



CONSTRUCTION, REPAIR,
REPLACEMENT REQUIREMENTS
FOR SANITARY SEWERS AND APPURTENANCES

and

DETAIL DRAWINGS

for

UPPER GWYNEDD TOWNSHIP
MONTGOMERY COUNTY, PENNSYLVANIA

OCTOBER 2016



ENVIRONMENTAL ENGINEERING
& MANAGEMENT ASSOCIATES, INC.

**CONSTRUCTION, REPAIR, REPLACEMENT REQUIREMENTS
AND DETAIL DRAWINGS
FOR
SANITARY SEWERS AND APPURTENANCES**

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SECTION 1

GENERAL CONDITIONS

ARTICLE 1-DEFINITIONS

Wherever used in this manual for Sewer Construction the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

CONTRACTOR – The person, firm or corporation constructing or repairing any portion of the TOWNSHIP's sanitary sewer infrastructure.

DETAIL DRAWINGS - The detailed construction drawings provided in this Manual for Sewer Extension Construction.

DEVELOPER - The person, firm or corporation, ultimately responsible for construction of the sewer with whom TOWNSHIP has entered into the Agreement, as well as agents acting on behalf of DEVELOPER, including the DEVELOPER's CONTRACTOR.

DEVELOPER's AGREEMENT - The written agreement between TOWNSHIP and DEVELOPER covering the Work to be performed.

DEVELOPER'S CONTRACTOR - The person, firm or corporation constructing the sewer extension on behalf of DEVELOPER if other than Developer.

DEVELOPER's Drawings - The drawings which show the character and scope of the Work to be performed and which have been prepared by DEVELOPER and approved by ENGINEER and are referred to in the Sewer Extension Agreement.

ENGINEER - The person, firm or corporation named as such by the TOWNSHIP.

LAWS AND REGULATIONS: Laws or Regulations - Laws, rules, regulations, ordinances, codes and/or orders.

MANUAL - The Manual for Construction Requirements and Detail Drawings for Sanitary Sewers and Appurtenances.

PROJECT - The total construction of the sanitary sewer extension.

PROJECT INSPECTOR The authorized representative of the TOWNSHIP assigned to the site or any part thereof for inspection of construction.

SHOP DRAWINGS - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for DEVELOPER/CONTRACTOR to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by DEVELOPER/CONTRACTOR to illustrate material or equipment for some portion of the Work.

SPECIFICATIONS - Those portions of the Manual consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

SUPPLIER - A manufacturer, fabricator, supplier, distributor, materialman or vendor.

TOWNSHIP - Upper Gwynedd Township

UNDERGROUND FACILITIES - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

WORK - The entire completed construction of the sewer extension or the various separately identifiable parts thereof required to be furnished under this Manual. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by this Manual.

ARTICLE 2 - PRELIMINARY MATTERS

Before Starting Construction:

- 2.1. The DEVELOPER/CONTRACTOR must provide 10 days prior notification to the TOWNSHIP before undertaking the project.

Preconstruction Conference:

- 2.2. At least 10 days prior to construction but before the DEVELOPER/CONTRACTOR starts the Work at the site, a conference attended by DEVELOPER's CONTRACTOR, TOWNSHIP, ENGINEER and others as appropriate will be held to discuss procedures for handling Shop Drawings and other submittals and to establish a working understanding among the parties as to the Work.

ARTICLE 3 - DEVELOPER/CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

- 3.1. DEVELOPER/CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Manual. DEVELOPER/CONTRACTOR shall be solely responsible for the means, methods, techniques, safety sequences and procedures of construction. DEVELOPER/CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Manual.
- 3.2. DEVELOPER/CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent. The superintendent will be DEVELOPER/CONTRACTOR's representative at the site and shall have authority to act on behalf of DEVELOPER/CONTRACTOR. All communications given to the superintendent shall be as binding as given to DEVELOPER/CONTRACTOR.

Labor, Materials and Equipment:

33. DEVELOPER/CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Manual. DEVELOPER/CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Manual, all Work at the site shall be performed during "regular" working hours between 7 AM and 7 PM, and DEVELOPER/CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without TOWNSHIP's written consent given after prior written notice.
34. All materials and equipment shall be of good quality and new, except as otherwise provided in the Manual. If required by ENGINEER, DEVELOPER/CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Manual; but no provision of any such instructions will be effective to assign to ENGINEER, or any of ENGINEER's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 5.7.

Substitutes or "Or-Equal" Items:

- 35.1. Whenever materials or equipment are specified or described in the Manual by using the name of a proprietary item or the name of a particular Supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by ENGINEER if sufficient information is submitted by DEVELOPER/CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than DEVELOPER/CONTRACTOR. If DEVELOPER/CONTRACTOR wishes to furnish or use a substitute item of material or equipment, DEVELOPER/CONTRACTOR shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.
- 35.2. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Manual, DEVELOPER/CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to ENGINEER, if DEVELOPER/CONTRACTOR submits sufficient information to allow ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in paragraph 3.5.1. as applied by ENGINEER.

- 3.5.3. ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by an approved Shop Drawing. TOWNSHIP may require DEVELOPER/CONTRACTOR to furnish at DEVELOPER/CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute. ENGINEER will record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by DEVELOPER/CONTRACTOR and in making changes in the Manual occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, DEVELOPER/CONTRACTOR shall reimburse TOWNSHIP for the charges of ENGINEER and ENGINEER's consultants for evaluating each proposed substitute.

Record Documents:

- 3.6. DEVELOPER/CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Directive Changes, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 5.4) in good order and annotated by the DEVELOPER/CONTRACTOR to show all changes made during construction and all lateral locations and depths. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, samples and Shop Drawings will be delivered to ENGINEER for TOWNSHIP.

Shop Drawings and Samples:

- 3.7. After checking and verifying all field measurements and after complying with applicable procedures specified in this manual, DEVELOPER/CONTRACTOR shall submit to ENGINEER for review and approval, seven copies of all Shop Drawings, which will bear a stamp or specific written indication that DEVELOPER/CONTRACTOR has satisfied DEVELOPER/CONTRACTOR's responsibilities under the Manual with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to- review the information as required.
- 3.8. ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but ENGINEER's review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the Manual and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Manual) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. DEVELOPER/CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review and approval. DEVELOPER/CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

- 3.9. ENGINEER's review and approval of Shop Drawings or samples shall not relieve DEVELOPER/CONTRACTOR from responsibility for any variation from the requirements of the Manual unless DEVELOPER/CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission as required by paragraph 3.7 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve DEVELOPER/CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of paragraph 3.7.
- 3.10. Where a Shop Drawing or submittal is required by the Manual, any related Work performed prior to ENGINEER's review and approval of the pertinent submission will be the sole responsibility of DEVELOPER/CONTRACTOR and may be subject to rejection.

ARTICLE 4 - TOWNSHIP'S RESPONSIBILITIES

- 4.1. TOWNSHIP's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 7.4.

ARTICLE 5 - TOWNSHIP'S STATUS DURING CONSTRUCTION

Owners Representative:

- 5.1. ENGINEER will be TOWNSHIP's representative during the construction period.

Visits to Site:

- 5.2 As may be directed by OWNER/MUNICIPALITY, ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Manual. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for TOWNSHIP a greater degree of confidence that the completed Work will conform to the Manual. On the basis of such visits and on-site observations as an experienced and qualified design professional, ENGINEER will keep TOWNSHIP informed of the progress of the Work and will endeavor to guard TOWNSHIP against defects and deficiencies in the Work.
- 5.3 ENGINEER will not be responsible for DEVELOPER/CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for DEVELOPER/CONTRACTOR's failure to perform or furnish the Work in accordance with the Manual.
- 5.4 ENGINEER will not be responsible for the acts or omissions of DEVELOPER/CONTRACTOR or of DEVELOPER'S CONTRACTOR, any Supplier, or of any other person or organization performing or furnishing any of the Work.

Project Inspector:

- 5.5. TOWNSHIP will either appoint an inspector or request that ENGINEER provide a project inspector to observe the performance of the work. Inspection shall be provided solely for the purpose and to the extent necessary to insure conformance with the Manual construction requirements.

Authorized Variations in Work:

- 5.6. ENGINEER may authorize minor variations in the Work from the requirements of the Manual only in accordance with the procedures described in Section 3 of the Manual.

Rejecting Defective Work:

- 5.7. ENGINEER or the TOWNSHIP'S DESIGNATED REPRESENTATIVE will have authority to disapprove Work which ENGINEER or REPRESENTATIVE believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 7.9 whether or not the Work is fabricated, installed or completed.

Shop Drawings:

- 5.8. In connection with ENGINEER's responsibility for Shop Drawings and samples, see paragraphs 3.7 through 3.10 inclusive.

ARTICLE 6 - CHANGES IN THE WORK

- 6.1. All changes in project shall be in accordance with Section 3 of the Manual.

ARTICLE 7 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

- 7.1. DEVELOPER/CONTRACTOR warrants and guarantees to TOWNSHIP and ENGINEER that all Work will be in accordance with the Manual and will not be defective. Prompt notice of all defects shall be given to DEVELOPER/CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article.

Access to Work:

- 7.2. ENGINEER and other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. DEVELOPER/CONTRACTOR shall provide proper and safe conditions for such access.

Tests and Inspections:

- 7.3. DEVELOPER/CONTRACTOR shall give ENGINEER timely notice (minimum 48 hours) of readiness of the Work for all required inspections, tests or approvals.

- 7.4. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, DEVELOPER/CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. DEVELOPER/CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with TOWNSHIP's or ENGINEER's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to DEVELOPER/CONTRACTOR's purchase thereof for incorporation in the Work.
- 7.5. All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to TOWNSHIP and DEVELOPER/CONTRACTOR (or by ENGINEER if so specified).
- 7.6. If any Work (including the work of others) that is to be inspected, tested or approved is covered without concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at DEVELOPER/CONTRACTOR'S expense unless DEVELOPER/CONTRACTOR has given ENGINEER timely notice of DEVELOPER/CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.
- 7.7. Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve DEVELOPER/CONTRACTOR from DEVELOPER/CONTRACTOR's obligations to perform the Work in accordance with the Manual.

Uncovering Work:

- 7.8. If any Work is covered contrary to the request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at DEVELOPER/CONTRACTOR's expense.
- 7.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, DEVELOPER/CONTRACTOR, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question. DEVELOPER/CONTRACTOR shall furnish all necessary labor, material and equipment. If it is found that such Work is defective, DEVELOPER's CONTRACTOR shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals).

Correction or Removal of Defective Work:

- 7.10. If required by ENGINEER, DEVELOPER/CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with nondefective Work. DEVELOPER/CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

SECTION 2

REFERENCE STANDARDS

ARTICLE 1 - QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the DEVELOPER's Agreement date.
- C. When required by individual Specification section, obtain copy of standard. Maintain a copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

ARTICLE 2 - SCHEDULE OF REFERENCES

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York NY 10020
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AMCA	Air Movement and Control Association 30 West Broadway New York, NY 10018
ASME	American Society of Mechanical Engineers 345 East 47111 Street New York, NY 10017

ASTM	American Society for Testing Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 NW 7 th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street Suite 2110 Chicago, IL 60601
EJMA	Expansion Joint Manufacturers Association 708 Westchester Avenue White Plains, NY 10604
FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg., 197 Washington, DC 20407
IEEE	Institute of Electrical and Electronics Engineers 345 East 47 th Street New York, NY 10017
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 823 15 th Street, N.W. Washington, DC 20005
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NEMA	National Electrical Manufacturers' Association 2010 L. Street, N.W. Washington, DC 20037

NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
PennDOT	Pennsylvania Department of Transportation Harrisburg, PA 17120
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062

SECTION 3

PROCEDURES FOR PROJECT CHANGES

ARTICLE 1 – PROCEDURES

- A. TOWNSHIP or ENGINEER may initiate changes by submitting letter of project change to the DEVELOPER/CONTRACTOR.
 - 1. Description of the change, products, and location of the change in the Project.
 - 2. Supplementary or revised Drawings and/or Specifications.
- B. DEVELOPER/CONTRACTOR may initiate changes by submitting a written notice to ENGINEER, containing:
 - 1. Description of the proposed changes.
 - 2. Statement of the reason for making the changes.
 - 3. Statement of compliance with Project Manual requirements.
 - 4. Documentation supporting need for change.
 - 5. No changes from the approved design shall be made without written authorization from the ENGINEER.

ARTICLE 2 – CONSTRUCTION CHANGE AUTHORIZATION

- A. In lieu of letter of project change, ENGINEER may issue a field Construction Change Authorization for CONTRACTOR to proceed with a change for subsequent inclusion in letter for project change.
- B. Authorization will describe changes in the Work including both additions and deletions.
- C. ENGINEER will sign and date the Construction Change Authorization in the field as authorization for the DEVELOPER/CONTRACTOR to proceed with the changes.
- D. CONTRACTOR may sign and date the Construction Change Authorization to indicate agreement.

SECTION 4

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

ARTICLE 1- SHOP DRAWINGS

- A. Present in a clear and thorough manner. Title each drawings with Project name and number.
- B. Identify field dimensions; show relation to adjacent or critical features of Work or products.
- C. Minimum Sheet Size: 8 1/2 x 11 inches.

ARTICLE 2 – PRODUCT DATA

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.
- C. Provide manufacturer's preparation, assembly, and installation instructions.

ARTICLE 3 – DEVELOPER'S CONTRACTOR REVIEW

- A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Manual.
- B. Coordinate submittals with requirements of Work and Manual.
- C. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Manual. Notify ENGINEER in writing at time of submittal of any deviations from requirements of Manual.
- D. Do not fabricate products or begin work which requires submittals until return of submittal with ENGINEER's acceptance.

ARTICLE 4 – SUBMITTAL REQUIREMENTS

- A. Transmit submittals in accordance with approved procedures.
- B. Apply DEVELOPER's CONTRACTOR stamp, signed or initialed, certifying to review, verification of products, field dimensions and field construction criteria, and coordination of information with requirements of Work.
- C. Coordinate submittals into logical groupings to facilitate interrelation of the several Items.
- D. Submit number of opaque reproductions of shop drawings CONTRACTOR requires, plus three which will be retained by ENGINEER. Maximum number of copies not to exceed seven.
- E. Submit number of copies of product data DEVELOPER's CONTRACTOR requires, plus three copies which will be retained by ENGINEER. Maximum number of copies submitted not to exceed seven.
- F. Submit number of samples required by individual Specification sections.
- G. Submit under transmittal letter. Identify Project by title and number; identify Contract by number. Identify Work and product by Specification section and Article number.

ARTICLE 5 - RESUBMITTALS

- A. Make resubmittals under procedures specified for initial submittals; identify changes made since previous submittal.

ARTICLE 6 - ENGINEER REVIEW

- A. ENGINEER will review and return submittals within 15 working days.

ARTICLE 7 - DISTRIBUTION

- A. Distribute reproductions of shop drawings, copies of product data, and samples, which bear ENGINEER stamp of approval, to job site file, Record Documents file, subcontractors, suppliers, and other entities requiring information.

SECTION 5
TEMPORARY CONTROLS

ARTICLE 1-DUSTCONTROL

- A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

ARTICLE 2-DIVERSIONANDCAREOFWATERDURINGSTREAMCROSSINGS

- A. The DEVELOPER/CONTRACTOR must obtain the necessary permits for swamp area and stream crossings from the Pennsylvania Department of Environmental Resources Division of Dams and Waterways and the Pennsylvania Fish Commission. DEVELOPER/CONTRACTOR shall not perform any work in a stream channel, unless he has been notified that the required permit has been issued, and whether or not the permit is subject to stipulations or special conditions. DEVELOPER/CONTRACTOR shall take sufficient precautions to prevent pollution of swamp areas or streams with fuels, oils, bitumens, or other harmful materials. He shall conduct his operations in such a way that will minimize damage to the stream channel and stream banks, prevent erosion of stream banks and deposits of excess sediment in streams, or otherwise harm streams or the properties along streams.
- B. Diversion and care of water during swamp area or stream crossing and canal embankment excavation work shall consist of diverting and maintaining the flow during the construction period, and dewatering work areas. All permanent construction work shall be performed in areas free from water unless otherwise specifically authorized by ENGINEER. The finished structures and portions thereof shall be protected from damage by flowing water until completion of work.
- C. The CONTRACTOR shall lay the pipe in the dry by diverting streams and/or dewatering the swamp areas. In diverting streams, extreme care must be used to prevent property damage.
- D. The pipe across stream crossings shall be encased in concrete in accordance with the dimensions shown on the Detail Drawings. The pipe shall be installed on wood blocks in order to maintain the proper grade. If the material in swamp areas or stream bottoms is soft, forms shall be used to constrict the concrete encasement. Unsuitable material shall be removed to a depth at which stable, undisturbed earth or rock is encountered, not to exceed a depth below pipe invert of three (3) feet, or to the limits designated by the ENGINEER. Trench sub bedding shall be backfilled with No. 3 crushed stone. If swamp areas or stream bottom is rock, forms shall not be used and, instead, the concrete shall be placed on firm rock below the pipe, and against firm rock on both sides of the pipe.

- E. After the concrete is placed, the balance of the trench under streams and their banks shall be backfilled with PA Select Granular Material. The trench over the encasement in swampy areas shall also be backfilled with PA Select Granular Material in accordance with Section 6 and the Detail Drawings, or as directed by the ENGINEER.
- F. Removal of Temporary Work: Unless otherwise authorized, all temporary protective structures and other works shall be removed upon completion of work. All banking and filling which is not part of the permanent work shall be removed to the original ground surfaces existing prior to beginning of work and all diversion channels, ditches, and other cavities shall be backfilled with embankment material, placed and compacted in accordance with Section 6. Materials used in temporary construction shall be disposed of to the satisfaction of the ENGINEER. Whenever the ENGINEER determines that the removal of sheeting and bracing will endanger completed work, he will direct that it be cut off not less than 2 feet below the ground surface, left in place, and backfilled. All temporary protective works shall be removed from the site after having served their purpose.

ARTICLE 3 - WATER CONTROL

- A. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas, and to direct drainage to proper runoff.
- B. Maintain excavations and trenches free of water, provide and operate pumping equipment of a capacity to control water flow. Provide and place all necessary or other channels of adequate size to carry temporarily all streams, brooks, storm water or other water which may flow along or across the lines of the sewer. All flumes or channels thus utilized shall be tight so as to prevent drainage into trenches.
- C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas, comply with applicable codes and regulations, and Article 1.07.

ARTICLE 4 - DEBRIS CONTROL

- A. Maintain all areas under DEVELOPER/CONTRACTOR's control free of extraneous debris.
- B. Initiate and maintain a specific program to prevent accumulation of debris.
 - 1. Provide containers for deposit of debris.

2. Prohibit overloading of trucks to prevent spillages.
 - a. Provide periodic inspection to enforce requirements.
- C. Schedule periodic collection and disposal of debris.
 1. Provide additional collections and disposal of debris whenever the periodic schedule is inadequate.

ARTICLE 5 - SOIL EROSION SEDIMENTATION AND POLLUTION CONTROLS

- A. Plan and execute construction to control surface drainage to prevent erosion and sedimentation.
- B. Comply with Erosion and Sedimentation Control Hand Book, Montgomery County Conservation District, (Mailing Address: Montgomery County 4H Center, Rt. 113, P.O. Box 164, Creamery, PA 19430) and in accordance with DEVELOPER/CONTRACTOR's approved plan.
- C. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams and impoundments or into natural or manmade channels leading thereto. Wash water or waste from concrete mixing operations shall not be allowed to enter streams.

ARTICLE 6 - TRAFFIC CONTROL

- A. The CONTRACTOR shall provide and maintain access to and from all properties along the line of this work. The CONTRACTOR shall also provide temporary by-passes and bridges and maintain them in a safe and usable condition whenever, in the opinion of the ENGINEER, detouring of traffic to parallel routes cannot be done without hardship or excessive increase in travel by the public.
- B. Where single lane by-passes are provided, the CONTRACTOR shall furnish signalmen to control traffic operations and minimize delays.
- C. Where directed by the ENGINEER, the CONTRACTOR shall perform excavating, paving, and other operations on one-half of the road at a time to allow for movement of traffic.

ARTICLE 7 - DETOURS

- A. The CONTRACTOR shall set up and maintain all necessary detours to the satisfaction of the ENGINEER and the Pennsylvania Department of Transportation. The CONTRACTOR shall supply and erect all necessary signs along the routes approved by the ENGINEER and Pennsylvania Department of Transportation. The CONTRACTOR shall notify police, fire, school and Township officials as well as adjacent municipalities, if necessary. All proposed detours shall be marked clearly on a map and submitted to the ENGINEER two weeks in advance of the time the detour will go into effect. The

CONTRACTOR will submit the plans to the Pennsylvania Department of Transportation and/or Municipality affected by the detour for approval. Signs used for marking all detours shall be as approved by the Pennsylvania Department of Transportation and/or Municipality affected by the detour and shall be securely fastened in place to prevent vandalism.

ARTICLE 8-SAFEGUARDS

- A. The CONTRACTOR shall provide, erect and maintain adequate barricades, warning signs and lights at all excavations closures, detours and points of danger.
- B. All haul routes proposed to be used-by the CONTRACTOR shall be approved by the Township prior to the start of any work.

SECTION 6

TRENCHING

ARTICLE 1- GENERAL

1.01 WORK INCLUDED

- A. Excavated trenches for sewers and structures as shown on Drawings.
- B. Compacted bedding and compacted fill over sewers to subgrade elevations.

1.02 RELATED WORK

- A. Section 5 - Temporary Controls: Control of Water, Traffic Control.

1.03 REFERENCES

- A. Pennsylvania Department of Highways Bulletin 408.
- B. OSHA 29 CFR 1926.

1.04 SUBMITTALS

- A. The CONTRACTOR, ten (10) days before beginning any earthwork, shall submit to the ENGINEER the following information:
 - 1. Location of source(s) for all types of fill materials.
 - 2. Numbers and types of compacting equipment to be used.
 - 3. Starting date of earthwork operations.
- B. The CONTRACTOR shall submit to a testing laboratory for testing and review one 100-pound representative bag sample of each kind of fill material at least ten (10) days prior to fill or backfill operations. By submitting samples of these materials, the CONTRACTOR agrees and guarantees that fill materials actually used in the construction will conform to the accepted samples submitted. The testing lab report shall be delivered to the ENGINEER five (5) days prior to the start of fill or backfill operations.

1.05 LINES AND ELEVATIONS

- A. Elevations
 - 1. Pipes shall be laid true to the lines and elevations shown on the Plans. Work not conforming to the elevation shall be corrected by the CONTRACTOR at his own expense.

B. Locations of Lines

1. The locations of the proposed lines are shown on the Plans.
2. Approximate elevations are shown on the Plans.
3. The ENGINEER reserves the right to make changes in lines and elevations of pipe lines and in locations of pipes and manholes when such changes may be necessary or advantageous.

1.06 SAFETY REQUIREMENTS

- A. Provide and maintain barricades, signs, lights, etc. as required to protect the public.

B. Excavation Near Existing Structures

1. Excavations near structures will not be allowed closer to the structure than the depth of the excavation below the existing structure foundation plus two (2) feet without shoring the excavation with sheeting.

C. Underground Utilities

1. Attention is directed to the fact that there may be water pipes, drains and other utilities in certain locations. Prior to the start of any work, the CONTRACTOR shall independently confirm the locations of all existing utilities in the Project area and shall comply with the provisions of the underground utility line protection law.

D. Mud, Dirt and Debris

1. During the progress of the work, the CONTRACTOR shall conduct his operation and maintain the area of his activities so as to minimize the creation and dispersion of dust. If the TOWNSHIP decides that it is necessary to use a water truck or other dust control inhibition for more effective dust control, the CONTRACTOR shall furnish the material, load, deliver, and distribute same as authorized.
2. The CONTRACTOR shall maintain existing access roads and facilities free of mud, dirt and debris.

1.07 CARE AND RESTORATION OF PROPERTY

- A. Excavating machinery and cranes shall be operated with care to prevent damage to existing structures and/or wires.

- B. On paved surfaces, the CONTRACTOR shall not use or operate tractors, bulldozers, or other power operated equipment, the treads or wheels of which will cut or otherwise damage such surfaces.
- C. All surfaces which have been damaged by the CONTRACTOR's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.
- 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.

1.08 WORK IN PRIVATE RIGHT-OF-WAY

- A. Right-of-way, if required, to be secured by DEVELOPER. Protect from injury all property including land, ornamental shrubs and trees, fences, and other improvements thereto that may exist; and replace in kind all those damaged.
- B. Pay all claims for property damage, trespass occupation for damage outside the right-of-way.
- C. It shall be the DEVELOPER/CONTRACTOR's responsibility to obtain all other rights-of-way for access to the Construction site. Written authorization from all affected property OWNERS shall be provided to the ENGINEER before beginning work in the affected area.

1.09 REGULATIONS

- A. During excavation and backfill in State, County and Township highways, the CONTRACTOR shall be governed by the conditions, restrictions and regulations made by OSHA 29 CFR 1926, Pennsylvania Department of Transportation, the County Commissioners, and Township. All such regulations shall be in addition to the ones set down in these Specifications.

ARTICLE 2 PRODUCTS

2.01 MATERIALS - GENERAL

- A. In general, materials used for fill (site fill, structural fill, backfill, etc.) shall be foreign materials and be brought to the site from acceptable sources. The use of excavated materials as backfill will be approved on a case by case basis.
- B. Present on site materials excavated in the course of construction which are deemed suitable by the ENGINEER may be stored on the site for use as backfill.
- C. All material, whether from the excavations or from borrow, shall be of such nature that after it has been placed and properly compacted, it will make a dense, stable fill. It shall not contain vegetation, cinders, ashes, refuse, masses of roots, stones

larger than sizes allowed in the following paragraph, or porous matter. Organic matter shall not exceed minor quantities and shall be well distributed.

2.02 SELECT MATERIALS

- A. Coarse Aggregate AASHTO No. 8.
- B. Coarse Aggregate AASHTO No. 57.
- C. Coarse Aggregate PA No. 2A.

ARTICLE 3 EXECUTION

3.01 GENERAL DESCRIPTION

- A. Make all excavations in such manner and to such widths as will give suitable room for building the structures.
- B. Be solely responsible for the stability of excavations and provide all sheeting, shoring, bracing, etc., required to retain excavations.
- C. The excavation, dewatering, sheeting and bracing shall be carried out in such manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure or any work previously completed under this Contract, unless otherwise allowed in writing by the ENGINEER.
- D. Where damage is liable to result from withdrawing sheeting, the sheeting shall be left in place. Sheeting shall be left in place only when agreed to or requested by the ENGINEER.
- E. Excavated unsuitable and excess material shall be removed from the site. Any excavated material, deemed suitable by the ENGINEER, may be reused as backfill if authorized by the ENGINEER.
- F. Provide and operate pumping equipment necessary to maintain all excavations free of subsurface and storm water during the life of construction. Dispose of pumped water as permitted by the ENGINEER in such a manner that operation and storage areas and other facilities are not flooded.

3.02 SEPARATION OF SURFACE MATERIALS

- A. From areas within which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again; or, if CONTRACTOR prefers not to separate surface materials, he shall furnish, clean backfill and topsoil at least equal in quantity and quality to that excavated.

- B. When excavations are to be made in paved surfaces, the pavement shall be cut and removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement.
- C. If pavement is removed in large pieces, it shall not be mixed with other excavated material, but shall be disposed of away from the site of the work before the remainder of the excavation is made.

3.03 SHEETING AND BRACING

- A. Where necessary, particularly for safety or to prevent disturbance, damage or settlement of adjacent structures, pipelines, utilities, improvements or paving, excavations shall be sheeted and braced. Any damage to new or existing structures occurring through settlement, water or earth pressure, or other causes due to inadequate bracing, through negligence or fault of the CONTRACTOR in any other manner, shall be repaired by the CONTRACTOR.
- B. Where trenches or excavations exceed five (5') feet in depth, the CONTRACTOR shall, in advance of the start of the work, submit pipe installation and excavation procedures to the ENGINEER for his review. The information shall include complete details and descriptive data of materials and installation procedures for sheeting and bracing, trench boxes and excavation of side slopes as proposed to be used.
- C. Where sheeting or trench boxes are used, they must be designed by a Professional ENGINEER licensed to practice in the State of Pennsylvania. Said ENGINEER shall provide the CONTRACTOR with a certification signed and sealed by him stating that the design of the sheeting and bracing conforms to all applicable requirements of the Pennsylvania Construction Safety Code and the Occupational Health and Safety Act. Copies of this certification shall be submitted to the ENGINEER.
- D. The CONTRACTOR 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.
- E. 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.
- F. Sheeting Left In Place
 - 1. To prevent subsequent damage to structures or property, it may be necessary to leave sheeting, bracing, etc. in place to be embedded in backfill or concrete.

- 2 Materials used for sheeting and bracing may have to be cut off at any specified elevation due to job conditions.

3.04 DRAINAGE

- A. The CONTRACTOR shall provide, place and maintain ample means and devices with which to remove promptly and dispose properly of all water entering trenches and other excavations, or water that may flow along or across the site of the work and keep said excavations dry until the structures, pipes, and such appurtenances to be built therein have been completed to such extent that they will not be damaged.

3.05 PROTECTION OF EXISTING UTILITY LINES

- A. As the excavation approaches pipes, conduits, or other underground structures, digging by conventional trenching machine methods shall be done with extreme care. Manual excavation may be required to locate utilities and/or underground structures.
- B. All existing pipes, wires, fences, curbs, property-line markers, and other structures which in the opinion of the ENGINEER must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage, and in case of damage, the CONTRACTOR shall notify the "property OWNER" so that proper steps may be taken to repair any and all damage done. When the "property OWNER" does not wish to make the repairs themselves, all damage shall be repaired by the CONTRACTOR or, if not promptly done by him, the ENGINEER may have the repairs made at the expense of the CONTRACTOR.
- C. All utility services shall be supported by suitable means so that the services do not fail when tamping and settling occurs.

