VILLAGE OF SISTER BAY
DOOR COUNTY, WISCONSIN

STANDARD SPECIFICATIONS AND DETAILS

SEWER AND WATER MAIN CONSTRUCTION INCLUDING ROAD, STREET, AND NON-TRAFFIC SURFACE RESTORATION

April 2012

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INTRODUCTORY INFORMATION

TABLE OF CONTENTS

INTRODUCTORY INFORMATION

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 – EXISTING CONDITIONS

DIVISION 3 - CONCRETE

DIVISION 31 - EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 - UTILITIES

DIVISION 33 – UTILITIES (CONTINUED)

DIVISION 40 – PROCESS INTEGRATION

DETAILS & DRAWINGS DIVISION

01

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 11 00

SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

ENGINEER ENTER PROJECT DESCRIPTION HERE

B. Related Sections and Divisions: Applicable provisions of the General Conditions and Supplementary Conditions shall apply to this section.

1.02 CONTRACT DOCUMENTS—INTENT AND USE

A. Intent of Documents:

1. Singular notations and specifications shall be considered plural where application is reasonably inferred.
2. Mention or indication of extent of work under any work division or specification section is done only for convenience of Contractor and shall not be construed as describing all work required under that division or section.
3. Some individual sections may contain a list of related sections. The list of related sections in individual sections is provided for the convenience of Contractor and is not necessarily all-inclusive. Contractor may not rely upon this listing for determination of scope of work. Other sections of the specifications, not referenced in individual sections shall apply as required for proper performance of the work.
4. Command type sentences may be used in the Contract Documents. These sentences refer to and are directed to Contractor.
5. Symbols for various elements and systems are shown on the drawings. Should there be any doubt regarding the meaning or intent of the symbols used, a written interpretation shall be obtained from Engineer.

B. Use of Documents:

1. Contractor shall examine all specifications and drawings for the work, including those that may pertain to work Contractor does not normally perform with its own forces.
2. Contractor shall use all of the project drawings and specifications:
   a. For a complete understanding of the project.
   b. To determine the type of construction and systems required.
   c. For coordination with other contractors.
   d. To determine what other contractors.
   e. To anticipate and notify others when work by others will be required.
   f. And all other relevant matters related to the project.
3. Contractor is also bound by all requirements of the Contract Documents which are applicable to, pertain to, or affect its work, as may be shown or inferred by the entire set of project drawings and specifications.

1.03 GENERAL WORK PROVISIONS

A. Driveways and other access to residences, business, or other commercial properties shall be maintained at all times during construction. ***At the time of the preconstruction meeting, the Contractor shall submit a proposed work sequence for Municipal Engineer/Owner approval.***

B. All utilities aboveground or underground that need to be supported during the prosecution of this contract shall be coordinated with the utilities and the cost thereof shall be the sole responsibility of the Contractor.

C. The Contractor shall maintain local traffic in areas not under immediate construction. The Contractor will be responsible for immediate local traffic control signage. The signage and traffic control shall be according to the "Manual on Uniform Traffic Control Devices for Streets and Highways", latest edition. The associated cost shall be included in the appropriate bid item of the Contractor's bid.

D. All trenches within existing or proposed paved or graveled roadways, driveways, sidewalks, and other hard surfaces shall be backfilled with Soil Class G1 or C3/C6 **(Project Manager choose one)** and compacted to 95% of modified proctor.

E. Extreme care shall be taken to protect all trees along the construction route, which are not marked for removal or within the right-of-way and easement areas. For damaged trees and trees that die due to construction, the Contractor shall be responsible for the cost of tree replacement up to $1,000 per tree. The total amount shall be deducted from final contract payment.

F. The Contractor will furnish the municipality and Municipal Engineer with a telephone list, including cell or home phone numbers, of key personnel available for after hours and weekend emergencies.

G. At all times, the Contractor shall see that affected work site areas shall be kept drained and free of groundwater and surface water. The Contractor shall dispose of the water so as not to cause injury to public or private property or to cause a nuisance or menace to the public. Additionally, the Contractor shall prevent excessive dust; and he shall, at his own expense, provide adequate dust control measures acceptable to the Municipal Engineer.

