

THE BORDENTOWN SEWERAGE AUTHORITY
BORDENTOWN, BURLINGTON COUNTY, NEW JERSEY

STANDARD SPECIFICATIONS AND REQUIREMENTS
FOR CONSTRUCTION OF
SANITARY SEWERS, FORCE MAINS AND PUMPING STATIONS

SEPTEMBER , 1988

LAST REVISED

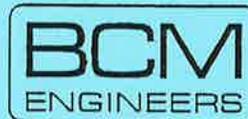
MARCH, 2004

APPROVED BY :



DONALD A. RUSSO, P.E., DEE

PREPARED BY:



A Division of 

920 GERMANTOWN PIKE
PLYMOUTH MEETING, PENNSYLVANIA

SET NO. _____

TABLE OF CONTENTS

SECTION NO.	SECTION TITLE	PAGES
-------------	---------------	-------

DIVISION 1 - GENERAL REQUIREMENTS

01010	INTRODUCTION	7
01020	EROSION AND SEDIMENT CONTROL PLAN	15
01030	LOCATIONS OF EXISTING LINES	1
01300	SUBMITTALS	5
01500	TEMPORARY FACILITIES AND CONTROLS	2
01900	COLOR AUDIO-VIDEO TAPES	6

DIVISION 2 - SITE WORK

02110	CLEARING AND GRUBBING	3
02220	EARTHWORK FOR UTILITIES	13
02230	ROCK EXCAVATION	3
02511	FORCE MAIN AND APPURTENANCES	19
02551	SANITARY SEWERS AND APPURTENANCES	17
02560	MANHOLES	20
02561	GREASE TRAPS	14
02602	REPAVING	3
02810	RESTORATION OF DISTURBED AREAS	6

TABLE OF CONTENTS

DIVISION 3 - CONCRETE

03301	CAST-IN-PLACE CONCRETE	5
-------	------------------------	---

DIVISION 11 - MECHANICAL EQUIPMENT

11077	PUMPING STATIONS	9
-------	------------------	---

PLATE NO.

CONSTRUCTION DETAILS

1	PRECAST MANHOLES WITH POURED CONCRETE BASE
2	CONCRETE BLOCK MANHOLE
3	PRECAST MANHOLE/GREASE TRAP JOINTS AND MANHOLE TRANSITION DETAIL
5	DROP MANHOLE
7	CAST IRON MANHOLE FRAME AND COVER
8	CAST IRON WATERTIGHT MANHOLE/GREASE TRAP FRAME AND COVER
9	ANCHOR BOLT DETAILS
10	↖ DROP FRONT MANHOLE STEP
11	PRECAST MANHOLE/GREASE TRAP BASE
12	REINFORCEMENT FOR POURED CONCRETE BASE

Rev: 3/04

TABLE OF CONTENTS

22	CONCRETE ENCASEMENT
22A	CONCRETE ENCASEMENT – PVC PIPE
24	CRUSHED STONE ENCASEMENT
25	TYPICAL LATERAL BASEMENT CONNECTION
26	CURB CLEANOUT FOR BUILDING CONNECTION
32A	"Y" BRANCH
33	DEEP CUT LATERAL
34	SADDLE CONNECTION
40	DETAIL TRENCH IN QUICKSAND
46	JOINT DETAIL
47	TYPICAL 500 GAL. EXTERIOR GREASE TRAP
48	TYPICAL; 500 GAL. HS20 EXTERIOR GREASE TRAP
50	PERIMETER FENCING
	PIPELINE MARKER DETAIL
	BYPASS PUMP CONNECTION DETAIL

Division 1
GENERAL REQUIREMENTS

Section 01010
INTRODUCTION

PART 1 - GENERAL

1.1 SCOPE

- A. These Specifications have been adopted by the Bordentown Sewerage Authority to specify the manner in which sanitary sewerage facilities shall be installed by Developers/Builders within their jurisdiction.
- B. The Developer/Builder prior to construction shall comply with all regulations and requirements of The Bordentown Sewerage Authority and the New Jersey Department of Environmental Protection.
- C. Before any work is started at the construction site, the Developer/Builder shall notify The Bordentown Sewerage Authority, the respective Township or City Police Department, local County and State agencies (i.e. NJDOT) when appropriate, and the various utility companies serving the area.
- D. It shall be understood that the Authority at its discretion reserves the right to visit the construction site and inspect the installation of the sanitary sewers and require corrective actions to assure compliance with these standards.
 - 1. All costs associated with the Authority inspection of the work shall be paid for by the Developer/Builder.
 - 2. When required, the Developer/Builder will deposit an initial escrow amount specified by the Authority.
- E. A minimum of seven (7) days prior to the start of construction the Developer/Builder shall arrange and hold a Preconstruction Meeting. The Developer/Builder shall arrange for all interested parties to attend which may include utility companies, police, city or township officials or any other parties that the Authority may want to be present.

1.2 DEFINITIONS

- A. Wherever the word "Authority" is used, herein after it shall mean "The Bordentown Sewerage Authority".
- B. Wherever the word "Developer/Builder" is used, herein after it shall mean the "developer" or "builder" doing the work.
- C. Wherever the word "Owner" is used, herein after it shall mean "The Bordentown Sewerage Authority".

Section 01010
INTRODUCTION

- D. "Adopted Plans", wherever referred to in the Specifications, shall mean the Developer/Builder's Construction Plans, reviewed by the Authority and formally accepted for construction.

PART 2 - REQUIREMENTS

2.1 MISCELLANEOUS PERMITS AND REQUIREMENTS

- A. The Developer/Builder shall transmit to the Owner three (3) copies or sets of the following data, unless otherwise noted:
1. Three (3) sets of Drawings unless additional copies are required.
 - a. Drawings shall be signed by a professional engineer licensed to practice in the State of New Jersey.
 - b. The Drawings shall be clear and legible.
 - c. The profile shall be drawn at a vertical scale of 5 feet equals 1 inch and a horizontal scale of 50 feet equals 1 inch and the plan view shall be scaled at fifty feet equals 1 inch with a North arrow.
 2. Maintenance Bond
 - a. Bond and insurance shall be provided in accordance with the Improvement Construction Agreement.
 3. Approved copies of New Jersey Department of Environmental Protection Permits and Reports (when required).
 4. New Jersey Department of Transportation (NJDOT) Highway Occupancy Permit (when required).
 5. City and/or County Highway Occupancy Permit (when required).
 6. Township Highway Occupancy Permit (when required).
 7. Railroad Permit (when required).
 8. Letters of Certification as to Compliance with the Specifications For:

Section 01010
INTRODUCTION

- a. Paving Material
 - b. NJDOT Backfill Material
 - c. Crushed Stone for Pipe Bedding
 - d. Concrete
 - e. Pipe
 - f. Manholes
- 9. Erosion and Sediment Control Plan
 - 10. Blasting Reports and Blasting Records
 - 11. Tunnel calculation
 - 12. Sheeting and Shoring Calculation
 - 13. Soil Test
 - 14. Core Test for Paving
 - 15. Three (3) Copies of all Shop Drawings:
 - a. Pipe and Appurtenances
 - b. Manholes (precast M.H. only)
 - c. Manhole Covers
 - d. Fittings (Wyes, elbows, valves, etc.)
 - e. All other appurtenant data

Section 01010
INTRODUCTION

2.2 PLAN REVIEW

- A. The Authority's review of the Developer/Builder's plans is for the general conformance with these Standard Specifications, the requirements of the Authority, and the plans submitted for review. The Developer/Builder is also responsible for the accuracy of the Adopted Plans and for the designed facility to function as intended. The Developer/Builder is also responsible for determining the size and location of all existing utilities.
- B. Sewer systems shall be designed to serve basements unless otherwise approved by the Authority.

2.3 ROCK EXCAVATION

- A. All blasting shall be performed under the supervision of a professional engineer licensed to practice in the State of New Jersey as described in Section 02230, ROCK EXCAVATION, and in accordance with City, Township, State and County regulations.

2.4 SOILS TESTING

- A. All soils testing as described in Section 02220, EARTHWORK FOR UTILITIES of these Specifications shall be performed by a reputable testing and control firm when required by the Authority.

2.5 BUILDING LATERALS

- A. Building laterals are to be installed from the Sewer to the Street Right-of-Way Line in accordance with the Construction Details. Laterals installed from the Street Right-of-Way Line to the building shall be installed in accordance with the local plumbing code.
- B. Where sewers are to be capped, the Developer/Builder shall install Building Laterals from the sewer to the Street Right-of-Way Line, for each property.

2.6 ACCESS TO WORK

- A. Representatives of the Authority will have access to the work. The Developer/Builder shall provide proper and safe facilities for such access and observation of the work and also for any inspection or testing thereof by others.

Section 01010
INTRODUCTION

2.7 AUTHORITY MAY STOP THE WORK

- A. If the work is defective, or the Developer/Builder fails to supply suitable materials or fails to maintain proper escrow, the Authority may order the Developer/Builder to stop the work, or any portion thereof, until the cause for such order has been eliminated.

2.8 WARRANTY AND GUARANTEE

- A. The Developer/Builder warrants and guarantees to the Authority that all work will be of good quality and free from faults or defects. All unsatisfactory work, all faulty or defective work, and all work not conforming to the Adopted Plans and these Specifications shall be considered defective. The Authority will give timely notice of all defects to the Developer/Builder. At the option of the Authority, all defective work, whether or not in place, may be rejected, or accepted, with or without requiring corrections from the Developer/Builder.

2.9 TESTS AND INSPECTIONS

- A. Where so indicated in these Specifications, or if the laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to specifically be inspected, tested, or approved by some public body, the Developer/Builder shall assume full responsibility therefore, pay all cost in connection therewith and furnish Authority the required certificates of inspection, testing or approval.
- B. The Developer/Builder shall give at least 48 hours notice of readiness of the work for all inspections or approvals.
- C. The Developer/Builder shall be responsible for obtaining and disposal of all liquids used for testing. Water base liquids used for testing shall be potable water, creek or stream water or other Authority approved sources.

2.10 FINAL INSPECTION

- A. Upon written notice from the Developer/Builder that the project is complete, the Authority will make a final inspection with the Developer/Builder and will notify the Developer/Builder in writing of all particulars in which this inspection reveals that the work is incomplete or defective. The Developer/Builder shall immediately take such measures as are necessary to remedy such deficiencies.

Section 01010
INTRODUCTION

2.11 FINAL APPLICATION FOR ACCEPTANCE

- A. After the Developer/Builder has completed all such corrections to the satisfaction of the Authority and delivered all schedules, guarantees, bonds, certificates of inspection and other documents, the Authority shall issue a letter of final acceptance.

2.12 TWO YEAR CORRECTION PERIOD

- A. If after final inspection and prior to the expiration of the two (2) year maintenance bond or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Authority any work installed by the Developer/Builder is found to be defective, the Developer/Builder shall promptly, in accordance with Authority's written instructions, either correct such defective work, or, if it has been rejected by the Authority, remove it from the site and replace it with nondefective work. If the Developer/Builder does not promptly comply with the terms of such instructions, the Authority may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services shall be paid by the Developer/Builder.
- B. The two-year maintenance bond shall go into effect after the last house of the development is titled or as otherwise accepted.

2.13 TELEVISION INSPECTION OF SANITARY SEWERS

- A. Prior to the expiration of the maintenance bond period or at a date established by the Authority, all sewers constructed as part of the approved project shall be T.V. inspected. All defects such as leaks, cracks, broken pipe etc., shall be repaired by grouting, dig-up or what ever means necessary. Once all repairs have been successfully completed, the sewers shall be T.V. inspected and a VHS type VCR tape recording shall be made. Two copies of the tape shall be given to the Authority for review. All the above including two copies of the tape given to the Authority shall be completed prior to the expiration of the maintenance bond period.

Section 01010
INTRODUCTION

2.14 RECORD PLANS

- A. At completion of work the Developer/Builder shall provide the Authority with two (2) sets of Reproducibles of the original Drawings (wash off Mylars) and three (3) sets of Blue Lines of the original Drawings, in a neat and clean condition, marked "Record Drawings". These "Record Drawings" shall by dimensions and stationing show the actual location and elevations of all pipe, manholes, laterals, wye fittings, and any other structures installed during construction. In addition, all manhole rim and invert elevations and material of construction for the pipe shall be shown on said "Record Drawings". Each sheet of these "Record Drawings" shall be signed by an official of the Developer/Builder's Company, certifying that each sheet reflects the as-built conditions. Also, all "Record Drawings" shall be signed and sealed by a professional engineer licensed to practice in the State of New Jersey.

2.14 SPECIAL PRECAUTIONS

A. Wells

1. Prior to construction of sewers and sewage force mains, the Developer/Builder shall locate all domestic wells within the construction area. If a well falls within a 50 foot radius of the new sewer or sewage force main, the sewer and sewage force main shall be encased in concrete within the 50 foot radius.
2. The Developer/Builder shall report to the Authority any possibility of damage, caused by blasting to existing underground water supply to wells. In the event that the Developer/Builder's activities affect the groundwater supply to wells, such that the wells do not yield their normal amount of water, the Developer/Builder shall provide temporary water service until the original groundwater level has been reestablished. If damage is permanent, the Developer/Builder shall be responsible for providing a long term, effective solution for providing water service.

END OF SECTION

Revised: 2/96

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

PART 1 - GENERAL

1.1 INTENT

- A. The State of New Jersey, by the "Soil Erosion and Sediment Control Act" of 1975 requires the preparation and implementation of a plan to reduce the danger from stormwater runoff, to retard pollution from sediment and to conserve and protect the land, water, air and other environmental resources of the State. The State of New Jersey authorized the establishment of the State Soil Conservation Committee who created the State's soil conservation districts which is interdepartmental in nature. Each soil conservation district is responsible for developing and implementing plans for the conservation of natural resources within the district.
- B. It shall be the responsibility of the Developer/Builder to implement this plan in the field and meet all state and local regulations. The Developer/Builder shall assign this responsibility to a person experienced in sediment and erosion control procedures. Modifications or deviations from this plan will be allowed only if he first obtains written permission from the New Jersey Department of Environmental Protection.
- C. A copy of the approved Sediment Control Plan shall be submitted to the Authority for its file.

1.2 APPLICABLE STANDARDS

- A. Standards for Soil Erosion and Sediment Control in New Jersey:
 1. State Soil Conservation Committee
Division of Rural Resources
New Jersey Department of Agriculture
- B. Environmental Guidelines for Planning, Designing and Construction Interceptor Sewers:
 1. New Jersey Department of Environmental Protection

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Clearing and grubbing: Section 02110, CLEARING AND GRUBBING
- B. Excavation and backfilling: Section 02220, EARTHWORK FOR UTILITIES,
- C. Seeding and Sodding: Section 02810, RESTORATION OF DISTURBED AREAS

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

1.4 STANDARD CONDITION RELATING TO D.E.P. PERMITS

- A. The Developer/Builder shall familiarize himself and shall be responsible for carrying out all requirements or guidelines pertaining to construction of the project and relating to control of soil erosion and sediment control at the site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products and materials shall meet the requirements of the local soil conservation service or as specified elsewhere in these Specifications.

PART 3 - EXECUTION

3.1 PLANNING AND DESIGN FOR CONSTRUCTION

- A. Construction projects that involve major land disturbance shall be planned and designed with soil erosion and sediment control in mind. While erosion and sedimentation controls are important on all sites, particular attention should be given to areas of steep topography and highly erodible soils. Cleared areas shall be kept to a minimum and the shortest practical distance ahead of construction.
- B. Restoration work shall be done as the project progresses and not be left until the end of the project. No areas shall be left unprotected for more than twenty (20) days without some form of temporary seeding or if in a non-growing season, some other form of stabilization such as mulch.

3.2 SEDIMENT CONTROL MEASURES

- A. Some of the sediment control measures or devices which can be used to control sedimentation of streams, water courses or pipelines are:
1. Earth Berms and/or Diversion Ditches
 - a. The primary purpose of these structures is to divert stormwater runoff to sediment traps or basins, thus preventing sediment from reaching streams, etc. The

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

berm/ditch is usually constructed simultaneously by compacting the material just excavated from the ditch to form the berm.

- b. Earth berm/diversion ditches are normally 12 inches to 18 inches in width and have an average depth of 12 inches to 18 inches
- c. Side slopes should not exceed 2 horizontal to 1 vertical. If ditch slopes exceed 4 percent, they shall be stabilized with crushed stone.
- d. Whether the berms are temporary or permanent, they shall be stabilized immediately with seed or other acceptable stabilizers.

2. Sediment Basins

- a. Sediment basins may be temporary or permanent formed by excavation and/or embankment to intercept sediment-laden runoff and to trap and retain sediment.
- b. Embankments shall not exceed 4 feet in height as measured at the low point of the original ground along the centerline of the embankment. Embankments shall have a minimum 4 foot top width at stone filter outlets and 2 foot minimum width for earth berms connecting the trap. Side slopes shall be 2:1 or flatter. The embankment shall be compacted while being constructed.
- c. All excavation operations shall be carried out in such a manner that erosion and water pollution shall be minimal. Any excavated portion of sediment traps shall have 2:1 or flatter slopes.
- d. There are two types of outlets generally used for basins.
 - (1) Stone filter outlet
 - (a) This outlet consists of a basin formed by embankment or a combination of embankment and excavation. The outlet is a built up stone embankment with a core of straw bales and covered by a minimum of 6 inches of stone. Stone shall be similar to AASHTO No. 57 stone. A stone emergency overflow weir shall be constructed 1 foot below the top of embankment.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

(2) Pipe outlet

(a) The outlet is a combination of a corrugated metal perforated riser pipe connected to a horizontally sloped pipe going through the embankment. Trash rack, anti-vortex device and anti-seep collars, if required, shall be as specified in NJDOT Standard Details for Roadway Construction.

e. Embankments and other areas disturbed by construction of basins shall be seeded with temporary approved mixture at the rate of 1 pound per 1000 square feet. After contributing areas have established permanent vegetation the temporary sediment traps shall be removed, the areas regraded and reseeded permanently.

3. Sediment Traps

a. Sediment traps are the same as the sediment basins described above but are normally existing low spots where stormwater runoff drains to naturally. The construction is mostly excavating to form a more shallow type earth containment system. Generally, a crushed stone filter berm outlet is sufficient for these traps similar to Paragraph 3.2, A, 2, d, (1) above. If earth berms are constructed, they shall be stabilized immediately.

4. Filter Berms

a. When construction operations take place within existing curbed roadways and backfilling will not immediately take place, crushed stone filter berms may be required by the Engineer. The filter shall be 6 inches high placed perpendicular to the curb, and be shaped with side slopes which will facilitate vehicular traffic.

5. Filter Inlets

a. Temporary filter inlets shall be used at existing stormwater inlets where required by the Engineer and are built by first setting concrete blocks in circle around the inlet and then piling crushed stone against the blocks. The stone filters sediment from the runoff and the blocks prevent the stone from being washed into the

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

storm sewer system. After all disturbed areas draining to the inlet have been stabilized the filtering materials can be removed.

6. Silt Fence

a. Materials

(1) Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

<u>PHYSICAL PROPERTY</u>	<u>TEST</u>	<u>REQUIREMENTS</u>
Filtering Efficiency	VTM-51	75% (minimum)
Tensile Strength at 20% (max.) Elongation*	VTM-52	Extra Strength - 50 lbs./lin. inch (minimum) Standard Strength - 30 lbs./lin. inch (minimum)
Flow Rate	VTM-51	0.3 gal./sq.ft./minute (minimum)

* Requirements reduced by 50 percent after 6 months of installation.

Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

(2) Posts for Silt Fences shall be either 4-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.

(3) Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.

b. This sediment barrier utilizes standard strength or extra strength synthetic filter fabrics. It is designed for

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

situations in which only sheet or overland flows are expected.

- (1) The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).
- (2) The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.
- (3) Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.
- (4) A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier.
- (5) When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.
- (6) The standard strength filter fabric shall be stapled or wired to the fence, and 8 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.
- (7) When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric shall be stapled or wired directly to the posts with all other provisions of Subparagraph (6) applying.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

- (8) The trench shall be backfilled and the soil compacted over the filter fabric.
- (9) Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

c. Maintenance

- (1) Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
- (2) Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.
- (3) Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.
- (4) Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

7. Other Filter Devices

- a. Other devices which can be used to trap sediment are straw bales, rock and stone dams, planting of grass or other vegetative cover on bare areas.

3.3 EROSION CONTROL MEASURES

- A. Steep slopes, potential landslide areas, stream crossings, stream encroachments, cut and fill sections and trenching operations are the potential sources of soil erosion and the resulting sedimentation. Some soil erosion control measures which are available are:

1. Earth Slope Protection

- a. Earth slopes shall be protected from accelerated erosion as soon as possible after the cut or fill operation. This can be done by quick establishment of vegetative cover

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

(temporary and/or permanent), benching or terracing or making flatter slopes where possible; mulches, providing jute matting or synthetic netting on steeper slopes or a combination of the above.

- b. On stream crossings, special planning and design consideration shall be done and complete details included in the Drawings and/or in these Specifications.

2. Pipeline Trenches

- a. When trenches are backfilled, they shall be filled above the original ground to allow for settling and to allow water to run off instead of following the trench line when backfill settles.
- b. Where the grade along the top of the backfilled trench is over 5 percent, water breaks shall be installed diagonally across the trench to divert water onto grassy areas at about a 30-degree angle from a line perpendicular to the trench line and spaced at proper intervals. Intervals shall not exceed two hundred feet.
- c. A water break may be an earth berm 6 inches to 8 inches high, a crushed stone berm or a straw bale barrier constructed diagonally across the trench to divert runoff to one side of the trench at intervals, thus preventing a constant flow of stormwater along the side of the backfilled trench.

3. Large Diversion Channels

- a. Where large stormwater diversion channels are to be constructed as a permanent facility, crushed stone, rip rap or gabions may be required for bottom and/or slope protection.
- b. Where diversion channel gradients are steep, grade control structures (example: stepped gabions) may be required.
- c. Where space limitations are not a factor, wide channels with flat slopes lined with grass are normally sufficient to control erosion.
- d. Every effort should be made to preserve and upgrade existing natural channels.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

4. Preservation of Existing Vegetation
 - a. Good stands of existing vegetation adequate to control erosion should be preserved wherever possible. Regeneration of wood plants should be encouraged where acceptable.
 - b. New vegetation, soil treatments, etc. shall be done as specified on the Drawings and in the applicable Sections of these Specifications.
5. Storm Inlets and Endwalls
 - a. Storm inlets and endwalls in grassy areas are usually permanent but are still devices that will slow erosion and sedimentation by directing surface waters safely underground. They may require special treatments at entrances or outlets to control erosion.

3.4 STREAM PROTECTION

- A. Where construction is close to existing streams and other waterways, construction shall be performed in a manner which will not contribute to stream pollution. Construction practices shall include the following:
 1. Construction debris, excavated materials, brush, rocks, refuse and topsoil shall be kept as distant from the stream as is possible.
 2. Stream crossings and machinery operation in streams is prohibited. Under no circumstances will a stream bed be permitted to become a highway for machinery traffic.
 3. There shall be no change in preconstruction contours (excess material must be removed to an upland disposal area).
 4. The discharge of dredged or fill material shall not destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species.
 5. The discharge of dredged or fill material shall consist of suitable material free from toxic pollutants in other than trace quantities.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

6. The fill created by the discharge of dredged or fill material shall be properly maintained to prevent erosion and other non-point sources of pollution.
7. The discharge of dredged or fill material shall not occur in a component of the National Wild and Scenic Rivers System or in a component of a State wild and scenic river system.
8. The discharge of dredged or fill material shall not be located in the proximity of a public water supply intake.
9. The discharge of dredged or fill material shall not occur in areas of concentrated shellfish production.
10. Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.
11. Discharges in spawning areas during spawning season shall be avoided.
12. The discharge shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the waters (unless the primary purpose of the fill is to impound waters).
13. If the discharge creates an impoundment water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow, shall be minimized.
14. Discharges in wetland areas shall be avoided.
15. Heavy equipment working in wetlands shall be placed on mats.
16. Discharges into breeding and nesting areas for migratory waterfowl shall be avoided.
17. All temporary fills shall be removed in their entirety.

3.5 TRAFFIC CONTROL

- A. Minimization of the area of disturbance also involves traffic control. Corridors for equipment travel shall be established to protect those areas that will not be denuded. Instructions shall be issued that routes for convenience shall not be allowed and that the established equipment travel corridors must be used. These

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

instructions must be enforced. Traffic shall be kept to an absolute minimum. Material delivery traffic shall enter and leave on a designated access route. Passenger vehicle traffic shall be discouraged. Workmen shall walk from the street rather than drive and they shall park on stabilized areas whenever possible. The filtering of sediment-laden runoff by the vegetation is an important measure in the reduction of sediment delivered to down-stream areas and it must be preserved. Indiscriminate and convenience travel shall not be allowed to destroy these natural filter areas.

3.6 STOCKPILES

- A. Stockpile areas shall also be selected and maintained by on-site personnel. Site selections and stockpile design shall incorporate sediment and erosion control facilities to prevent the potential direct production and delivery of sediment to waterways, damage to vegetation that is part of the total sediment and erosion control plan, and the unnecessary destruction of trees that are selected for preservation. Temporary or interim stabilization of soil stockpiles shall be promptly instituted. The existence of critical slopes on stockpiles shall be avoided. Stockpiling in or immediately adjacent to diversion channels will not be allowed because the stockpiled material may provide a direct and high volume source of sediment due to storm runoff. Containment structure shall be installed on large stockpiles. Their design and implementation shall be accomplished by competent on-site personnel.
- B. Temporary vegetative measures planned for implementation on stockpile areas shall be established immediately after the stockpile operation is completed or within twenty (20) days. Proper mulching and soil stabilization in conjunction with seeding operations shall also be carried out.

3.7 PUMPED WATER

- A. Pumped water management shall be practiced by the Developer/Builder to reduce the production of sediment. Pumped water shall be discharged onto stabilized surfaces and then allowed to be filtered by existing vegetation. If ditches are required to remove pumped water from construction excavations they shall be given the same consideration as any other man-made waterway and they shall be stabilized so they do not degrade and produce sediment.
- B. A permit for dewatering may be necessary. The Developer/Builder shall contact the NJ DEP to determine if a permit for dewatering is necessary.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

3.8 EXCAVATION AND BACKFILL

- A. Excavation shall be closely controlled. The material removed from the excavation shall be selectively stockpiled in areas where a minimum of sediment will be generated and where other damage will not result from the piled earth. Drainageways shall be protected at all times and the piling of soil in drainageways will not be allowed. Backfilling operations shall be performed in such a manner that remaining trees are not damaged. Temporary repaving shall be placed promptly after backfill operations are completed in improved areas.

3.9 TEMPORARY STABILIZATION DURING DROUGHT EMERGENCY

- A. During declared drought emergencies, if so approved by the state agency, the Developer/Builder shall utilize the following site stabilization and soil protection measures pursuant to the overall plan requirements.
 1. Soil Erosion Prevention
 - a. Bare soil during extremely dry and windy weather shall be protected with a mulch cover to reduce wind erosion potential.
 - b. Diversion ditches shall be constructed above exposed soil areas to minimize the possibility of surface water flows across the site.
 - c. If possible the surface of the soil shall be left rough until the drought emergency is terminated, or permanent vegetation is installed.
 2. Temporary Ground Cover
 - a. On level land or gentle slopes (up to 2%), seeding will not be required until sufficient moisture has accumulated to cause seed germination and can sustain seedling growth.
 - b. On 3% to 5% slopes, leave the surface rough with predominant ridges and furrows running with the contour.
 - c. On slopes greater than 5%, apply hay, straw or other organic mulch and bind with a sticker such as asphaltum to prevent the mulch material from shifting or blowing from the site. The mulch may be tacked or pressed into the soil with straight discing or other equipment in place of using a binder.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

3. Channel Protection

- a. In channels with slopes from 1% to 2%, a mulch material shall be applied in the channel bottom. A drought resistant seed mixture shall be seeded to the channel bottom before mulching. This seeding may germinate and grow in the channel without any artificial watering.
- b. In channels with slopes from 3% to 4%, the channel bottom shall be seeded with a drought resistant seed mixture, the area mulched and the mulch stabilized with either jute matting or some commercial mulch and netting.
- c. Channels with slopes greater than 4% shall be protected with erosion resistant materials according to the surface water velocities expected during a design storm.

3.10 TEMPORARY SEEDING

- A. Optimum seeding dates of February 15 thru May 1 or August 15 thru October 15 for the following species which may be planted throughout summer if the soil moisture is adequate or can be irrigated.

1. Schedule

<u>Species</u>	<u>Pounds Per Acre</u>	<u>Optimum Seed Depth (Double for Sandy Soil)</u>
Annual Ryegrass	40	0.5 inch
Perennial Ryegrass	40	0.5 inch
Oats	86	1 inch
Barley	96	1 inch

- B. Optimum seeding dates of May 1 thru August 15 for the following species which may be planted throughout summer if the soil moisture is adequate or can be irrigated.

1. Schedule

<u>Species</u>	<u>Pounds Per Acre</u>	<u>Optimum Seed Depth (Double for Sandy Soil)</u>
Pearl Millet	20	1 inch

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

<u>Species</u>	<u>Pounds Per Acre</u>	<u>Optimum Seed Depth (Double for Sandy Soil)</u>
Sudangrass	30	1 inch
Millet (German or Hungarian)	30	1 inch
Weeping Lovegrass	5	1 inch

3.11 FINAL GRADING AND SEEDING

- A. Finish grading, topsoiling, seeding and/or sodding shall be performed as specified in Section 02810, RESTORATION OF DISTURBED AREAS, of these Specifications. Types and quantities of soil conditioners, fertilizers, and seed mixtures shall be as specified above or in accordance with the recommendations of the local state agricultural agent. Sod shall be installed on all slopes steeper than 2 to 1. Under no circumstances shall slopes exceed 1-1/2 to 1 after final grading is completed.
- B. After the construction phase is complete permanent vegetation on the areas that have been disturbed shall be reestablished as rapidly as possible. If the completion of the construction activities does not coincide with a season in which permanent vegetation can be started an interim or temporary program is required. This shall include soil stabilization, mulching, or the establishment of filter strips. In any case sediment and erosion controls shall be installed promptly and their maintenance assured.

3.12 MAINTENANCE

- A. Sediment and erosion control practices will not function properly throughout their designed life span if they are not maintained. Periodic inspection shall be made at frequent intervals to detect any impairment in the ability of the erosion control facilities installed as part of this plan to continue to function effectively. Responsibility for maintenance shall be assigned to an individual who has access to equipment, material and funds required to sustain the maintenance schedule.
- B. Most control structures require work to restore them after each storm. This maintenance shall be performed to allow the structure to continue to perform the function for which it was designed.

SECTION 01020

EROSION AND SEDIMENT CONTROL PLAN

- C. Vegetative practices require maintenance. Frequently, a stand of vegetative cover established in the sediment and erosion control program is allowed to deteriorate and become ineffective. A fertilization, reseeding and watering program shall be established and carried out as the construction proceeds. Areas where failures have been experienced in the establishment of vegetative protection shall be promptly treated. The reestablishment of permanent vegetative cover shall be initiated as soon as possible in an effort to keep the area requiring maintenance work to a minimum.
- D. Information shall be distributed to all persons on the construction site describing and stressing the importance of the proper installation and maintenance of the erosion and sediment control procedures included in this plan. The actions and language of supervisors on the project shall continually emphasize the seriousness and importance of sound erosion and sediment control procedures.
- E. The approved erosion and sediment control plan and any standard conditions relating to Soil Erosion and Sediment Control issued as part of any permits shall be available at the immediate site of construction activity at all times.
- F. The maintenance of the soil and erosion control facilities shall continue throughout the life of the project.

+ + END OF SECTION + +

SECTION 01030
LOCATIONS OF EXISTING LINES

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. The Developer/Builder, prior to performing excavation or demolition work on the job site shall obtain all recorded locations of existing lines.
2. Contact Utility Companies to provide field location of Utility and field verify before excavation or demolition work is started.

B. Related Work Specified Elsewhere

1. Excavation for Utilities, Section 02220, EARTHWORK FOR UTILITIES.
2. Rock excavation, Section 02230, ROCK EXCAVATION.

1.2 SUBMITTALS

- A. The Developer/Builder shall furnish to the Authority a certification listing the names of the utilities whom he has contacted during course of construction.

+ + END OF SECTION + +

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCHEDULES

- A. The Developer/Builder shall be responsible for preparing a Progress or Work Schedule for the entire project.

1.2 SHOP DRAWINGS AND SAMPLES

- A. The Developer/Builder shall submit the required shop drawings to the Authority and he shall be responsible for their timely submission.
- B. Any proposed deviations/substitutions from that specified shall be clearly noted on the cover letter transmitting the shop drawing. Failure to so note will be cause for rejection of equipment, materials, etc. after installation.
- C. All submissions shall be marked with the Specification Section number containing the item submitted for review.
- D. Revised shop drawings submitted for review shall be marked "RESUBMISSION."

1.3 CONSTRUCTION PHOTOGRAPHS

- A. The Developer/Builder shall be responsible for all pre-construction and post-construction photographs. One set shall be submitted to the Authority.
- B. Preconstruction video tapes may be required at the discretion of the Authority. The tapes shall be "VHS" type and acceptable to the Authority.

1.4 SUBMITTAL PROCEDURES

- A. All submittals shall be delivered to the Authority.
- B. The processed submittals will be returned to the Developer/Builder.

PART 2 SCHEDULE

2.1 PREPARATION

- A. The Developer/Builder shall prepare a Progress or Work Schedule for the entire Project.

SECTION 01300

SUBMITTALS

- B. Each activity in the Progress or Work Schedule shall be identified and a time for the performance of such activity indicated. Each activity shall be preceded by all work that must be accomplished prior to that activity. All abbreviations, codes and/or symbols used shall be described on the Schedule.

2.2 SUBMISSION

- A. Submit six (6) copies of Schedule to the Authority for review within 10 days prior to starting work. Update and resubmit Schedule monthly thereafter until completion of the work. Updated Schedule shall have completed activities removed or indicated as such.

PART 3 - SHOP DRAWINGS

3.1 GENERAL

- A. Shop drawings are defined as drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by Developer/Builder which illustrate how specific portions of the work shall be fabricated and/or installed.
- B. Shop drawings are a supplementary means of communications to assist in the understanding of what the Developer/Builder proposes to provide and to establish that whatever he intends to install either does or does not conform to the "Adopted Plans" and these Specifications.
- C. In the instance of a request for a substituted item, the Developer/Builder shall verify that it is equal to the originally required item and that it will fit into the space allocated to the originally required item. Where modifications to the Adopted Plans are proposed, the Developer/Builder must clearly indicate such deviation in writing in his transmittal letter. If the modifications and/or substitutions are agreed to by the Authority the Adopted Plans will be appropriately modified.

3.2 SUBMITTAL PROCEDURES

- A. Shop drawings shall be delivered to the Authority. The Authority will screen the shop drawings to insure that the shop drawings have been properly certified and identified. If they are submitted properly, the Authority will review the items.

SECTION 01300

SUBMITTALS

3.3 CATALOG SHEETS

- A. For standard manufactured items considered by the Authority as not requiring special shop drawings, the Developer/Builder shall submit three (3) copies of manufacturer's catalog sheets showing illustrated cuts of the items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring and control diagrams and all other pertinent information.
- B. The Authority will retain two (2) copies and return the third to the Developer/Builder.

3.3 SHOP DRAWINGS

- A. The Developer/Builder shall submit for review three (3) white prints of shop and working drawings of materials fabricated for which such drawings are specifically requested.
- B. Prior to submitting drawings to the Authority, the Developer/Builder shall check thoroughly all such drawings to satisfy himself that the subject matter conforms to the Adopted Plans and these Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and certification of the Developer/Builder's approval, and then shall be submitted to the Authority. Any shop drawings submitted without the Developer/Builder's certification will be returned without review.
- C. The Authority will retain two (2) copies and return the third to the Developer/Builder.
- D. Shop drawings shall show the principal dimensions, weight, structural and operating features and performance characteristics. When it is customary to do so, when the dimensions are of particular importance or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the installation.
- E. When so specified or if considered by the Authority to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop and working drawings. In such case the requirements shall be as specified for shop and working drawings, insofar as applicable.
- F. The Developer/Builder shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.

