for the construction of any public improvements, together with adequate security or collateral acceptable to ERMD shall be required prior to the commencement of construction of any public or private addition thereto. No preliminary Planned Unit Development plans or preliminary subdivision plat shall be approved until the applicant has submitted them for review to ERMD. ERMD may in turn have other engineering firms look at the plans if necessary. Approved plans will be granted if subdivision improvements agreement guaranteeing to construct required public improvements shown in the final PUD plan or the final subdivision plat, together with collateral which is sufficient in the judgment of ERMD, to make reasonable provisions for the completion of the improvements in accordance with the design and time specifications. Subcontractors doing work within the subdivision for developers are subject to ERMD

construction specifications and the following security agreements as well. The types of collateral which may be used as security under this section are as follows:

- Performance bond if the project is over \$2500
- Check if the project is under \$2500

ERMD shall not require security agreements with collateral arrangements in excess of ERMD or Professional Engineers estimate of the cost of public improvements. Any security agreements, collateral arrangements or bonds furnished pursuant to this section shall not expire for a period of fourteen (14) months after the date upon which construction of public improvements is to be completed.

### **1-9 Same-Releases or Use of Collateral, Security**

As public improvements are completed, the applicant may apply to ERMD for a release of part or all of the collateral or security deposited with ERMD; provided, however, ERMD, upon recommendation of the ERMD engineer, shall retain a reasonable portion of such collateral, which shall not be less than fifty (50) percent thereof, during the one-year warranty period required under the improvements agreement. Upon final inspection, approval and acceptance of the public improvements by the ERMD its designated representative, the ERMD shall release that portion of the collateral or security not required to secure the warranty period. If the ERMD determines that any of the improvements are not constructed in substantial compliance with applicable specifications, the ERMD, pursuant to the improvements agreement, shall withdraw and employ from the deposited collateral of security such funds as may be necessary to construct or repair the improvements in accordance with such specification.

### **1-10 Permits**

No person shall excavate, trench, dig or otherwise disturb, in any way whatsoever, any Public roadway or right-of-way for the purpose of constructing, installing or repairing any utility, or conduct "work" defined here in, without first having obtained a permit or Memorandum of Understanding to do so as set forth in this document.

Permits or Memorandum of Understanding shall be obtained before work begins, except that, in cases of emergency, permits shall be obtained as soon as practical after work begins, but in no event later than the next working day.

Permits shall be issued by the administrative office of ERMD. Permit copies shall be available for inspection at the project site at all times.

Permits will be \$25 dollars per permit up to a \$2500 project. Projects on ERMD public ways above \$2500 dollars will be subject to 1.0% of the project bond as permit pricing.

Any person or utility found to be conducting or to have conducted any excavation activity within the public right-of-way without having first obtained the required permit(s) shall immediately cease all activity (exclusive of actions required to stabilize the area) and be required to obtain a permit before work may be restarted. In addition to penalties which may be imposed, a

surcharge of two hundred fifty dollars (\$250.00) shall be required in addition to all applicable permit fees in cases where excavation has proceeded without a permit.

### **1-11 Process for Permitting**

Contractors or residents doing “work” as defined here in, independent of any phase development processes, impacting the following, but not limited to, ERMD R.O.W., easements, lands, infrastructure, boring, or streets will need to obtain a permit from the ERMD administrative office. Plans showing total costs of the project including labor and materials will be required to determine surety requirements. If the cost estimate of the project is under \$2500 the contractor/resident/builder will provide a surety check to ERMD administrative office in the amount of \$500. This will be returned upon completion of the project, after inspection to impacted areas to determine if damage to ERMD property has occurred. In the case of damage, as determined by ERMD staff, the amount needed to fix the damage will be forfeited. If the amount is over the surety check amount the surety will be forfeited and any additional costs will be billed to the contractor/resident/builder. If the project is over \$2500 then a performance bond equal to the total cost of the project including materials, time, and labor will need to be submitted to ERMD administrative office in order to obtain a permit for work impacting ERMD holdings, showing ERMD as a beneficiary.

Warranty of work. By applying for and obtaining a permit, the permittee warrants the work and all labors and materials used therein for a period of one year from the acceptance of the work by ERMD and guarantees that no further repairs or maintenance shall be required at the worksite due to any defect or omission in the work. The permittee agrees that any repairs needed of an emergent nature, determined by ERMD staff, will be handled within a 24 hour period from notification. Non emergent repairs will be handled within 30 days of notification. All warranty and rehabilitation work for the entire project will be done at the contractor/resident’s expense.

Development scope activity. In ERMD the physical construction of public improvements in new developments is the responsibility of the developer/land owner. The ERMD will require the listing of, and documentation of, Edgemont Ranch Metropolitan District as a beneficiary next to that of La Plata County on the bond for the development project, before the project can proceed. Ownership of those improvements remains with the developer of the land until acceptance by the ERMD. Prior to acceptance by the ERMD, “work” as define here in, on those improvements which are within a public way shall require a Memorandum of Understanding between the ERMD and developer/owner of the improvements in the public way. The developer/owner shall be financially responsible for the improvements to carry out all remedial work necessary to receive acceptance by the ERMD of those improvements. This financial obligation shall apply only to the work in the public way done by the developer/owner on public improvements.

Warranty of work. By agreeing to a Memorandum of Understanding for development of ERMD approved public improvements developer/owner warrants the work and all labors and materials used therein for a period of one year from the acceptance by ERMD of the work, and guarantees that no further repairs or maintenance shall be required at the worksite due to any defect or omission in the work. The developer/owner agrees that any repairs needed of an emergent nature, determined by ERMD staff, will be handled within a 24 hour period from notification. Non

emergent repairs will be handled within 30 days of notification. All warranty and rehabilitation work for the entire project will be done at the developer/owner's expense.

### **1-12 Insurance**

Prior to the granting of any permit or Memorandum of Understanding, the permittee shall file with the ERMD an insurance policy or certificate in a form satisfactory to the ERMD to be held with the permit and bond reflecting coverage as follows:

A comprehensive general liability policy, including broad form property damage, completed operations and contractual liability, for limits not less than one million dollars (\$1,000,000.00) each occurrence for damages of bodily injury or death to one (1) or more persons; and five hundred thousand dollars (\$500,000.00) each occurrence for damage to or destruction of property;

### **1-13 Indemnification**

Indemnification of ERMD. By applying for and receiving a permit or Memorandum of Understanding the permittee, utility company, contractor, resident, or developer agrees to hold harmless ERMD from and against all lawsuits, liability, damage, claims, demands, judgment and losses whatsoever in nature, and reimburse ERMD for all its reasonable expenses arising out of the operations of any utility, contractor, resident, developer or any permittee within the subdivision, including any third-party claims, administrative hearings, and litigation. None of the ERMD expense reimbursed pursuant to this section shall be surcharged. Nothing herein contained shall obligate any utility, contractor, resident, developer or any permittee to hold ERMD harmless or indemnify ERMD to the extent any lawsuits, liability, damage, claims, demands, judgments or losses shall have been found to have arisen out of or in connection with any negligent act, failure to act or intentional wrongdoing of ERMD or of its officers, agents or employees by final decision of the court or administrative agency of competent jurisdiction in an action where ERMD is a party.

### **1-14 Savings Clause**

If any portion of this document is held unconstitutional or otherwise unlawful, the remaining section of this article shall remain effective and are, for the purpose, hereby declared to be severable.

### **1-15 Final Inspection and Acceptance**

The acceptance of all pipelines by ERMD will be based on the following:

- Submittal of satisfactory results of required tests (such as pressure test, leakage tests, compaction, bacteriological test, etc.)
- Passing a final inspection of the work by ERMD.
- Submittal of "As-Built" construction drawing on 24" x 36" reproducible mylar or other suitable material.

### **1-16 Measurement and Payment**

The complete and accepted pipeline will be paid for in accordance with the contract bid, by the developer. Items listed in the bid documents will be paid for in accordance with the contract bid items listed in the bid schedule, approved change orders, and within these specifications.

The unit process bid for the various contract pay items shall be full compensation for furnishing all materials, labor, equipment, tools and other incidental items required for completion of the work in accordance with the construction plans and specifications.

The quantities shown on the bid schedule are approximate only. Payment will be based on measurement of actual quantities installed and approved.

### **1-17 Installation of Pipe and Appurtenances**

All pipe, valves, hydrants, manholes and other pipeline appurtenances shall be installed and tested in accordance with the construction plans and specifications, applicable AWWA, ASTM or AASHTO Standards and Manufacturer's Instructions. When installation instructions or procedures differ, the ERMD will determine which will take precedence.

### **1-18 Public Safety and Traffic Access**

The contractor's operations shall cause no unnecessary inconvenience. The safety and access rights of the public shall be considered at all times.

Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time. If backfill has been completed to such an extent that safe access may be provided, and the street opened to local traffic, the Contractor shall immediately clear the street and driveways and provide and maintain access.

The Contractor shall cooperate with the various parties involved in the delivery of mail and the collection and removal of trash and garbage to maintain existing schedules for these services, additionally access for snow removal and EMS will be maintained by steel plates or other methods.

### **1-19 Barricades and Warning Sign**

All signs, barricades, flagmen, lights and other devices necessary for the protection of work and safety of the public shall be the Contractor's responsibility. A traffic control plan shall be submitted and approved by the Traffic Engineer prior to beginning construction where any construction activity will involve the use of public right-of-way as deemed by ERMD.

### **1-20 Location and Protection of Utilities**

The locations of existing utilities shown on the construction drawings are approximate only. The Contractor shall be responsible for the exact locations and protection of all utilities

encountered. In the event of a break in an existing water main, gas main, sewer or underground cable, the Contractor shall immediately notify the responsible officials of the organization operating the utility interrupted and shall lend all possible assistance in restoring services.

### **1-21 Interruption of Water Service**

The contractor shall not discontinue water service to any residence, business or other occupied dwelling without notifying the (ERMD) at last 24 hours in advance. The residents of all dwellings to which water service is temporarily discontinued shall be notified by the Contractor not less than thirty (30) minutes before the water is shut off. Water service shall not be discontinued for more than two (2) consecutive hours without special written permission from ERMD.

### **1-22 Removal of Plantings**

Where trees, hedges, shrubs or other ornamental planting within the construction limits are not designated to be protected or saved, the Contractor shall notify the owner of the property fronting the plantings in question not less than ten (10) days prior to removing the plantings. This notification shall include allowing the property owner the option to transplant the plantings fronting his property onto his property instead of having the Contractor remove them.

### **1-23 Mud and Earth Tracking on Public Streets**

The Contractor shall conduct his operations so as not to have the equipment tracking mud and earth onto the adjacent public streets. Upon notification by ERMD, the Contractor may be required to clean from the public streets mud and/or earth tracked by his equipment or that of material equipment to the project.

### **1-24 Handling**

All materials shall be handled with equipment and methods adequate to prevent shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the coating or lining is damaged, the Contractor shall repair or replace the material at his expense as directed by ERMD. All pipe and appurtenances shall be handled in accordance with the appropriate AWWA and ASTM Standards.

### **1-25 Storage**

The Contractor will be held responsible for the safe storage and protection of all pipe and other materials delivered to the work site. The interiors of all pipe and pipe fittings shall be kept free from dirt and foreign matter at all times. Gaskets for pipe joints shall be stored in a cool location out of direct sunlight.

Any material that has been damaged before actual incorporation in the work shall be repaired or replaced at the Contractor's expense. Any material which does not meet these material specifications shall be removed from the construction site.

### **1-26 Written Agreements for Installations and Connections**

All parties connecting to ERMD water or sanitary sewer utility shall be required to execute for the benefit of ERMD a Memorandum of Understanding agreement pursuant to which all installations and connections shall be accomplished in accordance with existing ERMD specifications.

### **1-27 Timely Commencement of Work Done Under Permit**

All work undertaken by virtue of any permit shall be done with reasonable dispatch and no work shall be done or commenced upon any public place of ERMD prior to the granting of a permit therefore.

### **1-28 Location Requests**

ERMD will be responsible for location of water and sewer mains, water service lines to the meter, sewer stub outs to the property line. ERMD will not perform secondary locates on private property beyond R.O.W.'s

### **1-29 Resident Requests for Modifications**

Requests by residents for any and all modification to engineered infrastructure, traffic modification, or any work requested on roadways, right of ways, metro property, or district defined easements shall have the following process for approval. The resident is required to place such requests on the ERMD board agenda and present the request to the Edgemont Ranch Board of Directors at a regular or emergency meeting of the board. The request will be discussed by the board, with staff input, either at the meeting or at a later date and a response will be rendered. The decision for action, investigation, or rejection of the request will lie solely with the ERMD.

### **1-30 Access to Buildings**

Access to buildings must be provided in accordance with the Uniform Fire Code, as published by the International Conference of Building Officials, chapter 10.107(a) and (c). Except for course and cul-de-sacs, streets will connect with streets, already dedicated in adjoining or adjacent subdivisions, or provide for future connections to adjoining un-subdivided tracts, or should be a reasonable projection of streets in the nearest subdivided tracts.

### **1-31 On-Street Parking - ERMD Parking Policy**

In an effort to keep traffic lanes clear, and promote safe and convenient traffic flow on Edgemont roads, the ERMD Board of Directors has adopted the following Parking Policy for Edgemont Ranch roads. These can be amended as necessary through board action:

- No parking shall be permitted on roadways or shoulders, provided however,
- Temporary resident, guest and construction parking will be permitted except in areas posted “No Parking”.
- Temporarily parked vehicles are not allowed to be left overnight.
- Illegally parked vehicles will receive a notice of parking violation posted on their windshield for the first offense. For the second parking violation, and all subsequent violations, the vehicle will be towed at the owner’s expense.

### **1-32 Landscaping**

Landscaping must be planned to contribute to safety. Landscaping must not create visual obstructions to motorists or pedestrians particularly at intersections and access points. No private tree shall be located within any right-of-way, easements, or drainages maintained by ERMD. Low maintenance plantings are required. Planning of street landscaping shall give consideration to location of existing or proposed underground utilities.

### **1-33 Approval, Acceptance of Plans**

Construction standards for streets and utilities as set forth in this standard shall be followed in the design and construction of public facilities. Two (2) prints of construction plans must be submitted for approval. All plans must be approved by the ERMD in writing. Once approved, plans will not be amended without approval of the ERMD. A Memo of Understanding between the ERMD and owner/developer must be entered into prior to construction of any public facilities. Acceptance of each phase of construction of public improvements (water, storm sewer, sanitary sewer, roads, etc.) is contingent upon:

- Submittal of approved as-built plans;
- Submittal of required test results as per the EMRD specifications; results to be delivered or emailed to ERMD.
- A final inspection by the ERMD engineer and the owners or their representatives. After final inspection, the ERMD engineer shall inform the owner in writing of any deficiencies and whether or not a re inspection will be necessary. Re inspections by ERMD personnel shall require an inspection fee of 25.00 to be paid by the permit holder pursuant the schedule of fees adopted by resolution of the ERMD.

### **1-34 Conduit**

Unless otherwise specified, conduit of the various sizes, types and classes shown on the bid schedule will be paid for at the contract unit price per linear foot of pipe installed and approved.



Measurement will be made along the centerline of the conduit from end to end. The footage of conduit to be paid for will include the lengths of fittings, valves and valve vaults in line with the pipe but will not include the lengths of manholes, drain inlet boxes, culvert and sections, or their structures in line with the pipe.

### **1-35 Valves and Hydrants**

Valves and fire hydrants will be paid for at the contract unit price “each” for the different sizes, types and classes listed in the bid schedule. The number of valves and hydrants to be paid for will be the number of units furnished, installed and approved.

### **1-36 Water Service Lines**

Water service lines will be paid for at the contract unit price per linear foot for each size of line installed and approved, by the developer. This price shall include the cost of furnishing and installing a corporation stop and curb stop and curb stop box on each service line.

### **1-37 Manholes and Inlets**

Manholes and storm drain inlets will be paid for at the contract unit price “each” for the various sizes, types and depths listed in the bid schedule, The number of manholes and inlets to be paid for will be the number of complete units (including ring and cover or grate and frame) constructed and approved.

### **1-38 Rock Excavation**

No payment will be made for “rock excavation” unless the method and costs of such work are established and approved by the P.E. or ERMD in writing before any rock excavation is done.

### **1-39 Pavement Replacement**

The area of pavement replacement to be paid for will be the same area designated for removal. Where pavement is approved, the Contractor shall replace the pavement at his own expense. The contract unit price per square yard for “Pavement Replacement” shall be full compensation for replacement of the pavement structure, including all hot bituminous pavement and aggregate base course required to restore the paved surface to its original condition.

### **1-40 Incidental Construction**

Unless otherwise specified or provided for, the following list of materials and items of work will not be paid for separately but will be considered incidental to the contract pay items and all costs of these incidental items shall be included in the contract prices for the various pay items.

- The furnishing and maintenance of barricades, warning signs and other traffic control devices.
- All surface removals including removal of asphalt pavement, concrete, fences, plantings and structures.
- The location and protection of existing utilities.
- All excavation (for trenches, compaction test, etc.) except rock excavation. (See section 107.6 for payment for rock excavation.)
- The support bracing and sheeting of trenches.
- The dewatering of trenches.
- The furnishing and placement of all granular bedding and haunching material, and all backfill material with moisture and density control.
- The clean-up and restoration of grounds.
- The removal and disposal of all waste material including excess excavated material, trash and debris resulting from the work.
- The furnishing and installation of tracing wire.
- The furnishing and installation of concrete support and thrust blocking required on pressure pipelines.
- All pressure and leakage testing.
- The flushing and disinfection of waterlines. Water from ERMD mains for the required flushing and disinfection shall not be charged to the Contractor, Water for compaction, cleanup, and non-required flushing shall be a Contractor expense, and, if ERMD water is used, shall be paid for at the rate of \$2.00/1000 gallons.
- The connection of new pipeline to existing facilities.
- The separation, removal and disposal of muck, large rock, organic matter or other materials from project excavations which in the opinion of the Engineer are unsuitable for use in the backfill. No separate or additional payment will be made for hauling unsuitable materials to the Contractor's disposal site.

## 2

### **RATE RELATED**

#### **2-1 User Charge System**

The user charge system shall generate adequate annual revenues to pay costs of annual operation and maintenance including replacement and other related sewer system costs which ERMD may determine by ordinance to be paid by the user charge system. That portion of the total user charge which is designated for operation and maintenance including replacement of the treatment works shall be established by the ERMD Board.

#### **2-2 Water Infrastructure Schedule of Fees**

Any applicant desiring to take and use water from the water utility of ERMD shall pay to ERMD through its office, a water fee pursuant to the schedule of fees then in effect pursuant to resolution duly adopted by the ERMD. No water connection shall be made to ERMD water utility until such time as the fees have been paid. The fees are authorized by resolution of the ERMD board of directors. Fees shall not apply to a water connection to the ERMD utility exclusively for the purpose of providing a sprinkling system for fire protection within a structure.

#### **2-3 Sewer Fees**

It is determined and declared to be necessary and conducive to the protection of the public health, safety, welfare and convenience of ERMD to collect charges from all users who contribute wastewater to ERMD treatment works. The proceeds of such charges so derived will be used for the purpose of operation reserves and maintenance and other related costs as determined by ERMD for such public wastewater treatment works.

#### **2-4 Charges**

**Reference ERMD Current Rate Schedule – located at [www.edgemontranch.com](http://www.edgemontranch.com) under the Metro Tab**

This includes: Annual Metro District Fees on Unimproved Lots, Monthly Metro District Fees on Improved Lots, Prices, Road Snow Plowing Fee, Sewer Fees, Residential and Multi-family Water Usage Rates, Pond Water Usage Rates, Late Penalties, Collection Fees and Water Shut-Off, Resident Request for Water Shut-off, Delineation of Responsibilities for Water and Sewer Line Maintenance and Repairs, Water and Sewer Lines, Unauthorized Turn-On of Service, Unauthorized Water or Sewer Taps, Late Plat Filing, and Unauthorized Dumping Penalty.

**2-5 Late Penalties, Collection Fees and Water Shut Off**

1.38% interest per month will be charged to all accounts when payment is not received by the due date. If delinquent, in addition to the interest charge there will be 2% per month delinquency fee. Customer will be responsible for any and all collection expenses including but not limited to legal fees, collection charges, and delinquency charges. An account that remains delinquent for 60 days may be subject to shut off. Customer will receive 72 hours' notice and, if requested, a hearing with the Metro District board. There will be a shut off fee pursuant to the current schedule of fees. Any account delinquent for more than 90 days may be subject to a lien on the respective property.

**2-6 Materials Furnished by ERMD**

All water users within ERMD connected to the ERMD water system shall reimburse ERMD for all materials furnished to each user by ERMD including, but not limited to, the tap, corporation cock and connection, curb cock, service box, water meter, meter pit, meter readout and any other materials. The applicant for water service shall pay ERMD the published charges, and costs of installation prior to the connection of the water utility. All excavations for reaching the mains and for placing the curb cock and service box as well as the furnishing and laying of connection pipes shall be done at the expense of the owner of the premises to which such pipes are placed. All service pipes shall be laid not less than four (4) feet below the established grade of any avenue, street or alley.

# 3

## WATER RELATED

### 3-1 Water System Standards General Requirements

All water distribution facilities installed within public rights-of-way or easements shall be constructed in accordance with the standard drawings and construction specifications of ERMD. In addition, all minimum standards of the Colorado State Department of Health shall be followed in the planning and construction of the water pumping, distribution and transmission facilities. All water system construction plans shall be approved by a P.E. prior to beginning of any construction.

### 3-2 Waterlines

Waterline construction plans must be sufficiently complete to provide assurances of compliance with design standards. Construction plans must contain the statement that all facilities are to be installed in accordance with Standard Specifications for Construction of Waterlines., Sanitary Sewers and Storm Drainage Facilities. Additionally, the plans or accompanying report must provide the following:

- Maximum and minimum delivery pressures;
- 20' easements (twenty foot easements) are a minimum requirement for water mains, laterals, etc. to provide satisfactory access too, and maintenance of, water mains, laterals, etc. that are ERMD responsibility.
- Surface drainage features will be constructed using BMP's to provide no conflict with access and maintenance of water mains, laterals, etc..
- Waterline profiles where slope exceeds fifteen (15) percent on any reach or where vertical fittings are proposed;
- Existing and proposed physical features within ten (10) feet of the waterline, including trees, geologically unstable areas, cliffs, ponds, ditches and other topographic features;
- Pipe material, size and bedding class for all reaches of pipe, existing and proposed.
- Approximate location of proposed and existing utilities within twenty (20) feet of the proposed construction;
- Existing and proposed roads,
- Right-of-way lines, easement lines, street names, one-hundred-year floodplain, benchmarks, origin of survey, basis of bearing section, township, range and professional engineer's seal.

Construction plans should be provided in the same general format as are preliminary improvement plans submitted per the subdivision procedures.

As-built plans shall include all information required in the construction plans and shall provide additional or revised information on location of valves, service lines, fittings, hydrants and water main lines. As-built plans shall be stamped by a professional engineer certifying that all facilities were installed in substantial accordance with the approved plans.

### **3-3 Restrictions, Regulations Established**

Any person making connection to the water utility of ERMD shall be subject to the restrictions and regulations set forth in this document.

### **3-4 Qualified Installers to Perform Work**

It shall be unlawful for any person not a duly qualified installer to do any work in plumbing or laying or connection of pipes for the distribution of water from the water mains or connecting drains to the ERMD sewers. It shall be unlawful for any person except for ERMD approved installers to tap any water main, adjust any corporation cock, curb cock or service box cover or tap any sewer main.

### **3-5 Maintenance of Pipes and Fixtures**

The owner of any premises to which water shall be conducted shall keep all fixtures and pipes from the discharge side of the meter pit to the premises, and inside the premises, in good repair. The owner shall promptly repair any fixtures of pipes when notified by ERMD, the water shall be turned off and shall not be turned on again until repairs are made.

### **3-6 Right of Entry**

ERMD shall have the right to enter all private premises and buildings in which a ERMD water service is connected. ERMD will make every effort to consult with property owners prior to any entry, if possible, and set up an appointment. ERMD reserves the right to shut water off if access is denied pursuant to CDPHE Article 1-114 and 1-114.1 of Title 25 of the Colorado Revised Statutes and of section 39 of 5 CCR1002-11 of The Colorado Primary Drinking Water Regulations.

### **3-7 Right to Shut Off Water for Repair, Other Work**

ERMD reserves the right to cause the water to be shut off from the mains when necessary for repairs, making connections or extensions or doing any other necessary work. No claim shall be made against ERMD on account of shutting off the water from the mains or for the breaking of any service pipe or fixtures connected thereto.

### **3-8 Compliance Required**

Any person who shall lay any water pipes or introduce into or about any building or on any grounds any water drainpipes or do any plumbing work in any building or on any grounds for the purpose of connection such pipe or plumbing work with ERMD water mains or of preparing them for connection or who shall make any addition to or alterations of any water pipes, fixtures or apparatus for the supplying of any premises with water shall be deemed guilty of violation of this Code.

### **3-9 Tampering with System; Unauthorized Use**

It shall be unlawful for any person to open any fireplug or curb cock or any valve or other fixture appertaining to or connecting with ERMD waterworks or to turn or shut off water from any water pipe connected with the same without authority.

It shall be unlawful for any person to use water from the water system of ERMD unless prior authorization for such shall have been obtained under and according to the terms of this article.

### **3-10 Restriction on Use Under Shortage Conditions**

Whenever, in the opinion of ERMD, and at it's sole discretion, a shortage of the water supply exists or is from any cause threatened, ERMD by order, via email and notification on ERMD website, shall prohibit the use of water for irrigation, shorten the hours for irrigation, change the hours of irrigation, provide for the irrigation of different parts of ERMD on different days, or as deemed necessary by ERMD staff and board, until the situation is deemed resolved by ERMD staff and the board. At the scheduled ERMD board meeting, or otherwise such order may be confirmed, continued or annulled by the ERMD by resolution. Such resolution shall be published in the same manner as the original order.

### **3-11 Water Main Inspection**

All water infrastructure created and/or installed by the developer must be inspected by an Edgemont Ranch Metro District approved engineering firm, or by an ERMD staff member. ERMD Staff members can be available upon request; however a 24 hour notice before the inspection time is suggested so staff can be available. For each pipe and each individual stub out the district will require an inspection report signed by the individual inspector. This inspection report must be accompanied by representative dated photos and/or video of water and sewer lines and dated photos and /or video of all service line stub outs. The results from all tests must be documented by the engineering firm, and/or ERMD representative and included in their inspection report. No infrastructure will be accepted by the district without written inspection reports indicating compliance with ERMD published infrastructure requirements and all authorities referenced therein.

### **3-12 Water Service Inspection and Water Meter Installation**

The builder or contractor shall notify the ERMD office to schedule a request for an inspection at a minimum of 24 hours in advance. The request shall include the builder or contractor phone number, address and lot number, and date and time for the inspection. Refer to the ERMD Construction Specifications for the proper method of installation. The inspector will take a picture of the connection to the water meter pit and any other portion of the water service if needed. The inspector will complete the ERMD Water service inspection form along with any other information or asbuilts. The picture and inspection form will be placed in the homeowner's file on the ERMD data sever. A Water Meter installation request shall be done in the same manner as the water service inspection request.

### **3-13 Cross Connection Control**

The Colorado Department of Public Health and Environment (CDPHE) has approved a new law that became effective on 1/1/16/. This law is now a requirement for all drinking water providers in Colorado. It is CDPHE Article 1-114 and Article 1-114.1 of Title 25 of the Colorado Revised Statues and of Section 39 of 5 CR 1002-11 of the Colorado Primary Drinking Water Regulations (Regulation 11)). This new regulation concerns backflow prevention and cross connection control (BPCCC). The ERMD staff will need to review all drawings for any type of construction that will be served with a water line service. This includes all new homes, commercial buildings, or any other type structures and landscaping projects. The approved ERMD policy on Cross Connection Control can be found on the ERMD website, or call the ERMD office and a copy of it can be provided.

### **3-14 Water Mains**

Water main extensions and replacements shall be a minimum of eight (8) inches in diameter. Extensions to serve limited development may be served by a six- inch main where no potential exists for future development and where fire flow requirements can be met. Larger mains may be required in accordance with ISO firefighting requirements or ERMD master water plan. All mains shall be extended to the furthest property line of any lot or development where future development is at all possible. All waterlines shall be looped, if possible.

Lines shall be installed with a minimum of four (4) feet of cover to the proposed or existing grade whichever may be less. The developer will be responsible to set grade stakes to ensure proper depth for all waterline installations.

Waterlines shall be installed before paving or repaving of existing or proposed roads.

### **3-15 Pipe Laying**

Pipe shall be laid on the alignment shown on the plans or staked. Unless otherwise specified or approve, all pressure pipelines shall be laid to a minimum depth of forty-eight (48) inches measured from the proposed final ground surface or of the proposed road surface.



The inside of the pipe and jointing surfaces shall be kept clean and free from mud, dirt, gravel, groundwater and other foreign material. When pipe laying is not in progress, the open ends of the pipeline shall be kept closed with water-tight plugs. All pipe lengths shall be squarely cut.

Long radius horizontal or vertical curves may be laid with standard pipe by deflections at the joints of rigid pipe. Maximum deflections at pipe joints shall be per the Manufacturer's recommendations or applicable AWWA Standard.

### **3-16 Water Service Lines and Additional Fire Service Connections**

All buried service lines shall be of type K copper or blue poly pipe. If using poly pipe, yolk must be supported and tracer wire must be provided, see detail. Poly pipe shall meet ASTM D 2737 standard specification for PE plastic tubing. PVC shall meet AWWA C800 standards and AWWA C900 standards. Service lines including curb stop and box shall be installed from the main to the property line for each existing or proposed lot which is along a roadway to be paved as part of the improvement project. (See detail) Service line locations must be noted on construction plans and as-built drawings.

Separate service lines shall be supplied to each separately owned lot. Townhomes and single-family dwellings shall have a separate service line to each dwelling unit. Where two (2) or more commercial buildings lie on a single parcel, each shall have a separate service line.

### **3-17 Installation of Water Service Pipe**

Underground water service pipe shall be laid not less than ten (10) feet horizontally from the building sewer service line. Where this separation is not possible, the water service line shall be at least eighteen (18) inches above the top of the building sewer service line.

Each water service line shall be machine tapped and connected to the water main through a brass corporation stop. The main shall be tapped at an angle of forty-five degrees (45 degrees) from the vertical, and the stop must be turned so that the T-handle will be on top of saddle tap approved by ERMD (see detail).

Additionally consecutive taps may not be less than 18" (eighteen inches) apart on any main line section.

### **3-18 Maintenance of Water Service Line and Meter Regarding Freezing**

**As a condition of utility service**, each person served by the water utility shall take precautions to prevent the entire water service line and the water meter from freezing. This may include, but shall not be limited to, leaving a faucet dripping during time of non-usage or absence, installation of heat tape, or putting a drop light in the meter pit.

From December through April the homeowner will bare **all** costs associated with a repair of a frozen service line from the premises to the main line under the pavement. The property owner should notify ERMD to help investigate the frozen water line and meter. The property owner

is responsible for the thawing and maintenance of their service line, ERMD will not be responsible for any damage caused by the thawing of a frozen water service line.

If ERMD determines that the meter is frozen ERMD will thaw out or replace the meter at no expense to the property owner. The second time this occurs, the ERMD will thaw out or replace the meter, but the property owner will be charged for time and materials expended to thaw out or replace the meter.

### **3-19 Water Service Taps**

(a) Water fees must be paid prior to any connection being made. The ERMD or its representative will make service taps into all existing waterlines that are not already stubbed out. The service line taps in all new main lines shall be made prior to pressurizing the water main.

(b) Main line connections must be approved and inspected by the ERMD staff, approved ERMD developer representative, or P.E of the developers choosing. An inspection report for all services will be supplied to ERMD by the developer's engineer when this option is selected, or done by ERMD personnel on Tuesday and Thursday.

### **3-20 Ductile Iron Pipe**

Ductile iron pipe for water mains shall conform to AWWA C-151, thickness-classes. Pipe thickness shall be AWWA C-104.

**Joints:** Unless otherwise specified in the Construction Plans or Special Conditions, ductile iron pipe joints shall be mechanical or push on Joints conforming to AWWA C-111. Caskets shall be of neoprene or other synthetic rubber material.

**Fittings:** Fittings for ductile iron pipe shall be in accordance with AWWA C-110 and shall have a pressure rating of not less than that specified for the pipe. Fittings shall be ductile iron or cast iron and shall be cement lined per AWWA C-104.

### **3-21 Valves**

Three (3) gate valves are required at each main line tee except fire line.