H. The Contractor shall implement all erosion control in conformance with the WDNR Conservation Practice Standards (Latest Edition). All existing and installed inlets shall have erosion protection. These items shall be incidental to the project.

I. Restoration

1. All damaged, disturbed, or removed surfaces, structures, or utilities, whether private or public, shall be repaired, restored, and/or replaced to a condition equal to or better than that which existed prior to the start of the work, including all ditches, culverts, roadways, alleyways, field lawns, walkways, retaining walls, fences, buildings, driveways, mailboxes, and any other items that may exist in the construction area.
2. Following initial soil disturbance, all areas shall be restored within one month, weather permitting.
3. All disturbed areas within the right-of-way and outside the paved streets and all easements shall be topsoiled to provide a minimum depth of 6 inches with salvaged topsoil, fine graded, raked free of lumps and stones, seeded and mulched. Any additional topsoil required to return the site to a condition as good as or better than existing condition shall be the responsibility of the Contractor.

4. All restoration will be considered as incidental to the appropriate construction bid item. Restoration work will not be paid for as a separate item.

J. The owner shall have prior claim to all surplus excavated material. All excess excavated material shall be disposed of on-site as directed by the Owner. The topsoil shall be removed prior to placing the material and replaced when completed. If the Owner does not desire to claim surplus excavated material, the contractor shall be totally responsible for obtaining a disposal site. **NO** material shall be disposed of in a flood plain, wetland, or waterway.

K. Clearing, grubbing, and stripping of the topsoil will be the responsibility of the Contractor, and shall be considered incidental to the appropriate bid item. The topsoil shall be temporarily stockpiled on-site.

L. The subgrade condition and elevation shall be checked by the Municipal Engineer prior to placement of base course material. The base course condition and elevation shall be checked by the Municipal Engineer.

M. Submit list of subcontractors to Municipal Engineer.

N. Removal of concrete sidewalk, bituminous pavements, curb and gutter, and driveway shall include disposal by the Contractor at a site that will accept such material. This work shall be included in the appropriate bid item.

O. Contractor shall not commence work on-site until all materials are approved and are on-site.

P. Payment requests shall be submitted to the engineer in Excel software form on the form provided in Section 00 62 76, Application for Payment, page 00 62 76-3.

1.04 SPECIAL REQUIREMENTS

NOT APPLICABLE OR….ENTER SPECIALS YOU NEED FOR YOUR JOB.

****PROJECT MANAGER****
IF YOU ARE NOT UTILIZING ANY SPECIAL REQUIREMENTS INSERT "NOT APPLICABLE" IN THIS SECTION

1.05 OWNER-FURNISHED PRODUCTS

A. Owner is responsible for the following items when supplying material or equipment to Contractor for installation.
   1. Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
   2. Delivery supplier's bill of material to Contractor.
   3. Arrange and pay for delivery to site.
   4. Inspect deliveries jointly with Contractor.
   5. Submit claims for transportation damage and arrange for replacement of damaged, defective or missing items.

B. Contractor's responsibilities for Owner furnished new products are:
   1. Handle products at the site, including uncrating and storage.
   2. Inspect deliveries jointly with Owner.

3. Protect products from damage and from exposure to the elements.
4. Assemble, install, correct, adjust, and finish products in accordance with the appropriate section of these specifications.
5. Contractor shall coordinate manufacturer's services in accordance with Section 01 75 00.
6. Contractor shall coordinate start-up and training in accordance with Section 01 75 00.
7. Contractor shall complete all checklists in accordance with Section 0178 43 and submit to the Engineer.
8. Repair or replace items damaged by Contractor at no additional cost to Owner.
9. Contractor's responsibility for materials and equipment furnished by Owner shall begin at the point of delivery to the site. Materials and equipment already on the site shall become Contractor's responsibility on date of Notice to Proceed with Contract.

C. The Owner will provide **(Designer: List Equipment/materials).** Detailed shop drawings and installation instructions are available for review at the office of the Engineer:

1.06 WORK BY OTHERS

1.07 WORK SEQUENCE

A. The Contractor shall submit a construction schedule documenting all phases of construction. The construction schedule shall be submitted in accordance with Section 01 32 19, Submittals.