SECTION 01300

SUBMITTALS

- G. No material shall be purchased or fabricated until the required shop and working drawings have been submitted and reviewed. All materials and work involved in the construction shall then be as represented by said drawings.
- H. The Authority's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given. The Developer/Builder is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

3.5 FIELD DISTRIBUTION

- A. The Developer/Builder shall be responsible for the required number of processed drawings or catalog cuts for field distribution.
- B. The Developer/Builder shall have the overall responsibility for coordinating the necessary information to properly coordinate the work.

PART 4 - SAMPLES

4.1 SUBMISSION OF SAMPLES

- A. Unless otherwise specified, the Developer/Builder shall provide samples in duplicate and identify each sample by an appropriate tag or label listing the names of the Project, the Owner, the Developer/Builder and/or Subcontractor as well as the exact identification of the sample. Tag or label shall be large enough to provide a blank space for review stamps.
- B. Samples of items submitted for destruction tests or for use in testing mixture with other materials will not be returned. Review of these items will be given by letter.
- C. When reviewed, one sample of each item, not submitted for destruction, will be returned to the Developer/Builder and shall be kept and maintained in good condition in the Developer/Builder's office at the project site for later use in comparison with material actually delivered for the work. When samples of large fabricated items or of costly items are required, reviewed samples may be installed in the work if the exact location of such samples is recorded on the Authority's Record Drawings.

SECTION 01300

SUBMITTALS

PART 5 - CERTIFICATIONS AND TESTS

5.1 GENERAL

- A. Two (2) copies of certifications and reports of tests when required under the various sections of these Specifications, shall be submitted.

PART 6 - CONSTRUCTION PHOTOGRAPHS

6.1 GENERAL

- A. The Developer/Builder shall provide 3 sets of clear, sharp, color photographs monthly, starting when the work begins and continuing as long as the work is in progress. Views shall be as requested by the Authority. The requirement for these photographs may be deleted at the discretion of the Authority.

6.2 COLOR AUDIO-VIDEO TAPES

- A. The Developer/Builder shall provide 2 sets of Color Audio-Video Tapes of the entire project alignment.

* * END OF SECTION * *

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SCOPE

- A. The Developer/Builder is referred to conditions and requirements given in various Sections of these Specifications.

1.2 OCCUPYING PRIVATE LAND

- A. Written consent from the proper parties shall be obtained by the Developer/Builder prior to entering or occupying with men, tools, materials or equipment any land other than his property for any purpose related to his performance of the work on this Contract.

1.3 PROTECTION OF EXISTING UTILITIES

- A. The Developer/Builder shall conduct his operations and take all special precautions necessary to protect equipment, utility lines, roadways and subsurface, submerged and overhead facilities which are to remain in place and undisturbed by his operations. The Developer/Builder shall immediately notify the owner of the facilities or areas which are disturbed, damaged or injured as a result of the Developer/Builder's operations, and determine the proper method of replacing or repairing the affected facilities at least to the conditions which existed prior to the Developer/Builder's operations. The Developer/Builder shall, at his own expense, replace, repair or restore the affected facilities or areas to their original condition or shall reimburse the owner of said facilities or areas for such expenses as the said owner may accrue in performing the work.

1.4 INTERFERENCE WITH/AND PROTECTION OF STREETS

- A. The Developer/Builder shall not close or obstruct any portion of a street, road or private way without obtaining the required permits from the proper authorities. If any street or private way shall be rendered unsafe by the Developer/Builder's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the appropriate authority.
- B. The Developer/Builder shall assume full responsibility for the maintenance and restoration of those roadways within the construction area and also those roadways on which equipment must operate to reach the construction area.

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

- C. Street, roads, private ways and walks not closed shall be maintained passable by the Developer/Builder at his expense, and the Developer/Builder shall assume full responsibility for the adequacy and safety of provisions made.
- D. The Developer/Builder shall, 48 hours in advance of closing any street, notify the police and fire departments in writing, with a copy to the Authority. He shall cooperate with the police department in the establishment of alternate routes and, at his own expense, shall provide adequate, plainly marked detour signs. The signs shall be as required by the agency that has jurisdiction over the roadway.
- E. For the proper control of traffic, the Developer/Builder shall provide an adequate number of persons employed at his own expense.
- F. For control of dust the Contractor shall keep the streets being worked in, swept clean. Sweeping shall consist of hand sweeping with brooms and cleaning with rubber tired street cleaning vehicles.

1.5 PROTECTION OF FACILITIES AND EQUIPMENT

- A. Until final acceptance of the work, the Developer/Builder shall continuously maintain adequate protection, of his work from damage. He shall make good any such loss or damage. He shall adequately protect adjacent private and public property as provided by law.

+ + END OF SECTION + +

SECTION 01900

COLOR AUDIO-VIDEO TAPES

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials and equipment to furnish color audio-video tapes for the entire right-of-way for the alignment of the project prior to the start of any construction work.
2. Provide the Authority with two (2) copies of acceptable audio-video tapes of the total project.
3. Work shall consist of, but not be limited to the following:
 - a. The Developer/Builder shall tape areas with paved roads, through easements, parks, lawns, and open fields.
 - b. All video taping shall be done during regular business hours, unless otherwise specified by the Authority.
4. Field Checks
 - a. When taping rights-of-way other than in streets, the Developer/Builder and the Authority shall review the days taping, and if tapes are judged unsatisfactory the right-of-way shall be retaped.
 - b. Review of tapings in the street or paved area shall be done on a random basis. If these tapes are judged unacceptable all tapes shall be reviewed for quality and unacceptable areas retaped.
5. Taping of rights-of-way shall be done prior to Clearing and Grubbing, and removal of paving material. In order to insure proper taping between manholes, the Developer/Builder shall perform light clearing as required for the movement of taping equipment. The extent of the light clearing shall be approved by the Authority.

B. Condition of Work

1. Stationing shown on the Adopted Plans is to be used by the Developer/Builder when describing structures, topographical features, etc.

SECTION 01900

COLOR AUDIO-VIDEO TAPES

- a. When taping gravity sewers the audio shall reference the actual locations of manholes.
2. Prior to the beginning of taping, the Developer/Builder shall make a visual survey of the project alignment, noting those features not visible when taping along project route (street and rights-of-way). In order to determine the feasibility of taping those features not readily visible from the project alignment, the Developer/Builder shall, prior to taping, review those special features with the Authority.
3. No taping will be permitted if the weather is not acceptable such as snowing, rain, fog, etc. or if it is late afternoon when elongated shadows distort perception and tend to prevent clear resolution and periods when there is snow on the ground area.

1.2 QUALIFICATIONS

A. Audio-Video Equipment

1. The Developer/Builder may use his own equipment if such equipment is satisfactory to the Authority.

B. Authority's Requirements

1. The Developer/Builder shall notify the Authority seven (7) calendar days prior to the beginning of taping.
2. A "sample" route of the project must be taped by the Developer/Builder for the Authority's review. The sample route will be established by the Authority. If there are paved areas and grass easements on the projects, a sample of both will be required for review by the Authority. It will be the taping of the sample route that the job quality standards will be based and judged. This "sample" tape shall be submitted to the Authority before any additional taping is started to allow the tape to be reviewed by the Authority.

1.3 SUBMITTALS

- A. The Developer/Builder shall submit to the Authority prior to starting work, a sample VHS format color video cassette tape meeting the exact contract requirements and upon request, must submit at least three (3) letters of reference for audio-video work, said letters being pertinent to the satisfactory performance and completion of color audio-video work for various municipalities.

SECTION 01900

COLOR AUDIO-VIDEO TAPES

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. All equipment, accessories and materials to perform this service shall be furnished by the Developer/Builder or an acceptable audio-video firm.
- B. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall be as high as possible to insure proper perspective.
- C. In some instances, audio-video tape coverage will be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance acceptable to the Authority.
- D. When taping in rights-of-way from manhole to manhole, the camera shall be mounted on a tripod. Horizontal and vertical shots shall be made from the tripod, in order to insure proper perspective. (Hand-held cameras shall not be allowed unless specifically approved by the Authority.
- E. When taping in rights-of-way, the camera shall be set up on manholes. In order to insure proper viewing between manholes, the Developer/Builder shall furnish sighting rods to be placed at intervals along the centerline of the facility in order to properly locate existing conditions within the legal and construction rights-of-way. Standard type sighting rods with flagging attached shall be set up both upstream and downstream from point of taping. When it is impossible to view the upstream manhole due to grades, trees or other obstructions, the camera shall be moved to said obstruction and taping continued.

2.2 TAPE REQUIREMENTS

- A. Audio-video tapes shall be premium grade 2, 4 or 6 hour format. Tapes shall be the standard VHS format and be suitable for viewing on conventional VCR/television.

PART 3 EXECUTION

3.1 LOCATION INFORMATION

- A. Audio
 - 1. Each tape shall begin with the current date, Owner's name and project name, and be followed by the general location, i.e., name of the street, viewing side, and direction of progress.

SECTION 01900

COLOR AUDIO-VIDEO TAPES

B. Video

1. The engineering station numbers must be continuous, be accurate, correspond to the project stationing, and include the standard engineering symbols (i.e. 14 + 84). This transparent information must appear in the lower half of the viewing screen.
2. Below the engineering stationing, periodic transparent alpha numeric information will appear. This information will consist of the name of the project, name of the area covered, direction of travel, viewing side, etc.

C. Digital

1. To preclude the possibility of tampering or editing in any manner, all video recordings must, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording as well as the corresponding engineering stationing numbers. The date information will contain the month, day, and year, i.e. 10/5/72, and shall be placed directly below the time information. The time information shall consist of hours, minutes and seconds separated by colons, i.e. 10:35:18. This transparent information will appear on the extreme upper left-hand third of the screen.

3.2 MULTI-CAMERA REQUIREMENTS

- A. The audio-video tape shall consist of one (1) video and one (1) audio track, which must be recorded simultaneously, and shall consist of original live recordings and thus shall not be copies of other audio or video recordings. The audio track shall contain the narrative commentary of the electrographer recorded simultaneously with his fixed elevation video record of the zone of influence of construction. In order to maintain viewer orientation, transition from fixed camera overview to remote camera picture shall be by means of an electronic dissolve.

3.3 LIGHTING REQUIREMENTS

- A. The color audio-video tape recording of surface features of the construction area located within the area of coverage of construction shall have the following minimum lighting:

SECTION 01900

COLOR AUDIO-VIDEO TAPES

1. In order to produce the proper detail and perspective, a minimum of 25,000 watts or 3400 Kelvin temperature lighting will be required to fill in the shadow area caused by trees, utility poles, road signs and other such objects.

3.4 TAPE COVERAGE

- A. The area of coverage shall be defined as the taping of those areas a minimum of 15 feet outside the actual right-of-way (Roadway, Construction, etc.). Taping may be ordered outside of the area of coverage in order to establish those features deemed necessary by the Authority.
- B. The color audio-video tape recording of surface features of the construction area located within the area of coverage of construction shall have the following tape coverage:
 1. Taped coverage shall include all surface features located within the area of coverage of construction supported by appropriate audio description. Audio description shall be made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls and retaining walls or buildings located within such area of coverage. The diameter size and type of trees in the area of coverage shall be detailed.
 2. Houses and buildings shall be identified visually by house number, when visible in such a manner that structures of the proposed system, i.e. manholes, can be located by reference.
 3. The average rate of travel during a particular segment of coverage (e.g. coverage of one side of a street) shall be indirectly proportional to the number, size, and value of the surface features within that construction area of coverage. The following table, which characterizes typical areas, shall be used to establish approximate limits on actual average rates of travel:

SECTION 01900

COLOR AUDIO-VIDEO TAPES

<u>AREA</u>	<u>TYPICALLY CHARACTERIZED BY</u>	<u>AVE RATE MAX</u>
a. High Density (e.g.developed subdivision)	hard surface streets, curbs, drives, & sidewalks: 50 ft lots; very few empty lots	30 ft/min
b. Med. Density (e.g.partially developed subdivision)	gravel roads, hard & soft surface drives, no side- walks, culverts & headwalls, 100 ft lots, few empty lots	60 ft/min
c. Low Density (e.g.suburban fringe)	gravel roads, small fields or woods, occasional houses	80 ft/min
d. Extra Low Density (e.g.rural)	gravel roads, large fields sparse number of houses	100 ft/min

4. The authority will designate what areas may be omitted or added for audio-video coverage.

3.5 IDENTIFICATION

- A. All tapes (cassettes and cases) shall be properly identified by tape number, location, and project name and municipality in a manner acceptable to the Authority.
- B. A record of the contents of each tape shall be supplied by a run sheet identifying each segment in the tape by location, i.e. roll number, street or road viewing, tape counter number, viewing side, point starting from, traveling direction and ending destination point.

** ** END OF SECTION ** **

Division 2
SITE WORK

SECTION 02110
CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

- A. Description of Work
 - 1. All clearing and grubbing shall be done as shown on the Adopted Plans and as specified herein.
- B. Related Work Specified Elsewhere
 - 1. Removal of peat, moss, lignite and vegetable matter below ground other than as specified in this section, Section 02220, EARTHWORK FOR UTILITIES.
 - 2. Pruning, shearing and trimming of trees, shrubs and bushes, Section 02810, RESTORATION OF DISTURBED AREAS.
 - 3. Stripping and stockpiling topsoil, Section 02220, EARTHWORK FOR UTILITIES.
 - 4. Soils erosion, Section 01020, EROSION AND SEDIMENT CONTROL PLAN.

1.2 PROTECTION

- A. Streets, roads, adjacent property and other works to remain shall be protected throughout the work.
- B. Existing trees, shrubs and bushes
 - 1. Trees shall be protected by fencing, barricades, or wrapping as may be required.
 - 2. Shrubs and bushes shall be protected by fences or barricades as may be required.
 - 3. Shallow-rooted plants shall be protected at ground surface under and in some cases outside the spread of branches by fences, barricades or ground cover protection as may be required.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. Federal, State and Local laws and code requirements shall control the disposal of trees and shrubs.

2901K

0114-17

SECTION 02110

CLEARING AND GRUBBING

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials shall be at the Developer/Builder's option.

PART 3 EXECUTION

3.1 CLEARING

- A. Limits of clearing shall be within the Rights-of-Way, or to limits shown on the Adopted Plans.
- B. All trees bordering any construction zone or Right-of-Way shall be protected by acceptable methods. (Trees damaged by the Developer/Builder will be either repaired or replaced as determined by the Authority at the Developer/Builder's expense).
- E. Remove trees, sapling, shrubs, bushes, vines and undergrowth within the limits of clearing to the heights above ground given in the following table:
 - 1. Trees over 6-inches in diameter: 12 inches
 - 2. Shrubs, saplings, bushes and trees under 6 inches in diameter: 3 inches
 - 3. Vines and undergrowth: 2 inches

3.2 GRUBBING

- A. Limits of grubbing shall coincide with the limits of clearing.
- B. Remove all stumps, roots over 4-inches in diameter, and matted roots within the limits of grubbing to the depths below. Such depths shall be measured from the existing ground surface or the proposed finish grade whichever is the lower.
 - 1. Footing - - - 18 inches
 - 2. Walks - - - 12 inches
 - 3. Roads - - - 18 inches
 - 4. Parking Areas - 12 inches

SECTION 02110

CLEARING AND GRUBBING

5. Lawn Areas - - 8 inches

6. Fills - - - - 12 inches

3.3 TRIMMING OF TREES

A. When required, with the Authority's approval, trees shall be trimmed to remove branches or roots which interfere with construction or traffic. Paint all cut branches and roots with wound paint as recommended for the application.

3.4 DISPOSAL

A. Burning of materials on the site will not be permitted.

B. Removal:

1. Material shall be removed from the site daily as it accumulates.

** ** END OF SECTION ** **

SECTION 02220
EARTHWORK FOR UTILITIES

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. All earthwork excavated for pipe trenches and backfill after the installation of the pipe shall be in accordance with the Adopted Plans and as specified herein.

B. Related Work Specified Elsewhere

1. Soil and erosion, Section 01020, EROSION AND SEDIMENT CONTROL PLAN
2. Existing lines, Section 01030, LOCATIONS OF EXISTING LINES
3. Clearing, Section 02110, CLEARING AND GRUBBING
4. Rock Excavation, Section 02230, ROCK EXCAVATION
5. Piping, Section 02551, SANITARY SEWERS AND APPURTENANCES
6. Concrete, Section 03301, CAST-IN-PLACE CONCRETE

1.2 LINES AND GRADES

A. Grades

1. Pipes shall be laid true to the lines and grades shown on the Adopted Plans. The grade shown on the profile shall be the invert to which the work must conform.

1.3 CLEARING

- A. Clearing of the site is described in Section 02110, CLEARING AND GRUBBING.

1.4 TRENCHING REGULATIONS

- A. In open trenching on State, City, County and Township highways, the Developer/Builder shall be governed by the conditions, restrictions and regulations made by the State Highway Department, the County officials, Municipal Officials and the Township Officials. All such regulations shall be in addition to the ones set down in these Specifications.

Section 02220
EARTHWORK FOR UTILITIES

PART 2 - PRODUCTS

2.1 BACKFILLING MATERIALS

A. Crushed Stone

1. Crushed stone shall be " Quarry Blend" as shown on the table in the following paragraph, not washed, with fines present to stabilize it in the trench. If amount of fines is insufficient, then stone screenings shall be added to extent required to stabilize it in the trench.

<u>Square Mesh Sieve Size</u>	<u>Percent Passing by Weight</u>
1 1/2 in.	100
3/4 in.	55-90
No. 4	25-60
No. 50	5-25
No. 200	3-12

2. Sharp stones and crushed rock (larger than 3/4 inch) shall be excluded from the bedding material.

B. Trench Backfill

1. Material proposed for use as trench backfill shall meet the requirements of the New Jersey Department of Transportation Soil Aggregate Gradation Designation I-2.

C. Concrete

1. Concrete used for cradles, thrust blocks, or encasement shall be Class B concrete as specified in Section 03301, CAST-IN-PLACE CONCRETE. Tests of concrete for this usage are waived.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General

1. All excavation, unless otherwise authorized by the Authority, shall be made by open cut. Side walls of trenches shall be kept vertical and shall be properly sheeted and braced.

Revised: 3/00

**

SECTION 02220

EARTHWORK FOR UTILITIES

2. Where damage is liable to result from withdrawing sheeting, the sheeting shall be left in place. Where sheeting is left in place it shall be cut off 18 inches below grade.
3. Care shall be taken not to excavate below the depth specified.

B. Rock

1. Rock excavation, when needed, shall be done in accordance with Section 02230, ROCK EXCAVATION.

C. Excavation Below Grade

1. Where the bottom of the trench, by mistake of the Developer/Builder, is taken out to a greater depth than specified for a given pipe bedding the trench shall be brought back to grade by filling with crushed stone so as to comply with the requirements for crushed stone foundation.
2. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.

D. Blasting

1. Blasting, when needed, shall be done in accordance with the Specification For Blasting in Section 02230, ROCK EXCAVATION.

3.2 EXCAVATION NEAR EXISTING STRUCTURES

- A. Attention is directed to the fact that there may be water pipes, drains and other utilities in certain locations. See Section 01030, LOCATIONS OF EXISTING LINES, for additional information on buried lines.
- B. All water or other utility lines shall be located on the ground with pipe locating equipment well ahead of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. Such locations shall be established at least 50 feet in advance of all trench excavations.
- C. As the excavation approaches pipes, conduits or other underground structures, digging by conventional trenching machine methods shall be done with extreme care.
- D. When excavating within 2 feet (vertical or horizontal) of a gas or oil line, the Developer/Builder shall use the manual method of excavation. At no time will conventional trenching equipment be permitted under these conditions.

SECTION 02220

EARTHWORK FOR UTILITIES

- E. Excavation near structures will not be allowed closer to the structure than the depth of the excavation below the bottom of the foundation without shoring the excavation with sheeting. Pipes shall be laid no closer than 10 feet to any structure unless otherwise approved by the Authority.
- F. The Developer/Builder shall carefully protect from disturbance and damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations. These monuments and/or markers shall then only be removed when authorized by the agent or the Authority. Monuments and/or markers shall be reinstalled to the satisfaction of the property owner or agent.

3.3 PROTECTION OF EXISTING STRUCTURES

- A. All existing pipes, poles, wires, fences, curbing, property-line markers and other structures which must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage.
- B. In case of damage to any structure, the Developer/Builder shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. If the owner of the structure wishes to make his own repairs, the Developer/Builder shall reimburse the owner of the structure for all the time and materials required to make the repairs.
- C. When the owners of the damaged structures do not wish to make the repairs themselves, all damage shall be repaired by the Developer/Builder or, if not promptly done by him, the Authority will have the repairs made at the expense of the Developer/Builder.
- D. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.

3.4 CARE AND RESTORATION OF PROPERTY

- A. Excavating machinery and cranes shall be operated with care to prevent damage to existing structures, paving and/or wires.
- B. It is suggested that to protect the pavement and shoulders, all equipment should have rubber wheels or runners and should have rubber, wood or similar protective pads between the outriggers and the surface unless otherwise authorized by the Authority or State and County Highway Departments. In the event that other than rubber equipped machinery is authorized for use, the pavement and shoulders shall be protected by the use of matting, wood or other suitable

SECTION 02220

EARTHWORK FOR UTILITIES

protective material having a minimum thickness of 4 inches. In any event it shall be the Developer/Builder's responsibility to take whatever steps necessary to protect pavement and shoulders.

- C. The Developer/Builder must exercise care not to damage paving, curb, inlets, sidewalks, etc. Any damages shall be replaced in kind by the Developer/Builder at his own expense, to the satisfaction of the Authority.
- D. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

3.5 TRENCHING

- A. Trenches shall be dug to the depth required by the Adopted Plans adding, however, to such depths the thickness of the pipe and the required bedding.
- B. During installation, upon encountering quicksand or a wet spongy material, the Developer/Builder shall determine the actual depth of the soft material. Once the depth of the soft material has been determined, one of the following methods of construction work shall be used as determined by the Authority:
 - 1. Installation by the quicksand excavation method
 - 2. Crushed stone foundation
 - 3. Concrete encasement

3.6 TUNNELLING

- A. Prior to undertaking any tunnelling, the Developer/Builder shall have a professional engineer, licensed to practice in the State, prepare a design and outline the proposed tunnelling methods, procedures and shoring requirements to be followed. An informational copy of these data shall be furnished the Authority before beginning the tunnelling.

3.7 SHEETING AND SHORING

- A. Where sheeting, shoring, bracing, or trench boxes are used, they must be designed by a professional engineer licensed to practice in the State of New Jersey. Said engineer shall provide the Developer/Builder with a certification signed and sealed by him

SECTION 02220

EARTHWORK FOR UTILITIES

stating that the design of the sheeting and bracing conforms to all applicable requirements of the New Jersey Construction Safety Code and the Occupational Health and Safety Act. Copies of this certification shall be submitted to the Authority.

- B. Trenches shall, at all times, be properly protected to prevent accidents, caving of the sides of the trench or breaking of the ground outside of the lines of the trenches proper or damage to buildings or other structures along the line of construction. Underground structures of all types shall be protected by the Developer/Builder, who shall use all necessary shoring, bracing or other appliances for the protection of same. Care must be taken not to damage in any way water mains, water service pipes, drain pipes, sanitary or stormwater sewers, gas mains, oil mains, electric conduits or other structures encountered on the lines of the Work.
- C. The Developer/Builder must follow the proposed sheeting plans submitted. No deviations may be made from the filed procedure without first submitting a revised sheeting and bracing plan, signed and certified as required for the original submission, by the same licensed professional engineer who prepared the original submission.
- D. All sheeting and bracing not to be left in place shall be carefully removed in such a manner as not to endanger the construction or other structures. All voids left or caused by withdrawal of sheeting shall be immediately backfilled with well-compacted material.
- E. When installing pipe the sheeting and shoring shall not project below a point one foot above the top of pipe, except during quicksand excavation or to stabilize trench bottom.
- F. If when installing pipe, sheeting must be placed below the pipe invert in order to stabilize trench bottoms, the sheeting shall be left in place from the trench bottom to a point 1 foot 6 inches above the top of the pipe, and the remainder of the sheeting cut and removed before final backfilling.

3.8 QUICKSAND EXCAVATION

- A. Where quicksand excavation is encountered, the Developer/Builder shall drive either tight tongue and groove wooden sheet piling or steel sheet piling to a depth which will effectually cut off the flow of sand. Well points and other methods shall then be used to dewater the trench. Excavation and construction shall follow as rapidly as possible thereafter. A satisfactory foundation must, however, be secured either by close tongue and groove planking held

SECTION 02220

EARTHWORK FOR UTILITIES

by piling or some other acceptable method. Where pipe is to be constructed through quicksand excavation, the trench shall be carried to a sufficient depth below the grade line to permit the pipe to be encased in concrete, on a 2-inch x 10-inch plank platform or cradle.

- B. The Developer/Builder shall comply with Paragraph 3.7, A of this Section of the Specifications for design of the sheet piling.

3.9 TRENCHING IN ADVANCE OF PIPE LAYING

- A. The trench for the pipe lines shall not be opened for a distance of more than 100 feet at any one time. At no time will the Developer/Builder be permitted to leave the trench open at the end of a working day.
- B. If concrete is to be installed for pipe cradle or encasement, longer lengths of trench may be left open with the Authority's approval, provided that:
 - 1. All trenching regulations are met (refer to para. 1.4, "Trenching Regulations")
 - 2. All trenches are properly secured and protected.

3.10 KEEPING TRENCH DRY

- A. All ground water which may be found in the trenches and any water which may get into them from any cause whatsoever shall be pumped or bailed out so that the trench shall be dry during pipe laying period. No water shall be permitted to reach concrete until it has set sufficiently. All water pumped from the trenches shall be disposed of in compliance with the applicable local regulations of the appropriate governing body. The Developer/Builder shall provide a minimum of two pumps for each trench opened in wet ground, one operating and one standby. The standby pump shall be of a size that will replace the largest operating pump.
- B. The Developer/Builder shall contact the NJ DEP and determine if any permits are necessary for trench dewatering. Also the Developer/Builder is advised that proper erosion and sedimentation control practices shall be employed which may include silt traps at dewatering locations.
- C. The Developer/Builder shall provide and place all necessary flumes or other channels of adequate size to carry temporarily all streams, brooks, stormwater or other water which may flow along or across the

SECTION 02220
EARTHWORK FOR UTILITIES

lines of the pipe line. All flumes or channels thus utilized shall be tight so as to prevent leakage into the trenches. Water pumped from trenches shall be handled in accordance with the approved Erosion and Sedimentation Control Requirements.

3.11 PIPE BEDDING

A. General

1. Take care to avoid contact between the pipe and compaction equipment. The tampers shall be hand or pneumatic of the proper size to operate between trench wall and pipe.
2. Do not use compaction equipment directly over the pipe while placing the pipe bedding to insure that such equipment will not damage or disturb the pipe.
3. Refer to the Construction Details at the end of these Specification for bedding details.
4. The bedding shall be compacted to not less than 95% of the maximum dry density as determined by ASTM D1557.

B. Crushed Stone Cradle

1. Ductile Iron Pipe shall be supported in a crushed stone cradle. This cradle shall be constructed in accordance with the Construction Details. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade. Suitable recesses shall be provided in the cradle to permit adequate clearance for bells, couplings or similar projections.
2. Cradle material shall be spread in 4-inch layers, and each layer shall be compacted with tampers until the bedding has reached the spring line of the pipe.
3. The balance of the bedding to 1 foot above the pipe shall be Bank Run Gravel compacted in four inch layers or the material required by the State or County Highway Department compacted in four inch layers.

C. Crushed Stone Encasement

1. For PVC, the trench shall be excavated to the depth shown on the Construction Details. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade.

SECTION 02220

EARTHWORK FOR UTILITIES

2. Encasement material shall be spread in 4-inch layers and each layer shall be compacted with tampers until the required total depth of bedding has been built up.

D. Concrete Encasement

1. Where specified or required in the field, the pipe shall be supported by Concrete Encasement.
2. The trench shall be excavated to a minimum depth as shown on the Construction Details. The excavated space shall then be completely filled with, and the entire pipe encased in concrete such that the concrete encasement measures a minimum 1 foot above the top of the pipe. The total minimum width of the Concrete Encasement shall equal the width of trench excavation. Unless otherwise shown on the Adopted Plans or specified herein, concrete shall be Class B in accordance with the requirements of Section 03301, CAST-IN-PLACE CONCRETE. Freshly poured concrete shall be maintained free from ground water for at least the first four hours. No backfilling of the trench shall begin until a minimum time period of 24 hours has elapsed after the encasement has been poured.

E. Concrete Cradle

1. Where unstable conditions are encountered, the pipe shall be supported on Concrete Cradle. Concrete Cradles shall be installed where no suitable supporting soil or rock stratum exists within two feet of the bottom of the pipe.
2. The concrete cradle shall be furnished and installed equal to the "Concrete Encasement," except that only that portion of the encasement at and below the horizontal diameter of the pipe shall be poured, forming a true cradle under the bottom half of the pipe.
3. The balance of the bedding to 1 foot above the pipe shall be as specified for crushed stone cradle or crushed stone encasement.

3.12 FOUNDATION

A. Crushed Stone

1. In all bedding conditions where a suitable supporting soil or rock stratum occurs at a depth greater than required on the Construction Details or Adopted Plans but less than 2 feet below the pipe or where moderately unstable soil conditions are encountered or where the trench is excavated below the specified depth or where required by the Authority, the foundation shall be modified as follows:

SECTION 02220

EARTHWORK FOR UTILITIES

- a. Except in the case of over-excavation where no extra excavation will be required, the trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Crushed stone shall be spread in 4-inch layers, and each layer shall be compacted with 20-pound hand or pneumatic tampers.
 - b. The foundation shall carry vertically from the supporting stratum up to the required level depending on the pipe diameter and the type of bedding specified.
2. When the above method of stabilizing trenches with crushed stone is unfeasible, the Developer/Builder shall proceed or the suitable supporting soil or rock is greater than 2 feet below the Pipe as described in Paragraph 3.8, QUICKSAND EXCAVATION.

3.13 BACKFILLING

A. General

1. No backfilling shall be done before the Authority gives permission. After pipes have been checked for alignment and bedding, the backfilling may be started. Backfill material may be deposited in trench either by hand or machine. Sufficient number of men shall be available to spread the backfill in uniform layers.
2. At least 30 inches of cover over the top of the pipe shall be provided before the trench is subjected to vehicular loads.
3. At least 48 inches of cover shall be provided before using mobile trench compactors of the impactor type. These compactors shall only be used after the pipe has been properly backfilled in accordance with these Specifications.

B. Visual Inspection

1. After the gravity sewers have been laid and backfill placed to 1 foot above the pipe, a light will be flashed between manholes, or, if the manhole has not yet been constructed, between the location of manholes, by means of a flashlight or mirrored light, to determine whether the alignment of the main is true and whether any pipe has been displaced subsequent to laying. If alignment is correct and no other defects are disclosed, backfilling may be continued. If the inspection shows poor alignment of the main, misplaced pipe or other defects, such defects shall be remedied by the Developer/Builder before the work of backfilling proceeds.

SECTION 02220
EARTHWORK FOR UTILITIES

C. Backfilling In Other Than NJDOT or County Highways.

1. Initial Backfilling of Pipe

- a. This portion of the pipe trench shall be backfilled to provide crushed stone encasement, or crushed stone cradle as previously described.
- b. When concrete cradle is used the initial backfill shall start at the top of the concrete and then continue as specified above.
- c. When concrete encasement is used, the initial backfill of crushed stone will not be required.

2. Backfilling Trench To Underside of Paving or Ground Surface After Initial Backfilling.

- a. After initial backfilling has been compacted as specified above, backfill the remainder of the trench with "Bank Run Gravel" compacted in layers not to exceed 12 inches using a mechanical tamper up to the bottom elevation of the pavement structure, or to within 6 inches of grade in grassed areas.

D. Backfilling in NJDOT and County Highways

1. All material used and backfilling procedures shall comply with the regulations having jurisdiction over the road.

E. Backfilling in Paved Areas

1. When backfilling in paved areas, the backfill material shall be placed or stored on the side of the operation farthest from the road, metal or pavement unless otherwise authorized by the Authority or Highway Authority and in such a manner that there will be no interference with the flow of water in any gutter, drain, pipe, culvert, ditch or waterway. The remaining excavated material must be removed from the site each day as the Work progresses.

3.14 COMPACTION AND TESTING IN PAVED AREAS AND IN AREAS TO BE PAVED IN THE FUTURE

- A. In all paved areas the backfill shall be thoroughly compacted over and around the pipe by use of vibratory tamping pads or where these

SECTION 02220

EARTHWORK FOR UTILITIES

Cannot be used, by mechanical or hand tamping. Backfilling shall be compacted to not less than ninety-five (95%) percent of maximum dry density as determined by ASTM D1557, "Laboratory Compaction Characteristics of Soil Using Modified Effort".

- B. The optimum moisture content and the maximum density of each type of material used for trench backfill shall be determined by "Tests for Moisture-Density Relations of Soils, using 10 lb. Rammer and 18 inch Drop" (ASTM D1557 or ASSHO T-180).
- C. The field moisture content of materials being compacted shall be determined by "Nuclear Test Method ASTM D 3017". The field density of compacted material shall be determined by "Nuclear Test Method ASTM D 2922".
- D. A soils engineering and testing laboratory retained by the Developer/Builder shall perform sufficient tests and inspection procedures both in the field and lab to insure that the provisions of this Specification are met.
- E. After testing is completed and reports are provided, all subgrades below the paving will be examined by the Authority before any paving is authorized.
- F. The responsibility of the Soils Engineering and Testing Laboratory is to the Authority, to whom that firm must promptly, faithfully and accurately report the results of its tests and inspections. The firm must, in addition, work in coordination with the Developer/Builder, making all tests required. The reports must state whether or not the reported results comply with the specified requirements. The tests and control firm shall promptly type and deliver all its reports to the Authority with a copy to the Developer/Builder.

3.15 DISPOSAL OF MATERIAL

- A. Excavated material shall be so placed as not to unreasonably interfere with travel. All macadam and other street surfacing, surface loam and sod shall be kept separate from the remainder of the excavated material.
- B. Upon completion of the backfilling, the property shall be cleaned, all surplus material removed and the surface restored to the condition in which it was, before ground was broken.

Revised 3/00

SECTION 02220

EARTHWORK FOR UTILITIES

- C. Unless otherwise specified, all materials left over shall become the property of the Developer/Builder. Also, underground structures removed, such as brick, concrete and sewer pipe, shall become the property of the Developer/Builder. All surplus excavation shall be removed from the site of the work by the Developer/Builder.

3.16 LIMITS OF TRENCH WIDTH

- A. While installing piping the Builder/Developer shall limit the width of the trench excavation to the following criteria:
 - 1. The maximum width of the trench shall be the bell dimension of the pipe plus 12 inches each side plus 6 inches each side for shoring or trench box.

+ + END OF SECTION + +

SECTION 02230
ROCK EXCAVATION

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. All rock shall be excavated and disposed of as specified herein.

B. Related Work Specified Elsewhere

1. Trench Excavation, Section 02220, EARTHWORK FOR UTILITIES.
2. Sewers, Section 02551, SANITARY SEWERS AND APPURTENANCES.

1.2 DEFINITION

- A. The word "rock", wherever used as the name of an excavated material or material to be excavated, shall mean boulders and pieces of concrete or masonry exceeding 1/3 cubic yards in volume; or solid ledge rock which requires, for its removal drilling and blasting, wedging, sledging, barring, or breaking up with power-operated tools.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. The Developer/Builder shall observe all municipal ordinances and State and Federal laws relating to the transportation, storage, handling and use of explosives.
- B. The licensed blaster(s) shall at all times, have his license on the work site and shall permit examination thereof by official having jurisdiction.

PART 2 PRODUCTS

2.1 EXPLOSIVES

- A. Where blasting is permitted, explosives shall be kept on the site only in such quantity as may be needed for the work under way and only during such time as they are being used.
- B. Explosives shall be stored in a secure manner, separate from all tools and flammable substances.
- C. Caps or detonators shall be safely stored at least 100 feet distant from the explosives.