Any extensions to the end of property which cannot be looped shall be terminated with a gate valve at least nine (9) feet in length of pipe and plug and thrust block with minimum of 2 inch flushing hydrant or blow off.

Air/vacuum release valves will be installed at all high points in transmission lines. Air release valves shall be installed in distribution system lines as required by ERMD engineers.

Gate valves shall be located so that no more than about four hundred (400) feet of main line would be out of service due to a break anywhere in the main line.

All-weather vehicular access shall be provided to each valve location.

### 3-22 Fire Hydrants

Hydrants shall be located in accordance with the Uniform Fire Code and shall be installed as shown in standard drawing. All hydrant locations are subject to approval by the director of fire services from the Durango Fire Authority. Hydrant tee, valves and waterline runs to the curb line shall be installed where potential development may occur along a street to be paved repaved as a part of the development.

Fire hydrants shall be the dry bowl type and shall conform to the requirements of AWWA C-502. Hydrants shall be Kennedy or Mueller Centurion A423 (National Standard Thread). (See Drawing No. W-1).

The standard hydrant shall have a six-inch inlet construction, a 5 ½ inch main valve opening, two (2) 2 ½ inch hose nozzles (National Standard – 7 ½ threads per inch) and one (1) 5 inch pumper nozzle with 6.055" O.D. male thread (Seagraves Thread). The hydrant barrel shall be marked with a circumferential rib to denote the interceded ground line. The center of the hose nozzles and pumper nozzle shall be at least 20 inches above the ground line mark.

Hydrants shall be of the “traffic” or “breakaway” design, having easily replaceable breaking devices for the grade line flange and operating stem that prevents damage to the barrel sections upon impact. The hydrant base must be a 4’6” below the breakaway base. The breakaway base shall be set at the ground level.

The operating nut and nozzle cap wrench nuts shall be 1 ½ inches pentagon, measuring from point of opposite flat side at the base and tapering uniformly to 1 7/16 inches at the top. The height of the nut shall not be less than one inch.

The nozzle caps shall be removable and the operating nut opened by turning to the left (counter-clockwise). Nozzle caps shall be securely chained to the upper barrel section.

**Painting:** Fire hydrants shall be painted Red with Dupont Centari #700-A; or equivalent

### 3-23 Gate Valves

The minimum requirements for all gate valves shall conform to the standards of AWWA C-500 or AWWA C-509.

All gate valves shall be double disc or resilient wedge, cast or ductile iron body, fully bronze mounted with non-rising stem and parallel seats. The stem and all wearing surfaces shall be bronze or other approved non-corrosive material. Contact surfaces shall be machine finished and all wearing surfaces shall be easily renewable. Nonferrous bushings shall be of substantial thickness rightly fitted and pressed into machined seats. A clockwise turn of the stem shall close the valve. Acceptable brands of double disc gate valves are APS Smith Metropolitan, Mueller, Dresser or Stockham. Acceptable brands of resilient seat gate valves are Watrous, Mueller, and Dresser.

**End Connections:** End connections of gate valves shall consist of mechanical or push-on (rubber gasket.) joints conforming to AWWA C-111 or flanged ends in accordance with ANSI B-16.1

**Wrench Nuts:** Wrench nuts shall be made of cast iron and shall be 1 5/16 inches square at the top, 2 inches square at the base, and 1 3/4 inches high.

### **3-24 Butterfly Valves**

Butterfly valves shall conform to AWWA C-504 specifications. Valves shall be manufactured by BIF, Allis Chalmers, or Henry Pratt Co. All valves shall be 200 psi working pressure with direct buried operators. Provision shall be made for locking the disc in the fully open or fully closed position. Counter clockwise turn of the operating nut shall open the valve.

### **3-25 Valve Boxes**

A cast iron valve box and lid shall be provided for each underground valve. Valve boxes shall be 5 1/2 –inches diameter, adjustable screw-together type, sized for the type of valve and depth of bury. The lid shall have the word “WATER” permanently cast in the top.

### **3-26 Air and Vacuum Valves**

Air and vacuum valves shall be of the type and size specified. They shall be designed for 200 psi working pressure and shall be Crispen Type RN or equal. A separate isolation valve of the same size and pressure rating as the air valves shall be installed between the water main and the air and vacuum valve. The air and vacuum valve shall be housed in a vault made of reinforced concrete pipe or manhole rise section. The vault shall be covered with a precast concrete lid and cast iron manhole ring. The vault shall be insulated in a manner acceptable to the ERMD.

### **3-27 Bonding Straps**

A bonding strap shall be installed across each joint in the water line to provide metal to metal continuity for tracing purposes. The Contractor shall be responsible for installation. Bonding straps shall be a minimum #9 copper wire properly attached at each end by means of magnesium weld or other approved method.

### **3-28 Meter Yolks**

Meter yolks shall be made of brass and shall be the same size as the service line. The inlet end of the valve shall be threaded in accordance with AWWA- 800 for use with AWWA c-800 for use with type K compression copper service tubing. All meter valves shall be provided with an approved locking device and meter coupling attached.

### **3-29 Meters**

All connections to ERMD’s water distribution system shall be metered. Each meter shall be of sufficient size to ensure that the peak demand required does not exceed eighty (80) percent of the recommended meter capacity as set forth by the American Water Works Association.

All meters, meter pits and covers, meter risers, remote reads, generators and all other appurtenances shall be furnished by ERMD at the expense of the property owner. ERMD shall maintain and repair all meters and the meters shall remain the property of ERMD. All meters shall be installed by ERMD.

It shall be unlawful for any person, except for ERMD, to unlock, interfere, or tamper with any meter belonging to the ERMD.

### **3-30 Flanged Adapter**

The flanged adapters shall be Smith-Blair 912 or Baker Series 601 cast flanged coupling adapters with anchor studs or equal approved by the Engineer.

### **3-31 Flexible Couplers**

Flexible couplings shall have cast iron or steel sleeves the same as pipe type furnished; ductile iron flanges, bronze bolts and nuts; and wedge-type rubber gaskets. The couplings shall be designed for a 200 psi working pressure except as noted and each shall be sized to properly fit the ends of the two pieces of pipe being joined. The couplings shall be Smith-Blair Type 433, Baker Series 236 Cast Transition Couplings, or equal approved by the ERMD.

### **3-32 Miscellaneous Appurtenances**

Check valves, service materials, saddles, pipe type furnished; ductile iron flanges, bronze bolts and nuts; and wedge-type rubber gaskets. The couplings shall be designed for a 200 psi working pressure except as noted and each shall be sized to properly fit the ends of the two pieces of pipe being joined. The couplings shall be Smith-Blair Type 433, Baker Series 236 Cast Transition Couplings, or equal approved by the ERMD.

### **3-33 Cement, Concrete and Mortar**

All concrete used in construction of, inlet boxes, vaults, concrete encasement, thrust blocks, etc., shall be Colorado Division of Highways "Class B". Unless otherwise specified, all concrete shall be made with Type II Portland Cement.

Cement mortar used in construction of inlets, vaults, etc., shall be mixed at a ratio of one part Portland Cement to three parts sand. The amount of water used in the mortar shall be the minimum amount required for workability of the mix. Mortar shall be made with Type II Portland Cement unless otherwise specified. Mortar used for the patching of existing manholes shall be non-shrink type approved by the ERMD.

### **3-34 Concrete Blocking**

Concrete support or thrust blocks shall be poured at all pipe bends, tees, caps, valves, hydrant and other locations shown on the plans. The size and location of blocking shall be as shown on the plans or in accordance with the Standard Drawing, see details. Thrust blocks shall be poured on firm, stable foundation material and all bearing surfaces shall be against undisturbed earth.

Concrete for support and thrust blocks shall be made with Type II Portland Cement and shall reach a minimum compressive strength of 3000 psi in 28 days.

Reinforcing steel and belts used to anchor valves, fittings, etc., to thrust blocks shall meet tensile requirement of ASTM Grade 40. All anchorage steel not embedded in concrete shall be coated with coal tar or other approved coating material.

### **3-35 Installation of Valves and Valve Boxes**

Each valve shall be installed in a vertical position and anchored to a concrete support clock as shown on the Standard Water Line Drawing, see details. An adjustable screw type valve box shall be set into position during backfilling operations. The lower section of the valve box shall be cushioned with backfill material so that it does not rest directly upon the body of the valves or upon the water main. The upper section of the unit shall be place in proper alignment and adjusted so that its top will be at final grade. The completed valve box shall be vertically centered over the valve operating nut and each valve shall be tested for proper access and operation.

### **3-36 Installation of Fire Hydrants**

Hydrants shall be installed at the locations shown on the plans. They shall be plumb and set so that the bottom of the pumper nozzle is no less than twenty (20) inches above finished grade.

A minimum of  $\frac{1}{4}$  cubic yard of washed gravel shall be placed around the base of the hydrant after use. Blocking of the hydrant shall consist of pouring solid concrete base of not less than  $\frac{1}{4}$  cubic yard extending from the hydrant base to the undisturbed soil on the bottom and sides of the trench. Weep holes which drain the hydrant shall not be covered with concrete (see details).

### **3-37 Connection to Existing Mains**

New water main lines shall be isolated until the new lines have been tested, disinfected and have a residual of fifty (50) ppm after 24hrs of CL2 disinfection. Additionally the line will be flushed and high concentration CL2 water to be dechlorinated and disposed of by contractor. A bacteriological test will be performed before acceptance by ERMD, unless inspecting engineer signs off that this process has happened.

Where the connection of the new work to old requires interruption of service, the ERMD and the Contractor shall mutually agree upon a date and time for connections which will allow ample time to assemble labor and materials.

### **3-38 Testing Pipeline Participants**

All pressure and leakage testing shall be performed by the Contractor under direct control of the Construction Observer, P.E. or ERMD staff.

### **3-39 Testing Pressure Pipelines**

Water mains and all other pipelines that will operate under pressure shall be tested for pressure and leakage in accordance with these specifications and AWWA Standard C-601, Section 4.

The Contractor shall furnish all labor, equipment, tools, water and other incidental items required to conduct the tests. Test results will not be considered valid without the presence of the ERMD or his representative throughout the test.

No pressure testing shall be performed until all thrust blocks have been placed and cured for at least two (2) days, and the pipeline backfilled adequately to prevent any movement or lifting of the pipe. Pavement or other permanent surfaces shall not be placed until all pressure and leakage tests are satisfactorily completed.

### **3-40 Test Pressure**

Unless otherwise specified, the test pressure for all pipes shall be double the operating pressure at the lowest elevation of the test section or the class designated of the pipe plus fifty (50) psi, whichever is less, except that the minimum test pressure for water distribution lines shall be one hundred fifty (150) psi.

### **3-41 Filling**

The pipeline shall be filled with potable water at least twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly and all air expelled by means of taps at points of highest elevation. Tapping to remove air shall be the responsibility of the Contractor and location of taps shall be approved by ERMD.

### **3-42 Procedure**

The pressure and leakage tests may be performed simultaneously or separately. The total time for the combined pressure and leakage tests shall be a minimum of two (2) hours for each section of pipeline. If separate tests are made, the pressure test shall be made first. The duration of the pressure test shall be a minimum of one (1) hour and the duration of the leakage test shall be a minimum of four (4) hours. The pressure of the leakage test may be reduced to one hundred and fifty percent (150%) of the maximum working pressure that will occur on that portion of the line.

The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to ERMD. No pipe installation will be accepted if the leakage for the section of line being tested is more than the rate calculated using the following formula.

$$L = \frac{NDVP}{7,400} \text{ where}$$

L – allowable leakage in gallons per hour  
 N – number of joints in length of pipeline tested  
 D – nominal diameter of pipe in inches  
 P – average test pressure in psi gauge

Leakage is defined as the quantity of water to be supplied to the section of pipeline being tested, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

### **3-43 Disinfection of Water Lines**

After completion of pressure and leakage testing and prior to being placed into service, all new water mains and repaired portions of or extensions of existing mains shall be chlorinated by the Contractor in accordance with AWWA Standard c-601.

### **3-44 Prevention Reverse Flow**

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

### **3-45 Chlorinating Valves and Hydrants**

In the process of chlorinating newly laid pipe, all valves or other appurtenance shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

### **3-46 Final Flushing and Testing**

Following chlorination, all treated water shall be thoroughly flushed and de-chlorinated from the newly laid pipe at its extremity until the replacement water throughout its length shows upon test a chlorine residual of less than 2 mg/l.

### **3-47 Bacteriological Testing**

Following flushing samples shall be collected by the Contractor for testing for Bacteriological quality. Each 1,000 feet of water main shall be sampled and tested and results of the test supplied to ERMD before acceptance of any portions of the line.



### **3-48 Water Pressure**

Water shall be supplied to each building in any development at pressures not less than forty (40) psi during peak consumption hours with all water tanks operating one-half full. Any development unable to meet this requirement shall provide complete plans for booster pump and tank system which shall be approved by ERMD engineers.

Water shall be supplied in each development at pressures not exceeding one hundred forty (140) psi at any building under static conditions. Any development unable to meet this requirement must supply individual pressure reducing valves in service lines to the buildings.

In no case shall pressures in excess of one hundred eighty (180) psi be allowed in any main line under static conditions. A main line pressure reducing station shall be designed by the developer and approved by a P.E. for any development whose pressures would exceed the one hundred eighty (180) psi limit.

### **3-49 Sewer Line Crossing**

Should the condition exist where a sewer main must be constructed crossing above or below a water main, the minimum clear distance vertical shall be eighteen inches (18).

When sewer mains cross above water mains or within a vertical clear distance of eighteen (18) inches below water mains, the crossing must be constructed so as to protect the water main.

Minimum water main protection under these conditions shall consist of the installation of an impervious and structural sewer (e.g. PVC, with concrete encasement, cast iron or ductile iron pipe) for a distance of ten (10) feet each side of the water main. In all cases, suitable backfill or other structural protection shall be provided to preclude settling or failure of the upper pipe.

In no case shall a water main be located closer than then (10) feet horizontally from a main sewer line unless the sewer line is of cast or ductile iron construction

### **3-50 Curb Stops, Curb Stop Boxes, Corporation Stops**

Curb stops shall be Mueller. Curb Stop Boxes shall be Mueller H-10350 or approved equal. Corporation Stops shall be Mueller.

# 4

## SEWER RELATED

### 4-1 Sanitary Sewer System Standards and General Requirements

All sewer collection and pumping facilities installed within public right-of-way or easements shall be constructed in accordance with standard drawings and construction specifications of ERMD. In additions, all minimum standards of the State of Colorado Department of Health shall be followed in planning and construction of wastewater pumping and collection facilities. All sanitary sewer plans shall be approved by the ERMD engineer prior to beginning construction.

### 4-2 Sanitary Sewers

Sanitary sewer construction plans must be sufficiently complete to provide assurance of compliance with design standards. Construction plans must contain a statement that all facilities are to be installed in accordance with the Standard Specifications for Construction of Waterlines, Sanitary Sewers and Storm Drainage Facilities. Additionally, the plans or accompanying report must provide the following:

- Plan and profile, bearing, distance, size and grade of each reach; of sanitary sewer and force mains showing finished ground or pavement elevation and invert and rim elevations at each manhole;
- 20' easements (twenty foot easements) are a minimum requirement for sewer mains, lateral trunk lines, etc. to provide satisfactory access too, and maintenance of, sewer mains, lateral trunk lines, etc. that are ERMD responsibility.
- Surface drainage features will be constructed using BMP's to provide no conflict with access and maintenance of sewer mains, lateral trunk lines, etc..
- Existing and proposed lift stations with site details;
- Existing and proposed physical features within ten (10) feet of the waterline, including trees, geologically unstable areas, cliffs, ponds, ditches and other topographic features;
- Pipe material, size and bedding class for all reaches of pipe, existing and proposed.
- Approximate location of proposed and existing utilities within twenty (20) feet of the proposed construction;
- Existing and proposed roads, sidewalks and curblines;
- Right-of-way lines, easement lines, street names, one-hundred-year floodplain, benchmarks, origin of survey, basis of bearing section, township, range and professional engineer's seal.

Construction plans should be provided in the same general format as are preliminary improvement plans submitted per subdivision procedures.

As-built plans shall include all information required in the construction plans and shall provide additional or revised information when changes in horizontal alignment exceed one (1) foot or vertical alignment exceeds one-tenth foot. If the standards are compromised or if public facilities are installed outside of public rights-of-way or easements, the as-built plans shall note the same. As-built plans shall be stamped by a professional engineer certifying that facilities were installed substantially in accordance with approved plans.

#### **4-3 Location of Sewer Lines**

Sewer lines shall be located generally on the centerline of streets but in no case shall main line sewer be located closer than ten (10) feet horizontally from the water main unless the sewer line is encased or of cast or ductile iron pipe (see detail). Depth of sewer shall be at least three (3) feet from top of pipe to proposed or existing grade, whichever is lower.

Deeper installation may be required by the ERMD engineer to serve future growth. Structural design must be demonstrated for line to be laid deeper than ten (10) feet

Lines laid between manholes must be straight. No curved sewers will be allowed.

Sewer lines shall be extended to the farthest boundary of subdivisions or property being served where future development is possible. Sewer mains shall be terminated with manholes only. Sewer lines shall be installed before paving or repaving of existing or proposed roads.

Main line connections must be approved and inspected by the ERMD staff, approved ERMD developer representative, or P.E of the developers choosing. An inspection report for all service line connections will be supplied to ERMD by the developer's engineer when this option is selected.

#### **4-4 Compliance Required**

Any person who shall lay sewer pipes or introduce into or about any building or on any grounds or do any plumbing work in any building or on any grounds for the purpose of connection such pipe or plumbing work or of preparing them for connection or who shall make any addition to or alterations of any fixtures or apparatus for the supplying of any premises with sewer shall be deemed guilty of violation of this Code.

#### **4-5 Tampering with System; Unauthorized Use**

It shall be unlawful for any person to open any fixture pertaining to or connecting with ERMD sewer systems or to turn or shut off any flow through the pipe connected with the same without authority.

It shall be unlawful for any person to use water from the water system of ERMD unless prior authorization for such shall have been obtained under and according to the terms of this article.

#### **4-6 Required Temporary Toilets**

Except as provided in this division, it shall be unlawful to construct or maintain any privy, privy vault, septic tank, cesspool or other facility intended or unused for the disposal of sewage.

The owners of all houses, building or properties used for human employment, recreation or other purposes, situated within ERMD or right-of-way in which there is now located or may in the future be located a public sanitary or combined sewer of ERMD, is hereby required at his expense to install suitable toilet facilities therein, and to connect such facilities directly with the proper public sewer in accordance with the provisions of this division, within ninety (90) days after date of official notice to do so, provided that such public sewer is within four hundred (400) feet of the property line.

#### **4-7 Discharge Regulations**

No person shall discharge or cause to be discharged any storm water, surface water, groundwater, roof runoff, subsurface drainage including interior and exterior foundation drains, uncontaminated cooling water or unpolluted industrial process waters to any sanitary sewer.

#### **4-8 Unlawful Deposits of Objectionable Waters; Discharges into Natural Outlets**

It shall be unlawful for any persons to place, deposit or permit to be deposited in any unsanitary manner on public or private property within the jurisdiction ERMD any human or animal excrement, garbage or other objectionable waste.

It shall be unlawful to discharge to any natural outlet within the jurisdiction of ERMD any sewage or other polluted waters, except where suitable treatment has been provided in accordance with subsequent provisions of this article.

#### **4-9 Discharge of the Following Described Waters or Wastes to Any Public Sewer Are Prohibited**

Any gasoline, oil, benzene, naphtha, fuel oil or other flammable or explosive liquid, solid or gas;

Any waters or wastes containing toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, create a public nuisance or create any hazard in the receiving waters of the sewage treatment plant, including but not limited to cyanides in excess of two (2) mg/l as CN in the wastes as discharged to the public sewer;

Any water or wastes having a pH lower than 5.5, or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works;

Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works such as, but not limited to , ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, buttermilk, carcasses or hides of dead animals or fowl, underground garbage, whole blood, paunch manure, hair and fleshings, entrails, paper dishes, cups, milk containers, etc. either whole or ground by garbage grinders and fats or oils.

#### **4-10 Discharge of the Following Harmful Substances to Any Public Sewer Are Prohibited**

No person shall discharge or cause to be discharged the following described substances, materials, waters or wastes if it appears likely in the opinion of ERMD that such wastes can harm either the sewers, sewage treatment process or equipment, have an adverse effect on the receiving stream, or can otherwise endanger life, limb, public property or constitute a nuisance. In forming his opinion as to the acceptability of these wastes, ERMD will give consideration to such factors as the quantities of subject wastes in relation to flows and velocities in the sewer, materials of construction of the sewer, nature of the sewage treatment process, capacity of the sewage treatment plant, degree of treatability of wastes in the sewage treatment plant and other pertinent factors. The prohibited substances are:

- Any liquid or vapor having a temperature higher than one hundred fifty (150) degrees Fahrenheit (65) degrees Celsius;
- Any water or wastes containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperatures between thirty-two (32) degrees and one hundred fifty (150) degrees Fahrenheit (zero (0) and sixty-five (65) degrees Celsius);
- Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourths horsepower (0.76 hp metric) or greater shall be subject to the review and approval of the director;
- Any waters or wastes containing strong acid from pickling wastes or concentrated plating solutions whether neutralized or not;
- Any waters or wastes containing iron, chromium, copper, zinc and similar objectionable or toxic substances, or wastes exerting an excessive chlorine requirement, to such degree that any such material received in the composite sewage at the sewage treatment works exceeds the limits established by ERMD for such materials;
- Any waters or wastes containing phenols or other taste-or odor-producing substances, in such concentration exceeding limits which may be established by the ERMD as necessary, after treatment of the composite sewage, to meet the requirements of state, federal or other public agencies of jurisdiction for such discharge to the receiving waters.
- Any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the director in compliance with applicable state or federal regulations;

- Any waters or wastes having a pH in excess of 9.5;

Material which exert or cause:

- Unusual concentrations of inert suspended solids such as, but not limited to, fuller's earth, lime slurries and lime residues or of dissolved solids such as, but not limited to, sodium chloride or sodium sulfate;
- Excessive discoloration, such as, but not limited to, dye wastes and vegetable tanning solutions;
- Unusual Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), or chlorine requirement in such quantities as to constitute a significant quantities as to constitute a significant load on the sewage treatment works;
- Unusual volume of flow or concentrations of wastes constituting slugs as defined in this article;

(10) Waters or wastes containing substances which are not amenable to treatment or reduction by the sewage treatment processes employed or are amenable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of state agencies having jurisdiction over discharge to the receiving waters;

(11) Any waters or wastes having:

- A five (5) day BOD greater than three hundred (300) parts per million by weight;
- More than three hundred (300) parts per million by weight of suspended solids;
- An average daily flow greater than two (2) percent of the average sewage flow of the ERMD.
- Shall be subject to the review of the ERMD.

Where necessary in the opinion of ERMD the owner shall provide, at his expense, such preliminary treatment as may be necessary to:

- Reduce the biochemical oxygen demand to three hundred (300) parts per million by weight;
- Reduce the suspended solids to three hundred (300) parts per million by weight; or
- Control the quantities and rates of discharge of such waters or wastes.

Plans, specifications, and any other pertinent information relating to proposed preliminary treatment facilities shall be submitted for the approval of ERMD and no construction of such facilities shall be commenced until such approvals are obtained in writing.

#### **4-11 Damaging, Tampering with Sewage Works**

No unauthorized person shall break, damage, destroy, uncover, deface, or tamper with any structure, appurtenance or equipment which is part of the sewage works. Any person violating this provision shall be subject to liability for damages and be reported the appropriate law enforcement division for prosecution.

#### **4-12 Inspections; Sampling; Testing**

ERMD shall be permitted to enter all properties for the purposes of inspection, repair, observation, measurement, sampling and testing in accordance with the provisions of this article.

While performing the necessary work on private properties referred to in subsection (a) of this section, ERMD shall observe all safety rules applicable to the premises established by the owners. The owners shall be held harmless for injury or death to the ERMD employees and ERMD shall indemnify the owners against loss or damage to its property by ERMD employees and against liability claims and demands for personal injury or property damage asserted against the owners and growing out of the gauging and sampling operation, except as such may be caused by negligence or failure of the owners to maintain safe conditions.

ERMD and other duly authorized agents of ERMD bearing proper credentials and identification shall be permitted to enter all private properties through which ERMD duly negotiated easements for the purposes of, but not limited to, inspection, observation, measurement, sampling, repair and maintenance of any portion of the sewage works lying within such easement. All entry and subsequent work, of any, on such easement, shall be done in full accordance with the terms of the duly negotiated easement pertaining to the private property involved.

#### **4-13 New Construction Testing of Sanitary Sewers**

Testing sanitary sewers for acceptability shall include the following test:

- Exfiltration of water or exfiltration of air under pressure by Contractor's P.E., Construction Observer or ERMD staff.
- Lamping by ERMD staff

#### **4-14 Exfiltration Tests**

An exfiltration or leakage test shall be performed on all newly constructed sanitary sewer mains. The Contractor will determine whether the test will be made with water or air pressure and shall furnish all labor, tools and equipment necessary to conduct the test

The exfiltration test will not be considered valid without the presence of Contractor's P.E., Construction Observer or ERMD staff throughout the test.

**Air Leakage Test:** If the contractor chooses to test for exfiltration with air pressure, the testing shall be in accordance with ASTM Standard c-828. The ends of the test section shall be sealed at the manholes with pneumatic plugs. One of the plugs provided shall have two taps. One tap will be used for introducing air into the pipeline through suitable valves and fittings so that the input air may be regulated. The second tap shall be fitted with valves and fittings to accept a pressure gauge to monitor the internal pressure of the sewer pipe.

**Procedure:** Connect the pressure gauge and air control equipment to the proper fittings and slowly apply air pressure. Pressurize the pipe line to 4.0 psig and throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium

between air temperature and pipe walls. During this time check all plugs for leakage. If plugs are found to leak, bleed off air, tighten plugs and re-pressurize the pipeline. After the temperature has stabilized, allow the pressure to decrease to 3.5 psig. At 3.5 psig begin timing to determine the time required for pressure to drop to 2.5 psig. The time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig should be greater than the minimum test time shown in the following table:

**MINIMUM TEST TIME FOR VARIOUS PIPE SIZES**

<b>Nominal Pipe Size. In.</b>	<b>T(time) Min/100ft.</b>	<b>Nominal Pipe size, In.</b>	<b>T(time) Min/100 ft.</b>
		21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.9
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

If the air test fails to meet the above requirements, the leaks shall be located and repaired at the Contractor's expense, and the pipeline retested until the leakage is within the allowable limits.

In areas where the ground water level is above the pipe, the hydrostatic pressure of the ground water above bottom of the pipeline shall be determined and added to all test pressures.

#### **4-15 Lamping Test**

Lamping or camera inspection will be performed on all sanitary sewer pipe by the ERMD staff. In order to pass the lamping test full pipe circle shall be observed both vertically and horizontally between manholes.

#### **4-16 Applicability to Connectors**

Any person making connection to the sewer utility of ERMD shall be subject to the restrictions and regulations set forth in this article.

#### **4-17 Violations; Penalties**

Any person found to be violating any provision of this document shall be served by ERMD with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, with the period of time stated in such notice, permanently cease all violation.



Any person who shall continue any violation beyond the time limit provided for in the notification shall be referred to the appropriate law enforcement division for prosecution and be subject to fines from ERMD. Each twenty-four-hour period in which any such violation shall continue shall be deemed a separate offense.

Any person violating any of the provisions of this article shall become liable to ERMD for any expense, less or damage occasioned ERMD by reason of such violation.

#### **4-18 Sewer Main Inspection**

All sewer infrastructure created and/or installed by the developer must be inspected by an Edgemont Ranch Metro District approved engineering firm, or by an ERMD staff member. ERMD Staff members can be available upon request; however a 24 hour notice before the inspection time is suggested so staff can be available. For each pipe and each individual stub out the district will require an inspection report signed by the individual inspector. This inspection report must be accompanied by representative dated photos and/or video of water and sewer lines and dated photos and /or video of all service line stub outs. The results from all tests must be documented by the engineering firm, and/or ERMD representative and included in their inspection report. No infrastructure will be accepted by the district without written inspection reports indicating compliance with ERMD published infrastructure requirements and all authorities referenced therein.

#### **4-19 Sewer Service Inspection**

The builder or contractor shall notify the ERMD office to schedule a request for an inspection at a minimum of 24 hours in advance. The request shall include the builder or contractor phone number, address and lot number, and date and time for the inspection. Refer to the ERMD Construction Specifications for the proper method of installation. The inspector will take a picture of the connection to the sewer service stub and any other portion of the sewer service if needed. The inspector will complete the ERMD sewer service inspection form along with any other information or asbuilts. The picture and inspection form will be placed in the homeowner's file on the ERMD data server.

#### **4-20 Pipe Laying**

After the trench has been dewatered and the bedding prepared, the pipe shall be laid to the line and grade shown on the plans or staked. Variance from established line and grade shall not be greater than three (3) inches horizontally and on-half (1/2) inch vertically, provided that such variation does not result in a level or reverse sloping invert.

The Contractor shall constantly check line and grade of the pipe with a laser beam or batter boards. Whenever the pipe is found to be outside the specified limits, the misaligned sections shall be removed and re-laid to the correct line and grade at the Contractor's expense.

Pipe shall be laid upgrade from the point of connection to the existing sewer or from a designated starting point. Pipe with bell and spigot joints shall be laid with the bell forward or upgrade.

The inside of the pipe and jointing surfaces shall be kept clean and free from mud, soil, gravel, ground water and other foreign material. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a temporary plug.

#### **4-21 Installation and Maintenance of Sewer Service Lines**

Service pipe shall be laid at a minimum slope of one-quarter (1/4) inch per linear foot for the entire length of the line. The alignment of service lines shall be established by the Engineer.

The maximum deflection permissible at any one fitting or any combination of adjacent fittings shall not exceed 45 degrees, unless otherwise approved.

Where service lines are stubbed out to the right-of-way line and ended for future connection, the end of the pipe shall be plugged and marked with rebar extending from the end of the service to 3 ft. above ground level, with painted 1 inch PVC cover. The ends of the service lines shall be capped with water-tight plugs braced to withstand test pressures.

Additionally consecutive saddle taps will have a minimum of 1' (one foot) between them when applied to the main.

**As a condition of utility service**, sewer service lines from the main, including connection to the main by wye fitting or saddle tap, to the residence shall be maintained by the property owner. The property owner shall promptly repair any sewer service line that backs up or causes a sanitary spill.

1 If sewerage is flowing onto the ground, a water shut off notice will be issued and executed immediately to stop illegal dumping of sewerage onto or into the ground. Water service will not be restored until repairs are completed.

2 In the event of a constriction issue, causing a potential or real sanitary spill, the property owner will be issued a water shut off notice. A corrective action plan will be proposed and executed by the responsible party to repair the line. If the plan is not executed water service shall be discontinued by the ERMD to the property. Water service will not be restored until repairs are completed.

It is the responsible party's responsibility to determine the cause of blockage or damage and the location. If the service line fails in the ERMD ROW the responsible party will affect repairs **at their expense** and with the consultation of ERMD.

#### 4-22 Slope of Sewer Lines

Minimum slopes of sewer lines shall be as follows:

<i>Type</i>	<i>Slope (percent)</i>
4-inch service	2.0
6-inch service	2.0
8-inch main	0.5
10-inch main	0.4
12-inch main	0.3

Larger mains shall be designed to transport average sewer flows at minimum mean velocities of two (2) feet per second under flowing full conditions.

Maximum design velocity for sewers flowing full shall not exceed ten (10) feet per second. Slopes between manholes must be constant.

#### 4-23 Minimum Pipe Size

Minimum pipe size for mains shall be eight (8) inches. Pipe shall be installed in accordance with line sizes recommended in the sanitary sewer master plan. Where line sizes are not recommended in the master plan the ERMD engineer will determine the appropriate line sizes.

#### 4-24 Construction of Manholes

The foundation for each manhole base shall be prepared by replacing unsuitable material with subgrade stabilization material as directed by the Engineer, and placing granular bedding material in accordance with the standard detail sheets.

The manhole base shall be cast-in-place on the line and grade staked or shown on the plans. The invert shall be formed and smoothly finished to match the shape and elevation of all pipes connected to the manhole. The internal diameter of the manhole shall be not less than 48”.

Precast manhole bases may be used when laid on a firm unyielding upgrade as determined by the ERMD. Prior to placement of manhole base, the ground surface shall be compacted to a smooth and level supporting surface. Any unevenness or over excavation shall be brought to final grade using gravel backfill material.