B. Final work to be completed will include site grading and landscaping.

C. Operation and start-up of all equipment must be approved by the Engineer prior to proceeding. Start-up shall be in accordance with Section 01 75 00, Starting of Systems.

PROVIDE A DETAILED WORK SEQUENCE

1.08 CONTRACTOR USE OF SITE

A. General:
1. The "area of the site" referred to in these specifications shall be limited to existing rights-of-way or easements as shown on the drawings.
2. Construction activities shall be confined within the area of the site limits.
3. From the start of work to completion Contractor is responsible for the care of the site and the premises which are affected by operations of work of this Contract.
4. Except for permanent site improvements provided under the Contract, Contractor shall restore property disturbed during the work, to the conditions which previously existed.
5. Work in occupied spaces shall be restricted to specified work and essential activities, such as making necessary connections and extending services or constructing temporary access ways. Such work shall be scheduled in advance with Owner.

B. Parking and Deliveries:
1. Contractor is responsible for control of traffic by vehicles and persons within the limits of its operations.
2. Parking for employees, subcontractors, and agents of Contractor shall be in areas subject to approval of Owner.
3. Access to the site for delivery of construction material or equipment shall be subject to approval of Owner.

C. Work in Private Right-of-Way

1. Whenever the work is to be prosecuted through property for which the Owner has obtained a license, permit, or easement, the Contractor shall abide fully with the terms of the license, permit, or easement, a copy of which is on file with the Owner.
2. Prior to final payment, the Contractor shall send a notice to all easement grantors by certified mail, return receipt requested, a copy of which shall be filed with the Owner. Said notice to be similar to the following:

   The undersigned Contractor has completed the restoration of the construction site on which you have granted an easement for installation of certain utilities and improvements. If said site restoration is not completed to your satisfaction, please contact the Engineer, Robert E. Lee & Associates, Inc., 4664 Golden Pond Park Court, Hobart, WI 54155, in writing, and arrangements will be made immediately to view the site and restore the site in conformance with our contract obligations.

   If the Engineer, Robert E. Lee & Associates, Inc., 4664 Golden Pond Park Court, Hobart, WI 54155, does not hear from you in writing within 10 days from the above date, site restoration of your property will be deemed completed and approved by you.

   _____
   (Name of Contractor)

   _____
   (Address of Contractor)

   Owner shall furnish contractor with names and addresses of easement grantors.

1.09 OWNER OCCUPANCY

A. The Owner will occupy the site during construction.

B. Provide access for state and local review agencies.

1.10 EXISTING SERVICES AND STRUCTURES

A. Interruption of existing services shall be kept to a minimum and shall be limited to times approved by the Owner.

B. The Contractor shall coordinate with Owner and local utility companies in keeping the services in operation and repair any damages to the satisfaction of the Owner and local utility.

C. Contractor shall not interrupt any existing services until written approval is received from the Owner.

D. In accordance with Wisconsin Statute 182, the Contractor shall contact Diggers Hotline prior to beginning any excavations. A call to Diggers Hotline does not absolve the Contractor of the requirements of this statute.

E. Contractor shall proceed with caution in excavating and preparing the site so that the location of existing structures can be determined. Contractor shall keep an accurate record of existing services and structures and provide a copy to the Owner. The record shall include adequate measurements, depths, and conditions.

1.11 PROTECTION OF WORK

A. Contractor shall protect the Owner's property from damage, dust, debris and other resulting construction activities.

B. Contractor shall keep property free from dirt, dust and fumes from construction activities at all times.

C. Property damaged by the Contractor shall be repaired or replaced by the Contractor to the satisfaction of the Owner.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes all project meetings required during construction.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19 – Submittals.
3. All related equipment specifications.

1.02 MEETINGS

A. Project meetings will be held throughout the project at intervals agreed to by the Engineer, Owner and Contractor.

B. Contractor's project manager, job superintendent, subcontractors and necessary equipment suppiers shall attend the project meetings, as appropriate. Contractor's representative shall have the authority to bind the Contractor to decisions at the meeting.

C. The following meetings, at a minimum shall be attended by the Contractor representatives, Engineer, and Owner:
1. Preconstruction Meeting
2. Monthly Progress Meeting
3. Project Close-Out Meeting

D. Notice of meetings shall be mailed to those required to attend and copies to interested parties such as suppliers and governmental agencies.