3.06 RELOCATION AND REPLACEMENT OF EXISTING UTILITY LINES

- A. If in the course of construction, the CONTRACTOR encounters utility services of any kind which encroach upon or are encountered near and substantially parallel to the edge of the excavation and in the opinion of the ENGINEER will impede progress to such an extent that satisfactory construction cannot proceed, they shall be changed in location, removed (later be restored), or replaced.
- B. In removing existing pipes, the CONTRACTOR shall use care to avoid damage to material.
- C. When fences interfere with the CONTRACTOR'S operations, he shall remove and (unless otherwise specified) later restore them to at least as good condition as that in which they were found immediately before the work was begun. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.07 SUBGRADE PREPARATION

- A. If, in the opinion of the ENGINEER, the materials at or below the elevations shown on the plans are unsuitable for support of structures or piping, it shall be removed to such depth and width as the ENGINEER may direct. Such extra excavation shall be placed with Class D Concrete or Type 2A Modified Stone as directed by the ENGINEER. Such changes shall be authorized in writing. All surplus excavated materials shall be removed from the site.
- B. Residual soil or decomposed rock subgrade areas which are located beneath or very close to the groundwater level shall be immediately covered with a granular working mat to prevent softening of the natural soil material due to subsequent construction activities or by exposure to the elements. The granular working mat shall have a minimum thickness of 6 inches and shall consist of select fill. The material shall be compacted on-grade using manually guided compaction equipment.

3.08 DEEP EXCAVATIONS

- A. The sides of the excavation up to a height of two (2') feet from the bottom of the trench shall be kept as nearly vertical as possible, consistent with the type of material encountered. Above this height, the CONTRACTOR shall slope or bench the trench walls or provide temporary sheeting to maintain safe working conditions for the work persons and traffic. A clear area shall be maintained to avoid overloading which may cause slides, cave-ins or shifting of the pipes. All damages to pipe or structures occurring due to settlement, heaving, water or earth pressure, slides or other causes shall be repaired or replaced by the CONTRACTOR at his own expense.

It is the responsibility of the CONTRACTOR and his superintendent to ensure that all the work is performed in accordance with O.S.H.A. and Pennsylvania Occupational Safety Laws requirements.

3.09 GROUNDWATER CONTROL

- A. Installation of sewers and structures below the groundwater table will require a temporary dewatering system if water is observed to seep into the excavation through the sidewalls or bottom. If required, this system shall consist of sump pits or trenches located around the perimeter of the excavation. Pumping from the sump pits for trenches shall continue until the water level is at least one to two feet below the bottom of the excavation, and the excavation bottom is observed to be dry and stable. The water table must be maintained below this grade until the pipe or structure has been placed, the peripheral excavation backfilled, and sufficient load provided to resist hydrostatic uplift.

3.10 EARTHWORK FOR SEWERS

A. Trench Width

1. The trench width shall be such as to provide sufficient working space on each side of the pipe for proper laying, but shall not be less than:

<u>Nominal Diameter of Pipe in Inches</u>	<u>Minimum Trench Width In Inches</u>	<u>Maximum Trench Width In Inches</u>
Up to 20	O.D.+ 16	O.D.+ 24
20 and Over	O.D + 20	O.D.+ 28

2. The trenches shall be sufficiently straight between the designated points to permit the laying of pipe approximately in the center of the trench. The width of the trench for sheeting and shoring shall be measured between the closest interior faces of sheeting. The width of the trench at and below the top of pipe shall be wide enough to permit workmen and the ENGINEER free access for inspection.
3. If the CONTRACTOR excavates the trench more than the above width requirements, for any reason, he shall at his own expense encase or cradle the pipe in a manner satisfactory to the ENGINEER.

B. Excavation Below Grade

1. The CONTRACTOR shall excavate all trenches to at least six (6") inches below the pipe barrel to the proper profile shown on the Contract Drawings. The CONTRACTOR shall avoid over-excavation and provide a uniformly graded bottom surface. All loose material shall be removed from the trench. The bedding, pipe installation and backfilling shall then be accomplished as specified.
2. Where the bottom of the trench, by mistake of the CONTRACTOR, is taken out to a greater depth than specified for a given pipe bedding, the trench shall be brought back to grade as follows:
 - a. The over-excavation shall be filled with crushed stone so as to comply with the requirements for crushed stone foundation.
3. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
4. This additional material required due to the over-excavation shall be furnished and installed by the CONTRACTOR at his own expense.

C. Trench Length

1. The length of trench to be opened in advance shall depend upon the CONTRACTOR's ability to complete the installation of pipe and backfilling of the trenches at the end of the day. In no case shall the trench be opened more than 100 feet in advance of the pipe lines laid. Where the rock excavation is encountered, the ENGINEER may limit the length of trench to lesser than 100 feet to protect the pipes already installed.
2. All trenches shall be backfilled at the end of each day. Wherever necessary, trenches shall be covered with steel plate, properly anchored, adequately barricaded and provided with safety lights. All open ends of the pipes installed shall be adequately protected overnight from moisture and foreign materials. All such work shall be considered incidental to the construction of the pipe.

D. Pipe Bedding

1. General

- a. 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.
- b. 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.
- c. Pipe bedding shall, in all cases, extend up until one (1') foot of cover has been built up over the pipe.
- d. Refer to Drawings at the end of these specifications for bedding details.
- e. The bedding shall be compacted to not less than 95% of the maximum dry density as determined by ASTM 01557.

2. Crushed Stone Bedding (Encasement)

- a. All pipe shall be installed in a crushed stone encasement that is 6" below and 12" atop the pipe. The crushed stone shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade.
- b. Encasement material shall be spread in 4-inch layers and each layer shall be compacted with tampers until the required total depth of bedding (encasement) has been built up.

3. Concrete Encasement

- a. Where specified or required in the field, the pipe shall be supported by Concrete Encasement.
- b. The trench shall be excavated to a minimum depth as shown on the Plans. The excavated space shall then be completely filled with, and the entire pipe encased in concrete such that the concrete encasement measures a minimum 6 inches 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 Plans or specified herein, concrete shall be as specified herein. 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. Steel reinforcing, if required shall be as shown on the Plans.

4. Concrete Cradle

- a. 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.
- b. 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.
- c. The balance of the bedding to one (1') foot above the pipe shall be crushed stone.

E. Crushed Stone Foundation

- 1. In all bedding conditions where a suitable supporting soil or rock stratum occurs at a depth greater than required on the Plans but less than two (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 ENGINEER, the foundation shall be modified as follows:
 - 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.

F. Backfilling Pipe Trenches

1. General

- a. No backfilling shall be done before the ENGINEER 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.
- b. At least 30 inches of cover over the top of the pipe shall be provided before the trench is wheel-loaded.
- c. At least 24 inches of cover shall be provided before using mobile trench compactors of the hydro hammer or impactor type. These compactors shall only be used after the pipe has been properly backfilled in accordance with these Specifications.

2. Visual Inspection

- a. After the gravity sewers have been laid and backfill placed to one (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 CONTRACTOR before the work of backfilling proceeds.
 - (1) The portion of the pipe trench shall be backfilled with crushed stone to provide crushed stone encasement, installed as described above.
 - (2) When concrete cradle is used, the initial backfill will start at the top of the concrete and then continue as specified above.
 - (3) When concrete encasement is used, the initial backfill of crushed stone will not be required.

3. Final Backfilling

a. Backfilling Trench to Finished Grade After Initial Backfilling in Paved Areas

- i. After initial backfilling has been compacted the remainder of the trench shall be backfilled with Select Granular Material to underside of paving base course or subbase and shall be compacted to not less than 95% of the maximum dry density as determined by ASTM D1557.

b. Backfilling Trench to Finished Grade After Initial Backfilling in Grassed Areas

- i. After initial backfilling has been compacted as specified above, the remainder of the trench shall be backfilled with suitable material. When the material excavated from the trench is deemed unsuitable for backfilling, the CONTRACTOR shall supply and install either suitable material from outside sources or Select Granular Material. Backfill material shall be compacted to not less than 90% of the maximum dry density as determined by ASTM D1557.

4. Settlement

- a. If settlement occurs, additional backfill shall be deposited and mechanically compacted to the required elevation.

3.11 BACKFILLING – GENERAL

- A. Complete all backfilling to the dimensions and levels shown on the Plans.
- B. Excavations shall be backfilled as specified herein.
- C. Backfilling shall be done as promptly as is consistent with non-damage to the Structures, but no backfilling shall be done before the ENGINEER gives permission.
- D. Frozen material shall not be placed in the backfill, nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required before new backfill is placed.
- E. Upon completion of the backfilling, the streets or property shall be cleaned, and surplus material removed and the surface restored to the condition in which it was before ground was broken. All materials left over in public highways shall become the property of the CONTRACTOR, and he shall promptly remove same.

3.12 PLACEMENT AND COMPACTION

- A. Placement and compaction of material shall begin only after permission has been given by the ENGINEER. No material shall be placed or compacted when it is too wet or frozen or when the subgrade or previously placed material is too wet or frozen. The ENGINEER shall determine when conditions are suitable for placing and compacting material. All loam and top soil, sludge and other material judged to be unsuitable by the ENGINEER shall be removed before any material is placed and compacted.

3.13 DISPOSAL OF MATERIAL

- A. Excavated material shall be so placed as not to unreasonably interfere with travel. All macadam, 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.
- C. Unless otherwise specified, all materials left over shall become the property of the CONTRACTOR. Also, underground structures removed, such as brick, concrete and sewer pipe, shall become the property of the CONTRACTOR, unless otherwise noted on the Plan. If the CONTRACTOR shall fail to promptly remove surplus material, the TOWNSHIP may have the material removed and charge the cost thereof as money paid to the CONTRACTOR. All surplus excavation shall be removed from the site of the work by the CONTRACTOR, but none shall be deposited on private property until written consent of the property owner has been filed with the ENGINEER. The CONTRACTOR's disposal shall comply with all Federal, State and Local laws and regulations.

3.14 ROCK EXCAVATION

- A. If rock is uncovered requiring the explosives method for rock disintegration, notify the ENGINEER and execute as follows:
 - 1. Conduct Seismic Survey
 - 2. Advise owners of adjacent buildings or structures in writing prior to setting up seismographs. Describe blasting and seismic operations.
 - 3. Disintegrate rock and remove from excavation.
 - 4. Conduct blasting operations to avoid injury to persons and property.
 - 5. Use explosive quantity and strength required to break rock approximately to intended lines and grades and yet leave rock in unshattered condition.
 - 6. Cover rock with logs or mats, or both where required.

7. Issue sufficient audible warning to all persons prior to detonating a charge.
 8. Store caps and exploders separately from explosives.
 9. Remove all explosives from site at completion of blasting operations.
 10. Comply with additional and or more strict requirements of governing authorities as applicable to work.
 11. Provide copies of insurance certificate indicating CONTRACTOR and any subcontractors are all fully covered for blasting damage. Insurance policy shall be for a minimum of \$2,000,000.
- B. Blasting (**if authorized**) shall not be permitted in areas where the proximity of structures, underground facilities, or public safety preclude the use of explosives. If the CONTRACTOR elects to blast and is so authorized, nothing in this section shall relieve the CONTRACTOR of his responsibilities for damages.
- C. Blasting work shall be supervised by licensed and experienced personnel and performed in conformance with applicable Federal, State and local codes, including but not limited to:
1. PaDEP Rules and Regulations, Chapters 21O and 211
 2. OSHA General Industry Standard 29 CFR 1910.109 Explosive and Blasting Agents
 3. OSHA Construction Industry Standards & Interpretations, 29 CFR, 1926.900 Explosive and Blasting Agents
 4. PA Act 287
 5. PA Labor and Industry Code, Chapter 4, Subchapter D, Explosives; Subchapter E - Excavation and Construction
- D. Before any blasting is carried out the CONTRACTOR shall complete the following:
1. Submit to the ENGINEER a report prepared by a professional engineer licensed to practice in the State of Pennsylvania or Geologist containing specified recommendations for blasting. Should the report indicate potential damage to existing facilities, the AUTHORITY will not allow blasting.
- E. All blasting in open cuts shall be properly covered and protected with approved blasting mats.

- F. Charges shall be of such size that the excavation will not be unduly large and shall be so arranged and time that adjacent rock, upon or against which pipelines or structures are to be built, will not be shattered.
- G. In accordance with Pa Title 67, Chapter 459, Paragraph 7(14);
 - 1. No blasting will be performed within 25 feet of any bridge, box culvert or well.
 - 2. No blasting shall be conducted within any PaDOT road right-of-way, unless authorized by the Highway Occupancy Permit. If the CONTRACTOR desires to undertake blasting within the road right-of-way, he shall post the necessary bonds and obtain a revised Occupancy Permit prior to the initiation of blasting activities.
 - 3. If the CONTRACTOR desires to undertake blasting activities within 100 feet of any bridge, box culvert or well, a detailed plan, prepared by a professional engineer experienced in blasting, of excavating, shoring, blasting and backfilling shall be submitted to the ENGINEER. Work may not be initiated until approval has been received.
- H. Blasting will not be permitted within 25 feet of pipe lines or 50 feet of structures.
- I. Pre-blast surveys shall be conducted of all structures within a 1000 foot radius of the blasting permit area or to satisfy the regulations of the PA Explosives and Blasting Laws.
- J. All blasting shall be field monitored using seismographic type equipment and shall be performed under the supervision of a professional engineer, licensed to practice in the State of Pennsylvania or a geologist.
- K. Submit to the ENGINEER an accurate record of each blast within 48 hours. 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.
- L. Repair of Damages Due to Blasting
 - 1. Any injury or damage to the work or to existing pipes or structures or wells shall be repaired or rebuilt by the CONTRACTOR at his own expense.
 - 2. Whenever blasting may damage pipes, structures, or wells blasting shall be discontinued and the rock removed by drilling, barring, wedging or other methods.

M. Explosives

1. The maximum amount of explosives to be kept at the site shall not exceed the expected one day's usage. Such explosives shall be stored, handled and used in conformity with all applicable laws and regulations.
2. Accurate daily records shall be kept showing the amounts of explosives on hand, both at a site and at any storage magazine, the quantities received and issued, and the purpose for which issued.
3. The CONTRACTOR shall be responsible for any damage or injury to any persons, property or structures as a result of his handling, storage or use of explosives.

N. Rock Clearance in Trenches

1. Ledge rock, boulders and large stones shall be removed from the sides and bottom of the trench to provide clearance for the specified embedment of each pipe section, joint or appurtenance; but in no instance shall the clearance be less than 9-inches. Additional clearance at the pipe bell or joint shall be provided to allow for the proper make-up of the joint.

SECTION 7

PIPED UTILITIES

ARTICLE 1 - GENERAL

1.1 WORK INCLUDED

- A. Installation of Sanitary Sewers and Manholes.

1.2 QUALITY ASSURANCE

- A. Piping and specials specified herein shall be essentially the standard products of manufacturers who have been regularly engaged in the successful production of high quality materials of this type for at least ten years, have supplied such materials for at least five years of the ten year period, and have at least five installations in successful operation for at least five years.

- B. Repair or replace defective piping or specials.

- C. Sewer Line Acceptance Tests.

- 1. General:

- a. All sewers and plugged laterals shall be air tested. Sewer lines will be tested for leakage between manholes as the work progresses. The allowable leakage rates shall apply to each reach of sewer line, manhole-to-manhole, and manholes excluded. Manholes shall be tested separately.
 - b. Infiltration or exfiltration tests may be utilized only with prior approval of the ENGINEER. The allowable leakage rates shall apply to each reach of sewer line, manhole-to-manhole, manholes included.
 - c. All sewers, including manholes, shall be inspected prior to air testing, and all visible or detectable leaks shall be repaired before testing begins. The line acceptance tests shall be made after backfilling has been completed. Inspection shall include visual inspection and television inspection as specified in Section 8, Sewer Pipeline Televising.
 - d. The DEVELOPER shall repair all visible or detectable leaks or defects of any nature to the satisfaction of the ENGINEER, even if the allowable leakage rates are not exceeded.

- e. Any damage caused to properties due to sewage handling and/or sewage backup while testing shall be the responsibility of the CONTRACTOR.

2 Testing equipment:

a. Air Testing:

- 1) Air testing shall be performed utilizing testing equipment consisting of an air-compressor and storage tank of adequate capacity; an air control panel equipped with all necessary piping, valves and pressure gages to control the rate at which the air flows to the test section and to monitor the air pressure inside the test section; and all required plugs. In order to prevent overloading the test section with the full pressure of the compressor, the test equipment must be provided with an approved pressure relief device set to blow out at 10 psi. An extra pressure gage of known accuracy shall also be provided so that the gages of the test equipment can be frequently checked. The air testing equipment and all accessories shall be subject to the approval of the ENGINEER.

b. Infiltration Test:

- 1) Infiltration tests will be acceptable only when the ground water can be established as imposing a minimum six (6) foot head at the pipe invert.
- 2) Plug the upstream manhole and make a measurement of the downstream flow with a portable V-notch weir. A flow stabilization period of 20 minutes is required. The amount of leakage from any section of the sewer shall not exceed the allowable gallonage as stated per inch diameter of pipe per mile per 24 hours.

c. Exfiltration Test:

- 1) Exfiltration tests will be acceptable only when a minimum interval head of six (6) feet of water can be maintained above the invert of the pipe.
- 2) The leakage limit shall not exceed the leakage allowance as stated per inch diameter per mile per 24 hours. The tests must be performed for a 24-hour period during which time volumetric make-up quantities will be tabulated.

- d. Deflection Testing:
 - 1) Deflection testing shall be performed using a rigid "Go-No Go" device. A hydro-cleaner or blower/parachute device, complete with string lines, shall be provided for attaching pull-lines.
- 3. Cleaning:
 - a. No debris, silt, or other material shall enter existing sewers. It shall be the responsibility of the CONTRACTOR to have the pipe clean at the time of air testing and deflection testing. If required, the pipe shall be cleaned by hydro-flushing with water or by passing through the pipe a full gauge squeegee in a manner approved by the ENGINEER.
- 4. Air Testing Procedure:
 - a. All wyes, tees, or end of side sewer stubs placed for future connections shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressure. Plugs or caps shall be readily removable.
 - b. Immediately following the pipe cleaning, the pipe installation between each reach of the plugged lateral connections shall be tested with low pressure air. The ENGINEER shall specify the duration permitted for a prescribed low pressure air exfiltration pressure drop between two consecutive manholes. The prescribed drop shall not exceed 0.5 psi from 5 to 4.5 psi, in excess of the groundwater pressure above the top of the sewer. At least two minutes shall be allowed for temperature stabilization, adding only the amount of air required to maintain pressure.
 - c. The pipe shall hold the required test pressure for the duration prescribed in the Air Test Table (Table 1) attached to this section.
 - d. Repair and retest sections of sewer not meeting test requirements.
- 5. Infiltration or Exfiltration Tests:
 - a. Maximum allowable leakage for either infiltration or exfiltration shall be 50 gal/inch - diameter mile/24 hours.

6. Deflection Testing Procedure:

- a. Deflection testing is not considered standard test requirements. It will only be used under special circumstances when directed by the ENGINEER.
- b. Use Go-No-Go device in accordance with pipe manufacturer's requirements. Method to be approved by the ENGINEER prior to testing.
- c. Unless specified otherwise by the ENGINEER, long term pipe deflection (reduction in vertical inside diameter) should not exceed 5%. Recommended mandrel dimensions, based on 5% deflection, are as shown below:

<u>Pipe Dia. In.</u>	<u>Mandrel. In.</u>
8	7.37
10	9.23
12	10.98
15	13.44
18	16.15
21	19.02
24	21.43
27	24.10

- d. Repair and retest sections of sewer not meeting test requirements.

D. Manhole Acceptance Tests:

1. General:

- a. After the manhole has been completely constructed, the frame bolted thereon, and the trench backfilled, a "Manhole Acceptance Test" shall be performed using the vacuum test.
- b. Any damage caused to properties due to sewage handling and/or backup while testing shall be the responsibility of the CONTRACTOR.

2. Vacuum Test Procedures:

- a. The testing shall be done after assembly of the manhole.

- b. All lift holes shall be plugged with a non-shrinking mortar, as approved by the ENGINEER.
- c. The seal between the manhole sections shall be in accordance with ASTM C923.
- d. The CONTRACTOR shall plug the pipe openings, taking care to securely brace the plugs and the pipe.
- e. With the vacuum tester set in place:
 - 1) Inflate the compression band to effect a seal between the vacuum base and the structure.
 - 2) Connect the vacuum pump to the outlet port with the valve open.
 - 3) Draw a vacuum to 10" of Hg. and close the valve.
- f. The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time specified for the particular size manholes tested.

VACUUM TEST TABLE

<u>Manhole Diameter</u>	<u>Test Period</u>
48"	60 sec.
60"	75 sec.
72"	90 sec.

If the manhole fails the initial test, the CONTRACTOR shall locate the leak and make proper repairs. Testing shall continue until the manhole passes the aforementioned criteria.

- g. Testing of manholes by the CONTRACTOR shall be performed in the presence of the Municipality's representative.

E. Minimum Testing Requirements

- 1. The CONTRACTOR shall take care to securely fasten and brace all line plugs in the pipe section being tested so that none of the plugs is suddenly released when the compressed air is applied to the pipe section. The CONTRACTOR shall limit the internal pressure in the sewer line to 5 psi greater than the average back pressure of any ground water that may submerge the pipe.
- 2. The CONTRACTOR shall be responsible for any damages caused by the internal pressurizing of the sewer line.

3. All gages, air piping manifolds and valves of the air testing equipment shall be located above ground at the top of the trench.
4. No one shall be allowed in the manholes during testing.
5. Special care shall be exercised during removal of plugs; and the pressure in the piping of the test section shall be completely relieved before any plug shall be removed.

F. Force Main Testing

1. All force mains shall be hydrostatically tested in conformance with the requirements of AWWA C 600, latest edition.
2. Pressure Tests
 - a. All force mains shall be tested by the CONTRACTOR at a pressure of 50 psi in excess of normal pump discharge pressure or a minimum of 75 psi whichever is greater and approved by the ENGINEER before acceptance. All equipment required for testing shall be furnished by the CONTRACTOR. Any leaks which develop as a result of the pressure test shall be repaired by the CONTRACTOR and pipes then retested. All defects revealed by the tests shall be made good with new material. Tests and repairs shall be continued until all test requirements have been met.
 - b. All testing of piping systems shall be completed prior to insulating and/or painting.
 - c. After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for one hour to a pressure test of the intensity specified above. Each valve shall be opened and closed several time during the test. Exposed pipe, joints, fittings and valves shall be carefully examined during the open-trench test. Joints showing visible leakage shall be replaced or remade as necessary. Leaking rubber-gasketed joints shall be remade, using new gaskets if necessary. Cracked or defective pipe, mechanical joints, fittings or valves discovered in consequence of this pressure test shall be removed immediately and replaced with sound material, and the test shall be repeated with sound material, and the test shall be repeated until the test results are satisfactory.

3. Leakage Tests

- a. A leakage test for force mains shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be at least two hours, and during the test the pipe shall be subjected to a 150 percent of the pump discharge pressure or a minimum of 75 psi whichever is greater. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SDP^{1/2}}{133,200}$$

in which L equals the allowable leakage in gallons per hour; S is the length of pipeline tested; D is the normal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage. Should any test of pipe laid disclose leakage greater than that specified above, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the TOWNSHIP.

G. SUBMITTALS

- A. Submit shop drawings or catalog cuts, as appropriate, for materials listed under Article 2.01 of this Section. Submit only those materials that are actually to be used in the work. These will usually be as follows:
1. PVC & Ductile Iron Pipe & Fittings
 2. Precast Concrete Manholes.
 3. Manhole Steps.
 4. Manhole Castings.
 5. Gaskets, Adapters, Pipe Couplings, Sealing Compounds, and Other Appurtenances.
- B. Make submittals prior to start of construction. Make submittals to the ENGINEER.

H. DELIVER, STORAGE, AND HANDLING

- A. Deliver, store and handle the piping, manholes, manhole frames and covers and appurtenances in accordance with the manufacturer's recommendations, and in such manner as to protect the materials from damage.
- B. Pipe and related materials shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such material be dropped or skidded against pipe already on the ground.
- C. Pipe and related materials shall at all times be handled with care to avoid damage. The interior shall be kept free from dirt and foreign matter. All pipe, manholes, manhole frames and covers and appurtenances shall be carefully lowered or raised into place with suitable equipment in a manner that will prevent damage to the material. Under no circumstances shall pipe or accessories be dropped or dumped.
- D. Manholes, and all related materials, shall be thoroughly inspected for defects prior to their being installed. Any defective, damaged, or unsound material, as determined by the ENGINEER, shall be repaired or replaced as directed.
- E. All lumps, blisters, and excess coating shall be removed from the ends of each pipe. The joints shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe is installed.

ARTICLE 2 - PRODUCTS

2.01 MATERIALS

- A. General
 - 1. All gravity sewer mains and laterals 12' and smaller shall be either Class 52 ductile iron pipe or DR 18 pipe as approved by the ENGINEER
 - 2. All gravity sewer mains 14" and larger, unless approved otherwise by the ENGINEER, shall be Class 52 ductile iron pipe.
 - 3. All sewage force mains 4" to 12' in size shall be either Class 53 ductile iron pipe or DR 18 pipe as approved by the ENGINEER
 - 4. For new construction, all lateral connections to the sewer main shall be made by means of a wye and a 45° elbow. The use of a tee or tee/wye fitting is not acceptable.

5. Class 52 Ductile Iron Pipe shall be used from manhole to manhole for any sewer run that has a depth of cover exceeding fifteen feet (15') for any portion of piping in that run and sewers placed in fills.
6. The minimum lateral pipe size from the main to the property line shall be six (6) inches in size when a new sewer main is being installed. When the sewer main is existing and a saddle is required, then the lateral shall be four (4) inches in size for an eight (8) inch main and six (6) inches in size for a main larger than eight (8) inches.

B. Ductile Iron Pipe and Fittings.

1. Pipe
 - a. Ductile iron pipe shall be centrifugally cast, annealed ductile iron manufactured in accordance with ANSI A21.51.
 - b. Pipe joints shall be push-on or mechanical joint and shall conform to ANSI specification A21.11. Furnish joints with all required accessories.
 - c. Ductile iron pipe shall be made of ductile iron of good quality and of such character as shall make the metal castings strong, tough and of even grain and soft enough to satisfactorily permit drilling, tapping, and cutting. All piping shall be smooth, free from scale, lumps, blisters, and sand holes and defects of every nature which make it unfit for the use intended. All piping shall be straight and shall be true circles in section with its inner and outer surfaces concentric. Piping shall be subject to inspection and approval by the ENGINEER upon delivery, and no broken, cracked, misshapen, or otherwise damaged or unsatisfactorily piping will be accepted.
 - d. Each piece of pressure ductile iron pipe shall have the weight and class designation conspicuously painted on it as near as possible to the flange or bell end of the pipe and these designations shall be clearly legible.
2. Fittings.
 - a. Furnish fittings in accordance with ANSI 21.10 350 psi rating.
 - b. Joints shall be mechanical joint in accordance with ANSI A21.11. Furnish joints with all required accessories.
 - c. Ductile iron compact fittings meeting ANSI A21.53 requirements shall not be used.

- d. Where restrained joints are required, use EBAA Iron, Inc. Mega-lug or equal glands.
- 3. Cement and Mortar Lining.
 - a. Cement and mortar line all pipe and fittings in accordance with ANSI A21.4.
 - b. Lining Thickness: 1/8 inch minimum.
 - c. Tolerance: plus 1-8 inch.
 - d. Paint seal coat in accordance with ANSI A21.4.
- 4. Tar Coat exterior of ductile iron pipe and fittings.
- 5. Furnish gaskets in accordance with ANSI A21.11.

C. Plastic Pipe

- 1. All pipe shall meet the requirements of AWWA C900, "Standard for Polyvinyl Chloride Pressure Pipe, 4 inches through 12 inches for Water" and shall be furnished in cast iron pipe equivalent outside diameters with rubber-gasketed separate couplings as listed in that standard. The pipe shall have a pressure rating of 125 PSI and shall be furnished in 20 foot laying lengths. Each length of pipe shall pass a hydrostatic integrity test at the factory at four (4) times the pressure class of the coupling for five (5) seconds. Pipe and couplings shall not fail when subjected to the following tests which are outlined in AWWA C900: sustained pressure, burst pressure, flattening and extrusion quality.
- 2. Fittings and sleeves used with the pipe shall be ductile iron mechanical joint meeting the requirements of paragraph 2.01.B.2. As an alternate to DI MJ fittings, Class 150 fittings as manufactured by Harco may be used. All fittings for C900 pipe shall be manufactured in one piece of injection molded compound meeting ASTM 01784. Fittings shall be Class 150 and conform to requirements of DR18. Fittings shall be designed to withstand a minimum of 755 psi quick burst pressure @ 73° F tested in accordance with ASTM 03139 with gaskets conforming to ASTM F477.

D. Steel Casing Pipe

- 1. Smooth steel wall casing pipe conforming to ASTM A-252 Grade 2, minimum plate thickness 1/2-inch.

2. Pipe to be coated with coal tar epoxy as manufactured by Koppers, or equal. Apply coating in accordance with coating manufacturer's recommendation.
3. Submit manufacturer's certification.