The first pre-cast manhole section shall be placed on the concrete base structure before the base has taken initial set; or the section shall be grouted into a suitable groove formed in the top of the manhole base. The first section shall be adjusted to the proper grade and alignment so that it is uniformly supported by the base concrete and not bearing on any of the pipes.

The remaining pre-cast sections shall be placed and aligned to provide vertical sides and alignment of the ladder rungs. Approved bitumatic sealer shall be placed between pre-cast sections so that the completed manhole is rigid and watertight. Horizontal joints and any holes shall be plastered with no-shrink grout to a smooth finish inside and out.

The manhole ring and cover shall be adjusted to grade with pre-cast grade rings. The total height of grade rings shall not be more than twelve (12) inches. Grade rings shall be grouted together and the cast iron ring set in a bed of mortar at the finished grade elevation.

Where the manhole is in an unpaved street, alley or other area where grade has not been established, 12 inches of grade rings shall be placed between the top of cone and bottom of casting (to allow future adjustment of the ring to grade).

Where the manhole is in a cultivated area, the top of the casting shall be eighteen (18) inches below the existing ground surface.

Where the manhole is in an uncultivated but open area, the top of the casting shall be 6" above the existing ground surface.

All newly constructed manholes shall be cleaned of an accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

#### **4-25 Manhole Placement**

Manhole shall be placed:

- At all changes in alignment;
- At all changes in grade;
- At a intersections of two (2) or more main lines;
- At intervals no greater than four hundred (400) feet along a main; and
- At the end of all mains (cleanouts on mains are not acceptable).
- Drop manholes shall be designed whenever elevation differences between any two (2) inverts is twenty-four (24) inches or greater, (see detail)
- Manholes shall be constructed in accordance with ERMD Standard Detail.

#### **4-26 Cement, Concrete and Mortar**

All cement used in mortar, concrete bases, and precast manhole riser sections, cones and flat tops, for sanitary sewer manholes, shall be Type V or modified Type II Portland cement having less than five (5) percent tricalcium aluminate. Type II Portland cement may be used in the various concrete elements of storm sewer manholes

All concrete used in construction of manholes, inlet boxes, vaults, concrete encasement, thrust blocks, etc., shall be Colorado Division of Highways "Class B". Unless otherwise specified, all concrete shall be made with Type II Portland Cement.

Cement mortar used in construction of manholes, inlets, vaults, etc., shall be mixed at a ratio of one part Portland Cement to three parts sand. The amount of water used in the mortar shall be the minimum amount required for workability of the mix. Mortar shall be made with Type II Portland Cement unless otherwise specified. Mortar used for the patching of existing manholes shall be non-shrink type approved by the ERMD.

#### **4-27 Precast Concrete Manhole Sections**

Manhole risers, cones, flat tops, manhole and grade rings shall be precast reinforced concrete sections conforming to ASTM C-478 or AASHTO M 199. Manholes which are 5 feet or less in depth as measured from the invert to the top of rim shall have a flat reinforced concrete top. Manholes greater than 5 feet deep as measured from the invert to the top of rim shall use eccentric conical top section.

Manhole rises and conical sections shall be made with tongue and groove ends for continuous and uniform joints between sections. Such joints shall be sealed with preformed bitumatic material and other approved flexible joint sealant.

#### **4-28 Manhole Steps**

Manhole steps shall be plastic coated steel or other approved materials. The rungs shall be 10 inches wide with non-slip surface free from splinters, burrs or sharp edges which may be a hazard. The legs shall be long enough to provide a 3-1/2 inch minimum embedment length and 6 inch projection from the wall.

The steps shall be fabricated with tapered legs which lock into specially formed holes in cured concrete walls or with lugs for embedment in wet concrete.

#### **4-29 Rings and Covers**

Manhole rings and covers shall be cast iron. The standard ERMD manhole shall be Castings Inc. MH-250-24" C.I., Neenah R-1657, Deeter 1258, or approved substitute. The bearing surfaces between the ring and cover shall be machine finished or ground to assure non-rocking fit in any position (See Detail).

#### **4-30 Manhole Adjusting Rings**

To raise grades of manhole rims by 1" to 3", cast iron manhole adjusting rings may be used. The bearing surfaces between the ring and cover shall be machine finished to assure non-rocking fit. Set screw fasteners shall be included in each adjusting ring. Adjusting rings shall be Neenah R-1979 Series or approved equal. Adjusting rings shall be dimensioned to fit existing rings snugly or concrete.

#### **4-31 Service Lines**

Service lines shall not enter at manholes. Service lines to eight (8) or more units in an apartment or condominium building shall be six (6) inches. Separate service lines must serve each building on a parcel of land. Each parcel of land must have its own service lines. Service lines shall be extended to each lot or proposed lot line along any road which is to be paved surfaced before paving occurs. Townhouses and single family residences shall be served with individual four-inch service line. One (1) to each unit.

#### 4-32 Force Mains

Maximum size of force mains shall be four (4) inches. Pipe shall be sized such that maximum velocity does not exceed six (6) feet per second. Force mains should be installed at a positive grade to a manhole where a gravity sewer line begins. Where positive grades cannot be maintained, air and vacuum release valves must be installed at all relative high points in the line. Minimum depth for force mains shall be four (4) feet.

#### 4-33 Pipe and Fittings for Sanitary Sewer Construction

Pipe used in construction of gravity sanitary sewer mains and service lines shall be of ERMD approved, polyvinyl chloride (PVC) or ductile iron.

The minimum pipe size for gravity sewers shall be eight (8) inch diameter for mains and laterals, and four (4) inch diameter for service lines. Sanitary sewers under pressure shall be of ductile iron, or PVC pipe.

#### 4-34 Polyvinyl Chloride Pipe

Polyvinyl Chloride (PVC) sewer pipe and fittings shall conform to ASTM D 3034, Type PSM. The minimum wall thickness for PVC pipe shall conform to Standard Dimension Ratio (SDR) 35.

**Joints:** PVC sewer pipe shall have integral bell and spigot joints. PVC sewer pipe shall be connected with flexible elastomeric seals per ASMT D 3212. Gaskets shall be neoprene or other synthetic rubber material conforming to ASTM D 1689.

**Fittings:** Taps for 4" or 6" service connections to sewer mains shall be saddle-type fittings made of SDR 35 and siliconed in place, with SS strapping

#### 4-35 Ductile Iron Pipe

Ductile iron pipe for sanitary sewers under pressure shall conform to AWWA c-151. Pipe thickness shall be AWWA Class 52 unless a higher class is required by the ERMD Engineer. Ductile iron pipe shall be cement lined per AWWA c-104.

**Joints:** Unless otherwise specified in the Construction Plans or Special Conditions, ductile iron pipe joints shall be mechanical or push on joints conforming to AWWA C-111. Gaskets shall be neoprene or other synthetic rubber material.

**Fittings:** Fittings for ductile iron pipe shall be in accordance with AWWA C-110 and shall have a pressure rating of not less than that specified for the pipe. Fittings shall be ductile iron or cast iron and shall be cement lined per AWWA C-104.

#### 4-36 PVC Pressure Pipe

PVC pipe unused for sanitary sewers under pressure shall meet the requirements of ASSA C-900 and shall be Class 150 unless the pressure class is shown on the plans or otherwise specified.

**Joints:** Joints shall be bell and spigot type sealed with an elastomeric gasket conforming to ASTM D-1869 and E-477. The bell section shall be at least as strong as the pipe wall.

**Fittings:** Fittings for PVC pipe shall be of cast iron or ductile iron in accordance with Section 101.5c of these specifications.

#### 4-37 Lift Stations

Lift stations are discouraged. When necessary, they shall be designed to serve an entire sub basin. All lift stations will be of the wet well/dry well design. (see detail). All designs are subject to approval of a P.E., and in addition to meeting current Colorado State Health Department criteria, shall include:

Auxiliary alarm systems, with provisions for connection to alarming by hard-line telephone, radio, or SCADA communication line;

Auxiliary power supply (see state health department requirements);

Control panel which provides for:

- Automatic alternator for lead-lag operation
- Automatic reset;
- Hour meter for each pump motor;
- Low voltage protection relays;
- running overload and high level light;
- HOA switch for each pump;

Basket strainers that are easily accessible;

Auxiliary heaters and insulation in the dry well;

Separate check and gate valves for each pump;

Dry well sump pump or drain outlet;

Epoxy paint coatings inside and outside for all metal surfaces.

Wet and dry well lids should be twelve (12) inches above finished grade.

Designs should state the consequence of power failure on the lift station and population served by the lift station.

#### 4-38 Pretreatment, Equalization of Deleterious Waste Flows

If any waters or wastes are discharged or are proposed to be discharged to the ERMD sewers, which waters contain substances or possess the characteristics to harm wastewater

treatment processes, sewage works, equipment or receiving waters, or which otherwise create a hazard to life to constitute a public nuisance, ERMD may:

- Reject the wastes;
- Require pretreatment to an acceptable condition for discharge to the public sewer;
- Require control over the quantities and rates of discharge;
- Require payment to cover the added cost of handling and treating the wastes not covered by existing taxes of sewer charge.

If ERMD permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to the review and approval of ERMD, and subject to the requirements of all applicable codes, ordinances and laws.

#### **4-39 Maintenance of Pretreatment Equalizing Facilities**

Where preliminary treatment or low-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the owner at his expense.

#### **4-40 Interceptors**

Grease, oil and sand interceptors shall be provided when, in the opinion of ERMD they are necessary for the proper handling of liquid wastes containing grease in excessive amount, or any flammable wastes, sand or other harmful ingredients; except that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by ERMD and shall be located as to be readily and easily accessible for cleaning and inspection.

#### **4-41 Control Manholes for Commercial/Industrial Use**

When required by ERMD the owner of any property serviced by a building sewer carrying industrial wastes shall install suitable control manholes together with such necessary meters and other appurtenances in the building to facilitate observation, sampling, and measurement of the water. Such manholes, when required, shall be accessible and safely located and shall be constructed in accordance with plans approved by ERMD. The manhole shall be installed by the owner at his expense and shall be maintained by him so as to be safe and accessible at all times.

#### **4-42 Measurements, Tests, Analyses**

All measurements, tests and analyses of the characteristics of waters and wastes to which reference is made in this article shall be determined in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater," published by the American Public Health Association, and shall be determined at the control manhole provided, or upon suitable samples taken at such control manhole. If no special manhole has been required, the



control manhole and be considered to be the nearest downstream manhole in the public sewer to the point at which the building sewer is connected. Sampling shall be carried out by customarily accepted methods to reflect the effect of constituents upon the sewage works and to determine the existence of hazards to life, limb and property. (The particular analyses involved will determine whether a twenty-four hour composite of all outfalls of a premise is appropriate or whether a grab sample or samples should be taken. Normally, but not always, BOC and suspended solids analyses are obtained from twenty-four-hour composites of all outfalls whereas pH's are determined from periodic grab samples.)

#### **4-43 Agreements Between ERMD Commercial/Industrial Concerns**

No statement contained in this division shall be construed as preventing any special agreement or arrangement between ERMD and any commercial/industrial concern whereby an industrial waste of unusual strength or character may be accepted by ERMD for treatment, subject to payment therefore, by the industrial concern

# 5

## ROAD RELATED

### 5-1 General

The intent of this section is to specify materials and methods to be used for the construction or overlaying of streets, roads, parking lots, walks, drainways and other miscellaneous work requiring the use of asphalts and aggregates. While road paving and development will generally be monitored by the contractor, ERMD will require the use of the following standards for construction. The work covered shall include general requirements that are applicable to embankment and subgrade preparation, roadway excavation and grading, aggregate base course, bituminous tack coat and asphalt concrete overlay. All workmanship and materials shall be in accordance with the requirements of these specifications, and in conformity with the lines, grades, depths, quantity requirements and the typical cross section shown on the plans or as directed by the Geotechnical Engineer.

### 5-2 Submission of Construction Plan-roads

Road construction plans must be sufficiently complete to provide assurance of compliance with design standards. Plans must contain a statement that all facilities are to be installed in accordance with the latest revisions to the Standard Specifications for Construction of Streets and Roads. Additionally, the plans or accompanying report must provide the following:

- Plan and profile of original grounds and design elevation of roadway centerline or each curbline;
- Design calculations and structural sections for pavement design, or minimum required section per ERMD specifications;
- Approximate location of existing and proposed underground utilities and exact location by station of existing and proposed drainage structures and profiles of any drainage piping under the proposed construction;
- Soil test report;
- Details of any road structures and street cross sections at fifty-foot intervals where side slopes exceed four to one (4:1) slope;
- Existing and proposed physical features within twenty (20) feet of the construction including geologically unstable areas, trees, cliffs, ponds, ditches and other topographic features;
- Right-of-way lines, easement lines, street names, one-hundred-year floodplain, bench-marks, origin of survey, basis of bearing. Section, township, range and professional engineer's seal.

Construction plans should be provided in the same general format as preliminary improvement plans are submitted per subdivision procedures.

As-built plans shall include all information required in the construction plans and shall provide additional or revised information when changes in horizontal alignment exceed three (3) feet or vertical alignment exceeds twenty-five hundredths, (0.25) feet. If the standards are compromised or if public facilities are installed outside of public rights-of-way or easements, as-built plans shall note the same. As-built plans shall be stamped by a professional engineer certifying that facilities were installed in substantial accordance with approved plans.

### **5-3 Permits and Inspection**

Permits shall be obtained before work begins. The Contractor shall call for inspection from ERMD giving 24 hours minimum notice, before the placement of any material. In the event that any of the work or material fails to meet any of the requirements of the specifications, written notice of rejection shall be given to the Contractor and work shall be halted until such time as corrective action is taken.

A complete set of the approved drawings and a valid permit shall be on the job site and available to the ERMD, Construction Observer, or the Geotechnical P.E. onsite at all times.

The Contractor shall be licensed and bonded for work in ERMD.

Inspection is only an aid to the Contractor and in no way reflects a responsibility on the part of ERMD for quality or quantity control, and in no way implies acceptance of the work or any part thereof by the ERMD.

### **5-4 Street and Sidewalk Standards**

The standards set forth in this division for right-of-way and road design are to be used in the design and construction of all new roads and as guides in the improvements of the existing street system. The objectives in presenting street development standards is to establish factors which should be considered in the design process. The standards set forth in this standard have been adopted by ERMD in the interest of safety, aesthetics and maintenance expense to the residents of this community. All construction plans for roadway, shall be approved by the ERMD engineer prior to beginning construction.

### **5-5 Street Layouts and Designations**

Arrangement of streets and selection of typical road sections shall conform as nearly as possible to and be consistent with development practices of the Edgemont Highlands. In all cases, provisions shall be made for the extension of arterials and collectors, as designated on the master plan.

## **5-6 Typical Street Design**

Typical street design for streets to be maintained by the District will include **8” of class 2, 4” of class 6, 4” of asphalt done in 2 lifts, 3’ shoulders of class 6**, and the associated compaction values listed in this document and the typical street detail. Modification to street design standard can be accomplished through a geotechnical engineer or by staff approval.

## **5-7 Rights-of-Way**

Street rights-of-way must be sufficient to accommodate vehicular traffic, pedestrians, all public utilities, special storm drainage facilities or other special treatments such as medians or traffic channelization.

Greater widths may be required by the P.E. when the need for such additional width is supported by a traffic study. A drainage easement, in addition to the provided street right-of-way width, may be required where streets parallel streams or drainage area. The widths for such drainage easements shall be determined by the P.E.

## **5-8 Testing**

A number of quality control tests shall be performed by an approved Material Testing Laboratory to determine compliance with the requirements of this section. An approved laboratory shall be construed to mean any institution or firm properly equipped to perform such tests and who has in their employment a registered professional engineer experienced in testing. The test will be performed at the Contractor’s expense and all test results shall be submitted to the ERMD for approval prior to the placement of any material or, in the case of in-place testing, prior to acceptance of any work by ERMD. All materials, whether or not in place, failing to meet the requirements herein set forth, after testing, shall be removed, replace (if necessary) and retested at the Contractor’s expense.

Several basic tests and their minimum frequencies are listed below; these and any additional tests are more fully described in the text for each specification.

**Required Quality Control Tests:**

<b>Item</b>	<b>Type of Test</b>	<b>Minimum Test Frequency</b>
Subgrade & Embankment	Moisture-Density Curve	1 per soil type
Compaction	In-Place Density	1/6000 sq.ft./lift
Aggregate Base Course or Subbase Course	Gradation, Plasticity Index, Liquid Limit	1/1000 ton or fraction thereof on each class
	Moisture-Density Curve	1/source on each class
		In-Place Density 1/200 ton
Hot Bituminous Pavement	Asphalt Content	1/500 tons or 2 per project, whichever is greater
	Gradation	Aggregate-Minimum of 2/source

**5-9 Roadway Excavation and Grading**

This work shall consist of excavation, disposal, shaping or compaction of all material encountered within the limits of the roadway in close conformity with the lines, grades and typical cross sections shown on the plans or as directed by the Engineer.

**5-10 Clearing**

Excavation and grading for street improvements and paving projects shall include removal of trash, rubbish and low lying vegetation in the construction area. All vegetation in the construction area. All vegetation and objects designated to remain shall be protected from injury or defacement.

**5-11 Grubbing**

All excavation such as trees, stumps, hedges, shrubs, brush, heavy sod, heavy growth of grass, decayed getable matter, rubbish and other unsuitable material. All such materials shall be wasted or spread outside the construction area or disposed of as directed ERMD. In no case shall such objectionable material be allowed in or under an embankment.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed, shall be backfilled with suitable material and compacted in accordance with these specifications.

**5-12 Stripping**

Stripping shall consist of removing unsuitable overburden material before removal of other material for use in the roadway. All areas to be graded and all embankments or hill areas under paved slabs shall be stripped.

### **5-13 Excavation**

After all clearing, grubbing and stripping has been done, excavation of every description and of whatever materials encountered within the grading limits of the project shall be performed. All suitable excavated materials shall be transported to and placed in embankments or fills within the limits of the work.

The excavation and embankments for the roadway and ditches shall be finished to reasonably smooth and uniform surfaces. Variation from the subgrade plane shall not be more than 1" unless approved by the ERMD. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed, but all cuts shall be made to subgrade a minimum of 1 foot outside the proposed edge of pavement or curb. Prior to beginning grading operations in any area, all necessary clearing and grubbing in that area shall have been performed. The Contractor shall not excavate beyond the dimensions and elevations established, and material shall not be removed prior to the staking.

If excavation to the finished graded section encounters a subgrade or slopes of spongy material, vegetable matter or trash pockets, or standing water, the Contractor will remove the unsuitable materials and backfill to the finished graded section with suitable material. Subgrade stabilization matter (Type 1, Aggregate Classification Table) may be used to backfill the excavations of unsuitable material. The Engineer may designate as unsuitable those soils or material shall be disposed of outside the construction area.

### **5-14 Shouldering and Miscellaneous Work**

The Contractor shall deposit sufficient suitable earth between property lines, so that when smoothed and consolidated in final deposition, it will provide a uniform smooth slope from top of shoulder to the adjacent property line. All broken concrete, trash and debris shall be removed before any fill is placed. In case excavation is necessary to accomplish the above purpose, the Contractor shall make such necessary excavation, and he shall leave the parking area so filled or excavated free from all trash and debris,

The Contractor shall set all manholes, water boxes or other service boxes, to the proper finished grade of the pavement. This work will be considered as part of the grading.

### **5-15 Embankments**

Embankment construction shall consist of constructing roadway embankments, including preparation of the area upon which they are to be placed; the construction of dikes; the placing and comparing of approved material within project areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the project area. Only approved materials shall be used in the construction of embankments and backfills.

Free running water shall be drained from the material before the material is placed. Rocks, broken concrete or other solid materials more than 6" in greatest dimension shall not be placed in embankment areas higher than 1 foot from the finished subgrade. Materials up to 150 pounds in

weight may be placed at the lower area of fills when they will lie 3 feet below the finished subgrade. All fill material shall be free from roots, organic material, trash and frozen material.

When an embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built ½ width at a time, the slopes that are steeper than 4:1 when measured longitudinally or at right angles to the roadway shall be continuously benched over those areas where it is required as the work is brought up in layers. Benching shall be keyed and where practical a minimum of 8 feet wide. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be re-compacted along with the new embankment material at the Contractor's expense.

Embankment material shall be placed in horizontal layers not to exceed 8 inches in loose depth and compacted prior to placing each following layer.

The Contractor shall add moisture to or dry by aeration each layer as may be necessary to meet the requirements for compaction. Materials shall not be placed in embankments or fills when the moisture content exceeds 5% above or is 3% below optimum moisture content for that curb line measured perpendicular from the centerline embankments shall be compacted for the entire depth of the fill to a density of not less than 93% maximum dry density as measured by AASHTO T 180.

### **5-16 Subgrade Preparation**

After all necessary grading has been done to bring the surface to the subgrade, the subgrade shall be scarified and compacted to a depth of 8 inches, the entire road bed width, then compacted to a density of not less than 5% of maximum dry density as measured by AASHTO T 180. If necessary, subgrade stabilization material may be used to achieve the specified compaction. Failure to attain the specified density shall be cause for re-scarifying and re-compacting.

Base or subbase shall not be placed upon the subgrade or any previously placed layer of the pavement section until compaction tests are completed and approved by ERMD. Testing shall include but not be limited to trenches for water, sanitary, storm, telephone, gas, electric and around manholes, valve boxes, or inlets. After the specified compaction density is approved by ERMD, the subgrade shall be struck off and rolled with a smooth roller to the exact cross section as shown on the plans, then proof rolled by the contractor with ERMD in attendance, and approved or rejected.

### **5-17 Base Course Aggregate**

Aggregates shall be crushed stone, crushed slag, crushed gravel or natural gravel which conforms to the requirements for AASHTO M 147. Aggregate shall meet the grading requirements in the Classification Table below. The type used shall be specified on the plans or special provisions. The liquid limit (LL) shall be as shown in the table and the plasticity index (PI) shall not exceed 6 when the aggregate is tested in accordance with AASHTO T 89 and T 90, respectively.

In advance of the beginning of placing any aggregated, the Contractor shall submit suitable samples of the proposed material to an approved Materials Testing Laboratory for tests to determine the compliance with the requirements of this specification. The results of all tests shall be submitted to the ERMD for approval prior to the placement of any aggregate material. Tests shall be at the Contractor's expense.

**Classification Table for Aggregate Base Course**

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves						
	LL not greater than 35			LL not greater than 30			
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
4 inch	---	100	---	---	---	---	---
3 inch	---	95-100	---	---	---	---	---
2 ½ inch	100	---	---	---	---	---	---
2 inch	95-100	---	---	100	---	---	---
1 ½ inch	---	---	---	90-100	100	---	---
1 inch	---	---	---	---	95-100	---	100
¾ inch	---	---	---	50-90	---	100	---
No. 4	30-65	---	---	30-50	30-70	30-65	---
No. 8	---	---	---	---	---	25-55	---
No. 200	3-15	3-15	20 max.	3-12	3-15	3-12	5-15

Note: Class 3 material shall consist of bank or pit run material

### **5-18 Base Course Placement and Compaction**

The subbase course material shall be placed on the previously prepared subgrade. Subgrade shall be graded and rolled to a smooth and uniform surface free of cracks and soft spots with approximate optimum moisture obtained immediately prior to placement of subbase. The base course material shall be placed on the previously prepared subbase at the locations and in the proper quantities to conform to the typical cross sections as shown on the plans and as directed by the Geotechnical Engineer or ERMD. Placing and spreading shall be done by means of spreader machine, moving vehicle, motor grader or other approved equipment methods. The material shall be placed without segregation. Any segregated areas shall be removed and replaced with uniformly graded material at the Contractor's expense.

Each layer of subbase material shall be placed in layers not to exceed eight (8) inches in loose depth. Each layer shall be wetted or aerated, if necessary, and compacted to not less than 95% of maximum density as determined by AASHTO T 180, Method D (Modified Proctor). If water is needed, it shall be uniformly applied as necessary during compaction to obtain optimum moisture content and to aid in consolidation. The surface of each layer shall be maintained during the Compaction operations in such a manner that a uniform texture is produced and the aggregates are firmly keyed. No subbase material shall be placed upon a soft, spongy or frozen subgrade or other subgrade, the stability which is, in the opinion of the Engineer, unsuitable for the placement thereof.



The above specifications are required for the placement and compaction of the base course material with the exception that each layer of base course material shall have a thickness not to exceed 6 inches when compacted.

The finished base course surface shall be smooth and free of ruts and irregularities and true to grade and crown as shown on the plans or as directed by the Engineer. The final surface shall be finished with a surface smoothness tolerance of one-fourth (1/4") measured as vertical ordinate from the face to a ten-foot straightedge laid parallel or 3/8" perpendicular to the station line. The base course shall be maintained in this condition by watering, drying, rolling or blading, as necessary until the surfacing is placed.

In-place field density determinations shall be made in accordance with AASHTO T 191 or T 205. The use of a nuclear density gauge will be allowed when correlated with one of the above test methods and must also be proof rolled and approved by ERMD.

### **5-19 Plant Mix Hot Bituminous Pavement**

The Bituminous pavement shall be composed of a mixture of aggregate, filler if required, and bituminous material, to mixed at a central plant and placed on the prepared base in conformity with the cross section and grades shown on the approved plans.

### **5-20 Testing**

The Contractor at his expense, shall submit suitable samples of all materials proposed for use on the project to a materials testing laboratory approved by the ERMD. The Testing Laboratory shall, at the Contractor's expense, test all materials for compliance with these specifications and establish a job mix formula for each mixture proposed for use on the project.

The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and single temperature at which the mixture is to be mixed. The job mix formula shall be within the master range specified in the following subsection. The job mix formula may be derived by either the Marshall (ASTM 1559) (AASHTO T 245) or the Hveem methods (AASHTO T 246) (ASTM 1560) but shall employ all current, applicable AASHTO, ASTM or Asphalt Institute procedures. An immersion compression test (AASHTO T 165) will be performed on a sample made at the optimum asphalt cement content to determine the effect of water on the cohesion of the compacted bituminous mixture.

The aggregate source is undesignated but test results proving that the aggregate meets these specifications must be submitted to the Geotechnical Engineer with the job mix formula. The aggregate must be tested for size and grading, cleanliness and soundness, toughness, surface texture and particle shape, absorption and stripping potential using current, applicable AASHTO, ASTM and/or Asphalt Institute procedures.

Test results must be submitted to the Geotechnical Engineer before paving is to begin and his approval must be obtained in writing before any paving is begun.

Job mix formula testing will not have to be conducted for each new paving project if a mix formula conforming to these specifications has previously been established using the same aggregate source that the contractor is proposing for this project. The test results and mix formula from the earlier lab tests shall then be submitted to the Geotechnical Engineer for approval before paving begins.

However, a written statement is required with the job mix submittal from the lab performing the earlier tests verifying the: (1) the Contractor's proposed aggregate is the same as that of the previously established mix formula and (2) the performance of the two mixes, produced under similar conditions, will essentially be the same, with proper allowances for testing deviation.

Should a change in sources of materials be made, a new job-mix formula shall be established before a new job-mix formula.

### **5-21 Asphalt**

Asphalt cement shall adhere to the requirements of viscosity grade AC-10 as specified by AASHTO M 226, Table 1 unless otherwise permitted by the Engineer in writing.

### **5-22 Prime Coat Asphalt**

Cutback asphalt for prime coat shall be MC-70 complying with requirements of AASHTO M 82. Emulsified asphalt may be substitute where special construction methods, as outlined in 209.1, are followed. Emulsified asphalt shall conform to those requirements specified under 208.25 Tack Coat.

### **5-23 Tack Coat**

Emulsified asphalt for tack coat shall be SS-1, SS-1h, CSS-1 or CSS-1h diluted one part water to one part emulsified asphalt. Before dilution the emulsified asphalt shall comply with the requirements of AASHTO M 140 or M 208.

### **5-24 Aggregate**

Mineral aggregate shall consist of hard, durable particles or fragments of crushed stone or gravel which shall be free from disintegrated stone, vegetable matter, clay lumps or other deleterious substances. Aggregate shall conform to the following grading limits (Grading C)

Sieve Size	Percent by Weight Passing Square Mesh Sieves
3/4"	100
1/2"	70-95
3/8"	60-88
# 4	44-72
# 8	30-58
# 30	12-34
#200	3-9

The aggregate shall also conform to the following requirements:

- Percentage of wear, Los Angeles Test (AASHTO T 96), not more than 35,
- At least 90 percent of the gravel retained on the No. 4 sieve shall have at least two fractured faces.
- When tested for stripping potential (AASHTO T 182), aggregate shall have a retained bituminous film of above 95 percent
- Plasticity index shall not exceed 6 when the aggregate is tested in accordance with AASHTO-T 90.

### 5-25 Mineral Filler

If mineral filler is required to meet gradation or strength requirements, finely powdered limestone, Portland cement, hydrated lime or other approved materials may be used for the filler.

### 5-26 Job Mix

The job mix for the asphalt aggregate mixture shall meet the following criteria by testing method:

The exact percentage of asphalt cement in the job mix shall be determined by the testing laboratory for the aggregate to be used on the project. The percentile will vary between 4% and 7% percent. The amount of filler or anti-stripping agent, if necessary, will be determined by the testing laboratory. The stability will be at least 1500 pounds. Per cent air voids will be between 3% and 7%. The flow value will be between 8% and 16%.

All mixtures furnished for the project shall conform to the job-mix formula within the following ranges of tolerances:

Passing No. 8 and Larger Sieves*	+/- 8 percent
Passing Sieves Smaller than No. 8 to larger than No. 200	+/- 6 percent
Passing No. 200 Sieve	+/- 3 percent
Bitumen	+/- 0.5 percent
Temperature of Mixture when emptied from Pugmill mixers	+/- 20 degrees F

\* Exclusive of the maximum size designated in the job-mix formulas.

### 5-27 Preparing Area to be Paved

The area to be paved shall be properly prepared surface before paving operations begin. If road grade is over 8% a geo-technical engineer shall be consulted with overlay placement. Prime coat shall be applied uniformly at a rate of 0.25 gallons per square yard to the surface of aggregate base course prior to placement of hot bituminous pavement. The prime coat shall be sprayed at temperature of between 120 degrees F and 130 degrees F. Where emulsified asphalt is applied as a prime coat, it shall be applied to finished base course prior to compaction. It shall be applied at a rate of 0.3 gallons per square yard. The surface shall be rolled and compacted after placement of emulsified asphalt. Emulsions may be used when air temperature is above 60 degrees F and where application of asphalt paving will be completed within 24 hours of placing of prime coat.

If new asphalt is to be placed over existing asphalt, holes and depressions in existing surfaces shall be repaired by removing all loose and defective material to sound pavement or base and applying prime coat and replacing with an asphalt-aggregate patching material. The patching mixture shall be compacted to produce a tight surface conforming to the adjacent pavement area. If there is excess asphalt in existing patches or joints, it shall be removed and made level with the surrounding pavement grade. A geotextile fabric will be added to reduce crack mirroring.

A tack coat shall be applied uniformly at the rate of 0.10 gallons per square yard between layers of hot bituminous pavement (either between the layers or existing and new layers). Likewise, surfaces of curbs, gutters, vertical faces of existing pavements, and all structures to be in actual contact with the asphalt-aggregate mixture shall be given a thin, even coating of asphaltic material. Care shall be taken to prevent splattering, with asphalt, surfaces that will not be in contact with the asphalt-aggregate mixture. Immediately prior to application of the asphalt tack coat, all loose and foreign material shall be removed by sweeping or by blowing, or both.

### 5-28 Bituminous Mixing Plant

The aggregate shall be dried and heated to provide a paving mixture temperature in conformance with placing conditions, but not to exceed 163 degrees C (325 degrees F).

The heated and dried aggregates shall not contain enough moisture to cause the mixture to slump, the asphalt to foam, or the aggregate to adhesion of the asphalt aggregate mixture.

Mixing time shall be the shortest time that will produce a satisfactory mixture. It will be established by the contractor based on the procedure for determining the percentage of coated particles described in AASHTO Method T 195 (ASTM Method D 2489). The mixing times will be set to achieve 95 percent of coated particles for all mixtures.

The aggregates shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job-mix formula.

The job-mix temperature at the mixer discharge (for Pugmill or dryer drum) shall be between 245 degrees F and 300 degrees F. Mixtures shall be delivered for use on the road at not less than 235 degrees F nor greater than 290 degrees F. The mixture shall be hauled in such a manner so that it is protected from the weather and so that the minimum temperature stated above is maintained until the mixture is unloaded into the paver.