SECTION 02230

ROCK EXCAVATION

- D. When the need for explosive has ended, all such materials remaining at the site shall be promptly removed from the premises.

PART 3 EXECUTION

3.1 GENERAL

- A. Rock in pipe trenches shall be excavated to limits in accordance with the Specifications.

3.2 BLASTING

- A. All operations involving explosives shall be conducted by experienced personnel only, with all possible care to avoid injury to persons and damage to property.
- B. Blasting shall be done only with such quantities and strengths of explosives and in such manner as will break the rock approximately to the intended lines and grades and yet will leave the rock not to be excavated in an unshattered condition.
- C. Care shall be taken to avoid excessive cracking of the rock upon or against which any structure will be built, and to prevent damage to existing pipes or other structures and property above or below ground.
- D. Rock shall be well covered with logs, blasting mats, or both, where required.
- E. Sufficient warning shall be given to all persons in the vicinity of the work before a charge is exploded. Flagmen shall be employed to stop or direct traffic as required.
- F. All blasting effects shall be monitored in the field by a professional engineer or geologist.
- G. Before any blasting is carried out, the Developer/Builder shall submit to the Authority a report prepared by a professional engineer licensed to practice in the State of New Jersey or Geologist containing specific recommendations for blasting, a copy of the blaster's NJ state license and a copy of the blaster's insurance portfolio. The report shall cover amount of charge, firing times, ground velocities, accelerations and displacements, effects on adjacent structures and field monitoring program. The report shall also include Material Safety Data Sheets (MSDS) for the specific explosives to be employed. The Developer/Builder will also be requested to conduct a pre-blast survey of properties and facilities within a 500 feet of each detonation.

- H. At the end of each Work day remove all wires from blast holes and pick up and dispose of all blasting wires that are laying around the Work area.
- I. The Developer/Builder shall pre-cut paving before blasting to prevent paving from heaving beyond normal trench width. However, this does not relieve the Developer/Builder from the responsibility of repairing damaged paving beyond trench width.

3.3 EXCESS ROCK EXCAVATION

- A. If rock is excavated beyond the limits indicated on the Adopted Plans or in the Specifications, the excess excavation, whether resulting from overbreakage or other causes, shall be backfilled, by and at the expense of the Developer/Builder, as specified below:

- 1. Pipe Trenches

- a. In pipe trenches, excess excavation below the elevation of the bottom of the pipe bedding shall be refilled to the proper grade, using crushed stone.
- b. Excess excavation beyond the specified trench width shall be filled with the specified backfill that is applicable for that section of the trench.
- c. Refer to specification Section 02220, EARTHWORK FOR UTILITIES for definition of crushed stone and backfill material.

3.4 SHATTERED ROCK

- A. If rock below normal depth is shattered due to drilling or blasting operations, the shattered rock shall be removed and the excavation shall be backfilled as described above in "EXCESS ROCK EXCAVATION".

3.5 BLASTING RECORDS

- A. All blasting shall be field monitoring using seismographic type equipment and shall be performed under the supervision of a professional engineer or Geologist, licensed to practice in the State of New Jersey.
- B. Keep and submit to the Authority an accurate record of each blast. The record shall show the general location of the blast, the depth and number of drill holes, the kind and quantity of explosive used, ground velocity and displacements, and other data required for a complete record.

Section 02511
FORCE MAIN

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Provide all labor, materials and equipment necessary to furnish and install all piping, fittings, valves and appurtenances as shown on the Drawings and/or as specified herein.
2. The pipe material for the force main 4 - inches and greater shall be only Ductile Iron Pipe, minimum class 52.
3. The pipe material for force mains 3 - inches and under shall be PVC Pipe, minimum class SDR-26.

Revised: 3/99

CLASS
160

B. Related Work Specified Elsewhere

1. Submittals, Section 01300, SUBMITTALS
2. Clearing, Section 02110, CLEARING AND GRUBBING
3. Earthwork, Section 02220, EARTHWORK FOR UTILITIES
4. Rock, Section 02230, ROCK EXCAVATION
5. Manholes, Section 02560, MANHOLES
6. Concrete, Section 03301, CAST-IN-PLACE CONCRETE
7. Pumping Stations, Section 11077, PUMPING STATIONS

C. Piping Items (included, but not limited to)

1. Piping

Section Added: 2/96

Section 02511
FORCE MAIN

2. Fittings and related appurtenances

1.2 SUBMITTALS

A. Shop Drawings and Catalog Cuts

1. Submit shop drawings and/or legible catalog cuts of all items to be used in the construction of the force main. Submissions shall be in accordance with Section 01300, SUBMITTALS.

B. Test Reports

1. Tests of pipe shall be made by the pipe manufacturer in accordance with requirements of ASTM and/or ANSI.
2. Certified copies of the tests made by the manufacturer, or by a reliable commercial laboratory acceptable to the Authority, shall be submitted to the Authority prior to the first shipment of pipe.

PART 2 PRODUCTS

2.1 PIPE

A. Ductile Iron Pipe

1. Class D-1c, Ductile Iron (mechanical joint) (coal tar epoxy lined)
 - a. Service: Wastewater
2. Class D-2c, Ductile Iron (Push on joint) (Underground with mechanical joint fittings) (coal tar epoxy lined)
 - a. Service: Wastewater
3. Class D-3c; Ductile Iron (flanged) (coal tar epoxy lined)
 - a. Service: Wastewater

B. Pipe Couplings for Ductile Iron Pipe

1. Pipe couplings shall be provided in sizes and at locations shown on the Drawings. Couplings shall be of gasketed, sleeve type, with diameter to properly fit the pipe, and shall consist of one (1) steel middle ring; two (2) steel follower rings; two (2) rubber compound wedge section gaskets and sufficient steel

Section 02511

FORCE MAIN

track-head bolts to properly compress the gaskets. Provide galvanized steel bolts and nuts for outdoor and underground couplings. All underground couplings shall be coated with bitumastic. Aboveground couplings shall be painted. Couplings shall be assembled to provide permanently tight joints, and shall be as manufactured by Dresser Mfg. Div., Bradford, PA, Smith Blair, or equal.

C. Polyvinyl Chloride Pipe

1. Class G-10, PVC 1120, Class SDR-26

a. Service: Wastewater 3 inch and under

Revised: 3/99

PART 3 EXECUTION

3.1 RESTRAINTS

A. General

1. All pipe bends, elbows and fittings shall be restrained with retainer glands and thrust blocks. In addition, all pipe joints located within the designated Zones shall also be restrained.

B. Ductile Iron pipe restraints

1. When Ductile Iron pipe is installed, the method of restraining shall be by means of Mechanical Joint Retainer Gland as manufactured by Standard Water Works Equipment Co., equivalent of American Cast Iron Pipe, or equal.

2. In addition, if Ductile Iron pipe is installed, the type of joint (s) located within all retaining zones shall be Mechanical Joint.

C. Installation

1. Pipe restraints shall be installed in accordance with manufacturers recommendations.

Section 02511
FORCE MAIN

D. Thrust Blocks

1. Fittings, horizontal, and vertical changes of alignment shall be secured in place with suitable concrete foundation or thrust blocks as detailed in the construction details.

E. Restraining Zones

1. All pipe joints within 30 feet from fittings, horizontal and vertical changes of alignment, measured in all directions, shall be provided with mechanical joint pipe and retainer glands.

3.2 DUCTILE IRON INSTALLATION

A. Pipe Installation - General

1. All pipe, fittings and appurtenances shall be carefully inspected in the field before lowering into the trench. All pieces found to be defective shall be rejected. Such rejected pipe shall be clearly tagged in such a manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Developer/Builder at his own expense.
2. Any conflicts during the installation of piping shall be brought to the attention of the Owner and/or his representative.

B. Handling

1. Pipe and accessories shall be handled in such a manner as to insure delivery of the work in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fitting any time after the coating has been applied.

C. Cutting

1. Cutting of pipe shall be done in a neat manner by a method which will not damage the pipe. All cutting of pipe shall be done by means of mechanical cutters of an approved type.

D. Placing, Laying

1. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe will be

Section 02511
FORCE MAIN

rejected. Pipe shall be laid with the bells facing in the direction of laying and for lines on an appreciable slope bells shall face up-grade.

E. Coupling DIP with Push-On Rubber Gasket Joints

1. Gasket seat in the socket and the gasket should be wiped with a cloth. The gasket should be placed in the socket with the large round end entering first, then sprung into gasket seat so that the groove fits over the bead in the seat. A thin film of lubrication should then be applied to the inside surface of the gasket that will come in contact with the entering pipe. Only non-toxic vegetable soap lubricant as recommended by pipe manufacturers shall be used. Mineral oil or petroleum base lubricant shall never be used.
2. The plain end of the pipe to be entered, should be wiped clean and placed in approximate alignment with the bell of the pipe to which it is to be joined. In some cases, it might be desirable to apply a thin film of lubricant to the outside of the plain end for about one (1) inch back from the end. After lubrication, the plain end of the pipe should then be lifted and started into the socket so that it is in contact with the gasket. The joint should be made up with entering pipe deflected at an angle.
3. When pipe is cut in the field, the cut end shall be conditioned so that it may be used to make up the next joint. The outside of the cut end should be tapered back about 1/8 inch at an angle of about thirty (30) degrees with the center line of the pipe by using a coarse file or portable grinder. The operation should remove any sharp, rough edges which otherwise might injure the gasket.
4. When installing rubber gasket joint pipe in below freezing temperatures, keep lubricant and gaskets workable by leaving them in hot water bath when not actually in use or in a heated storeroom.
5. Pipe pulling tools may be rented or purchased from the Pipe Manufacturer by the Developer/Builder.
6. With "Push-On Joints", the joint deflection angle should not exceed amounts recommended by the manufacturer.

Section 02511
FORCE MAIN

F. Mechanical Joints

1. Mechanical joints shall conform to ANSI A21.11, latest issue, be of stuffing box type, adapted for use of a gasket, cast-iron gland and bolts.
2. In making each mechanical joint, the surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material and to provide clean surfaces, which should be brushed with soapy water just prior to slipping the gasket over the spigot end and into the bell. Soapy water brushed over the gasket prior to installation also removes loose dirt, and lubricates the gasket as it is forced into its retaining space.
3. The sequence of assembly is to be as follows: the gland followed by the rubber gasket is to be placed over the spigot end which is inserted into the socket. The gasket should be pushed into position so that it is evenly seated in the socket. The gland is then moved into position against the face of the gasket. Bolts are then to be inserted and made finger tight.
4. When tightening bolts, it is essential that the gland be brought toward the pipe flange evenly maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolts next to the bolts at either side, and last the remaining bolts. This cycle is to be repeated until all bolts are within the following range of bolt torque:

<u>Pipe Size</u>	<u>Range of Torque (Ft.-Lb.)</u>	<u>Bolt Size</u>	<u>Length of Wrench</u>
4-24	75 - 90	3/4 in.	10 in.

5. The above torque load may be applied with torque measuring or indicating length of wrench recommended above. If effective sealing is not attained at the maximum torque indicated above, the joints should be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation will not be permitted.

Section 02511

FORCE MAIN

3.3 PVC PIPE INSTALLATION

A. Handling

1. PVC sewer pipe and fittings shall be stored either inside or outdoors. If it is stored outdoors for long periods, it shall be protected from direct exposure to sunlight.
2. PVC sewer pipe and fittings shall be stored in such a way so that the surfaces to be mated are protected from physical damage and are kept as clean as possible.
3. The pipe shall be stored by providing support at each end and intermediate support at 5-foot intervals along the length of the pipe. The pipe shall be stored in such a way as to prevent sagging or bending.

B. Joints

1. The joints shall be assembled in accordance with the manufacturer's recommended procedure.
2. Lubricants, if necessary for the assembly of the elastomeric gasket joint, shall not be support bacterial growth nor have any deteriorating effect on pipe, fitting or gasket materials and shall be the type recommended by the pipe manufacturer.

C. Pipe Installation

1. Installation shall be made in accordance with ASTM D 2321, "Underground Installation of Flexible Thermoplastic Sewer Pipe".
2. Any field cutting and fitting of the PVC plastic sewer main shall be done in accordance with procedures and techniques specified by the pipe manufacturer.
3. The pipe and fittings shall be installed in accordance with Section 02220 - EARTHWORK FOR UTILITIES.
4. During the installation and backfill of the pipe, care must be taken to prevent movement of the pipe.

Revised: 3/99

Section 02511
FORCE MAIN

PART 4 - TESTING

4.1 TESTING

- A. All pipe testing shall be performed by Developer/Builder at his expense in presence of the Owner and/or his representative as follows:
1. Upon completion of the force main, it shall be tested as one complete unit from beginning to end, filled with water.
 2. Testing shall be performed and passed in accordance with the latest edition of AWWA C600. Testing procedures shall be modified by the following stipulation:
 - a. The point of testing shall be at the low point of each system at 150% of operating pressure or at 75 psi, whichever is greater.
 3. Force Mains shall be tested for leakage at pressure of 50 lbs. above normal working pressure for future condition. (No leakage will be permitted inside buildings.)
 4. Duration of each pressure test shall be one (1) hour.
 5. Allowable leakage, for force mains outside buildings, shall conform to limits indicated in applicable table in the latest edition of AWWA C600.
 6. For convenience only, a copy of AWWA C600-99, Section 5, is attached for reference. However, the Contractor is required to use the latest edition of C600 when performing the pressure test.
 7. All other pipes not listed shall be tested to 50 percent above normal operating pressure. No leakage is permitted.
 8. The Developer/Builder shall provide a certification of all pipe tests.

SECTION 5: VERIFICATION

Sec. 5.1 Inspection

If stipulated in the specifications, all materials are subject to inspection and approval at the manufacturer's plant.

5.1.1 *Inspection on delivery.* All pipe and appurtenances are subject to inspection on delivery. Neither inspection nor failure to provide inspection shall relieve the manufacturer of the responsibility to provide materials meeting the specifications. Material found to be defective because of manufacture or damage in shipment shall be rejected or recorded on the bill of lading and removed from the jobsite. Tests may be performed as specified in the applicable AWWA standard to ensure conformance with the standard. Pipe or appurtenances that fail to comply with specified tests shall be rejected.

5.1.2 *Workmanship.* All pipe and appurtenances shall be installed and joined in conformance with this standard and tested under pressure for defects and leaks in accordance with Sec. 5.2 of this standard.

Sec. 5.2 Hydrostatic Testing

WARNING: The testing methods described in this section are specific for water-pressure testing. These procedures should not be applied for air-pressure testing because of the serious safety hazards involved.

5.2.1 Pressure test.

5.2.1.1 Test restrictions. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section.

Test pressure shall not exceed pipe or thrust-restraint design pressures.

The hydrostatic test shall be of at least a 2-h duration.

Test pressure shall not vary by more than ± 5 psi (34.5 kPa) for the duration of the test.

Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. A test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired.

The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

5.2.1.2 Pressurization. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied using a pump connected to the pipe. Valves shall not be operated in either the opened or closed direction at differential pressures above the rated pressure. The system should be allowed to stabilize at the test pressure before conducting the hydrostatic test.

5.2.1.3 Air removal. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at these points to expel the air as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and the pipe plugged or left in place as required by the specifications.

5.2.1.4 Examination. Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.

5.2.1.5 Testing allowance defined. Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi (34.5 kPa) of the specified test pressure after the pipe has been filled with water and the air has been expelled. Testing allowance shall not be measured by a drop in pressure in a test section over a period of time.

5.2.1.6 Testing allowance. No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula:

In inch-pound units,

$$L = \frac{SD\sqrt{P}}{133,200} \quad (\text{Eq 1})$$

Where:

- L = testing allowance (makeup water), in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

In metric units,

$$L_m = \frac{SD\sqrt{P}}{715,317} \quad (\text{Eq 2})$$

Where:

- L_m = testing allowance (makeup water), in liters per hour
- S = length of pipe tested, in meters
- D = nominal diameter of the pipe, in millimeters
- P = average test pressure during the hydrostatic test, in kPa

These formulas are based on a testing allowance of 11.65 gpd/mi/in. (1.079 L/d/km/mm) of nominal diameter at a pressure of 150 psi (1,034 kPa).

5.2.1.6.1 Testing allowance at various pressures is shown in Tables 6A and 6B.

5.2.1.6.2 When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gal/h/in. (1.2 mL/h/mm) of nominal valve size shall be allowed.

5.2.1.6.3 When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

5.2.1.7 Acceptance of installation. Acceptance shall be determined on the basis of testing allowance. If any test of laid pipe discloses a testing allowance greater than that specified in Sec. 5.2.1.6, repairs or replacements shall be accomplished in accordance with the specifications.

5.2.1.7.1 All visible leaks are to be repaired regardless of the allowance used for testing.

Table 6A Hydrostatic testing allowance per 1,000 ft of pipeline — gph^{\dagger}

Avg. Test Pressure psi	Nominal Pipe Diameter—in.																	
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60	9.56	10.19
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11	9.01	9.61
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58	8.43	8.99
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02	7.80	8.32
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72	7.47	7.97
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41	7.12	7.60
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03	6.76	7.21
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73	6.37	6.80
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36	5.96	6.36
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97	5.52	5.88
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53	5.04	5.37
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.80

*If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

† Calculated on the basis of Eq. 1.

Table 6B Hydrostatic testing allowance per 300 m of pipeline— L/h^\dagger

Avg. Test Pressure KPa	Nominal Pipe Diameter—mm																	
	76	102	152	203	254	305	356	406	457	508	610	762	914	1,067	1,219	1,400	1,500	1,600
3,000	1.84	2.30	3.45	4.59	5.74	6.89	8.04	9.19	10.34	11.49	13.78	17.23	20.67	22.97	27.57	32.16	34.46	36.75
2,800	1.78	2.22	3.33	4.44	5.55	6.66	7.77	8.88	9.99	11.10	13.32	16.64	19.97	22.19	26.63	31.07	33.29	35.51
2,600	1.71	2.14	3.21	4.28	5.35	6.42	7.48	8.55	9.62	10.69	12.83	16.04	19.25	21.39	25.66	29.94	32.08	34.22
2,400	1.64	2.05	3.08	4.11	5.14	6.16	7.19	8.22	9.25	10.27	12.33	15.41	18.49	20.55	24.66	28.76	30.82	32.87
2,200	1.57	1.97	2.95	3.93	4.92	5.90	6.88	7.87	8.85	9.84	11.80	14.75	17.70	19.67	23.61	27.54	29.51	31.47
2,000	1.50	1.88	2.81	3.75	4.69	5.63	6.56	7.50	8.44	9.38	11.25	14.07	16.88	18.76	22.51	26.26	28.13	30.01
1,800	1.42	1.78	2.67	3.56	4.45	5.34	6.23	7.12	8.01	8.90	10.68	13.35	16.01	17.79	21.35	24.91	26.69	28.47
1,600	1.34	1.68	2.52	3.36	4.19	5.03	5.87	6.71	7.55	8.39	10.07	12.58	15.10	16.78	20.13	23.49	25.16	26.84
1,400	1.26	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	9.42	11.77	14.12	15.69	18.83	21.97	23.54	25.11
1,200	1.16	1.45	2.18	2.91	3.63	4.36	5.08	5.81	6.54	7.26	8.72	10.90	13.08	14.53	17.43	20.34	21.79	23.25
1,000	1.06	1.33	1.99	2.65	3.32	3.98	4.64	5.30	5.97	6.63	7.96	9.95	11.94	13.26	15.91	18.57	19.89	21.22
800	0.95	1.19	1.78	2.37	2.97	3.56	4.15	4.74	5.34	5.93	7.12	8.90	10.68	11.86	14.23	16.61	17.79	18.98
600	0.82	1.03	1.54	2.05	2.57	3.08	3.60	4.11	4.62	5.14	6.16	7.70	9.25	10.27	12.33	14.38	15.41	16.44

*If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

†Calculated on the basis of Eq. 2.

PIPING MATERIAL SPECIFICATIONS

CLASS D-1

Material	:	Ductile Iron
Nominal Rating	:	200 psi
Maximum Temperature	:	150 Deg. F.
Construction	:	Mechanical Joint

<u>ITEM</u>	<u>SIZE</u>	<u>DESCRIPTION</u>
Pipe:	3 inch and larger	*Centrifugally cast, thickness class in accordance with Table 51.1 ANSI A21.51. Laying Condition Type "2" (Minimum class thickness shall be 52).
Standard Fittings:	3 inch through 48 inch	Conforming to ANSI A21.10.
Compact Fittings:	3 inch through 12 inch	Conforming to ANSI A21.53.
Joints:		
1.	Pipe and Fittings	Mechanical Joint, ANSI A21.11.
2.	Glands	Ductile, Iron, ANSI A21.11.

PIPING MATERIAL SPECIFICATIONS

CLASS D-1

Gaskets:

1. Mechanical-Joint Rubber, ANSI A21.11.

Couplings:

Coupling shall be cast iron, gasketed, sleeve type, with diameter to properly fit the pipe. Dresser Style 38 as manufactured by Dresser Manufacturer Division or equal. Or Mechanical Joint Sleeve ANSI A21.10. Bolts to be of non-corrosive material.

Bolts:

1. Mechanical Joints High strength; heat treated cast-iron tee-head bolts with Hex. Nuts - ANSI A21.11.

Coatings (Inside):

1. D-1c (Coated) Interior to be coated with 20 mils dry film thickness of coal tar epoxy, Kop-Coat Bitumastic 300-M or equivalent by Valspar Corp. or equal. Exterior shall receive standard bituminous coating.

PIPING MATERIAL SPECIFICATIONS

CLASS D-2

Material	:	Ductile Iron
Nominal Rating	:	200 psi
Maximum Temperature	:	150 Deg. F
Construction	:	Push-on Joint

<u>ITEM</u>	<u>SIZE</u>	<u>DESCRIPTION</u>
Pipe:	3 inch and larger	*Centrifugally cast, thickness class in accordance with Table 51.1 ANSI A21.51 Laying Condition Type "2" (Minimum class thickness shall be 52)
Standard Fittings:	3 inch through 48 inch	Conforming to ANSI A21.10.
Compact Fittings:	3 inch through 12 inch	Conforming to ANSI A21.53.
Joints:		
	1. Pipe	Push-on Joint, ANSI A21.10
	2. Fittings	Mechanical Joint, ANSI A21.11
	3. Glands	Ductile Iron, ANSI A21.11

PIPING MATERIAL SPECIFICATIONS

CLASS D-2

<u>ITEM</u>	<u>SIZE</u>	<u>DESCRIPTION</u>
Couplings:		Coupling shall be cast iron, gasketed, sleeve type, with diameter to properly fit the pipe. Dresser Style 38 as manufactured by Dresser Mfg. Div., or equal. Or Mechanical Joint Sleeve ANSI A21.10
Bolts:		
1.	Mechanical Joints	High strength, heat treated cast-iron tee-head bolts with Hex Nuts - ANSI A21.11
Coatings (Inside):		
1.	D-2c (Coated)	Interior to be coated with 20 mils dry film thickness of coal tar epoxy, Kop-Coat Bitumastic 300-M or equivalent by Valspar Corp. or equal. Exterior shall receive standard bituminous coating.
Gaskets:		
1.	Push-on	Rubber, ANSI A21.11
2.	Mechanical Joint	Rubber, ANSI A21.11

PIPING MATERIAL SPECIFICATIONS

CLASS D-3

Material	:	Ductile Iron
Maximum Working Pressure	:	250 psi
Maximum Temperature	:	150° F.
Construction	:	Flanged

ITEM	SIZE	DESCRIPTION
Pipe:	3 inch and larger	* Centrifugally cast, thickness class in accordance with Table 51.1 ANSI A21.51
Fittings:		Conforming to ANSI A21.10
Joints:	1. Pipe	Threaded flanged according to Table 15.3 ANSI A21.15
Fittings:		Flanged according to ANSI A21.10 Table 10.14
Couplings:		Coupling shall be cast iron of gasketed sleeve type, with diameter to properly fit the pipe. Dresser Style 38 as manufactured by Dresser Manufacturing Division, or equal.
Bolts:	1. Flanged	Bolts and nuts ASTM-A-307 Grade B

PIPING MATERIAL SPECIFICATIONS

CLASS D-3

ITEM	SIZE	DESCRIPTION
Gaskets:		
1.	Flanged	
	a. Water	1/8 inch red rubber ring gasket, dimension in accordance with ANSI A21.15, Appendix A Table A.1
	b. Air, oil, etc.	1/8 inch compressed fibers
Coatings (Inside):		
1.	D-3c. (Epoxy)	Interior to be coated with 20 mils dry film thickness of coal tar epoxy, Kop-Coat Bitumastic 300-M or equivalent by Valspar Corp. or equal. Exterior shall receive standard bituminous coating.

Section 02551
SANITARY SEWERS AND APPURTENANCES

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. All sanitary sewers and appurtenances shall meet the requirements as shown on the Adopted Plans and specified herein.

B. Related Work Specified Elsewhere

1. Utility location, Section 01030, LOCATIONS OF EXISTING LINES.
2. Submittals, Section 01300, SUBMITTALS.
3. Clearing, Section 02110, CLEARING AND GRUBBING.
4. Earthwork, Section 02220, EARTHWORK FOR UTILITIES.
5. Rock, Section 02230, ROCK EXCAVATION.
6. Manholes, Section 02560, MANHOLES.
7. Concrete, Section 03301, CAST-IN-PLACE CONCRETE.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings, cuts and/or samples of all materials to be used in the construction of the sewer lines. Submittals shall be in accordance with Section 01300, SUBMITTALS.

B. Test Reports

1. Tests of pipe shall be made by the pipe manufacturer in accordance with requirements of ASTM and/or ANSI.
2. Certified copies of the tests made by the manufacturer, or by a reliable commercial laboratory acceptable to the Authority, shall be submitted to the Authority prior to the first shipment of pipe.

Section 02551
SANITARY SEWERS AND APPURTENANCES

PART 2 PRODUCTS

2.1 DUCTILE-IRON PIPE WITH RUBBER GASKET JOINTS

A. General

1. Ductile-iron pipe shall be bell and spigot type, centrifugally cast and conforming to standard specifications of American National Standards Institute, ANSI A21.51, Ductile-Iron thickness Class dependent upon size of pipe and depth of cover for Laying Condition Type "2" (minimum Class 52), with slip-on joint of type that employs a single modified bulb shape grooved rubber gasket to effect the joint seal. Inside contour of bell shall provide a seat for the gasket, and an internal bead in the socket shall fit into the groove in the gasket. Plain end of the pipe shall be slightly tapered to ease its sliding fit with the gasket when joint is being made.

B. Fittings For Ductile-Iron Pipe

1. Fittings for Ductile-Iron Pipe may be either gray or ductile iron conforming to latest issue of ANSI A21.10 for short body Gray and Ductile Iron Fittings, for 250 psi water pressure, plus water hammer, and shall be made with mechanical joint ends conforming to ANSI A21.11.

C. Painting Cast Iron and Ductile Iron Pipe and Fittings

1. Extent of Painting
 - a. Interior surfaces of pipe and fittings shall be coated with a coal-tar epoxy.
2. Surface Preparation
 - a. The pipe and fittings shall be painted at the pipe and fittings company's plant. The pipe shall be blown free of all dirt and debris and brushed clean before painting.

Section 02551
SANITARY SEWERS AND APPURTENANCES

3. Painting

- a. The coal tar epoxy shall be Koppers Bitumastic No. 300-M as produced by Koppers Company, Inc., equivalent of Valspar Co. or equal. Apply the coal tar epoxy to pipe interior at a per coat rate recommended by Paint Manufacturer to provide a final dry film thickness of 20 mils. Each coat shall differ enough in color that application of subsequent coats may be easily followed.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. Pipe and Fittings

1. The polyvinyl chloride (PVC) pipe, 4 inches through 15 inches, shall be manufactured in accordance with ASTM D3034 "Specifications for Type PSM Poly (vinyl chloride) (PVC) sewer Pipe and Fittings" having a minimum wall thickness equal to SDR-26 (Standard Diameter Ratio).
2. The polyvinyl chloride (PVC) pipe, 18 inches through 27 inches, shall be manufactured in accordance with ASTM F679 "Specifications for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings" having a minimum wall thickness equal to T-1.
3. The pipe shall be "bell and spigot" type wherein the bell is integral to the pipe. For pipe with belled ends, the thickness of the wall in the bell may be considered satisfactory if the bell was formed on pipe meeting the requirements of the applicable standards.

B. Joints

1. The pipe and fittings shall be joined by the elastomeric gasket system conforming to ASTM D3212 "Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals."
2. The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances.

Section 02551
SANITARY SEWERS AND APPURTENANCES

3. The elastomeric gasket shall be rubber and shall comply with the physical requirements of ASTM F477 "Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe."

Revised: 2/96

2.3 APPURTENANCES

A. Stoppers For Open Ends of Pipe

1. Stoppers shall be provided for the open end of each wye fitting, and lateral and manhole. This stopper shall be compatible to type of joint material being used.

PART 3 EXECUTION

3.1 HANDLING OF DUCTILE-IRON PIPE

- A. Pipe and accessories shall be handled in such a manner as to insure delivery on the work site in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fitting at any time after the coating has been applied.

3.2 HANDLING PVC PIPE

- A. PVC sewer pipe and fittings may be stored either inside or outdoors. If it is stored outdoors 30 days or longer,, it shall be protected from direct exposure to sunlight by covering with opaque materials.
- B. PVC sewer pipe and fittings shall be stored in such a way so that the surfaces to be mated are protected from physical damage and are kept as clean as possible.
- C. The pipe shall be stored by providing support at each end and intermediate support at 5-foot intervals along the length of the pipe. The pipe shall be stored in such a way as to prevent sagging or bending.

Section 02551
SANITARY SEWERS AND APPURTENANCES

3.3 SPECIALS ("Y" BRANCHES)

- A. Wherever necessary, the Developer/Builder shall lay "Y" branches of the same material and strength as the sewer main for the purpose of making building connections. The "Y" branches shall be laid at an angle as shown on the Construction Details.
- B. The spur of the "Y" branch shall be supported by Class "B" concrete or crushed stone in accordance with Standard Construction Details for the pipe used. "Y" branches shall not be backfilled until location has been made by the Authority.

3.4 SADDLES

- A. The saddle location shall be determined in the field. After selecting the location, the hole in the sewer main shall be cut with an approved type of tapping machine as recommended by the pipe manufacturer. No Hand Cutting will be allowed.
- B. The saddle shall be properly located over the hole and held in place with the straps provided with the saddle, in accordance with the Construction Details. Saddles shall be encased in concrete under pipe and over saddle flange.
- C. Saddles will only be used where authorized by the Authority.

3.5 BUILDING CONNECTIONS

- A. Building connections from sewer to curb line, or to the point as required, shall be laid by the Developer/Builder. Building laterals shall be laid in accordance with Standard Construction Details.
- B. In general, specifications for materials, workmanship and watertight construction for building connections shall be the same as for sewers.
- C. Building connections shall be 6" minimum diameter pipe, Schedule 80 PVC minimum, SDR 21, or Ductile Iron Pipe Class 52 minimum.
- D. All building connections shall be provided with a 6" diameter curb cleanout in accordance with the Construction Details.
- E. Building connections from curb line, or to the point as required, to the building shall be constructed on a crushed stone bedding with a minimum thickness of four (4) inches.

Section 02551
SANITARY SEWERS AND APPURTENANCES

3.6 DEEP CUT LATERALS

- A. Where required, deep cut laterals shall be constructed as per Standard Construction Details. All pipe shall conform to specifications. Care shall be taken to have all the joints perfectly made and the alignment correct. They shall be encased in Class "B" concrete to the required height. The concrete shall in all places cover the pipe for a depth of at least 5 inches.

Revised: 2/96

3.7 STOPPERS

- A. Stoppers shall be securely installed in the open end of each wye fitting, lateral and manhole stub. The stopper shall make a watertight closure of the pipe bell end of the pipe.

3.8 PROTECTING AND KEEPING PIPE CLEAN

- A. During construction, the mouth of the completed pipe shall always be kept properly closed with a suitable plug to prevent the entrance therein of any water, earth, stones or other debris. The Developer/Builder shall also take any and all measures to keep the pipe clean and free from deposits and protect the pipe from damage.
- B. If the pipe is damaged from any cause or becomes either partly or completely filled with dirt, stones, sand or other debris, the Developer/Builder shall make all necessary repairs and remove at his own expense all such material.

3.9 PIPE LAYING

- A. After the trench has been brought to the proper grade as heretofore specified, the pipe and specials shall be laid.
- B. Care shall be taken to lay the pipe to true lines and grades. Every pipe laid shall be tested as to grade and alignment. Care must be taken to fit the joints together properly so that the centers of the pipes shall be in one and the same straight line, and so as to give an opening of even thickness, all around between spigot end of pipe and the socket end of specials and fittings. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. The bottom of the trench shall be shaped to give substantially uniform

Section 02551
SANITARY SEWERS AND APPURTENANCES

circumferential support to the bottom quadrant of each pipe when earth bedding is used. Any pipe that has its grade or joints disturbed after laying, shall be taken up and relaid. The interior of all pipe shall be thoroughly cleaned of all foreign matter, before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved

Revised: 2/96

methods. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions, or the weather, is unsuitable for such work. In all cases, water shall be kept out of the trench until the concrete cradle, where used, has hardened. Every precaution necessary to obtain watertight construction for all joints must be taken. This same precaution must be taken for all connections with manholes.

3.10 ASSEMBLY OF DUCTILE-IRON PIPE

- A. Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method which will not damage the pipe. All cutting of pipe shall be done by means of mechanical cutters of an approved type or types. Wheel cutters shall be used wherever practicable.
- B. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged, or unsound pipe will be rejected. Except where necessary in making connections with other lines, pipe shall be laid with the bells facing in the direction of laying and for lines on an appreciable slope bells shall face up-grade.
- C. Coupling DIP With Rubber Gasket Joints
 - 1. The gasket seat in the socket and the gasket should be wiped with a cloth. The gasket should be placed in the socket with the large round end entering first. It can then be sprung into the gasket seat so that the groove fits over the bead in the seat. A thin film of lubricant should then be applied to the inside surface of the gasket that will come in contact with the entering pipe. Only non-toxic vegetable soap lubricant as recommended by pipe manufacturer shall be used. Mineral oil or petroleum base lubricant shall never be used.

SANITARY SEWERS AND APPURTENANCES

2. The plain end of the pipe to be entered, should be wiped clean and placed in approximate alignment with the bell of the pipe to which it is to be joined. In some cases it might be desirable to apply a thin film of lubricant to the outside of the plain end for about one inch back from the end. When sub-freezing temperatures prevail, the joint should assemble easier if lubricant is applied only to the gasket. After lubrication, the plain end of the pipe should then be lifted and started into the socket so that it is in contact with the gasket. The joint should be made up with entering pipe deflected at an angle.
3. The joint should be made by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket (which is thereby compressed) until it makes contact with the base of the socket. This can be accomplished by one of the methods recommended by the Pipe Manufacturer, by crowbar, fork tool or jack type tool.

D. Rubber Gasket Joint Assembly With Field Cut Pipe

1. When pipe is cut in the field, the cut end shall be conditioned so that it may be used to make up the next joint. The outside of the cut end should be tapered back about 1/8 inch at an angle of about 30 degrees with the center line of the pipe by using a coarse file or a portable grinder. The operation removes any sharp, rough edges which otherwise might injure the gasket.

E. When installing Rubber Gasket Joint Pipe in below freezing temperatures, keep lubricant and gaskets workable by leaving them in hot water bath when not actually in use, or in a heated storeroom.

F. The joint deflection angle should not exceed amounts recommended by manufacturer of pipe.

G. Paint Touch-Up of Interior Surfaces

1. Before placement in the field, all areas abraded in transit will be touched up with two (2) coats of the coal-tar epoxy using any additional bonding agent to obtain a proper bond as required by the paint manufacturer. When each joint has been completed, the interior surfaces at the joint shall be fully covered with two (2) coats of the coal-tar epoxy using any necessary bonding agent if recommended by the paint manufacturer to obtain a proper bond.