E. Pipe Couplings and Adapters

1. Couplings used to join plain end pipe shall be full-sleeve mechanical couplings with stainless steel bolts, 4-bolt min. Smith-Blair models 413, 415, 441, Ford models FC1, FC2A, FC2W, FRC, and, Romac model 501 couplings are acceptable. Fernco's are not acceptable. An alternate coupling shall be Ford Style FS1 or FS2 stainless steel repair clamp or approved equal. The coupling shall be rated for a minimum 150 psi working pressure.
2. An alternate coupling will be permitted if the referenced coupling is not suitable for use on either pipe O.D. The coupling must be submitted for approval prior to installation. The exact O.D. of both pipes must be known prior to the coupling being ordered.

F. Lateral Connections

1. When approved by the ENGINEER, an Inserta-Tee may be used to connect a new lateral to an existing main.
2. Contractor shall refer to manufacturer's guidelines, and install per manufacturer's installation instructions.
3. Connection shall be made as specified in paragraph 2.01 and as shown on the Detail Drawing.

G. Manholes

1. Precast Concrete Manhole Bases
 - a. Precast concrete bases shall be of the design and dimensions shown on the Detail Drawings. Precast concrete bases shall be manufactured by the wet cast process. The placing of concrete and steam curing of the precast concrete base shall be performed in accordance with the requirements specified in Section 3.6.11 and Section 3.7.2 respectively of AWWA Standard C302 for Reinforced-Concrete Water Pipe-Noncylinder Type, Not Prestressed.

- b. Concrete used in the manufacture of precast bases shall have a minimum compressive strength of 4000 pounds per square inch at 28 days and the cement used in the concrete shall be Type II portland cement conforming to ASTM. Specification Designation C150.
- c. Openings in precast bases to accommodate the connection of the sewer piping shall be custom preformed for each manhole base at the time of manufacture of the bases at the manufacturer's plant. Openings for connection of sewer piping shall be of the size and shape required for the particular type of pipe seal provided.
- d. The tops of the precast bases shall be accurately formed to receive the tongue of the bottom precast concrete manhole section of the wall.
- e. The vertical wall section shall extend at least six (6) inches above the top of the highest inflowing sewer pipe joining the manhole section.
- f. A minimum of four (4) inch clearance shall be provided between the floor of the precast base and invert of the lowest outflowing sewer pipe to provide for the construction of formed invert and bench wall within the manhole. Only two (2) lift inserts shall be permitted for the cast in bases. Thickness of the bottom slab shall be a minimum of eight (8) inches for manholes up to twelve (12) feet in depth. Thicker bottom slabs may be required for manholes greater than twelve (12) foot depths.

2. Monolithic Poured-In-Place Concrete Manhole Bases

- a. The use of poured-in-place concrete bases can only be used in special casts and must be approved in writing by the ENGINEER.
- b. Monolithic poured-in-place concrete bases shall be of the design and dimensions indicated on the Detail Drawings.
- c. Consistency: The mixed concrete shall be of uniform consistency. The maximum allowable slump shall be 2 inches.
 - 1) This strength requirement shall be verified by tests. At least one test shall be made per

day or one test structure. A test shall consist of at least two cylinders whose 28-day compressive strengths shall be determined by an approved laboratory. The cylinders shall be made by the CONTRACTOR subject to the inspection of the Inspector.

- 2) Fill concrete shall be 2500 psi, that is required as backfill for over-excavated foundations, for foundation voids or cavities, pipe encasements, or reaction backings, shall have an average compressive strength of 2500 psi at 28 days and a 3 inch maximum slump.
3. Concrete used for channels inside precast manhole bases shall be of a 2500 psi mix design with a 5/8" diameter maximum allowable aggregate size.
 - a. Consistency: The mixed concrete shall be of uniform consistency. The maximum allowable slump shall be 1 inch.
4. Precast Reinforced Concrete Manhole Riser and Top Sections
 - a. Walls of manholes shall be constructed of precast reinforced concrete manhole sections. Except as otherwise specified herein, the riser and top sections shall be manufactured in compliance with the requirements of ASTM C478 for Precast Reinforced Concrete Manhole Sections.
 - b. The riser sections and conical top sections shall be manufactured by the wet cast process. The placing of concrete and the stream curing thereof shall be performed in accordance with the requirements specified in Section 3.6.11 and Section 3.7.2 respectively of AWWA Standard C302 for Reinforced-Concrete Water Pipe-Noncylinder Type.
 - c. Concrete used in the manufacture of precast manhole riser and top sections and precast grade rings shall conform to the requirements specified in ASTM C47B, and the cement used in the concrete shall be Type II portland cement conforming to ASTM C150.

- d. Riser section joint shall be of the ship-lap type with an equivalent lap of three (3) inches and a minimum wall thickness as shown on the Detail Drawings. Top sections shall be of eccentric cone or flat slab top design as required. Eccentric cone top sections shall have the same minimum wall thickness and area of circumferential steel reinforcement as the round riser sections. Flat slab tops shall have a minimum thickness as shown on the Detail Drawing and shall be reinforced with steel in accordance with the design requirements specified in ASTM C478. Top sections shall have a straight side cone section with a minimum opening at 24 inches, and shall have a top width of such design and dimensions as to properly support the required manhole frame and cover. The lower joint shall be the ship lap type with an equivalent lap of three (3) inches.

5. Steel Reinforcement

- a. Steel reinforcement used in the manufacture of precast concrete manhole bases and precast concrete riser and top sections shall conform to the requirements specified in Section 6 of ASTM C478.

6. Gasket for Sealing Precast Concrete Manhole Joints

- a. Manhole section joint gasket materials specified herein shall be used in accordance with the Detail Drawings. Only one method of joint sealing and gasketing (e.g., preformed plastic gaskets and non-shrink cement grout) will be permitted for all manholes, unless otherwise directed by the ENGINEER.

1) Preformed Plastic Gaskets for Manhole Joints

- a) Flexible plastic gasket-type sealant for manhole joints shall be "RUB'R-NEK" as manufactured by K.T. Snyder Company, Inc., of Houston, Texas, or approved equal, as

directed by the ENGINEER. Butyl rubber (plastic) sealant shall meet the requirements of Federal Specification SS-S- 210A (3.4 Adhesion & Hydrostatic Pressure) and shall conform with the applicable requirements specified in Section 5.7 of ASTM C361.

- b) The sealing compound shall not leak at the joints (while being tested at 10 psi) for a period of 24 hours. Requirements for sag and flow resistance (vertical and overhead 1" wide joints) shall be such that no sagging is detected (while being tested at 135 degrees F) for a period of 5 days. Requirements for chemical resistance shall be such that no visible deterioration of the sealing compound occurs (when immersed separately in a solution of acid, alkalies and saturated hydrogen sulfide) for a period of 30 days.
- c) The sealing compound shall be supplied in extruded rope form of suitable cross- section. The size of the sealing compound shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out of the material around the entire interior and exterior circumference when the joint is completed. 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. The sealing compound contained within the joint shall be the sole element utilized in sealing the joint from internal and external hydrostatic pressure. Joint surfaces shall be primed, sealing

compound applied, and joint made in strict conformance with the written specifications of the sealing compound manufacturer.

2) Rubber O-Ring Gaskets for Manhole Joints

- a) For joints sealed with rubber gaskets, the joint design and rubber gaskets shall conform with the applicable requirements specified in ASTM C443 and in Section 5.7 and Section 4.10 respectively of ASTM C361. A rectangular groove shall be provided in the tongue end of each manhole section to receive the rubber gasket and to contain the deformed gasket on all four sides when the joint is completed.

7. Rubber Manhole Pipe Gaskets

- a. All manhole pipe gaskets shall be integrally cast in the manhole wall and properly sized for the outside diameter of the pipe being used. Gaskets shall be all-rubber composition, flexible, pliable, and provide up to 15 degrees lateral, diagonal or vertical pipe deflection. Gaskets shall be leak-proof tested to 20 psi, and shall meet or exceed rubber quality standards of ASTM C443 and Test Performance Requirements ASTM C425 for compression joints.
- b. Gaskets shall be A-LOK as manufactured by A-LOK Products Corp. or Star Seal as manufactured by Galaxy Sales Co.
- c. In the event a hole has to be made into an existing manhole to receive a pipe, the hole shall be made only by core drilling. The annular space between the pipe and manhole wall shall be sealed with a modular type seal as manufactured by Thunderline Corp. The seal shall consist of interlocking synthetic rubber links, two (2) pressure plates and stainless steel nuts and bolts.

8. Manhole Drop Connections

- a. Pipe and fittings used for making drop connections shall be of the same type as the pipe and fittings used to construct the sewer line from which the drop connection is made, unless approved otherwise.

- b. Inside drops shall be used unless approved otherwise. The minimum manhole size for an inside drop connection shall be five (5) feet inside diameter.

9. Manhole Steps

- a. Manhole steps shall be of aluminum as made by Alcoa Aluminum Company, No. 15785 alloy 6061-16, tensile 38,000 p.s.i., yield 35,000 p.s.i., or approved equal. Manhole steps shall be installed in the reinforced concrete walls of the riser and eccentric top sections.
- b. Field installation of manhole steps shall not be permitted. Steps shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole, a maximum distance apart 12 inches. Steps shall be located the minimum distance from the ends of riser and top sections as shown on the Detail Drawing. Each step shall be embedded in the riser section at least three and one-half (3 1/2) inches but not more than four (4) inches.
- c. The exterior of the step cast in the concrete shall be coated with bituminous coating prior to casting.
- d. Plastic-coated, deformed reinforcing bar encapsulated with injection molded propylene shall be an acceptable alternate. The step shall be provided with a separate tread and end lugs to prevent feet from slipping off.

10. Manhole Castings

- a. Castings for manhole frames and covers shall be heavy duty cast iron and designed for HS-20 loading.
- b. Castings shall be of uniform quality, free of blow holes, shrinkage distortion, or other defects.
- c. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Frames and covers shall have continuously machined bearing surfaces to prevent rocking.
- d. As-cast dimensions may vary one half the maximum shrinkage characteristic of the metal or $\pm 1/16$ inch.

- e. All castings shall be cleaned by means of sand blast, neatly finished, and have one coat of black asphaltum paint applied at the factory.
- f. The wording "Sanitary Sewer, 20_" shall be cast appropriately on each watertight cover. The year shall indicate the year of installation. Lettering shall be a minimum of 2" high. Paved area, non-watertight covers shall not have this requirement.
- g. Manholes, frames, and covers shall be as shown on the Detail Drawings.

11. Precast Concrete Manhole Grade Rings

- a. Precast concrete manhole grade rings for leveling units shall be manufactured in compliance with the requirements of the Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478; and shall be as thick as necessary to provide the required grade adjustment. Each grade ring shall have four holes cast therein at the manufacturer's plant for the manhole frame hold down bolts. Broken or cracked concrete grade rings will not be acceptable. Grade adjustment for a manhole shall not exceed nine (9) inches.

12. Leveling Brick

- a. Brick generally will not be permitted for grade adjustment unless conditions prevent the use of precast concrete grade rings as determined by the ENGINEER.
- b. 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 on line, cracks, and checks extending into the body of the bricks, shall be used. The brick shall be new, whole smooth brick of uniform standard commercial size with straight parallel edges and square comers. The sides and ends of brick shall be plane surfaces at right angles and parallel one to the other.
- c. When struck with a trowel, bricks shall give a clear ringing sound; and a fracture shall show uniform and compact structures.

- d. The brick shall comply with ASTM Specification C-32, Grade MA or as specified.
- e. If deemed necessary by the ENGINEER, the brick shall be culled and the truest brick shall be used.

13 Cement Grout

- a. Grout shall be non-shrink or water plug grout.

14 Protective Coatings

a. General

- 1) All interior and exterior epoxy coatings shall be factory-applied by the manhole manufacturer. Prior to applying the coatings, all concrete surfaces shall be blown free of all dirt and debris and brushed clean.

b. Exterior

- 1) The coating shall be Bitumastic Super Service Black as manufactured by Koppers Co., Inc. equivalent of Mobil Chemical Co., or equal. At least two (2) coats shall be applied giving a total dry film thickness of a' minimum of 24.0 mils. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 24 mils dry film thickness.
- 2) As an alternate, the coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49- 51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.
- 3) Wrapidseal, or approved equal, shall be installed from the cone section up to and over the bottom flanges of the manhole frame casting. Install per manufacturer's requirements.

c. Interior

- 1) The coating shall include 2 coats of epoxy-amine adduct, multi-mill, two component, catalyzed epoxy, with total solids volume of 49 - 51%, which is resistant to alkali, salt and ground water immersion, petroleum products and acids. Coating shall meet AWWA D102-78, paint system No. 1 standards and a minimum 12 mils dry film thickness.

- 2) In areas where the potential for severe corrosion problems may occur, the use of "DURA Plate 100" interior PVC liner may be required by the ENGINEER.
- 3) Parsonpoxy FP, or approved equal, chimney seal shall be installed in the upper section of the cone, up to and incorporating the manhole frame casting. Install per manufacturer's requirements.

ARTICLE 3 - EXECUTION

3.01 LAYING PIPE

A. General

1. Following trench excavation, pipe laying shall proceed upgrade with pipe laid carefully, hubs upgrade, spigot ends fully centered into adjacent hubs, and true to lines and grades given.
2. 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. Each pipe shall be firmly held in position so that the invert forms a continuous grade with the invert of the pipe previously placed.
 - a. Utilize portable laser to establish grades of sewers, laser shall be used in accordance with manufacturer's written instructions.
 - 1) Grade shown on Drawings is that of Sewer invert.
Tolerance $\pm 1/4$ inch.
3. Under no conditions shall pipe be laid in water, on subgrade containing frost, and/or when trench conditions are unsuitable for such work. In all cases, water shall be kept out of the trench until concrete cradles, supports, encasement, or saddles, where used, and materials in the joints have hardened.
4. Any pipe that has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe.
5. Walking or working on top of the completed pipeline, except as may be necessary in backfilling or tamping, shall not be permitted until the trench has been backfilled to a height of at least 2 feet over the top of the pipeline.
6. Maintain pipelines free and clear of debris during the progress of the work.

7. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by watertight plugs.
8. Diversion of sewage during construction.
 - a. Sewage flowing in existing sewer shall be temporarily plugged or diverted around or through the construction by means of by-pass pumping, fluming, or any other means acceptable to the ENGINEER.
 - 1) If by-pass pumping is required, provide stand-by pump equivalent to the largest by-pass pump in service. Reliability of the pumping system must be proven before any sewer can be taken out of service.
 - b. At completion of each work day, tie sewage flow back into existing sewer. Tie-in shall be covered so there is no visible sewage.
 - c. Prior to beginning work, the CONTRACTOR shall have on hand all required materials necessary to accomplish the work.
 - d. The CONTRACTOR shall be responsible for any property damage caused by sewage handling.
9. The CONTRACTOR shall maintain a log of service connection locations and lateral pipe lengths and sizes. The locations shall be based upon sewer line stationing and shall indicate if the lateral is in service or plugged.

B. Reconnect Existing Service Laterals

1. Use wye fittings as approved for connecting existing service laterals to the newly-constructed sewer.
2. Replace as much as possible of the existing service lateral with new piping of the same material as the sewer main. Couplings used to join plain end pipe shall be full-sleeve mechanical couplings with stainless steel bolts, 4-bolt min. Smith-Blair models 413, 415, 441, Ford models FC1, FC2A, FC2W, FRC, and, Romac model 501 couplings are acceptable. Fernco's are not acceptable. An alternate coupling shall be Ford Style FS1 or FS2 stainless steel repair clamp or approved equal. The coupling shall be rated for a minimum 150 psi working pressure.
3. Connection to the sewer main shall be made as specified in paragraph 2.01 and as shown on the Detail Drawing.

4. When installing new fittings (wye, Inserta-Tee, lateral pipe) in sanitary sewers or making connections to sanitary sewers, appropriate cutting tools and approved couplings shall be used.
- C. Connect New Service Lateral Into Existing Sewer Main
1. Connect the new service lateral into the sewer main or an adjacent manhole as directed.
 2. Connection to the sewer main shall be made as specified in paragraph 2.01 and as shown on the Detail Drawing.
 3. Connection to an existing manhole shall be in accordance with the requirements of paragraph 2.01 and as shown on the Detail Drawing.
- D. Ductile Iron Pipe
1. Push-on Type Joints
 - a. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. These parts shall be kept clean throughout assembly to the joint.
 - b. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket. Care shall be taken to insure that the gasket is properly seated.
 - c. A minimum amount of lubricant shall be evenly applied to the spigot end with a brush. Gasket lubricant shall be as supplied by the manufacturer.
 - d. The spigot end shall be properly centered and force applied, using a ratchet jack-type tool or a roller chain-type ratchet jack, until the white stripe at the spigot end is just visible at the face of the bell. Any required deflection shall be made only after the joint assembly has been made.
 - e. Proper positioning of the gasket shall be checked with a "feeler" gauge after each joint is made.
 - f. The edges of "field cut" pipe shall be touched up with a file or grinder so as to remove rough edges and facilitate assembly.

2 Mechanical Joints

- a. Thoroughly clean the bell and the spigot end of the pipe of all foreign matter and wash them with soapy water.
- b. Slip the gland and gasket over the plain end and seat the spigot end in the bell (the small end of the gasket and the lip on the gland shall face the bell).
- c. Push gasket into position with fingers, making sure it is evenly seated.
- d. Move gland into position for bolting, insert bolts and make all nuts finger tight, keeping the spigot centrally located within the bell.
- e. The following table is used in determining the wrench to be used by an average man in tightening the bolts.

<u>Bolt Size</u>	<u>Length of Wrench</u>
5/8"	8"
3/4"	10"
1-1/4"	12"
1-1/2"	14"

- f. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face by partially tightening the bottom bolt first, then the top bolt, next, two bolts at each side, and last, the remaining bolts. Repeat this cycle until all bolts are within the range of the torques listed below:

<u>Bolt Size</u>	<u>Range of Torque</u>
5/8"	40 - 60 ft lb
3/4"	60 - 90 ft lb
1-1/4"	70 - 100 ft lb
1-1/2"	90 - 120 ft lb

- g. If effective sealing is not obtained at the minimum torque indicated above, the joint must be disassembled and reassembled after thorough cleaning. Under no circumstances are bolts to be overstressed.

E. Plastic Pipe

- 1. Inspect pipe and fittings for defects or damage prior to lowering into the trench.
- 2. Install PVC pipe and fittings in accordance with manufacturer's written instructions.
- 3. Install metallic-backed PVC warning tape 12" atop each lateral pipe from the main to the property line.
- 4. Use of hydro-hammer for compaction will not be permitted within three (3) feet of the top of the pipe.

F. Steel Casing Pipe

- 1. Steel casing pipe shall be installed by one of the following methods (CONTRACTOR's option):
 - a. Boring
 - b. Boring and jacking simultaneously
 - c. Drilling
 - d. Jacking and tunneling
- 2. Rock, if encountered, shall be removed by means of air hammers or other approved means. Blasting will not be permitted unless approved by the ENGINEER.
- 3. Pits shall be of sufficient size to accomplish work. Pits shall be sheeted, shored, and braced as required to prevent subsurface subsidence. Pits shall be kept dry; and pumps shall be attended on a 24-hour basis, if conditions so require.
- 4. The CONTRACTOR shall submit detailed description of all procedures, schedules and details necessary to describe the work to the ENGINEER.

G. Pipe Couplings and Adapters

- 1. Install pipe couplings and adapters in accordance with the manufacturer's written instructions.
- 2. Test dig and determine the exact O.D. and ovality of existing pipe before submitting any coupling for approval.

H. Connection of Force Main to Manholes

1. Connection of a force main into a manhole shall be accomplished to minimize splashing.
2. Connection to a new manhole shall be through an opening provided with a gasket as specified in paragraph 2.01. Connection to an existing manhole shall be accomplished by core drilling a hole and sealing the annular space with Linkseal provided with stainless steel bolts.
3. Where possible, the force main shall be connected at the channel invert for a new manhole and within 3" of the top of the benching of any existing manhole. A smooth channel shall be provided to direct the discharge into the manhole main channel.
4. Where a force main cannot be connected in accordance with paragraph 3 above, then an inside drop or fittings shall be provided as directed by the ENGINEER. All pipe supports and anchors shall be stainless steel.

I. Anti-Seep Collars

1. Anti-seep collars shall be installed around the pipe to prevent the migration of water along the pipe through the bedding.
2. Anti-seep collars shall be utilized in areas of high ground water table or as directed by the ENGINEER.

J. Pipe Anchors

1. Pipe anchors shall be installed around the pipe to prevent the pipe from creeping down a slope due to high flow velocities.

3.02 MANHOLE CONSTRUCTION

A. General

1. Manhole shall consist of precast reinforced concrete round riser sections and eccentric or flat slab top sections on concrete bases, complete with cast iron frames and covers, steps, and protective coatings.
2. The DEVELOPER shall provide precast reinforced concrete bases for manholes. Poured-in-place bases shall only be used in special cases as approved in writing by the ENGINEER.
3. Manholes shall conform to the design and dimensions shown on the Detail Drawings and to the requirements specified herein.

4. Manhole tops installed within streets and ground surfaces of residential areas shall be set to match existing grade and slope.
5. Where the Drawings show manhole tops to be above existing ground in undeveloped areas and in open country, manhole shall be set at the top elevations called for on the plans, unless otherwise directed by the ENGINEER.
6. All pipes entering or exiting a manhole shall be provided a joint not more than 2' from the exterior face of the manhole wall.
7. A minimum drop of 0.1 feet in pipe invert elevation shall be provided through each manhole.
8. The minimum manhole inside diameter shall be four feet (4'). Larger inside diameters shall be provided as directed by the ENGINEER.

B. Precast Manhole Bases

1. All precast concrete bases shall be installed level and on a 6-inch layer of compacted coarse aggregate.

C. Poured In Place Concrete Manhole Bases

1. Poured in place concrete bases when permitted shall be constructed in accordance with the design and dimensions shown on the Detail Drawings.
2. Concrete shall be vibrated with a mechanical vibrator. The vibrator shall not be attached to the forms and it shall be capable of transmitting vibration to the concrete in frequencies of not less than five thousand impulses per minute.
3. The tops of poured in place manhole bases shall be accurately formed to receive the tongue of the bottom precast concrete manhole section by means of a template to be provided by the manufacturer of the precast concrete manhole section.
4. The concrete manhole base shall be poured monolithically as shown on the Detail Drawings.
5. Connections to sewer piping shall be made by means of a rubber gasket pipe seal which is suitable for casting directly into the concrete of the base wall caulk groove with polyurethane sealing compound.

D. Concrete Channels

1. In junction manholes, care shall be taken to properly channel the sewage from pipes entering the sides of the manhole to the flow in the main channel.
2. All channels shall be molded in the concrete base and shall be of proper size, cross section, and to required grade; all bends in channels shall be built with the maximum possible radius. Channels shall be finished smooth in a neat and workmanlike manner with steel trowels. No traps or standing water shall be permitted.

E. Precast Concrete Riser and Top Sections

1. All precast reinforced concrete riser and top sections necessary to build a completed manhole shall be furnished, and the different sections shall fit together readily to permit effective jointing. Jointing shall be in accordance with the Detail Drawings.
2. Rubber gasket joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer of the precast concrete manhole sections. After the joints have been made, the annular spaces which remain on the inside and outside of the joints shall be completely filled with non-shrink grout.
3. Preformed plastic sealing compound joints between adjacent sections shall be carefully made in accordance with the written instructions of the manufacturer. After the joints have been made, the preformed plastic sealing compound shall be cut or troweled smooth across the joint on the inside of the manhole wall. Where required on the Detail Drawings, joints shall also be sealed with non-shrink grout.
4. Lifting holes shall be sealed with properly designed tapered rubber plugs. The plugs shall be driven into the lifting holes to make the holes completely water and air tight. Sealing of lifting holes with non-shrink grout will also be permitted.
5. Adjoining riser and conical top sections shall be fitted together to assure true vertical alignment of manhole steps.

F. Caulking of Pipe Seals

1. Annular spaces between pipe seal and manhole base or wall after pipe connections have been completed shall be completely filled with polyurethane sealing compound. The sealing compound shall be tightly

caulked into the annular spaces in such a manner so as to completely fill the annular spaces, and troweled smooth at the inside face of the manhole base and wall. The polyurethane sealing compound shall be Sikaflex-1A, manufactured by Sika Chemical Company of Lyndhurst, New Jersey, or approved equal.

G. Manhole Steps

1. The manhole steps shall be as shown on the Detail Drawings and shall be set in a straight line on the side of the manhole and spaced as set forth on the Detail Drawings.

H. Drop Manhole Connection

1. Drop manhole connections shall be constructed in accordance with the Detail Drawings at the locations shown on the drawings or as otherwise directed by the ENGINEER. Pipe and fittings shall be the same pipe material that is used in the actual sewer line construction.
2. A minimum of a five (5) foot inside diameter manhole shall be provided.

I. Manhole Frames and Covers

1. Where required, final adjustment of frame to elevation shall be made using precast concrete manhole grade rings. Grade elevation adjustments shall not be permitted to exceed 1-foot.
2. Joints between grade rings for leveling units shall be made with preformed plastic sealing compound, and shall be ½-inch thick and troweled or trimmed smooth on the inside of the manhole. In addition, the leveling units shall be sealed on the outside and inside surface using non-shrink grout.
3. The joint between the bottom of the frame and the top of grade ring leveling units, or the top manhole section as applicable, shall be made with preformed plastic sealing compound and shall be sealed on the outside and inside surface using non-shrink grout.
4. Frames for all manholes not located in paved areas shall be bolted to the manhole as shown on the Detail Drawings. Studs, nuts, and washers shall be of galvanized steel and conform to ASTM A325. Bolts shall have a sufficient number of proper sized threads for proper connection.
5. Bolt frames to top manhole section.
6. Secure covers to frame as shown on the Detail Drawings.
7. Install chimney seal, Parsonpoxy FP, and Wrapidseal outside wrap, or approved equals. Install per manufacturer's requirements.

J. Tapping Existing Manholes

1. Tapping of existing manholes shall be in accordance with the requirements of paragraph 2.01 and the Detailed Drawing.
2. If the distance between the invert of the new sewer and the existing benching exceeds 1'-6", the inside drop shall be constructed. No tap shall be made in the area between 12" to 18" above the existing benching or through a manhole wall joint.
3. The inside base of the existing manhole shall be modified as required to provide for a smooth transition of flow into the existing channel.

3.03 CONCRETE FOUNDATIONS

- A. Where required by the ENGINEER, or where shown on the Drawings, pipe shall be placed on a formed concrete cradle, or unformed concrete shall be placed around pipes for bedding and encasement.
- B. Concrete cradles shall consist of structures requiring forms and be composed of concrete, built-in trenches to support pipes, and to the dimensions shown on the Detail Drawings.
- C. Concrete bedding and encasement shall be composed of concrete placed in trenches, without forms as pipe bedding, or encased around pipes, to the dimensions and in the locations indicated on the Detail Drawings.

3.04 INSTALLATION OF NEW MANHOLE IN AN EXISTING SEWER MAIN

- A.
 - In the event a manhole has to be installed in an existing sewer main, it shall be accomplished by saw cutting out an appropriate length of sewer main, inserting a precast manhole base with two (2) 2' long PEXPE DIP or DR 18 PVC pipe lengths of the appropriate diameter installed in the inlet and outlet connections. The new pipe sections shall be joined to the plain ends of the existing sewer main by using an appropriately sized Ford style FC2A cast coupling with stainless steel nuts and bolts or another coupling approved prior to the start of work. Construction and connection of the manhole shall be in accordance with the Detailed Drawings.
- B. During the installation of the manhole, the CONTRACTOR shall pump all sewage flows from the manhole immediately upstream to the manhole immediately downstream. If the existing sewage flow is small and the conditions are acceptable to the ENGINEER, stopping the sewage flow by plugging upstream manhole may be approved.
- C. The construction of a poured-in place concrete base with a "Doghouse" riser section will only be considered as an alternate to the above under special cases. Approval of this type of construction must be obtained in writing from the ENGINEER.

3.05 PIPE BURSTING

- A. Pipe bursting for the repair of laterals and mains may be acceptable means of repair. The Township and Engineer must review the specific application and approve prior to any work. The method must meet all applicable IPBA and NASSCO standards.
- B. Final tie-ins after bursting shall be per applicable Detail, using full sleeve mechanical couplings; refer to Sections 2.01 E and F, and 3.01 B and C.

TABLE I

AIR TEST TABLE

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED

Pipe Diameter (In)	Minimum Time (min:sec)	Length for		Specification Time for Length (L) Shown (min: sec)						
		Minimum Time (ft)	Longer Length (sec x Length.ft)	100 ft	150 ft	200 -ft	250 ft	300 ft	350 ft	400 ft
4	1:53	597	.19 x Length	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 x Length	2:50	2:50	2:50	2:50	2:50	2:50	2:51
8	3:47	298	.760 x Length	3:47	3:47	3:47	3:47	3:48	4:26	5:04
10	4:43	239	1.187 x Length	4:43	4:43	4:43	4:57	5:56	6:55	7:54
12	5:40	199	1.709 x Length	5:40	5:40	5:42	7:08	8:33	9:58	11:24
15	7:05	159	1.671 x Length	7:05	7:05	8:54	11:08	13:21	15:35	17:48
18	8:30	133	3.846 x Length	8:30	9:37	12:49	16:01	19:14	22:26	25:38
21	9:55	114	5.235 x Length	9:55	13:05	17:27	21:49	26:11	30:32	34:54
24	11:20	99	6.837 x Length	11:24	17:57	22:48	28:30	34:11	39:53	45:35
27	12:45	88	8.653 x Length	14:25	21:38	28:51	36:04	43:16	50:30	57:42

SECTION 8

SEWER PIPE TELEVISION

ARTICLE 1 GENERAL

1.01 DESCRIPTION

- A. The work in this section includes, but is not limited to:
 - 1. The internal inspection of the sanitary sewers utilizing closed circuit cameras and associated equipment.
 - 2. The preparation of permanent records of televising activities.
- B. Requirements
 - 1. All newly constructed sewer mains shall be televised prior to conducting any sewer line being accepted for dedication.
- C. Related Work Specified Elsewhere
 - 1. SewerLineAcceptanceTests-Section 7

ARTICLE 2 PRODUCT

2.01 CAMERA, MONITOR & MOBILE STUDIO

- A. Operation of the equipment shall be controlled from above ground with a skilled technician at the control panel in the television studio, controlling the movement of the television camera. The technician shall have the capability to adjust the brilliance of the built-in lighting system and be able to change the focus of the television camera by remote control.
- B. The color television camera used for the inspection and the back-up camera shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. Picture quality shall be such as to produce a minimum of 600 lines of resolution, in 100% humidity conditions, from the television camera. Picture quality and definition shall be to the complete satisfaction of the TOWNSHIP and, if unsatisfactory, the equipment shall be removed and replaced with satisfactory equipment and the inspection shall be conducted again at no extra cost to the TOWNSHIP.