E. The Engineer shall be responsible for the mailing of meeting notices, meeting agenda and meeting minutes.

F. The Contractor shall submit typed reports detailing the project schedule, schedule compliance and future construction plans affecting the project schedule at the project meetings. The Contractor shall keep the project schedule updated throughout the construction period.

1.03 EQUIPMENT INSTALLATION AND START-UP MEETINGS

A. When required in the individual specification sections, the Contractor shall coordinate an equipment installation meeting prior to beginning the work.

B. When required in the individual specification sections, the Contractor shall coordinate a start-up meeting prior to start-up of the equipment.

C. Contractor shall be responsible for the mailing of meeting notice, meeting agenda and meeting minutes.

D. Contractor shall be responsible for coordinating the attendance of all parties involved in the work.

E. Contractor shall notify the Engineer at least 7 days prior to the meeting date.

F. Contractor shall record the meeting minutes and distribute within 3 working days after the meeting.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 32 19

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This Section includes administrative and procedural requirements for submittals required for performance of the work, including the following:
   1. Contractor's progress schedule.
   2. Submittal schedule.
   3. Shop drawings.
   4. Submittal Transmittal Data Sheet.
   5. Product data.
   6. Samples.
   7. Quality assurance submittals.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Requirements for submittals are described in other sections of the specifications.

1.02 IDENTIFICATION OF SUBMITTALS

A. The Contractor shall mark each submittal and re-submittal by providing the information described in 1.06, Submittal Transmittal Data Sheet.

B. The Contractor shall stamp each submittal indicating that submittal was reviewed by the Contractor and meets the requirements of the plans and specifications. Unstamped submittals will not be reviewed by the Engineer and returned.

1.03 CONSTRUCTION SCHEDULE

A. The Contractor shall prepare and submit a detailed progress schedule in accordance with the General Conditions. The construction schedule shall be of sufficient detail to assure adequate planning and execution of the work and provide an appropriate basis for monitoring and evaluation of the progress of work.

B. The progress schedule shall indicate the sequence of all work including the start date, completion date and duration.

C. The progress schedule shall incorporate shop drawing and sample submittals schedule.

D. If, at any time during the Project, Contractor fails to complete an activity by its latest scheduled completion date, Contractor shall, within 3 working days of notification by Engineer, submit to Engineer written statement as to how and when work force will be reorganized to return Contract to current schedule.

E. When it becomes apparent from progress evaluation and updated schedule data that milestone completion or Contract completion dates will not be met, Contractor shall take some or all of following actions.

1. Increase construction staffing in such quantities and crafts as shall substantially eliminate backlog of work.
2. Increase number of working hours per shift, shifts per work day, work days per week, or amount of construction equipment, or combination thereof sufficient to substantially eliminate backlog of work.
3. Reschedule work items to achieve concurrency of accomplishments.

F. Addition of equipment or construction forces, increasing working hours or other method, manner or procedures to return to current Construction Progress Schedule will not be considered justification for amending Contract Documents or treated as acceleration.

G. The progress schedule shall be updated throughout the construction period. The Contractor shall revise the schedule monthly and submit with the monthly payment request. The progress schedule will be reviewed at the monthly construction progress meetings.

1.04 SUBMITTAL SCHEDULE

A. Contractor shall make all submittals far enough in advance of scheduled installation dates to ensure adequate time for review and approval by the Engineer. This schedule shall also take into account possible revisions and resubmittals.

B. To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
1. Allow 4 weeks for submittals.
2. Allow 2 weeks for re-submittals.
3. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the work to permit processing

1.05 SHOP DRAWINGS

A. All shop drawings shall be addressed to shop drawing coordinator at Robert E. Lee & Associates. The shop drawing coordinator will be identified at the pre-construction meeting.

B. Shop drawings shall be submitted under an industrial submittal transmittal data sheet as described in 1.06.

C. Shop drawings shall include technical data including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and other pertinent data. Shop drawings shall be submitted for all manufactured or fabricated items.

D. Shop drawings shall be checked, approved and stamped by the Contractor in accordance with the General Conditions before submitting to the Engineer for review and approval.