Section 02551
SANITARY SEWERS AND APPURTENANCES

The Contractor shall make certain that when coatings at joints have been completed, that the interior surface of the pipe has a continuous, unbroken coating.

3.11 INSTALLING PVC PIPE

A. Joints

1. The joints shall be assembled in accordance with the manufacturer's recommended procedure.
2. Lubricants, if necessary for the assembly of the elastomeric gasket joint, shall not support bacterial growth nor have any deteriorating effect on pipe, fitting or gasket materials and shall be the type recommended by the pipe manufacturer.

B. Pipe Installation

1. Installation shall be made in accordance with ASTM D-2321, "Underground Installation of Flexible Thermoplastic Sewer Pipe".
2. Any field cutting and fitting of the PVC plastic sewer main shall be done in accordance with procedures and techniques specified by the pipe manufacturer.
3. The pipe and fittings shall be installed in accordance with Section 02220 - EARTHWORK FOR UTILITIES.
4. During the installation and backfill of the pipe, care must be taken to prevent movement of the pipe.

3.12 TESTS

A. General

1. The Developer/Builder shall perform one or more required tests and shall furnish all apparatus and materials needed for these tests.
 - a. PVC pipe shall be tested for the following:
 - (1) Infiltration or exfiltration tests

Section 02551
SANITARY SEWERS AND APPURTENANCES

- (2) Air tests
 - (3) Deflection tests
 - b. DIP shall be tested for the following:
 - (1) Infiltration or exfiltration tests
 - (2) Air tests
 - 2. After backfilling has been completed, the pipes cleaned and before permanent paving has been installed, the Contractor shall make these tests to ascertain that there are no broken pipe, leaking joints or deflected pipe sections. Pipes failing these tests shall be repaired, or removed at once by the Developer/Builder to the satisfaction of the Authority.
 - 3. The sewer lines and laterals shall be tested for leakage between manholes as the work progresses by both of the following methods.
 - a. Infiltration or Exfiltration Test
 - (1) When 10 feet or more difference in grade occurs between manholes, the Air Testing method will be used.
 - b. Low Pressure Air Test
 - 4. A deflection test will be required for PVC pipe in addition to the above leakage tests.
 - 5. All tests will be witnessed by the Owner and/or his representative.
- B. Infiltration or Exfiltration Methods
- 1. General
 - a. Infiltration or exfiltration tests of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.

Section 02551
SANITARY SEWERS AND APPURTENANCES

2. Infiltration Test

- a. Infiltration tests will be acceptable only when the ground water can be established as imposing a minimum 6 foot head at the pipe invert.
- b. Plug the upstream manhole and make measurement of the flow at the downstream manhole. Amount of leakage from any section of the sewer shall not exceed the allowable gallonage as stated hereinafter per inch diameter of pipe per mile per 24 hours.

3. Exfiltration Test

- a. Exfiltration tests will be acceptable only when a minimum internal head of 6 feet of water can be maintained above the invert of the pipe..
- b. The leakage limit shall not exceed the leakage allowance as stated hereinafter per inch diameter per mile per 24 hours.
- c. When using the exfiltration test method, the average internal pressure in the system under test shall not be greater than 5 pounds per square inch (11.6 ft. hd.), and the maximum internal pressure in any part of the system under test shall not be greater than 10.8 pounds per square inch (25 ft. hd.).

4. Leakage Allowance

- a. Maximum allowable leakage for either infiltration or exfiltration shall be:

<u>Pipe Material</u>	<u>Leakage per inch dia. of pipe per mile per 24 hrs.</u>
PVC	50 gallons
DI	50 gallons

Section 02551
SANITARY SEWERS AND APPURTENANCES

- C. Air Method (For pipes up to and including 16 inches diameter)
1. Low pressure air test of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before trench surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
 2. Equipment shall be as manufactured by Cherne Industrial, Inc. of Edina, Minnesota; N.B. Products, New Britain, PA, or equal. Equipment used shall meet the following minimum requirements:
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - (1) All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs must hold against this pressure without having to be braced.
 - c. All air used shall pass through a single control panel
 - d. Three individual hoses shall be used for the following connections:
 - (1) One hose from control panel to pneumatic plugs for inflation.
 - (2) One hose from control panel to sealed line for introducing the low pressure air.
 - (3) One hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

Section 02551
SANITARY SEWERS AND APPURTENANCES

3. Procedures

- a. After a manhole reach of pipe including laterals has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average ground water back pressure. At least two (2) minutes shall be allowed for the air pressure to stabilize.
- b. After the stabilization period with 3.5 psig minimum pressure remaining in the pipe, the air hose from the control panel to the air supply shall be disconnected. The portion of the sanitary sewer (line) being tested shall be termed "Acceptable," if the time required in minutes or seconds is greater than the times indicated on the Table "B" below for the pressure to decrease from 3.5 psig (greater than the average ground water back pressure) to 2.5 psig (greater than the average ground water back pressure).

TABLE "B"

<u>Pipe Size (in.)</u>	<u>Time</u>
4	2-1/2 minutes
6	4 minutes
8	5 minutes
10	6-1/2 minutes
12	7-1/2 minutes
15	9-1/2 minutes

- c. In areas where a high ground water table (ground water back pressure) is known to exist, the Developer/Builder shall install a 1/2 inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air

Section 02551
SANITARY SEWERS AND APPURTENANCES

through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height of water in the plastic tube in feet shall be divided by 2.3 to establish the pounds of ground water back pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added ground water back pressure shall be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same as defined in the attached tables.)

D. Deflection Test - PVC Only

1. General

- a. Deflection testing shall be performed on all portions of the PVC sewer system. This test shall be performed in sections between manholes 30 days but not more than 12 months after final backfilling has been completed and tested in the area, and the pipe tested for leakage.
- b. Deflection testing shall be performed in accordance with the procedure outlined below.

2. Maximum Deflection

- a. The maximum allowable deflection for all installed PVC sewer pipe shall not exceed 5% of the pipe's original internal diameter.

3. Testing Apparatus

- a. Deflection testing shall be performed with a "go, no-go" mandrel which is sized to such dimensions that it will not "go" when encountering deflection greater than permissible. The test mandrel shall be constructed, at the Developer/Builder's expense, according to the dimensional tolerances as shown in Figure 1, attached herewith.

Section 02551
SANITARY SEWERS AND APPURTENANCES

4. Deflection Testing Procedure
 - a. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
 - b. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A nylon ski rope is recommended).
 - c. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
 - d. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
 - e. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.
 - f. Draw mandrel through the sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.
 - g. If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced at the Contractor's expense; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.
 - h. Re-test this section for deflection.

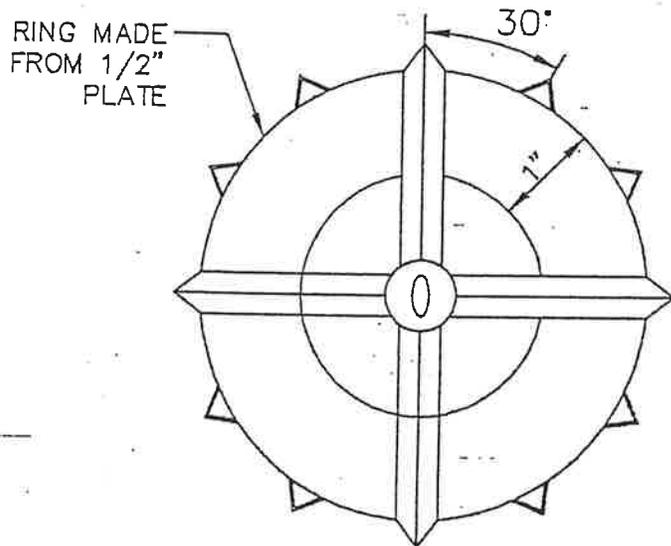
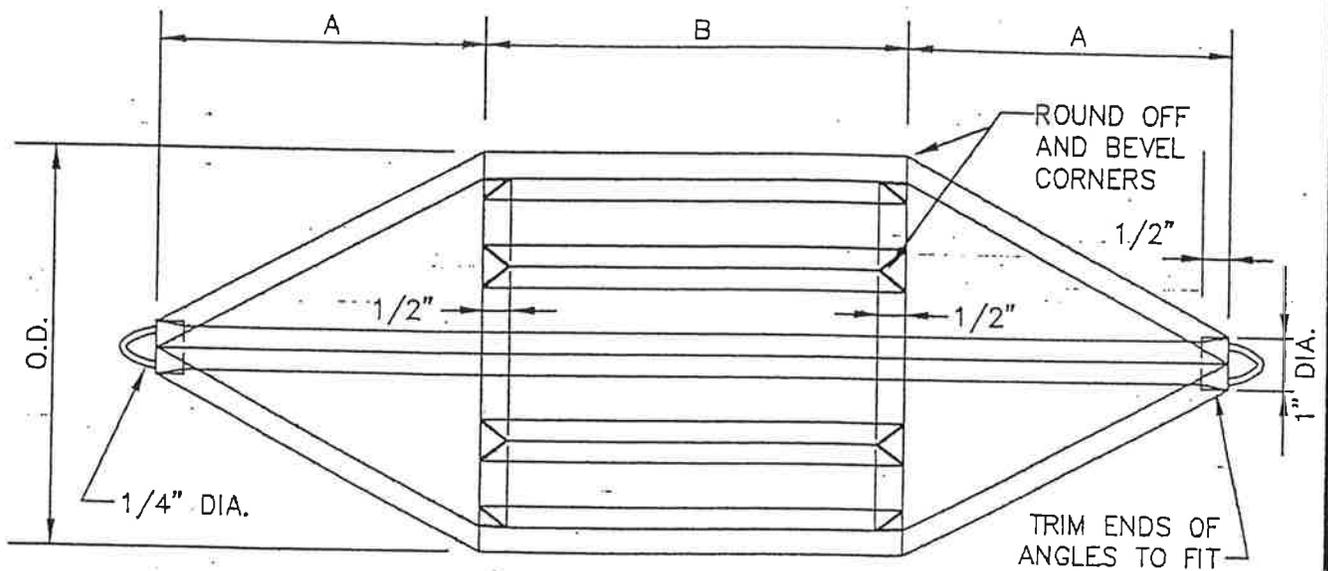
F. Test Failures

1. If the installation fails to meet the stated test requirements, the Developer/Builder at his own expense shall determine the source of leakage, repair or replace all defective materials and/or workmanship failing to meet tests and shall retest same until proven acceptable to the Authority.

Section 02551

SANITARY SEWERS AND APPURTENANCES

2. In the event the result(s) of the test(s) does not fall within the allowable range of acceptance, the Developer/Builder shall take whatever corrective action is necessary including replacement of the said pipe, etc., to bring the result(s) of the test(s) to within the allowable range of acceptance.



NOTES:

1. AFTER WELDING IS COMPLETED, TRUE THE OUTSIDE DIAMETER DIMENSION FOR THE FULL LENGTH OF "B" TO ± 0.010 BY TOOL AND LATHE OR GRINDING.
2. MANDREL CONSTRUCTED OF 1" ANGLE IRON AND 1/2" PLATES.

SIZE	A (inch)	B (inch)	DEFLECTION O.D.	SIZE	A (inch)	B (inch)	DEFLECTION O.D.
4"	3	4	3.71	15"	5	15	13.43
6"	3	6	5.50	18"	6	18	16.13
8"	4	8	7.37	21"	7	21	19.00
10"	4	10	9.23	24"	8	24	21.36
12"	4	12	10.98	27"	9	27	24.06

REVISIONS	TYPICAL GO, NO-GO DEFLECTION TESTING MANDREL CONSTRUCTED FROM 1-INCH ANGLE IRON		DRAWN: LMB
			SCALE: NONE
			FIGURE NO. 1

Section 02560
MANHOLES

PART 1 - GENERAL

1.1 SCOPE

A. Description Of Work

1. All manholes shall be as indicated on the Adopted Plans, Construction Details and as herein specified.

B. Related Work Specified Elsewhere

1. Concrete, Section 03301, CAST-IN-PLACE CONCRETE
2. Trenching, Section 02220, EARTHWORK FOR UTILITIES

1.2 MANHOLE TYPES

A. Type of manholes used in the construction, as described below, shall be at the Developer/Builder's option, unless a specific type is specified on the Adopted Plans or elsewhere in these Specifications.

1. Concrete Block Manholes:

- a. Manholes shall have concrete block walls with corbelled upper section and coated with mortar on the inside and outside. Bottom shall be cast-in-place concrete.

2. Precast Concrete Manholes:

- a. Manholes shall be made up of precast concrete sections of which the top section shall be corbelled. Bottom section may be precast concrete or cast-in-place concrete. The type of manhole base shall be at the Developer/Builder's option.

1.3 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature

1. Submit shop drawings or manufacturer's "cuts" of all manhole items such as covers and frames, steps, type of connection for pipe to

Section 02560
MANHOLES

manhole wall, manhole section joint material and precast sections in accordance with Section 01300, SUBMITTALS.

2. The Developer/Builder shall submit to the Authority, for review, the type of manhole base he intends to use if he elects to use precast manholes.
- B. Samples
1. Samples of bricks shall be submitted for review, accompanied by a test certificate.

PART 2 - PRODUCTS

2.1 BRICKS

- A. Bricks shall be made of clay or shale and none but whole, sound, burnt hard entirely through, straight brick, uniform in structure, with true even faces, free from stones, pebbles, masses of lime, cracks and checks extending into the body of the bricks shall be used. Brick shall not be salvaged or reclaimed.
- B. When struck with a trowel, bricks shall give a clear, ringing sound and a fracture shall show uniform and compact structure.
- C. Brick shall comply with "Specification For Building Brick (Solid Masonry Units Made From Clay or Shale," (ASTM C 62). The bricks shall be tested by an independent laboratory for compression and absorption in accordance with "Brick, Sampling and Testing," (ASTM C 67).

2.2 MORTAR

- A. Composition of mortar shall conform to "Mortar For Unit Masonry," ASTM C 270, Type N.

2.3 CONCRETE AND GROUT

- A. Concrete shall be in accordance with Section 03301, CAST-IN-PLACE CONCRETE.

Section 02560
MANHOLES

- B. Grout shall be "Masterflow 713 Grout" manufactured by Master Builders, or "Non Shrink 5 Star Grout" manufactured by U.S. Grout Corporation or equal. Grout shall be capable of meeting the test requirements of ASTM C 827.

2.4 CRUSHED STONE

- A. Crushed stone shall be in accordance with the crushed stone specified in Section 02220, EARTHWORK FOR UTILITIES, of these Specifications.

2.5 MANHOLE STEPS

- A. Manhole steps shall be extruded 6061-T6 aluminum and shall be equal to the (Construction Details).
- B. Portions of manhole steps which are to be embedded in concrete shall be protected by coating those portions with a mastic or other suitable protective coating, which will prevent corrosion due to galvanic action. Direct contact between the aluminum alloy step and any steel reinforcing bars or other dissimilar metal will not be permitted.
- C. Manhole steps or plastic manhole step inserts shall be cast into the walls of risers and conical top sections at the factory, and shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole at a maximum distance apart of 12 inches and extend out of the wall a minimum of 7 inches for cast-in-place walls and minimum 6 inch for brick and precast manholes. Steps shall be located a minimum of 6 inches from the ends of riser and top sections, and shall be securely embedded in manhole risers and tops. Manhole step inserts shall be Flex Lok plastic or equal.

2.6 MANHOLE FRAMES AND COVERS

- A. General
 - 1. Castings shall be heavy duty gray cast iron, meeting ASTM A 48 Specifications, designed for H-20 loading as designated by AASHTO.
 - 2. Castings shall be free from cracks, holes, swells and cold shuts. All manhole castings shall be made accurately to the pattern and to the dimensions shown on Drawings, and shall be planed where

Section 02560
MANHOLES

marked, or where otherwise necessary to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid after construction is finished will be condemned and must be replaced by perfect lids.

3. No plugging, burning in or filling will be allowed. Covers must fit the frames in any position.

B. Standard Type Manhole Frame and Cover

1. Shall conform to details on the Construction Details and be standard sheet casting. Lettering as indicated on the Construction Details shall be cast on the cover in letters 2 inches high. Two (2) pick holes shall be located diametrically opposite and two (2) fixed lifting rings shall also be located diametrically opposite. Frame base shall have four (4) 1 inch diameter holes in it to receive the anchor bolts. Provide "O" ring gasket in cover.

C. Watertight Covers

1. Manholes at specific locations indicated on the Adopted Plans shall each be equipped with a watertight cover. Each of these manholes shall be of standard construction, equipped with Frame and Cover conforming to details on the Construction Details. Lettering as indicated on the Construction Details shall be cast on the cover in letters 2 inches high. Frame and Cover shall be watertight type with stainless steel bolts, machined bearing surfaces and flat neoprene gasket.

D. Anchor Bolts

1. Anchor bolts for bolting manhole frame to the precast or block manholes shall be made of 3/4 inch diameter all-thread steel rods with a minimum 2-inch projection through the frame. The all-thread steel rods shall have a 5 inch hook for embedment when block manholes are used. The all-thread steel rod, washer and nuts shall be galvanized.

Revised: 5/96

Section 02560
MANHOLES

2. The concrete inserts for use in pre-cast manholes shall be in accordance with Federal Spec. WW-H-171C (Type 18). Cinch anchoring will not be permitted.

F. Mastic

1. Mastic for use between manhole frame and manhole top shall be equal to that as specified for "Joint Material" in Paragraph 2.8,D of this section of the Specifications.

2.7 FIELD MADE PIPE CONNECTIONS

- A. The type of pipe connection for block manholes and cast-in-place bases for precast manholes shall be in accordance with the following:

1. When DIP or PVC pipe is used, Type "A" joint as detailed in the Construction details shall be furnished.

2.8 PRECAST CONCRETE MANHOLES AND COMPONENTS

A. General

1. The sections shall be a minimum of 4 feet in diameter for pipe sizes up to, and including 21 inches internal diameter. (For pipes with an internal diameter between 21 and 36 inches, the manhole shall be 5 feet in diameter, unless otherwise noted.)
2. The Sections shall conform to the requirements of "Specifications For Precast Reinforced Concrete Manhole Sections" (ASTM C 478), except that the joints shall be sealed with a preformed flexible plastic gasket.

B. Risers and Top Sections

1. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous manhole. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.

Revised: 2/96

Section 02560
MANHOLES

2. Manhole barrels shall consist of riser and top sections. The top section shall be an eccentric conical section with thickened upper walls with the smallest inside diameter equal to 30 inches, to receive the manhole frame and cover. No more than two (2) lift holes shall be cast in each barrel or top section.
3. Manhole riser and top sections shall be designed, manufactured, tested, finished and marked in accordance with this specification and "Specifications For Precast Reinforced Concrete Manhole Sections" (ASTM C 478 Latest Revision).
4. Manholes shall be constructed by the wet process method and shall have a slump of 3-1/2 inches to 4-1/2 inches. A letter of certification shall be submitted to the Authority stating that these requirements have been attained.

C. Precast Manhole Bases

1. The bases shall be integrally cast and shall consist of a manhole bottom and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of 4 inches between the invert of the lowest outflowing sewer and floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. No more than two lift holes shall be cast in the bases.
 - a. Manholes 4 feet in diameter shall have a bottom at least 6 inches thick and a wall at least 5 inches thick.
 - b. Manholes 5 feet in diameter shall have a bottom at least 8 inches thick and a wall at least 6 inches thick.

D. Joint Material

1. The joint material shall be a preformed flexible plastic gasket. It shall consist of hydrocarbon plastic and vulcanized rubber and shall be capable of meeting the following conditions:

Revised: 2/96

Section 02560
MANHOLES

- a. Hydrocarbon plastic content 50-70% by weight per ASTM D 297
 - b. Volatile matter 2.0% max. by weight per ASTM D 6
 - c. Specific gravity, 77 deg. F-1.20 to 1.35 per ASTM D 71
 - d. Ductility, 77 deg. F 5.0 cm min. per ASTM D 113
 - e. Softening Point, ring and ball, 320 deg. F min. per ASTM D 36
 - f. Penetration, cone 77 deg. F, 150 gm, 5 sec., in 0.1 mm. - 50-120 per ASTM D 217
 - g. Flash point, C.O.C., 600 deg. F min. per ASTM D 92
 - h. Fire point, C.O.C., 625 deg. F min. per ASTM D 92
 - i. Inert mineral filler 30-50% by weight
 - j. Material, when in place, shall not leak at joints while being subjected to 10 PSI test for 24-hr. period.
 - k. No sagging of vertical and overhead 1 inch wide joints shall be detected while being subjected to temperature of 135 deg. F for period of 5 days.
 - l. No visible deterioration of compound when immersed separately in solution of acid, alkalis and saturated hydrogen sulfide, for period of 30 days.
2. Sealing compound shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in place. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound.

Revised: 2/96

Section 02560
MANHOLES

- E. Pipe Connections To Precast Manhole Bases and/or Sections
1. The type and method of the pipe connection to the manhole base or section shall be in accordance with the following method:
 - a. When DIP or PVC pipe is used, Type "A" joint as detailed in the Construction details shall be installed at the time of casting.
- F. Curing Concrete Manhole Sections
1. When forms are stripped from a section, a cement slurry shall be brushed on to outside of section to fill in voids which appear on face of the section.
 2. Within 2 hours after the section has been cast, it shall be enclosed within a suitable steam-curing chamber or enclosure that will protect the pipe from outside drafts. Enclosure shall allow full circulation of saturated vapor around the inside and outside of the section, and the curing shall keep all concrete surfaces continuously moist throughout the curing process. The ambient temperature rise about the pipe at any time shall not exceed 30 Deg. F. per hour. The ambient temperature within the enclosure shall not be raised above 100 Deg. F. by the use of steam within 2 hours after completion of concrete placement; thereafter, the temperature shall be maintained between 90 Deg. and 150 Deg. F. for the remainder of the steam-curing, except as provided for interruption of cure to remove the headers and pallets to prepare the section ends.
 3. The curing cycle shall be maintained for a period of 12 hours.
 4. The top and bottom rings used to form the tongue and groove ends shall remain on the section for the entire curing cycle.
 5. Each manhole section shall be aged seven (7) days before coating is applied in the field.

Revised: 2/96

Section 02560
MANHOLES

2.9 CONCRETE BLOCKS

- A. Concrete blocks shall be solid, precast segmental concrete masonry units. They shall be made from portland cement conforming to requirements of current ASTM C150 Type I and coarse aggregate of broken stone or washed gravel. Broken stone shall be trap rock, granite or gneiss.
- B. Concrete blocks shall be rectangular in shape. The overall length shall not be less than 12 inches and not more than 18 inches. The height shall be not less than 5 inches and not more than 8 inches. The width shall be not less than 6 inches. Blocks intended for use in corbel section or tops of manholes may be of special shapes and heights.
- C. The compressive strength at the twenty-eight (28) day age of said blocks shall be not less than 5,000 pounds per square inch. Maximum absorption for any sample shall not exceed 7 percent.

PART 3 - EXECUTION

3.1 GENERAL

- A. Schedule
 - 1. Manholes shall be constructed promptly as the sections of the sewer between them are completed.
- B. Ground Water
 - 1. All ground water shall be kept away from newly poured concrete, or freshly laid blockwork, until concrete has properly set, and a watertight job is obtained. Manholes which admit ground water after completion, must be repaired to the satisfaction of the Authority and at such time as they may specify. The Developer/Builder shall use extra care in embedding pipes in blockwork and in the concrete floor to obtain watertight joints.
 - 2. Any noticeable ground water leakage into the manhole shall be repaired in a manner satisfactory to the Authority. As soon as the manhole is completed, the Developer/Builder shall remove all loose brick, mortar and debris.

Section 02560
MANHOLES

C. Drop Connections

1. In all manholes, where the grade line of one sewer is 2-feet or more higher than that of the other or where specifically noted on the Drawings, the connection shall be made by means of a "drop connection." Pipe and specials used shall conform to the piping specifications and/or as shown on the Construction Details. Concrete for encasing pipe shall be Class "B", poured against undisturbed earth.
2. For encasing PVC pipe in concrete, the complete rise cannot be poured until the bottom section is cured, see the Construction Details for the limit of pour.

D. Line and Grade

1. Care shall be taken to have all pipes laid to correct lines and grades as established for the project.

3.2 BLOCK MANHOLES

A. Placement of Cast-In-Place Manhole Bases

1. The bases shall be constructed of cast-in-place, reinforced concrete, and shall consist of the manhole bottom including the shaped invert and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer.
2. Manhole bases, including bottoms, inverts and walls shall be formed using standard metal forms designed specifically for this use.
3. The concrete to be used shall be Class "B".
4. The bases shall rest upon a base of sound, level, undisturbed earth. If required to reach a sound foundation, the Developer/Builder shall furnish and install crushed stone to provide a stable base.
5. Before pouring a cast-in-place base, the downstream and upstream pipes shall be set to proper grade so the pipe ends will be flush with the inside of the manhole. If PVC pipe is being used, place the coupling or rubber gasket around the pipe before pouring the base. When pouring the concrete base, an 8 inch concrete bedding shall

Section 02560
MANHOLES

be placed under the pipes out to the first pipe joint as indicated on the Construction Details. Flow channels shall be formed as the base is cast so as to conform to the inside diameter of the pipes.

B. Blockwork

1. All concrete blocks shall be carefully laid of thickness and dimension as shown on the Construction Details. Joints shall not be more than 1/4 inch thickness. Block masonry shall not be laid, or cement work of any kind done, when the temperature is below 40 Degrees F.
2. The walls shall be corbelled so that there is a straight side where steps are placed and shall be carried to such a height that when the casting is placed thereon, it shall not project above the finished grade of the street.

C. Plastering

1. The inside and outside of the blockwork of all manholes shall be plastered with Type I or Type II Portland cement mortar. The thickness of the mortar plaster shall be 1/2 inch, and the mortar shall be carefully spread and thoroughly troweled, leaving a smooth, substantially waterproof surface. The mortar shall be extended to completely cover the outside and inside surface of all blockwork.

D. Bitumastic Coating

1. Block manholes shall be bitumastic coated as specified for precast manholes.

3.3 PRECAST MANHOLES

A. Handling

1. All precast manhole components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast manhole lip.
2. All damage to precast sections shall be thoroughly repaired in the presence of the Authority. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before

Section 02560
MANHOLES

application of grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed to accommodate the bottom precast section.

B. Painting (Interior)

1. Extent of Painting

- a. Painting interior from top to and including bottom of manholes shall only be required for those first three (3) manholes downstream of a force main connection.
- b. Interior surfaces of these manholes requiring paint, shall be painted with a coal-tar epoxy.

2. Surface Preparation

- a. The manholes shall be painted at the manufacturers plant and shall be aged seven (7) days before being painted. The concrete shall first be wire brushed clean and then blown free of all dirt, debris and residue before painting.
- b. No slurry mix shall be used on the interior of manholes. If the manholes have been steel troweled on the interior surfaces, they shall be sandblasted (brush blast) and then blown free of all residue to provide a proper bonding surface.

3. Painting

- a. The coal-tar epoxy shall be Koppers Bitumastic No. 300M as produced by Kop-Coat, Division of Carboline Company, equivalent of Valspar Co. or equal. Apply the coal-tar epoxy to manhole interior at a per coat rate recommended by the paint manufacturer to provide a final dry film thickness of 20 mils. Each coat shall differ enough in color that application of subsequent coats may be easily followed.

Revised: 2/96

Section 02560
MANHOLES

4. Certification

- a. Prior to shipment to the job site, the Developer/Builder shall furnish and deliver to the Authority, a certification from the manhole manufacturer stating that the manhole being furnished has been painted in accordance with this specification.

C. Site Inspection of Precast Sections

1. Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manhole sections may be rejected because of any of the following:
 - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
 - b. Defects that indicate imperfect proportioning, mixing, and molding.
 - c. Surface defects indicating honey-combed or open texture.
 - d. Damaged or cracked end, where such damage would prevent making a satisfactory joint.
 - e. Any continuous crack having a surface width of 0.01 inch (0.25 mm) or more and extending for a length of 12 inches (305 mm) or more, regardless of position in the section wall.

D. Bitumastic Coating

1. Prior to setting the precast sections in place each section shall have the exterior concrete surface blown free of all dirt and debris and brushed clean and then coated with bitumastic.
2. The coating shall be Bitumastic Super Service Black as manufactured by Kop-Coat, a Division of Carboline Co., equivalent of Valspar Corp., or equal.

Revised: 2/96

Section 02560
MANHOLES

3. At least three (3) coats shall be applied giving a total dry film thickness of a minimum of 32.0 mils.
4. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 32 mils dry film thickness.
5. The Developer/Builder shall provide a certification to the Authority stating that he has installed the exterior manhole coating in accordance with the manufacturer's recommendations and that there is a minimum of 32 mil of material on all manholes.

E. Placement of Cast-In-Place Manhole Bases

1. The bases shall be constructed of cast-in-place, reinforced concrete, and shall consist of the manhole bottom including the shaped invert and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer.
2. Manhole bases, including bottoms, inverts and walls shall be formed using standard metal forms designed specifically for this use.
3. The concrete to be used shall be Class "B".
4. The bases shall rest upon a base of sound, level, undisturbed earth. If required to reach a sound foundation, Developer/Builder shall furnish and install crushed stone to provide a stable base.
5. Before pouring a cast-in-place base, the downstream and upstream pipes shall be set to proper grade so the pipe ends will be flush with the inside of the manhole. If PVC pipe is being used, place the coupling or rubber gasket around the pipe before pouring the base. When pouring the concrete base a concrete bedding shall be placed under the pipes out to the first pipe joint as indicated on the Construction Details. Standard metal forms supplied by the manhole manufacturer shall be used for the work in constructing the bases. The form shall include a ring at the top to form a groove to receive the first precast riser section. Flow channels shall be formed

Revised: 5/96

Section 02560
MANHOLES

as the base is cast so as to conform to the inside diameter of the pipes.

F. Placement of Precast Manhole Bases

1. The precast manhole bases shall be installed on a crushed stone foundation. The sub-base shall be leveled then compacted crushed stone, to a depth as indicated on the Construction Details shall be installed before the base is set. The stone shall extend up around the pipes to at least the spring line of the pipe. The maximum extent of the stone shall be in accordance with the pipe encasement details.
2. Pipes entering precast sections of manholes shall be installed as follows:
 - a. When DIP or PVC is used, joint shall be Type "A" as shown on the Construction Details.

G. Placement

1. Manhole sections shall not be set by wedging or placing shims to secure proper level and manholes shall not be backfilled without the permission of the Authority.
2. All lift holes shall be plugged with non-shrinking grout.

H. Masonry Work

1. The top of all precast manholes may be brought to proper grade for receiving manhole frames by using not more than three courses of brick. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick shall be laid in full beds of mortar and shoved into place. All joints shall be full and not more than 1/2 inch in thickness. The Developer/Builder shall set in place and bond in the masonry all necessary steps and miscellaneous items specified elsewhere. The masonry walls shall be parged on the inside and outside with a one-half inch coat of Portland Cement mortar.
2. Mortar used in brickwork, setting manhole frames, and parging, shall be prepared by thoroughly mixing: One (1) volume of Type II

Section 02560
MANHOLES

Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of uniform consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well graded, and shall pass a standard No. 4 sieve.

3. All mortar to be used in joining manhole sections, filling lift holes in risers, and in sealing pipe joints of manholes shall be a mixture of non-shrink grout. All manhole joints inside and outside shall be sealed with a mortar plaster after the sections have been set.
4. Masonry shall not be constructed during cold weather (air temperature below 40 Degrees F.) unless necessary precautions are observed as permitted by the Authority.

3.4 FLOW CHANNELS AND BENCH WALLS

- A. The method of constructing flow channels and bench walls is dependent on which manhole base has been installed.
- B. In precast bases, the flow channels and bench walls in each manhole shall be carefully formed of mortar and brick, or concrete.
- C. In cast-in-place bases, the flow channels and bench walls are monolithically constructed with the base.
- D. The minimum depth of flow channel shall be equal to $3/4$ the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole.
- E. Bench walls shall be pitched a minimum of 1 inch but not more than 2 inches per foot from the inside periphery of the manhole to the edge of the flow channel.

3.5 MANHOLE FRAMES AND COVERS

- A. Manhole frames and covers shall be brought to proper grade as previously noted, set in a $1/2$ inch bed of mastic that shall completely fill the space between the manhole frame and top of manhole. Frame shall be anchored in place with the four (4) $3/4$ inch diameter anchor bolts which shall be securely embedded in the top of the manhole.

Section 02560
MANHOLES

3.6 TESTS

A. General

1. After the gravity sewers, sewage force mains, and manholes have been installed and backfilled, the manholes shall be tested for leakage.
2. The Developer/Builder may select water testing or vacuum testing as specified below.

B. Water Testing

1. All sewers entering and leaving each manhole shall be plugged. Those manholes which are constructed in a high ground water table location shall be allowed to remain plugged for a period of not less than four (4) hours, after which the quantity of inward leakage accumulation shall be measured by bailing and measuring and/or computation against depth of water and diameter of the manhole. Those manholes constructed above the ground water table shall be filled with water to the top of the cast iron frame and allowed to stand until the walls are well soaked. The manhole shall then be refilled to the full or overflow point and remain undisturbed for a period of not less than four (4) hours. The loss of water shall be measured by refilling to the top with a premeasured quantity of water and/or computation against depth of water loss and diameter of the manhole.
2. Gain or loss by the respective methods shall not exceed the following:
 - a. 0.02 gal. per hour, per vertical ft. of depth in top section
 - b. 0.03 gal. per hour, per vertical ft. of depth in a cone section
 - c. 0.04 gal. per hour, per vertical ft. of depth in a 4 foot diameter barrel section

Revised: 2/96

Section 02560
MANHOLES

- d. 0.05 gal. per hour, per vertical ft. of depth in a 5 foot diameter barrel section
- e. 0.06 gal. per hour, per vertical ft. of depth in a 6 foot diameter barrel section
- f. 0.07 gal. per hour, per vertical ft. of depth in a 7 foot diameter barrel section
- g. 0.08 gal. per hour, per vertical ft. of depth in a 8 foot diameter barrel section

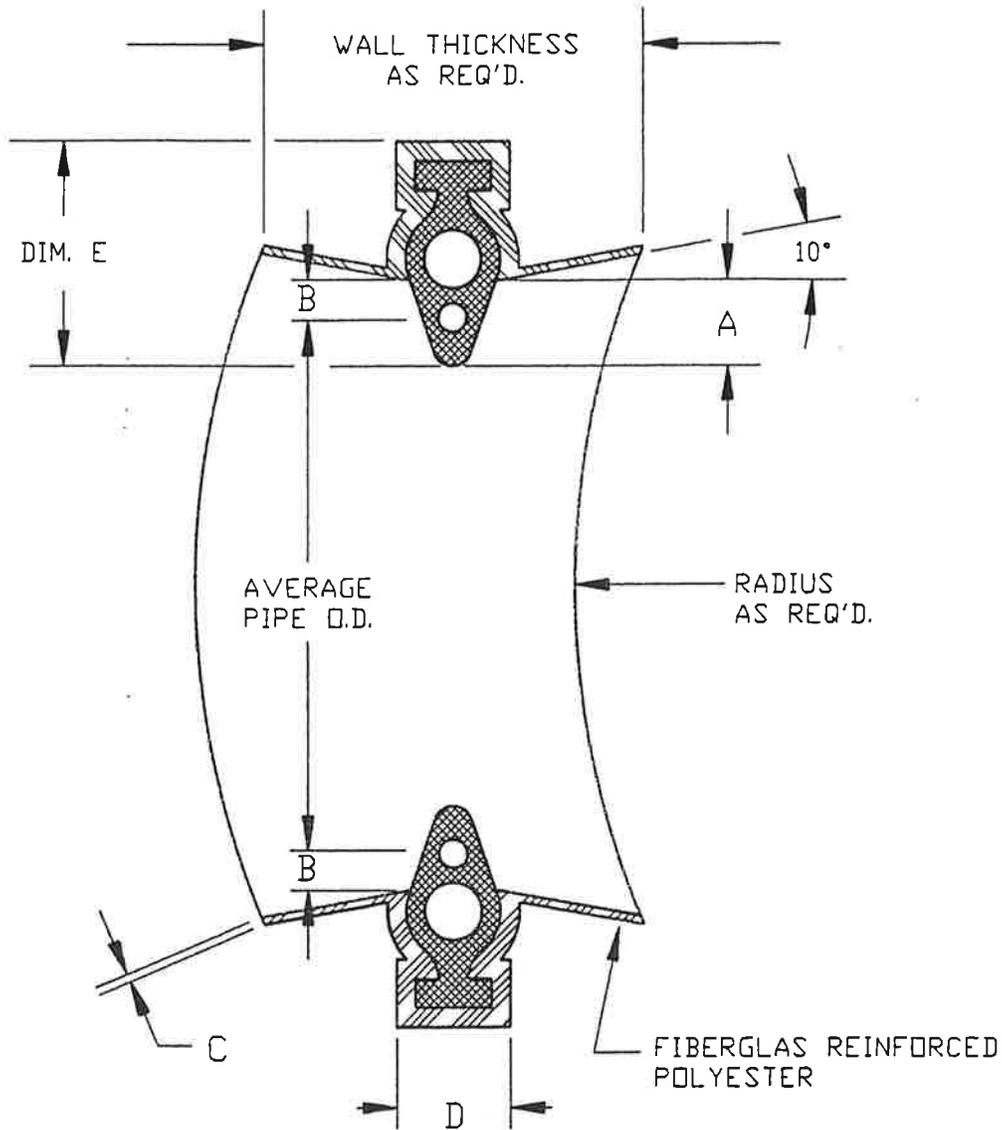
C. Vacuum Testing

- 1. All lines entering and leaving each manhole shall be plugged and plugs securely braced to prevent the vacuum from pulling the plugs out of the pipe. The vacuum test shall be performed before the frame and cover are installed. Lift holes shall be plugged with a non-shrinking mortar. Provide all the necessary hardware to perform the vacuum test as manufactured by NPC Systems, Inc., Milford, NH or equal. With the vacuum testing equipment in place proceed with the following:
 - a. Inflate the compression band to effect a seal between the vacuum base and the manhole.
 - b. Connect the vacuum pump to the outlet port with the valve open.
 - c. Draw a vacuum of 10 inches of Hg.
 - d. Close the valve.
- 2. A manhole will be considered acceptable if it takes more than 60 seconds for a 48-inch, 75 seconds for a 60-inch and 90 seconds for a 72-inch diameter manhole for the vacuum to drop from 10-inch of Hg to 9-inch of Hg. regardless of depth.