- C. The view seen by the television camera shall be transmitted to color television monitor of not less than 9 inches. The television monitors shall be located inside a movable TV studio which shall be large enough to accommodate up to six people for the purpose of viewing a monitor while the inspection is in progress. The ENGINEER shall have access to view a television monitor at all times.
- D. The camera shall be capable of being moved through the sewer line in either direction at a uniform, slow rate by means of manual cable winches or motorized mechanical equipment of the indirect drive type.
- E. A footage meter shall be provided such that the location of the camera and point of reference will be known at all times at ground level. The metering device shall be accurate to two-tenths (0.2) of a foot. A measuring target in front of the television camera shall be used as an exact measurement reference point and the meter shall be designed so that the distance recorder can be set at zero when the camera or packer is at the entrance of the pipe inside the manhole.
- F. The electricity for all I&I inspection operations shall be furnished by and at the expense of the CONTRACTOR.
- G. All cables attached to the camera must be of sufficient length to ensure the televising of a given reach of sewer in one continuous operation.
- H. The equipment used to televise the sanitary sewers must be capable of extending a minimum of seven hundred (700) feet per set up.

2.02 RECORDS

- A. Written records of all internal inspection operations shall be prepared by the CONTRACTOR. The records shall be printed in log form acceptable to the ENGINEER, indicating each section of sewer televised, CONTRACTOR's name, date, type and diameter of pipe, length of the sewer section and specific details as to service connection locations, broken pipe, the location of each infiltration point discovered and an estimate of the quantity of infiltration, and any other points of interest noted during the inspection. All locations shall be in relation to adjacent manholes and shall utilize the manhole designations shown on the sewer maps provided by the TOWNSHIP. A manhole inspection form acceptable to the ENGINEER must be completed by the CONTRACTOR for each manhole where televising activities have started, terminated, or passed through. A copy of the form must be included with the televising records. An acceptable copy of the written televising logs, the video tapes of the sewer reaches, and the written manhole inspection reports must be delivered to the TOWNSHIP.

- B. Video and audio tape recording of the inspection shall be made at the direction of the ENGINEER. The recording tape shall be DVD format and shall become the property of the TOWNSHIP after completion of the sewer reach. The recording shall identify and describe the section of sewer line. Stationing shall be given by audio recording at intervals of no less than ten feet and shall be given at all points of interest such as infiltration sources and service connections. The video recording shall continuously indicate DVD position and have a variable playback tape speed ranging from normal to one-third normal speed and shall have not less than 180 lines of resolution.

ARTICLE 3 EXECUTION

3.01 EQUIPMENT SET-UP

- A. After a sewer reach has been cleaned, all necessary equipment shall be set-up in preparation for televising. Equipment set-up shall include necessary traffic control, positioning of winches, power cable and TV camera positioning in the manhole.

3.02 TELEVISION ACTIVITIES

- A. The CONTRACTOR is requested to complete as many sewer reaches per equipment set-up as conditions permit.
- B. All televising activities shall be made in the presence of the ENGINEER.
- C. The camera shall be moved through the line at a uniform rate, not to exceed 1/2 foot per second by means of cables and winches positioned at each manhole. A suitable means of communication shall be established and maintained if remote controlled power winches are not used.
- D. The CONTRACTOR shall stop the camera at all leaks, cracks, laterals, separated joints and defects that might permit infiltration of groundwater into the sewer or where directed by the ENGINEER.
- E. If necessary, the camera shall be removed from the line and the lens cleaned. Picture quality and definition shall be to the complete satisfaction of the ENGINEER. Fogging conditions in the sewer atmosphere shall be eliminated by introducing forced fresh air into the sewer system or by other acceptable methods.
- F. The CONTRACTOR shall prepare the necessary written records and video DVD and manhole inspection forms at the time of televising. Copies of the written records shall be given to the TOWNSHIP upon completion of a given reach of sewer. The video DVD shall be delivered to the TOWNSHIP upon completion of the televising.

SECTION 9

CONCRETE FOR UTILITY CONSTRUCTION

ARTICLE 1 GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes, but is not limited to:

1. Cast-in-place cement concrete construction
2. Reaction and support blocking
3. Cradles and encasement

B. Related Work Specified Elsewhere

1. Trenching, Backfilling & Compaction: Section 6

1.02 QUALITY ASSURANCE

A. Reference Standards

1. Pennsylvania Department of Transportation:
Publication 408 Specifications
2. American Society for Testing and Materials (ASTM):
C31 Making and Curing Concrete Test
Specimens in the Field
C39 Test for Compressive Strength of
Cylindrical Concrete Specimens
C42 Obtaining and Testing Drilled Cores and
Sawed Beams of Concrete
C172 Sampling Fresh Concrete

1.03 SUBMITTALS

A. Certificates

1. Submit certification from the concrete producer attesting that the cement concrete conforms to Section 704, Publication 408 Specifications for the class of concrete being used.

2. Submit certified results of compressive strength tests performed by an independent testing laboratory.

B. Shop Drawings

1. Submit detailed shop drawings of reinforcing steel.

ARTICLE 2 PRODUCTS

2.01 CEMENT CONCRETE

A. Ready-mixed, conforming to Section 704, Publication 408 Specifications.

1. Requirements for State approved batch plants, design computations and plant inspection shall not apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.

B. Cement Concrete Criteria

1. Class A

- a. 28-day compressive strength: 3300 psi
- b. Slump: 1 to 3 inches

2. Class C

- a. 28-day compressive strength: 2000 psi
- b. Slump: 2 to 6 inches

3. High Early Strength

- a. 3-day compressive strength: 3000 psi
- b. Slump: 1 to 3 inches

4. Cement Factor and Maximum Water-Cement Ratio conforming to Table A, Section 704.1(b), PaDOT Publication 408 Specifications.

2.02 REINFORCEMENT STEEL

A. Reinforcement Bars

1. New billet-steel conforming to Section 709.1, Publication 408 Specifications.

2. Deformed, Grade 40

B. Steel Wire Fabric

1. Conforming to Section 709.3, Publication 408 Specifications

2.03 GROUTS

A. General

1. All grouting as indicated or noted on the Drawings, in other sections of the specification or obviously required to perform the work shall be non-shrink grout.

2. Grout in general shall be non-metallic type unless specifically noted on the Drawings or in other sections of the specifications to be a metallic type.

3. Grouting shall be in strict compliance with the directions contained in the manufacturer's current catalog or instructions provided with the product.

4. The grout manufacturer shall make available at no cost, upon 72 hours notification, the services of a qualified full-time field representative to aid in assuring proper use of the product under job conditions.

B. Non-metallic Type

1. Non-metallic grout shall be Masterflow 713 Grout (pre-mixed) as manufactured by Master Builders.

C. Epoxy Based Grouts shall be a 2 component, moisture insensitive epoxy adhesive, such as Sikadur 32 Hi-Mob by Sika Corporation.

ARTICLE 3 EXECUTION

3.01 CONSTRUCTION

A. Comply with Section 1001, Publication 408 Specifications for construction requirements including formwork, curing, protection, and finishing of cement concrete.

B. Excavate and shape trench bottoms and sides to accommodate thrust block forms, encasement, manhole bases, inlets and vaults.

- C. Support pipe, valves and fittings at the required elevation with brick or concrete block. Do not use earth, rock, wood, or organic material as supports.
- D. Construct manhole bases, reaction and support blocking, cradles, encasements, and miscellaneous mass concrete of Class A concrete.
- E. Provide spacers, chairs, bolsters, ties and other devices for properly placing, spacing, supporting and fastening reinforcement in place.
- F. Place concrete utilizing all possible care to prevent displacement of pipe or fittings. Return displaced pipe or fittings to line and grade immediately.
- G. Insure tie rods, nuts, bolts and flanges are free and clear of concrete.
- H. Do not backfill structures until concrete has achieved its initial set, forms are removed, and concrete work is inspected by the ENGINEER.
- I. Perform backfilling and compaction as specified in Section 6.

3.02 FIELD TESTS OF CONCRETE DURING CONSTRUCTION

- A. Test each 50 cubic yards or fraction thereof of each class of concrete for compressive strength. Retain an independent testing laboratory to test cylinders.
 - 1. Sample concrete in accordance with ASTM C172
 - 2. Prepare and cure two test cylinders in accordance with ASTM C31.
 - 3. Test cylinders in accordance with ASTM C39
- B. If test cylinders fail to meet strength requirements, the ENGINEER may require additional core tests in accordance with ASTM C42 at the expense of the CONTRACTOR.

SECTION 10

PAVING AND RESURFACING

ARTICLE 1 GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
 - 1. Temporary Paving
 - 2. Permanent Paving
 - 3. Shoulder Restoration
 - 4. Curb and Sidewalk Restoration
- B. Related work specified elsewhere:
 - 1. Trenching, Backfilling and Compacting: Section 6
 - 2. Concrete For Utility Construction: Section 9
- C. The CONTRACTOR and ENGINEER shall, prior to construction, make a visual inspection of all paved areas, determining the actual condition of the paving. Notes, photographs, etc., shall be made and kept on file at the ENGINEER's office for possible future reference. CONTRACTOR shall not disturb areas prior to the existing conditions being documented.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Pennsylvania Department of Transportation:
 - a. Publication 408 Specifications, latest edition
 - b. Publication 27 – Specification for Bituminous Mixtures (Bulletin 27)
 - c. Publication 37 – Specification for Bituminous Materials (Bulletin 25)
 - d. Publication 203 – Work Zone Traffic Control

1.03 SUBMITTALS

A. Certificates:

1. Submit certification from bituminous and aggregate suppliers attesting that materials conform to the State specifications.

1.04 JOB CONDITIONS

A. Control of Traffic:

1. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the ENGINEER.
2. Employ traffic control measures in accordance with Publication 203 "Work Zone Traffic Control" and the Contract Drawings.
 - a. Unless otherwise noted on the plans, CONTRACTOR shall submit details of all traffic control measures to be utilized. No traffic control measures may be used until CONTRACTOR receives approval from the ENGINEER in writing.

- #### B. Restore existing paving outside the limits of the work, that is damaged by the CONTRACTOR's operations, to its original condition at the expense of the CONTRACTOR.

ARTICLE 2 PRODUCTS

2.01 CONCRETE

- A. The concrete materials for streets shall conform to the applicable provisions of Section 704, CEMENT CONCRETE AND READY MIX CEMENT CONCRETE, in Commonwealth of Pennsylvania, Department of Transportation Specifications, Form 408.
- B. The concrete materials for walks, curbing and driveways shall be Class A, 3500 psi Concrete and shall conform to the specifications of Section 9.

2.02 CRUSHED STONE BASE COURSE

- A. Crushed stone base course shall be PennDOT No. 2RC Crushed Stone or AASHTO 2RC stone and shall be in accordance with Section 350 – Subbase of PennDOT Specifications, Publication No. 408, 1996.
- B. Crushed slag shall not be used for this material.

- 2.03 BITUMINOUS CONCRETE BASE COURSE
- A. Bituminous concrete base course shall conform to Section 305 of PennDOT Specifications, Publication No.408, 1996.
- 2.04 BITUMINOUS BINDER COURSE ID-2
- A. Bituminous binder course ID-2 shall conform to Section 421 of PennDOT Specifications, Publication No.408, 1996.
- 2.05 BITUMINOUS TACK COAT
- A. Bituminous tack coat shall conform to Section 460 of PennDOT Specifications, Publication No.408, 1996.
- 2.06 BITUMINOUS WEARING COURSE ID-2
- A. Bituminous wearing course ID-2 shall conform to Section 420 of PennDOT Specifications, Publication 408, 1996, or, 9.5mm, as determined by the Engineer.
- 2.07 MILLING OF BITUMINOUS PAVEMENT SURFACE
- A. Milling of bituminous pavement surface shall conform to Section 491 of PennDOT Specifications, Publication 408, 1996.
- 2.08 JOINT SEALING
- A. Joint sealing shall conform to Section 401 of PennDOT Specifications, Publication No.408, 1996.
- 2.09 CRACK FILLING AND SEALING
- A. Crack filling and sealing shall conform to Section 469 of PennDOT Specifications, Publication No.408, 1996.
- 2.10 BITUMINOUS PAVED SHOULDERS TYPE 6 and TYPE 61
- A. Paved shoulders Type 6 and Type 61 shall conform to Section 656 of PennDOT Specifications, Publication 408, 1996.
- 2.11 CONCRETE SHOULDERS
- A. Concrete shoulders shall conform to Section 658 of PennDOT Specifications, Publication No.408, 1996.

2.12 CEMENT CONCRETE SIDEWALKS

- A. Cement concrete sidewalks shall conform to Section 676 of PennDOT Specifications, Publication No.408, 1996.

2.13 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall conform to Section 705 of PennDOT Specifications, Publication No.408, 1996.

2.14 WELD WIRE FABRIC

- A. Weld wire fabric shall conform to Section 709 of PennDOT Specifications, Publication No.408, 1996'.

2.15 CONCRETE

- A. Concrete shall confirm to Section 704 of PennDOT Specifications, Publication No.408, 1996.

2.16 LINE PAINTING

- A. Line painting shall conform to Section 962 of PennDOT Specifications, Publication No.408, 1996.

2.17 MANHOLE ADJUSTING RINGS

- A. For raising manhole covers an acceptable manhole raising device shall be provided. The device shall be a solid adjusting ring or an adjustable manhole extension device.

2.18 RAISING MANHOLE COVERS AND VALVE BOXES

- A. Install the adjusting rings in all sewer manholes that require adjusting to meet the elevation of the repaving.
- B. Coordinate the raising of all valve boxes and/or manhole covers belonging to other utilities.
- C. The CONTRACTOR shall be responsible to see that all such items as mentioned above are adjusted to the new paving elevation.

ARTICLE 3 EXECUTION

3.01 MISCELLANEOUS

- A. All materials of construction shall conform to all applicable sections of PennDOT Specifications, Publication 408, latest edition.
- B. Restore existing paving outside the limits of the work that is damaged by the CONTRACTORs operation, to the original condition, to the satisfaction of the ENGINEER, at the expense of the CONTRACTOR.
- C. All finish paving shall be completed to match the finish grade of the adjacent existing pavement unless otherwise specified on the Contract Drawings.
- D. The CONTRACTOR shall seal all joints between new pavement and existing pavement, including roads, driveways, manholes, inlets, curbs, water boxes, etc. in accordance with Section 401 of the PennDOT Specifications, Publication 408, latest edition. This work is incidental to the installation of the bituminous material.
- E. Upon completion of the paving, any stretch marks, cracks, open seams, etc. which allow the penetration of water and dirt shall be repaired in accordance with instruction by the ENGINEER.
- F. Final restoration shall be completed by the CONTRACTOR within sixty (60) days of first disturbance in all paved areas. The only time extension which will be considered will be due to weather.
- G. All restored areas shall be maintained by the CONTRACTOR until expiration of the maintenance bond period as required by the TOWNSHIP.

3.02 SURFACE PREPARATION.

- A. The surface shall be prepared and cleaned by the CONTRACTOR.
- B. The CONTRACTOR shall apply a tack coat to the existing bituminous pavement prior to placing the new wearing course.
- C. The CONTRACTOR shall cut joints at all paved road connections. This work is incidental to the wearing course installation.
- D. All waste material removed from the roadway area shall be disposed of at a site provided by the CONTRACTOR.
- E. The road surface shall not be muddy or otherwise unsatisfactory when the binder and/or wearing course is placed thereon.

3.03 TRAFFIC CONTROLS

- A. The CONTRACTOR shall provide traffic controls as previously approved by the owner of the roadway. All traffic controls shall meet PennDOT criteria. The TOWNSHIP shall be notified a minimum of three (3) days in advance of any construction in the roadway.

3.04 ROADWAY EXCAVATION AND SUBBASE PREPARATION

- A. The CONTRACTOR shall smooth-cut the existing pavement at all limits of work. This work is incidental to the excavation of the roadway.
- B. The CONTRACTOR shall excavate and remove the existing road materials, rubble, stone and rock to the depth shown on the Plans, or suitable subgrade.
- C. All waste material removed from the road excavation shall be disposed of at a site provided by the CONTRACTOR.
- D. The CONTRACTOR shall re-compact the subgrade using equipment and methods in accordance with PennDOT Specifications, Publication No. 408, latest edition, Section 210 Subgrade and approved by the ENGINEER
- E. The subgrade shall not be muddy or otherwise unsatisfactory when the stone subbase is placed thereon.
- F. The CONTRACTOR shall construct a subbase of approved aggregate to the depth and width shown on the Plans. The trench for the installation of the stone shall have a minimum width of 36'. The stone shall be compacted and brought to the grade as shown on the Plans. The minimum size roller shall be a small vibrating trench roller approved by the ENGINEER. All materials and methods of construction shall conform to all applicable sections of PennDOT Specifications, Publication No. 408.

3.05 STONE ACCESS AND PARKING AREAS

- A. Stone parking areas shall be 10" of PennDOT No. 2RC stone over Class 2 Type "A" Filter Fabric on approved and compacted subbase as indicated on the Contract Drawings.
- B. Parking areas shall extend to the limits as shown of the Drawings.

3.06 DRIVEWAYS

- A. Driveways shall be restored to existing dimensions or reconstructed to the limits as shown on the Plans, or as directed by the TOWNSHIP.

1. Bituminous Driveways
 - a. Bituminous driveways shall be 2" of ID-2 wearing course over 6" of PennDOT No. 2RC stone on approved and compacted subbase.
 - b. Seal all joints.
2. Concrete Driveways
 - a. Concrete driveways shall be 6" of Class A, 3500 psi Concrete with 6 x 6 Welded Wire Fabric over 6" of PennDOT No. 2RC stone on approved and compacted subbase.
 - b. Provide performed expansion joint, where new concrete joins existing concrete and at intervals as directed by ENGINEER.
 - c. Form joints with a 1/4" radius edging tool.
 - d. Provide light broom finish.
3. Stone Driveways
 - a. Stone driveways shall be 10" of PennDOT 2RC stone over Class 2 Type "A" Filter Fabric on approved and compacted subbase.
4. Concrete Driveway Apron
 - a. Apron extends from depressed curb or joint with street to the furthest most point of the sidewalk.
 - b. Concrete apron shall be 6" of Class A, 3500 psi Concrete with 6 x 6 W\JF over 6" of PennDOT No.2RC on approved and compacted subbase.
 - c. Provide expansion joint where new concrete joins existing concrete and at intervals as directed by the ENGINEER.
 - d. Form joints with a 1/4" radius edging tool.
 - e. Provide light broom finish.
- B. The existing edges of all driveways shall be cut square.

3.07 SIDEWALKS

- A. Sidewalks shall be replaced to original limits or installed to the limits indicated in the Plans as directed by the TOWNSHIP.

1. Concrete Sidewalks

- a. Concrete sidewalks shall be 4" Class A, 3500 psi concrete over 4" PennDOT#57 stone on approved and compacted subbase.
- b. Provide a light broom finish.
- c. Form outside edges and joints with a 1/4" radius edging tool.
- d. Form joints at 5 feet intervals, approximately 1/8" mill and 1" deep.
- e. Provide full depth 1/2" thick pre-molded expansion joints at 20', and stagger with expansion joints in curbing.
- f. Sidewalks to be a minimum of 4' wide.
- g. The existing sidewalk shall be broken off evenly at the nearest "groove" or "dummy joint" on both sides of the trench.

2. Bituminous Sidewalks

- a. Bituminous sidewalks shall be 1 1/2" of 10-2 wearing course over 6" of PennDOT No. 2RC on approved and compacted subbase.
- b. Seal all new or cut joints.
- c. Sidewalks to be a minimum 4' wide.

3. Handicapped Ramps

- a. Ramps shall comply with ANSI A.117 and IBC Chapter 11 and Appendix E standards and the following:
 - i. Handicapped ramps shall be provided as indicated on the plans or directed by the ENGINEER.
 - ii. Handicapped ramps shall be a minimum of 4" Class A, 3500 psi Concrete over 4" PennDOT #57 stone on approved and compacted subbase.

- iii. Provide a light broom finish.
- iv. Form outside edged and joints with a 1/4" radius edging tool.
- v. Ramp to be a minimum of 36" wide and shall slope at 1:12.

3.08 CONCRETE CURBING

- A. Curbs shall be replaced in ten (10) foot sections with expansion joints every twenty (20) feet.
- B. New concrete curbing shall be 8" wide x 18" deep and shall have a reveal and cross-section that matches the existing curb.
- C. Provide 1/2" thick pre-molded expansion joints at 20' and stagger with expansion joints in sidewalk.
- D. Curbs shall be Class A, 3500 psi concrete.
- E. Place depressed curbs for drives or curb cuts where indicated or directed by ENGINEER.
- F. Curb depressions shall be provided with a smooth transition. This transition shall be over a minimum of 36".
- G. Existing concrete curbing damaged by construction shall be replaced to match existing.
- H. Reconstruct curbs to the first expansion joint on either side of damaged portion and install new expansion joint material.

3.09 CONCRETE SWALES

- A. Concrete swales shall be replaced or installed to the limits indicated on the Plans as directed by the ENGINEER.
- B. Existing swales which are removed shall be replaced with similar.
- C. Existing swales shall have saw cut straight joint lines parallel to the centerline of the swale.
- D. Reconstruct swales to the first expansion joint on either side of the area to be removed and install new expansion joint material.

- E. New concrete swales shall be a minimum of 36" wide and shall be 6" Class "A", 3500 psi concrete over 6" of PennDOT 2RC on approved and compacted subbase.
- F. Provide expansion joint where new concrete joins existing concrete.
- G. Provide 1/2" thick pre-molded expansion joints at 20'.

3.10 BITUMINOUS SWALES

- A. Bituminous swales shall be replaced or installed to the limits indicated on the Plans.
- B. Existing swales which are removed shall be replaced in kind.
- C. Existing swales shall have saw cut straight joint lines parallel to the centerline of the swale.
- D. New swales shall be 1 1/2" ID-2 wearing course over 6" PennDOT 2RC on approved and compacted subbase.
- E. All joints shall be sealed.

3.11 PAVED PARKING AREAS

- A. Existing paved parking area shall have saw cut straight joint lines parallel to the centerline of the trench.
- B. Restoration shall be 6" compacted 2A Modified Stone Sub-base, 211 BCBC Base and 1" ID-2 Wearing Course.
- C. All joints shall be sealed. Sealant shall be applied at a minimum of 4" in width.

3.12 RESTORATION TOWNSHIP ROADWAYS

- A. Roadways shall be reconstructed to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Existing roadway shall have saw cut straight joint lines parallel to the centerline of the trench.
- C. All joints shall be sealed. Sealant shall be applied for a minimum width of 4".

3.13 SHOULDER RESTORATION TOWNSHIP ROAD

- A. Shoulders shall be reconstructed to the limits indicated on the Plans as directed by the ENGINEER.
- B. Existing shoulders and roadway shall have saw cut straight joint lines parallel to the centerline of the trench.
- C. Shoulder restoration shall be compacted suitable backfill.
- D. Seal all joints for a minimum width of 4-inch each side of the joint.

3.14 SWALES

- A. Swales shall be restored to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Swales which are not paved shall be restored to the lines and grades that existed prior to construction. They shall be brought to within 12" of existing grade and lined with rip-rap minimum size to be R-4 for a minimum thickness of 12". The swale width shall be equal to the swale width prior to construction.
- C. Rip rap shall extend 3'0" in either direction longitudinally beyond the disturbed area.
- D. If flows in swale exceed that which an R-4 can stabilize, TOWNSHIP may direct CONTRACTOR to utilize a larger rock within the swale.

3.15 TEMPORARY PAVING

- A. Temporary paving shall be installed to the limits indicated on the Plans or as directed by the ENGINEER.
- B. Temporary paving shall be installed immediately after trench back fill is brought to needed grades in paved areas.
- C. Shape and compact subgrade material, then place and compact crushed stone base course to the required thickness.
- D. The temporary paving between March 1 and October 31 shall consist of hot-mixed, hot laid, bituminous concrete, and maintained for a minimum of forty-five (45) days.

- E. The temporary paving between November 1 and the end of February shall consist of bituminous stockpile patching material in accordance with PennDOT Bulletin 27, Section 484, or 485 of Form 408 placed on top of the compacted backfill, and maintained until trench is permanently restored.
- F. Place temporary paving material. Compact to required minimum thickness with trench roller having minimum 300 pounds per inch-width of compaction roll.
- G. Continuously maintain temporary paving to the satisfaction of the ENGINEER and the State and local road departments. Temporary paving on State roads must remain in place for a minimum of 45 days.

3.16 TEMPORARY ACCESS ROADS NEEDED BY CONTRACTOR

- A. Access roads shall be installed where needed by the CONTRACTOR to perform the work.
- B. Temporary access roads shall be AASHTO No. 1 rock a minimum of 8" over Class 2, Type A Filter Fabric.
- C. Access road shall be maintained until CONTRACTOR has progressed sufficiently enough as to no longer need road.

3.17 LINE PAINTING

- A. Line painting shall be in accordance with Section 962 of PennDOT Specifications, Publication No. 408, latest edition, or hot-tape thermals, as determined or specified by the ENGINEER.
- B. Line painting shall take place and be completed the same day as temporary paving and/or paving.
- C. Utilize Type I- Traffic Zone Paint, color to match existing.

3.18 PROPERTY MARKERS

- A. Property markers which are removed as a result of construction activities shall be replaced by a licensed surveyor.
- B. Property markers shall be installed prior to substantial completion and shall be incidental to the cost of the project.

3.19 DRIVEWAY STORMWATER PIPES

- A. Driveway storm water pipes which are removed as a result of construction activities shall be replaced.

- B. Driveway storm water pipes damaged by the CONTRACTOR shall be replaced with concrete pipes of similar size. Minimum size of replacement pipe shall be 12".
- C. Swales adjacent to driveway pipes shall be restored, regraded and stabilized to provide smooth transition entering and exiting pipe.

3.20 ROADWAY SIGNS

- A. All roadway signs which must be removed in order to perform construction activities shall be replaced with same in the same location.
- B. If needed, new signs shall be in accordance with Sections 1103 of PennDOT Specifications, Publication No. 408, latest edition, and the latest revision of PennDOT Publication 68, Title 67, Chapter 211 – Official Traffic Control Devices. All signs shall be HI, High Intensity grade.

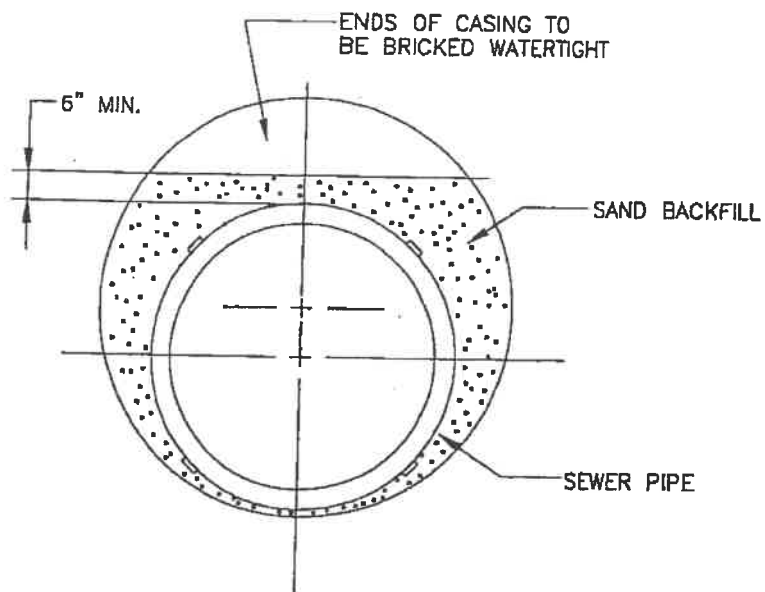
3.21 DELIVERY TICKET (PAVING MATERIALS)

- A. A delivery ticket indicating the quantities and types of paving material shall be submitted at the time of delivery. The complete delivery ticket shall be delivered to the ENGINEER. Failure to deliver such complete ticket to the ENGINEER will be cause for the ENGINEER to reject paving material.