### **5-29 Mixture Placement**

The asphalt mixture shall be placed by bituminous pavers which shall be self-contained, power-propelled units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing course of bituminous plant mix material in widths applicable to the specified typical section and thicknesses shown on the plans.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

The screed shall be maintained at the proper elevation at each end by controlling the elevation of one end and automatically controlling the transverse slope or by controlling the elevation of each end independently, as directed.

The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.

Rollers shall be of the steel wheel, vibratory, pneumatic tire type or combination and shall be in good condition, capable of reversing without backlash.

The base course mixture shall be placed in one or more lifts with an asphalt paver to provide a nominal compacted thickness. The minimum lift thickness shall be at least two times the maximum particle size. The maximum lift thickness shall be that which can be demonstrated to be laid in a single lift and compacted to required uniform density and smoothness.

Placing the mixture shall be a continuous operation. If any irregularities occur, they shall be corrected before final compaction of the mixture.

The minimum ambient temperature at the time of placement shall be 50 degrees F unless specifically approved by the ERMD or the Geotechnical Engineer. No asphalt shall be laid on a wet or damp base. The Geotechnical Engineer shall determine if the base is suitable for placement.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches; however, the joints in the top layer shall be located as follows:

For 2-lane roadway, at the centerline of the pavement and at the outside edge of the travel lanes.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading or finishing equipment impracticable, the mixture shall be spread, raked and luted by hand tools. For such areas, the mixture shall be dumped, spread and hand screened to give the required compacted thickness.

### **5-30 Compaction**

The mix shall be compacted immediately after placing initial rolling shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller, a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the road center line, each trip overlapping one-half the roller width, gradually progressing to the crown of the road.

Any displacement occurring as a result of the reversing of the direction of the roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water. Use of excess water will not be permitted.

Any mixture that becomes loose sand broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced.

### **5-31 Joints**

Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Geotechnical Engineer. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A coat of bituminous material shall be used on contact surfaces of all joints just before additional mixture is placed against the previously rolled material.

### **5-32 Surface Tolerances**

The variation between any two contacts with the surface shall not exceed 3/16 inch in 10 feet. All humps or depressions exceeding the specified tolerance shall be corrected by removing defective work and replacing it with new material or by overlying (patching) as directed by the Geotechnical Engineer. The final pavement surface shall not vary from the theoretical cross section by more than one (1) inch at any one point.

The final surface pavement adjacent to concrete gutter shall be finished from 1/8 inch o38 inch above the lip of the gutter into which it drains.

Any surface pavement that is above the lip more than 3/8 inch shall be removed and replaced to the specified height. Any surface pavement that is below the lip of the gutter shall be corrected as specified above.

### **5-33 Acceptance Requirements**

In addition to all other required tests described in previous sections, acceptance of paving will be based upon density tests conducted by an ERMD approved testing laboratory. The temperature of the asphalt material will be measured and recorded by the Contractor as the mixture is being placed. A sufficient number of samples shall be chosen at random at the job site to perform and asphalt content (extraction) test, (AASHTO T 164), aggregate grading of the extracted aggregate (AASHTO T 3) and laboratory compaction of a least 3 briquettes in accordance with ASTM D 1559 (AASHTO T 245).

The briquettes will be tested by the Marshall Method (AASHTO T 245) to determine the amount of voids, stability and flow of the compacted mixture. A specific gravity and unit weight of the briquettes will be determined (AAHTO T 166) to compare with the in-place density.

After the asphalt pavement has been rolled and has cooled, two four-inch diameter cores will be sampled from the mat. These cores will be measured for thickness and density (AASHTO T 230). This density will be compared to the density of the Marshall briquettes to determine the percent compaction of the cores.

As an alternative to core sampling, the compacted layers of asphalt can be tested for density using a nuclear device in accordance with ASTM D 2950.

Each day's paving and each layer of compacted asphalt will be tested as specified above. For acceptance by the ERMD, the average of the field density determinations must be equal to or greater than 94 percent, with no individual determination being lower than 93 percent, of the average density of the laboratory-prepared specimens.

### **5-34 Inspection and Acceptance of Work**

ERMD shall at all times have access to the work during its construction. All work done and all material furnished shall be subject to ERMD inspection and approval. Work and materials not meeting the requirements shall be made good, and unsuitable work or materials may be

rejected. All work which has been rejected shall be remodeled, or removed and replaced in an acceptable manner.

When ERMD has made a final inspection and determines that the work has been completed in all respects, and after as-built drawings are submitted, ERMD will formally accept in writing, the improvements.

### **5-35 Contractors' Guarantee**

The Contractor shall guarantee all portions of street construction for a period of one year after acceptance against defective workmanship and materials and shall keep surety during such guarantee period, for the Contractor to repair said street, or any portion thereof. Decision to do this shall rest entirely with ERMD Engineer., whose decision upon the matter shall be final and obligatory upon the Contractor.

### **5-36 Vertical Road Alignments**

The gradient within one hundred (100) feet of any four-way street intersection shall not exceed five (5) percent. Every effort should be made to keep grades at street intersections as flat as possible and in all cases the required sight distances shall be provided. Three-way street intersections shall have similar requirements unless circumstances warrant different grades as determined by the ERMD engineer.

All pavements on local or collector streets shall have a normal crown with a typical cross-slope of three-hundredths foot per foot. Pavement cross-slope on local or collector streets at intersections or in special cases shall not exceed five-hundredths foot per foot.

### **5-37 Intersections**

- Refer to the City of Durango specifications

### **5-38 Cul-de-sac and Dead-end Streets**

Dead end streets are not allowed unless provisions are made for turning of emergency vehicles. The minimum pavement diameter for turning shall be seventy (70) feet. Configurations other than circular drives shall be allowed where maneuvering room comparable to a seventy (70) foot diameter

Dead-end streets proposed to be extended to connect with future development shall be provided with a temporary turnaround which will consist of a seventy (70) foot diameter graveled surface meeting base requirements of the paved section of the street.



**5-39 Pavement Thickness**

Unless substantiated by detailed structural design using the State of Colorado Department of Highway roadway design manual or other acceptable design method, the following minimum compacted thickness of asphalt and aggregate base will be used: minimum = 4 inches.

## 6

### **HORIZONTAL AND DIRECTIONAL DRILLING, TRENCHING, BEDDING, COMPACTION RELATED**

#### **6-1 Horizontal Directional Drilling**

Prior to any work, the Contractor shall submit to ERMD a pilot bore plan with the vertical scale of 1" = 2' and horizontal scale of 1" = 20'. The plan shall include the bore entry point and angle, bore exit point and angle, ground line, deflection and radiuses of the pilot bore, and existing utilities with minimum vertical and horizontal clearances. The Contractor shall confirm the alignment and elevation of critical utilities by potholing, using vacuum excavation, or other suitable excavation method.

An electronic walkover tracking system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. It shall enable the driller to guide the drill head by providing real-time feedback regarding the azimuth (horizontal direction) and inclination (vertical direction) of the tool face. Readings shall be recorded every 10 feet, plotted on a scaled drawing, and made available to ERMD. ERMD will approve the location of the pilot hole prior to the reaming of the hole.

The bore hole diameter shall be increased to 1.2 to 1.5 times the outside diameter of the largest part of the carrier pipe to accommodate the pull-back operation. The type of hole opener or back reamer used shall be chosen by the Contractor with regard to the types of subsurface conditions identified during the pilot hole drilling operation. The open bore hole shall be stabilized by bentonite drilling slurry that is pumped through the inside diameter of the drill pipe and through openings in the reamer.

The Contractor shall provide an as-built plan and profile drawing to ERMD based on electronic walkover system readings showing the actual location, horizontally and vertically, of the installation. The Contractor is responsible for drilling fluid disposal and other restoration and shall comply with regulations regarding the proper disposal of drilling fluid. Cleaning, flushing, and hydrostatic testing of the pipe shall be conducted as specified in these Standards.

#### **6-2 General Trenching**

Following are the specifications that shall govern excavations and trenching for pipelines or other underground conduits and appurtenances within the street right-of-way for ERMD.

#### **6-3 Responsibility**

The Contractor shall notify all utility companies and interested parties prior to commencement of work in order to insure that there will not be interruptions of services during

construction. The Contractor shall notify all utility users in advance of any interruption to service. No interruption in service shall exceed 8 hours in duration. The Contractor shall be liable for all damages. An excavation permit must be secured from ERMD.

Should any utility be damaged in the construction operations, the Contractor shall immediately notify the owner of such utility and unless authorized by the owner of the utility, the Contractor shall not attempt to make repairs.

In the event that during construction it is determined that any underground utility conduit or any aboveground utility will be encountered, the Contractor shall notify the affected utility company 48 hours in advance so that any anticipated problems can be addressed and utilities located.

#### **6-4 Surface Removals and Topsoil Preservation**

The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All fences, landscaping and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete.

No more than one-half of the width of a street shall have an open trench at any time.

Removal of concrete curbs, gutters, sidewalks and driveways shall be along existing joints or neatly sawed lines.

Where excavation is required under paved areas, the pavement shall be cut in such a manner as to effect a smooth, straight cut edge and as a vertical face six (6) inches minimum beyond the trench wall. Trench width, shall be no wider than 12' wider than the conduit to be installed. All vegetation, concrete, asphalt and other refuse removed from the construction limits shall be separated from suitable topsoil and back fill material, and hauled to a disposal site secured by the Contractor.

Where the trench is in an unpaved area, clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved location, and restored to the surface after the trench is backfilled evenly. Where excavation is in a lawn covered area, the sod shall be cut and removed and replaced after trench filling so as to promote regrowth. Where sod is disturbed, the Contractor shall re-sod with like grass at his own expense.

#### **6-5 Stockpiling Excavated Material**

Excavated material shall be piled in locations that will not endanger the work, create traffic hazards or obstructed sidewalks and driveways, fire hydrants, valve boxes, obstructed sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points, shall be left unobstructed until the work is complete. Gutters and other water course shall not be obstructed unless other provisions are made for runoff and street drainage, silt fence or ERMD approved erosion control.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

## **6-6 Trenching Widths**

Trenches shall be excavated to the width necessary to permit the pipe to be laid and jointed properly and backfill materials placed and compacted as required. Where conduit is to be installed outside of existing pavement and pipes have an inside diameter of 33 inches or less, the trench shall be excavated at pipe level a minimum of 16 inches wider than the outside diameter of the pipe so that a clear space of not less than 8 inches is provided on each side of the pipe.

For pipes having an inside diameter of 36 inches or greater, the trench shall be excavated at pipe level a minimum of 24 inches wider than the outside diameter of the pipe so that clear space of not less than 12 inches is provided on each side of the pipe. Wherever it is necessary to exceed these limits, approval of the ERMD shall be obtained and provision shall be made for the additional load imposed on the pipe. When sheeting is used, the widths indicated above shall be measured to the inside dimension between the sheeting.

## **6-7 Trenches with Sloping Sides**

The banks of trenches shall be kept as nearly vertical as possible, however, where working conditions and easement or right-of-way permit (as determined by the ERMD), trenches may be excavated with sloping sides with the following limitations:

- In traveled streets, alleys or narrow easements, only vertical trenches with proper bracing will be allowed.
- Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top of the pipe. The trench shall be excavated with vertical sides below this point with widths not exceeding those specified on the Standard Detail Sheets (See Drawing No. 0-1).

## **6-8 Trench Length**

No more than 200 feet of unbackfilled trench may be left open overnight. During the months of November through April no uncovered trench shall be left overnight. Trenches should be backfilled as soon as possible to eliminate hazards and traffic congestion, but in no case shall the open trench length exceed 400 feet without the consent of the ERMD.

Trenches across existing streets are to be made so that traffic is not closed. Short duration closure may be allowed by ERMD. In such instances, the Contractor shall notify ERMD 48 hrs in advance.

## **6-9 Tunneling**

No tunneling under sidewalks, curb and gutter or other structures will be permitted, except when line can be pulled or jacked, in which case such line shall be left in place.

## **6-10 Bracing and Sheeting of Trenches**

All trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the work and adjacent property.

Bracing and sheeting shall conform to the recommendations in the Occupational Safety and Health Standards for Construction (OSHA). A sand box or trench shield may be used in lieu of sheeting and bracing as permitted by OSHA. Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

## **6-11 Excavation Below Grade**

When the excavation is carried beyond or below the lines and grades shown on the plans or staked, the Contractor shall, at his own expense, refill all such excavated space with suitable granular material.

## **6-12 Over-Excavating for Rock**

When bedrock or boulders are encountered in the trench bottom, or loose, stony soil where there is the possibility of pipe being subjected to "point" contacts, the trench shall be over excavated a minimum of six (6) inches. The over excavated material shall be relocated with Engineer-approved material and compacted.

If blasting is required for rock excavation, all work with explosives shall conform to Federal and State Laws, and OSHA rules and regulations. Any damage caused by blasting shall be repaired by the Contractor at his expense.

## **6-13 Unstable Trench Bottom**

Where the trench bottom is found to consist of soft, spongy or unstable soil, frozen material, organic matter or any other material that the ERMD determines to be unsuitable for supporting the pipe, an additional depth equal to the outside diameter of the pipe shall be removed and replaced with suitable granular material, properly compacted to provide adequate support.

## **6-14 Removal of Water**

Trenches shall be kept free of water during pipe laying operations by draining, pumping or other approved methods. The water level shall be maintained below the trench bottom throughout

the placement of bedding, pipe laying, joining and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. Under no circumstances shall trench water be discharged into sanitary sewers. The method of disposal of trench water shall be approved by the ERMD.

### **6-15 Preparing the Trench Bottom**

If soil conditions are stable, and the trench bottom is of a material that can be cut true and straight, pipe can be installed using the uniform trench bottom for support. The trench bottom must be straight, free of bumps or hollows, and at the correct grade. As the pipe is laid, any irregularities in the trench bottom must be leveled off or filled in with tamped soil. The trench grade and then bringing the trench bottom up to grade with selected refill material tamped to provide the proper cushion for the pipe. A coupling or bell hole shall be dug at each pipe joint so that the pipe is uniformly supported along its length. The hole shall have sufficient length, width and depth to permit assembly of the joint and provide a minimum clearance of two (2) inches between the coupling and the trench bottom.

### **6-16 Class A Bedding**

Class A bedding shall be defined as that method of bedding in which the lower half of the pipe is set in reinforced concrete (2000 psi min.). The minimum thickness of concrete under the lowest part of the conduit shall be  $\frac{1}{4}$  of the outside pipe diameter but not less than 4 inches.

The trench shall be maintained free of water during placing of the concrete cushion before the concrete has taken its initial set. The concrete shall extend upward around the pipe to the spring line of the pipe barrel. The width of the concrete cradle shall be at least equal to the outside pipe diameter plus 8 inches.

### **6-17 Class B Bedding**

Class B bedding shall be defined as that methods of bedding in which the pipe is set on compacted granular material. The trench shall be excavated to a depth below the established grade equal to  $\frac{1}{4}$  of the outside pipe diameter, but not less than 4 inches. In rock excavation, the minimum depth shall be 6 inches. Compacted granular material shall be placed under the pipe and around the sides of the pipe up to the springtime of the pipe barrel. The placing shall be done in a manner which will assure no separation or change in uniform gradation. The granular material shall be consolidated and compacted by hand operated mechanical vibrators to at least 90% of maximum dry density as determined by AASHTO T 180. Granular material shall be placed to one (1) foot above the top of the pipe.

### 6-18 Class C Bedding (Hand Shaped Bottom)

Class C bedding shall be defined as that method of bedding in which the pipe is placed on a native, stable soil foundation shaped to fit and uniformly support the lower quadrant of the pipe barrel for a width of at least 50% of the outside pipe diameter. Bell holes shall be excavated and kept free of foreign material.

The barrel of the pipe shall be bedded throughout its entire length. Native soil shall be hand compacted to spring line and then placed to one foot above the top of the pipe and compacted to at least 90% maximum dry density. The remainder of the backfill shall be placed in compliance with the section on trench and excavation backfill.

### 6-19 Granular, Bedding and Haunching Materials

Granular material required for bedding of pipe and structures, and haunching around pipe shall meet the following gradation requirements:

Sieve Size	Total Passing by Sizes (% by Weight)
3/4"	100 to 90
1/2"	-----
3/8"	20 to 55
No. 4	0 to 10
No. 8	0 to 5

The aggregate used shall contain not more than a total of 8% by weight of deleterious substances such as clay, shale or organic matter. The plasticity index shall not be over 6.

### 6-20 Stabilizing Material

In the event unstable trench conditions are found at pipe line grade, or in the case of over-excavation for rock, (dry) uniformly graded (class 1, 4, or 5) rock shall be used for trench stabilization. Nothing in this bedding material classification is intended to preclude the use of sand bedding provided the sand has a plasticity index of 6 or less, and having no more than 15% passing 100 sieve.

### 6-21 Backfill Material

In general, backfill shall be that material excavated from pipeline trenches on the site that is free from frozen material, large amount of organic material, concrete, asphalt, dry clods, muck, debris and rock over six (6) inches in diameter. When, in the opinion of the ERMD or Geotechnical Engineer, the excavated material is not satisfactory for use as backfill, suitable backfill material shall be furnished by the Contractor and condemned material removed from the site.

Backfill material consisting of earth and rock shall contain a sufficient amount of earth to completely fill all voids between the rocks.

### **6-22 Special Backfill Material**

Where required on the plans or In the Special Provisions, backfill shall consist of a flowable fill consisting of a plant mixed aggregate cement combination meeting the following specification: 94 pounds portland cement, 200 pounds fly ash, 2,990 pounds fine aggregate, and 49 to 57 gallons of water per cubic yard.

### **6-23 Compacting Backfill Material**

Backfill material in trenches shall be compacted to at least ninety (90%) percent of maximum density except for the top three (3) feet of the trench under existing or proposed roads which shall be compacted to at least ninety-five (95%) percent of maximum density. Maximum density shall be defined by AASHTO T 180. All approved backfill material shall be adjusted to within three (3) percent of the optimum moisture content prior to its placement in the trench. When sand is placed as backfill it must have a minimum moisture content of 5%. ERMD also requires 90% on 1 ft. of bedding.

### **6-24 Proof Roll Guidelines:**

- Proof Roll on surface will be conducted with a loaded tandem axel dump truck with 15 tons on truck. Scale ticket will be present or a loaded water truck with a capacity greater or equal to 3600 gallons.
- All Utility and Drainage will be installed and backfilled before a proof roll may be performed.
- No loose material allowed on top of surface to be proof rolled. Test surface shall be packed smooth with no ruts, no depressions and no cracks in the surface.
- Temperature must be 32 degrees in the shade for a minimum of 48 hours
- Surface shall not have any deflection for proof roll to pass
- Failing proof roll sections will be rerolled and passed before additional road lifts

### **6-25 Initial Bedding and Tamping**

Backfilling should follow pipe assembly as closely as possible, during initial bedding and backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. The first step in providing firm, continuous support for the pipeline is to tamp soil solidly under the pipe and couplings. The next step is providing effective support of the pipe in the haunching area. This is accomplished by placing bedding material equally along both sides of the pipe and thoroughly compacting it by hand under the haunches and around the pipe.



Backfilling of the trench with bedding material shall continue to a point that is at least one foot above the top of the pipe. The balance of the backfill may be machine placed in lifts not to exceed 24". Compaction between lifts is required by mechanical or other approved means. Trenches outside of proposed roads shall be backfilled to provide for mounding between 6" and 12" over existing natural ground.

#### **6-26 Flooding or Jetting of Trenches**

Flooding or jetting of trenches shall not be permitted unless approved by the ERMD.

#### **6-27 Testing**

All backfill shall be frequently tested to insure that the required density is being attained. The minimum requirements for compaction testing shall be as follows:

For every 300 lineal feet of trench and each branch or section of trench less than 300 feet in length, at least one compaction test shall be performed at 1 ft. of bedding above pipe, at the surface, and at mid-trench for excavations greater than 6 feet. Compaction tests shall be taken at random locations, along the trench and wherever poor compaction is suspected by the Engineer. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests if necessary and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense

All compaction testing shall be performed by an approved materials testing laboratory at the Contractor's expense. It shall be Contractor's responsibility to make necessary excavations in order to accommodate compaction tests at all locations designated.

A summary report of all compaction test results shall be submitted to the office ERMD. These test results are required as a basis of acceptance of facilities by ERMD.

#### **6-28 Restoration of Grounds**

The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the work. The Contractor shall keep the work site free from the accumulation of debris and waste material caused by his operation.

Immediately after the pipeline is backfilled, the area shall be cleaned and restored to the original grade and condition. All fences shall be replaced to the same elevation and alignment and restored to a condition equal to or better than that at the beginning of construction.

#### **6-29 Restoration of Paved and Concrete Surfaces**

Immediately after any section of a completed pipeline has been tested and accepted by the ERMD, the contractor shall replace all paved surfaces removed or damaged by his operation. All asphalt pavement and areas of curb removed shall be replaced with hot mixed bituminous

pavement. Paved spaces shall be restored to their original line and grade and finished to match adjacent undisturbed surfaces. The excavation contractor shall be responsible for the maintenance of the patch for a period of one (1) year or until it is removed and replaced by ERMD or their contractor. The equipment used for excavation must be equipped with pads for the stabilizers so as not to damage the street. Also, the front-end loader bucket must have a plank or buffer between the bucket and the street.

# 7

## **STORMWATER AND DRAINAGE RELATED**

### **7-1 Storm Sewers**

Storm sewer construction plans must be sufficiently complete to provide assurance of compliance with design standards. Construction plans must contain a statement that all facilities are to be installed in accordance with Standard Specifications for Construction of Waterlines, Sanitary Sewers and Storm Drainage Facilities. Additionally, the plans or accompanying report must provide the following:

- Plan and profile of storm sewer, bearing, distance, size and grade, showing original ground, proposed finished elevation and invert elevations at each manhole, inlet or wing wall;
- Design calculations of Flow (Q10, Q100) at critical points in the storm sewer, both off-site and on-site, including points of entry into the storm sewer system and points of departure from the storm sewer system;
- Two-foot contours, proposed and existing;
- Points of entry of flows onto the street system and direction of flow on the street system;
- Inlet location, type and capacity;
- Existing and proposed physical features within twenty (20) feet of the storm sewer, including geologically unstable areas, trees, cliffs, ponds, ditches and other topographic features;
- Pipe material, size and bedding class for all reaches of pipe, existing and proposed.

Construction plans should be provided in the same general format as are preliminary improvement plans submitted pursuant to subdivision procedures.

As-built plans shall include all information required in the construction plans and shall provide additional or revised information when changes in horizontal alignment exceed one (1) foot or vertical alignment exceeds on-tenth foot. If the standards are compromised or if public facilities are installed outside of public right-of-way or easements, the as-built plans shall note the same. As-built plans should be stamped by a professional engineer certifying that facilities were installed substantially in accordance approved plans.

### **7-2 Stormwater; Unpolluted Drainage; Industrial Cooling or Process Waters**

Storm water and all other unpolluted drainage shall be discharged to such water ways as specifically designated. Industrial cooling water or unpolluted process waters may be discharged only on approval of ERMD, to a storm sewer, or natural outlet.

### **7-3 Discharge of the Following Described Waters or Wastes to any Public Sewer Are Prohibited**

Any gasoline, oil, benzene, naphtha, fuel oil or other flammable or explosive liquid, solid or gas;

Any waters or wastes containing toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, create a public nuisance or create any hazard in the receiving waters of the sewage treatment plant, including but not limited to cyanides in excess of two (2) mg/l as CN in the wastes as discharged to the public sewer;

Any water or wastes having a pH lower than 5.5, or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works;

Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works such as, but not limited to , ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, buttermilk, carcasses or hides of dead animals or fowl, underground garbage, whole blood, paunch manure, hair and fleshings, entrails, paper dishes, cups, milk containers, etc. either whole or ground by garbage grinders and fats or oils.

### **7-4 Discharge of the Following Harmful Substances to any Public Sewer Are Prohibited**

No person shall discharge or cause to be discharged the following described substances, materials, waters or wastes if it appears likely in the opinion of ERMD that such wastes can harm either the sewers, sewage treatment process or equipment, have an adverse effect on the receiving stream, or can otherwise endanger life, limb, public property or constitute a nuisance. In forming his opinion as to the acceptability of these wastes, ERMD will give consideration to such factors as the quantities of subject wastes in relation to flows and velocities in the sewer, materials of construction of the sewer, nature of the sewage treatment process, capacity of the sewage treatment plant, degree of treatability of wastes in the sewage treatment plant and other pertinent factors. The prohibited substances are:

- Any liquid or vapor having a temperature higher than one hundred fifty (150) degrees Fahrenheit (65) degrees Celsius;
- Any water or wastes containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperatures between thirty-two (32) degrees and one hundred fifty (150) degrees Fahrenheit (zero (0) and sixty-five (65) degrees Celsius);
- Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourths horsepower (0.76 hp metric) or greater shall be subject to the review and approval of the director;
- Any waters or wastes containing strong acid from pickling wastes or concentrated plating solutions whether neutralized or not;

- Any waters or wastes containing iron, chromium, copper, zinc and similar objectionable or toxic substances, or wastes exerting an excessive chlorine requirement, to such degree that any such material received in the composite sewage at the sewage treatment works exceeds the limits established by ERMD for such materials;
- Any waters or wastes containing phenols or other taste-or odor-producing substances, in such concentration exceeding limits which may be established by the ERMD as necessary, after treatment of the composite sewage, to meet the requirements of state, federal or other public agencies of jurisdiction for such discharge to the receiving waters.
- Any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the director in compliance with applicable state or federal regulations;
- Any waters or wastes having a pH in excess of 9.5;
- Material which exert or cause:
  - Unusual concentrations of inert suspended solids such as, but not limited to, fuller's earth, lime slurries and lime residues or of dissolved solids such as, but not limited to, sodium chloride or sodium sulfate;
  - Excessive discoloration, such as, but not limited to, dye wastes and vegetable tanning solutions;
  - Unusual Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), or chlorine requirement in such quantities as to constitute a significant quantities as to constitute a significant load on the sewage treatment works;
  - Unusual volume of flow or concentrations of wastes constituting slugs as defined in this article;
- (10) Waters or wastes containing substances which are not amenable to treatment or reduction by the sewage treatment processes employed or are amenable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of state agencies having jurisdiction over discharge to the receiving waters;

Any waters or wastes having:

- A five (5) day BOD greater than three hundred (300) parts per million by weight;
- More than three hundred (300) parts per million by weight of suspended solids;
- An average daily flow greater than two (2) percent of the average sewage flow of the ERMD.
- Shall be subject to the review of the ERMD.

Where necessary in the opinion of ERMD the owner shall provide, at his expense, such preliminary treatment as may be necessary to:

- Reduce the biochemical oxygen demand to three hundred (300) parts per million by weight;
- Reduce the suspended solids to three hundred (300) parts per million by weight; or
- Control the quantities and rates of discharge of such waters or wastes.

Plans, specifications, and any other pertinent information relating to proposed preliminary treatment facilities shall be submitted for the approval of ERMD and no construction of such facilities shall be commenced until such approvals are obtained in writing.

### **7-5 Construction of Storm Inlets and Vaults**

Pre-cast or formed concrete boxes for storm inlets and vaults shall be placed on prepared granular bedding, uniformly supported, in correct alignment and at proper grade.

When the box is furnished in more than one section, the sections shall be joined and sealed with an approved bitumatic material so that the completed box is rigid and watertight.

Pipe connections to concrete structures shall be made by approved methods and shall result in a smoothly finished, watertight connection. Pipe ends shall not extend more than one inch beyond the inside face of the structure.

All inlet boxes, vaults and irrigation structures shall be cleaned of any accumulation of silt, debris or other foreign matter and shall be free from such accumulations at the time of final inspection.

### **7-6 Testing Storm Sewers and Culverts**

Testing of all gravity flow pipeline, other than sanitary sewers, shall consist of a physical inspection by the ERMD, All pipelines and sewer lines will be lamped to check for proper alignment and uniformity of grade.

### **7-7 Storm Drainage System**

- Refer to City of Durango specifications

### **7-8 Sidewalks, Curbs and Gutters, Cross Pans**

- Refer to City of Durango specifications

### **7-9 Storm Sewer Systems Standards Generally**

All storm sewer collection facilities within public rights-of-way of easements shall be constructed in accordance with standard drawings and construction specifications of the ERMD. In general, storm sewers or surface drainage channels and culverts shall be installed when the carrying capacity of the street is exceeded based on the following chart:

### USE OF STREETS FOR DRAINAGE

<i>Street Classification</i>	<i>Minor Storm runoff (10-year) Maximum roadway Encroachment)</i>	<i>Major storm runoff (100-year) (Allowable depth and Inundation)</i>
Local	No curb overtopping. Where no curbing exists, encroachment shall not be over property lines. Flow may spread to crown of street.	Inundation: Residential dwellings, public, commercial and industrial buildings shall not be inundated at ground line, unless buildings are flood-proofed. Depth of water over gutter flowline shall not exceed twelve (12) inches.
Collector	No curb overtopping (same as above). Flow spread must leave at least one (1) ten-foot lane free of water.	(Same as above)
Arterial	No curb overtopping (same as above). Flow spread must leave at least one (1) ten-foot lane free of water in each direction.	Inundation; (same as above). Depth of water at street crown shall not exceed six (6) inches. To allow operation of emergency vehicles. Depth of water flow line shall not exceed eighteen (18) inches.

All storm sewer plans shall be approved by a P.E. prior to construction.

#### 7-10 Storm Sewer Pipe Size

The minimum pipe size for storm sewers or culverts shall be twelve (12) inches nominal diameter. Sizes required shall be as shown in the urban storm drainage master plan. Where not covered in the master plan, storm drains shall be sized to transport the flow of a ten-year-flood from the fully developed sub basin in which the development lies to a natural drainage course or other point acceptable to the ERMD engineer. Design parameters given in the master plan shall be used in the calculation of the ten-year flood from sub basins of less than two hundred (200) acres.

For project sites of two hundred (200) acres or more, a method similar or equivalent to that identified in the Soil Conservation Service Procedures for Determining Peak Flows in Colorado Technical Release No. 55 shall be used.

#### 7-11 Pipe and Fittings for Storm Sewers, Culverts, and Siphons

Pipe shall be, corrugated aluminum non-reinforced concrete or reinforced concrete or HDPE.

## 7-12 Corrugated Aluminum Pipe (CAP)

Corrugated aluminum pipe and coupling bands shall conform to AASHTO M 196. Unless otherwise specified or approved by the ERMD Engineer, all round corrugated aluminum pipe shall be fabricated with helical corrugations and a continuous lock seam. Unless otherwise specified, the thickness gauge of CAP shall be per Colorado Division of Highways Standard M-603-MB.

**Joints:** Corrugated aluminum pipe shall be joined with gasketed coupling bands of the same alloy as the pipe. Bands shall be corrugated to match the ends of the pipe and form a watertight seal. Dimple bonds are not permitted. Gasket material shall be of neoprene or other approved synthetic rubber.

Concrete pipe with tongue and groove joints may be used for storm drainage only. Tongue and groove joints will not be allowed under paved surfaces.

## 7-13 Storm Sewer Slopes

The minimum slope for storm sewers shall be such as to maintain a flowing full velocity of two and one-half (2 ½) feet per second. Energy dissipaters must be installed in storm sewers where maximum velocity in the storm sewer would exceed ten (10) feet per second.

## 7-14 Storm Sewer Inlets

Inlets must be constructed in accordance with standard drawings at all locations necessary to prevent the sheet flow across paved road or private property of a two-year flood. (see detail) Double inlets are required on all streets where gutter slopes exceed five (5) percent.

## 7-15 Storm Sewer Outlets

Engineered storm sewer outlets shall not be infringed upon by structures, landscaping, or any appurtenances that would inhibit the flow or servicing of the drain by the ERMD.

## 7-16 Storm Sewer Manholes

Manholes for storm sewers are required at:

- Change in grade;
- Change in alignment;
- Intersection of two (2) or more storm sewers; and
- Intervals no greater than four hundred (400) feet for twenty-four (24) inches and smaller, five hundred (500) feet for forty-eight (48) inches and smaller, six hundred (600) feet for all others.



**7-17 Culverts**

Culverts, where required, shall have twelve (12) inches of cover under roads.

Culverts design shall be in an accordance with the Colorado State Department of highway's design manual. Capacity design calculations shall be submitted along with plans for circular and box culvert design.

No inverted siphons shall be permitted.

## 8

### UTILITY COMPANY RELATED

#### 8-1 Legislative Intent

Certain entities herein referred to as “utility companies” are involved in the transportation, distribution and sale of utilities within the municipal limits of ERMD through pipelines, mains and other fixed facilities, using streets, public property, easements and right-of-way granted by ERMD.