Section 02560
MANHOLES

3.7 FIELD CONNECTION OF NEW PIPE INTO AN EXISTING MANHOLE

- A. Field connections of new PVC or ductile iron pipe to an existing manhole shall be made in the following manner:
1. Draw a circle with a diameter 3 inches larger than that of the repair sleeve. On this circle, drill a series of 1 inch (or larger) holes no further than 5 inches center to center. Remove concrete and reinforcing steel within this circle.
 2. Set the repair sleeve in hole.
 3. Prepare a non-shrink grout in accordance with manufacturers instructions. Do not install in temperatures below 35 degrees F. Use clean water to mix materials.
 4. Pack annular space firmly with grout. Shave excess material flush with the wall of the manhole.
 5. Allow grout to cure a minimum of 6 hours before inserting pipe into the gasket.
 6. The repair sleeve shall be A-LOK as manufactured by A-LOK Concrete Products Inc. of Tullytown, Pennsylvania.



PIPE DIA.	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
4.00 [101.6] - 6.00 [152.4]	.875 [22.23]	.375 [9.53]	.250 [6.35]	1.250 [31.75]	1.975 [50.17]
8.00 [203.2] - 24.0 [609.6]	1.375 [34.93]	.625 [15.88]	.250 [6.35]	1.500 [38.10]	2.725 [69.22]
30.0 [762.0] - 59.5 [1511.3]	1.750 [44.45]	.750 [19.05]	.250 [6.35]	1.750 [44.45]	3.375 [85.73]
60.0 [1524] - UP	2.125 [53.98]	.875 [22.23]	.250 [6.35]	2.000 [50.80]	4.000 [101.6]

FLATWALL FIELD SLEEVE CAN BE MADE UPON REQUEST.

NOTE: TO DETERMINE OVERALL HEIGHT OF FIELD SLEEVE USE THE FOLLOWING FORMULA:

$$\text{DIM E} \times 2 + \text{A} \cdot \text{LOK I.D.} = \text{HEIGHT}$$

A•LOK PRODUCTS INC.

P.O. BOX 1647 TULLYTOWN, PA. 19007
697 MAIN STREET TULLYTOWN, PA. 19007

(215) 547-3366
1-800-822-2565

FIELD SLEEVE DETAIL CHART

Section 02561
GREASE TRAPS

PART 1 - GENERAL

1.1 SCOPE

A. Description Of Work

1. All grease traps shall be as indicated on the Adopted Plans Details and as herein specified.
2. All grease traps shall be located where they will be accessible to the Authority for inspection.
3. Grease traps shall serve that part of the plumbing system into which grease will be discharged. Grease traps shall not receive flow from any other source.

B. Related Work Specified Elsewhere

1. Concrete, Section 03301, CAST-IN-PLACE CONCRETE
2. Trenching, Section 02220, EARTHWORK FOR UTILITIES

1.2 GREASE TRAP TYPES

A. Type of grease trap used in the construction, as described below, shall be at the Developer/Builder's option, unless a specific type is specified on the Adopted Plans or elsewhere in these Specifications.

1. Concrete Block Grease Traps:
 - a. Grease Traps shall have concrete block walls with corbelled upper section and coated with mortar on the inside and outside. Bottom shall be cast-in-place concrete.
2. Precast Concrete Grease Traps:
 - a. Grease Traps shall be made up of precast concrete sections of which the top section shall be corbelled. Bottom section may be precast concrete or cast-in-place concrete. The type of grease trap base shall be at the Developer/Builder's option.

Section 02561
GREASE TRAPS

1.3 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature

1. Submit shop drawings or manufacturer's "cuts" of all Grease Trap items such as covers and frames, baffles, type of connection for pipe to grease trap wall, grease trap section joint material and precast sections in accordance with Section 01300, SUBMITTALS.
2. The Developer/Builder shall submit to the Authority, for review, the type of grease trap base he intends to use if he elects to use precast grease traps.

B. Samples

1. Samples of bricks shall be submitted for review, accompanied by a test certificate.

PART 2 - PRODUCTS

2.1 BRICKS

- A. Bricks shall be made of clay or shale and none but whole, sound, burnt hard entirely through, straight brick, uniform in structure, with true even faces, free from stones, pebbles, masses of lime, cracks and checks extending into the body of the bricks shall be used. Brick shall not be salvaged or reclaimed.
- B. When struck with a trowel, bricks shall give a clear, ringing sound and a fracture shall show uniform and compact structure.
- C. Brick shall comply with "Specification For Building Brick (Solid Masonry Units Made From Clay or Shale," (ASTM C 62). The bricks shall be tested by an independent laboratory for compression and absorption in accordance with "Brick, Sampling and Testing," (ASTM C 67).

2.2 MORTAR

- A. Composition of mortar shall conform to "Mortar For Unit Masonry," ASTM C 270, Type N.

Section 02561
GREASE TRAPS

2.3 CONCRETE AND GROUT

- A. Concrete shall be in accordance with Section 03301, CAST-IN-PLACE CONCRETE.
- B. Grout shall be "Masterflow 713 Grout" manufactured by Master Builders, or "Non Shrink 5 Star Grout" manufactured by U.S. Grout Corporation or equal. Grout shall be capable of meeting the test requirements of ASTM C 827.

2.4 CRUSHED STONE

- A. Crushed stone shall be in accordance with the crushed stone specified in Section 02220, EARTHWORK FOR UTILITIES, of these Specifications.

2.5 GREASE TRAP BAFFLES

- A. Grease trap baffles shall be molded polyethylene.

2.6 GREASE TRAP FRAMES AND COVERS

- A. General
 - 1. Castings shall be heavy duty gray cast iron, meeting ASTM A 48 Specifications, designed for H-20 loading as designated by AASHTO.
 - 2. Castings shall be free from cracks, holes, swells and cold shuts. All grease trap castings shall be made accurately to the pattern and to the dimensions shown on Drawings, and shall be planed where marked, or where otherwise necessary to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid after construction is finished will be condemned and must be replaced by perfect lids.
 - 3. No plugging, burning in or filling will be allowed. Covers must fit the frames in any position.

Section 02561
GREASE TRAPS

B. Standard Type Grease trap Frame and Cover

1. Shall conform to details on the Construction Details and be standard sheet casting. Lettering as indicated on the Construction Details shall be cast on the cover in letters 2 inches high. Two (2) pick holes shall be located diametrically opposite and two (2) fixed lifting rings shall also be located diametrically opposite. Frame base shall have four (4) 1 inch diameter holes in it to receive the anchor bolts. Provide "O" ring gasket in cover.

C. Watertight Covers

1. Grease traps at specific locations indicated on the Adopted Plans shall each be equipped with a watertight cover. Each of these grease traps shall be of standard construction, equipped with Frame and Cover conforming to details on the Construction Details. Lettering as indicated on the Construction Details shall be cast on the cover in letters 2 inches high. Frame and Cover shall be watertight type with stainless steel bolts, machined bearing surfaces and flat neoprene gasket.

D. Anchor Bolts

1. Anchor bolts for bolting grease trap frame to the precast grease traps shall be made of 3/4 inch diameter all-thread steel rods with a minimum 2-inch projection through the frame. The all-thread steel rods shall have a 5 inch hook for embedment when block grease traps are used. The all-thread steel rod, washer and nuts shall be galvanized.
2. The concrete inserts for use in pre-cast grease traps shall be in accordance with Federal Spec. WW-H-171C (Type 18). Cinch anchoring will not be permitted.

F. Mastic

1. Mastic for use between grease trap frame and grease trap top shall be equal to that as specified for "Joint Material" in Paragraph 2.8,D of this section of the Specifications.

Section 02561
GREASE TRAPS

2.7 FIELD MADE PIPE CONNECTIONS

- A. The type of pipe connection for block grease traps and cast-in-place bases for precast grease traps shall be in accordance with the following:
1. When DIP or PVC pipe is used, Type "A" joint as detailed in the Construction details shall be furnished.

2.8 PRECAST CONCRETE GREASE TRAPS AND COMPONENTS

A. General

1. The grease trap shall have a minimum capacity of 500 gallons, unless the Authority approves otherwise upon review of the appropriate engineering documentation which shall be submitted by the Developer/Builder
2. Grease traps shall be designed in accordance with the Building Code requirements of ACI 318, AASHTO H20 truck loading, and ASTM C913.
3. The materials shall conform to the following standards:
 - a. Concrete shall be Class "B"
 - b. Wire mesh shall conform to ASTM A185.
 - c. Reinforcing rods shall be ASTM A615 grade 60.
4. All joints shall be sealed with a preformed flexible plastic gasket.
5. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous grease trap. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the grease trap.
6. Grease traps shall be constructed by the wet process method and shall have a slump of 3-1/2 inches to 4-1/2 inches. A letter of certification shall be submitted to the Authority stating that these requirements have been attained.

Section 02561
GREASE TRAPS

B. Joint Material

1. The joint material shall be a preformed flexible plastic gasket. It shall consist of hydrocarbon plastic and vulcanized rubber and shall be capable of meeting the following conditions:
 - a. Hydrocarbon plastic content 50-70% by weight per ASTM D 297
 - b. Volatile matter 2.0% max. by weight per ASTM D 6
 - c. Specific gravity, 77 deg. F-1.20 to 1.35 per ASTM D 71
 - d. Ductility, 77 deg. F 5.0 cm min. per ASTM D 113
 - e. Softening Point, ring and ball, 320 deg. F min. per ASTM D 36
 - f. Penetration, cone 77 deg. F, 150 gm, 5 sec., in 0.1 mm. - 50-120 per ASTM D 217
 - g. Flash point, C.O.C., 600 deg. F min. per ASTM D 92
 - h. Fire point, C.O.C., 625 deg. F min. per ASTM D 92
 - i. Inert mineral filler 30-50% by weight
 - j. Material, when in place, shall not leak at joints while being subjected to 10 PSI test for 24-hr. period.
 - k. No sagging of vertical and overhead 1 inch wide joints shall be detected while being subjected to temperature of 135 deg. F for period of 5 days.
 - l. No visible deterioration of compound when immersed separately in solution of acid, alkalies and saturated hydrogen sulfide, for period of 30 days.
2. Sealing compound shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in place. The sealing compound shall be

Section 02561
GREASE TRAPS

protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound.

- C. Pipe Connections To Precast Grease trap Bases and/or Sections
1. The type and method of the pipe connection to the base or section shall be in accordance with the following method:
 - a. When DIP or PVC pipe is used, Type "A" joint as detailed in the Construction details shall be installed at the time of casting.
- D. Curing Concrete Grease trap Sections
1. When forms are stripped from a section, a cement slurry shall be brushed on to outside of section to fill in voids which appear on face of the section.
 2. Within 2 hours after the section has been cast, it shall be enclosed within a suitable steam-curing chamber or enclosure that will protect the pipe from outside drafts. Enclosure shall allow full circulation of saturated vapor around the inside and outside of the section, and the curing shall keep all concrete surfaces continuously moist throughout the curing process. The ambient temperature rise about the pipe at any time shall not exceed 30 Deg. F. per hour. The ambient temperature within the enclosure shall not be raised above 100 Deg. F. by the use of steam within 2 hours after completion of concrete placement; thereafter, the temperature shall be maintained between 90 Deg. and 150 Deg. F. for the remainder of the steam-curing, except as provided for interruption of cure to remove the headers and pallets to prepare the section ends.
 3. The curing cycle shall be maintained for a period of 12 hours.
 4. The top and bottom rings used to form the tongue and groove ends shall remain on the section for the entire curing cycle.
 5. Each grease trap section shall be aged seven (7) days before coating is applied in the field.

Section 02561
GREASE TRAPS

PART 3 - EXECUTION

3.1 GENERAL

A. Schedule

1. Grease traps shall be constructed promptly as the sections of the sewer between them are completed.

B. Ground Water

1. All ground water shall be kept away from newly poured concrete, or freshly laid brickwork, until concrete has properly set, and a watertight job is obtained. Grease traps which admit ground water after completion, must be repaired to the satisfaction of the Authority and at such time as they may specify. The Developer/Builder shall use extra care in embedding pipes in blockwork and in the concrete floor to obtain watertight joints.
2. Any noticeable ground water leakage into the grease trap shall be repaired in a manner satisfactory to the Authority. As soon as the grease trap is completed, the Developer/Builder shall remove all loose brick, mortar and debris.

3.2 BLOCK GREASE TRAPS

A. Placement of Cast-In-Place Grease trap Bases

1. The bases shall be constructed of cast-in-place, reinforced concrete.
2. Grease trap bases shall be formed using standard metal forms designed specifically for this use.
3. The concrete to be used shall be Class "B".
4. The bases shall rest upon a base of sound, level, undisturbed earth. If required to reach a sound foundation, the Developer/Builder shall furnish and install crushed stone to provide a stable base.

Section 02561
GREASE TRAPS

B. Blockwork

1. All concrete blocks shall be carefully laid of thickness and dimension as shown on the Construction Details. Joints shall not be more than 1/4 inch thickness and all brick shall be thoroughly wet before laying, preferably by immersion. Block masonry shall not be laid, or cement work of any kind done, when the temperature is below 40 Degrees F.

C. Plastering

1. The inside and outside of the blockwork of all grease traps shall be plastered with one (1) to two (2) Portland cement mortar. The thickness of the mortar plaster shall be 1/2 inch, and the mortar shall be carefully spread and thoroughly troweled, leaving a smooth, substantially waterproof surface. The mortar shall be extended to completely cover the outside and inside surface of all blockwork.

D. Bituminous Coating

1. Block grease traps shall be bituminous coated as specified for precast grease traps.

3.3 PRECAST GREASE TRAPS

A. Handling

1. All precast grease trap components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast grease trap lip.
2. All damage to precast sections shall be thoroughly repaired in the presence of the Authority. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed to accommodate the bottom precast section.

Section 02561
GREASE TRAPS

B. Site Inspection of Precast Sections

1. Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of grease trap sections may be rejected because of any of the following:
 - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
 - b. Defects that indicate imperfect proportioning, mixing, and molding.
 - c. Surface defects indicating honey-combed or open texture.
 - d. Damaged or cracked end, where such damage would prevent making a satisfactory joint.
 - e. Any continuous crack having a surface width of 0.01 inch (0.25 mm) or more and extending for a length of 12 inches (305 mm) or more, regardless of position in the section wall.

C. Bitumastic Coating

1. Prior to setting the precast sections in place each section shall have the exterior concrete surface blown free of all dirt and debris and brushed clean and then coated with bitumastic.
2. The coating shall be Bitumastic Super Service Black as manufactured by Kop-Coat, a Division of Carboline Co., equivalent of Valspar Corp., or equal.
3. At least three (3) coats shall be applied giving a total dry film thickness of a minimum of 32.0 mils.
4. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 32 mils dry film thickness.
5. The Developer/Builder shall provide a certification to the Authority stating that he has installed the exterior grease trap coating in

Section 02561
GREASE TRAPS

accordance with the manufacturer's recommendations and that there is a minimum of 32 mil of material on all grease traps.

D. Placement of Cast-In-Place Grease trap Bases

1. The bases shall be constructed of cast-in-place, reinforced concrete.
2. Grease trap bases, including bottoms and walls shall be formed using standard metal forms designed specifically for this use.
3. The concrete to be used shall be Class "B".
4. The bases shall rest upon a base of sound, level, undisturbed earth. If required to reach a sound foundation, Developer/Builder shall furnish and install crushed stone to provide a stable base.

E. Placement of Precast Grease trap Bases

1. The precast grease trap bases shall be installed on a crushed stone foundation. The sub-base shall be leveled then compacted crushed stone, to a depth as indicated on the Construction Details.
2. Pipes entering precast sections of grease traps shall be installed as follows:
 - a. When DIP or PVC is used, joint shall be Type "A" as shown on the Construction Details.

F. Placement

1. Grease trap sections shall not be set by wedging or placing shims to secure proper level and grease traps shall not be backfilled without the permission of the Authority.
2. All lift holes shall be plugged with non-shrinking grout.

H. Masonry Work

1. The top of all precast grease traps may be brought to proper grade for receiving grease trap frames by using not more than three courses of brick. Masonry construction shall be performed by

Section 02561
GREASE TRAPS

experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick shall be laid in full beds of mortar and shoved into place. All joints shall be full and not more than 1/2 inch in thickness. The Developer/Builder shall set in place and bond in the masonry all necessary steps and miscellaneous items specified elsewhere. The masonry walls shall be parged on the inside and outside with a one-half inch coat of Portland Cement mortar.

2. Mortar used in brickwork, setting grease trap frames, and parging, shall be prepared by thoroughly mixing: One (1) volume of Type II Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of uniform consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well graded, and shall pass a standard No. 4 sieve.
3. All mortar to be used in joining grease trap sections, filling lift holes in risers, and in sealing pipe joints of grease traps shall be a mixture of non-shrink grout.
4. Masonry shall not be constructed during cold weather (air temperature below 40 Degrees F.) unless necessary precautions are observed as permitted by the Authority.

3.4 GREASE TRAP FRAMES AND COVERS

- A. Grease trap frames and covers shall be brought to proper grade as previously noted, set in a 1/2 inch bed of mastic that shall completely fill the space between the grease trap frame and top of grease trap. Frame shall be anchored in place with the four (4) 3/4 inch diameter anchor bolts which shall be securely embedded in the top of the grease trap.

3.5 TESTS

A. General

1. After the gravity sewers and grease traps have been installed and backfilled, the grease traps shall be tested for leakage.
2. The Developer/Builder may select water testing or vacuum testing as specified below.

Section 02561
GREASE TRAPS

B. Test Procedure (Utilizing Water)

1. All sewers entering and leaving each grease trap shall be plugged. Those grease traps which are constructed in a high ground water table location shall be allowed to remain plugged for a period of not less than four (4) hours, after which the quantity of inward leakage accumulation shall be measured by bailing and measuring and/or computation against depth of water and inside perimeter area of the grease trap. Those grease traps constructed above the ground water table shall be filled with water to the top of the cast iron frame and allowed to stand until the walls are well soaked. The grease trap shall then be refilled to the full or overflow point and remain undisturbed for a period of not less than four (4) hours. The loss of water shall be measured by refilling to the top with a premeasured quantity of water and/or computation against depth of water loss and inside perimeter area of the grease trap.
2. Gain or loss by the respective methods shall not exceed the following:
 - a. 0.02 gal. per hour, per vertical ft. of depth in top section
 - b. 0.04 gal. per hour, per vertical ft. of depth in an inside perimeter area equivalent to a 4 foot diameter barrel section
 - c. 0.05 gal. per hour, per vertical ft. of depth in an inside perimeter area equivalent to a 5 foot diameter barrel section
 - d. 0.06 gal. per hour, per vertical ft. of depth in an inside perimeter area equivalent to a 6 foot diameter barrel section
 - e. 0.07 gal. per hour, per vertical ft. of depth in an inside perimeter area equivalent to a 7 foot diameter barrel section
 - f. 0.08 gal. per hour, per vertical ft. of depth in an inside perimeter area equivalent to an 8 foot diameter barrel section

C. Alternate Test Procedure (Utilizing a Vacuum Test)

1. All lines entering and leaving each grease trap shall be plugged and plugs securely braced to prevent the vacuum from pulling the plugs

Section 02561
GREASE TRAPS

out of the pipe. The vacuum test shall be performed before the frame and cover are installed. Lift holes shall be plugged with a non-shrinking mortar. Provide all the necessary hardware to perform the vacuum test as manufactured by NPC Systems, Inc., Milford, NH or equal. With the vacuum testing equipment in place proceed with the following:

- a. Inflate the compression band to effect a seal between the vacuum base and the grease trap.
 - b. Connect the vacuum pump to the outlet port with the valve open.
 - c. Draw a vacuum of 10 inches of Hg.
 - d. Close the valve.
2. A grease trap will be considered acceptable if it takes more than 60 seconds for a 48-inch, 75 seconds for a 60-inch and 90 seconds for a 72-inch equivalent inside perimeter area grease trap for the vacuum to drop from 10-inch of Hg to 9-inch of Hg. regardless of depth.

**** END OF SECTION ****

Section 02602
REPAVING

PART 1 - GENERAL

1.1 SCOPE

A. Description of Work

1. Repaving of all areas of paving disturbed or damaged by the construction work shall be in accordance with Township, City, State or County Highway requirements.
2. Work shall be in accordance with the Adopted Plans and/or as specified herein.

B. Related Work Specified Elsewhere

1. Restoration of non-paved areas, Section 02810, RESTORATION OF DISTURBED AREAS.

1.2 QUALIFICATIONS

A. Applicable Specifications

1. State of New Jersey, Department of Transportation Standard Specifications.

B. Qualifications

1. The Developer/Builder shall be experienced in paving and use the proper equipment as required by New Jersey Department of Transportation.

1.3 NOTIFICATIONS

- A. The Developer/Builder shall notify all companies and authorities that have existing utilities in the streets, that are to be overlaid, to raise their valve boxes, manholes or other affected system appurtenances.

Section 02602
REPAVING

1.4 SUBMITTALS

- A. In accordance with Section 01300, SUBMITTALS, submit for the Authority's review the type of "Winter Mix" temporary repaving that will be used during the winter months.

PART 2 - PRODUCTS

2.1 MANHOLE ADJUSTMENT

- A. For raising manhole covers, provide a maximum of three (3) courses of brick under the frame

PART 3 - EXECUTION

3.1 GENERAL

- A. Permanent repaving can only be done between March 1 and October 31.

3.2 RAISING OR LOWERING MANHOLE COVERS AND VALVE BOXES

- A. Install the bricks in all sewer and storm manholes that require adjusting to meet the elevation of the repaving. Manhole covers that are to be lowered shall be done so by removing a portion of the top of the manhole structure to meet the elevation of the repaving. The frame shall then be secured to the top of the manhole structure with a watertight connection.
- B. Coordinate the raising of all valve boxes and/or manhole covers belonging to other utilities.
- C. The Developer/Builder shall be responsible to see that all such items as mentioned above are adjusted to the new paving elevation.

Revised: 2/96

Section 02602
REPAVING

3.3 JURISDICTION OF HIGHWAYS

- A. The Developer/Builder shall contact the Authority(s) having jurisdiction of the road(s) involved to obtain the detailed repaving and restoration requirements.

END OF SECTION

SECTION 02810

RESTORATION OF DISTURBED AREAS

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. Areas disturbed by construction excavation and trenching for pipes must be restored to original condition by the Developer/Builder, upon completion of backfilling. Restoration work shall be done when weather conditions are suitable in spring and fall of the year.

B. Related Work Specified Elsewhere

1. Soil erosion: Section 01020, EROSION AND SEDIMENT CONTROL PLAN
2. Clearing and grubbing: Section 02110, CLEARING AND GRUBBING
3. Earthwork: Section 02220, EARTHWORK FOR UTILITIES

1.2 RECOMMENDATION OF AGRICULTURAL AGENT

- A. Two (2) one-pint samples from each source of topsoil proposed for use shall be forwarded to the Local State Agricultural Agent for his recommendations as to types and quantities of soil conditioners, fertilizers, and seed mixtures to be applied for a dense, vigorous growth of perennial lawn-quality grass. If a better seed is recommended by the Agricultural Agent than the minimum specified herein, then the Agricultural Agent's recommendation will govern.

1.3 SUBMITTALS

- A. In accordance with the Section 01300, SUBMITTALS, submit proposed names of fertilizers, sod and seed mixtures together with their composition to the Authority for review.

PART 2 PRODUCTS

2.1 TOPSOIL

- A. Topsoil shall be a natural, fertile, friable soil, typical of productive soils in the vicinity, obtained from naturally well drained areas, neither excessively acid nor alkaline, and containing no substances harmful to grass growth.
- B. Topsoil shall not be delivered to the site in frozen or muddy condition.

SECTION 02810

RESTORATION OF DISTURBED AREAS

- C. Topsoil stockpiled during construction may be used if it meets the above requirements.

2.2 FERTILIZERS

- A. The fertilizers shall be of the composition as recommended by the Agricultural Agent.

2.3 SEED

- A. The seed shall be of the composition as recommended by the Agricultural Agent.
- B. Seed shall be of an approved mixture, new crop, clean, high in germinating value and low in weed seed. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates relative to mixture purity and germinating value.

2.4 SOD

- A. Sod shall be live, fresh, and of similar mix as used in seeding lawns. It shall be suitable for the purpose intended and for the soil in which it is to be planted.
- B. All the sod for sodding shall be at least 8 inches wide, not less than 12 inches long, and shall have at least 1-1/2 inches in thickness, of dirt on its roots. Broken or damaged sod shall not be used.

2.5 JUTE NETTING

- A. Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yard, 48 in. in width plus or minus 1 inch and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of plus or minus five percent (5%), with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half of its normal diameter.
- B. Paper fabric with synthetic netting shall be biodegradable paper. The netting shall be interconnected and the paper interwoven by strips. The rolls should be no less than 60 inches and weigh an average of 0.23 pounds per S.Y. ii
- C. Staples for anchoring soil stabilization matting shall be made of 12 to 20 inch lengths of No. 8 plain iron wire.

SECTION 02810

RESTORATION OF DISTURBED AREAS

PART 3 EXECUTION

3.1 UNCULTIVATED AREAS

- A. All uncultivated areas that are disturbed by the Developer/Builders operation shall be restored to their original condition with similar materials.
- B. Areas shall be cleaned and all surplus materials removed.

3.2 CULTIVATED AREAS

A. General

- 1. Existing seeded and/or planted areas disturbed by the construction shall be loamed, fertilized and seeded or sodded.
- 2. Furnish and apply soil conditioners, fertilizers and seed as recommended by the Agricultural Agent.

B. Topsoil

- 1. The Developer/Builder shall place the topsoil on all grassed areas damaged by his operations. Topsoil shall be at least 6 inches deep.

C. Fertilizing and Rolling

- 1. Soil conditioners and fertilizers shall be spread and thoroughly worked into the topsoil, in accordance with the recommendations of the agent. Then the topsoil shall be raked until the surface is finely pulverized and smooth and shall be compacted with rollers, weighing not over 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines and grades. Minimum depth shall be 6 inches after compaction.

D. Seeding

- 1. Seeding shall be done when approved by the County Agent.
- 2. If there is a delay in seeding, during which weeds grow or soil is washed out, the Developer/Builder shall remove the weeds or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

SECTION 02810

RESTORATION OF DISTURBED AREAS

3. Seed shall be sown at the approved rate, on a calm day and preferably by machine, but if by hand, only by experienced workmen.
4. One half the seed shall be sown in one direction and the other half at right angles. Seed shall be raked lightly into the soil to a depth of 1/4 inch and rolled with a roller weighing not more than 100 pounds per linear foot of tread.
5. The surface shall be kept moist by a fine spray until the grass shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than three (3) square feet, the Developer/Builder shall reseed, roll, and water as necessary to obtain proper germination.
6. Water, weed, cut, and otherwise maintain and protect seeded areas as necessary to produce and maintain a dense, healthy growth of perennial lawn grass.

E. Sodding

1. Sodding shall be required if the grades exceed 2 to 1 slope.
2. Sod shall be planted only when the soil is moist and favorable to growth. The area to be sodded shall be shaped and finished and the surface loosened prior to placing the sod. The grade shall be kept moist by sprinkling, if necessary, until the sod is placed. The sod shall be placed on the prepared surface with the edges in close contact and, as far as possible, in a position to break joints. Each piece of sod laid shall be fitted and tamped into place with hand tampers not less than one hundred (100) square inches in area.
3. A sufficient quantity of water shall be applied to all sod after laying, to insure immediate and continued growth.

3.3 JUTE NETTING

A. Site Preparation

1. In general, jute and paper matting shall be used on the critical slopes or as required, to prevent seed washout and soil erosion.
2. Remove rocks, clods over 1-1/2 inches in diameter, sticks and other material that will prevent contact of the matting with the soil surface.

SECTION 02810

RESTORATION OF DISTURBED AREAS

B. Lime, Fertilizer and Seed

1. Lime, fertilize and seed in accordance with the applicable seeding standard except that for jute matting one-half of the seed may be applied prior to laying the matting and the remaining seed applied after laying the matting.

C. Installing Netting

1. Start laying the matting from the top of the channel or slope and unroll downgrade so that one edge of the strip coincides with the channel center. Lay a second strip parallel to the first on the other side of the channel and allow at least a 2 inch overlap for jute matting. If one roll of matting does not extend the length of the channel, continue downhill with additional rolls.
2. Secure the matting by burying the top end of jute strips in a trench 4 inches or more deep. Tamp the trench full of soil. Reinforce with a row of staples driven through the jute about 4 inches downhill from the trench. These staples should be about 10 inches apart. Then staple the overlap in the channel center. These staples should be 3 to 4 feet apart. The outside edges may be stapled similarly at any time after the center has been stapled. Closer stapling along the sides is required where concentrated water may flow into the channel.
3. Succeeding strips of matting, farther down the channel or slope, are secured in a similar manner. Strips of matting on the swale slopes should be layed and secured as above to a height of 3 feet above base of swale.
4. Where one roll of jute matting ends and another roll begins, the end of the top strip overlaps the trench where the upper end of the lower strip is buried. Make the overlap at least 4 inches and staple securely.

D. Erosion Stops

1. At any point, jute matting may be folded for burying in silt trenches and secured as were the upper ends. This checks water flow and erosion that may begin under the matting. It also gives improved tie-down. The procedure is recommended on the steeper slopes of sandy soil and gentler slopes subject to seepage. Spacings vary from 25 to 100 feet as required by the Authority.

SECTION 02810

RESTORATION OF DISTURBED AREAS

E. Diversions

1. Where diversions outlet into the waterway, the outlet should be protected with matting used in the same manner as in the main channel. The matting for the outlet is laid first so that matting in the main channel will overlap the outlet strip.

F. Matting Soil Contact

1. Get contact between matting and soil by rolling after laying, stapling and seeding are complete. Perfect contact is vital to keep water flow over, not under, the matting.

G. Inspection

1. After job completion, make sure the matting is in contact with the soil at all places and that critical areas are securely stapled down.

3.4 INSPECTION AND ACCEPTANCE

- A. At the beginning of the next planting season after that in which the permanent grass crop is sown, the seeded areas will be inspected. Any section not showing dense, vigorous growth at that time shall be promptly reseeded by the Developer/Builder.

+ + END OF SECTION + +

Division 3
CONCRETE

SECTION 03301
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

A. Description of Work

1. All concrete shall be as shown on the Adopted Plans and specified herein.

1.2 APPLICABLE SPECIFICATIONS

A. The Developer/Builder shall follow the practices and standards of the following American Concrete Institute Specifications which are made part of this specification:

1. ACI-214, "Recommended Practice for Evaluation of Compression Test Results of Field Concrete"
2. ACI-304, "Recommended Practice for Measuring, Mixing and Placing Concrete"
3. ACI-613, "Recommended Practice for Selecting Proportions for Concrete"

B. ASTM C150, "Specification for Portland Cement"

C. ASTM C33, "Specification for Concrete Aggregates"

D. ASTM A615, "Specification for Deformed Billet Steel Bars for Concrete Reinforcement"

1.4 CLASS OF CONCRETE

A. All concrete work shall be Class B.

B. Higher classes of concrete, if required by State or County Highway Departments shall be provided if necessary.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement shall be an acceptable brand of Portland Cement, ASTM C150, Type I. In the event field conditions require, and the Authority finds it acceptable, a high-early strength Portland Cement, Type III may be used. Only one brand of cement shall be used in this work.

SECTION 03301

CAST-IN-PLACE CONCRETE

- B. Water shall be clean, free from organic or vegetable matter, acid, alkali, or other injurious elements.
- C. Fine Aggregate shall be clean hard natural sand or manufactured sand, or a combination of both and shall conform to ASTM C33.
- D. Coarse Aggregate shall be hard, durable, uncoated crushed stone, gravel or air cooled blast-furnace slag conforming to ASTM C33. Maximum size of coarse aggregate shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear distance between reinforcing bars, whichever is least. In no case shall the maximum size exceed 1-1/2 inches.
- E. All reinforcing bars shall conform to ASTM A615 Grade 60.
- F. Wire for fabrication of the welded wire fabric shall conform to ASTM A82.

2.2 PROPORTIONING

- A. Concrete mix shall have a consistency enabling it to be readily worked into all corners of the form and around all reinforcing by usual methods of placing and consolidating without permitting segregation or excessive free water.
- B. All concrete on project shall be air-entrained, and the air content shall not exceed the requirements set forth in Table 3, ACI-613 for air-entrained concrete.
- C. Concrete mix shall be proportioned by an acceptable independent testing and/or inspection laboratory. The design shall provide the following minimum 28 day compressive strengths:
 - 1. Class B Concrete - 3000 psi
- D. Regardless of the strengths shown by testing, all Class B shall be designed with a minimum cement content of five (5) sacks per cubic yard.
- E. The slump of the concrete mix shall be 4 inches.
- F. Concrete design mix shall be submitted to the Authority for review before work commences. No concrete shall be placed until the Authority has reviewed and accepted the design mix.

SECTION 03301
CAST-IN-PLACE CONCRETE

2.3 NON-SHRINK GROUT

- A. Non-Shrink, Non-Metallic Grout shall be "Sika Grout 212" by Sika Corporation, Lyndhurst, NJ, or equal.
- B. The epoxy compound shall be "Sikadur 32, Hi-Mod" by Sika Corporation, Lyndhurst, NJ.

2.4 GROUT

- A. Grout shall be a Portland Cement Grout made from Type 2 cement, sand and 3/8 inch crushed stone plus a water reducer. Mix shall be designed for a 28 day strength of 4000 psi. with a minimum cement content of 700 pounds per cubic yard, and a slump of four (4) inches.