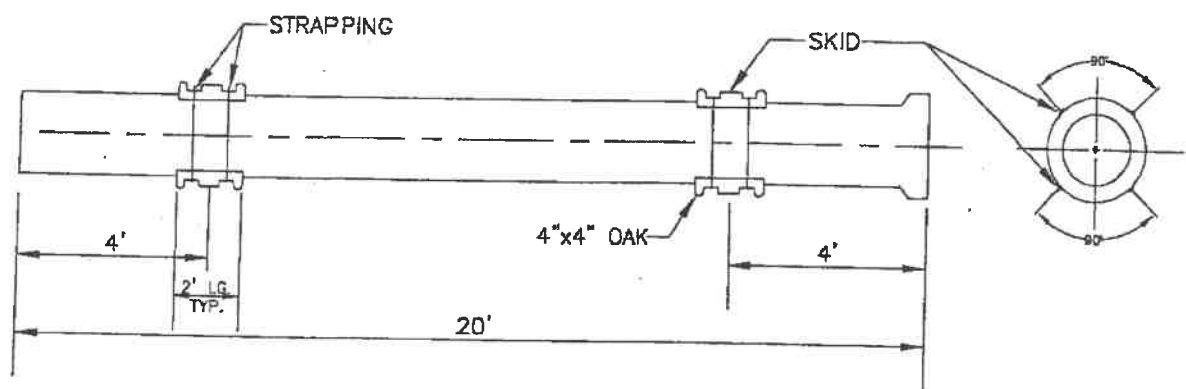
3.22 SURFACE IDENTIFICATION

- A. In accordance with "Occupancy of Highways by Utilities", Chapter 41, a mark of identification shall be placed at the nearest edge of the cut closest to the edge of the improved surface for each opening or impairment made within the improved surface of a State Highway.
- B. The paint shall be of a durable wearing quality and shall be color coded as follows:
 - 1. Blue - Water Lines
 - 2. Green - Sewer Lines
 - 3. Red - Electric Lines
 - 4. Yellow - Natural Gas Lines
- C. CONTRACTOR to mark all pavement following permanent restoration.

DETAIL DRAWINGS



CASING FILL DETAIL

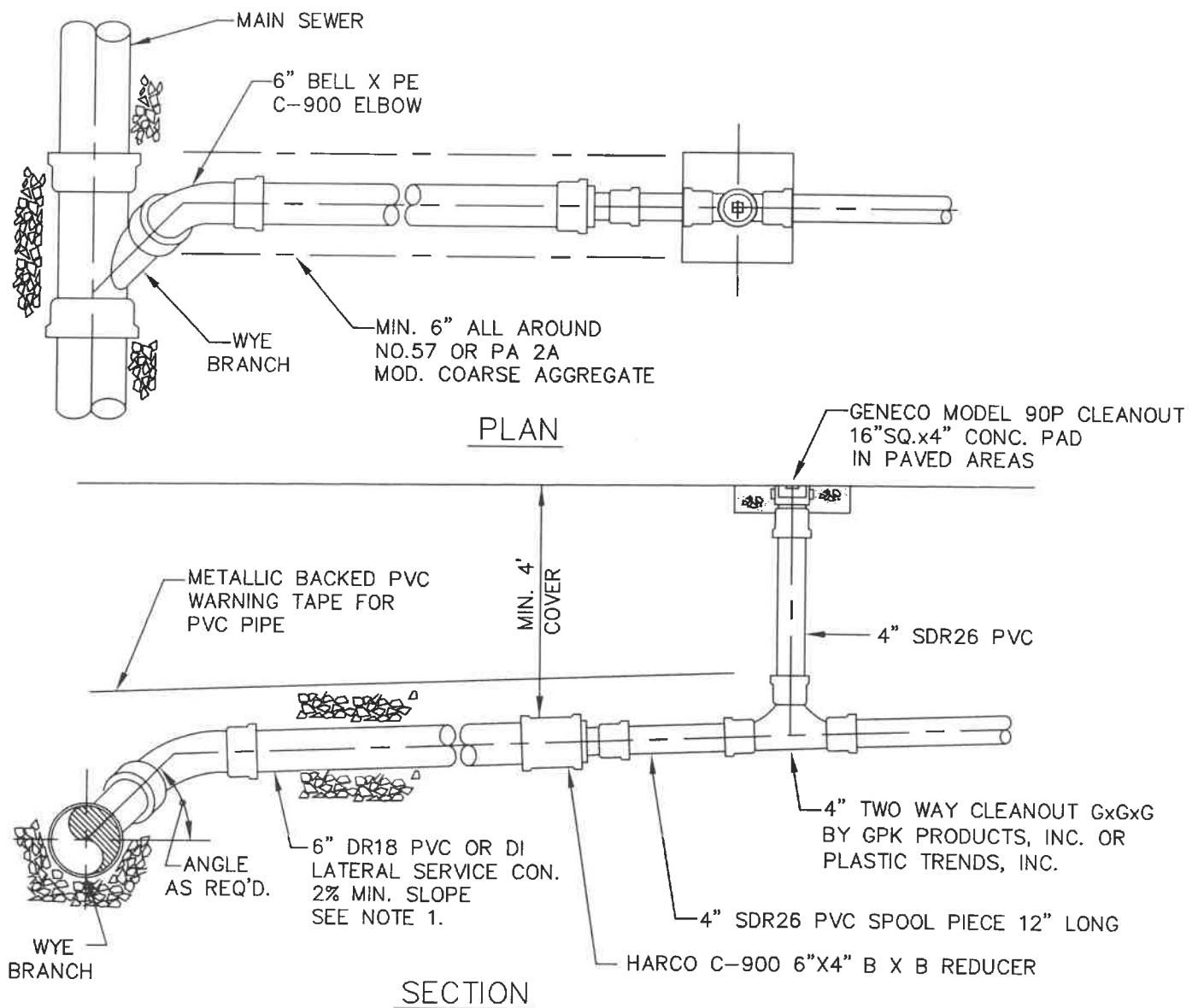


SKID PLACEMENT DETAIL

CASING DETAIL

NOTES:

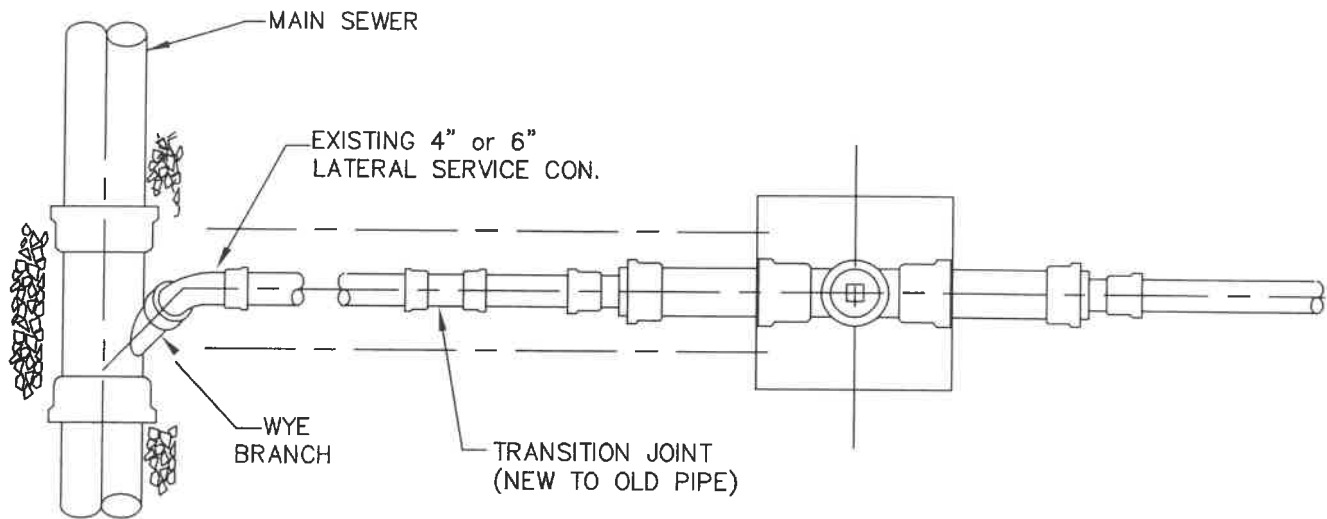
1. IF THE SEWER MAIN IS 8" AND AN INSERTA TEE IS REQUIRED FOR THE CONNECTION, THE LATERAL PIPE SIZE SHALL BE REDUCED TO 4".
2. IF CURBING OR PAVING DOES NOT EXIST, LATERAL SHALL BE 10 FEET IN LENGTH OR FOUR (4') FEET PAST THE EDGE OF THE RIGHT-OF-WAY, WHICHEVER IS GREATER.
3. CONNECTION FROM SERVICE LATERAL TO STRUCTURE SHALL BE IN ACCORDANCE WITH TOWNSHIP PLUMBING CODE.
4. PROVIDE STAKE (2"X3") AT END OF LATERAL EXTENDING 1 FT. ABOVE FINISH GRADE.
5. CLEANOUT IN NON-PAVED AREAS SHALL BE EAST JORDAN #1574, NEENAH FOUNDRY R-1975-A2, OR APPROVED EQUAL. CLEANOUT CAP PROTECTION CASTING SHALL HAVE A MIN. OF 2-INCH OF SEPARATION BETWEEN CLEANOUT THREADED PLUG AND CASTING.



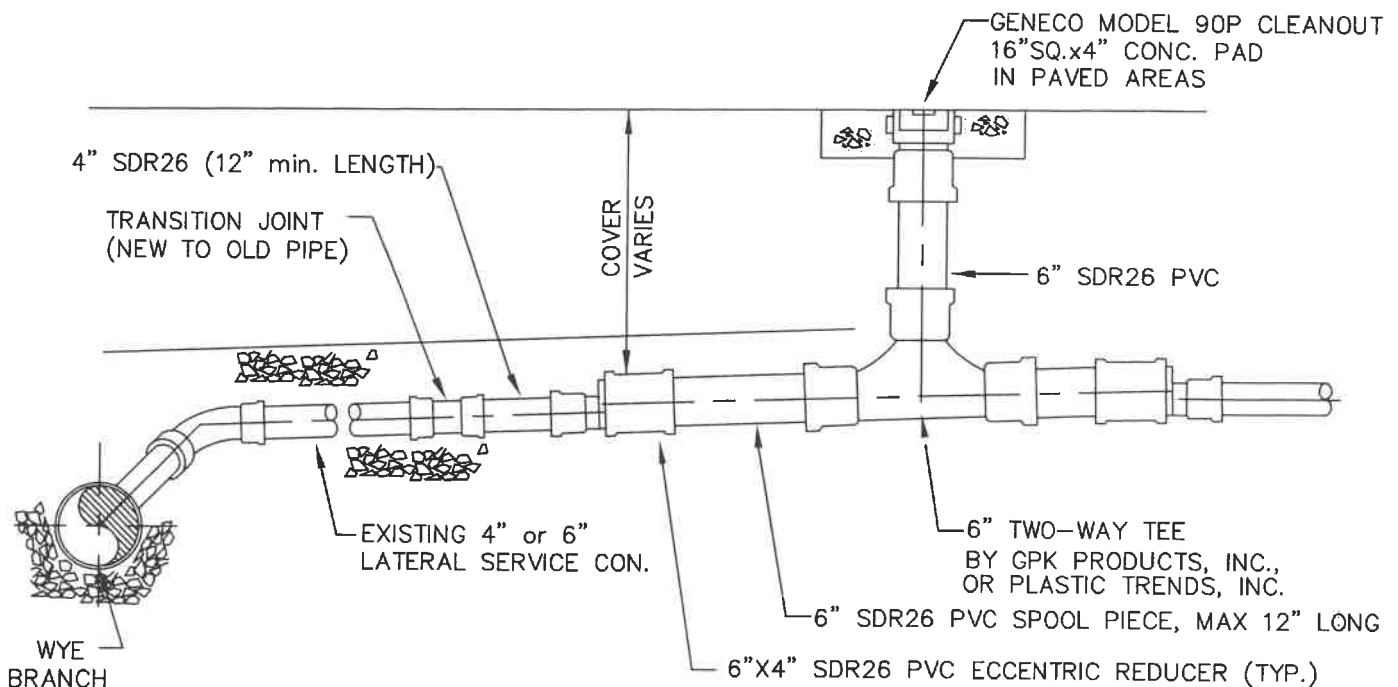
LATERAL CONNECTION, TWO WAY CLEAN-OUT
WITH THREADED PLUG

NOTE:

1. CLEANOUT IN NON-PAVED AREAS SHALL BE EAST JORDAN #1574, NEENAH FOUNDRY R-1975-A2, OR APPROVED EQUAL. CLEANOUT CAP PROTECTION CASTING SHALL HAVE A MIN. OF 2-INCH OF SEPARATION BETWEEN CLEANOUT THREADED PLUG AND CASTING.



PLAN

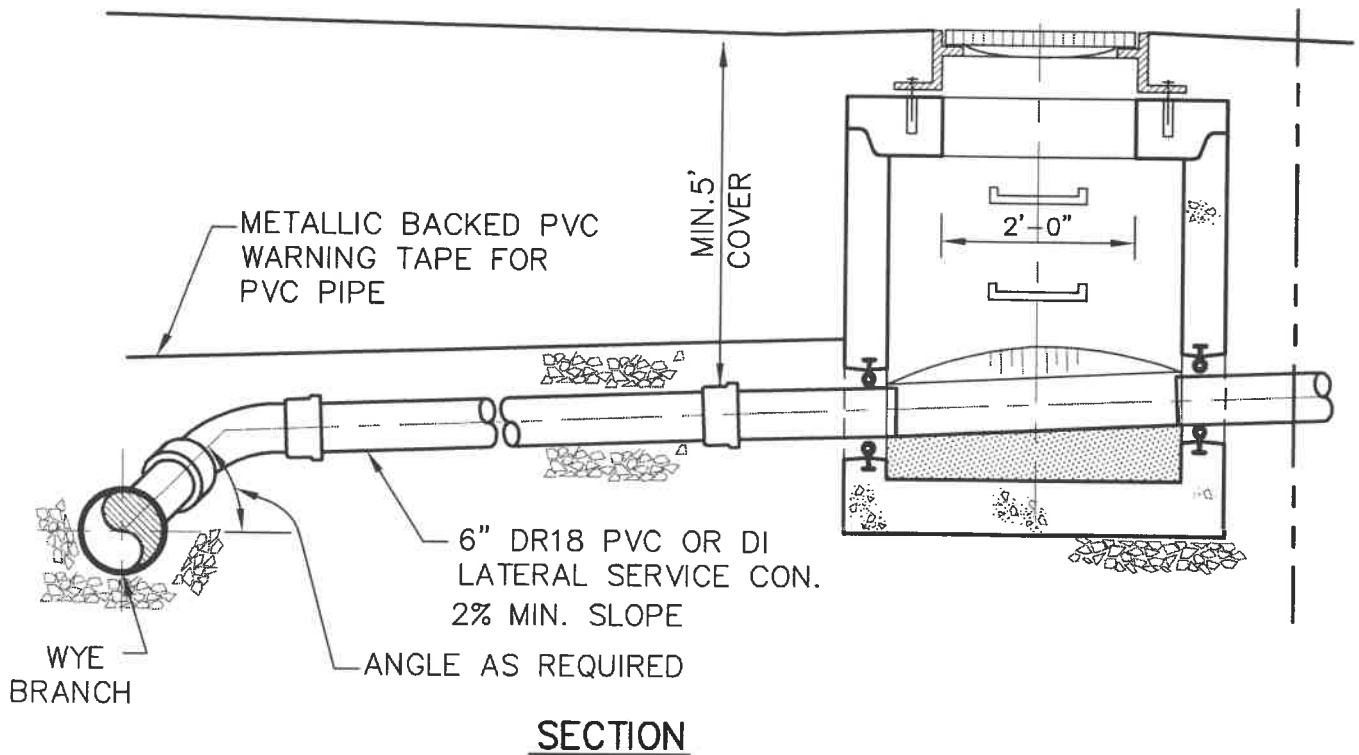
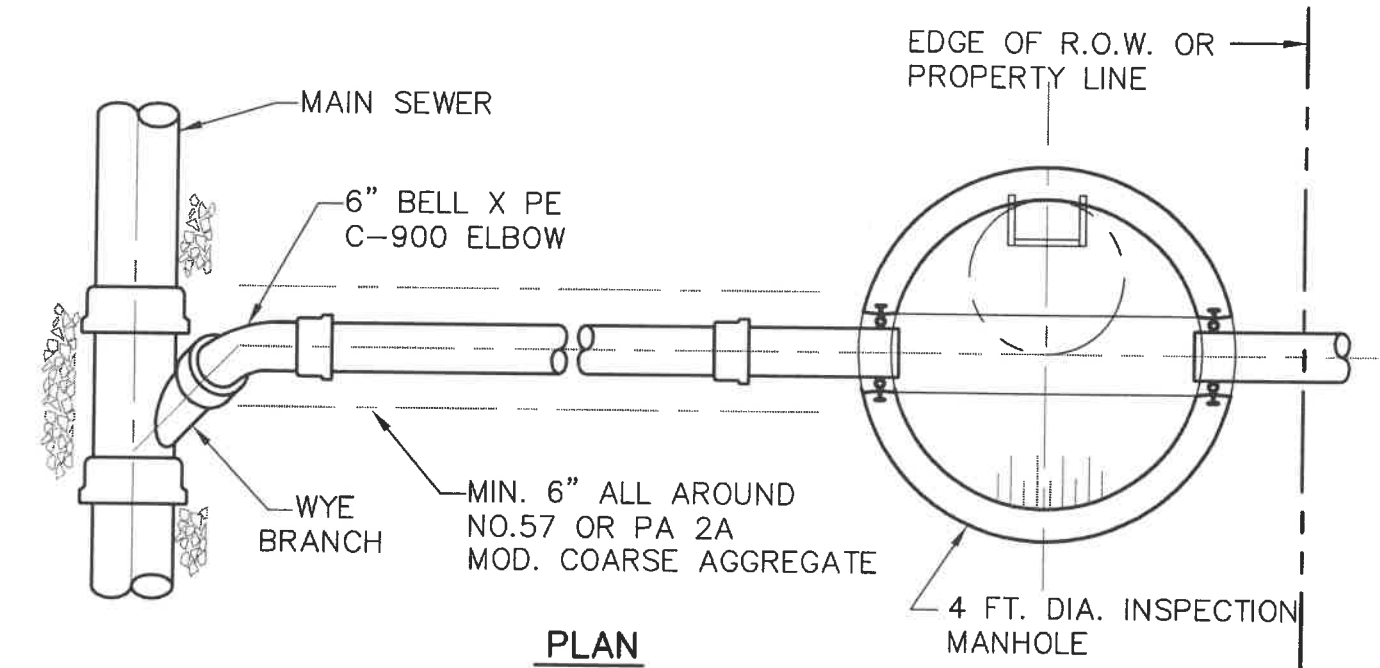


SECTION

LATERAL CONNECTION, TWO WAY CLEAN-OUT
WITH THREADED PLUG, EXISTING LATERAL

NOTES:

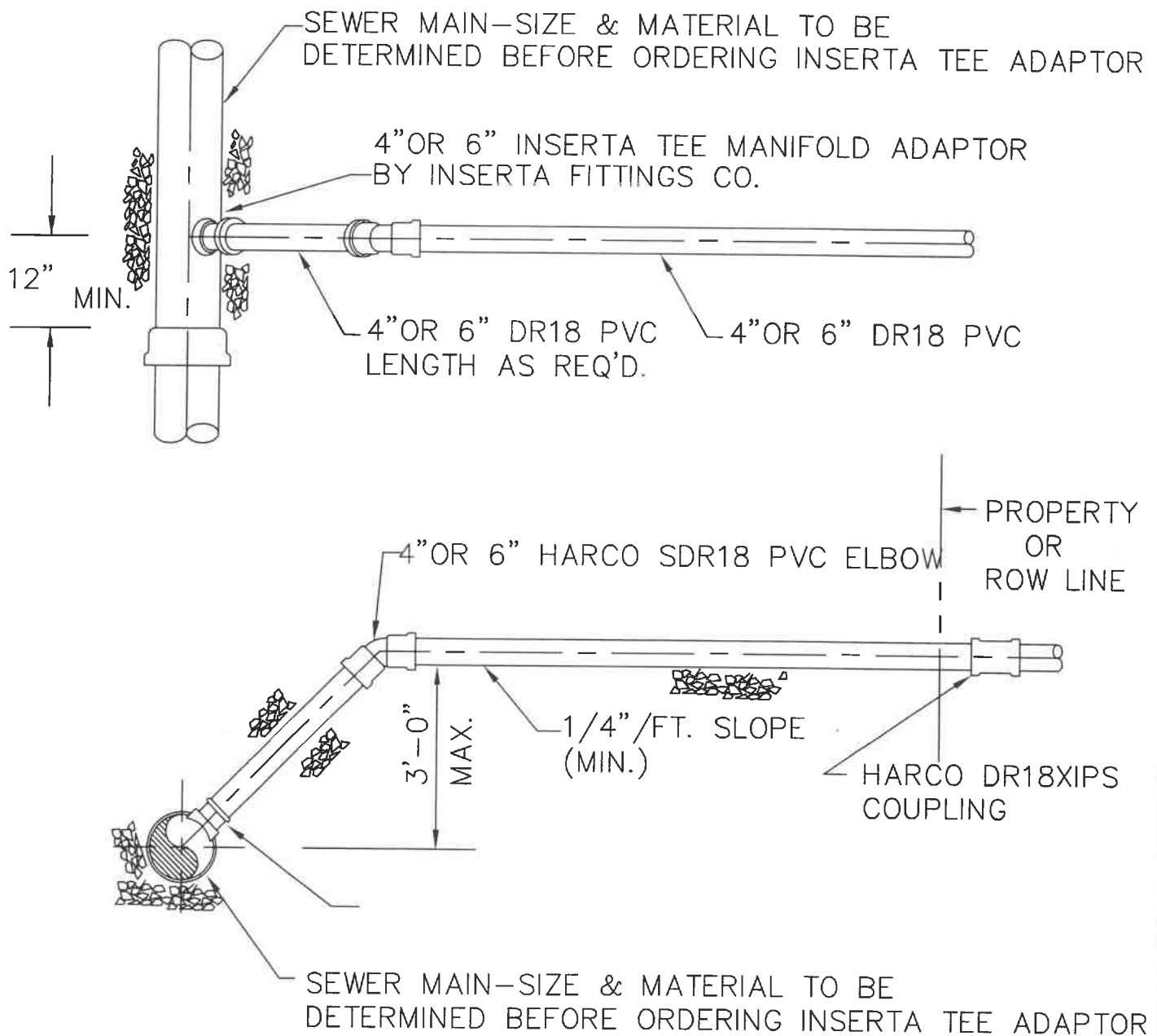
1. CONNECTION FROM INSPECTION MANHOLE SHALL BE IN ACCORDANCE WITH TOWNSHIP PLUMBING CODE



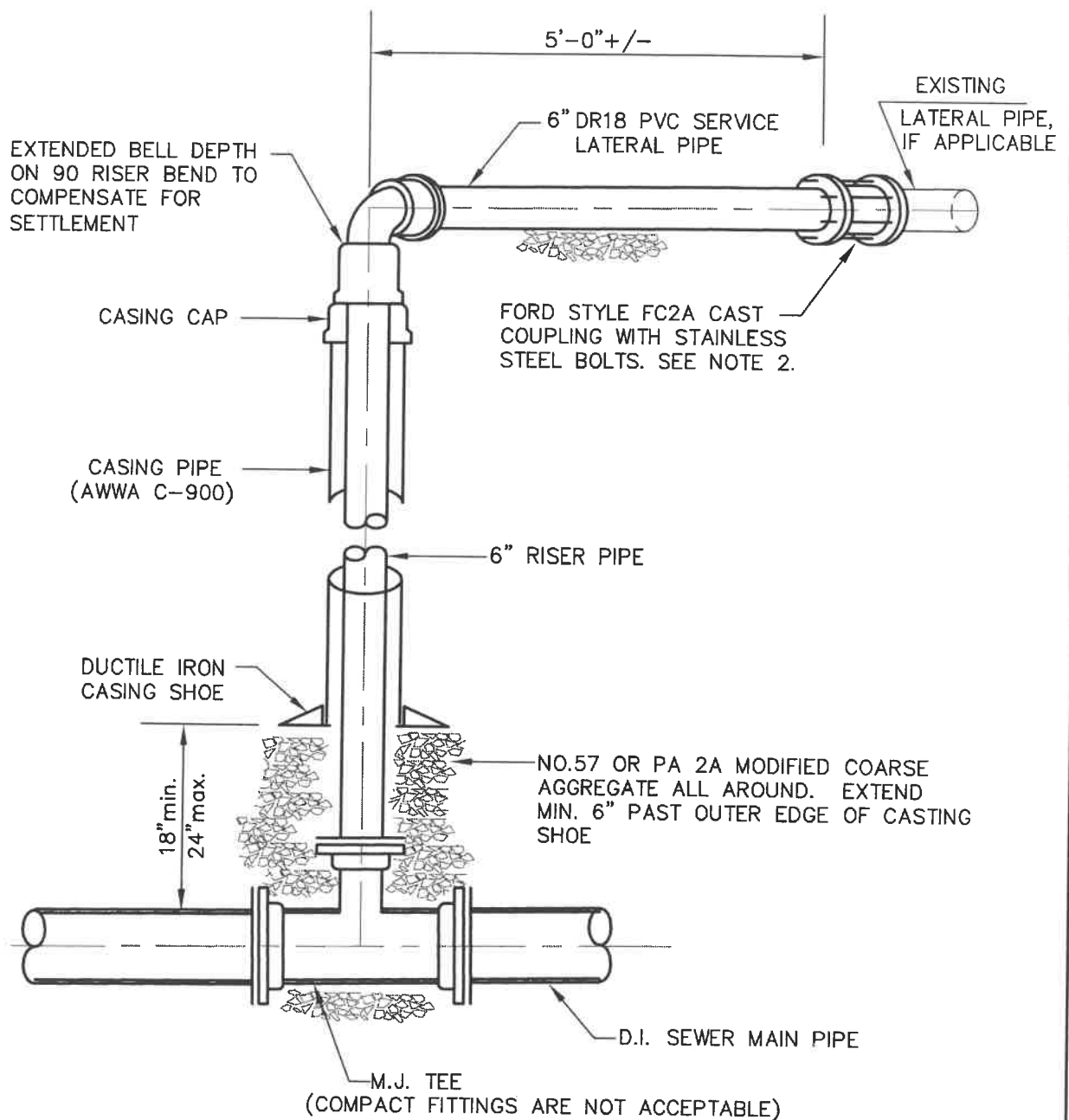
TYPICAL LATERAL DETAIL FOR INDUSTRIAL / COMMERCIAL CONNECTION

NOTE:

INSERTA TEE IS A THREE PIECE SERVICE CONNECTION CONSISTING OF A PVC HUB, RUBBER SLEEVE AND STAINLESS STEEL BAND. INSERTA TEE IS COMPRESSION FIT INTO THE CORED WALL OF A MAINLINE. INSTALL STRICTLY PER MANUFACTURER'S RECOMMENDATIONS.