E. Submit one correctable, translucent, reproducible print and one blue or black-line print for the Engineer/Architect's review. The Engineer/Architect will indicate and will return the reproducible print. Keep one print with the Record Drawings.

F. Do not use shop drawings without an appropriate final stamp indicating action taken.

G. Except for submittals for the record or information, where action and return is required, the Engineer shall review each submittal, mark to indicate action taken, and return promptly. The

Engineer/Architect will stamp each submittal with a uniform action stamp. The Engineer/Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. "No Exceptions Taken": The work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
2. "Make Corrections Noted": The work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents.
3. "Revise and Resubmit": Do not proceed with work covered by the submittal. Resubmit without delay. Do not use, or allow others to use, submittals marked "Revise and Resubmit" at the Project Site or elsewhere where work is in progress.
4. "Rejected": Do not proceed with work covered by the submittal. Resubmit without delay. Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where work is in progress.
5. “Submit Specified Item”: Item submitted does not meet specifications. Submit exact item specified.

H. Shop drawings that require resubmission shall be revised as follows:

1. Revise initial drawings and data and resubmit as required.
2. Provide an itemized list of all changes other than those requested by the Engineer in the cover letter.

1.06 SUBMITTAL TRANSMITTAL DATA SHEET

A. The Contractor shall submit a submittal transmittal data sheet for each shop drawing. Refer to the form at the end of this section.

B. Each shop drawing shall be submitted under its own submittal transmittal data sheet. If more than one shop drawing is submitted on one sheet, the submittal will be rejected and returned.

C. The submittal transmittal data Sheet must be filled out correctly or the submittal will be returned. The following information MUST be included:

1. Date.
2. Project Name.
3. Contractor.
4. Submittal Number.
5. Previous Submittal Number, if applicable.
6. Specification Section Number.
7. Submittal for.
8. Information Block.
9. Name and Signature of Contractor.

D. The submittal transmittal data sheet will be provided by e-mail, if desired by the Contractor.

1.07 PRODUCT DATA

A. Contractor shall provide product data as required to supplement shop drawings.

B. Submittal Transmittal Data Sheet shall be provided for each product data submittal.

C. Product data shall include illustrations, schedules, installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

D. Contractor shall mark each copy of the product data to identify products, models, options and other pertinent.

E. Submit five copies of each required submittal.

F. Contractor shall include all Material Safety Data Sheets (MSDS) required by OSHA.

1.08 SAMPLES

A. Contractor shall provide samples where noted or specified.

B. Submittal Transmittal Data Sheets shall be provided for each sample submittal.

C. Samples are physical examples which illustrate the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

D. Samples shall have attached labels for identification bearing the following information:
   1. Project name.
   2. Description of sample.
   3. Contractor name.
   4. Standards met by the sample.
   5. Submit three samples for review.

E. Approval of the samples shall be obtained before proceeding with the work relating to the sample.

F. Samples not incorporated into the work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site.

G. Field samples shall comply with submittal requirements to the fullest extent possible.

1.09 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the specifications.

B. Submittal Transmittal Data Sheets shall be provided for each quality assurance submittal.

C. Inspection and Test Reports shall be submitted as required by other sections of the specifications.

DELETE 1.10 AND 1.11 IF SECTIONS 01 78 23 AND 01 78 43 AREN'T INCLUDED IN YOUR INDIVIDUAL SPEC

1.10 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall furnish operation and maintenance manuals in accordance with Section 01 78 23, Operation and Maintenance Manuals.

1.11 INSTALLATION AND TRAINING CHECKLISTS

A. Contractor shall provide the Installation and Training checklists in accordance with Section 01 78 43, Installation and Training Checklists.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SUBMITTAL TRANSMITTAL DATA SHEET

(Attach to Each Submittal)

DATE: _____ PROJECT NAME: _____

CONTRACTOR: _____ CONTRACT NO.: _____

SUBMITTAL NO. _____ New Submittal ____ Resubmittal ____ Previous Submittal No. _____

SPECIFICATION SECTION NO. _____
(Cover only one section with each transmittal)

SUBMITTAL FOR: _____ Shop Drawings _____ Product Data _____ Samples

_____ O&M Information _____ Proposed Substitution _____ Other

Specifications Section	Number of Copies	Description ( )	Catalog Drawing or Brochure No.