PART 3 INSTALLATION

3.1 DELIVERY OF CONCRETE

- A. A delivery ticket shall be submitted with each batch at the time of delivery. Failure to render such ticket to the Developer/Builder's Job Superintendent shall automatically be cause for rejection of the concrete. The delivery ticket shall show the following:
 - 1. Amount of aggregate water
 - 2. Amount of batch water
 - 3. Quantities of sand, stone and cement
 - 4. Design strength
 - 5. Time that truck left batch plant
- B. The Developer/Builder's Job Superintendent shall write on the back of the delivery ticket:
 - 1. The time of arrival of the truck mixer on the site
 - 2. The time of deposit of the concrete from the truck
 - 3. The place of deposit of the concrete
- C. The completed delivery ticket shall be delivered to the Authority. Failure to deliver such completed ticket to the Authority will be cause for the Authority to reject the deposited concrete at any time and cause it to be removed and replaced.

SECTION 03301

CAST-IN-PLACE CONCRETE

- D. No concrete shall be deposited on the job when it has contained its mix water longer than 60 minutes.

3.2 PLACING CONCRETE

- A. Before placing concrete, all construction debris, water and ice shall be removed from the places to be occupied by the concrete.
- B. Rock surfaces upon which concrete is to be placed shall be level, free from oil, water, mud, loose semi-detached or unsound rock fragments and rough enough to assure bond with concrete.
- C. Where reinforcing bars are required, said bars shall be securely tied to prevent displacement during the pouring operation.
- D. Concrete shall be deposited in approximately horizontal layers not to exceed 18 inches in thickness to avoid flowing.
- E. Falling concrete shall be closely confined in a drop chute of the proper size to within two or three feet of the place of deposit in the forms and the final drop must be vertical to avoid segregation of aggregates. In no case shall concrete be deposited from a height that will cause separation of the aggregates.
- F. Concrete shall be mixed in such quantities as required for immediate use and shall be placed while fresh before loss of slump occurs. Retempering by adding water to restore slump lost during excessive mixing or due to too long a lapse of time since initial mixing will not be permitted.
- G. All slabs shall be placed for full thickness in one operation without any change in proportions.
- H. Use approved vibratory equipment to prevent slumping where necessary.

3.3 TEMPERATURE OF CONCRETE

- A. Concrete, when deposited, shall have a temperature ranging between a minimum of 50 deg. F. and a maximum of 90 deg. F.
- B. When the temperature of the surrounding air is below 40 deg. F. or above 90 deg. F., concreting shall be done in accordance with the recommendations noted in ACI-306 and ACI-305 respectively.

3.4 GROUTING

- A. Grout shall be installed in accordance with ACI 302.

SECTION 03301
CAST-IN-PLACE CONCRETE

3.5 PROTECTION OF NEW WORK

- A. All freshly placed concrete shall be adequately protected from mechanical injury or by action of the elements until such time as the concrete is thoroughly set.

3.6 CURING

- A. Curing shall be started immediately upon completion of the finishing operation. Curing shall continue uninterrupted for a minimum period of 14 days unless a longer period is hereinafter specified. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40 deg. F.

3.7 DEFECTIVE CONCRETE

- A. Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments and/or elevations as shown on the Adopted Plans.
- B. All defective concrete shall be removed and replaced in a manner meeting with the Authority's satisfaction.

+ + END OF SECTION + +

Division 11
MECHANICAL EQUIPMENT

Section 11077

PUMPING STATION

PART 1 - GENERAL

1.1 SCOPE

A. Description of Responsibilities

1. In those situations where topography or Authority requirements dictate that a Developer/Builder designs and builds a wastewater collection and conveyance system requiring pumping facilities as an integral part of the system, the general and technical conditions outlined in this section shall apply.
2. Attention is directed to all Developer/Builders that they shall contact the Bordentown Sewerage Authority and its Engineer prior to starting any aspects of either planning for or designing a wastewater pumping facility that in any way connects to or otherwise interacts with Authority facilities. Plans must be submitted to Authority for approval.
3. Where it is determined by the Authority's Engineer that insufficient spare capacity exists in a gravity sanitary sewer designated to receive the discharge from Developer/Builder's pumping station, Developer/Builder is advised that it is his responsibility to either replace the receiving sewer with one of sufficient size to accommodate the discharge or to route the discharge to a location approved by the Authority's Engineer where sufficient capacity exists.

B. General Technical Requirements

1. For facilities to be owned and maintained by the Authority, only above ground, wet well/dry well pumping stations will be acceptable. For privately owned and maintained stations the Authority will accept the following types of pumping stations, in order of preference: above ground, wet well/dry well, or submersible type pumping stations. Air activated ejector type stations are not acceptable. Pumping stations shall be equipped with pumps manufactured by Gorman Rupp and a Bubbler/Transducer Control System.
2. All pumping stations shall provide by-pass pumping capability. All submersible pumping stations shall incorporate both a separate valve chamber and a separate meter chamber with by-pass piping

Section 11077
PUMPING STATIONS

in the station design. Provisions for portable pump by-pass pumping must also be provided in all pumping stations along with the appropriate valves.

3. Pumping Station design shall include a Comminutor/Macerator manufactured by Disposal Waste Systems. Trade name of this unit is "Muffin Monster". Bar screens are not acceptable. The Authority reserves the right to eliminate a Comminutor/Macerator from the Pumping Station design. Minimum motor horsepower of the comminutor/macerator shall be 5 hp.
4. Pumping station design shall include a permanently installed emergency power generator housed in a building enclosure of a type and size to be approved by the Authority's Engineer. Generator shall be diesel or natural gas powered and the entire unit shall be self-contained including but not limited to such items as battery packs, starters, switchgear, block heaters, thermostats, base mounted fuel storage, controls, and all other accessories and appurtenances normally and customarily supplied with such stations. Emergency generator shall only be Onan "Quietsite". All power supply shall be 3 phase.
5. Safety equipment required to accommodate normal and customary maintenance of the pumping station, valve chamber, meter chamber and all appurtenances thereto shall be supplied with the station. This shall include non-conducting safety ladders, lights, locks, fire extinguishers and other facilities as identified by Authority Staff or Engineer, or as required by statute or NJDEP rules or regulations. Lockout capability must be provided on all breakers, disconnects and equipment.
6. Maintenance and repair equipment required to accommodate normal and customary routine maintenance of the pumping station, valve chamber, meter chamber and all appurtenances thereto shall be supplied with the station. This shall include one spare pump with impeller, davit crane, special tools, special test equipment, a standard contingent of spare parts for two (2) pumps, and three copies of repair manuals and operating manual.

Section 11077
PUMPING STATIONS

7. The pumping station facility shall be equipped with a continuous acting magnetic flow meter with compatible one (1) day circular chart recorder of type and manufacture approved by the Authority Engineer. For facilities to be owned and maintained by the Authority, all metering and recording equipment shall include appropriate alarms connected to the Authority's alarm panel at the Black's Creek Wastewater Treatment Plant. The meter recorder, as well as all electrical controls to the pumps and the generator shall be housed in a separate building. In no instance shall installation of the recorder or electrical controls be allowed to be located in either the meter or the valve chamber. Alarmed systems shall include loss of power, high/low water, generator running and others as may be specified by the Authority's Staff.
8. The Pumping station site shall be tastefully landscaped with fragrant spice viburnum and completely fenced with an eight (8) foot high plastic coated chain link fence. Fence shall be provided with twelve (12) - foot wide gate, opening inward, to allow the Authority's Jet Vac truck access to the site. Fence locking system to be able to be secured with Authority furnished Padlock. Top of fence shall be bent outward with no barbed wire. See Construction Details, Plate No. 50, Perimeter Fencing. Site work shall include area lights plus all weather receptacles. All area outdoor lighting to be controlled by an Astrotimer Intermatic Model No. V454-72R set for 40 degree latitude and the best available vandal proof fixtures. All windows shall be screwed with vandal proof protection and rock screens. Pump station site to be paved. Paving to extend 6 inches beyond fence line.
9. No site water to be furnished unless specified by the Authority.
10. Locking devices shall accept the Authority's existing keying system
11. Dehumidifier required in any dry well.
12. Running time meters shall be provided for all pumps and the generator shall be the type that cannot be reset.
13. Site design shall conform to all local, state and federal codes and/or requirements including but not limited to items such as flood plain and land use restrictions, wetland identification, historical and cultural resources, building setbacks and drainage. It is the Developer/Builder's responsibility to familiarize him with these requirements.

Section 11077
PUMPING STATIONS

14. Above Ground, Wet Well/Dry Well Pump Station Coating Protection.

A. Exterior Coating

1. Entire facility shall be coated with a urethane liquid waterproofing membrane system. Acceptable material shall be "One Kote" as manufactured by Karnak Chemical Corporation, Clark, NJ.
2. Urethane Liquid Waterproofing Membrane System
 - Fluid applied urethane waterproofing – 60 mils thick.
 - Primer
 - Thinner and Cleaner
 - Protective Cover
3. Urethane Physical Properties

<u>Property</u>	<u>Current ASTM Test Methods</u>	<u>Limiting Required Values</u>
Tensile Strength	D412	110 psi, minimum
Elongation	D412	400 percent, minimum
Hardness	D2240	35 + 5 Shore A durometer
Water Vapor Transmission	E96 Procedure BW	0.009 grams/hr./sq.ft.
Low Temperature Brittleness	D746	80 Degrees F.
Peel Strength on unprimed concrete	-	40 psi minimum
Storage Stability	-	6 months minimum when stored in tightly sealed containers in a cool, dry area.
Coverage	-	32 to 25 sq. ft. per gallon to provide 60 mil thickness.

Section 11077
PUMPING STATIONS

B. Wet Well

1. Interior surfaces that come in contact with sewage, sludge, or liquids shall be coated with the following coal tar epoxy system as manufactured by Carboline Company, 350 Hanley Industrial Court, St. Louis, MO 63144-1599.

- Prime Coat: Bitumastic No. 300-M, thinned with Thinner 2000; 8.0 mils.
- Finish Coat: Bitmuastic No. 300-M; 10.0 mils.
- Total Dry Film: 18 mils.
- Total Coats: Two (2).

15. Private, Submersible Type Pump Station Coating Protection

A. Wet Well

1. Exterior Coating

a. A bitumastic coating shall be applied to the exterior of all wet wells. Coating shall be Bitumastic Super Service Black as manufactured by Carboline Company, 350 Hanley Industrial Court, St. Louis, MO 63144-1599. At least three (3) coats shall be applied giving a minimum total dry film thickness of 32.0 mils.

2. Interior Coating

a. All surfaces that come into contact with sewage, sludge, or liquids shall be coated with the following coal tar epoxy system as manufactured by Carboline Company.

- Prime Coat: Bitumastic No. 300-M, thinned with Thinner 2000; 8.0 mils.

Section 11077
PUMPING STATIONS

- Finish Coat: Bitmuastic No. 300-M; 10.0 mils.
- Total Dry Film: 18 mils.
- Total Coats: Two (2).

B. Valve Chamber

1. Exterior Coating

- a. Entire facility shall be coated with a urethane liquid waterproofing membrane system as defined in Item 14.A, 1, 2, and 3 above.

2. Interior Coating

- a. Interior surfaces shall be coated with Kop-Coat as manufactured by Carboline Company. Finished coat shall be Glamorglaze 200 epoxy; 2.0 mils per coat; 2 coats.

16. All electrical conduit either buried or passing through concrete walls and/or slabs shall be PVC coated rigid conduit as manufactured by Robroy Industries, Verona, PA.

17. All outdoor electrical equipment shall be enclosed in NEMA 4X rated, Type 304 Stainless Steel enclosures.

18. Power Monitor

A. A power monitor shall be provided at the service entrance of all pump stations. The power monitor shall consist of pilot lights connected to each phase of the incoming electric service, and shall be protected by an individual circuit breaker taped from the load side of the service entrance disconnect. The pilot lights shall be 30mm transformer type, incandescent, NEMA 4X rated, Square "D" class 9001.

B. The pilot lights may be mounted to the front panel door of an outdoor control panel or in a separately mounted NEMA 4X stainless steel enclosure.

Section 11077
PUMPING STATIONS

19. All motors shall be of an energy efficient design and meet current standards for NEMA Premium Efficiency Electric Motors. Nominal and minimum efficiencies shall exceed efficiency ratings. Current standards are presented in NEMA MG1-1998, Table 12-12.
20. Requirements listed under Subparagraphs 1 through 18, above, are not meant to be nor should be considered as being all inclusive and the Authority, its Executive Director and/or Director of Operations or Engineer may add to, delete from or modify these requirements from time to time. Developer/Builder is advised that he should not proceed with detailed design of any pumping facility until all Authority requirements are clearly understood by Developer/Owner and its design professional. Design plans must be submitted to the Authority for approval prior to construction.

** END OF SECTION **

Annex A

NEMA MG 1-1998 Table 12-12
 Full-Load Efficiencies for NEMA Premium™ Efficiency Electric Motors
 Rated 600 Volts or Less (Random Wound)

OPEN MOTORS						
HP	2 POLE		4 POLE		6 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	86.5	81.5
2	85.5	82.5	86.5	84.0	87.5	81.5
3	85.5	82.5	89.5	84.0	88.5	86.5
5	86.5	84.0	89.5	84.0	89.5	87.5
7.5	88.5	86.5	91.0	89.5	90.2	88.5
10	89.5	87.5	91.7	90.2	91.7	90.2
15	90.2	88.5	93.0	91.7	91.7	90.2
20	91.0	89.5	93.0	91.7	92.4	91.0
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	94.1	93.0	93.6	92.4
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.0	94.1	94.5	93.6
100	93.6	92.4	95.4	94.5	95.0	94.1
125	94.1	93.0	95.4	94.5	95.0	94.1
150	94.1	93.0	95.8	95.0	95.4	94.5
200	95.0	94.1	95.8	95.0	95.4	94.5
250	95.0	94.1	95.8	95.0	95.4	94.5
300	95.4	94.5	95.8	95.0	95.4	94.5
350	95.4	94.5	95.8	95.0	95.4	94.5
400	95.8	95.0	95.8	95.0	95.8	95.0
450	95.8	95.0	96.2	95.4	96.2	95.4
500	95.8	95.0	96.2	95.4	96.2	95.4

11077/8

NEMA MG 1-1998 Table 12-12 (continued)
Full-Load Efficiencies for NEMA Premium™ Efficiency Electric Motors
Rated 600 Volts or Less (Random Wound)

ENCLOSED MOTORS						
HP	2 POLE		4 POLE		6 POLE	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1	77.0	74.0	85.5	82.5	82.5	80.0
1.5	84.0	81.5	86.5	84.0	87.5	85.5
2	85.5	82.5	86.5	84.0	88.5	86.5
3	86.5	84.0	89.5	87.5	89.5	87.5
5	88.5	86.5	89.5	87.5	89.5	87.5
7.5	89.5	87.5	91.7	90.2	91.0	89.5
10	90.2	88.5	91.7	90.2	91.0	89.5
15	91.0	89.5	92.4	91.0	91.7	90.2
20	91.0	89.5	93.0	91.7	91.7	90.2
25	91.7	90.2	93.6	92.4	93.0	91.7
30	91.7	90.2	93.6	92.4	93.0	91.7
40	92.4	91.0	94.1	93.0	94.1	93.0
50	93.0	91.7	94.5	93.6	94.1	93.0
60	93.6	92.4	95.0	94.1	94.5	93.6
75	93.6	92.4	95.4	94.5	94.5	93.6
100	94.1	93.0	95.4	94.5	95.0	94.1
125	95.0	94.1	95.4	94.5	95.0	94.1
150	95.0	94.1	95.8	95.0	95.8	95.0
200	95.4	94.5	96.2	95.4	95.8	95.0
250	95.8	95.0	96.2	95.4	95.8	95.0
300	95.8	95.0	96.2	95.4	95.8	95.0
350	95.8	95.0	96.2	95.4	95.8	95.0
400	95.8	95.0	96.2	95.4	95.8	95.0
450	95.8	95.0	96.2	95.4	95.8	95.0
500	95.8	95.0	96.2	95.4	95.8	95.0

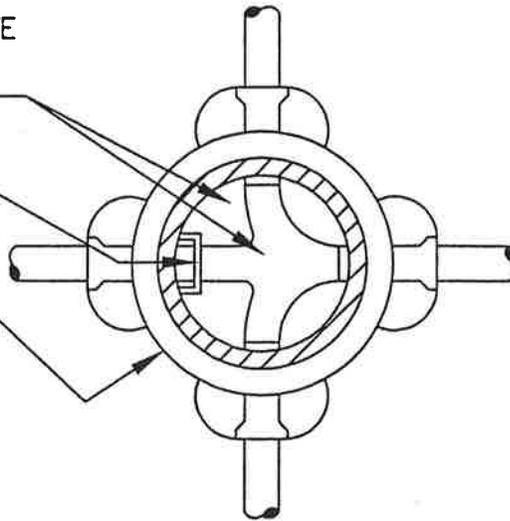
11077/9

CONSTRUCTION DETAILS

SEMI-CIRCULAR CONCRETE CHANNELS AND FLOOR TO BE SMOOTH

MANHOLE STEPS

CONCRETE BASE



FOR POURED BASE REINFORCEMENT REFER TO PLATE NO.12

PROVIDE (4) 3/4" BOLTS @ 90°

PLAN

MAX OF 3 COURSES OF BRICK TO ADJUST HEIGHT TO GRADE

ENTIRE OUTER SURFACE COATED WITH THREE(3) COATS OF BITUMASTIC PAINT

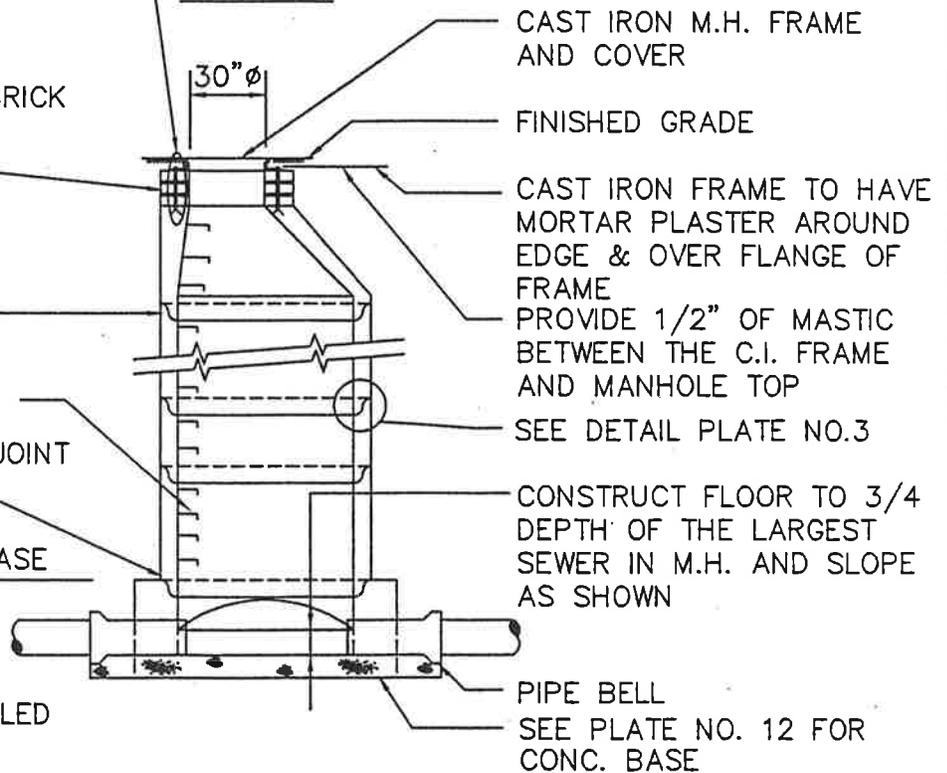
ALUM. M.H. RUNGS @ 12" CENTERS TO CENTERS

TYP:INSTALL PREFORMED JOINT SEALING COMPOUND

TOP OF POURED CONC. BASE

ALL SECTION JOINTS AND LIFT HOLES SHALL BE SEALED WITH A MORTAR PLASTIC

SECTION



CAST IRON M.H. FRAME AND COVER

FINISHED GRADE

CAST IRON FRAME TO HAVE MORTAR PLASTER AROUND EDGE & OVER FLANGE OF FRAME

PROVIDE 1/2" OF MASTIC BETWEEN THE C.I. FRAME AND MANHOLE TOP

SEE DETAIL PLATE NO.3

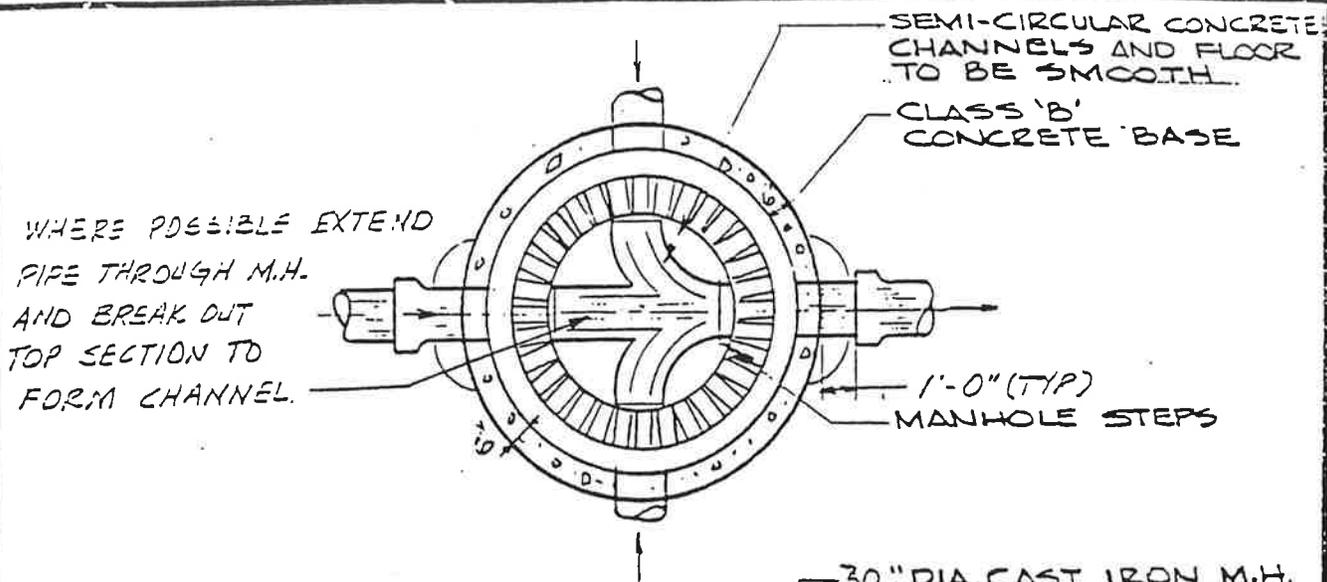
CONSTRUCT FLOOR TO 3/4 DEPTH OF THE LARGEST SEWER IN M.H. AND SLOPE AS SHOWN

PIPE BELL
SEE PLATE NO. 12 FOR CONC. BASE

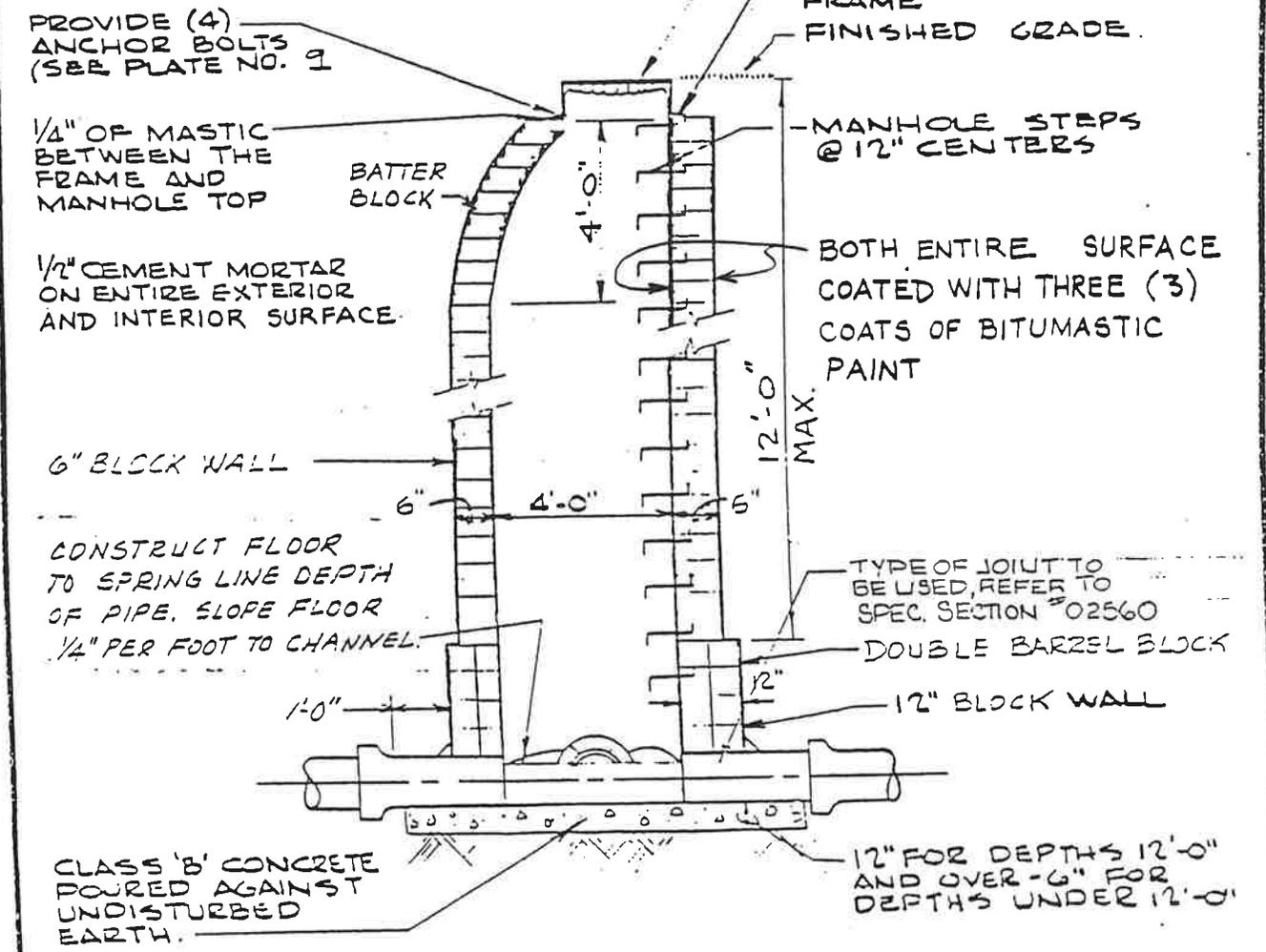
NOTES:

- 1) STEEL TEMPLATE TO BE SUPPLIED BY MANHOLE MFR. IN ORDER TO FORM PROPER RECESS IN CONCRETE.

12-01	 PRE-CAST MANHOLES WITH POURED CONCRETE BASE	DRAWN:
3-99		SCALE: NONE
2-96		PLATE NO. 1
REVISIONS		

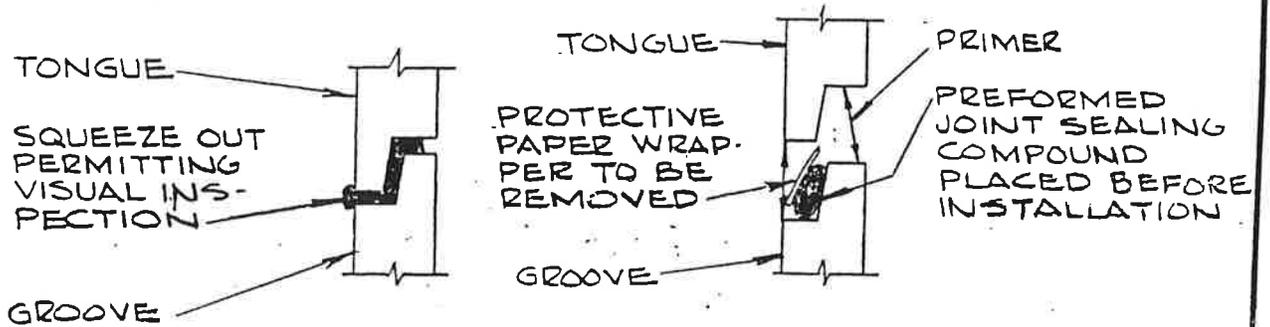


PLAN



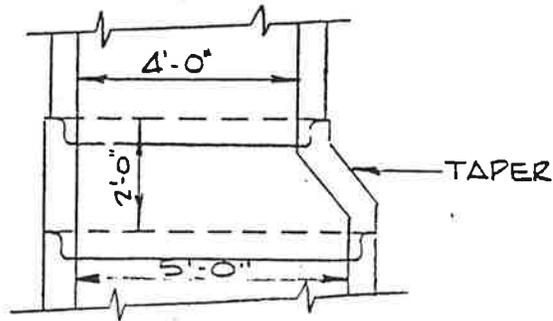
SECTION

	BCM ENGINEERS <small>A Division of TRC</small>	DWG. BY JLS
3-99		SCALE: NONE
4-90	CONCRETE BLOCK MANHOLE	PLATE NO. 2
REVISIONS		



CLOSED JOINT OPEN JOINT

DETAIL N^o 1



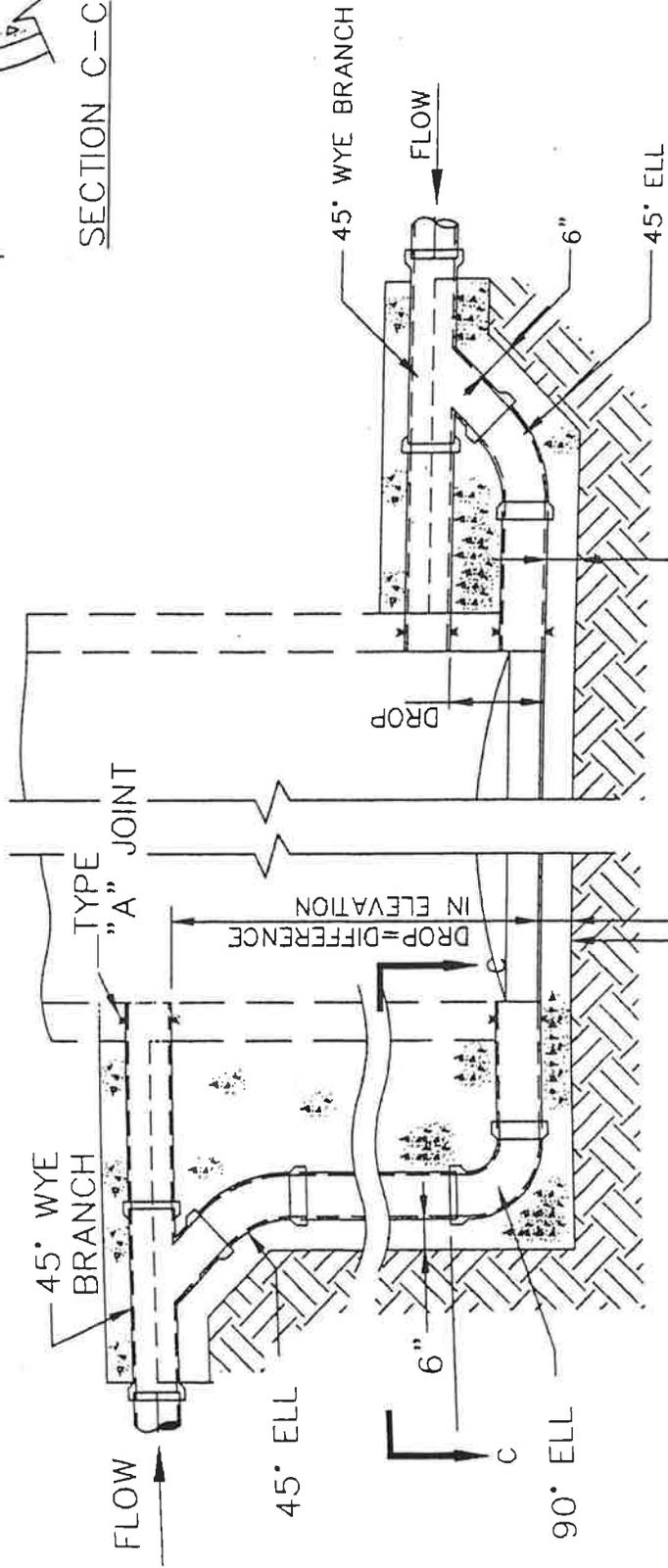
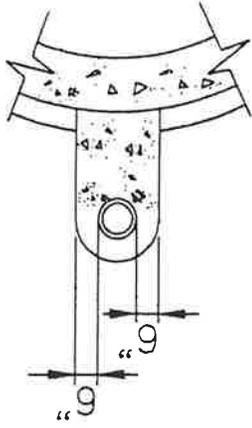
5'-0" DIA. PRE-CAST MANHOLE
TRANSITION DETAIL

NOTE:

1. RISER AND CONE SECTIONS TO BE ADEQUATELY REINFORCED IN ACCORDANCE WITH ASTM SPECIFICATION C-478

	BCM ENGINEERS <small>A Division of JACOBS</small>	
3-99	PRE-CAST MANHOLE / GREASE TRAP JOINTS AND MANHOLE TRANSITION DETAILS	DRAWN: J.L.S.
5-96		SCALE: NONE
9-8-80		PLATE NO. 3
REVISIONS		

NOTE:
 1) IN LIEU OF BELLS, PROVIDE MECH. JOINTS WHERE D.I. PIPE IS SPECIFIED
 2) FOR POURED BASE REINFORCEMENT REFER TO PLATE No. 12



TYPE "B" DROP CONN.
 MAX. DROP

8" SEWER	3'-6"
10" SEWER	3'-9"
12" SEWER	4'-6"
15" SEWER	4'-6"

CONCRETE AGAINST UNDISTURBED EARTH

TYPE A

TYPE B

NOTE: DROP CONNECTION ILLUSTRATION TYPICAL FOR PRECAST OR BLOCK MANHOLES, PRECAST OR POURED BASES.