LATERAL CONNECTION INTO EXISTING MAIN
WITH INSERTA TEE ADAPTOR

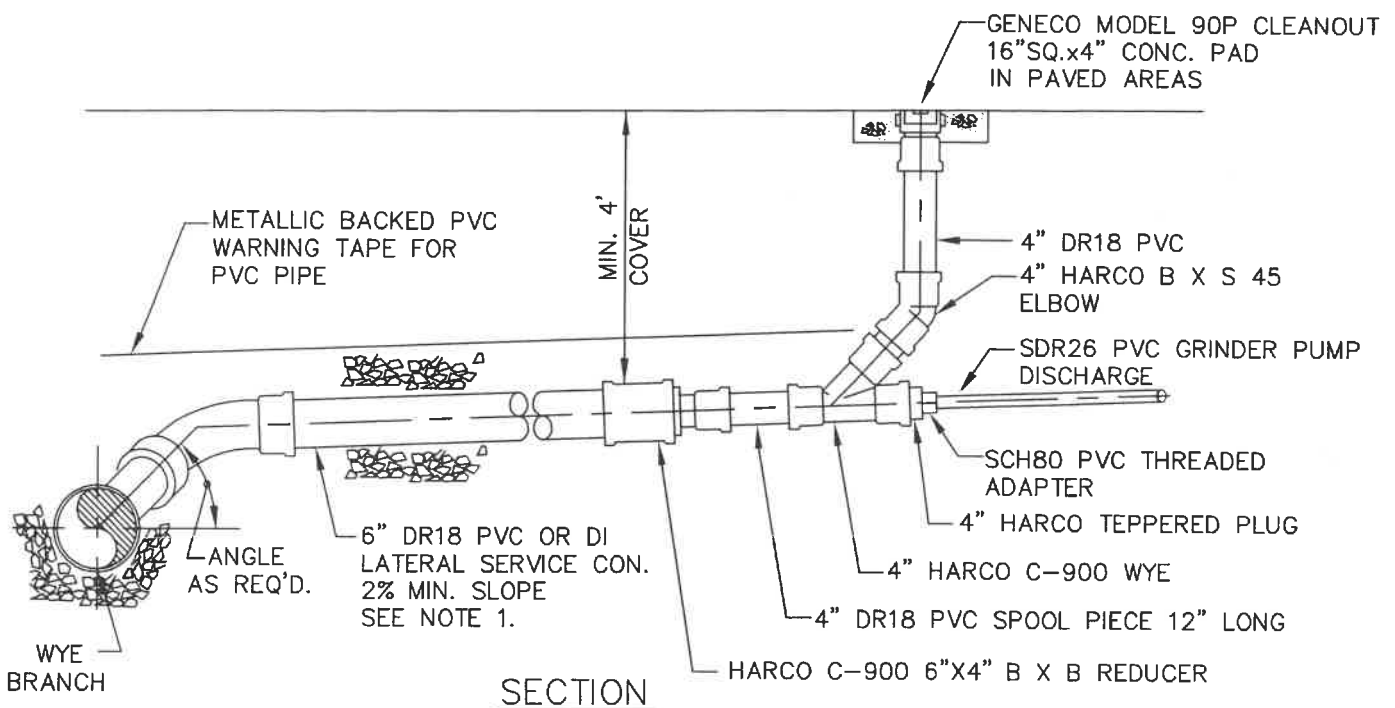
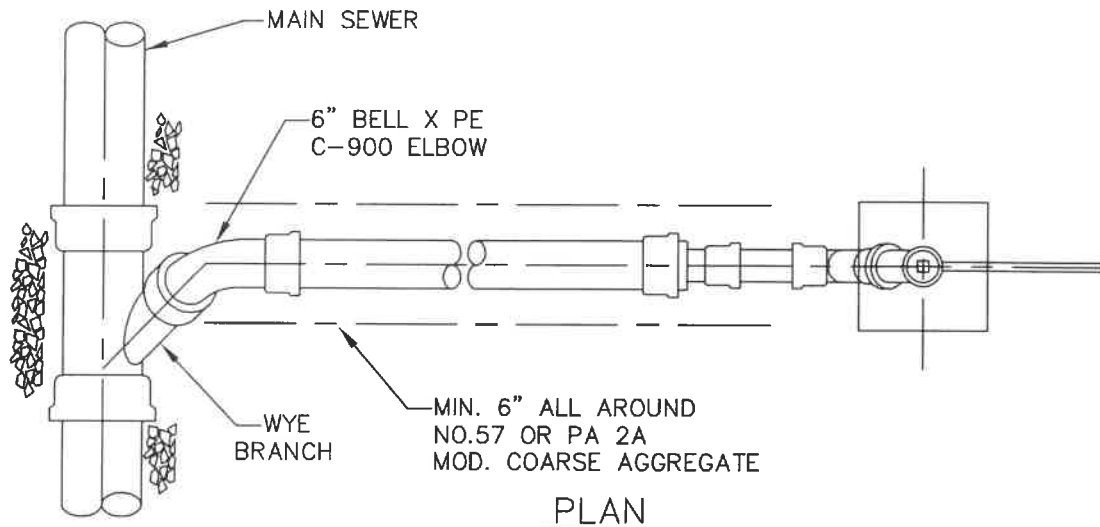


1. THE RISER SECTION OF THE LATERAL SHALL BE A "B & H" RISER OR APPROVED EQUAL
2. IF EXISTING LATERAL IS SMALLER THAN 6", USE FORD FRC CAST COUPLING WITH STAINLESS STEEL BOLTS

DEEP CUT LATERAL

NOTES:

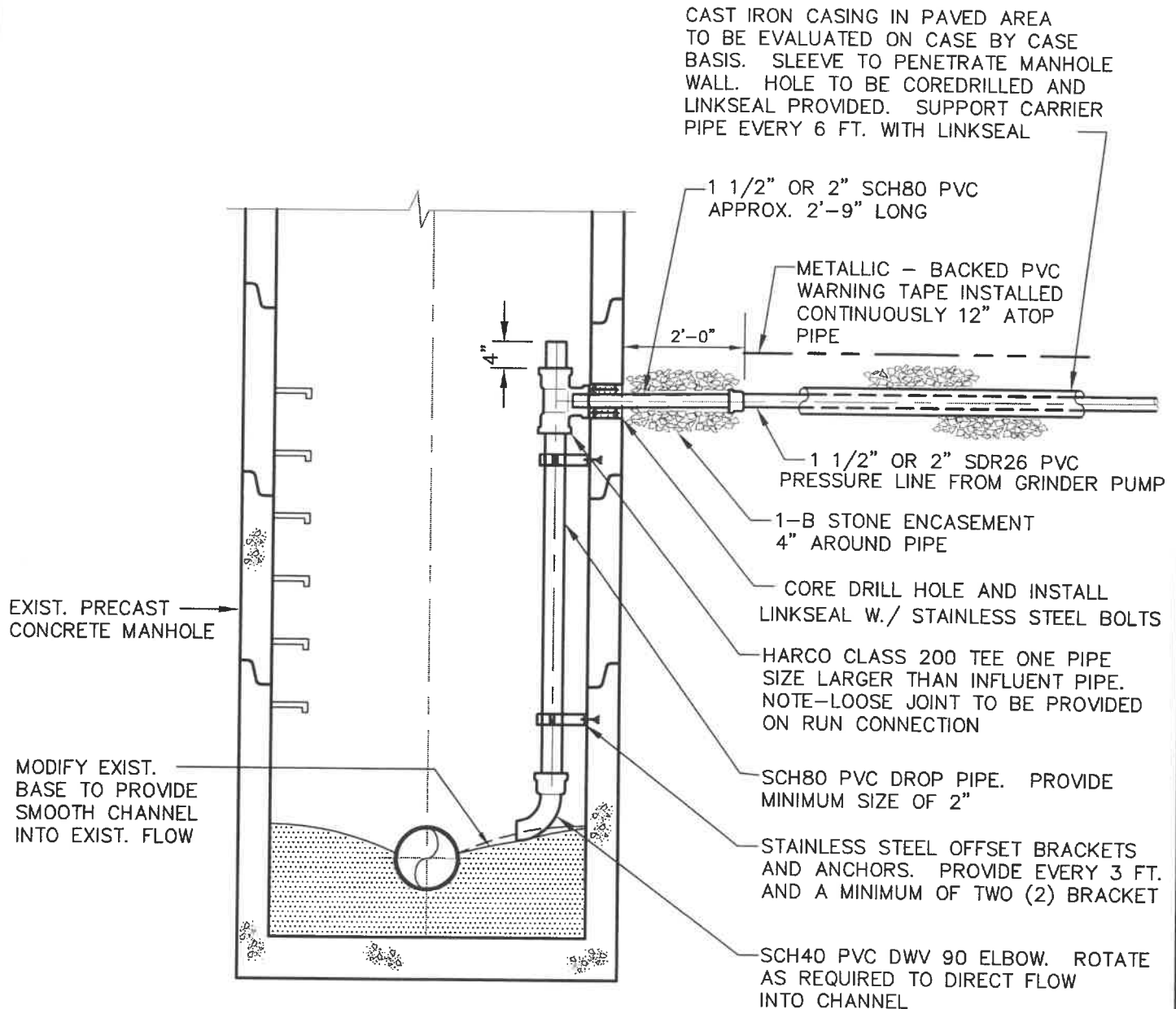
1. IF THE SEWER MAIN IS 8" AND A FITTING IS REQUIRED FOR THE CONNECTION, THE LATERAL PIPE SIZE SHALL BE REDUCED TO 4".
2. IF CURBING OR PAVING DOES NOT EXIST, LATERAL SHALL BE 10 FEET IN LENGTH OR FOUR (4') FEET PAST THE EDGE OF THE RIGHT-OF-WAY, WHICHEVER IS GREATER.
3. CLEANOUT IN NON-PAVED AREAS SHALL BE EAST JORDAN #1574, NEENAH FOUNDRY R-1975-A2, OR APPROVED EQUAL. CLEANOUT CAP PROTECTION CASTING SHALL HAVE A MIN. OF 2-INCH OF SEPARATION BETWEEN CLEANOUT THREADED PLUG AND CASTING.



GRINDER PUMP DISCHARGE
CONNECTION TO SEWER MAIN

NOTES:

1. AN INSIDE DROP CONNECTION WILL NOT BE REQUIRED IF THE INVERT OF THE PRESSURE PIPE IS WITHIN 4" OF THE TOP OF THE EXISTING BENCHING. PROVIDE AN ELBOW INSIDE MANHOLE AS REQUIRED TO MINIMIZE SPLASHING AND A SMOOTH CHANNEL INTO EXISTING FLOW.

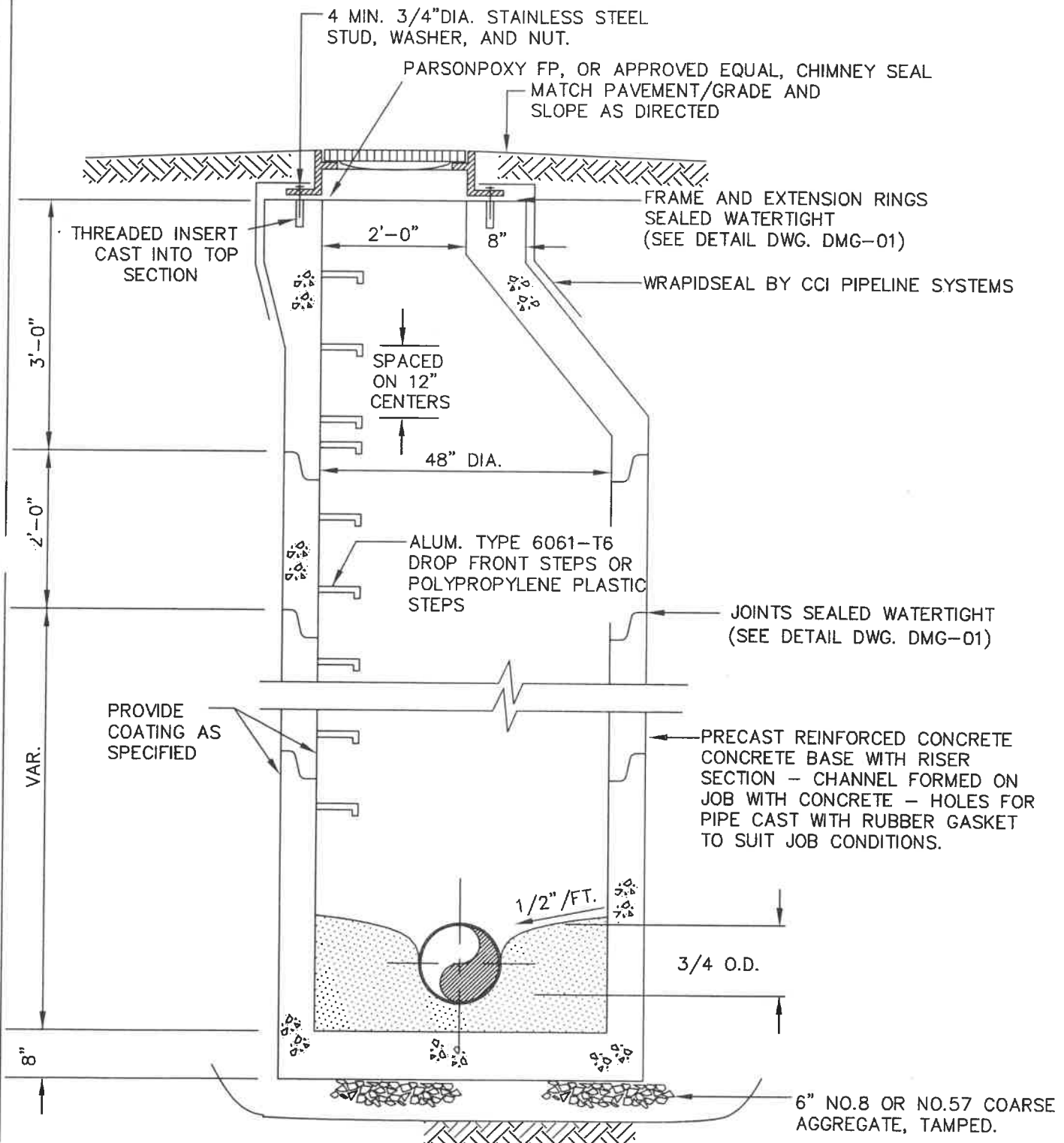


GRINDER PUMP FORCE MAIN CONNECTION TO MANHOLE

1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL



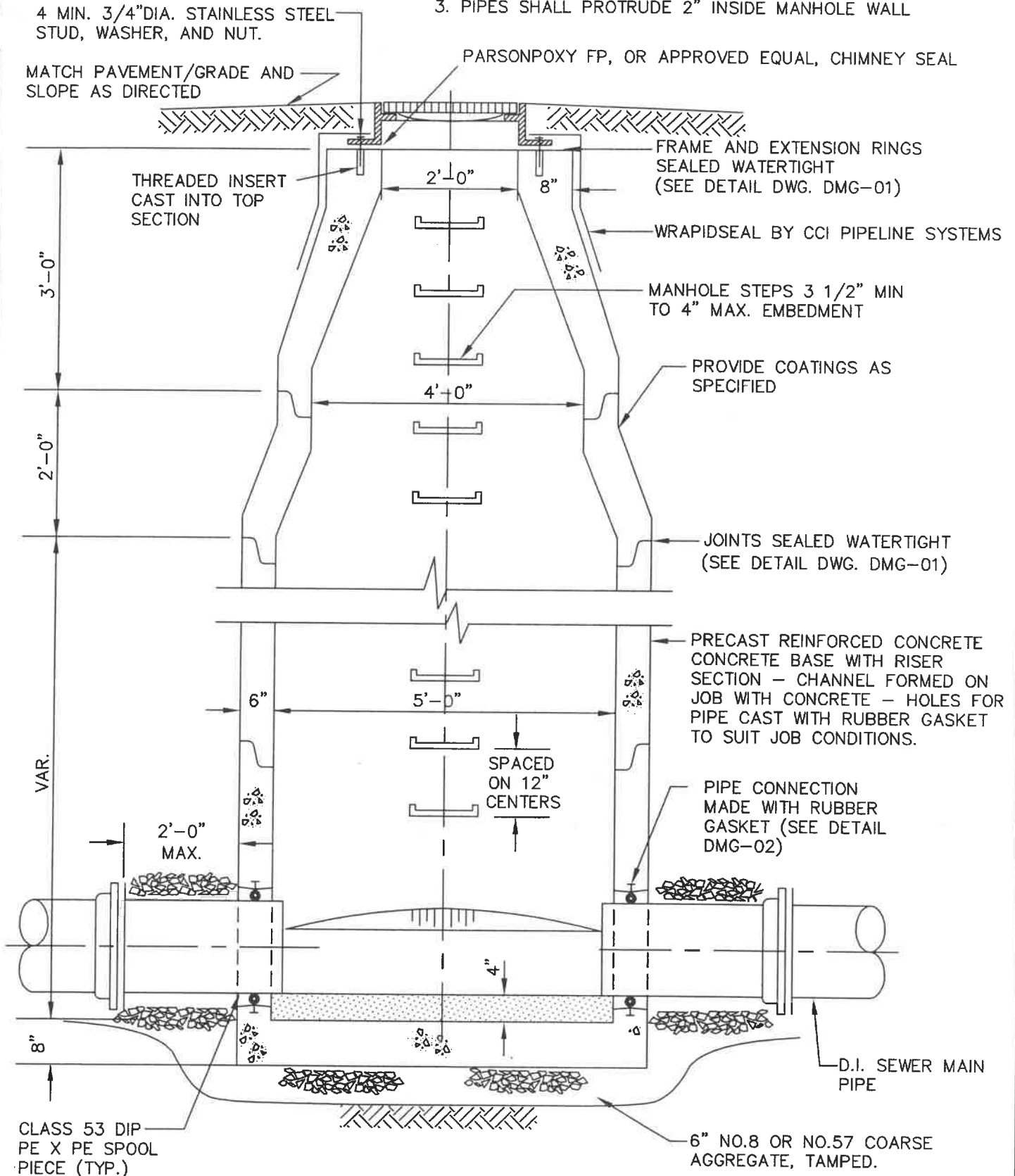
- NOTE: 1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES.
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL



PRECAST CONCRETE MANHOLE
W. / PRECAST CONCRETE BASE

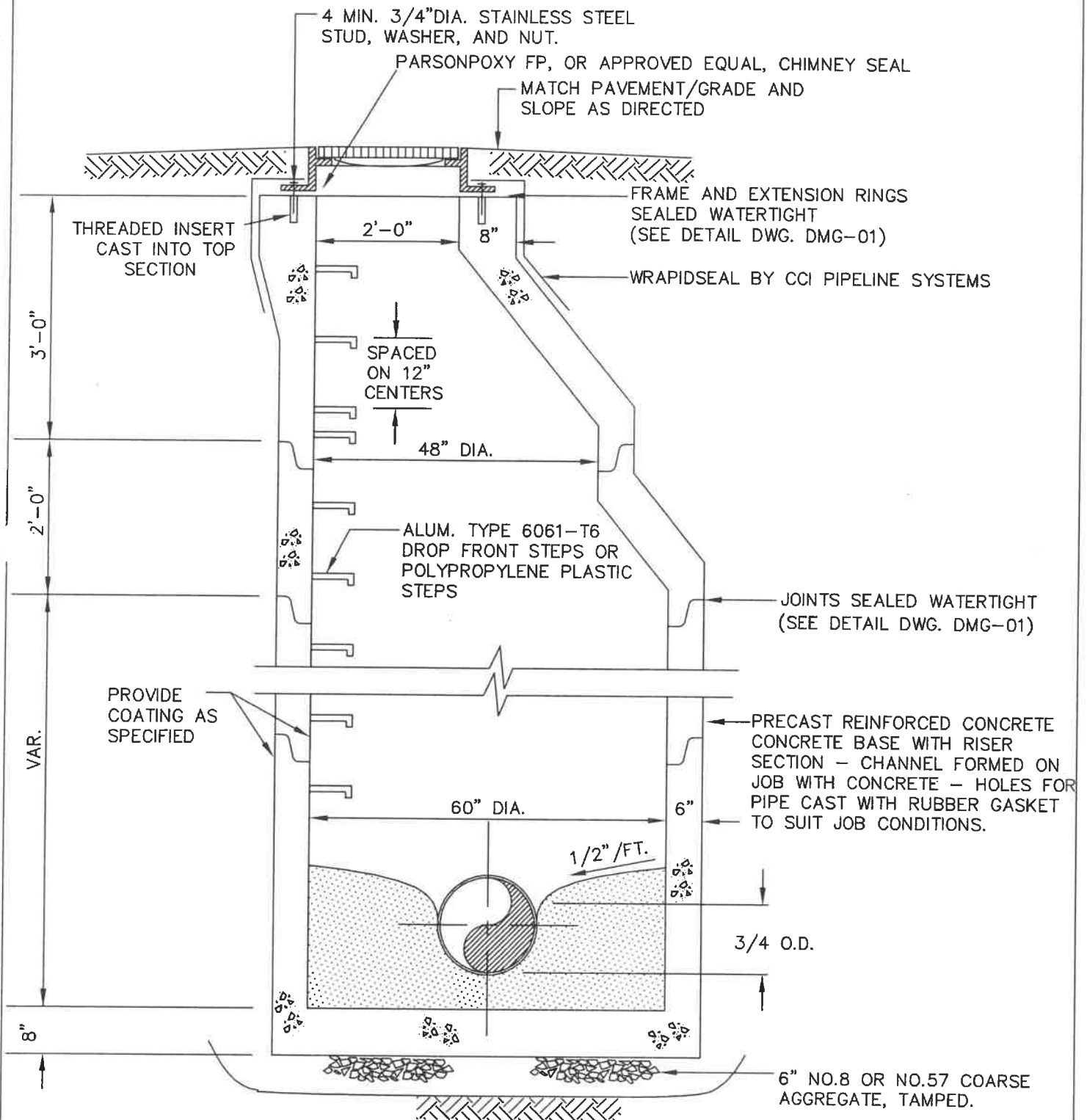
NOTES:

1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL

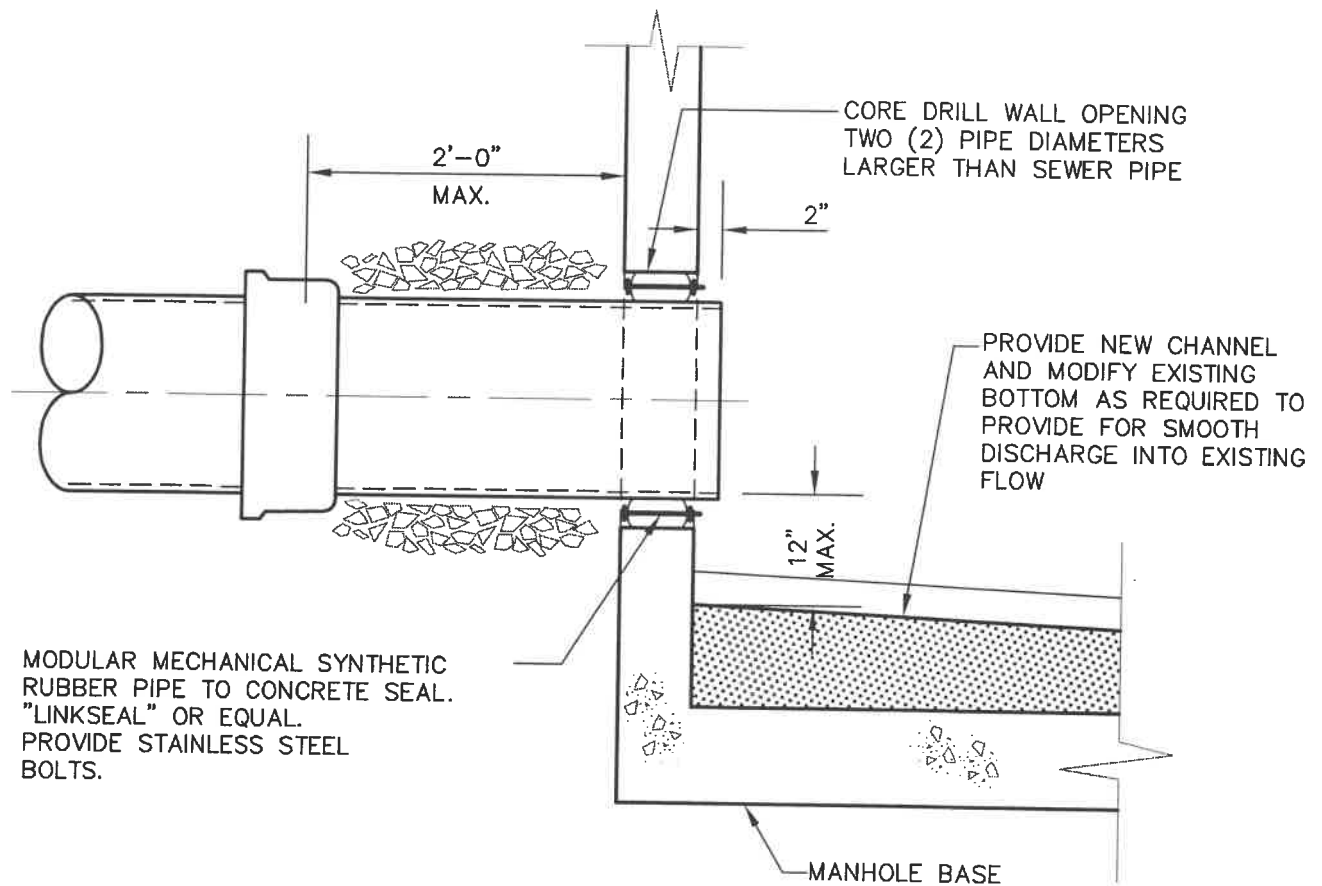


PRECAST CONCRETE 5' MANHOLE
W./ PRECAST CONCRETE BASE

- NOTE: 1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES.
 2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
 3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL



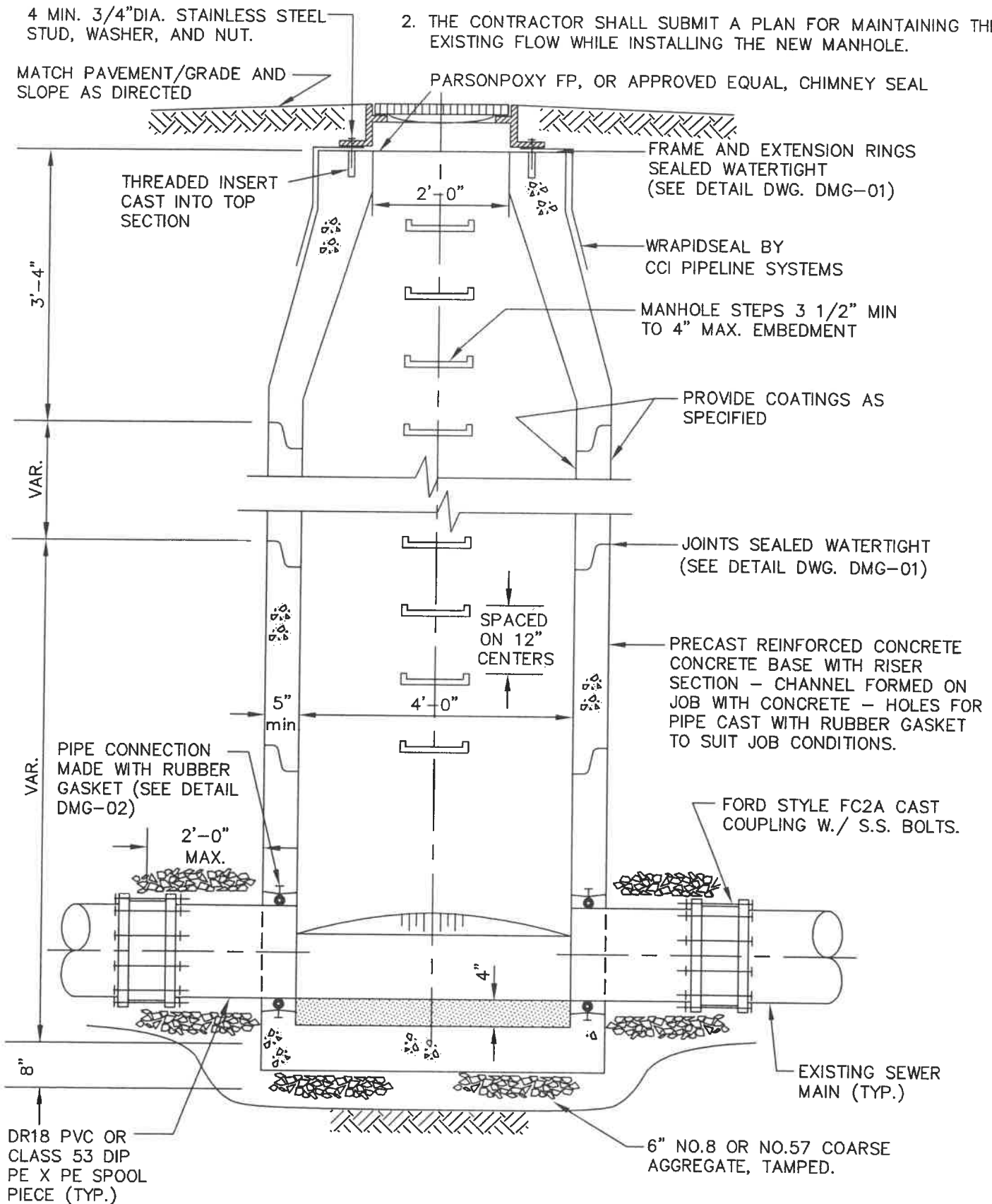
PRECAST CONCRETE 5' MANHOLE
 W. / PRECAST CONCRETE BASE



PIPE CONNECTION TO AN EXISTING MANHOLE

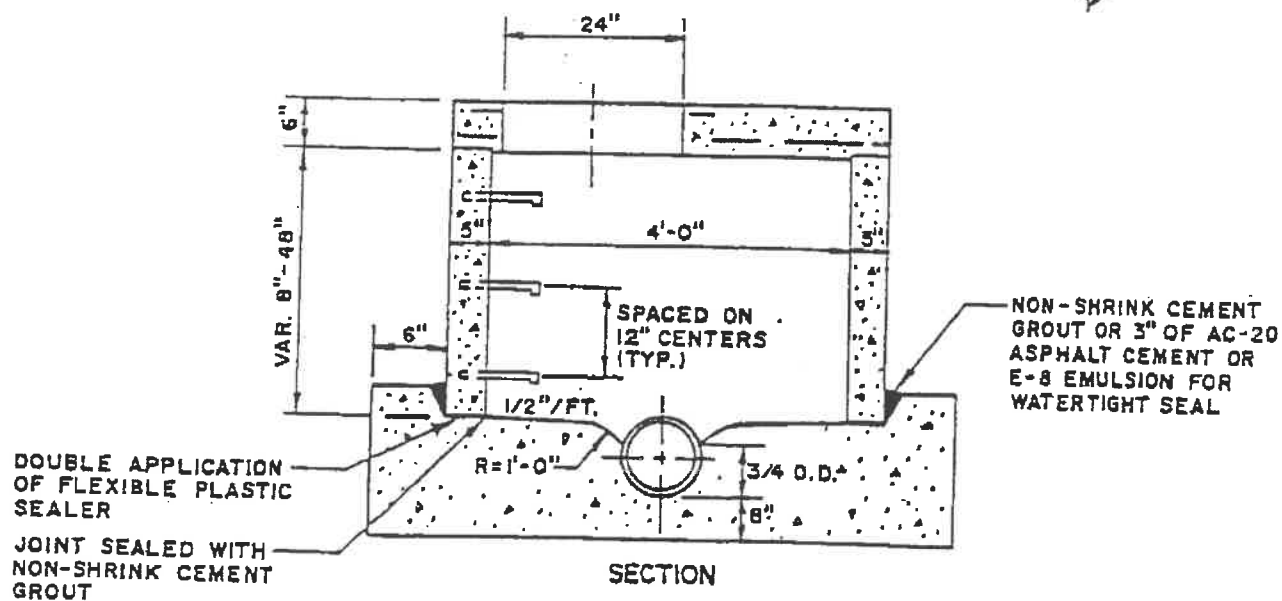
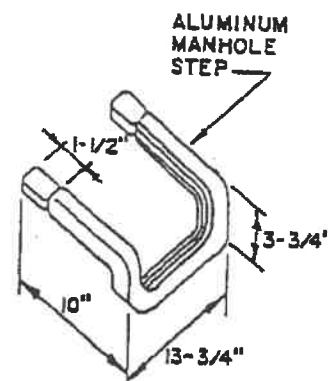
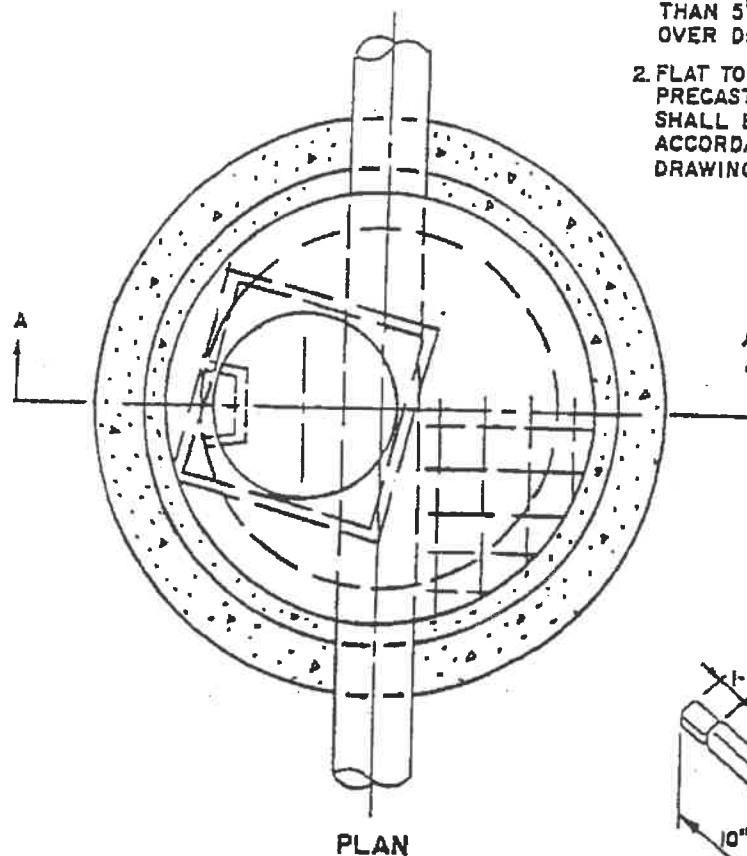
NOTES:

1. PRIOR TO INSTALLATION OF MANHOLE THE CONTRACTOR SHALL TEST DIG AND DETERMINE THE O.D. AND OVALITY OF THE EXISTING PIPE.
2. THE CONTRACTOR SHALL SUBMIT A PLAN FOR MAINTAINING THE EXISTING FLOW WHILE INSTALLING THE NEW MANHOLE.