The nature of the companies transporting, distributing and selling utilities, including, without limitation, their use of public and private easements, streets and right-of-way, and the potential and actual hazards from the operations of such companies, have a substantial effect upon the health, safety and welfare of ERMD.

The transportation and distribution of utilities involves a pervasive and permanent use of ERMD streets, rights-of-way and public places, and such use is necessary in order for the utilities companies to conduct their business.

ERMD operates storm drainage, water and sewer utilities using ERMD streets, right-of-way and public places, including those which are or may be used by utilities companies to conduct their business. In addition, such streets, rights-of-way and public places are utilized by the provider of electrical service and communications to the citizens of ERMD.

For purposes of protecting the public health, safety and welfare and in order to serve the convenience of the citizens of ERMD, it is necessary to coordinate activities relating to the use of the ERMD streets, rights-of-way and public places, including but not limited to, the placement of and relocation of facilities, excavations, construction and maintenance by utilities companies.

The regulations imposed herein are a matter of local concern relating to the use of public property by these companies and are imposed upon all utilities doing business within ERMD.

In order to provide for public health, safety, welfare and convenience, ERMD enacts this article, which governs the location and relocation of utilities company facilities as well as any excavation, opening or other use of public streets, rights-of-way and public places for the purposes of transportation, distribution and sale of utilities.

#### 8-2 Permit Procedure

When a utility company seeks to make, causes or permits to be made any excavation or opening in or under the surface or pavement of any street, alley, sidewalk, right-of-way or public property, it must apply for and receive a permit from ERMD.

Applications for a permit for excavation shall be filed pursuant to ERMD permitting processes.

Except in an emergency, prior to any construction or excavation in streets, alleys or public ways, the entity or its contractor shall submit a traffic control plan consistent with ERMD policies. Adequate traffic control measures shall be provided for all excavations in the public right-of-way.

### **8-3 Review of Construction and Design**

Except in emergency circumstances, prior to construction of any significant utilities above or below ground within or affecting public rights-of-way, easements or other public property or the construction of any building or similar structure within ERMD, each utility company shall furnish to ERMD the plans for such facilities and report of the impact of its proposed construction upon public property.

The plans and report required by this section shall be submitted in completed form to ERMD at the time application is made for building permit or an excavation permit.

The plans and report required by this section may be reviewed by ERMD assure:

- That all applicable laws including building and zoning codes and air and water pollution regulations are complied with;
- That ERMD standards pertaining to landscaping are complied with;
- That aesthetic and good planning principles are duly incorporated; and
- That adverse impacts on public property have been minimized.

In the construction of any facilities or any plant, building or similar structure within ERMD, gas companies shall comply with all regulatory requirements of ERMD and shall incorporate all other reasonable changes required by ERMD consistent with prudent engineering practice. Such regulations shall include, but not be limited to the following matters:

- Location of facilities in streets, dedicated easements and driveways;
- Interference with ERMD water mains, sewer mains and storm drainage facilities or any other municipal use of ERMD Streets and right-of-way;
- The minimization of interference with trees and other natural features and vegetation; and
- Interference with traffic and other transportation within ERMD.

### **8-4 Excavation and Construction**

All Construction, excavation, maintenance and repair work done by any utility company in or affecting public streets, rights-of-ways and public places shall be done in a timely and expeditious manner which minimizes the inconvenience to the public and individuals. Utility companies shall be liable for any damages to ERMD caused by their failure to act in a timely manner.

All public and private property in dedicated easements disturbed by utility company construction or excavation activities shall be restored by the utility company at its expense to a condition at least equal to its former condition subject to inspection by ERMD or its designee. All

utility companies operating within ERMD shall comply with reasonable remedial action required by said ERMD pursuant to inspection.

### **8-5 Installation and Maintenance of Utilities**

The installation, maintenance, renovation and replacement of any facilities by the company shall be subject to permits and fees related thereto, and inspection and approval of location by the ERMD, or a consulting engineer.

All utilities shall be installed in dedicated easements and/or rights-of-way so as to cause a minimal amount of interference with such property.

Each utility company shall erect and maintain its facilities in such a way as to minimize interference with trees and other natural features and vegetation.

Each utility company shall keep in good working order all facilities constructed, erected or used within the ERMD subdivision.

Each utility company and all subcontractors shall comply with all local regulations and ordinances.

Each utility company will comply with all ERMD requirements regarding curb and pavement cuts, excavation, digging and related construction activities as well as any reasonable direction provided by ERMD regarding replacement of lines and other similar facilities within ERMD.

### **8-6 Obligations Regarding Company Facilities**

Each utility company shall install, repair, renovate and replace facilities with due diligence in a good and workmanlike manner, and all such facilities shall be of sufficient quality and durability to protect the health, safety and welfare of the public and shall be kept and maintained by utility companies in a safe and suitable condition, and in good order and repair. In the event that ERMD incurs any expenses paid to third parties who are not employees of ERMD to obtain compliance with the utility company's use of any public way or public place, the utility company shall reimburse ERMD for such expense reasonably incurred.

### **8-7 Noninterference with Public Works**

Utility company facilities (any utility) shall not interfere in any way with ERMD water mains and facilities, sewers mains and facilities, storm drainage systems and facilities, or other municipal use of streets and rights-of-way.

### **8-8 Relocation of Facilities**

Upon receipt of reasonable advance notice, not to be less than five (5) business days, a utility company shall, at its own expense, protect, temporarily disconnect, temporarily relocate in the public way or temporarily remove from the public way, any property of the utility company

when lawfully required by ERMD by reason of traffic conditions, public safety, street construction, change or establishment of street grade, installation of sewers, drains or water pipes, or any other type of public structures or improvements by ERMD provided, however, the utility company shall in all cases have the right of abandonment of its property.

If at any time ERMD requests the utility company to permanently relocate any facilities in public ways in order to permit ERMD to make any use of public ways to construct any public improvement or to build any public project, such relocation shall be made by the utility company at its expense and shall be completed within a reasonable time not to exceed one hundred eighty (180) days from the date upon which ERMD requests that such relocation work commence; provided, however, that such time period may be enlarged with approval of ERMD, which approval shall not be unreasonable withheld.

The utility company may be granted an extension of time for completion equivalent to any delay caused by conditions not under its control, provided that such utility company proceeds with due diligence at all times.

Following temporary or permanent relocation of utility company facilities, all property shall be restored to a condition at least equal to its former condition at the expense of the utility company.

Nothing herein contained shall be construed to impose any obligation upon ERMD to make any payment for relocation of facilities.

## **8-9 Emergencies**

Any provision of this article to the contrary notwithstanding, a utility company may take such immediate unilateral actions as in its determination are necessary to protect the public health, safety, property and welfare in the event of an emergency, "Emergency" shall mean a leak, line break, explosion or fire, etc.. Such utility company shall within twenty-four (24) hours of the commencement of such emergency action notify ERMD of the emergency and of the general nature of the action taken and shall, within forty-eight (48) hours of the commencement of such emergency action notify, apply for any necessary permits as required. It shall be the duty of such utility company to fully repair and restore any and all public rights-of-way, easements or other public property to a condition at least equal to its former condition promptly upon resolution of such emergency. It shall also be the duty of such utility company to otherwise restore ERMD to its former position by promptly reimbursing ERMD for any other loss suffered by ERMD as the result of such emergency, whether such loss be direct, indirect, consequential or incidental.

# 9

## DEFINITIONS

All words used in this division, except where specifically defined in this section, shall carry their customary meanings when not inconsistent with the context. The following words shall have the definitions ascribed to them in this section whenever they shall appear in this division:

**Backfill** means material placed in an excavated space to fill such space.

**Base course** means the upper course of the granular base of the pavement or the lower course of and asphalt concrete pavement structure.

**B.O.D.** (denoting biochemical oxygen demand) means the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at twenty (20) degrees Celsius, expressed in milligrams per liter (mg/l).

**Building drain** means that part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer, beginning five (5) feet (1.5 meters) outside the inner face of the building wall.

**Building sewer** means the extension from the building drain to the public sewer or other place of disposal.

**Combined sewer** means a sewer receiving both surface and runoff waters and sewage.

**Culvert** means any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.

**Facilities** shall mean all physical components and all facilities reasonably necessary to provide or which are used in the provision of utilities directly or indirectly into, within and through the city for transportation, distribution, and sale and includes, but is not limited to, plants, works, systems, distribution structures, lines, equipment, pipes, mains, underground links, gas compressors and meters.

**Garbage** means solid waste from the domestic and commercial preparation, cooking and dispensing of food, and from the handling, storage and sale of produce.

**Gas or natural gas** shall mean such gaseous fuels as natural, artificial, synthetic, liquefied natural, liquefied petroleum, manufactured or any mixture thereof

**Industrial wastes** means the liquid wastes from industrial manufacturing processes, trade business as distinct from sanitary sewage.

**Natural outlet** means any outlet into a water-course, pond, ditch, lake or other body of surface water or groundwater.

**Normal domestic** wastewater means wastewater that has a BOD concentration of not more than three hundred (300) mg/l and a suspended solids (SS) concentration of not more than three hundred (300) mg/l. Normal domestic wastewater is considered to have a concentration which may generally range from approximately one hundred twenty-five (125) to three hundred (300) mg/l of both BOD and SS.

**Operation and maintenance** means all expenditures during the useful life of the treatment works for materials, labor, utilities and other items which are necessary for managing and maintaining the sewage works to achieve the capacity and performance for which such works were designed and constructed.

**Replacement** means expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the useful life of the treatment works to maintain the capacity and performance for which such works were designed and structured. The term “operation and maintenance” includes replacement.

**Residential contributor** means dwellings or structures used for residential purposes and that contain no more than two (2) families or groups of individuals living independently of each other in separate apartments. Residential swellings containing three (3) families or more or three (3) apartments or more shall be classified as industrial and commercial for purposes of this division.

**Pavement** means any surfacing of streets, alleys, sidewalks, courts, driveways or similar area, consisting of manual aggregate bound into a rigid or semi-rigid mass by suitable binder such as, but not limited to, portland cement or asphalt cement.

**Pavement structure** means the combination of, sub base, base course, and surface course place on a sub grade to support the traffic load and distribute it to the road bed.

**Permit** means any authorization for use of the public rights-of-way granted in accordance with the terms of this specifications document, and the policies and regulations of the ERMD.

**Permittee** means the holder of a valid permit issued by the ERMD pursuant to this specifications document.

**pH** means the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

**Property shredded garbage** means the wastes from the preparation, cooking and dispensing of food that have been shredded to such a degree that all particles will be carried freely under the flow conditioner normally prevailing in public sewers, with no particle greater than on-half inch (1.27 centimeters) in any dimension.

**Public improvements** means public facilities and shall refer to the construction or installation of streets, including curb and gutter, sidewalks, development, or extension of the water system, sanitary sewer system, storm sewer systems.

**Public sewer** means a sewer in which all owners of abutting properties have equal right, and is controlled by public authority.

**Right-of-way** means land, property or intersection therein, usually in a strip, acquired for or devoted to a street, highway or other public improvement.

**Road** means an open way for purposes of vehicular and pedestrian travel.

**Roadway** means the improved portion of the right-of-way intended primarily for vehicular traffic.

**Sanitary sewer** means a sewer which carries sewage and to which storm waters, surface water, and ground waters are not intentionally admitted.

**Sewerage** means a combination of the water-carried wastes from residences, business building, institutions and industrial establishments, together with such groundwater, surface waters, and storm water as may be present.

**Sewers** means conduits and related appurtenances employed to collect and carry off water and waste matter to a suitable point of final discharge.

**Sewage treatment plant** means any arrangement of devices and structures used for treating sewage.

**Sewage works** means all facilities for collection, pumping, treating and disposing of seater. Sewer means a pipe or conduit for carrying sewage.

**Shoulder** means that portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

**Slug** means any discharge of water, sewage or industrial waste which concentration of any given constituent or in quantity of flow exceeds for any period of duration longer than five (5) times the average twenty-four-hour concentration or lows during normal operation.

**“Specifications”** means engineering regulations, construction specifications, and design standards adopted by the ERMD, including, but not limited to the ERMD Construction and Specifications and Standards

**SS** (denoting suspended solids) means solids that either float on the surface off or are in suspension in water, sewage or other liquids and which are removable by laboratory filtering.

**Storm drain** means any conduit and appurtenance intended for the reception and transfer of storm water excluding sewage and industrial.

**Street** the improved area of the right-of-way.

**Structures** means bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, buildings, sewers, service pipes, under drains, foundation drains, fences, swimming pools, and other features which may be encountered in the work and not otherwise classed in the is division.

**Sub base** means the lower course of the base of a roadway, immediately above the subgrade.

**Sub grade** means the supporting structures on which the pavement and its special undercourses rest.

**Suspended solids** means solids that either float on the surface of, or are in suspension in, water, sewage or other liquids, and which are removable by laboratory filtering. **Treatment works** means any devices and systems for the storage, treatment, recycling and reclamation of municipal sewage, domestic sewage or liquid industrial wastes. These include intercepting sewers, outfall sewer,



sewage collection systems, individual systems, pumping, power and other equipment and their appurtenances; extensions improvement, remodeling, additions and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment unites and clear well facilities; and any works, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues resulting from such treatment; or any other method or system of preventing, abating, reducing, storing, treating, separating or disposing of municipal waste or industrial waste, including waste in combined stormwater and sanitary sewer systems.

**Use charge** means that portion of the total wastewater service charge which is levied in a proportional and adequate manner for the cost of the operation, maintenance and replacement of the wastewater treatment works.

**Useful life** means the estimated period during which a treatment works will be operated.

**Utility companies** shall mean any entity that sells, provides, delivers or distributes utilities with the corporate limits of ERMD through pipelines, mains and other related facilities and appurtenances located in whole or in part on easements and right-of-way granted by ERMD.

**Watercourse** means a channel in which a flow of water occurs, either continuously or intermittently.

**Water meter** means a water volume measuring and recording device, furnished or installed by ERMD.

**Work** means any labor performed on, or any use or storage of equipment or materials, including but not limited to, construction of streets and all related appurtenances, fixtures, improvements, driveway openings, street lights and landscaping. It shall also mean, construction, maintenance, and repair of all underground structures such as pipes, manholes, vaults, buried cable or wire, or any other similar structure located below surface.

# **10**

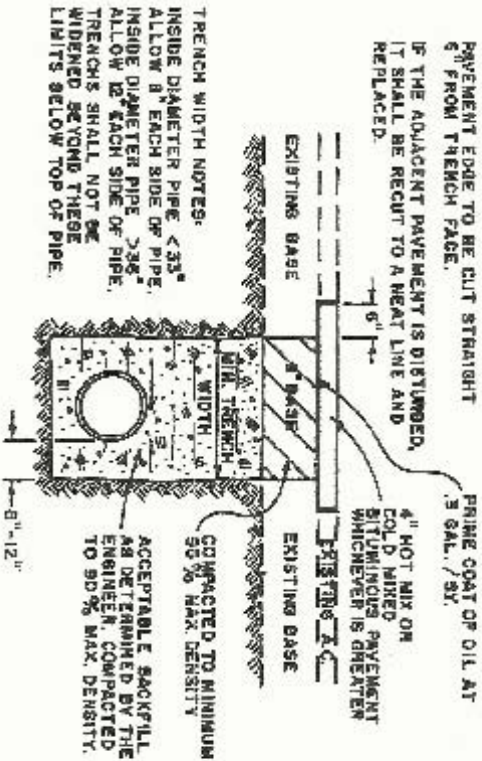
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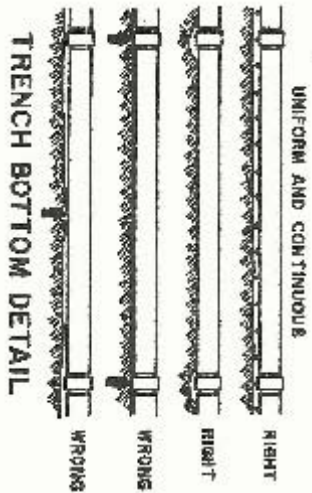
TRENCH SHAPE DETAIL



BEDDING COMPACTION DETAIL

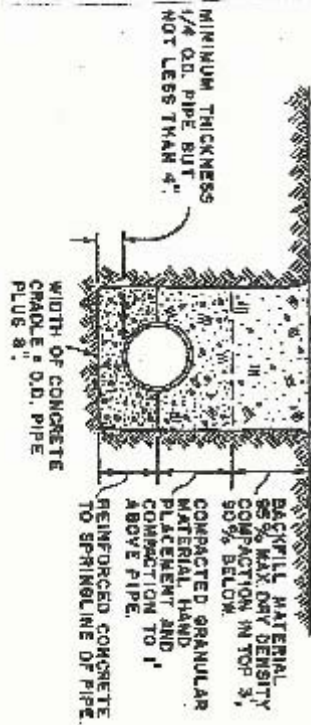


STANDARD TRENCH DETAIL

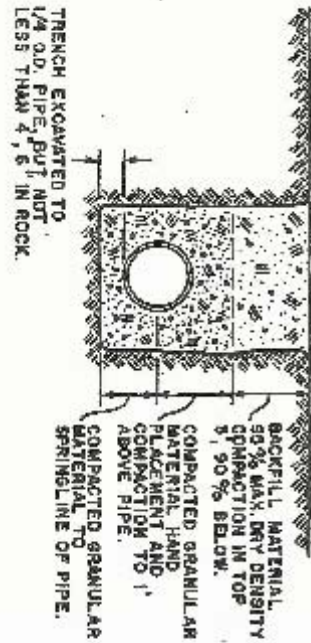


TRENCH BOTTOM DETAIL

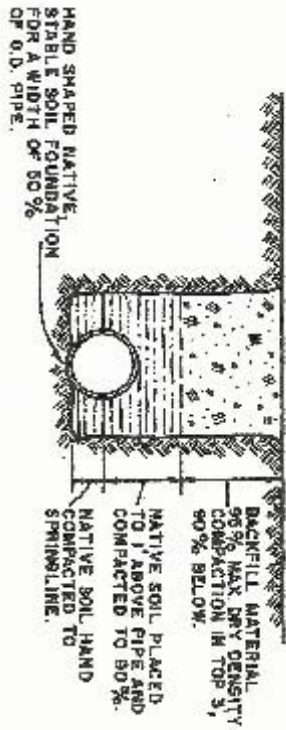
**CLASS A BEDDING**



**CLASS B BEDDING**

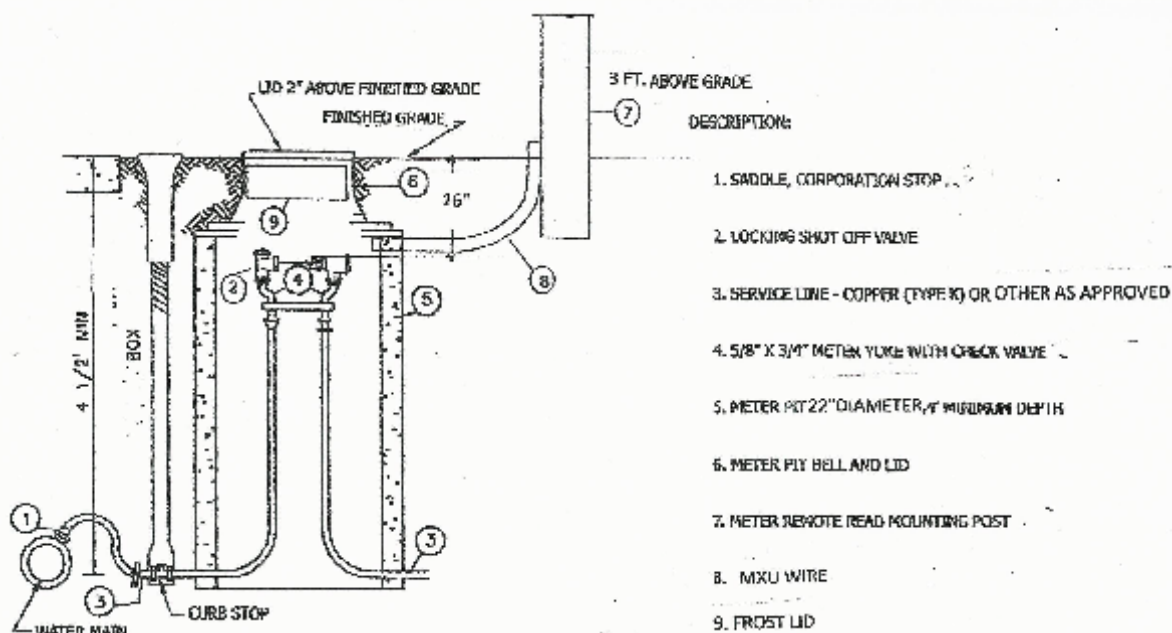


**CLASS C BEDDING**



DENSITY TESTING PER AASHTO - T 190

**STANDARD BACKFILL DETAILS**

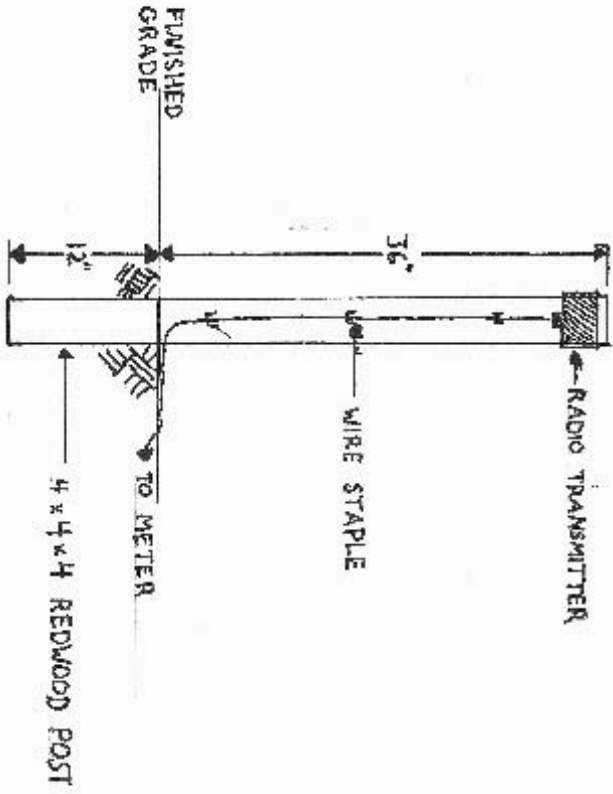


## NOTES:

1. WATER METER AND REMOTE READ DEVICE FURNISHED AND INSTALLED BY EDGEMONT WATER DISTRICT PERSONNEL.
2. SERVICE LINE MUST HAVE A MINIMUM COVER OF 4 FEET.
3. WATER DISTRICT PERSONNEL SHALL INSTALL THE SERVICE LINE FROM THE MAIN TO THE METER PRIOR TO BACKFILLING.
4. INSIDE METER SETTINGS WILL NOT BE PERMITTED.
5. IF BOTH RISERS TO YOKES ARE NOT COPPER, THEN YOKES WILL NEED TO BE SUPPORTED AS APPROVED BY DISTRICT.
6. METER PITS AND CURB STOPS SHALL BE LOCATED IN GRASSY, LANDSCAPED AREAS, UNLESS OTHERWISE APPROVED BY THE BOARD OF DIRECTORS PRIOR TO INSTALLATION.  
METER PITS CANNOT BE PLACED IN DRIVEWAYS, SIDEWALKS OR UNDER PARKING AREAS.
7. ALL METER SETTINGS MUST BE INSPECTED BY EDGEMONT WATER DISTRICT PERSONNEL BEFORE BEING BACKFILLED. METERS WILL NOT BE SET/APPROVED UNLESS METER SETTING AND SERVICE LINE ARE IN FULL COMPLIANCE WITH THE RULES AND REGULATIONS, STANDARD DRAWINGS AND APPROVED PROJECT DRAWINGS AS APPLICABLE.

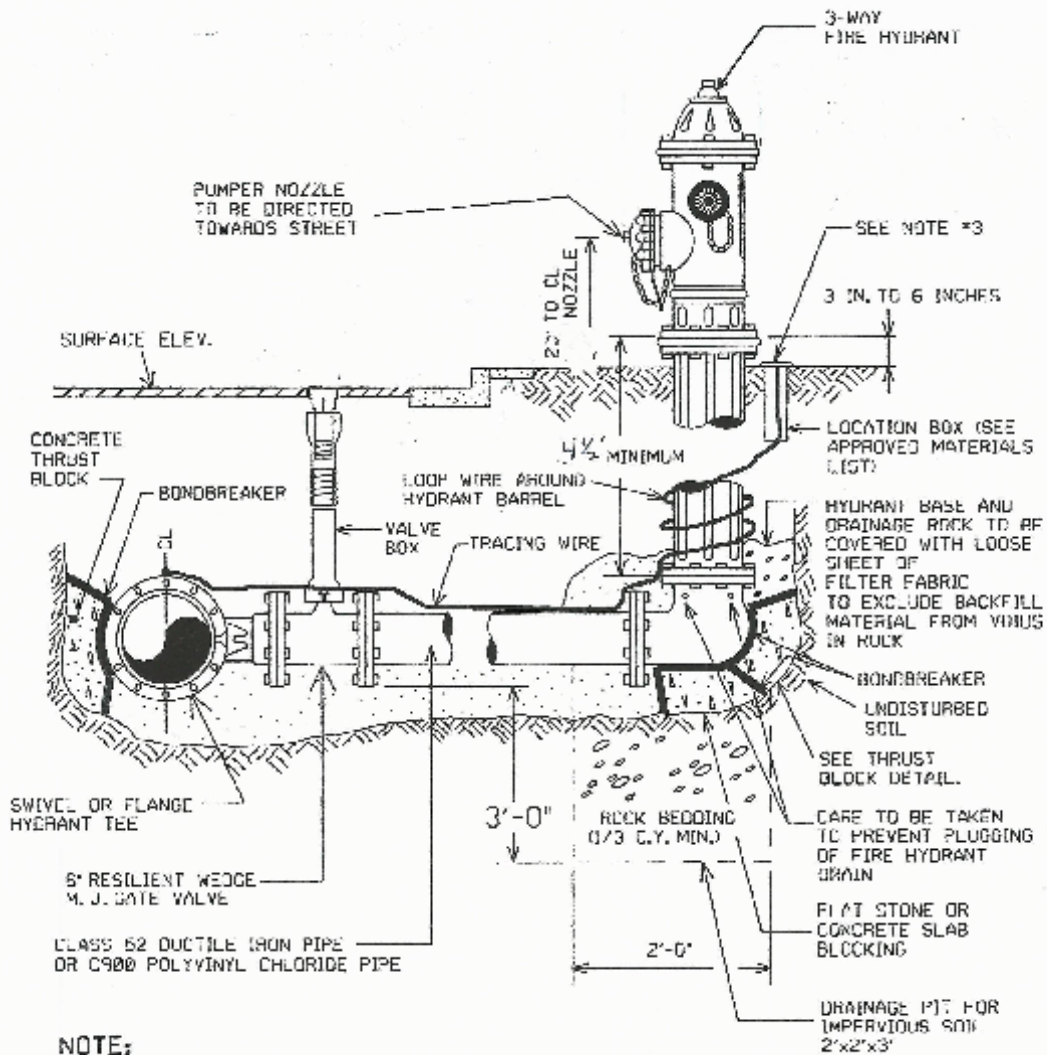
## SERVICE LINE METER PIT DETAIL

### MXU DETAIL



- NOTES:
1. MXU SHALL FACE THE STREET
  2. POST BURY DEPTH 12"
  3. FOUAGE SHALL NOT BLOCK LINE OF SIGHT TO STREET

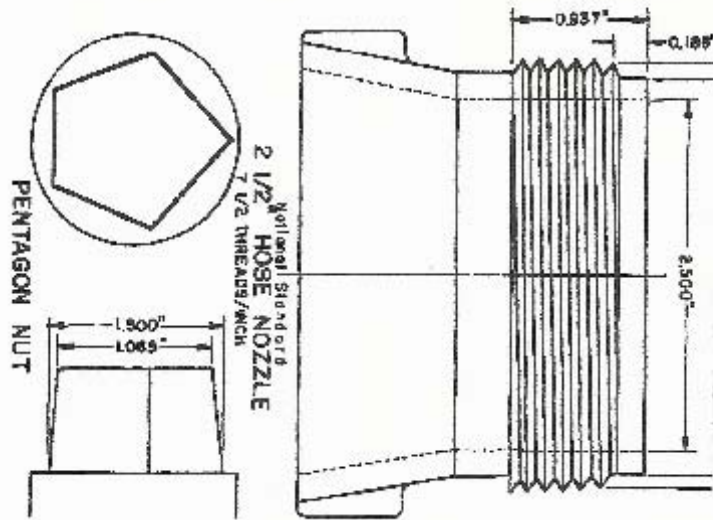
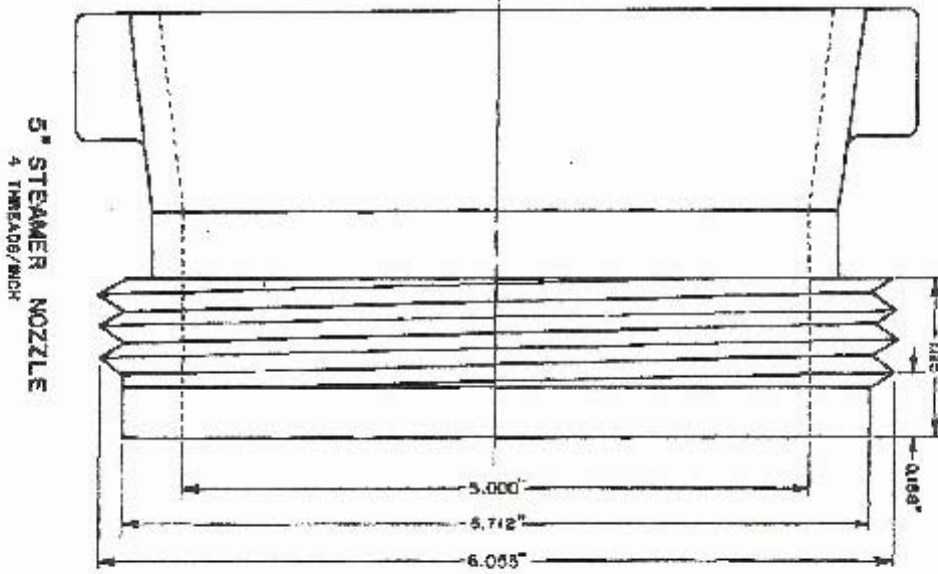
METER POST INSTALLATION  
 Sheet 4

**NOTE:**

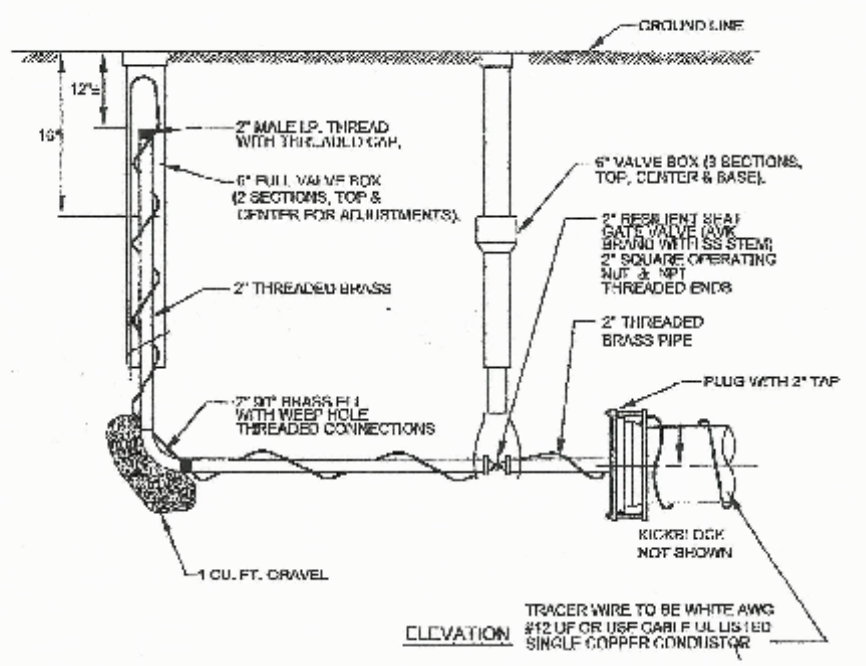
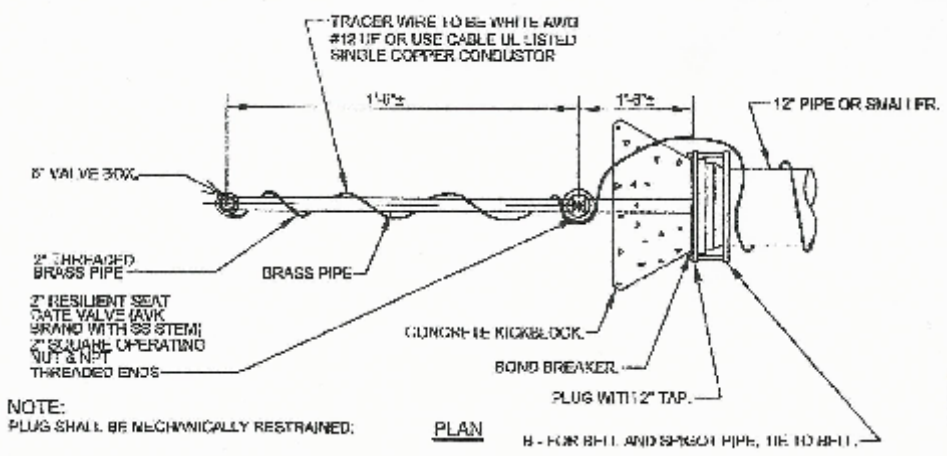
- 1) IF MORE THAN ONE BARREL EXTENSION IS USED TO RAISE A FIRE HYDRANT TO GRADE, ONLY ONE STEM EXTENSION OF THE PROPER LENGTH WILL BE ALLOWED. MULTIPLE STEM EXTENSIONS ARE NOT ACCEPTABLE.
- 2) ALL METALLIC PIPE MUST BE WRAPPED IN POLYETHYLENE INCLUDING HYDRANT BARREL.
- 3) A MINIMUM OF 12 INCHES OF SLACK SHALL BE INSTALLED FOR EACH WIRE IN THE LOCATION BOX.
- 4) ADDITIONAL TRACING WIRE STATIONS MAY BE NECESSARY IF FIRE HYDRANT SPACING IS TOO GREAT TO ADEQUATELY TRACE THE PIPELINE.