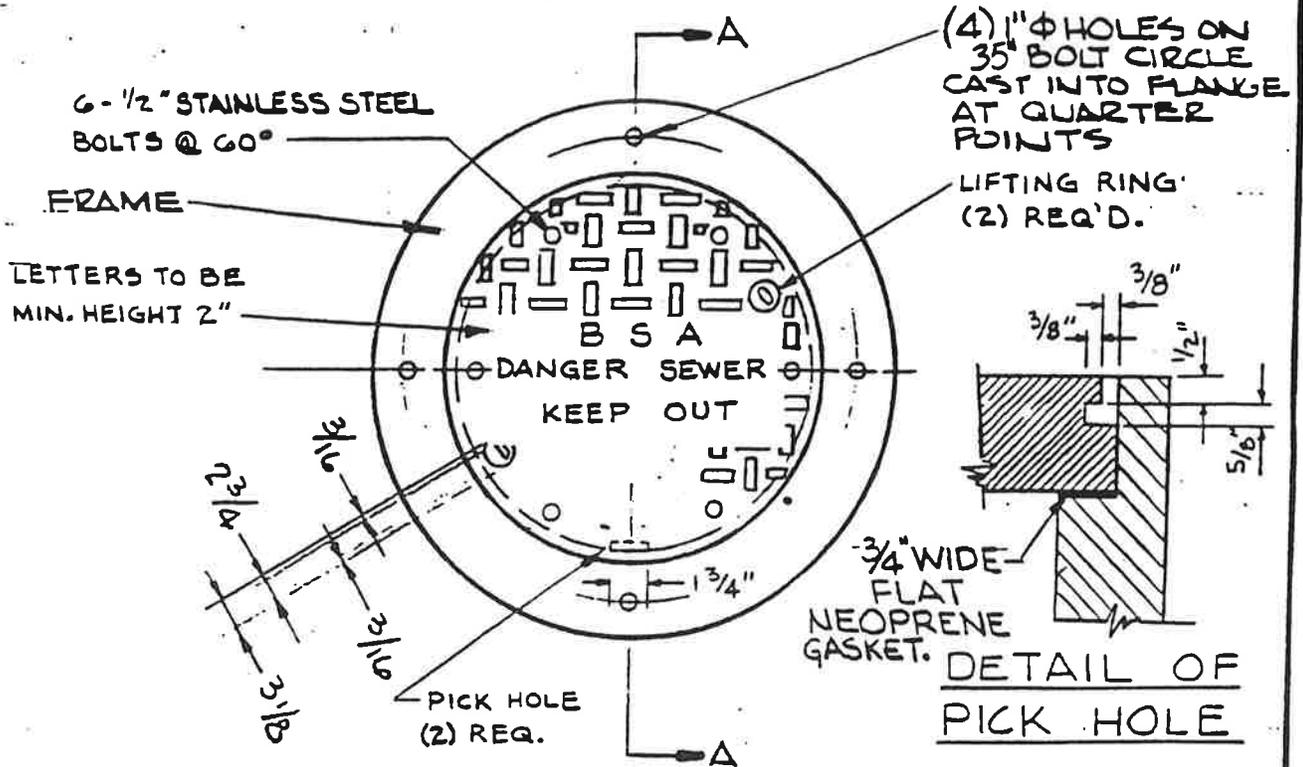
3-99
2-96
5-28-80
REVISIONS

BCM
 ENGINEERS

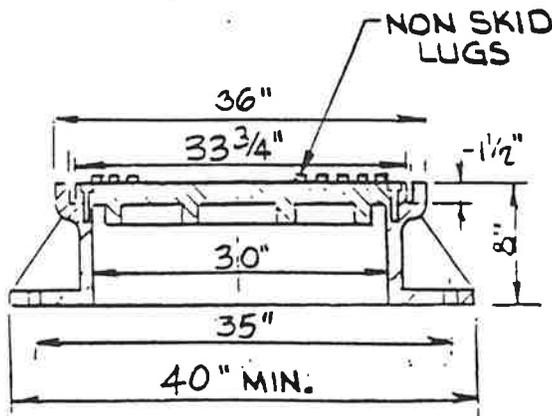
DROP MANHOLE

DRAWN:
SCALE: NONE
PLATE NO. 5

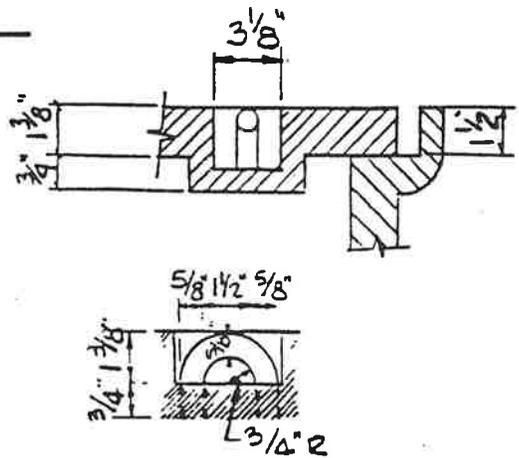
CASTING TO BE SUPPLIED WITH BOLTED COVER; AND MACHINED BEARING SURFACE.



PLAN



SECTION A-A



DETAIL LIFTING RING

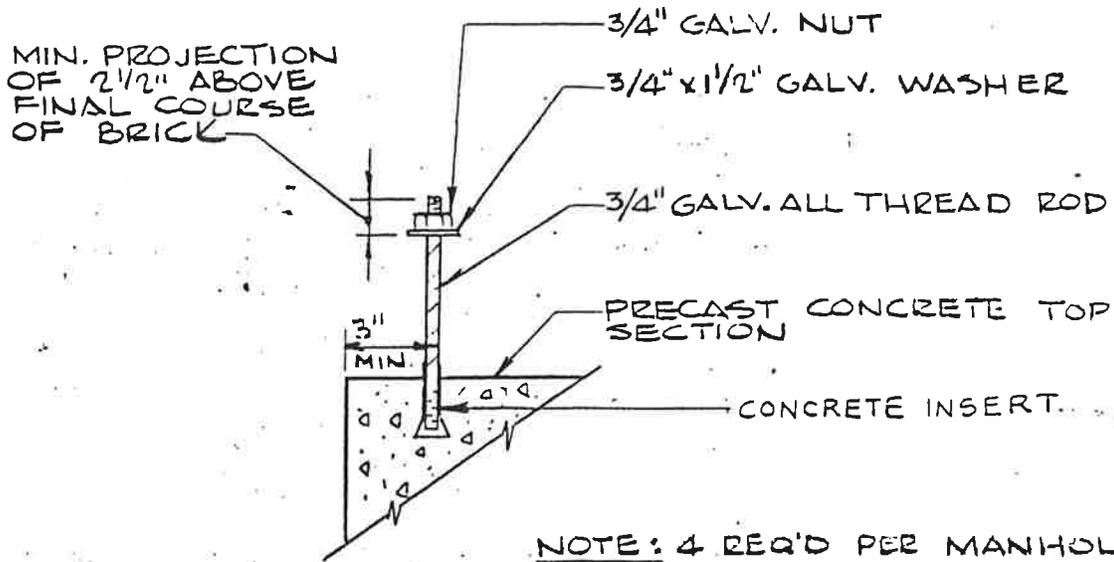
BRIDGESTATE FOUNDRY CO., HADDONFIELD N.J.
 (PATTERN NO. 1503 - TYPE A MODIFIED OR
 EQUAL, (APPROXIMATE WEIGHT 600#.)

3-99
5-96
12-89
7-83
9-8-80
REVISIONS

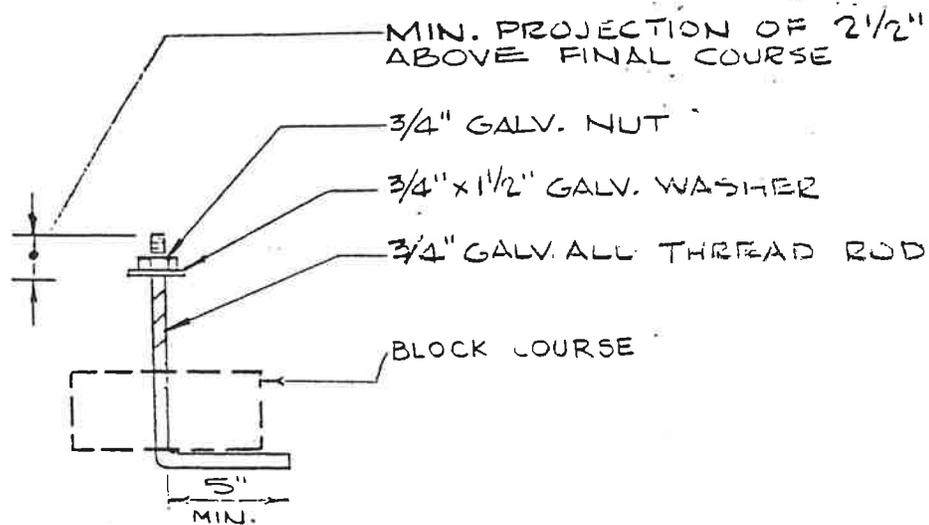


CAST IRON WATERTIGHT MANHOLE /
 GREASE TRAP FRAME & COVER

DRAWN: JLS
SCALE: NONE
PLATE NO. 8



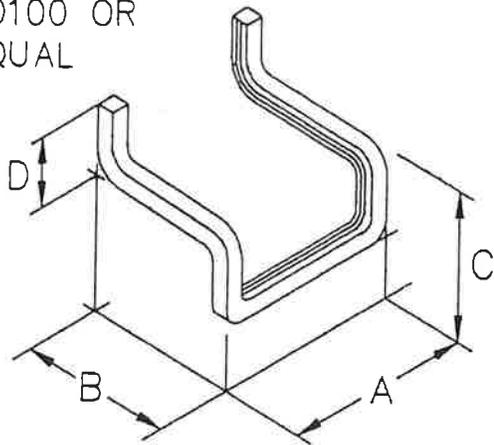
PRE-CAST MANHOLE



BLOCK MANHOLE

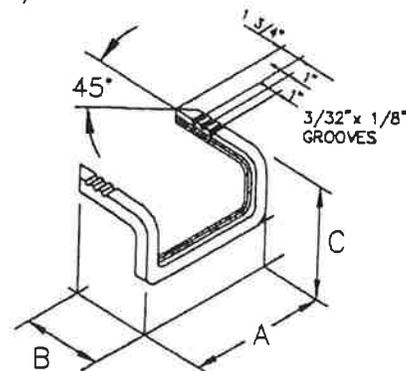
		DRAWN: JLS
3-99	<p>ANCHOR BOLT DETAILS</p>	SCALE: NONE
5-28-80		PLATE NO. 9
REVISIONS		

ALCOA No.
20100 OR
EQUAL

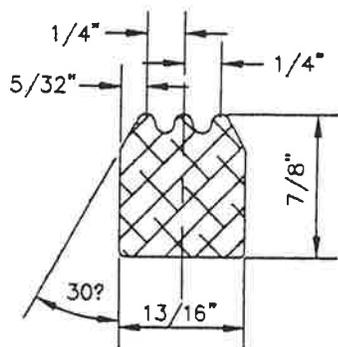


CAST IN PLACE WALLS

ALCOA No.
16027B OR
EQUAL
INSTALL W/
PLASTIC
INSERTS



PRECAST MANHOLES

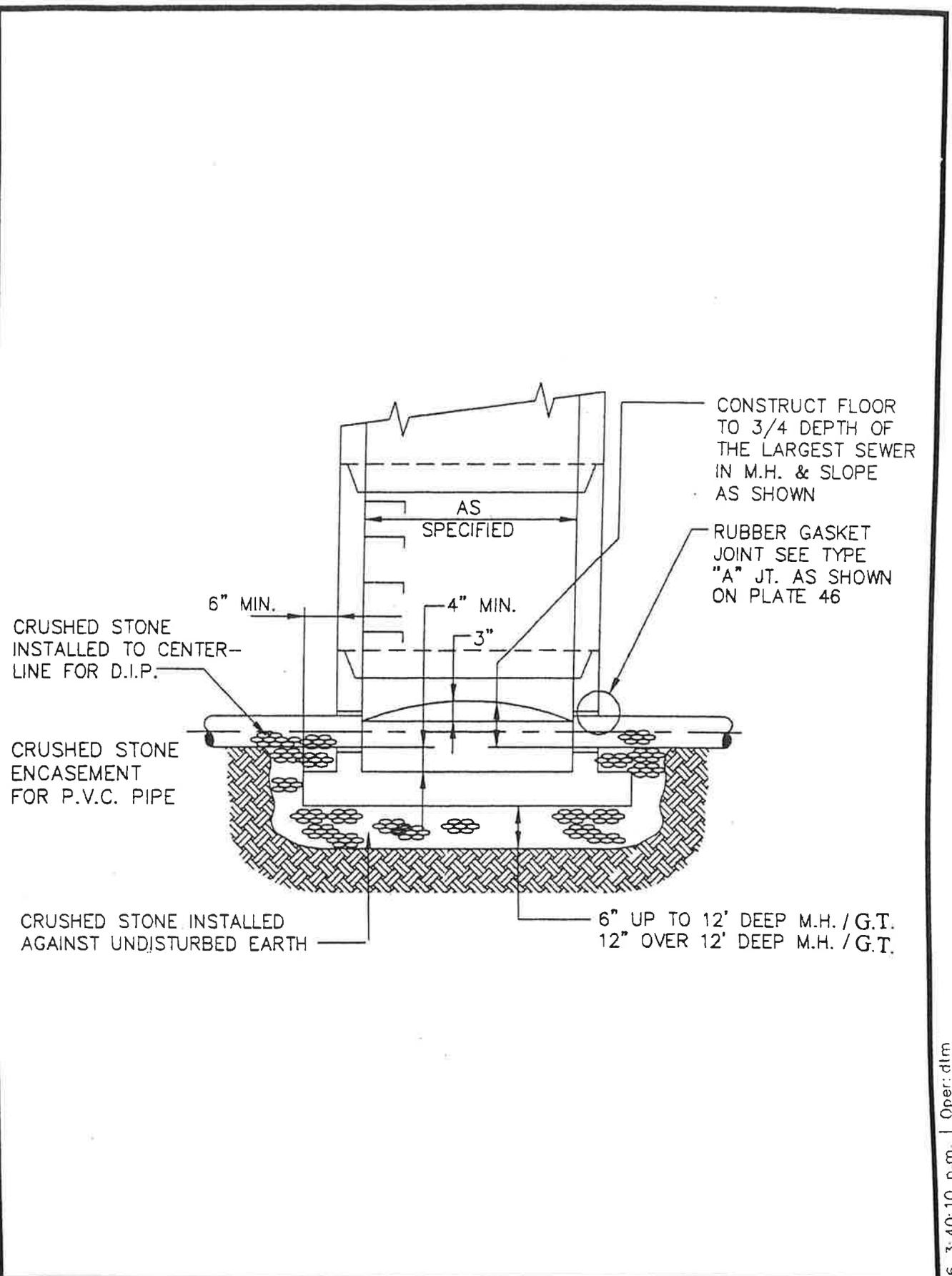


TYPICAL CROSS SECT.
ON ALL STEPS

APPLICATION	DIMENSION (IN.)			
	A	B	C	D
BLOCK MANHOLES	* 13 3/4	9 5/16	3 3/4	2
CAST IN PLACE WALLS	17 3/4	13 13/16	3 3/4	2
PRECAST MANHOLES	* 13 3/4	11	3 3/4	—

* MIN. 12" AND MUST MEET THE REQUIREMENTS OF ASTM C-478 SPECIFICATIONS

3-99	 DROP FRONT MANHOLE STEP	DRAWN:
2-96		SCALE: NONE
5-28-80		PLATE NO. 10
REVISIONS		

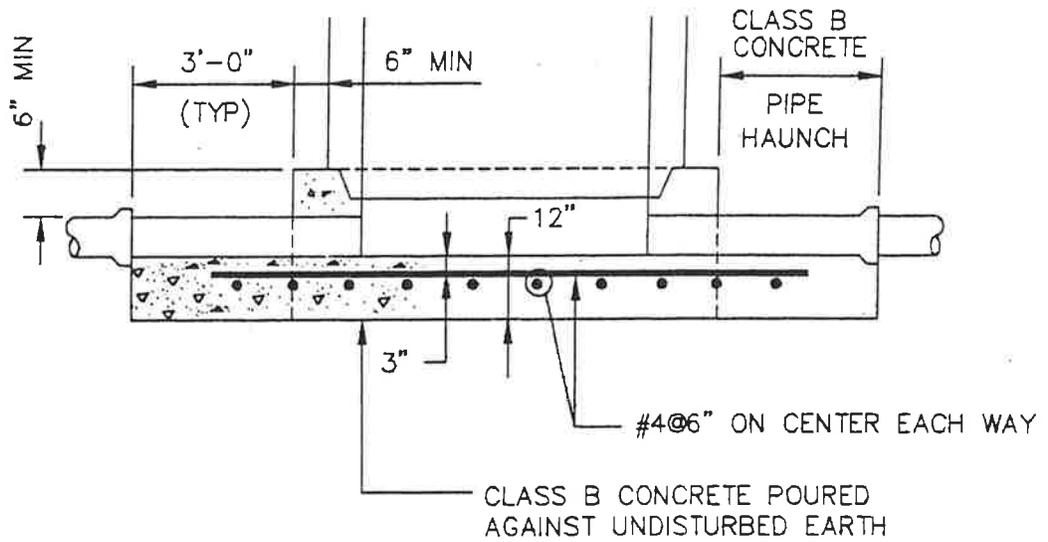


3-99
5-96
2-96
9-8-80
REVISIONS


**PRECAST MANHOLE / GREASE TRAP
BASE**

DRAWN:
SCALE: NONE
PLATE NO. 11

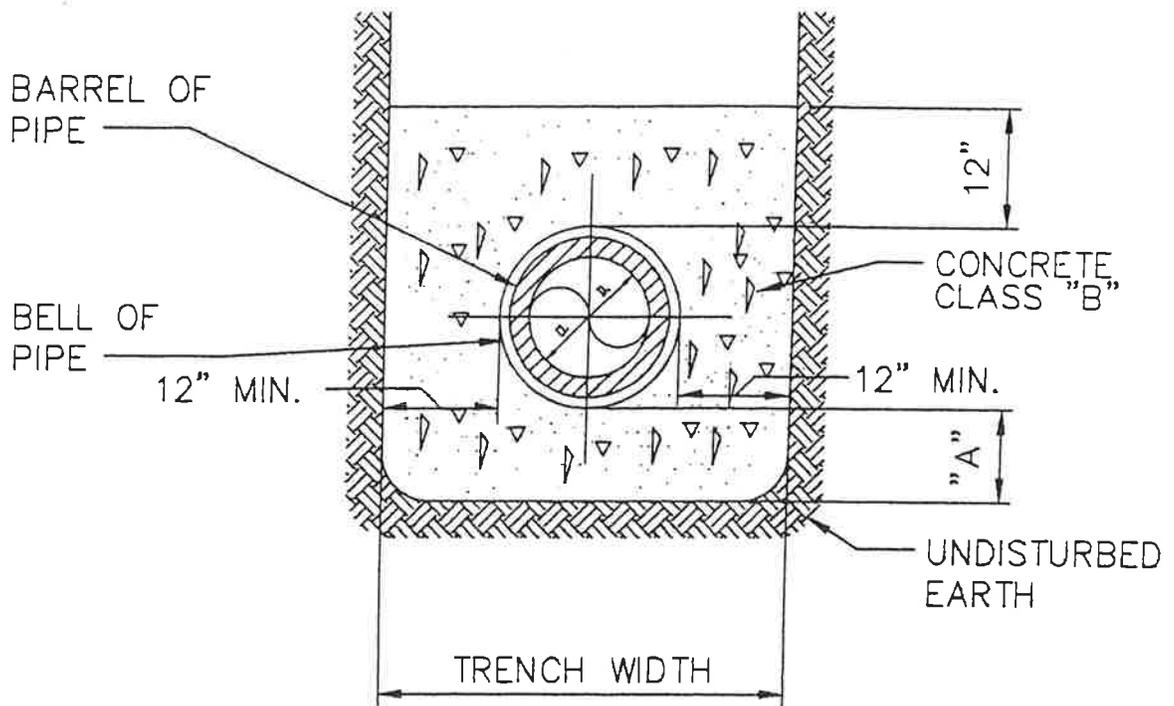
February 27, 1996 3:40:10 p.m. | Oper: dlm



NOTE:

1. REFER TO PLATE No. 1 FOR ADDITIONAL DETAILS

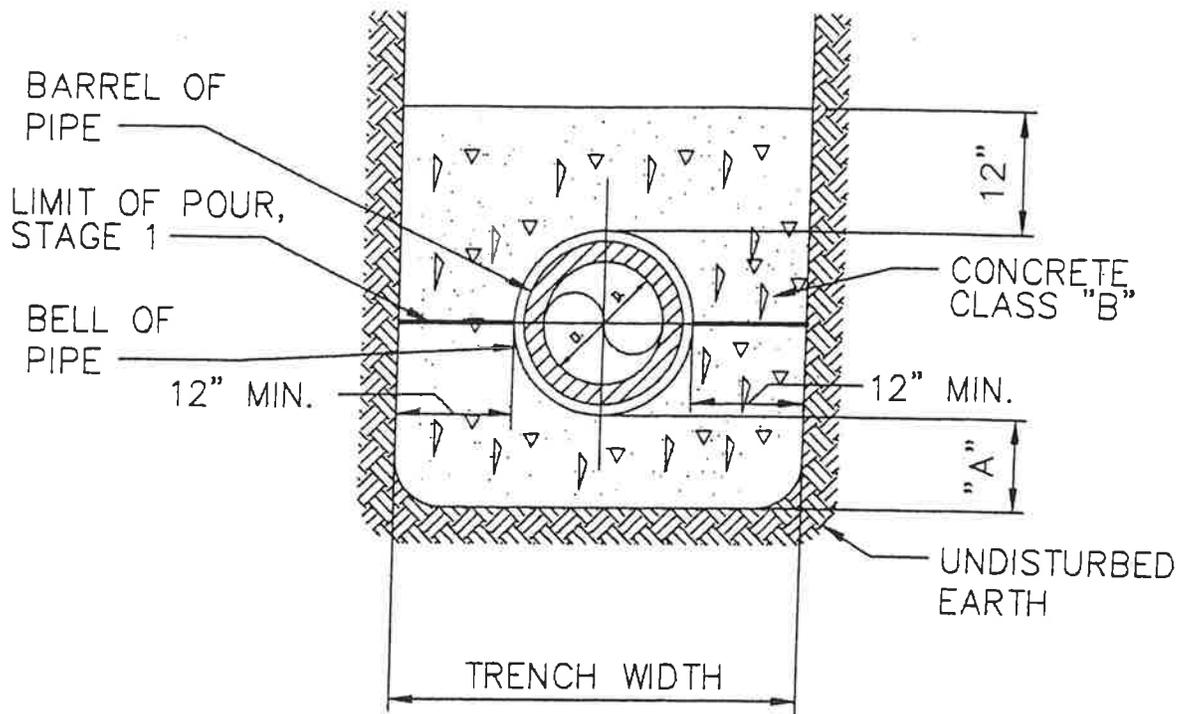
3-99	 BCM ENGINEERS REINFORCEMENT FOR POURED CONCRETE BASE	DRAWN:
2-96		SCALE: NONE
12-9-83		PLATE NO. 12
5-26-82		
REVISIONS		



PIPE DIAMETER	A
4"-16"	4"
18"-48"	6"

3-99	 CONCRETE ENCASEMENT	DRAWN:
2-96		SCALE: NONE
6-15-82		PLATE NO. 22
9-8-80		
REVISIONS		

February 27 1996 10 27 14 a.m. | Oper.dtm



PIPE DIAMETER	A
4"-16"	4"
18"-48"	6"

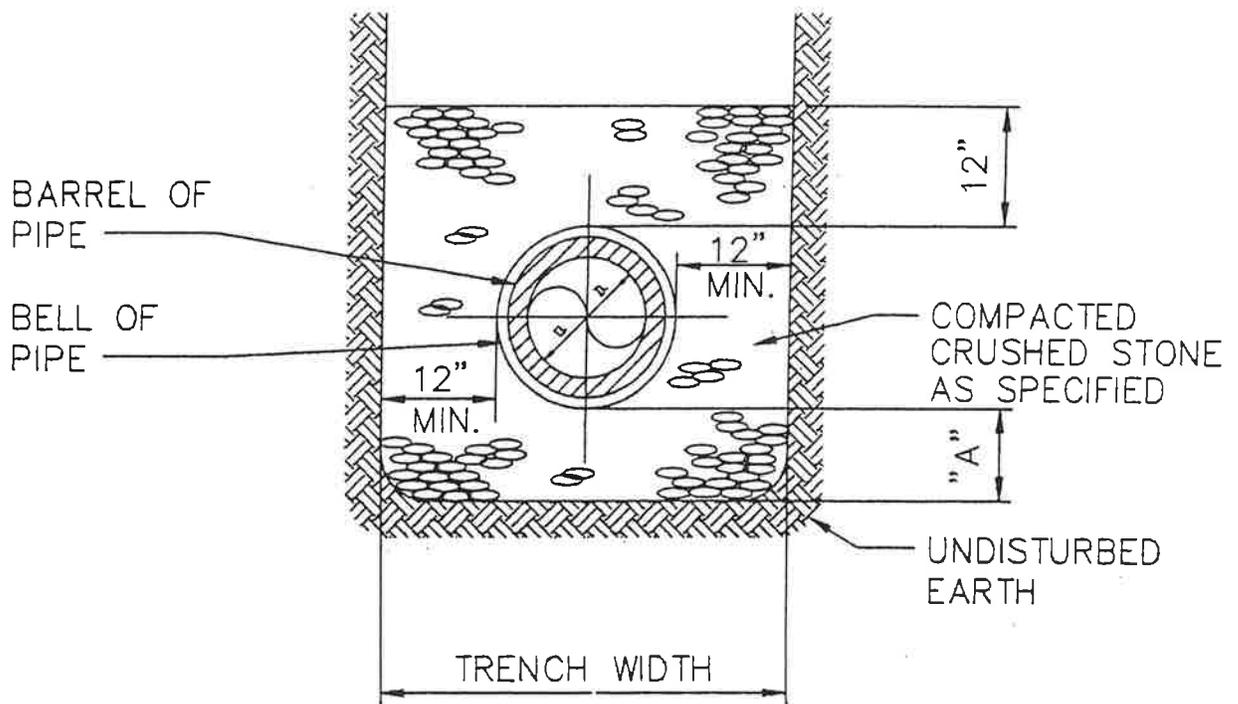
METHOD OF ENCASING P.V.C. PIPE IN CONCRETE

STAGE No.1—INSTALL CONCRETE FROM BOTTOM OF TRENCH TO CENTER LINE OF PIPE.

STAGE No.2—AFTER 24 HOUR PERIOD INSTALL CONCRETE FROM CENTER LINE OF PIPE TO 12" ABOVE BARREL OF PIPE.

3-99	 CONCRETE ENCASEMENT	DRAWN:
2-96		SCALE: NONE
9-8-80		PLATE NO. 22A
REVISIONS		

February 27, 1996 3:48:40 p.m. | Oper.dlm



PIPE DIAMETER	A
4"–16"	4"
18"–48"	6"

3-99	 CRUSHED STONE ENCASEMENT	DRAWN:
2-96		SCALE: NONE
9-8-80		PLATE NO. 24
REVISIONS		

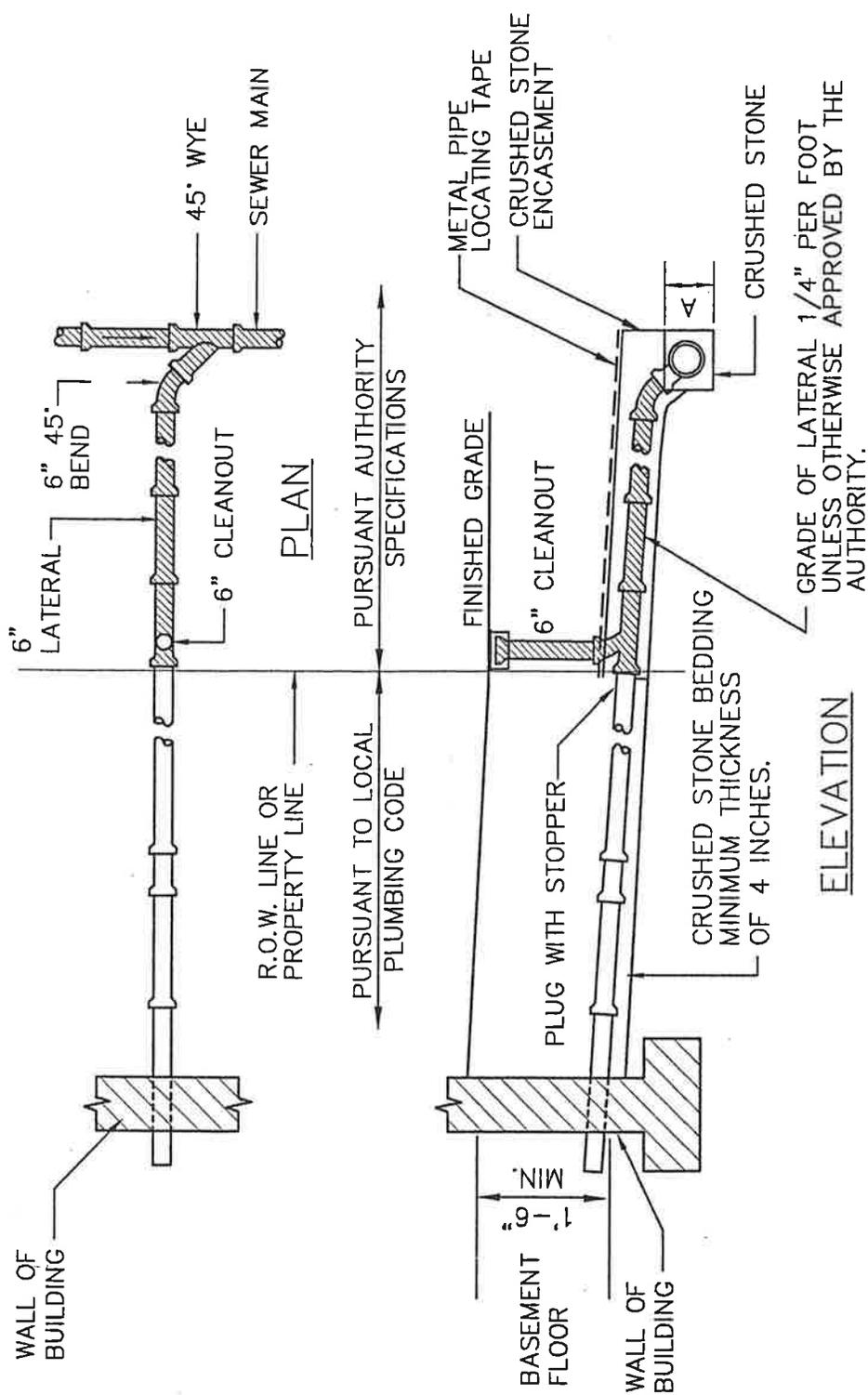
February 27, 1996 3:43:59 p.m. | Oper: dlm
 Drawing: 24

3-2004
8-2000
3-99
2-96
9-8-80
REVISIONS



TYPICAL LATERAL BASEMENT CONNECTION

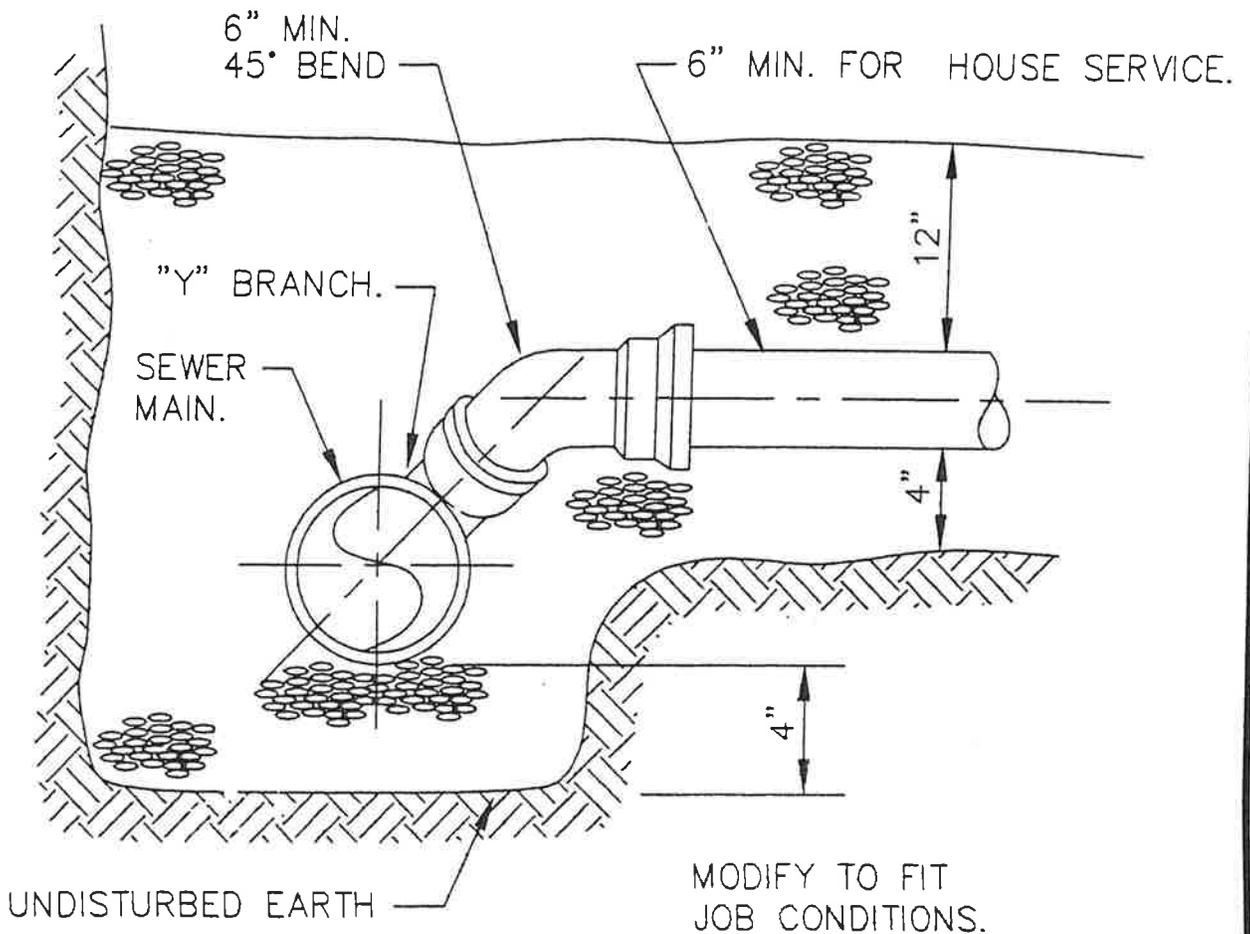
DRAWN: CMB/TLJ
SCALE: NONE
25



NOTES:

1. IN NO CASE SHALL INVERT OF THE BUILDING CONNECTION BE LESS THAN 4 FEET BELOW FINISHED GRADE
2. LATERAL BETWEEN SEWER MAIN AND CLEANOUT TO BE EITHER SDR 21; PVC SCHEDULE 80 (MIN.) OR DIP SCHEDULE 52 (MIN.).
3. LATERAL BETWEEN HOUSE AND CLEANOUT TO BE LAID ON A CRUSHED STONE BEDDING WITH A MINIMUM THICKNESS OF 4 INCHES.

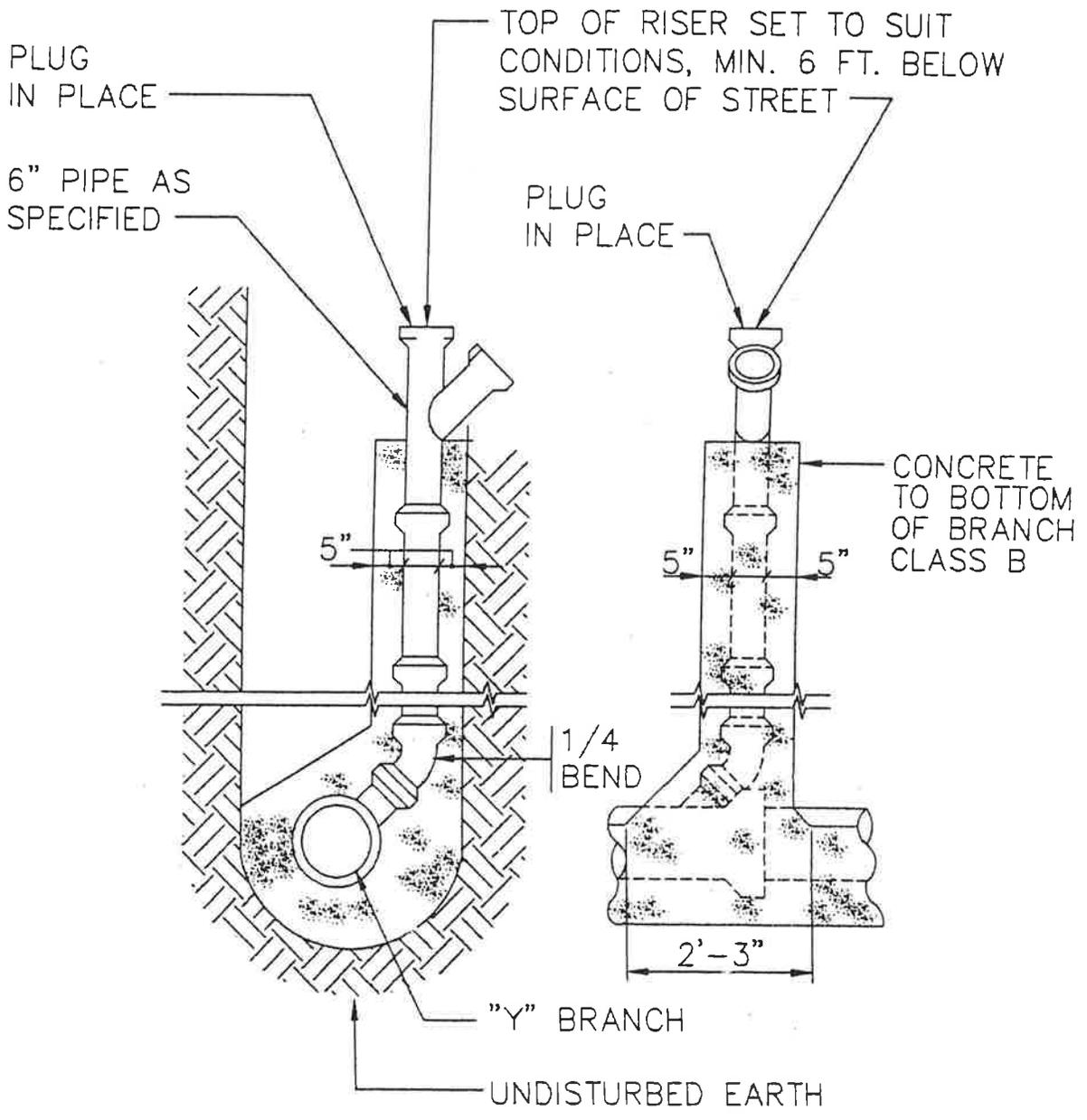
MINIMUM DISTANCE "A"	MINIMUM DISTANCE "A"
8" SEWER	8 3/4"
"	10 1/4"
"	12"
"	14 3/4"
"	17 1/2"



NOTE: HOUSE SERVICE BEND AND "Y" BRANCH SHALL BE THE SAME MATERIAL AS SEWER MAIN. PROVIDE CRUSHED STONE ENCASEMENT FOR P.V.C. PIPE. PROVIDE CRUSHED STONE CRADLE FOR D.I.P.