INSERTION OF A PRECAST CONCRETE MANHOLE INTO AN EXISTING SEWER MAIN

2. FLAT TOP MANHOLES WITH
PRECAST CONCRETE BASE
SHALL BE CONSTRUCTED IN
ACCORDANCE WITH DETAIL
DRAWINGS DM-01 AND DM-02



PRECAST CONCRETE SHALLOW MANHOLE WITH
FLAT TOP AND POURED MONOLITHIC CONC. BASE

- NOTES: 1. BOLTING OF MANHOLE FRAME AND COVER NOT REQUIRED FOR MANHOLES INSTALLED IN PAVED SURFACES
2. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION
3. PIPES SHALL PROTRUDE 2" INSIDE MANHOLE WALL

PARSONPOXY FP, OR APPROVED EQUAL, CHIMNEY SEAL

4 MIN. 3/4" DIA. STAINLESS STEEL STUD, WASHER, AND NUT.

MATCH PAVEMENT/GRADE AND SLOPE AS DIRECTED

PLAN

PARSONPOXY FP, OR APPROVED EQUAL, CHIMNEY SEAL

FRAME AND EXTENSION RINGS SEALED WATERTIGHT (SEE DETAIL DWG. DMG-01)

WRAPIDSEAL BY CCI PIPELINE SYSTEMS

MANHOLE STEPS 3 1/2" MIN TO 4" MAX. EMBEDMENT

PROVIDE COATINGS AS SPECIFIED

JOINTS SEALED WATERTIGHT (SEE DETAIL DWG. DMG-01)

PRECAST REINFORCED CONCRETE CONCRETE BASE WITH RISER SECTION

DOUBLE APPLICATION OF FLEXIBLE PLASTIC SEALER

2'-0" MAX.

PIPE CONNECTION MADE WITH RUBBER ADAPTER RING (SEE DMG-03)

SPACED ON 12" CENTERS

JOINT SEALER WITH NON-SHRINK CEMENT GROUT, OR 3" OF AC 20, OR E-8 EMULSION

PIPES TO BE COATED WITH LIQUID BONDING AGENT PRIOR TO POURING CONCRETE BASE

DIP PE X PE SPOOL PIECE (TYP.)

6" NO.8 OR NO.57 COARSE AGGREGATE, TAMPED.

SECTION

PRECAST CONCRETE MANHOLE

W/POURED MONOLITHIC CONCRETE BASE

DM-08

THREADED INSERT
CAST INTO TOP
SECTION

2'-0"

WRAPIDSEAL BY
CCI PIPELINE SYSTEMS

MANHOLE STEPS 3 1/2" MIN
TO 4" MAX. EMBEDMENT

5" min

4'-0"

2'-0" MAX.

RELINER INSIDE DROP BOWL
SECURED WITH STAINLESS STEEL
FASTENERS

RELINER STAINLESS STEEL PIPE
BRACKET SECURED TO WALL
W/ TWO S.S. BOLTS
(4' INTERVALS)

8"Ø C900 DROP PIPE

8"Ø C900 45° ELBOW

DROP BOWL

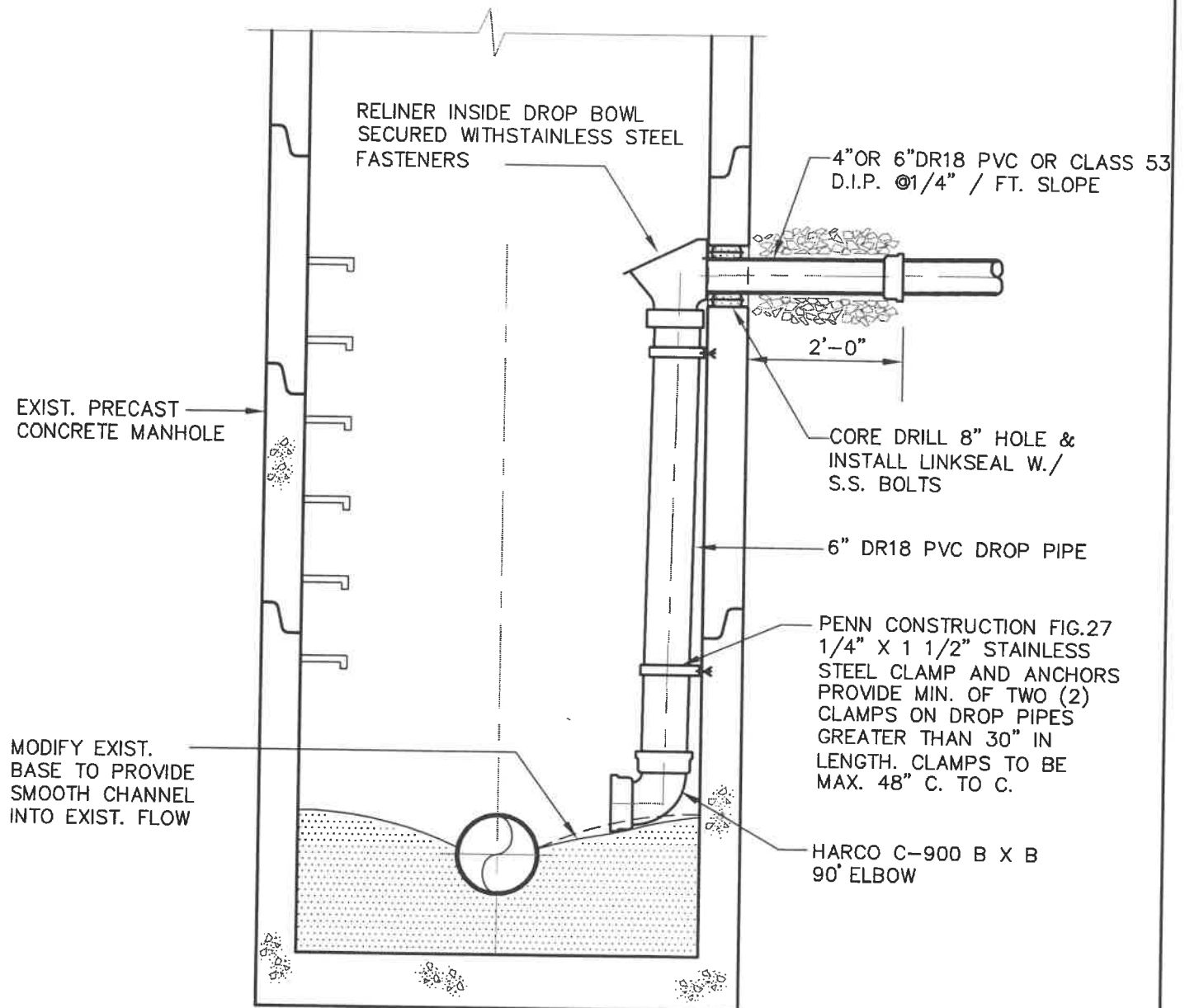
DROP PIPE CONNECTOR
S S STEEL CLAMPS

BENCH AS
E SMOOTH

PIPE CONNECTION
MADE WITH RUBBER
GASKET (SEE DETAIL
DMG-02)

DMDC-01

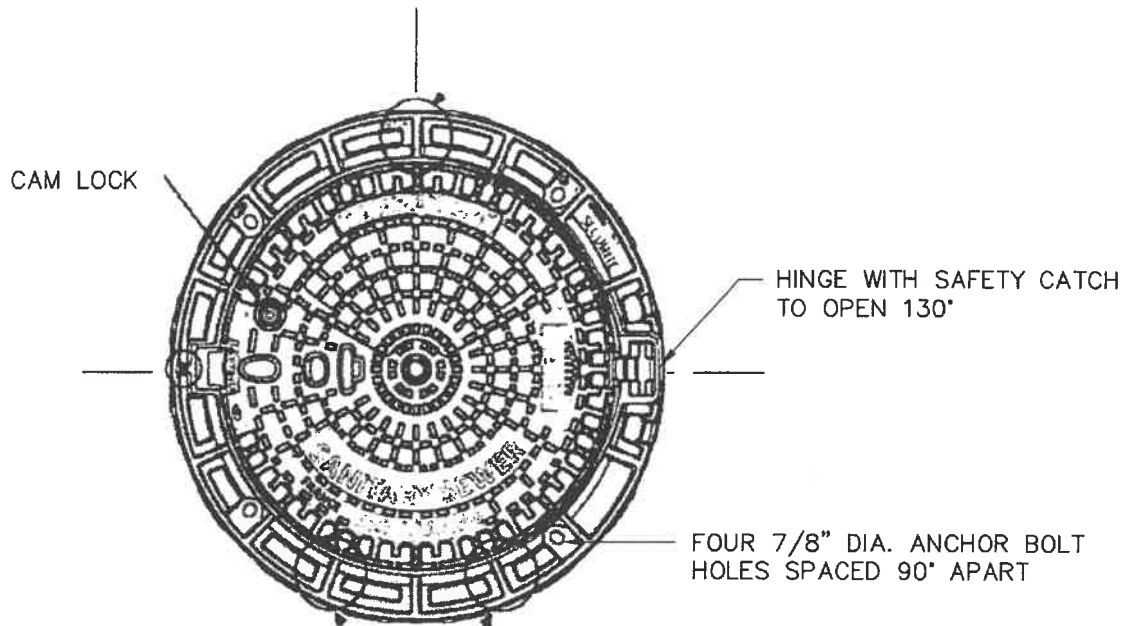
NOTE: INSIDE DROP PIPES NOT REQUIRED WHEN THE DISTANCE BETWEEN THE INVERT OF THE LATERAL AND THE CROWN OF THE EXISTING SEWER IS LESS THAN 15".



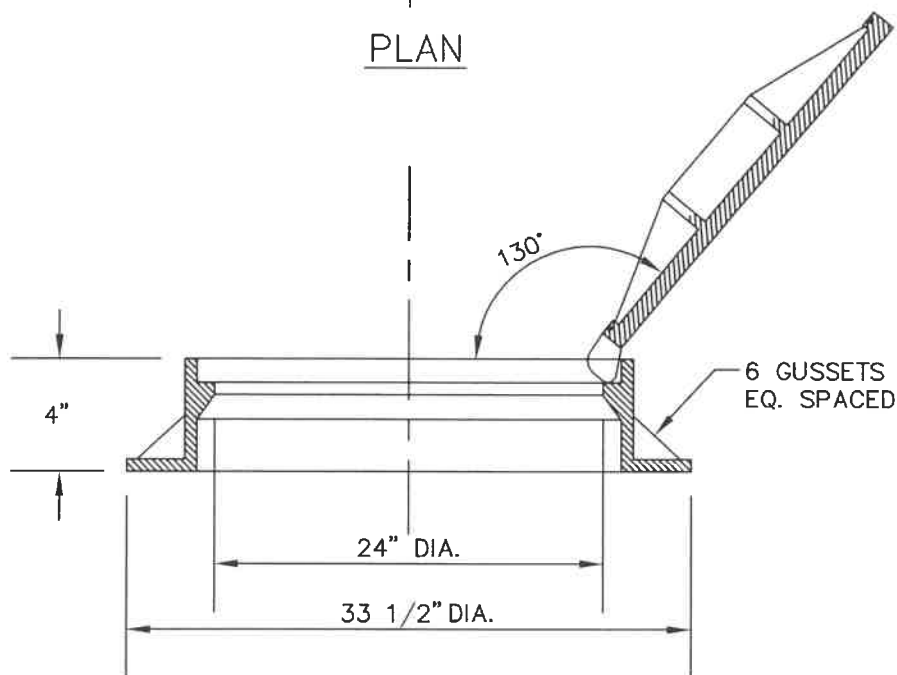
LATERAL CONNECTION TO EXISTING MANHOLE

NOTE:

PAMREX 24 MANHOLE COVER AND FRAME AS MFRD. BY CERTAINTED CORP.
MODEL # CDP60EHSSE



PLAN

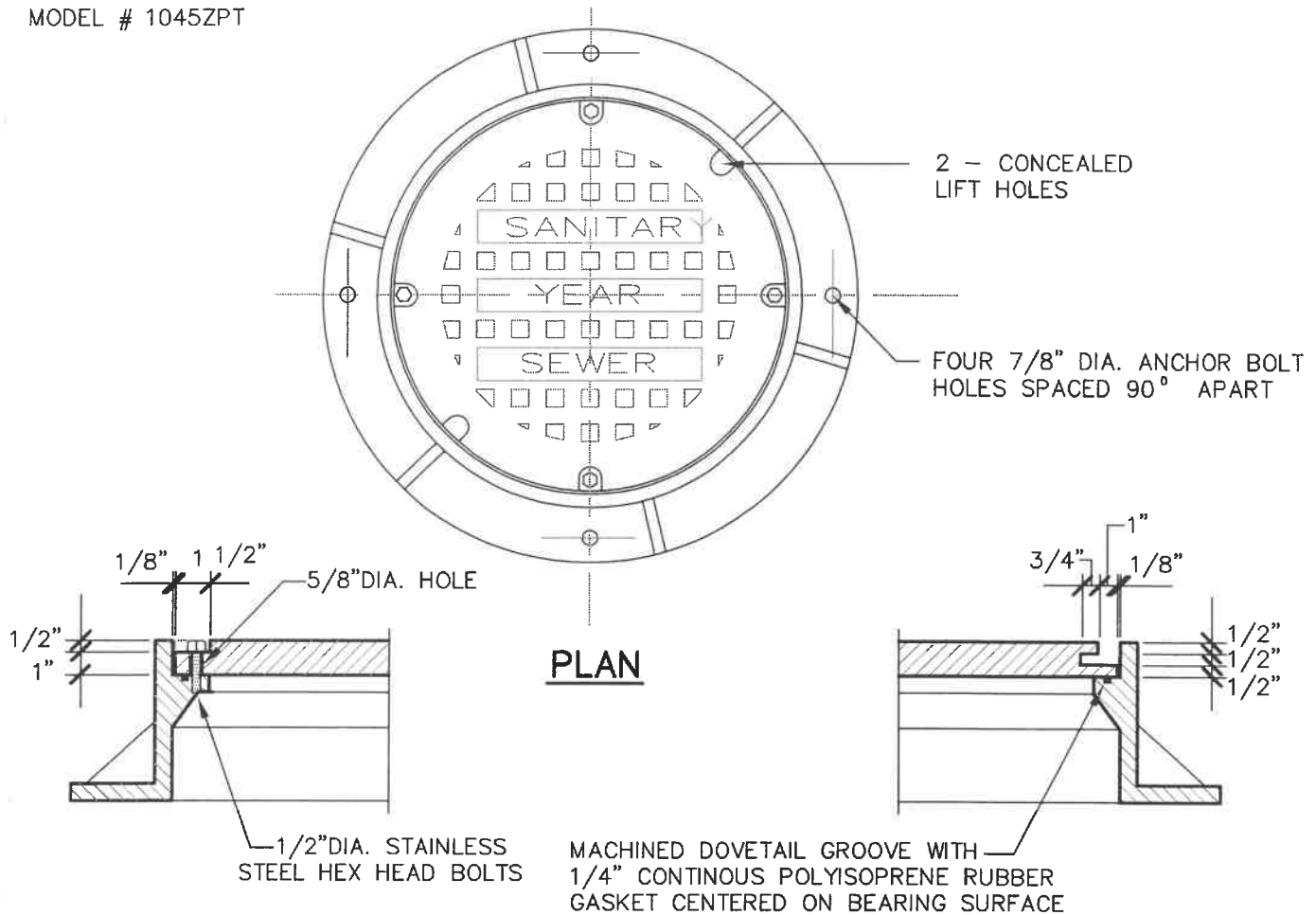


SECTION

HEAVY DUTY DUCTILE IRON MANHOLE
FRAME AND HINGED COVER

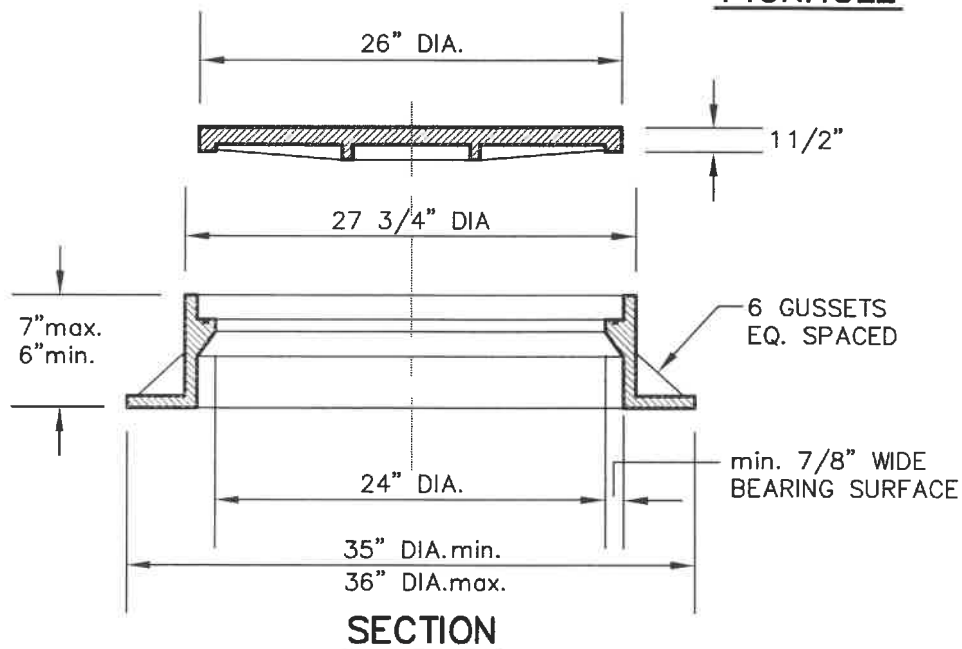
NOTE:

MANHOLE COVER AND FRAME AS MFRD. BY EAST JORDAN
MODEL # 1045ZPT



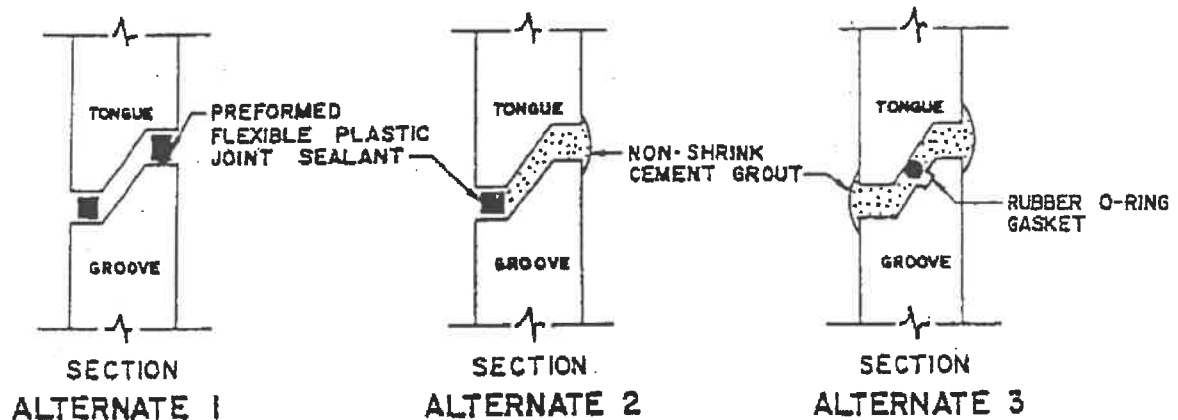
SECTION THRU BOLTS

SECTION THRU CONCEALED PICKHOLE

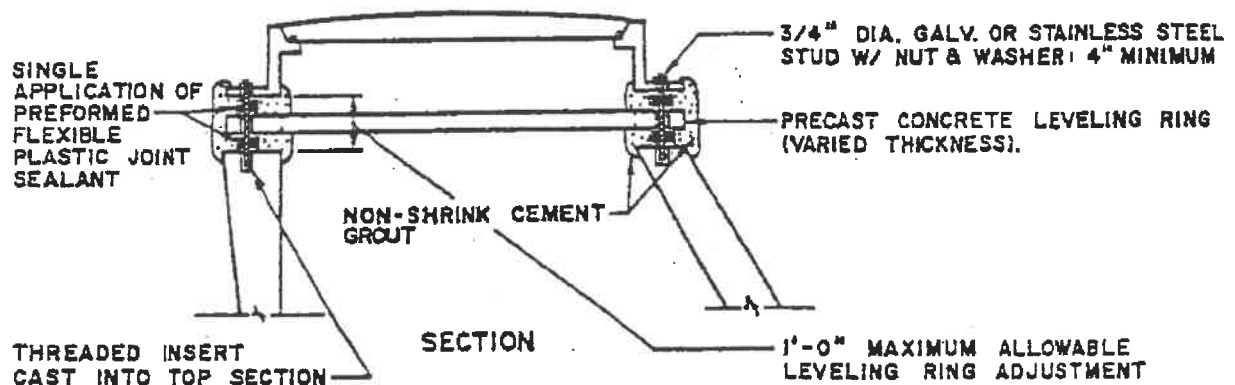


CAST IRON WATERTIGHT MANHOLE FRAME AND COVER

PRECAST CONCRETE MANHOLE SECTION GASKETS

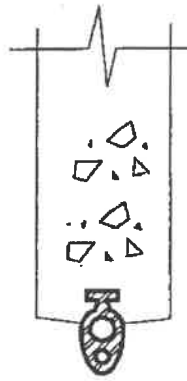


MANHOLE FRAME AND LEVELING RINGS

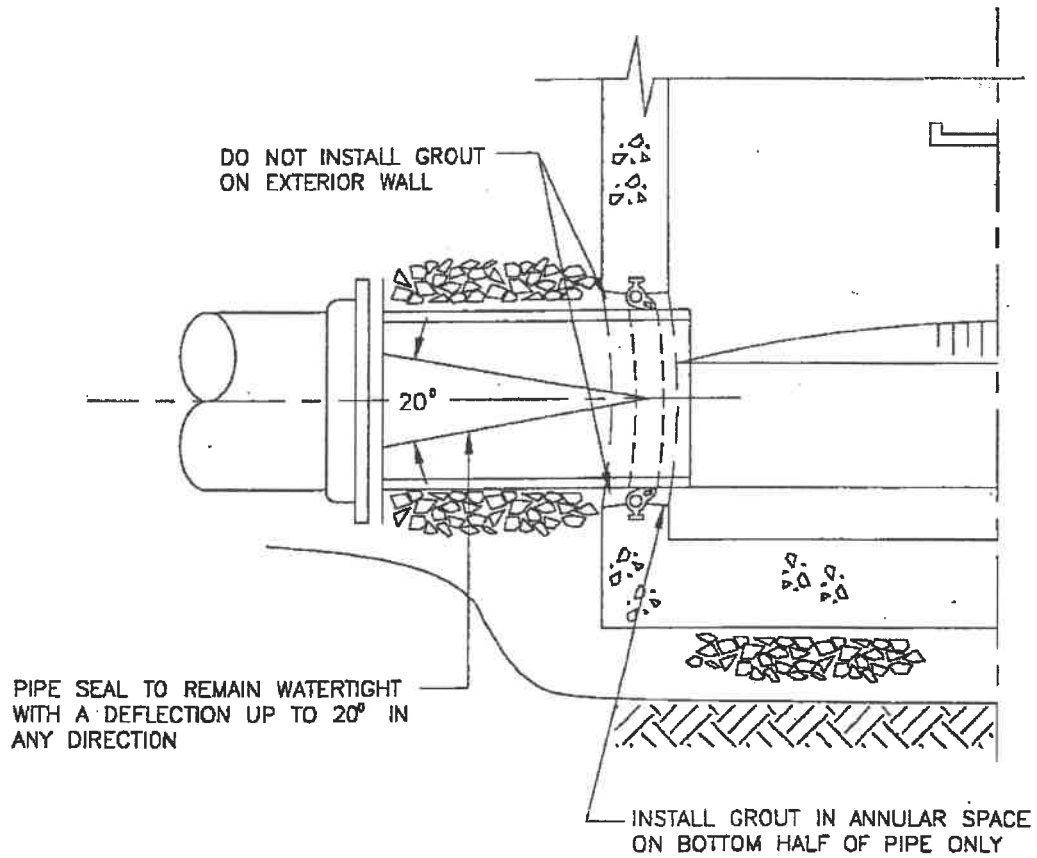


- NOTE: 1. ALL NON-SHRINK CEMENT GROUT SHALL BE TROWELED SMOOTH.
 2. EXCESS PREFORMED FLEXIBLE PLASTIC JOINT SEALANT SHALL BE NEATLY TRIMMED FOR ALL JOINTS.