I certify that the above submitted item has been reviewed in detail and is correct and in strict conformance with the contract drawings and specifications, except as otherwise stated, and is stamped accordingly.

_____
Signature of Contractor

SUBMITTAL REVIEW (**FOR ENGINEER'S USE ONLY**)

TO: _____ TARGET DATE: _____

REVIEWER INITIALS AND DATE: _____

COMMENTS _____

DISPOSITION:

1. No Exceptions Taken
2. Make Corrections Noted
3. Revise and Resubmit
4. Rejected
5. Submit Specified Item

Returned By: _____

Date: _____

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section includes photography of:
   1. Utility construction routes.
   2. Building sites.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 01 32 19, Submittals.

1.02 UTILITY CONSTRUCTION OR ROADWAY CONSTRUCTION ROUTES

A. Before construction may start in any section, the contractor shall deliver pre-construction photographs to the Engineer. The photographs shall be collated by project stationing. The photographs shall include:
   1. Intervals of 100-feet along pipeline route. (Indicate by station)
   2. Trees and shrubbery.
   3. Surfacing, sidewalks, driveways, and curb and gutter.
   4. Structures.
   5. Fencing, signs, and mail boxes.
   6. Culverts and topographic features.

1.03 BUILDING SITES

A. Building sites shall include wastewater treatment plants, water treatment plants, elevated tanks, bridges, and other structures.

B. Before construction may start, the Contractor shall provide pre-construction photographs to the Engineer. The photographs shall show building conditions and site features.

1.04 PHOTOGRAPHS

A. Photographs shall be in digital format, minimum 3.0 megapixels.

B. The digital footnote/file name shall include the date, name of work, direction of view, and location on each photo.

C. The Contractor shall provide two copies of each photo disc in .jpg format. The project name and project number shall be listed on each disc.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 40 00

FIELD ENGINEERING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work under this section is associated with:
   1. Staking.
   2. Profile and topography.
   3. Records and markers.

1.02 STAKING PROVIDED BY OWNER'S REPRESENTATIVE

A. Staking for utility construction shall include:
   1. Location of construction limits.
   2. Original staking of line and grade and location of all structures.
   3. Benchmarks on site.

B. Staking for building construction.
   1. Two construction baselines
   2. Establish benchmarks onsite.
   3. Location of construction limits.

1.03 STAKING TO BE PROVIDED BY CONTRACTOR

A. Any staking work required to complete the work and not specifically provided by the Owner's representative.

B. Contractor shall establish grade from stakes or benchmarks established by the Owner's representative.

1.04 CONSTRUCTION STAKING

A. The Contractor shall provide the Owner's representative an advance notification of three working days when requesting construction staking.

B. All construction shall be completed by the Contractor according to the alignments, grades, and baselines as established and set by the Owner's representative.

C. The Contractor shall be responsible for the cost of restaking baselines, line & grade, structures & benchmarks unnecessarily destroyed or altered as a result of his negligence during the construction period.

1.05 PROFILE AND TOPOGRAPHY

A. Contours or profiles of the ground are shown on the drawings. These profiles and contours are reasonably correct, but are not guaranteed to be absolutely so, and together with any schedule of quantities are presented only as an approximation.

1.06 CONTRACTORS RECORDS AND MARKERS

A. In addition to submittals and records required in other parts of the Contract Documents, Contractor shall record the following in such a manner that the Owner can locate same in the future by reference to recorded measurements:
   1. Any deviations of underground covered work from contract drawings.
   2. On pipeline construction, the exact location and depth below grade of all:
      a. Valves and pipelines.
      b. Changes in direction.
      c. or "T" branches on sewers.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes regulatory requirements in regard to the project. Regulatory agency's requirements supersede this section.

B. Related Sections and Divisions: Applicable provisions of the General Conditions shall govern the work in this section.

1.02 OSHA REQUIREMENTS

A. All work including site safety, equipment, materials and fabricated items provided by the Contractor shall comply with all OSHA requirements.