## STANDARD FIRE HYDRANT INSTALLATION PROFILE

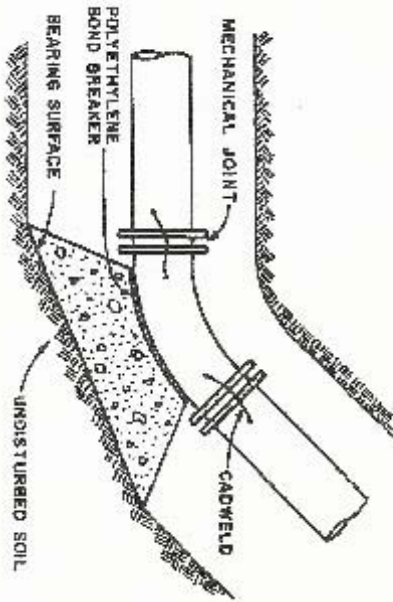
NTS



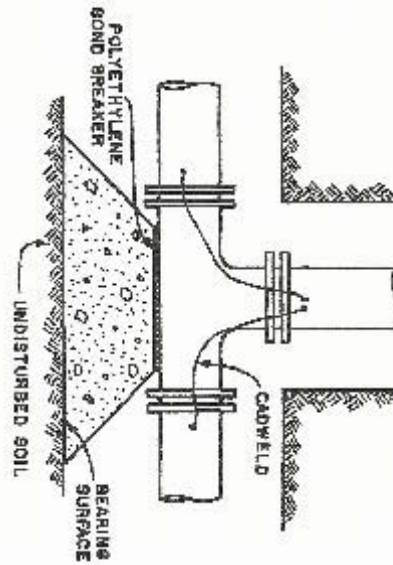




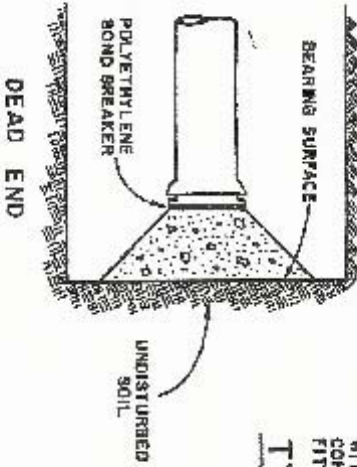
**BLOW-OFF INSTALLATION  
FOR 12" AND SMALLER PIPE**



11-1/4°, 22-1/2°, 45°, 90° BENDS



TEE



ALL FITTINGS REQUIRING THRUST BLOCKS SHALL BE WRAPPED WITH POLYETHYLENE ENCASUREMENT MATERIAL. CONCRETE SHALL NOT BEAR ON BOLTS OF MECHANICAL JOINT FITTINGS.

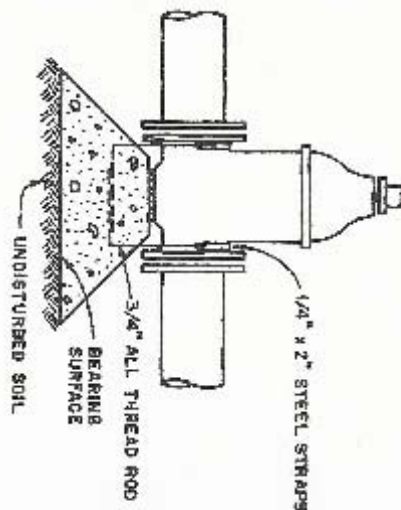
**TYPICAL THRUST BLOCK DETAILS**

**TABLE FOR CONCRETE THRUST BLOCKING BEARING AREAS (IN SQ. FT.)**

SIZE	BENDS			TEES, DEAD ENDS, AND CROSS W/ DEAD END BRANCHES
	90°	45°	22-1/2°	
3	1.0	0.6	0.3	0.7
4	1.8	1.0	0.5	1.3
6	4.0	2.2	1.1	2.8
8	7.1	3.8	2.0	5.0
10	11.1	6.0	3.0	7.9
12	16.0	8.6	4.4	11.3
14	21.7	11.8	6.0	15.4
15	25.0	13.5	7.0	17.6
18	28.4	15.3	8.0	20.0
18	36.0	19.4	10.0	25.4
20	44.2	24.0	12.2	31.4
21	49.0	26.8	13.8	34.6
22	54.0	29.0	14.8	38.0
24	64.0	34.6	17.7	45.0
30	100.0	54.0	27.6	71.0
36	144.0	78.0	40.0	102.0

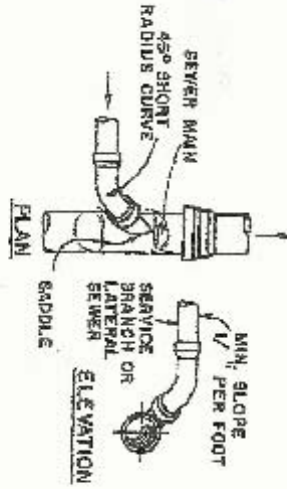
NOTE: TEE SIZE IS BRANCH SIZE.

AREAS GIVEN IN TABLE ARE BASED UPON INTERNAL STATIC PRESSURE OF 100 P.S.I. AND A SOIL BEARING CAPACITY OF 1,000 LB. PER SQUARE FOOT. BEARING AREAS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING TABULATED VALUES BY A CORRECTION FACTOR "F".  
 F = ACTUAL SPECIFIED TEST PRESSURE IN HUNDREDS OF P.S.I. / ACTUAL SOIL BEARING CAPACITY IN THOUSANDS OF P.S.I.

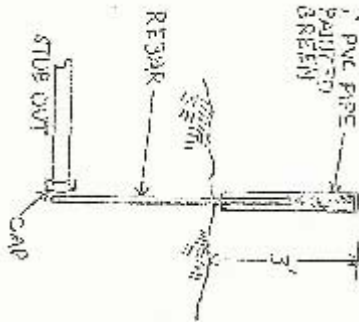


**THRUST BLOCK DETAILS**

ALL FITTINGS REQUIRING THRUST BLOCKS SHALL BE WRAPPED WITH POLYETHYLENE ENCASUREMENT MATERIAL. SOIL BEARING CAPACITIES SHALL BE DETERMINED BY THE ENGINEER.

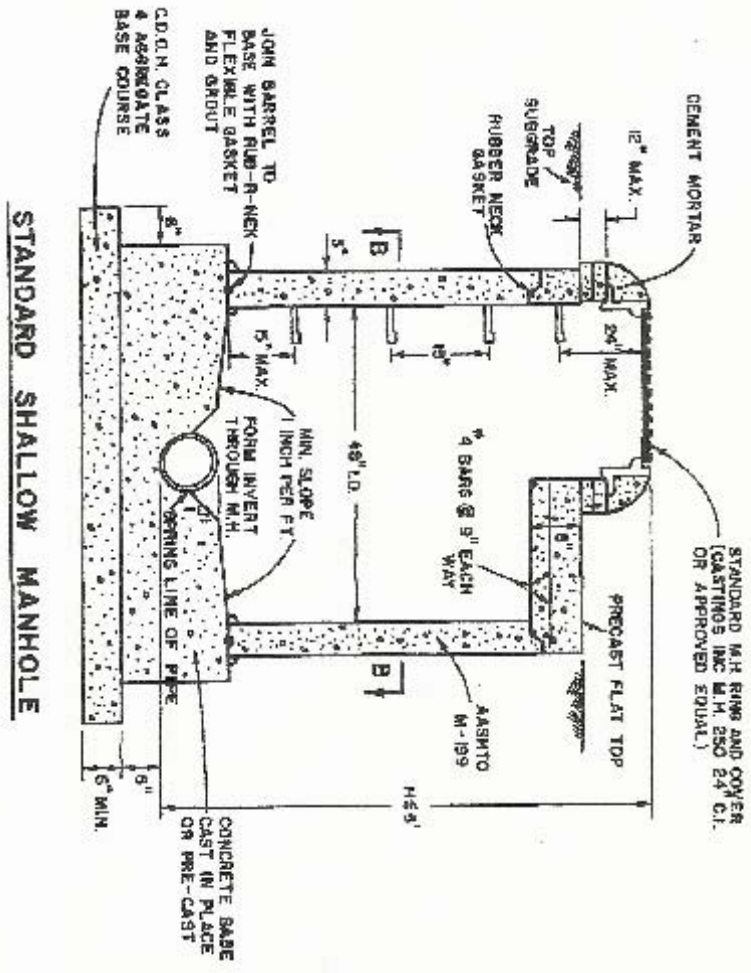


**SERVICE CONNECTIONS**



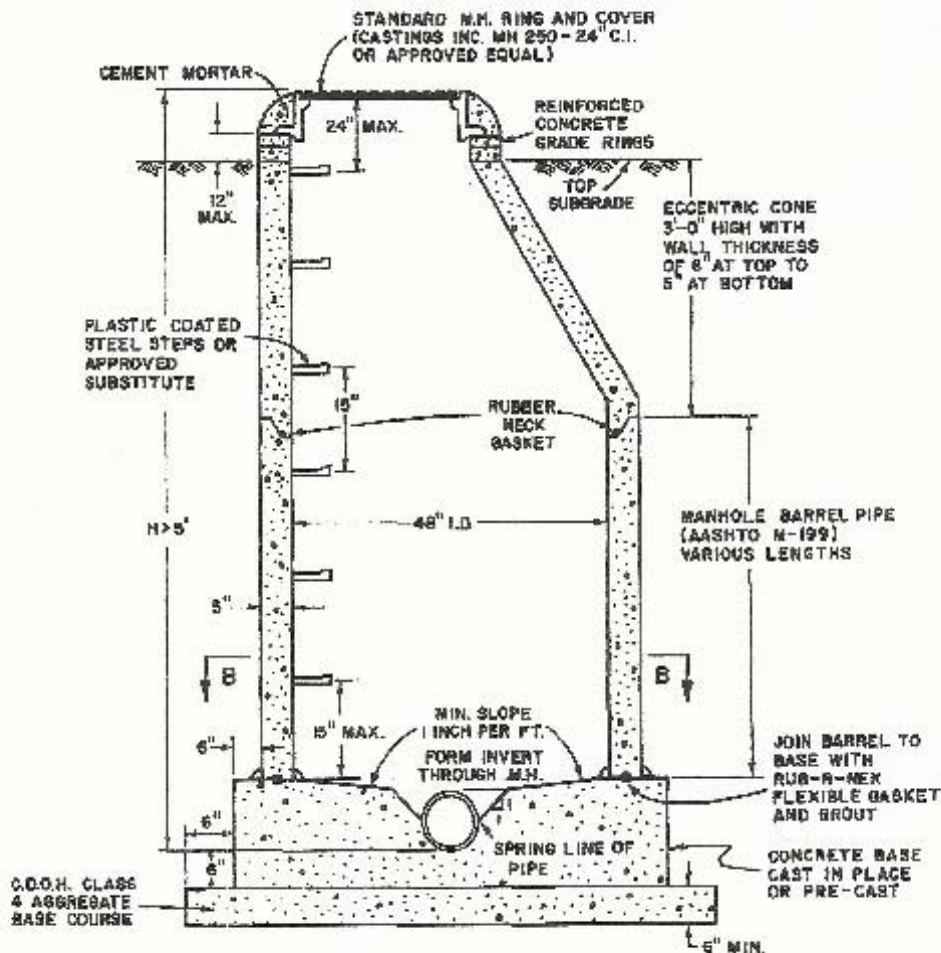
**NOTE:**  
SADDLES TO BE REMOVED BY HAND

**SEWER SERVICE MARKER**



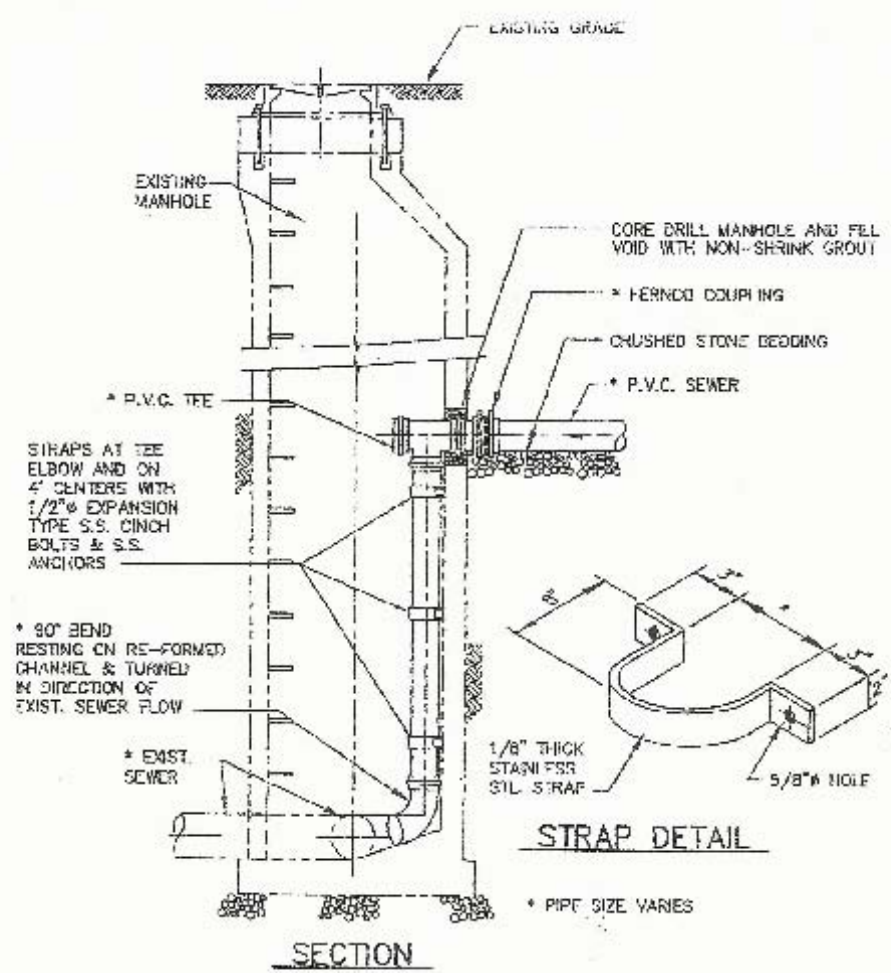
### MANHOLE NOTES

1. CONCRETE SHALL BE COLORADO DIVISION OF HIGHWAYS CLASS "B" (SECTION 601.02)
2. ALL CEMENT USED IN MORTAR, CONCRETE BASES, GRADE RINGS, RISER SECTIONS, CONES, AND FLAT TOPS, FOR SANITARY SEWER MANHOLES, SHALL BE TYPE I OR MODIFIED TYPE II PORTLAND CEMENT WITH LESS THAN 3% TRICALCIUM ALUMINATE.
3. MANHOLE RISER SECTIONS, CONES, FLAT TOPS, AND GRADE RINGS SHALL BE PRECAST REINFORCED CONCRETE CONFORMED TO ASTM C-478 OR AASHTO M-199.
4. FOR INLET SIZES GREATER THAN 36" DIAMETER A 60" DIAMETER MANHOLE WILL BE REQUIRED.



### STANDARD MANHOLE

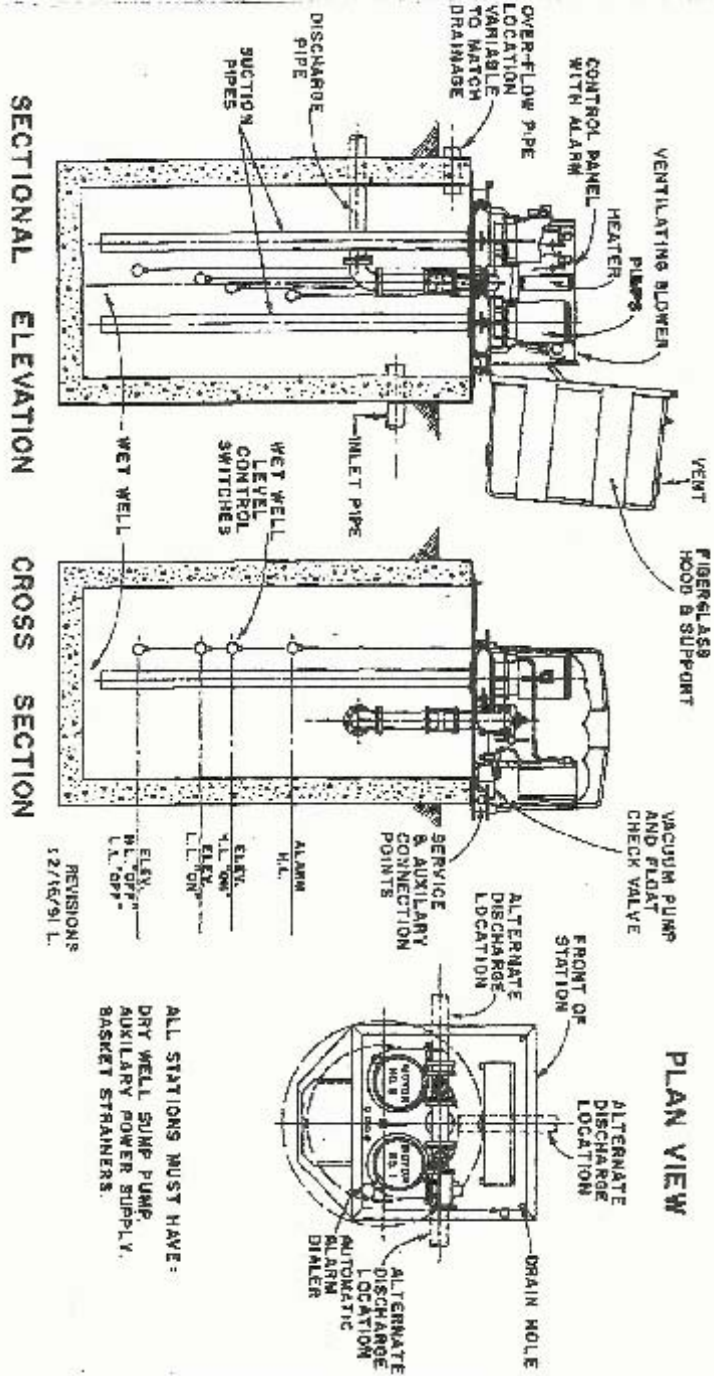
# DROP MANHOLE



NOTE: THE CONSTRUCTION OF AN INSIDE DROP MANHOLE IS ONLY PERMITTED WITH PRIOR APPROVAL OF THE AUTHORITY.

## INSIDE MANHOLE DROP CONNECTION

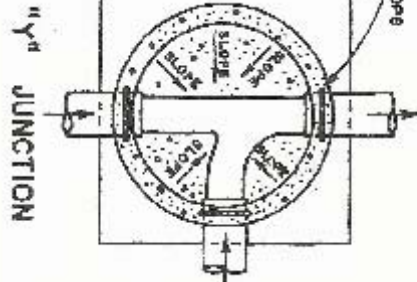
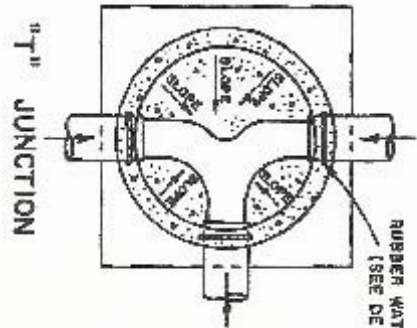
NO SCALE



ALL STATIONS MUST HAVE:  
 DRY WELL SUMP PUMP  
 AUXILIARY POWER SUPPLY.  
 BASKET STRAINERS.

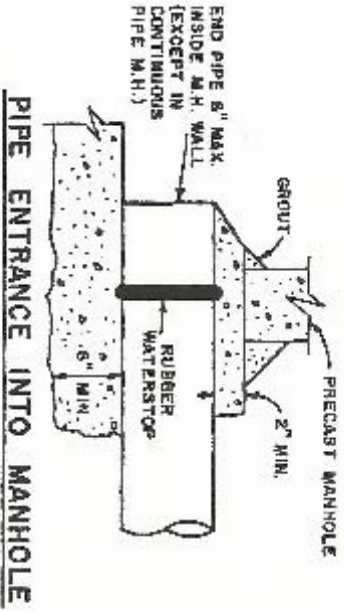
**STANDARD LIFT STATION DETAILS**





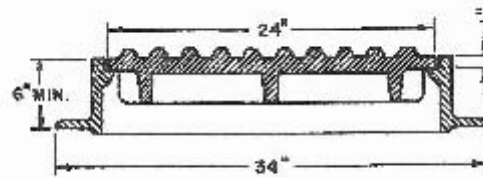
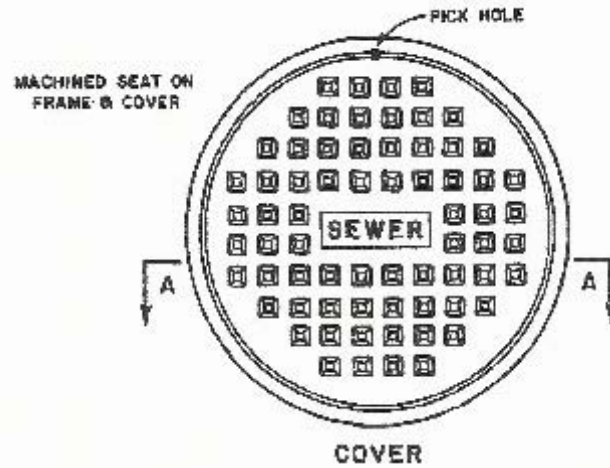
**SECTION B-B**

**CONTINUOUS PIPE**  
 NOTE: LAY PIPE CONTINUOUSLY THROUGH MANHOLE WHEN THERE IS NO CHANGE IN GRADE OR ALIGNMENT.



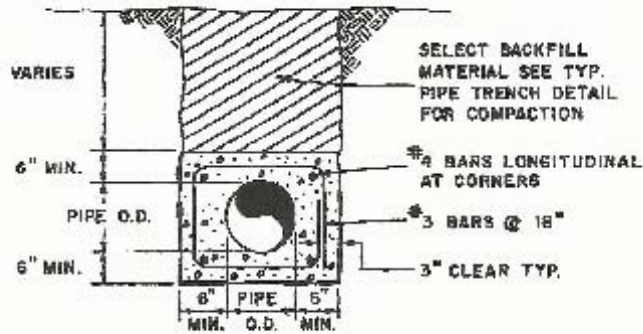
**PIPE ENTRANCE INTO MANHOLE**

STANDARD M.H. RING AND COVER  
 (NEENAH R-1657, J MARK J-1103,  
 CASTINGS INC. MH 250-24" C.I. OR  
 APPROVED EQUAL)

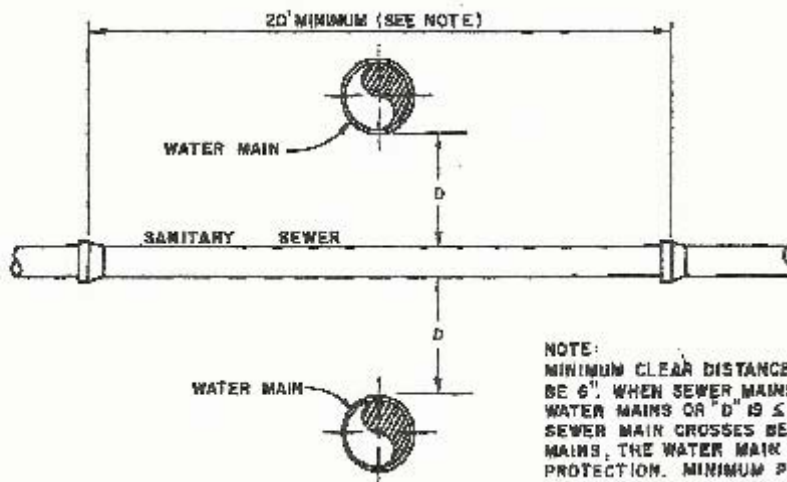


SECTION A-A (RING)

**STANDARD CAST IRON MANHOLE  
 RING & COVER**



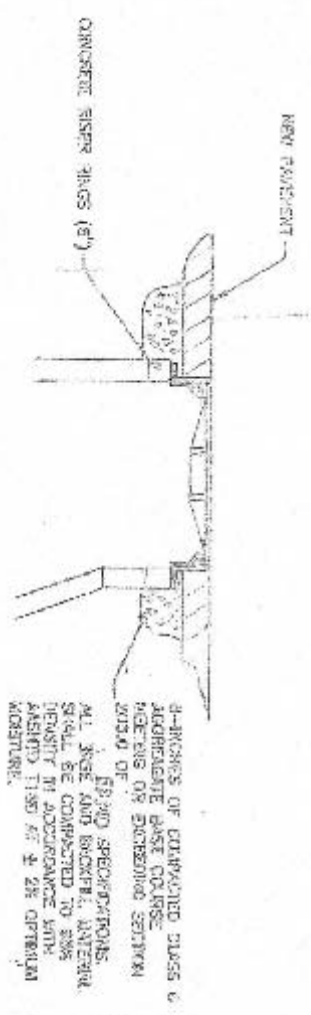
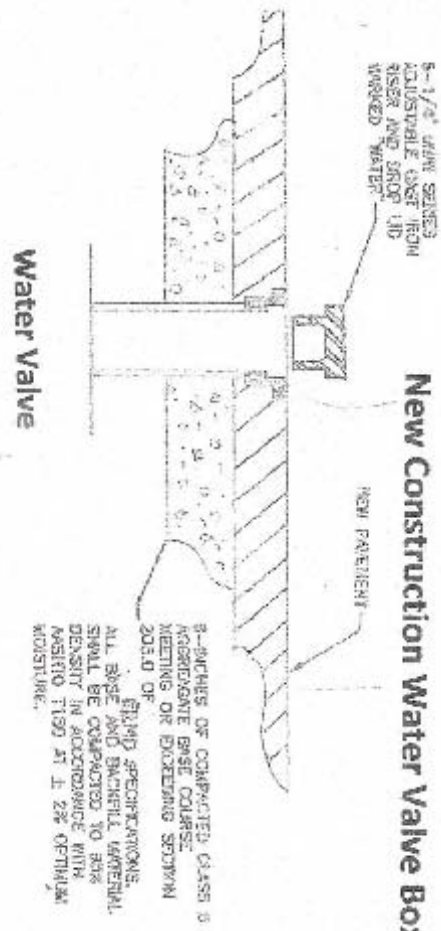
**CONCRETE ENCASEMENT**



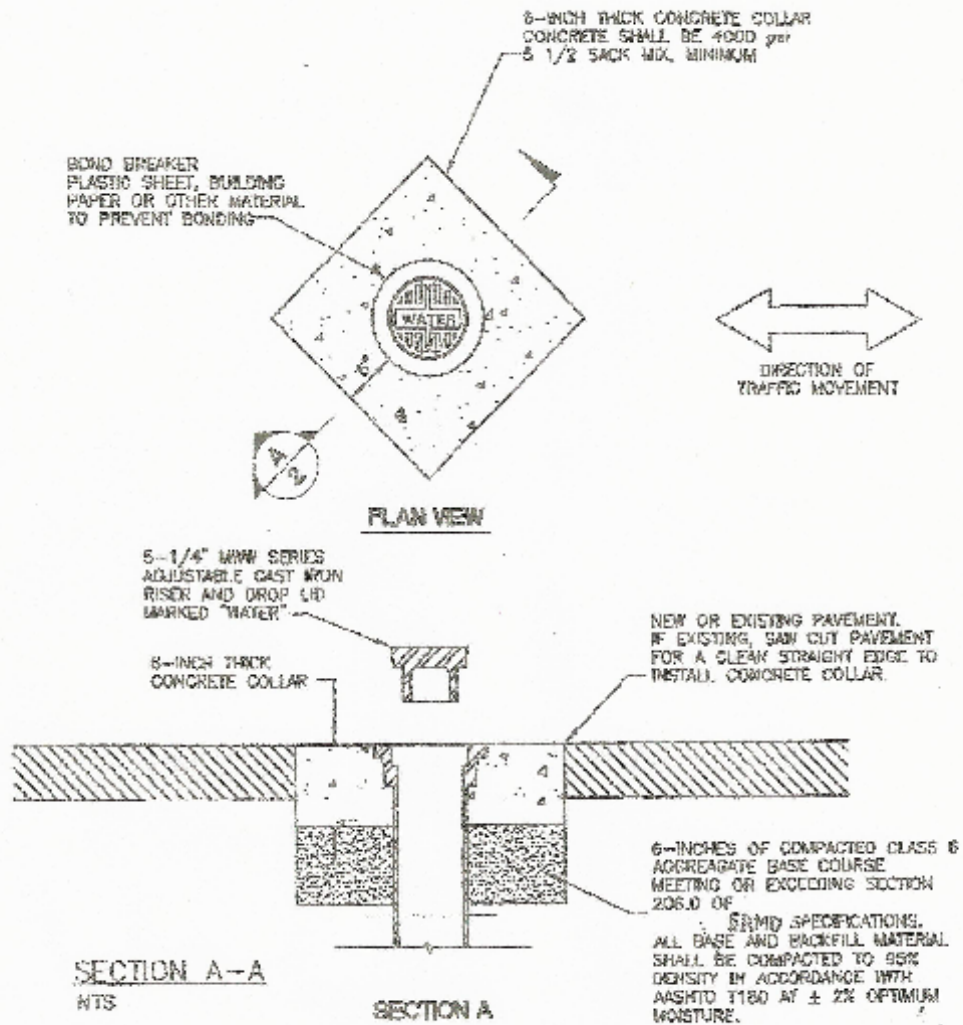
NOTE:  
 MINIMUM CLEAR DISTANCE FOR "D" MUST BE 6", WHEN SEWER MAINS CROSS ABOVE WATER MAINS OR "D" IS ≤ 18" WHEN SEWER MAIN CROSSES BELOW WATER MAINS. THE WATER MAIN MUST HAVE PROTECTION. MINIMUM PROTECTION SHALL BE AN IMPERVIOUS STRUCTURAL SEWER FOR A DISTANCE OF 10' EACH SIDE OF THE WATER MAIN.