MANHOLE GASKETS, LEVELING RINGS, AND BOLTED FRAME DETAIL

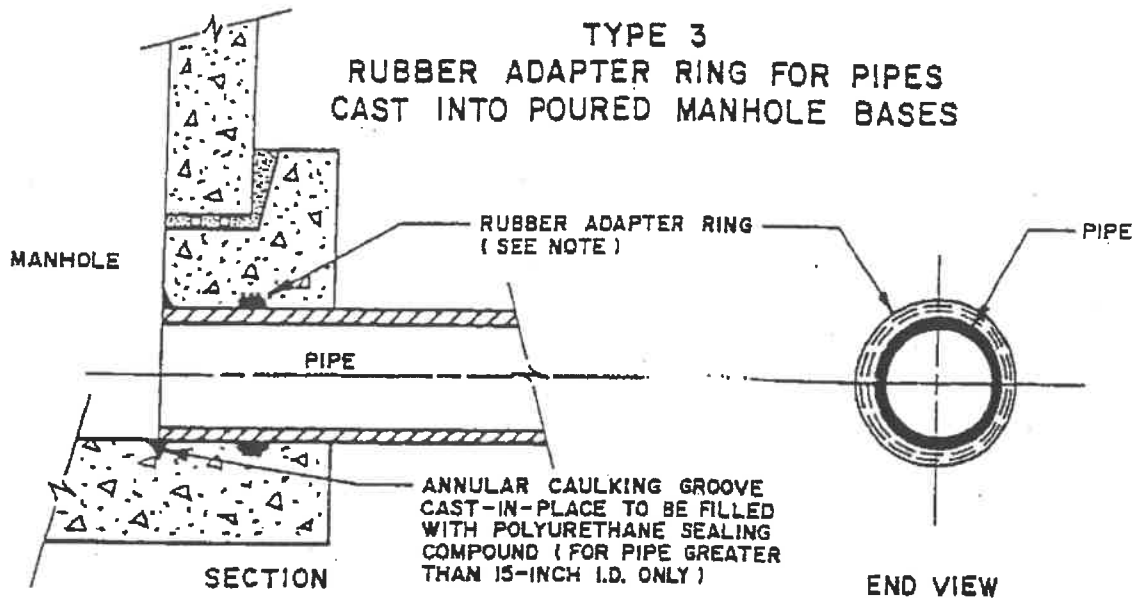


INTEGRAL PIPE GASKET (BEFORE INSTALLATION)



MANHOLE PIPE GASKET

TYPE 3 RUBBER ADAPTER RING FOR PIPES CAST INTO POURED MANHOLE BASES



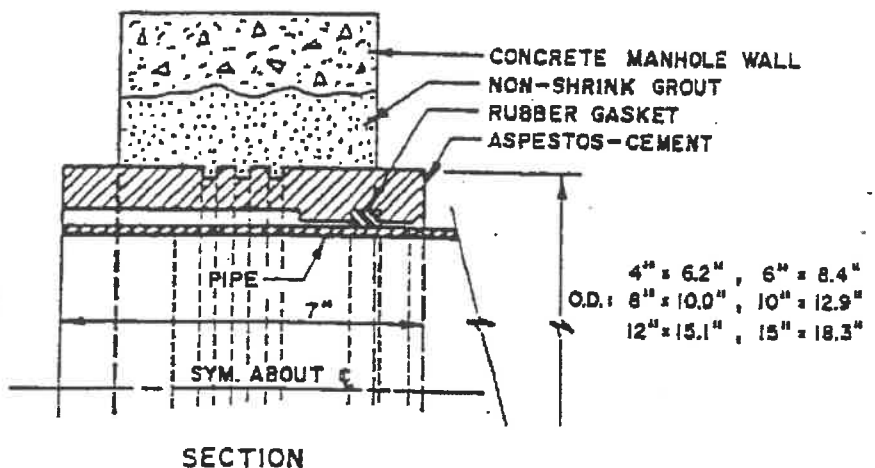
NOTE:

- 1) AVAILABLE SIZES 4,6,8,10,12 & 15 INCH

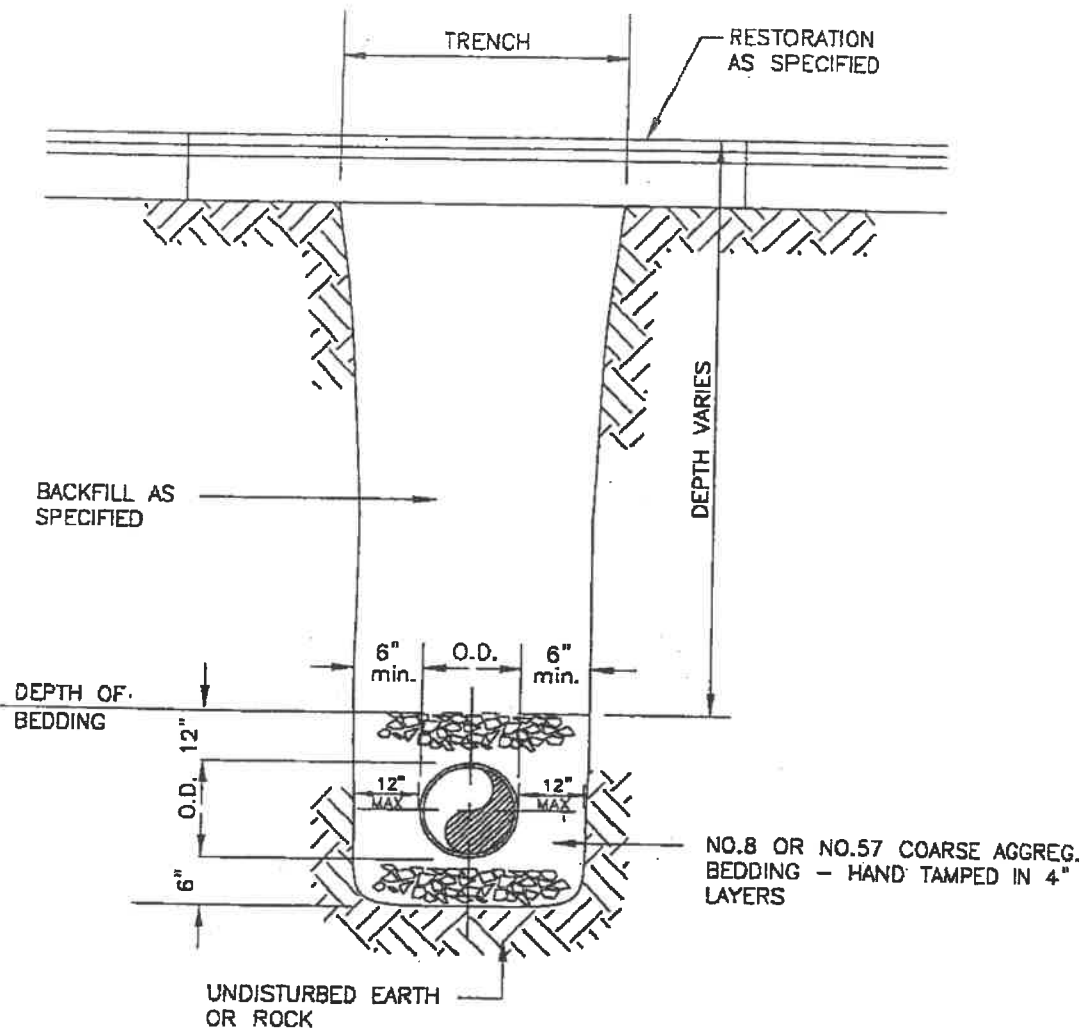
TYPE 4 ASBESTOS-CEMENT ADAPTER FOR CUT-IN PIPE OPENINGS

NOTE:

- 1) AVAILABLE SIZES 4,6,8,10,12 & 15 INCH
- 2) AFTER INSTALLATION, SEAL ANNULAR SPACE AROUND PIPE ON INSIDE OF MANHOLE WITH POLYURETHANE SEALING COMPOUND

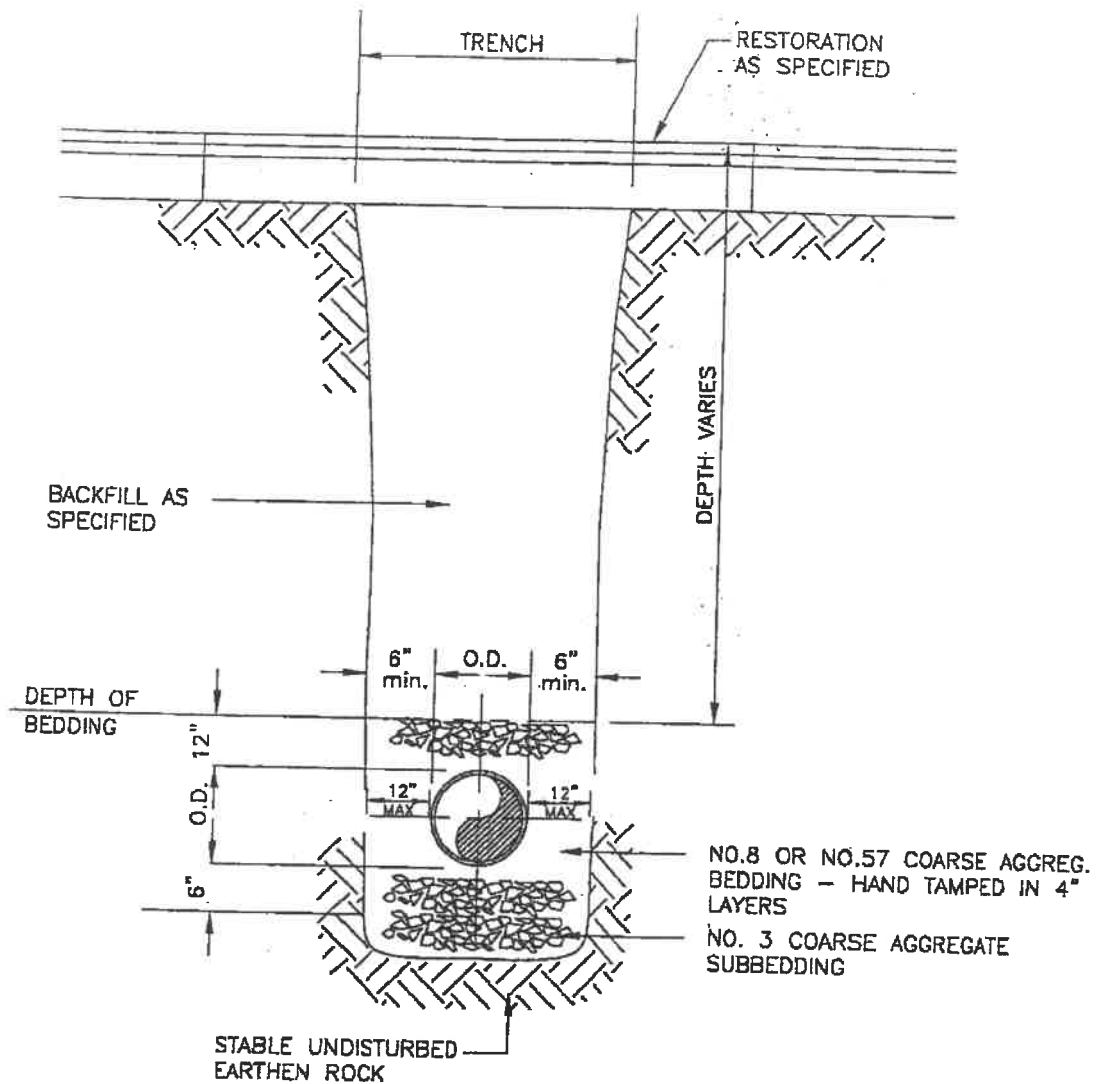


MANHOLE PIPE ADAPTERS



- NOTE: 1. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
2. DETAIL FOR PIPE 4" AND LARGER.

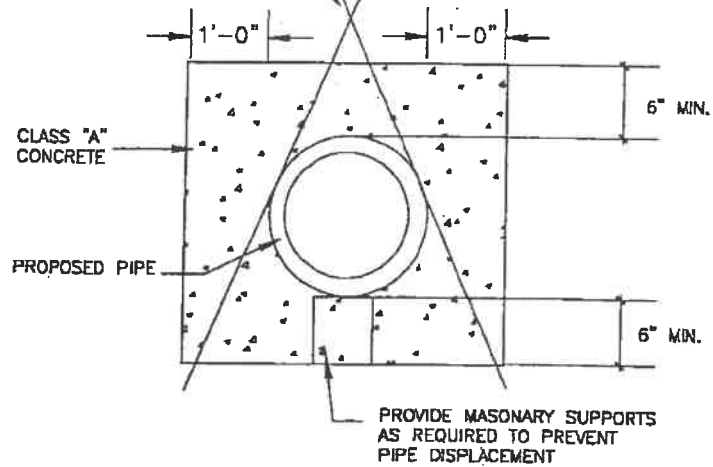
SANITARY SEWER BEDDING DETAIL



- NOTE: 1. ALL STONE GRADATIONS ARE AASHTO CLASSIFICATION.
2. DETAIL FOR PIPE 4" AND LARGER.

SANITARY SEWER BEDDING DETAIL UNSTABLE MATERIAL EXCAVATION

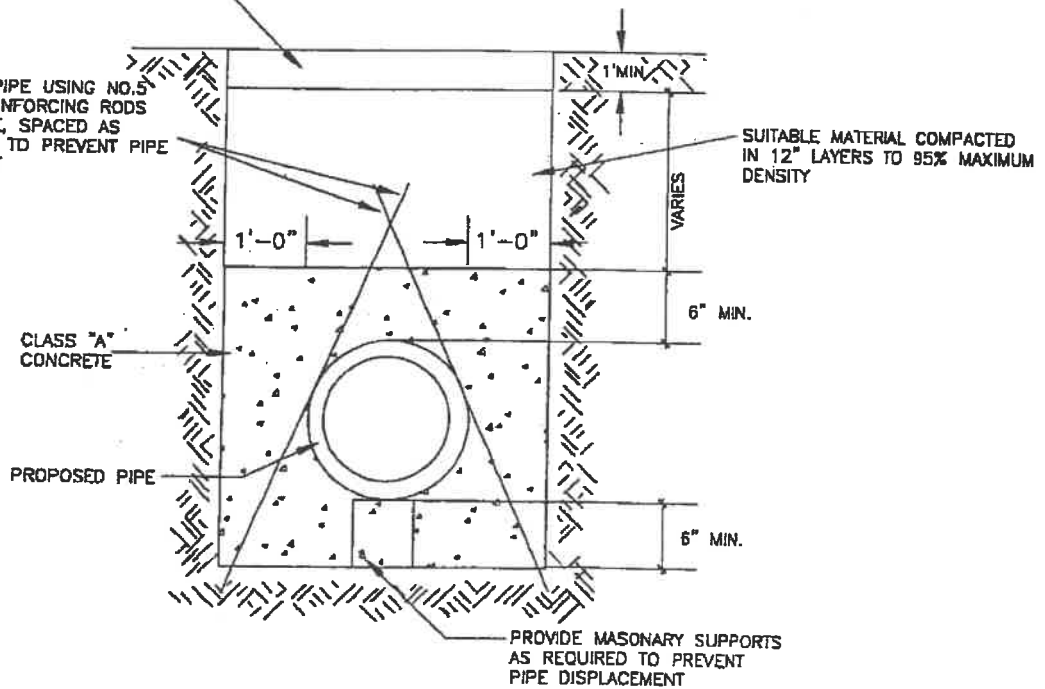
SECURE PIPE USING NO.5
STEEL REINFORCING RODS
WITH WIRE, SPACED AS
REQUIRED TO PREVENT PIPE
MOVEMENT



CONCRETE ENCASEMENT DETAIL

RIP-RAP - 75% BY WEIGHT
TO BE 6" OR LARGER

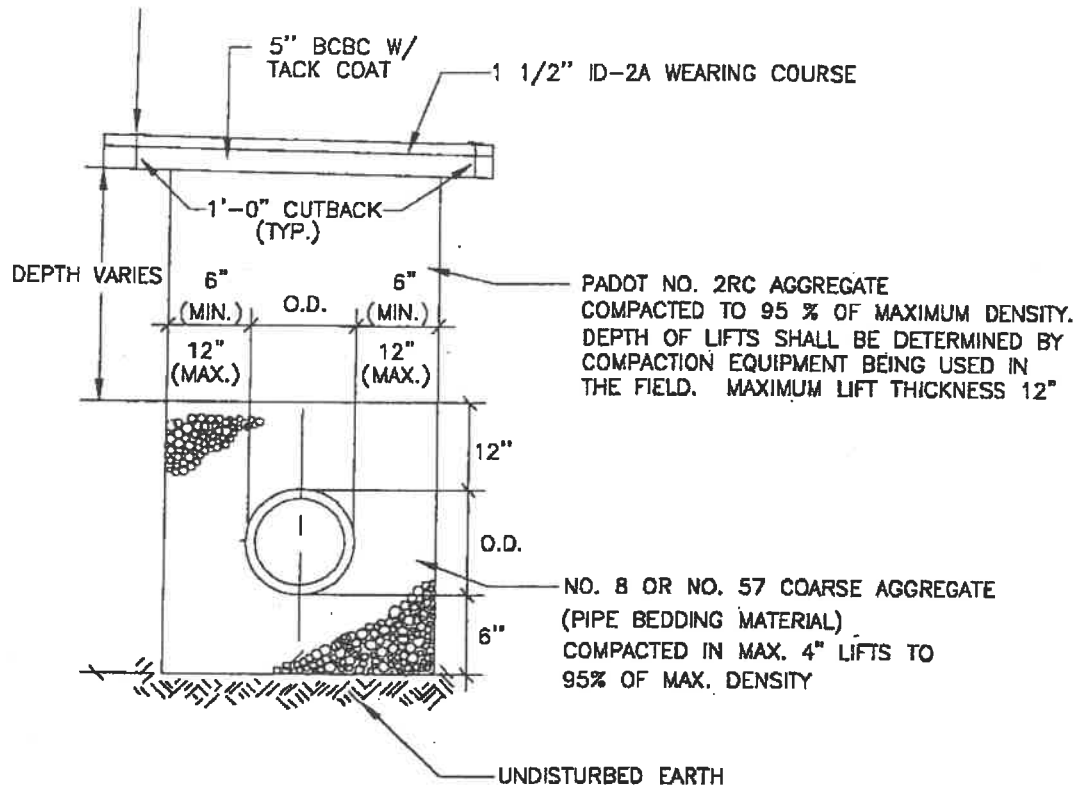
SECURE PIPE USING NO.5
STEEL REINFORCING RODS
WITH WIRE, SPACED AS
REQUIRED TO PREVENT PIPE
MOVEMENT



CONCRETE ENCASEMENT STREAM CROSSING DETAIL

CONCRETE ENCASEMENTS

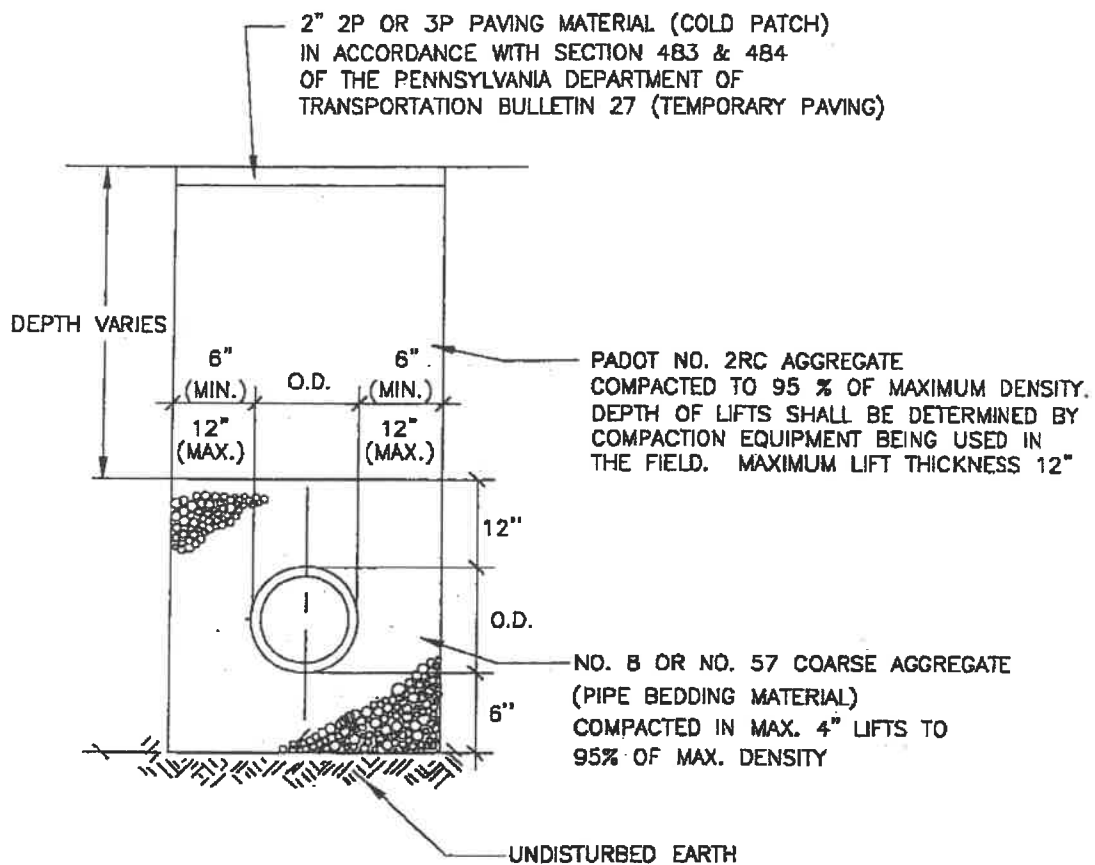
APPLY JOINT SEALANT — 4" WIDE
CENTERED ON SAW CUT LOCATIONS



NOTES:

1. ALL MATERIALS AND CONSTRUCTION METHODS SHALL COMPLY WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. FORM 40B (1996)
2. CONTRACTOR TO PROVIDE UNIFORM GRADE FROM EDGE OF EXISTING PAVING.
3. 90-DAY PAVING RESTORATION PERIOD REQUIRED. 2" OF HOT OR COLD BITUMINOUS PAVING MATERIAL MUST BE INSTALLED & MAINTAINED FOR PERIOD OF 90-DAYS PRIOR TO PERMANENT PAVING RESTORATION. AN ALTERNATE WOULD BE TO INSTALL 8" OF CONCRETE WITH A ONE FOOT CUT-BACK JUST BELOW BASE COARSE, FOLLOWED BY PERMANENT PAVING RESTORATION.

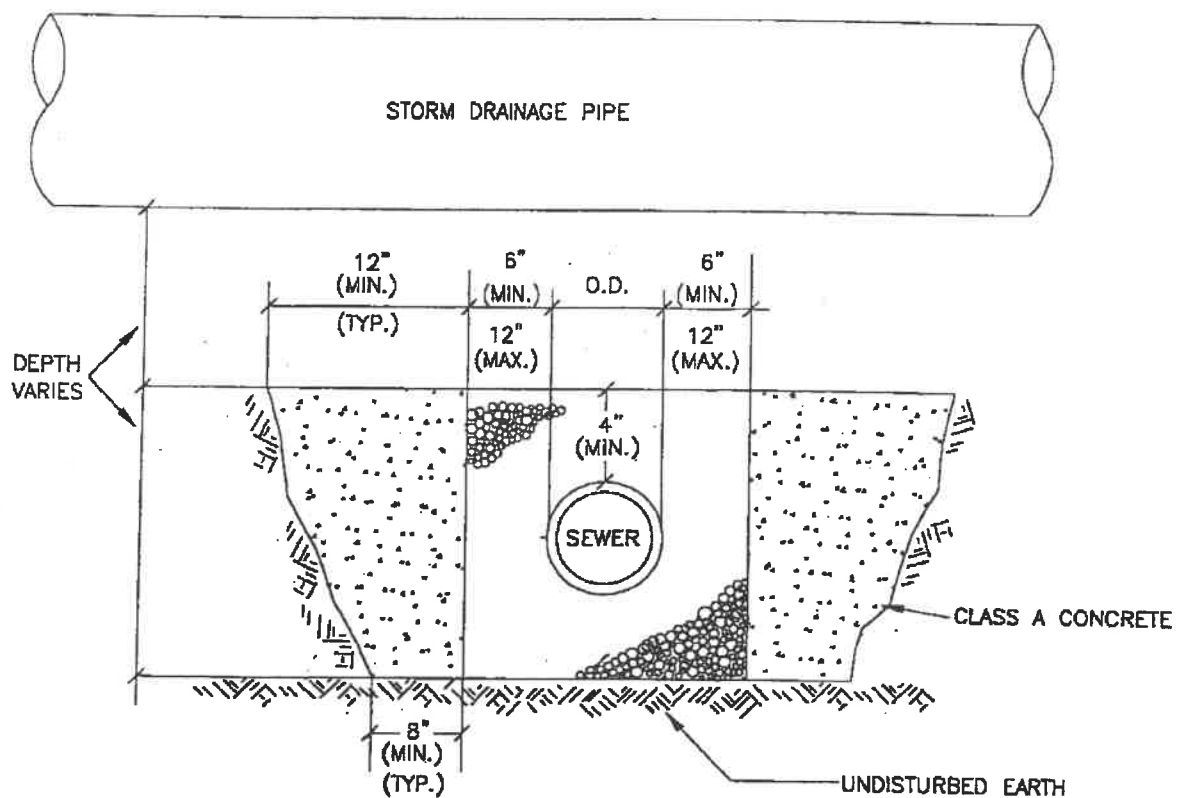
PERMANENT RESTORATION IN TOWNSHIP & STATE ROADS



NOTES:

1. ALL MATERIALS AND CONSTRUCTION METHODS SHALL COMPLY WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. FORM 408 (1996)
2. CONTRACTOR TO PROVIDE UNIFORM GRADE FROM EDGE OF EXISTING PAVING.

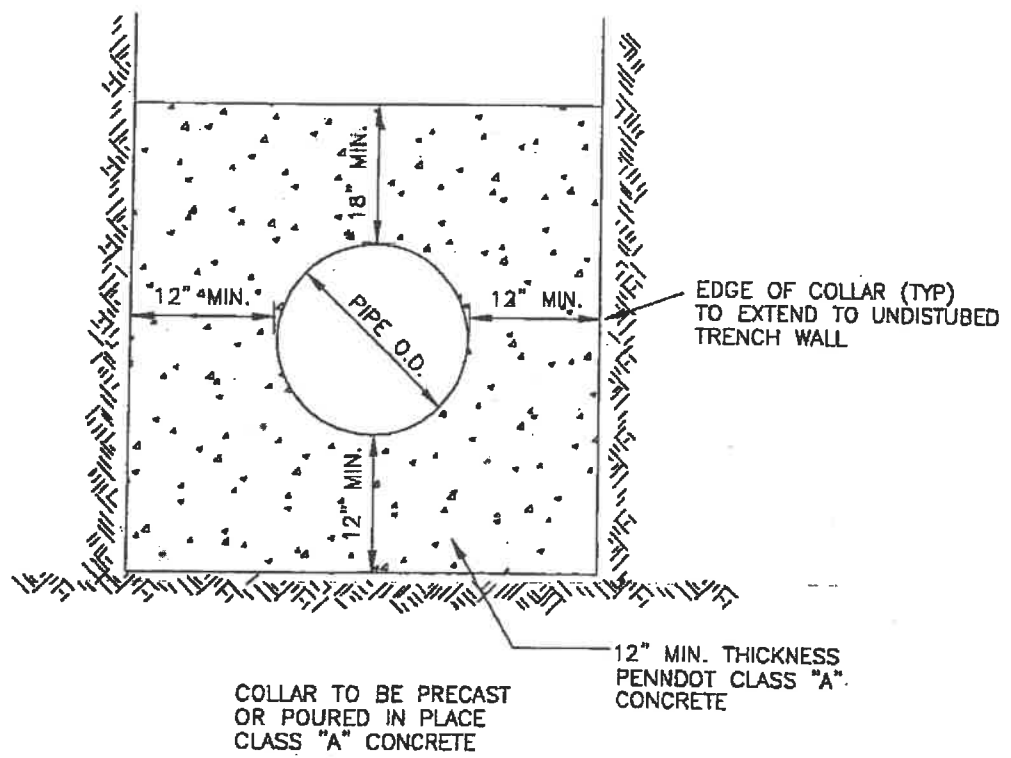
TEMPORARY RESTORATION IN TOWNSHIP ROADS & STATE ROADS



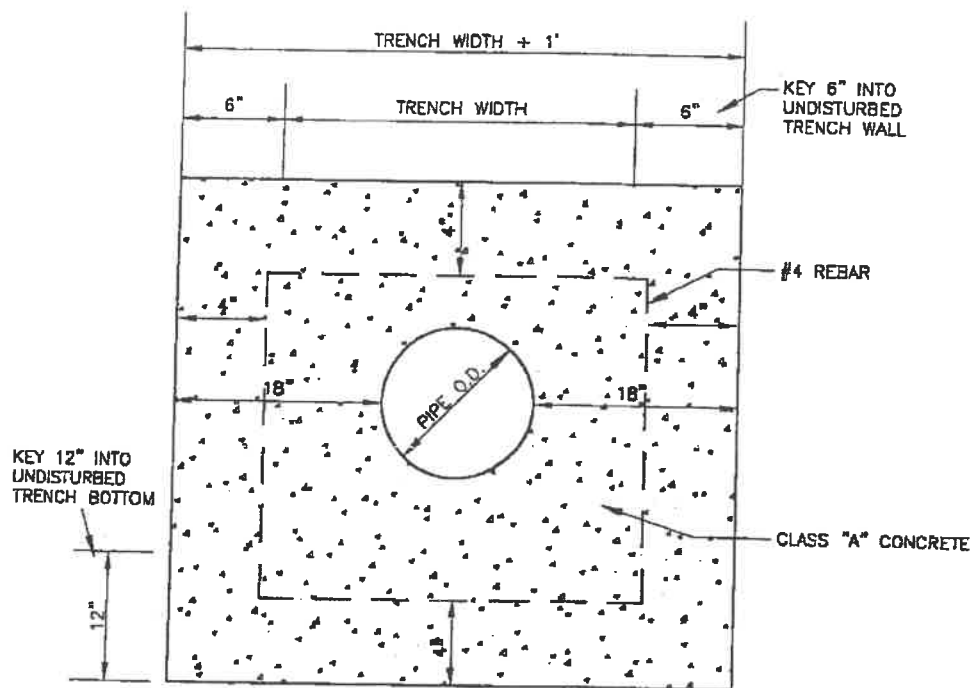
NOTES:

1. PIERS TO BE 5 FT. LONG CENTERED ON STORM DRAIN.
2. USE 3000 PSI CLASS A CONCRETE.
3. FORM PIERS AGAINST SOLID TRENCH WALLS.
4. PIERS REQUIRED WHEN CLEARANCE BETWEEN PIPES IS LESS THAN 18".

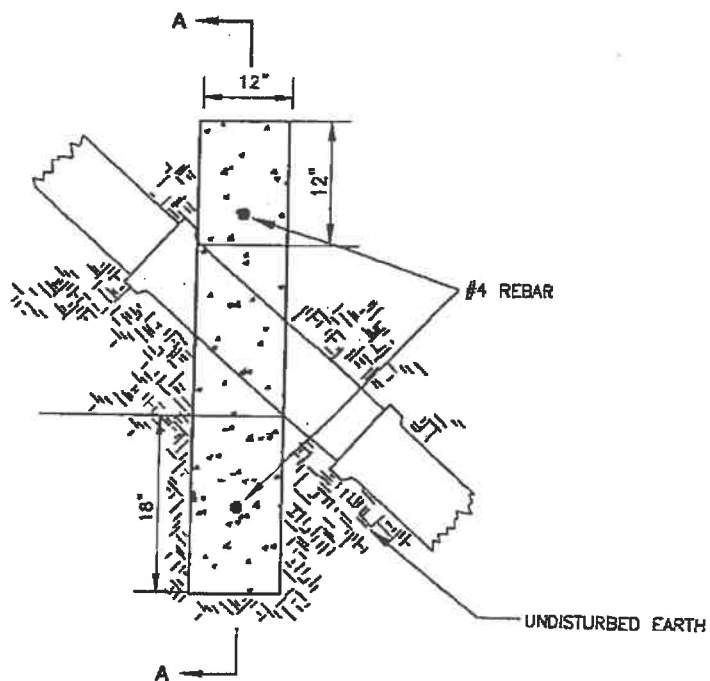
PIER SUPPORTS



CONCRETE ANTI-SEEP COLLAR



SECTION A-A



ELEVATION

CONCRETE ANCHORS
FOR STEEPLY SLOPED PIPES