3-99	BCM ENGINEERS <small>A Division of</small> "Y" BRANCH	DRAWN:
2-96		SCALE: N.T.S.
1-5-80		PLATE NO. 32A
9-8-80		
REVISIONS		

February 27, 1996 3:50:00 p.m | Oper: dtm



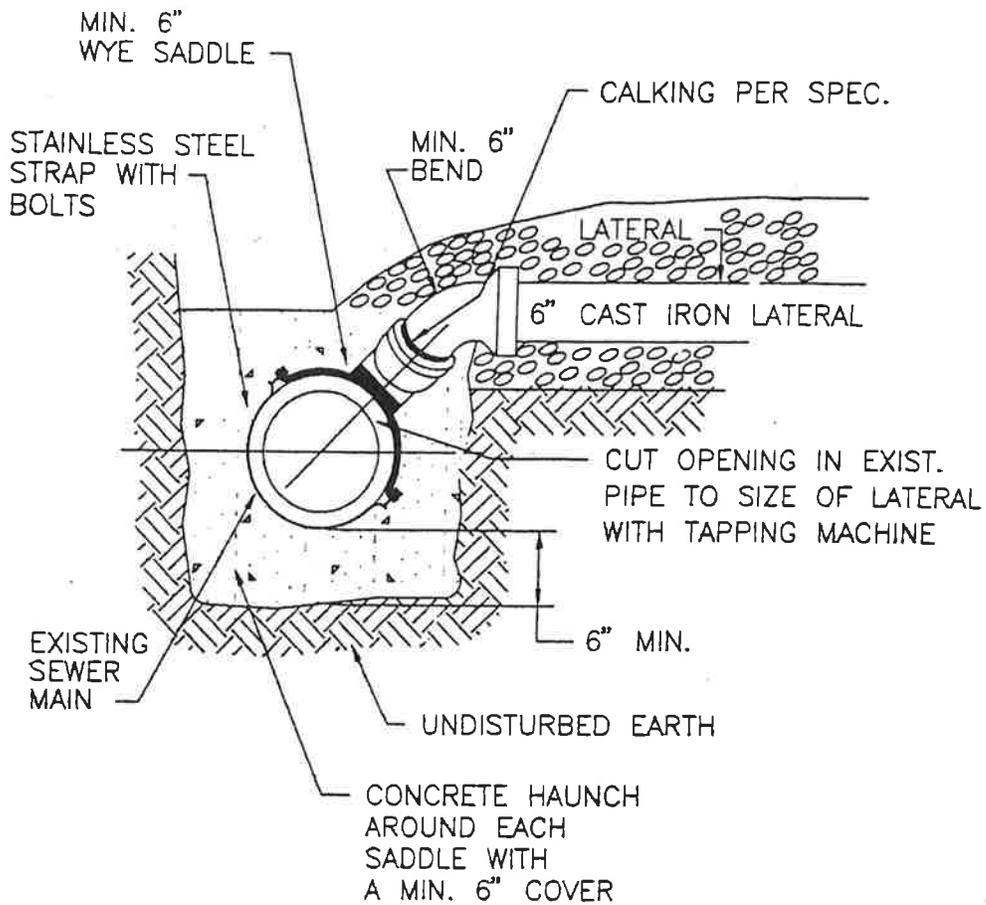
3-99
2-96
5-28-80
REVISIONS



DEEP CUT LATERAL

DRAWN:
SCALE: NONE
PLATE NO. 33

February 27 1996 4 30 52 pm | One...dlm



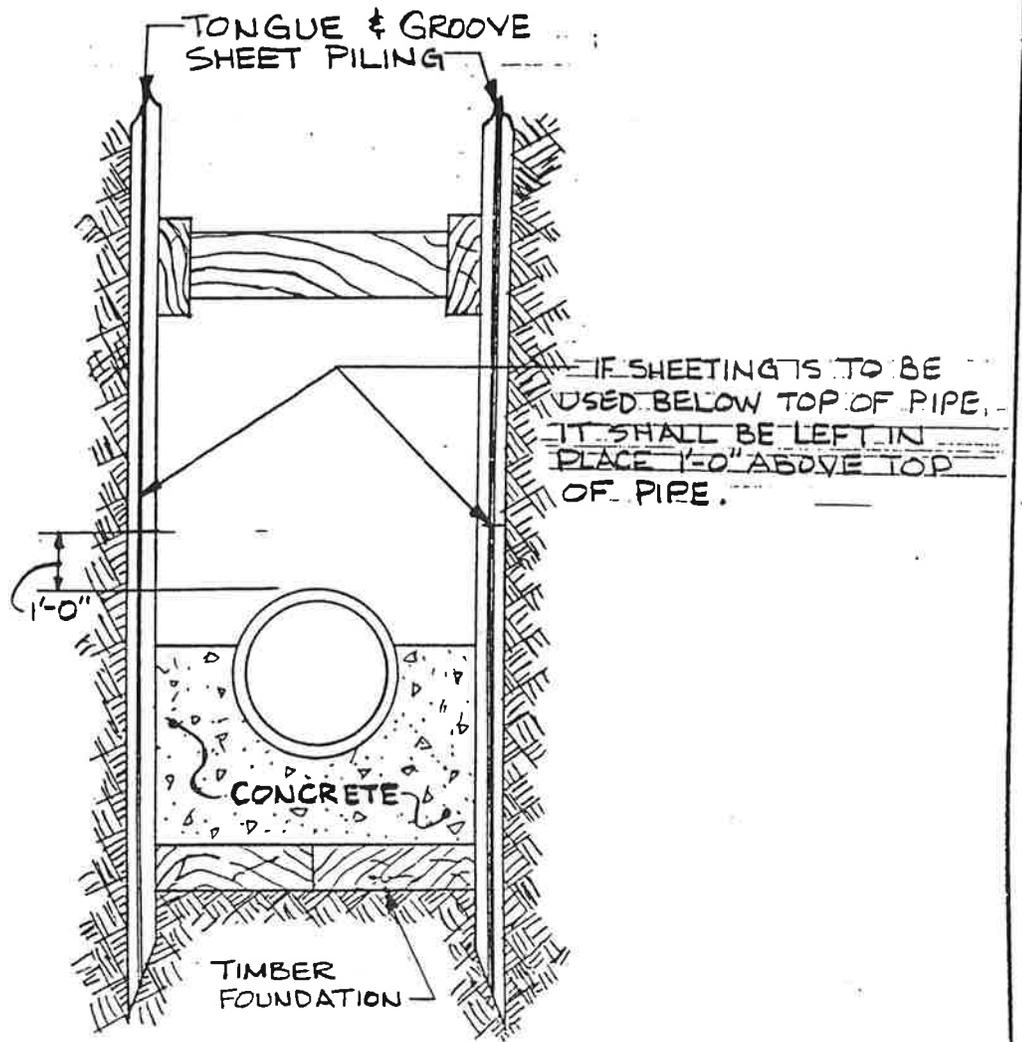
PRIOR TO INSTALLING
 CONCRETE HAUNCH
 PAINT SADDLE
 CONNECTION WITH
 BITUMASTIC COATING
 (CAST IRON SOIL
 PIPE ONLY)

3-99
2-96
4-2-85
5-28-80
REVISIONS



SADDLE CONNECTION

DRAWN:
SCALE: NONE
DETAIL 34

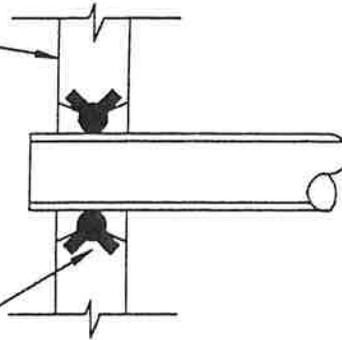


SECTION OF TRENCH IN
QUICKSAND SHOWING
SHEET PILING & CONCRETE

	BCM ENGINEERS <small>a Division of BMT</small>	DRAWN: J.E.Y
3-99	DETAIL-TRENCH IN QUICKSAND	SCALE: NONE
5-28-80		PLATE NO. 40
REVISIONS		

PRE-CAST MANHOLE / GREASE TRAP
WALL

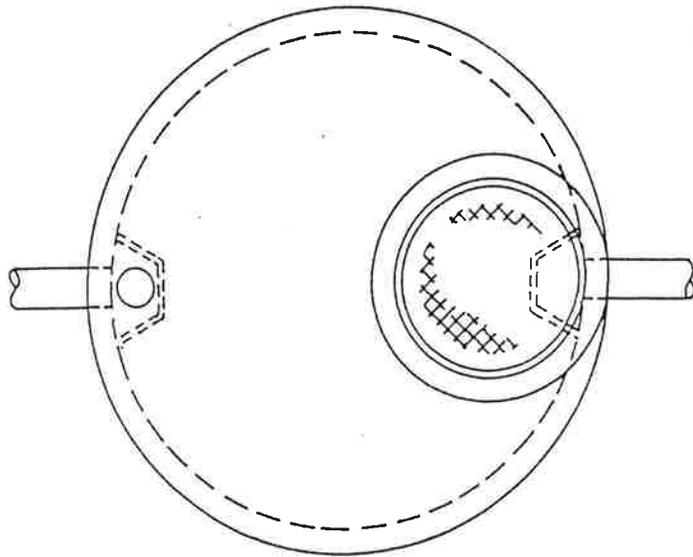
RUBBER GASKET JOINT
MANUFACTURED TO MEET
ALL MATERIAL AND
PERFORMANCE
REQUIREMENTS OF
ASTM C-923



TYPE "A" JOINT

NOTE: MECHANICAL HARDWARE (i.e. BANDS, STRAPS,
BOLTS, etc.) SHALL NOT BE UTILIZED.

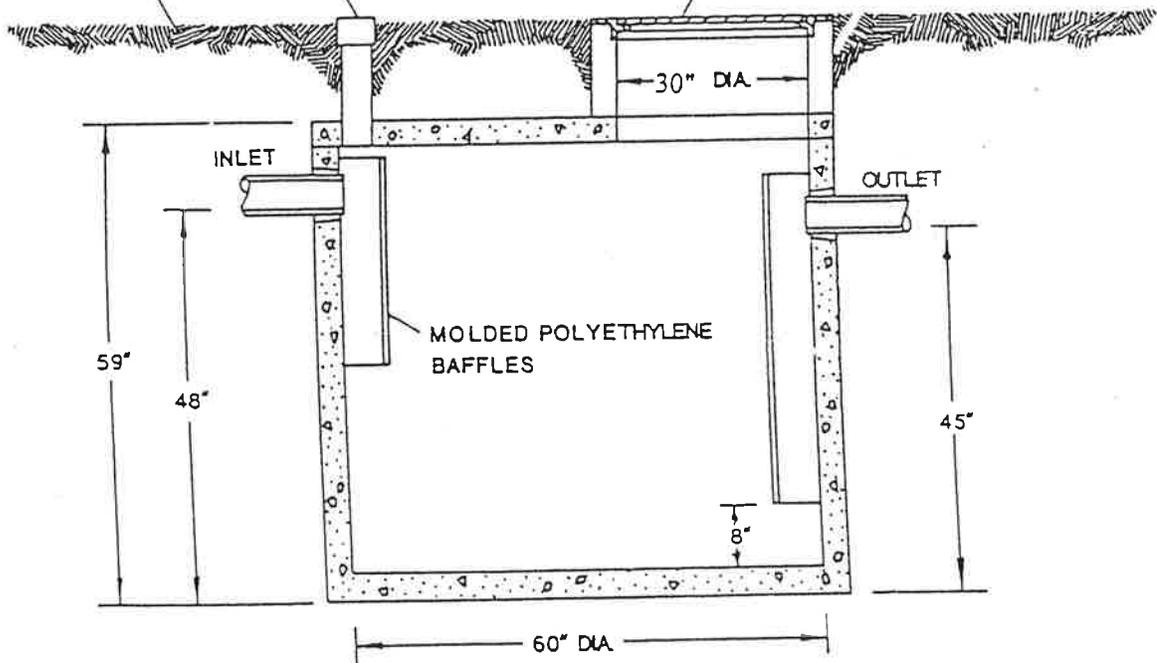
	BCM ENGINEERS	DRAWN:
3-99	JOINT DETAIL	SCALE: NONE
5-96		PLATE NO. 46
2-96		
REVISIONS		



4" BAFFLE ACCESS AND INSPECTION PORT

FRAME & COVER

FINISH GRADE



3-99
5-96
REVISIONS



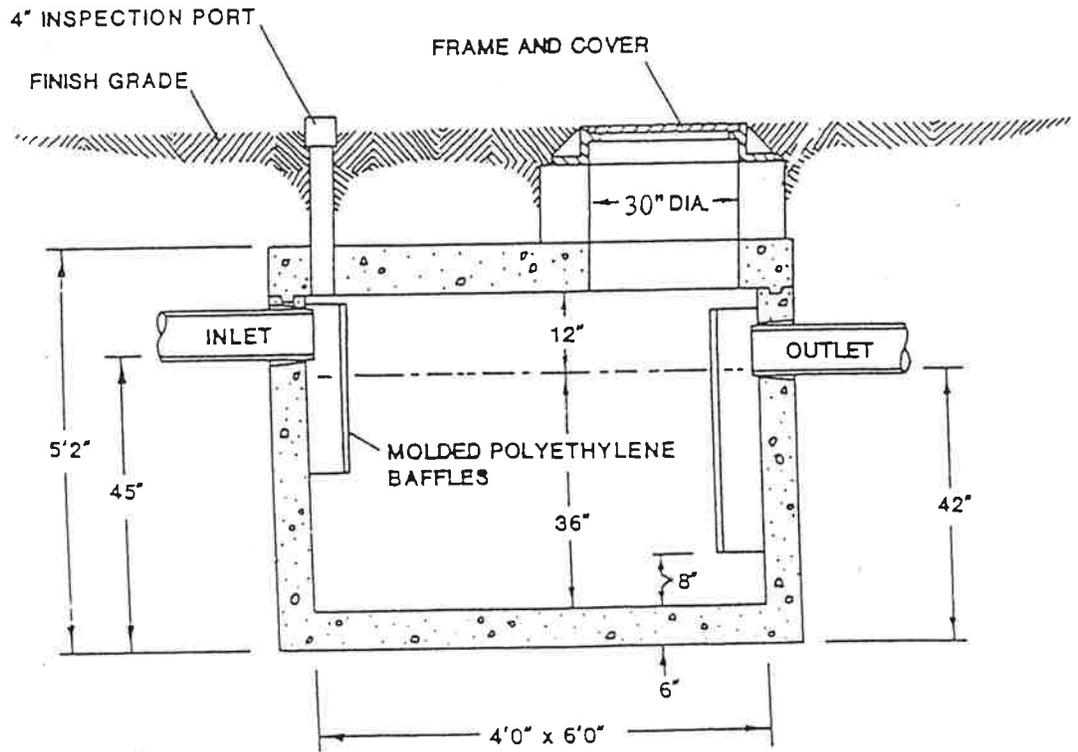
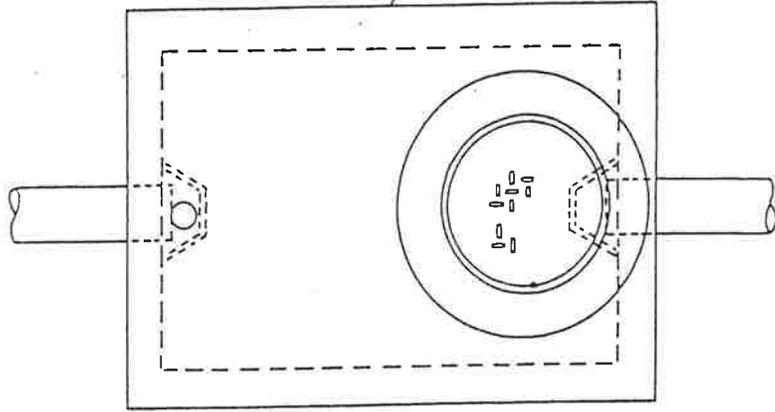
TYPICAL 500 GAL. EXTERIOR GREASE TRAP

DRAWN:

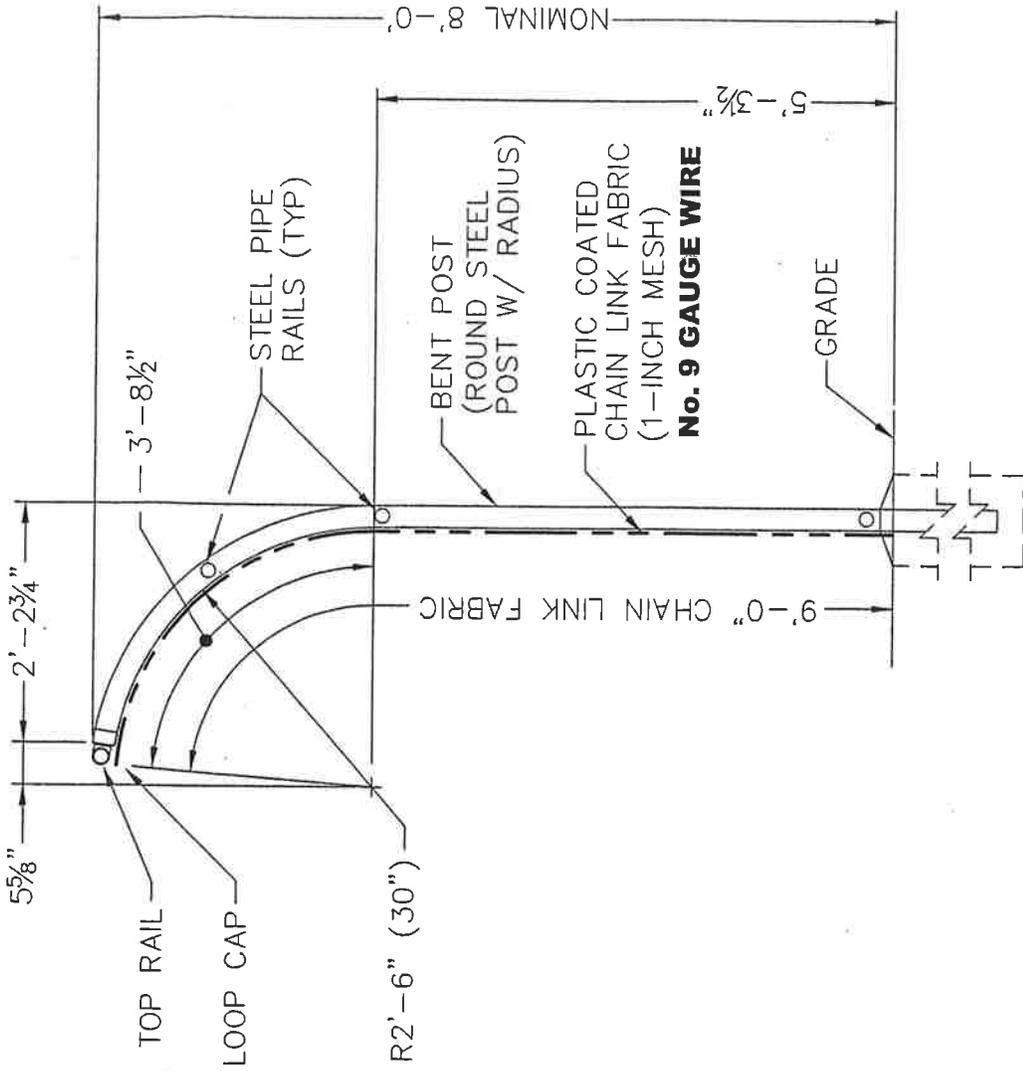
SCALE: NONE

47

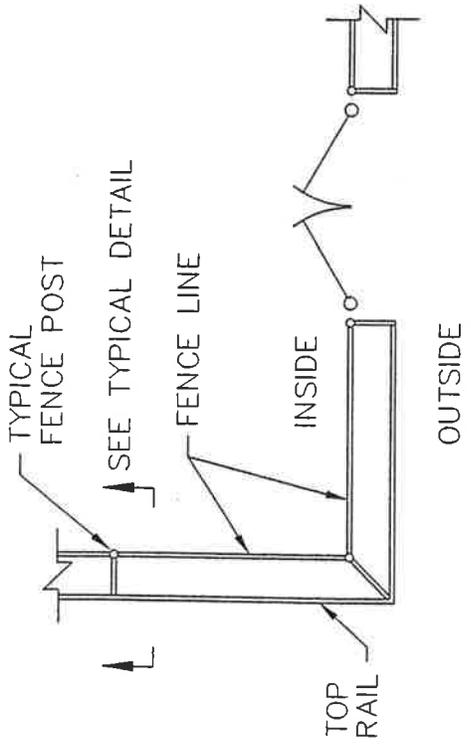
PRECAST CONFORMS TO
ASTM C913 SPECIFICATIONS



	 <small>A Division of TMC</small>	DRAWN:
3-99 5-96 REVISIONS	TYPICAL 500 GAL. HS20 EXTERIOR GREASE TRAP	SCALE: NONE
		48



TYPICAL FENCE POST DETAIL

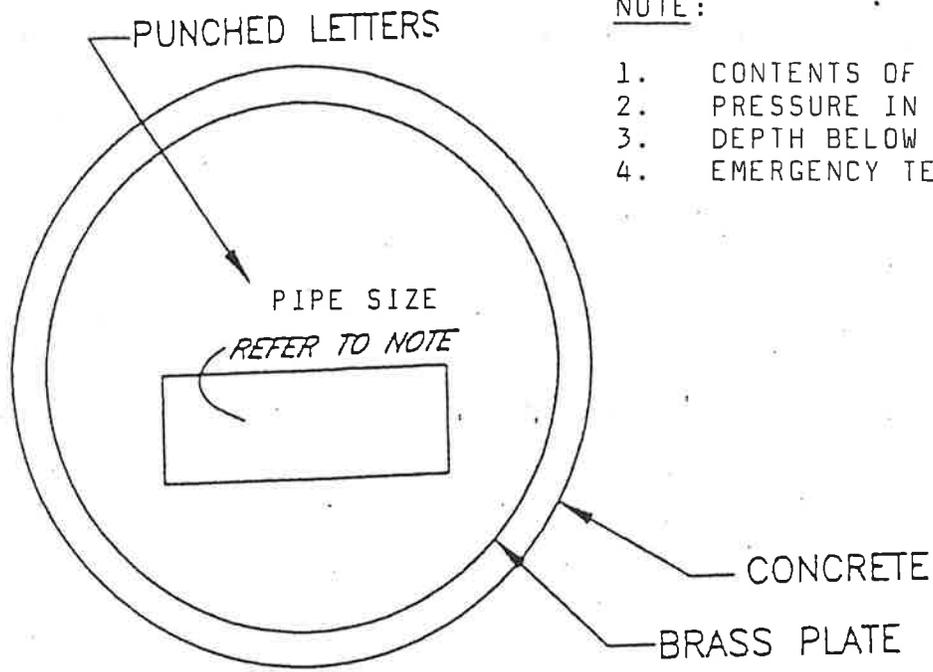


PARTIAL PLAN - TYPICAL

NOTES:

1. ALL RAILS, POSTS, AND HARDWARE TO BE GALVANIZED.
2. 12 FT WIDE GATE TO BE 8 FT HIGH (STRAIGHT, NOT BENT), DOUBLE LEAF. OPENING INWARD. NO BARBED WIRE, 1-INCH MESH.
3. FENCING TO BE ANCHOR FENCE PRODUCTS BY MASTER-HALCO, (800-229-5615)
4. MINIMUM DEPTH FOR CONCRETE FOOTING FOR LINE POST TO BE 42".

 BCM Engineers <small>ESTABLISHED 1982</small>		© 2002	DRAWN: GBT
PERIMETER FENCING		DATE: 12/12/02	SCALE: NONE
REVISIONS		PLATE NO. 50	

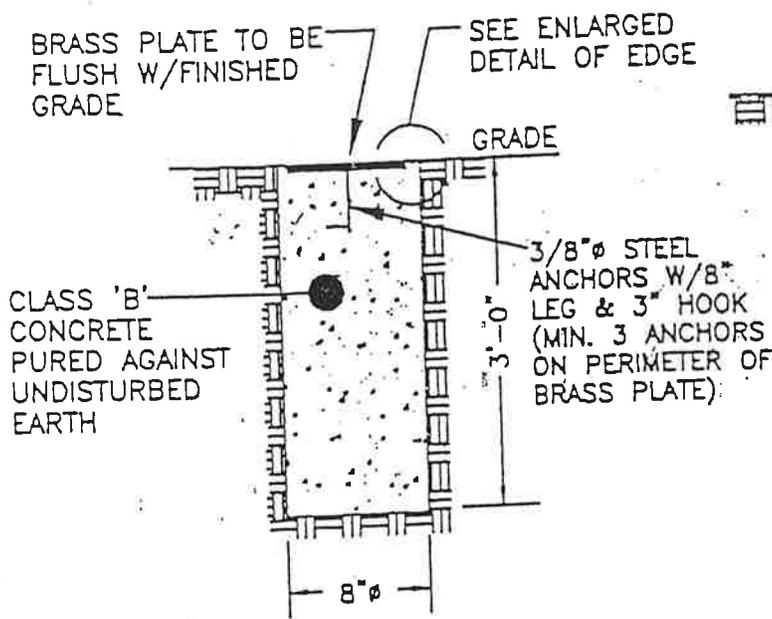


NOTE:

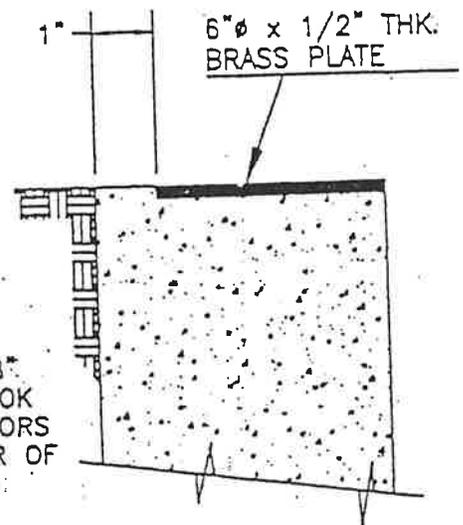
1. CONTENTS OF PIPE
2. PRESSURE IN PIPE
3. DEPTH BELOW GRADE
4. EMERGENCY TELEPHONE NUMBER

PLAN

LAYOUT OF PUNCHED LETTERS



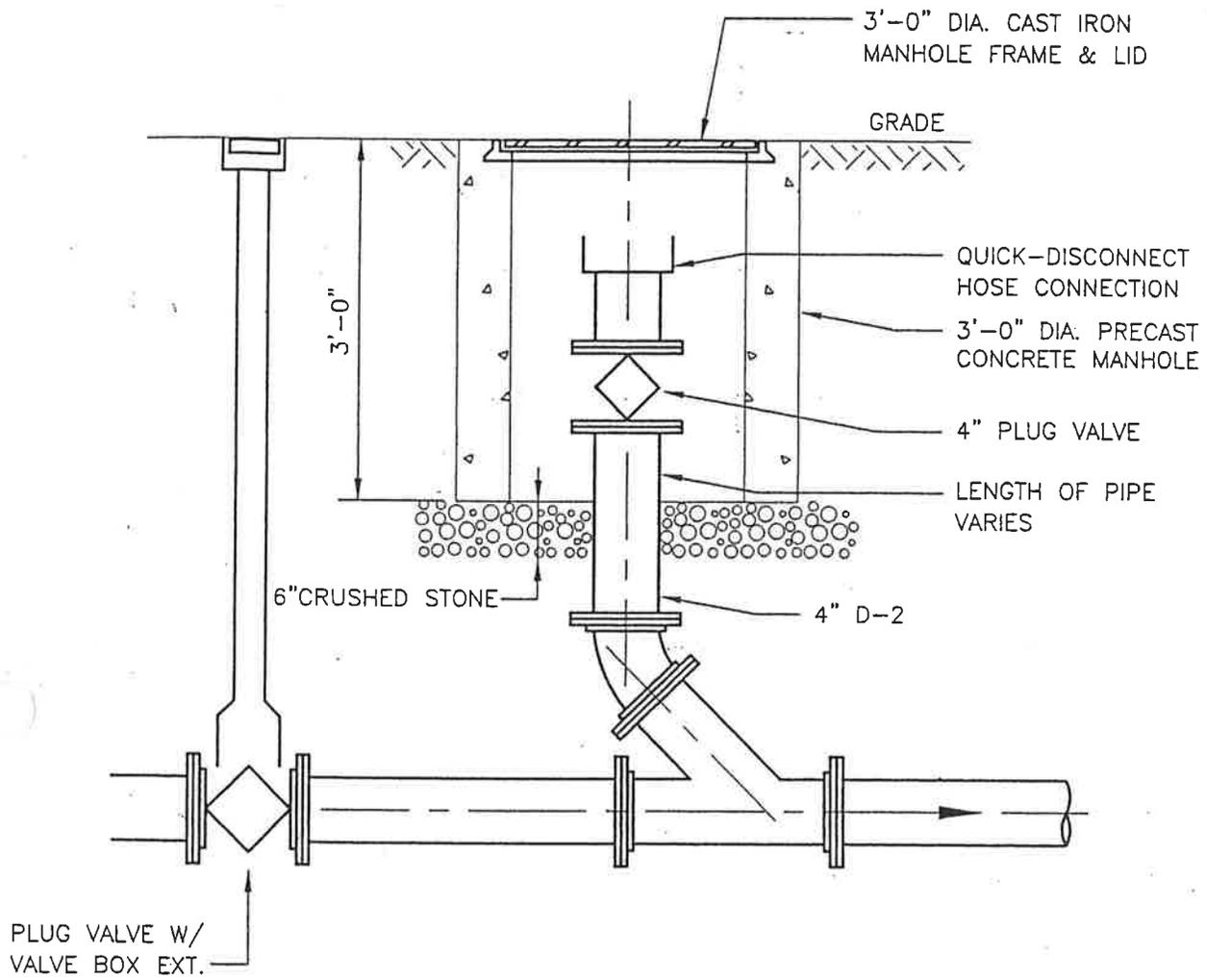
ELEVATION



ENLARGED DETAIL OF EDGE

PIPELINE MARKER DETAIL

NTS



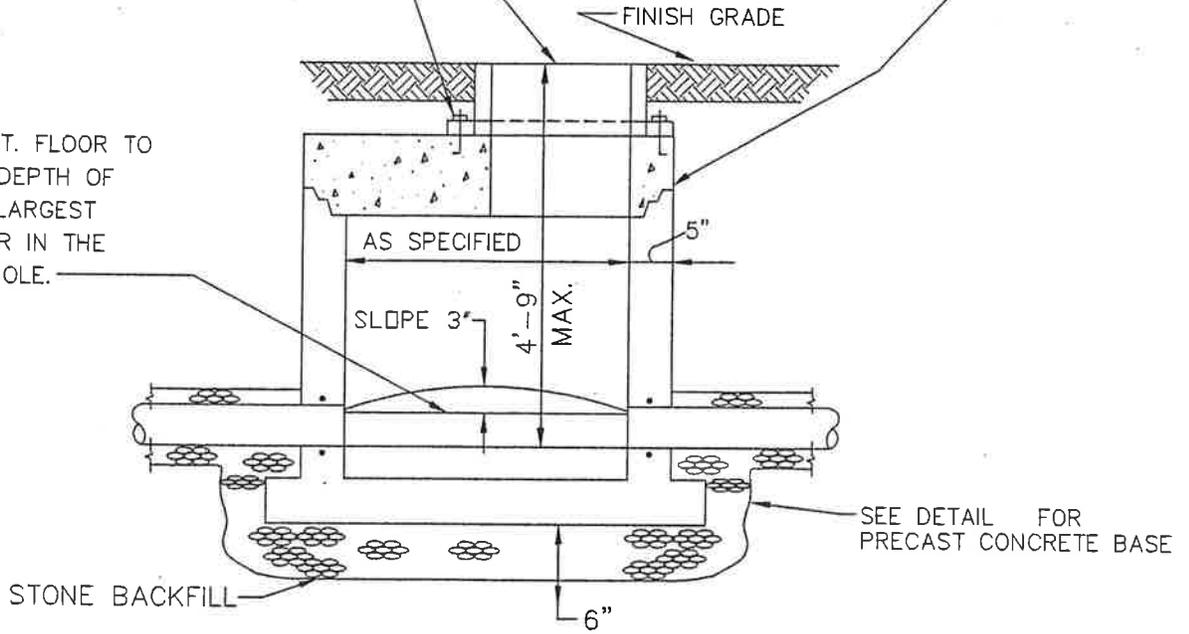
BYPASS PUMP CONNECTION DETAIL
 N.T.S.

MANHOLE FRAME
AND COVER TO BE
BEDDED IN 1/2" MASTIC

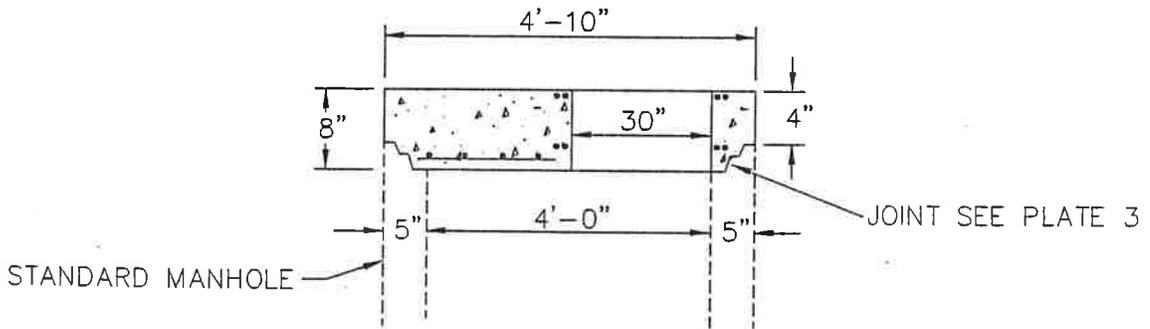
PROVIDE 4 - 3/4" Ø GALV.
STL. BOLTS WITH MIN.
OF 2" PROJECTION.

SEE DETAIL BELOW - M. H.
TOP SLAB

CONST. FLOOR TO
3/4 DEPTH OF
THE LARGEST
SEWER IN THE
MANHOLE.



SECTION "A-A"



DETAIL - M.H. TOP SLAB

MANHOLE DESIGN SHALL CONFORM TO ASTM C478 LATEST VERSION

		DRAWN: TLJ
		SCALE: NONE
MARCH 23, 2001	TYPICAL SHALLOW MANHOLE	PLATE NO. 4
REVISIONS		