**SANITARY SEWER - WATER MAIN CROSSING**

### New Construction Water Valve Box and Manhole Detail

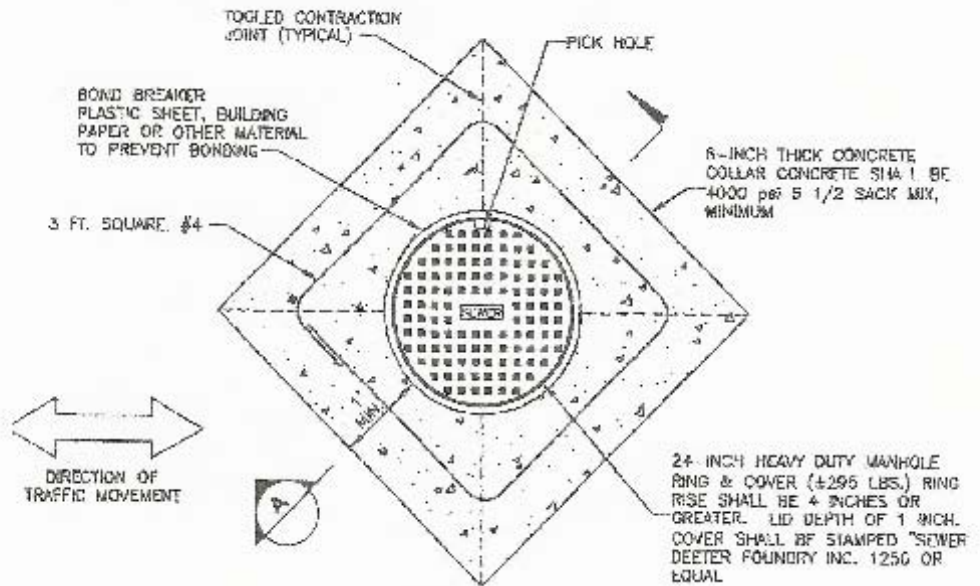


NOTE: All original installation of water valve boxes will be done with asphalt sealing to valve box. \*\*\*The concrete detail will be used for repair only.\*\*\*

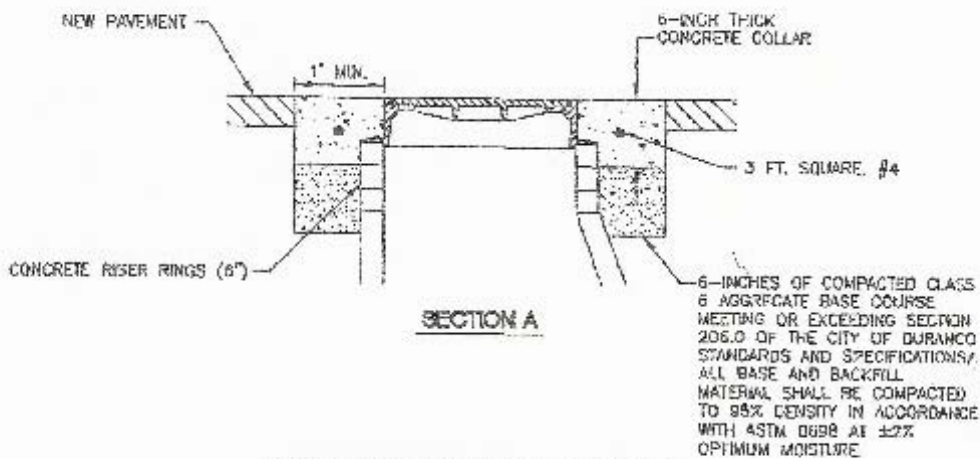


CONCRETE WATER VALVE DETAIL

NOTE: All original installation of manholes will be done with asphalt sealing to lid rings. \*\*\*The concrete detail will be used for repair only.\*\*\*



PLAN VIEW

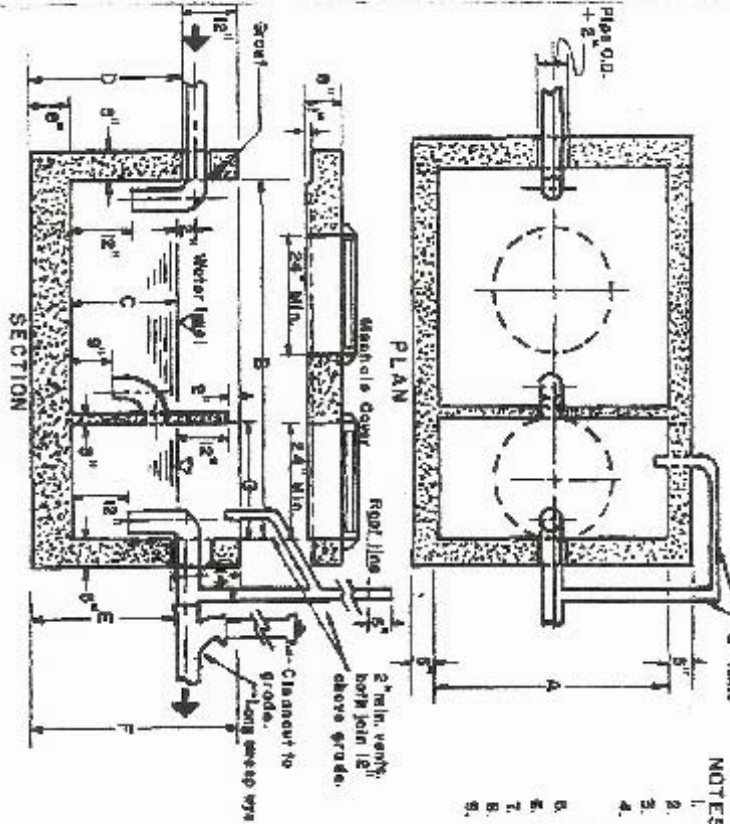


SECTION A

CONCRETE MANHOLE COLLAR DETAIL

Not to Scale

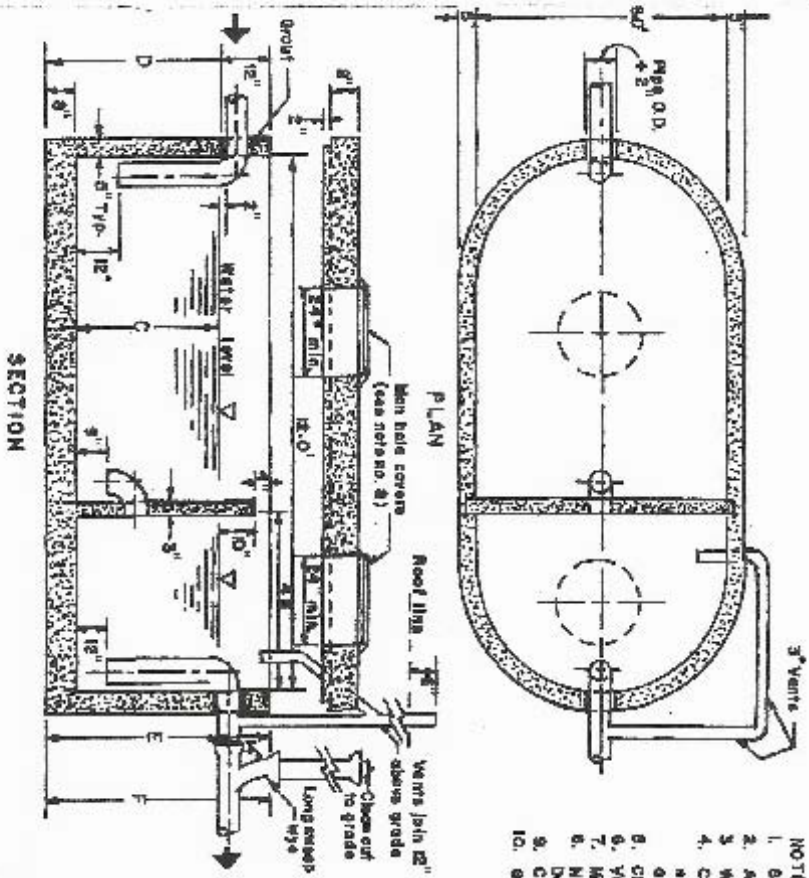
# GREASE INTERCEPTOR TYPE "A" COMMERCIAL



- NOTES:
1. Secondary compartment has volume equal to 1/3 of total capacity.
  2. All pipe & fittings to be cast iron, 8" dia. minimum.
  3. Write B bottom reinforcement throughout with 2x6 5/10 rebar.
  4. Covers to be reinforced longitudinally with no. 6 rebar on 8" center, no. 4 rebar on 6" centers widthwise, & no. 8 rebar diagonally around access holes.
  5. Cleanout shall be on Iron 300 y ferrula with brass screw plug.
  6. Vent pipe shall be cast iron to a point 6" above ground level.
  7. Manhole ring & cover shall be 12" thick cast or spread equal.
  8. Check with SUPPLIER for EXACT DIMENSIONS.
  9. NO SOFT DOWN COVERS ALLOWED without permission from the Weldsteel Division.

Capacity Approx. (Gallons)	Water Capacity Approx. (Gallons)	Airway Capacity Approx. (Gallons)	DIMENSIONS								
			TWO COMPARTMENT TANK (INCHES)								
			A	B	C	D	E	F	G	H	
UP TO 2000 SQ. FT.	300	12	40	72	88	88	90	44	84		
UP TO 3000 SQ. FT.	600	32	48	78	98	88	84	68	88		
UP TO 4000 SQ. FT.	780	42	48	88	80	88	88	88	80		
UP TO 5000 SQ. FT.	1080	74	78	108	84	88	88	88	80		
OVER 10000 SQ. FT.	1800	87	80	112	88	88	88	88	80		

# GREASE INTERCEPTOR TYPE "B" INDUSTRIAL

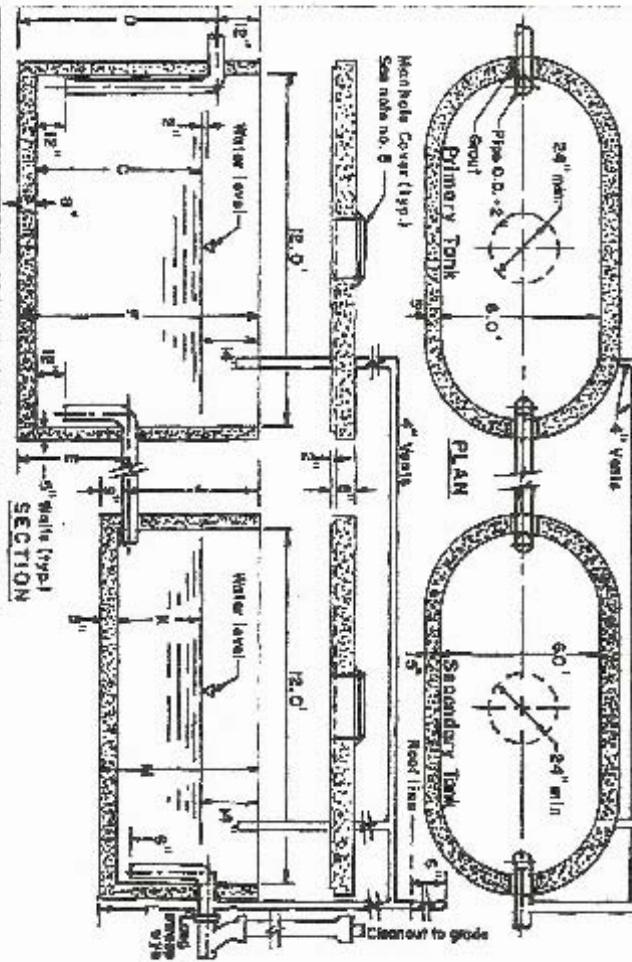


- NOTES:
1. Gas-tight compartment has volume equal to 1/2 of total capacity.
  2. All pipe & fittings to be cast iron, 2" dia. min.
  3. Walls & bottom reinforced throughout with 2x16 8/10 mesh.
  4. Covers to be reinforced longitudinally with no. 4 rebar on 6" centers, no. 4 rebar on 6" centers w/diaphragm, & no. 8 rebar diagonally around access holes.
  5. Check-out sheet to be an iron body ferrule with brass screw plug.
  6. Vent pipe shall be cast iron to a point 6" above ground level.
  7. Manhole ring & cover shall be J-Mark 1661 or approved equal.
  8. NO DUCT DOWN COVERS ALLOWED without permission from the Drainage Waste-water Dept.
  9. CHECK WITH SUPPLIER for EXACT DIMENSIONS.
  10. Grease capacity rated for large compartment only.

Capacity (Gallons)	Grease Capacity (Gallons)	Water Capacity (Gallons)	Dimensions - inches											
			1	2	3	4	5	6	7	8	9	10	11	12
100	1655	600	40	50	45	35	44	54	5.5	50	5.5	50	5.5	50
181	3058	1148	52	62	57	47	56	66	6.0	60	6.5	60	6.5	60
2500	4482	1698	64	74	69	59	68	78	7.5	72	8.0	72	8.0	72
3000	5282	1978	76	86	81	71	80	90	8.5	84	9.0	84	9.0	84
4000	7082	2678	88	98	93	83	92	102	9.5	96	10.0	96	10.0	96
over 10000	871	3448	98	108	103	93	102	112	10.5	104	11.0	104	11.0	104



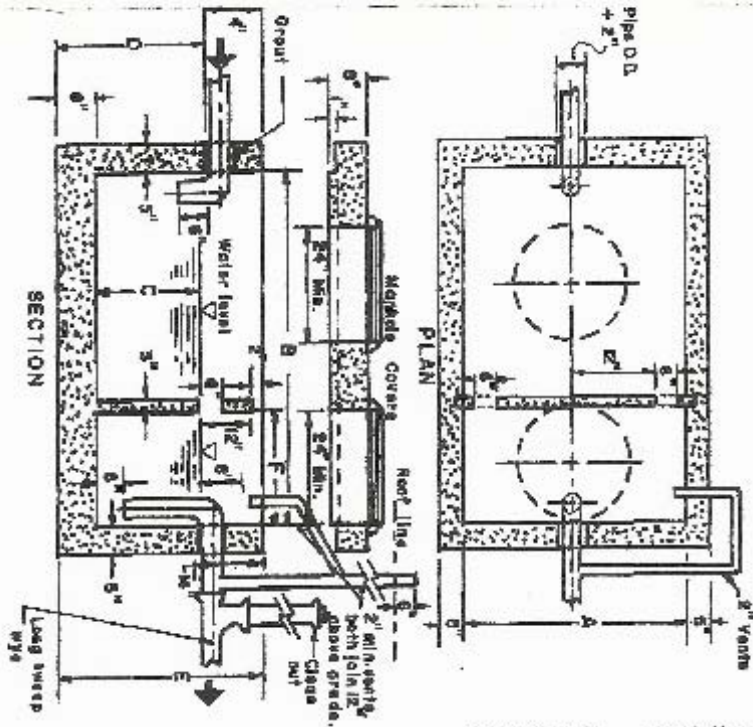
# GREASE INTERCEPTOR TYPE "C" INDUSTRIAL



- NOTES:
1. Secondary tank size volume equal to 1/3 of the combined capacity.
  2. All pipe @ fittings to be cast iron, 3" dia. min.
  3. Walls & bottom reinforced longitudinally with 2 x 16 5/10 mesh.
  4. Covers to be reinforced longitudinally with no. 8 rebar on 6" centers, no. 4 rebar on 6" centers widthwise, and no. 8 rebar diagonally around access holes.
  5. Cleanout shall be cast iron body ferrule with brass torsew plug.
  6. Vent pipe shall be cast iron to a point 8" above ground.
  7. Manhole ring & cover shall be "J-Mark" no. 118 or approved equal.
  8. NO BOLT DOWN COVERS ALLOWED without permission from Durango Waterworks Dept.
  9. Vents 1" min. above grade.
  10. Grease separator rated for 100% compartment.
  11. CHECK WITH SUPPLIER FOR EXACT DIMENSIONS.

Water Capacity gallons (Approx)	Grease Capacity Ch. Ft. (Approx)	DIMENSIONS										
		Primary					Secondary					
		G	D	E	F	J	K	L	M			
4160	811	70	80	45	32	47	24	42	56			
4640	843	74	86	48	36	50	40	48	62			
4880	875	82	92	51	40	53	40	48	62			
5360	407	88	98	51	41	58	46	54	68			
5600	439	94	104	57	46	59	46	54	68			
6080	471	100	110	57	52	65	46	50	74			

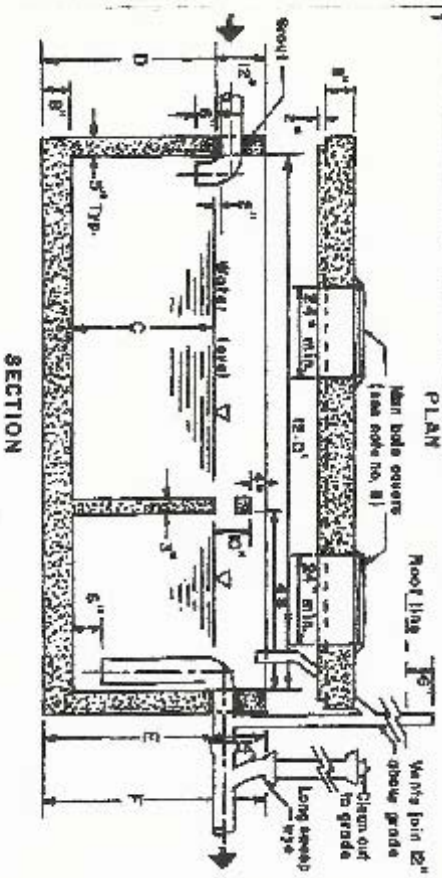
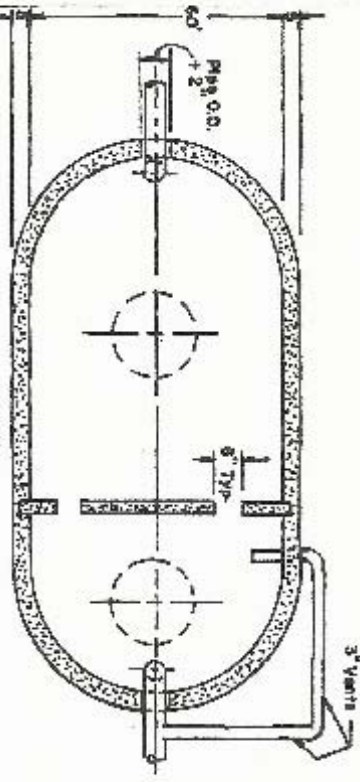
# SAND & OIL INTERCEPTOR TYPE "A" COMMERCIAL



- NOTES:
1. All pipe & fittings to be cast iron, 5" min. diameter.
  2. Small compartment see 1/3rd of the total capacity.
  3. Walls & bottom reinforced throughout with 2x12 6/10 rebar.
  4. Covers to be reinforced (cast in place) with no. 6 rebar on 8" centers, no. 4 rebar on 6" centers widthwise, & no. 6 rebar diagonally around goose holes.
  5. Cast iron shall be on iron body ferrule.
  6. Vent pipe shall be cast iron to a point 6" above ground.
  7. Manhole ring & cover shall be 4-Mark No. 161 or equal.
  8. Check with SUPPLIER for EXACT DIMENSIONS.
  9. NO BOLT DOWN COVERS ALLOWED without permission from Durango Wastewater Division.

WATER CAPACITY APPROX. GALLONS	DIMENSIONS					
	TWO COMPARTMENT TANK IN INCHES					
	A	B	C	D	E	F
320	48	72	22	30	44	24
500	48	72	34	46	56	24
780	48	96	40	48	62	20
1080	72	102	34	42	56	30

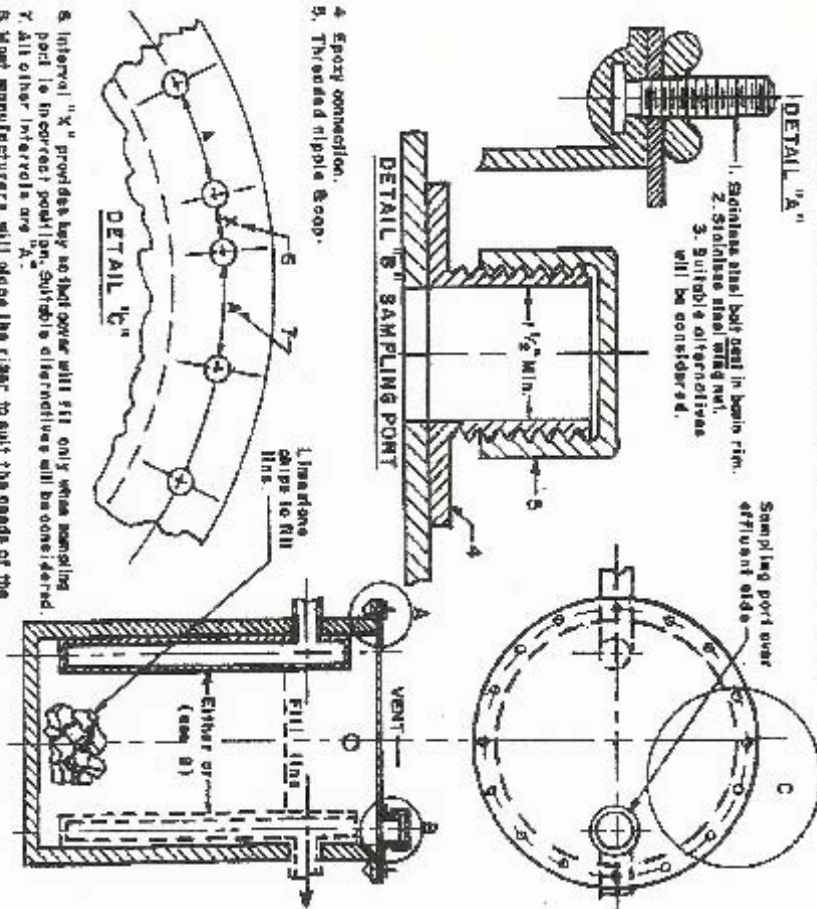
# SAND & OIL INTERCEPTOR TYPE "B" INDUSTRIAL



- NOTES:
1. Secondary compartment has volume equal to 1/3 of total capacity.
  2. All pipe & fittings to be cast iron, 3" dia. min.
  3. Walls & bottom reinforced throughout with 2x15 6/10 rebar.
  4. Covers to be reinforced longitudinally with no. 6 rebar on 6" centers, no. 4 rebar on 6" centers w/diameter, 30 no. 6 rebar diagonally around covers holes.
  5. Cleanout shall be on iron body ferrule with brose screw plug.
  6. Vent pipe shall be cast iron to a point 30 above ground level.
  7. Manhole ring & cover shall be 30" dia. 150 lb or approved equal.
  8. NO BOLT DOWN COVERS ALLOWED without permission from the Chicago Water & Sewer Dept.
  9. CHECK with SUPPLIER for EXACT DIMENSIONS.

Water Capacity Gallons (approx)	Dimensions - inches				
	C	D	E	F	A
1585	40	50	48	62	
1800	46	56	54	68	
2035	52	62	60	74	
2505	64	74	72	86	
2975	76	86	84	98	
3210	82	92	90	104	
3445	88	98	96	110	

# ACID NEUTRALIZATION UNIT

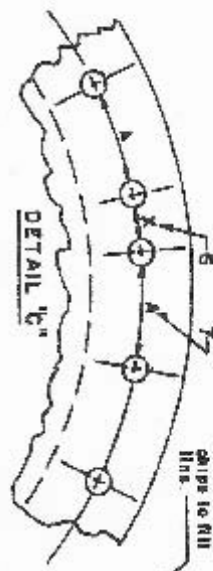


1. Stainless steel bolt used in basin rim.  
 2. Stainless steel nut and washer.  
 3. Suitable alternative materials will be considered.

Sampling port over effluent side

4. Epoxy connection.  
 5. Threaded nipple & cap.

1. Insulate gaps to fill ins.



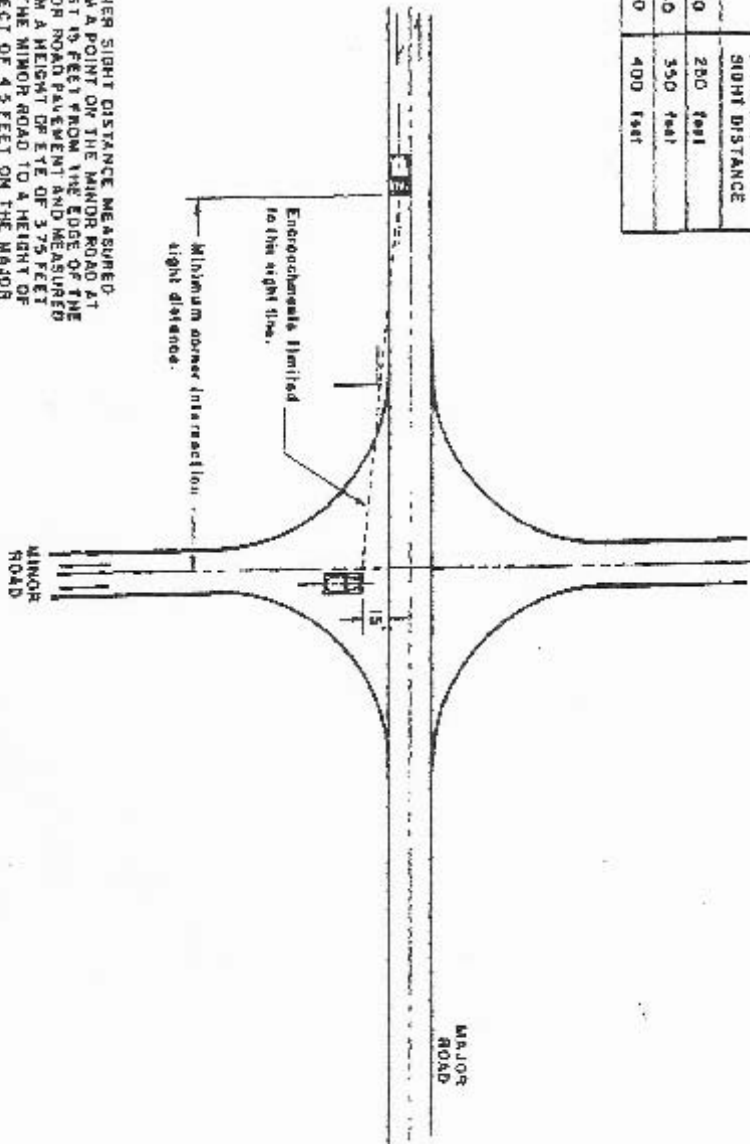
6. Interval "X" provided key so that cover will fit only when sampling port is in correct position. Suitable alternatives will be considered.  
 7. All other intervals are "A".  
 8. Meter manufacturers will place the riser to suit the needs of the customer. The riser must be in one location or the other, not both.  
 9. All units must be installed so that they are equally accessible for maintenance & testing.  
 10. Where a unit is to be located underground, a concrete vault must be provided & sampling port must be extended 100 feet no less than 6" and no more than 12" below the level of the finished floor or ground.

11. Materials: [Specific materials must be selected for specific applications.]  
 a. High density polyethylene & polypropylene materials are recommended in most cases.  
 b. Ventilated dry cells are suitable in most cases.  
 c. Concrete units lined with "acid resistant" material will not be approved.  
 12. Acid neutralization tanks & installations thereof must be inspected & approved by the Wastewater Div

# SIGHT DESIGN CRITERIA AT CORNERS

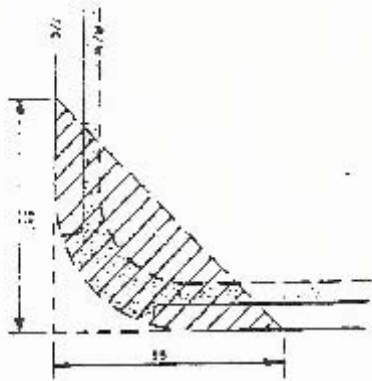
DESIGN SPEED MPH	MINIMUM CORNER INTERSECTION SIGHT DISTANCE
25-30	200 feet
35-40	350 feet
45-50	400 feet

CORNER SIGHT DISTANCE MEASURED FROM A POINT ON THE MAJOR ROAD AT LEAST 10 FEET FROM THE EDGE OF THE MAJOR ROAD PAVEMENT AND MEASURED FROM A HEIGHT OF EYE OF 3.75 FEET ON THE MINOR ROAD TO A HEIGHT OF OBJECT OF 4.5 FEET ON THE MAJOR ROAD.

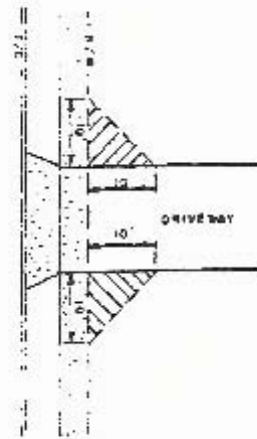


ALL PAVED ROAD INTERSECTIONS

VISIBILITY REQUIREMENTS

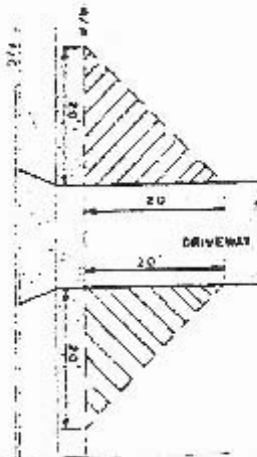


INTERSECTION



MINOR STREET  
(LESS THAN 60' RIGHT OF WAY)

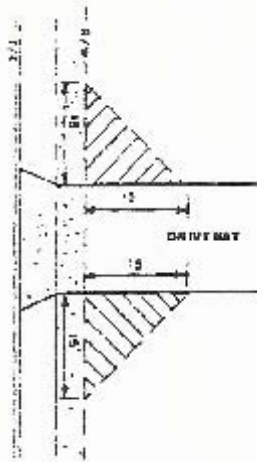
DRIVEWAY



MAJOR STREET  
(GREATER THAN 60' RIGHT OF WAY)

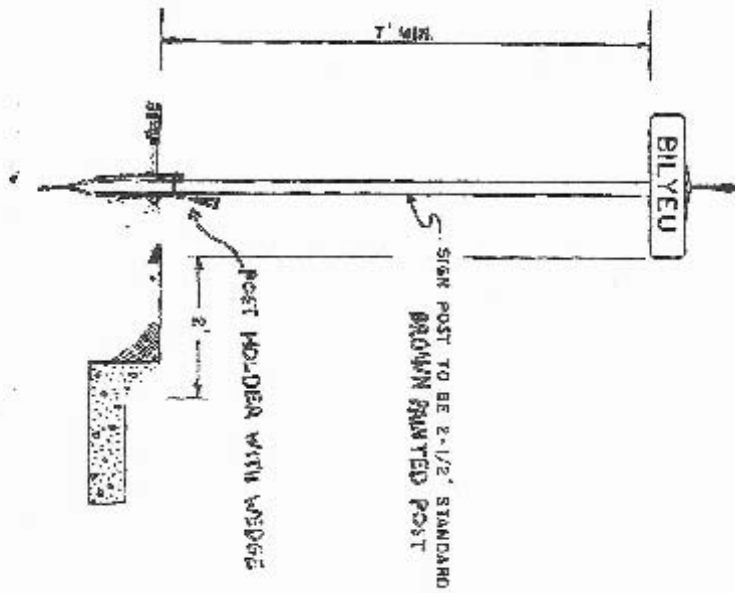
DRIVEWAY

WITHIN CROSSHATCHED AREA ALL SHRUBS, BUSHES, FENCES, AND OTHER IMPROVEMENTS SHALL BE RESTRICTED TO A 2'-6" MAXIMUM HEIGHT AND TREES MAINTAINED TO A CLEARANCE OF 7'-0" ABOVE GROUND

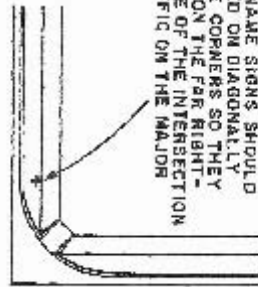


COLLECTOR STREET  
(SIXTY FOOT RIGHT OF WAY)

DRIVEWAY

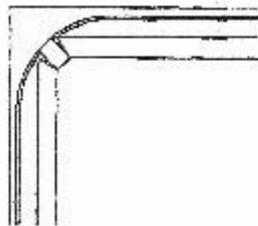


STREET NAME SIGNS SHOULD BE PLACED ON DIAGONALLY OPPOSITE CORNERS SO THEY WILL BE ON THE FAR RIGHT-HAND SIDE OF THE INTERSECTION FOR TRAFFIC ON THE MAJOR STREET.