1.03 PERMITS

A. The Contractor shall obtain all permits required for this project. Where the permit requirements of any permit are more restrictive than the plans and specifications, the permit requirements shall govern.

B. Contractor shall obtain required permits from all regulatory governmental agencies governing dewatering. Contractor shall be responsible to maintain existing private wells affected by dewatering activities. It shall be the responsibility of the Contractor to provide a water supply to the affected resident at no cost to the Owner. The Contractor shall be required to drill and close wells in accordance with WDNR requirement.

The governing agency in Wisconsin is:

Wisconsin Department of Natural Resources
Private Water Supply Section
P.O. Box 7921
Madison, Wisconsin 53707

C. Contractor shall comply with the WDNR requirements regulating the discharge of effluent from construction trenches. These provisions provide for the removal of suspended solids prior to direct discharge to surface water or wetlands. Contractor shall be responsible for obtaining any necessary permits.

1.04 UNDERGROUND UTILITIES

A. Under the provisions of Wisconsin Statutes, Section 182.0175, all contractors, subcontractors, and any firm or individual intending to do work on this contract shall contact all utility firms in the affected area of construction a minimum of three (3) working days prior to beginning construction so that affected utilities will be located and marked.

1.05 WASTEWATER TREATMENT DURING CONSTRUCTION

A. Maintain wastewater treatment during the construction period beginning with the effective date of the Agreement and ending at substantial completion. Wastewater treatment must achieve as a minimum the requirement of the Owner's WPDES Permit or be consistent with treatment plant performance within the previous 24 months, whichever is least stringent. Any damages assessed against the Owner as a result of the violation of these requirements and shown to be a result of the Contractor's failure to utilize accepted wastewater treatment plant operation and maintenance practices shall be paid in full by the Contractor.

B. The Owner's operating personnel are on site intermittently. The contractor shall maintain sufficient plant operating automation to ensure that required wastewater treatment is maintained continuously. The contractor shall also maintain sufficient alarm condition monitoring equipment and response personnel to ensure that emergency conditions that may develop at the plant during construction do not result in damage, flooding or reduced treatment efficiency.

C. The Contractor shall assume responsibility for any additional costs incurred by the owner as a result of the Contractor's failure to satisfactorily meet the requirements of the WPDES permit.

1.06 PROPERTY MONUMENTS

A. It shall be the responsibility of the Contractor to protect iron pipe and survey monuments from movement where possible. The cost of replacement of any monuments moved or destroyed by the Contractor shall be assessed to him.

1.07 WAGE RATES

REVISE BASED ON REQUIRED WAGE RATES—SEE SECTION 00 73 00, SUPPLEMENTARY CONDITIONS

A. State Wage Rates are not required. Section 66.0903 Wisconsin Statutes will prevail on the contracts in this project.

OR THE BELOW A, B, C/C

A. Not less than the prevailing wage rates shall be paid to the workers employed on this project.

B. Contractor shall comply with the State or Federal wage rates governing this project.

SELECT HOW WAGE RATES WILL BE PROVIDED

C. The wage rates for this project will be provided by Addendum.

C. The wage rates for this project are provided in the Contract Documents.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 45 24

TESTING AND INSPECTION OF PIPELINE CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section specifies various types of tests and inspection procedures to be used on installed pipelines for determining water and pressure tightness and alignment.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall apply to this section.
2. Section 01 32 19, Submittals
3. Section 33 34 00, Forcemain
4. Section 40 05 13.53, Ductile Iron Pipe
5. Section 40 05 13.13, Steel Pipe
6. Section 40 05 13.19, Stainless Steel Pipe and Fittings
7. Section 40 05 13.73, PVC Plastic Pipe
8. Section 40 05 13.74, Polyethylene Pipe
9. Section 40 05 13.76, PVC Lined R.C.P Sewer
10. Section 40 05 13.80, Centrifugally Cast Fiberglass Mortar Pipe
11. Section 40 05 13.78, Corrugated High Density Polyethylene Pipe
12. Section 33 11 13, Watermain
13. Section 33 33 13, Sanitary Sewer
14. Section 02 66 10, Double-Walled Leachate Transfer Line
15. Section 40 05 15, Methods and Materials for Piping Installation

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1.	ASTM 02774	Standard Practice for underground installation of thermoplastic pressure piping.
2.	ASTM D3034	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
3.	ASTM D3350-84	Polyethylene Plastic Pipe and Fittings Material
4.	ASTM F679S	Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
5.	ASTM F1417	Installation Acceptance of Plastic Gravity Sewer Lines using low pressure air.