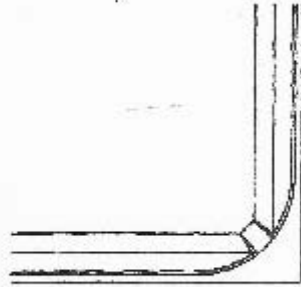


MAJOR

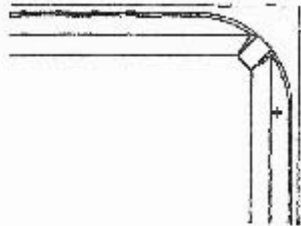
STREET



STREET

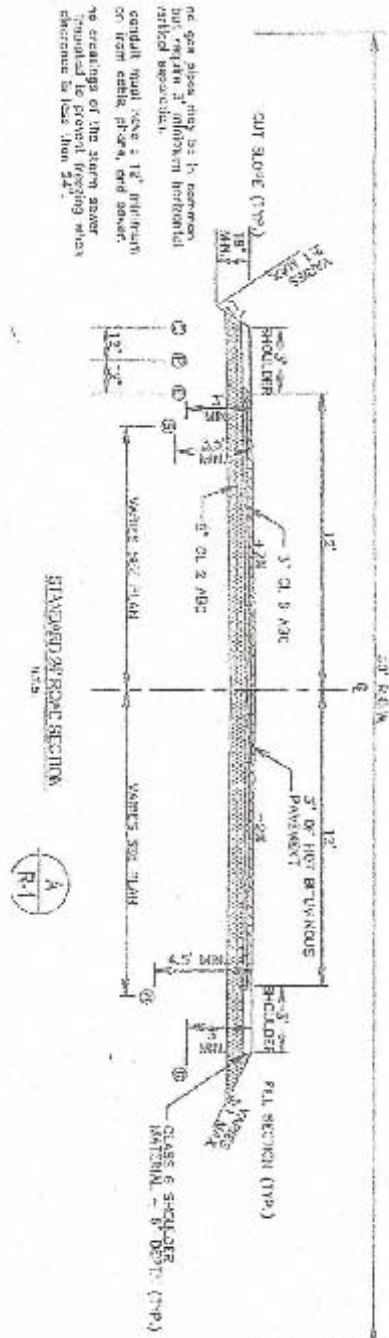


MINOR

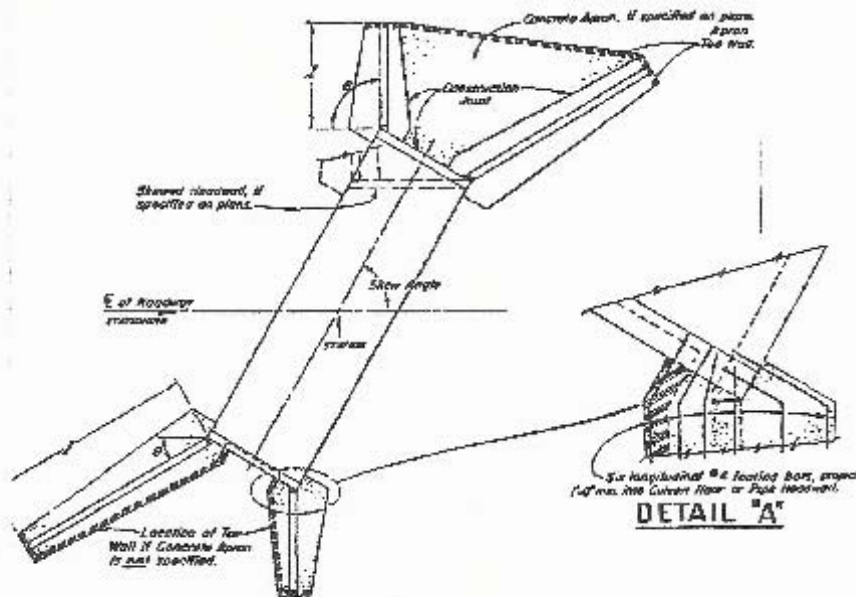


LOCATION

# Typical 24' Street Detail





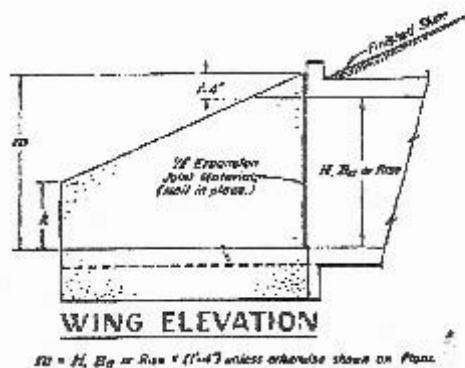


**TYPICAL CULVERT LAYOUT**

**GENERAL NOTES**

Revised COOH M-601-ED.  
 All exposed surfaces on concrete shall be finished 3/4".  
 Millboard formings and floor of Box Culvert shall be placed immediately.  
 Expansion Joint Material shall conform to AASHTO M-213 and payment therefor shall be included in the price for Concrete, (Box Culvert) or (wall).  
 Dimensions "H", "E", "H<sub>2</sub>", "H<sub>1</sub>", "F", "S" and angles for abutments shall be as shown on the plans.  
 The minimum splice length for common bar sizes shall be:  
 BAR SIZE      #4      #5      #6  
 SPlice LENGTH    1'-0"    1'-0"    1'-0"

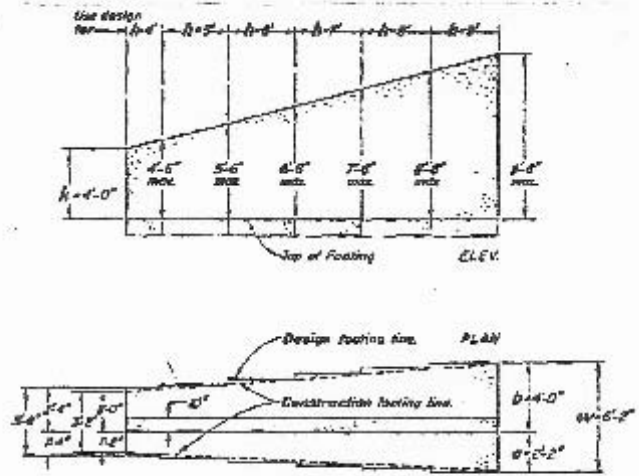
**DESIGN DATA:**  
 Unit Stresses:  $f_c = 20,000$  psi  
 $f_s = 1,200$  psi  
 $n = 10$   
 Equivalent Fluid Pressure = 30 lbs/lin ft.  
 Maximum Toe Pressure = 1 Ton/sq ft.  
 All construction joints shall be thoroughly cleaned before fresh concrete is poured.



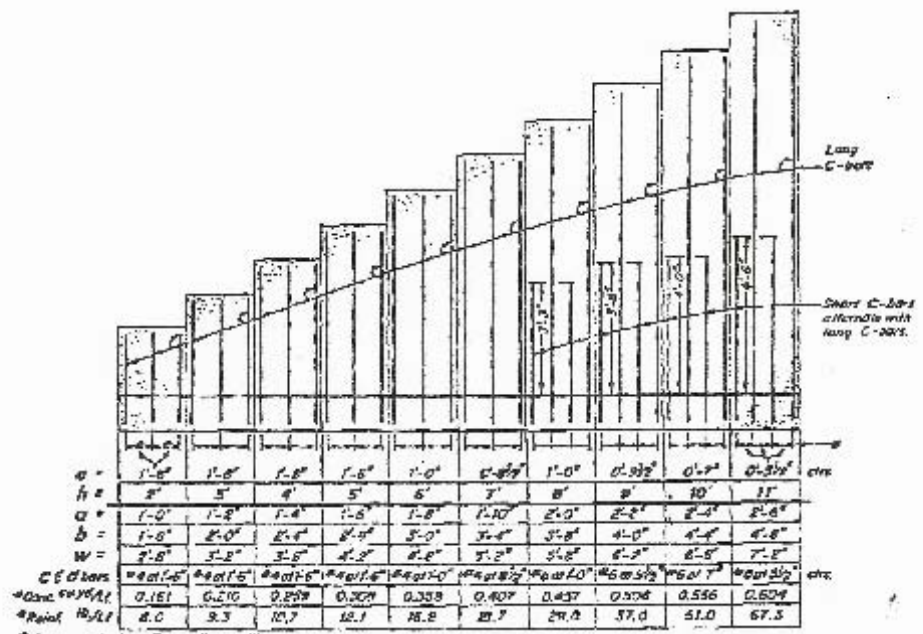
**WING ELEVATION**

**WING WALL DETAILS**





DESIGN EXAMPLE



DESIGN TABLE

WINGWALL DETAILS

**QUANTITIES FOR ONE CONCRETE HEADWALL (Cubic Yards)**

PIPE DIAMETER (15" to 24")	15" DIAMETER				24" DIAMETER				30" DIAMETER				36" DIAMETER				42" DIAMETER				48" DIAMETER			
	SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE	
TYPE	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN
C	1.0	1.2	1.2	1.5	1.0	1.2	1.2	1.5	1.0	1.2	1.2	1.5	1.0	1.2	1.2	1.5	1.0	1.2	1.2	1.5	1.0	1.2	1.2	1.5
A	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5

**QUANTITIES FOR ONE MASONRY HEADWALL (Cubic Yards)**

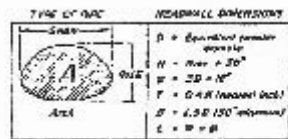
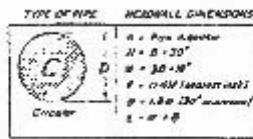
PIPE DIAMETER (15" to 24")	15" DIAMETER				24" DIAMETER				30" DIAMETER				36" DIAMETER				42" DIAMETER				48" DIAMETER			
	SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE		SINGLE		DOUBLE	
TYPE	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN	CONC	REIN
C	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
A	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

**CONCRETE FOR INTERCEPTING HEADWALL (Cubic Yards)**

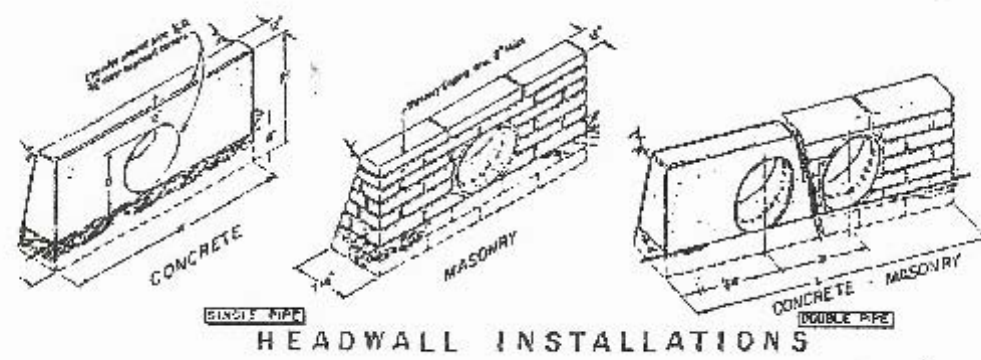
TYPE	15"	24"	30"	36"	42"	48"
C	1.0	1.5	2.0	2.5	3.0	3.5
A	1.0	1.5	2.0	2.5	3.0	3.5

**PAVING FOR CULVERT OUTLET (Cubic Yards)**

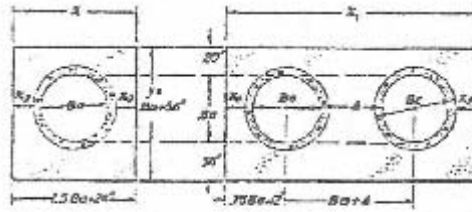
TYPE	15"	24"	30"	36"	42"	48"
C	0.5	0.5	0.5	0.5	0.5	0.5
A	0.5	0.5	0.5	0.5	0.5	0.5



NOTE: Volume developed for pipe (see Table) includes 2'

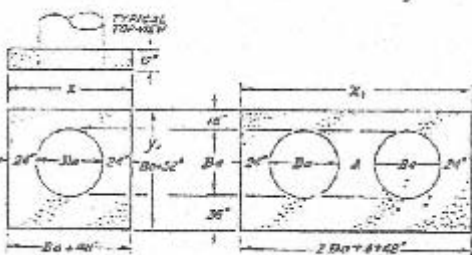


**HEADWALLS FOR PIPES  
15" TO 48" DIAMETER**



**HEADWALL FOR RCP - ROUND**

DIMENSIONS		QUANTITIES										
B <sub>0</sub>	x	CONCRETE		STEEL								
ft.	ft.-in.	Sq. ft.	cu. yd.	Sq. ft.	lbs.							
8.5	7	5.4	7	15.0	10	9-4	11	81	2.23	299	230	414
8.5	7	8.5	10.5	18.6	7	10-2	10	22	2.60	444	240	453
12	10	11-0	10	25-0	10	10-8	17	23	3.28	451	270	476
12	10	11-9	8 1/2	21-3	11	11-2	11	24	3.11	526	306	527
14	10 1/2	12-6	7	22-4	7	11-5	16	25	3.32	546	313	532
14	10 1/2	13-3	10 1/2	25-0	8 1/2	12-2	17	26	3.65	626	332	551
16	11-4	14-0	10	25-0	10	12-0	11	27	3.94	640	379	609
16	11-4	14-3	8 1/2	22-3	11 1/2	12-2	14	28	4.26	678	402	634
18	12-8	15-5	7	25-0	7	13-0	17	28	4.58	750	424	707



**HEADWALL FOR CMP - ROUND**

DIMENSIONS		QUANTITIES									
B <sub>0</sub>	x	CONCRETE		STEEL							
ft.	ft.-in.	Sq. ft.	cu. yd.	Sq. ft.	lbs.						
10	9-0	10	16-0	7	9-4	10	12	7.26	1.42	217	296
10	9-0	7	17-9	8 1/2	9-10	12	12	7.80	1.70	252	454
12	10-0	10	18-0	10	10-4	15	12	7.78	1.17	268	472
12	10-0	7	20-0	10	10-10	12	12	8.22	1.56	270	496
14	11-0	10	21-0	10	11-4	12	15	7.19	1.83	237	523
14	11-0	7	22-0	10	11-10	15	15	7.40	1.54	217	571
16	12-0	10	23-0	10	12-4	12	18	5.62	1.78	221	597
16	12-0	7	24-0	10	12-10	12	18	7.84	1.21	264	683
18	13-0	10	25-0	10	13-4	15	18	4.06	1.63	342	678

**GENERAL NOTES**

- Revised GDH M-601-10.
- Headwall shall be perpendicular to the centerline unless otherwise shown on the plan.
- For Wingwall details, see Standard M-601-WH.
- Volume occupied by pipe has been deducted from Steel and Concrete quantities.
- When 2 or more barrels are installed by side they shall be placed so that the adjacent pipes will be 1/2 pipe diameter or 1/2 ft. in the top or 3/4 ft. apart (including wall thickness) wherever is less.

**HEADWALLS FOR PIPES  
60" DIAMETER  
AND ABOVE**

**SKEW FACTOR TABLE**

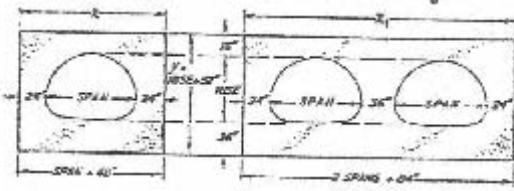
SKEW ANGLE °	FACTOR (times F)
00	1.000
05	1.004
10	1.018
15	1.034
20	1.054
25	1.078
30	1.106

\* Multiply X for S<sub>1</sub> dimension and all quantities by factor if (skew) skew is less than 90° and headwall remains parallel to the roadway E.

HEADWALLS FOR PIPES  
60" DIAMETER  
AND ABOVE

**HEADWALL FOR CMP ARCH**

Span D <sub>o</sub>	DIMENSIONS										QUANTITIES			
	SPAN		RISE	X	A	X <sub>1</sub>	A <sub>1</sub>	J	B	CONCRETE		STEEL		
	ft.	in.	ft.	ft.-in.	ft.	ft.-in.	ft.	ft.-in.	ft.	SOL cu. yd.	DBL sq. ft.	SOL lbs.	DBL lbs.	
22	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
24	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
26	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
28	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
30	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
32	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
34	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
36	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
38	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
40	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
42	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
44	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
46	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
48	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
50	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
52	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
54	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
56	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
58	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
60	01	00	00	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	



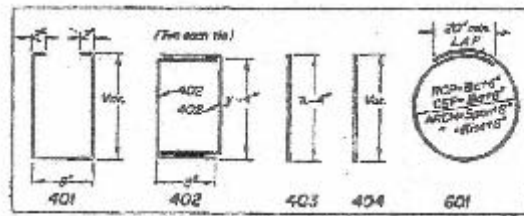
**HEADWALL FOR STRUCTURAL PLATE ARCH**

Span D <sub>o</sub>	DIMENSIONS										QUANTITIES			
	SPAN		RISE	X	A	X <sub>1</sub>	A <sub>1</sub>	J	B	CONCRETE		STEEL		
	ft.	in.	ft.	ft.-in.	ft.	ft.-in.	ft.	ft.-in.	ft.	SOL cu. yd.	DBL sq. ft.	SOL lbs.	DBL lbs.	
60	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
62	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
64	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
66	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
68	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
70	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
72	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
74	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
76	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
78	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
80	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
82	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
84	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
86	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
88	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
90	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
92	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
94	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
96	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
98	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	
100	0-1	0-0	0-0	0-0	00	00-0	0	0-0	00	0.00	0.00	0.00	0.00	

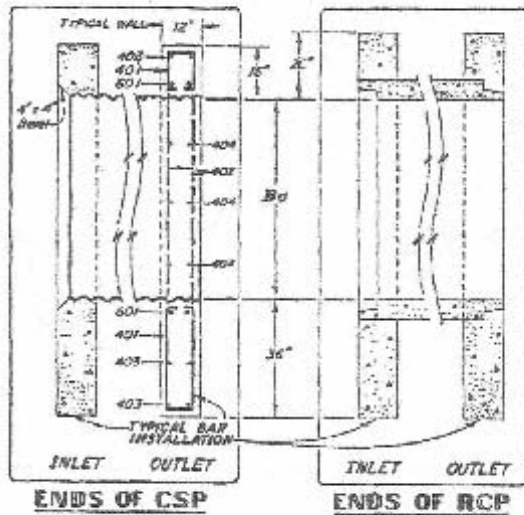
**\*SKEW  
FACTOR  
TABLE**

SKEW ANGLE °	FACTOR (MULT. BY)
00	1.000
05	1.004
10	1.017
15	1.035
20	1.058
25	1.086
30	1.120
35	1.159
40	1.204
45	1.256
50	1.315
55	1.382
60	1.458
65	1.543
70	1.638
75	1.743
80	1.858
85	2.000
90	2.000

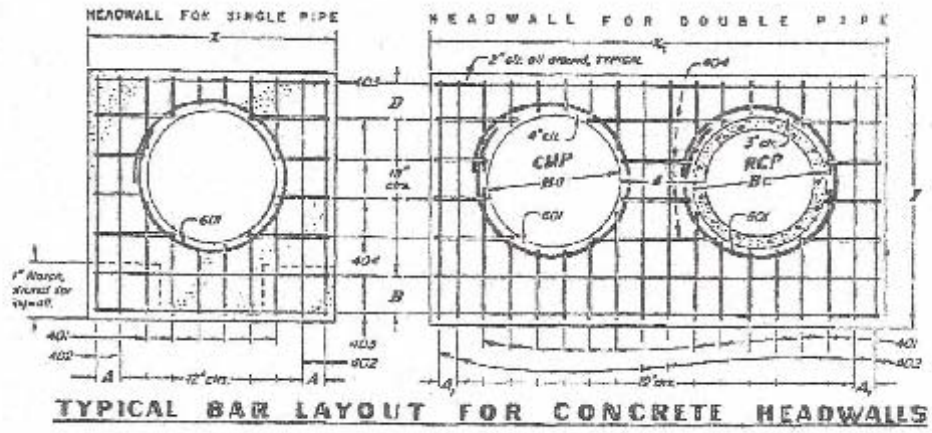
\* Multiply X<sub>1</sub> for X<sub>1</sub> dimension and all quantities by factor if skew angle is less than 90° and headwall is not parallel to the roadway.



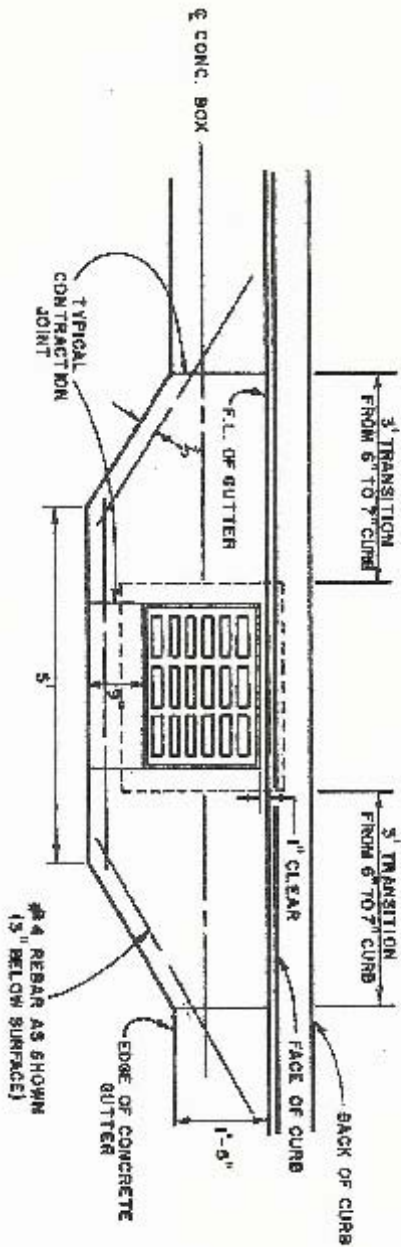
**BAR BENDING**



**HEADWALLS FOR PIPES  
60" DIAMETER  
AND ABOVE**



**TYPICAL BAR LAYOUT FOR CONCRETE HEADWALLS**



**GENERAL NOTES**

1. ALL PORTLAND CEMENT CONCRETE SHALL BE COLORADO DIVISION OF HIGHWAYS CLASS "B" (SECTION 601.02)
2. ANY EXISTING PAVEMENT NOT DESIGNATED FOR REMOVAL WHICH IS DISTURBED BY CONSTRUCTION SHALL BE REPLACED IN-KIND BY CONTRACTOR.
3. ALL WORK WITHIN PUBLIC RIGHT-OF-WAY SHALL BE PERFORMED BY A LICENSED CONTRACTOR, BONDED WITH THE CITY OF DURANGO.
4. SEE PLAN SHEETS FOR ALL PIPE SIZES AND ELEVATIONS WHICH WILL DETERMINE SIZES OF STRUCTURES AND OPENINGS.
5. ALL WORK SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

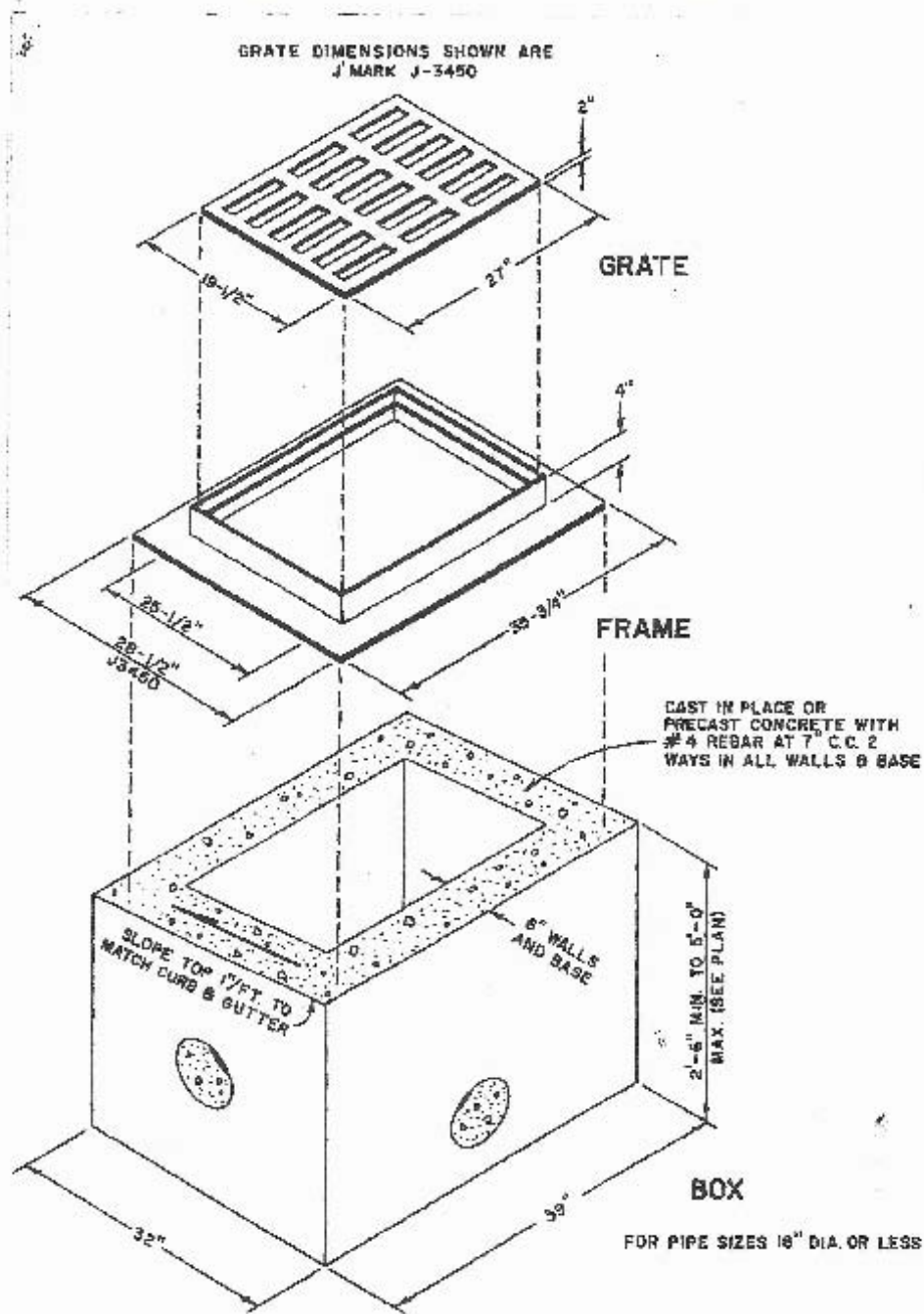
**GRATE AND FRAME**

ALL GRATES SHALL BE BICYCLE SAFE.

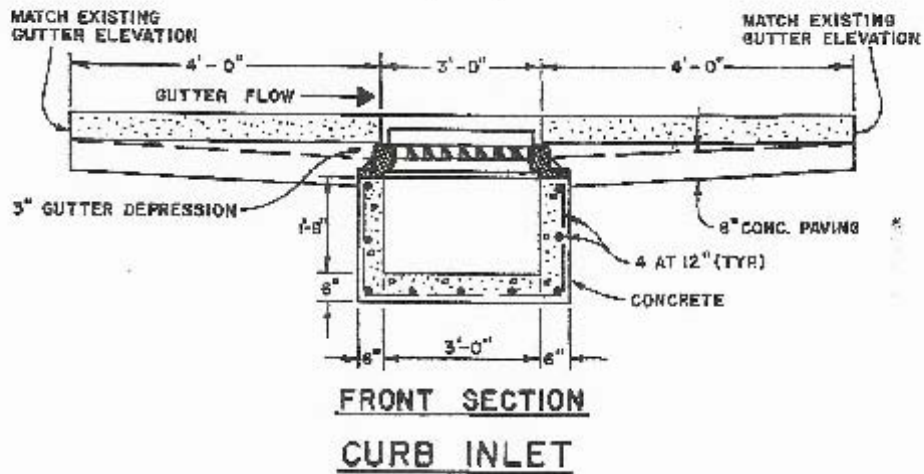
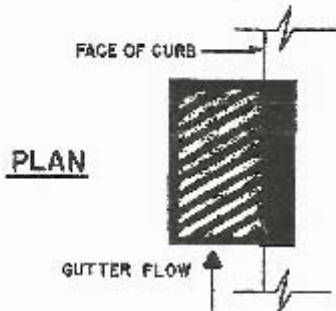
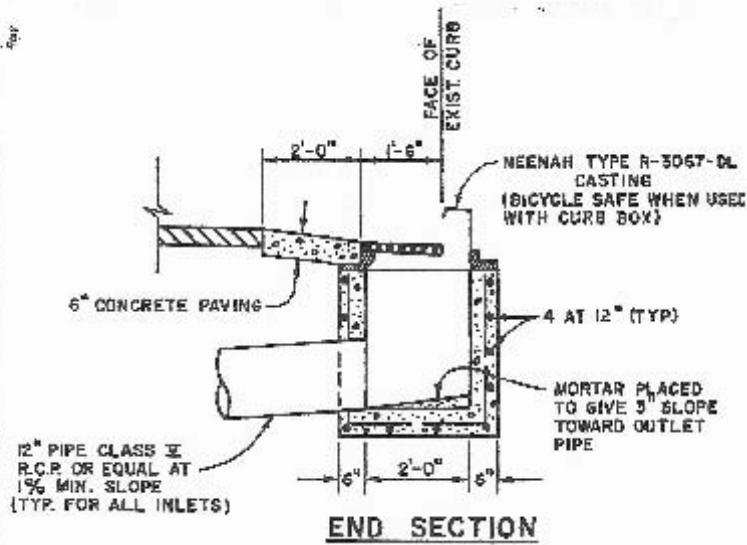
1. ADJACENT TO CURB - CURB OPENING REQUIRED; USE J-MARK J-3515 OR NEEMAH R-3246 WITH 1" CURB FACE RADIUS.
2. ADJACENT TO CURB - NO CURB OPENING REQUIRED; USE J-MARK J-2446, CASTING NO. 12 OR NEEMAH R-3246-1.
3. INLET NOT ADJACENT TO CURB; USE J-MARK J-2450 OR APPROVED SUBSTITUTE

**STORM DRAIN  
DETAILS**



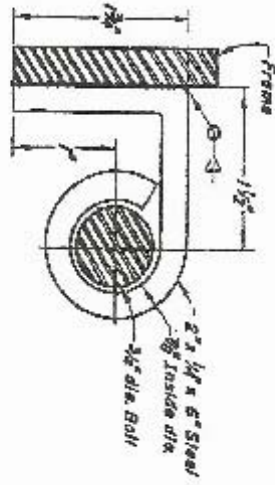


**STORM DRAIN INLET**

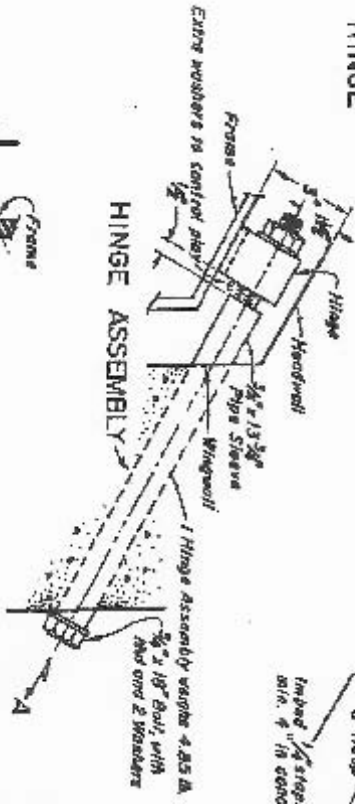


NOTE:  
FOR PIPE SIZES 16" DIA. OR LESS.

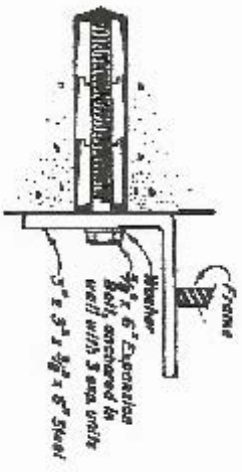




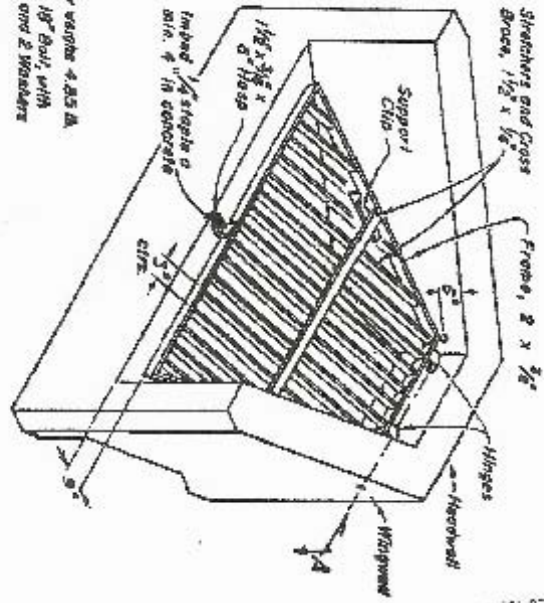
HINGE



HINGE ASSEMBLY



SUPPORT CLIP



STORM SEWER TRASH GUARD DETAILS