B. American Water Works Association (AWWA):
1. AWWA C651 Disinfecting Watermains

C. American National Standards Institute (ANSI):
1. ANSI B16.5-81 Pipe Flanges (150 lb.)
2. AWWA C600 Installation of Ductile Iron Water Mains and their appurtenances.

D. American Water Works Association (AWWA):

1. AWWA C207-86 Standard for Steel Pipe Flanges for Waterworks Service – Size 4 inches through 144 inches

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 PREPARATION OF PIPELINE BEFORE TESTING

A. The pipes shall be clean of debris and materials prior to testing.

B. Televising shall be performed immediately after cleaning.

3.02 STANDARD GRAVITY PIPELINE INFILTRATION TEST

A. Measurement of infiltrating flow utilizing weir or a dam with measuring container at downstream end of pipeline sector being tested.

B. Conditions to Prevail Before Infiltration Test Commences
1. Groundwater level shall produce a minimum positive head of 2 feet over all sections of pipeline being tested.
2. Groundwater level shall be measured by the Contractor prior to the infiltration test utilizing a measurement method acceptable to Engineer.
3. Weir or dam shall be in place 12 hours before measurement of flow.
4. Any source of water, sewage or other liquid except infiltrating groundwater shall be eliminated before conducting test.

C. Maximum Limits of Infiltration
1. Infiltration shall be limited to the maximum allowed as specified in the section for Materials and Methods of Construction for the pipeline specified.
2. When infiltration limits for gravity pipelines are not given in the appropriate section for Materials and Methods of Construction, the following limits shall apply:
   a. Two hundred gallons in 24 hours for each inch of the diameter of pipe being tested, for every one mile of pipe.
   b. Infiltration rate for manholes shall be computed using the total number of vertical feet of manhole expressed as the equivalent largest diameter sewer entering the manhole.

D. Equipment and Personnel to be supplied by the Engineer
1. Measuring weirs.
   a. "V" notch 30˚, 60˚, or 90˚ with end contractions.
   b. Sharp crested with edge ground to 45˚.
   c. Install in manhole or pipe in such a manner that leakage is zero.
   d. Discharge for "V" notch weirs shall be based on the following formula:
      When:
      Q = Cu. ft. per second
      C =.57
      L = Width of notch in ft. at H distance above the apex.

H = Head of liquid above the apex of notch in feet.
g = 32.174

e. End contractions shall not be less than 3/4 L.

2. Shallow measuring vessel calibrated to gallons and tenths of gallons.
3. Stop watch with sweep hand indicating seconds and tenths of seconds (certified accurate by a state licensed watchmaker).
4. Sufficient personnel to conduct tests.
5. Either weir method or stopwatch and container method may be used at discretion of Engineer.

E. Equipment and Personnel to be provided by Contract.
1. Qualified observer.
2. Personnel to assist in placing and removing weirs.
3. Contractor responsible for safety during tests including:
a. Providing signs.
b. Providing safety equipment including safety equipment for confined entry.
c. Providing signalmen when necessary.

3.03 STANDARD GRAVITY PIPELINE EXFILTRATION TEST

A. The Contractor may perform an exfiltration test when groundwater level is less than 2 feet above sections of pipeline being tested.

B. The following shall be completed prior to testing:
1. Pipeline shall be tested with a minimum positive head of 2 feet in all sections.
2. Pipeline and manholes shall be filled with water until the water level is a minimum of 2 feet above the highest section of pipe or a minimum of 2 feet above the groundwater level, whichever elevation is higher.
3. Groundwater level shall be measured by the Contractor prior to the infiltration test utilizing a measurement method acceptable to Engineer.

C. The following is the recommended test procedure:
1. Plug section to be tested.
2. Laterals on the line being tested shall be provided with a temporary cleanout to permit adequate release of trapped air in laterals.
3. Fill line and manhole with water as per paragraph B.
4. Let line stand for 12 hours adding water periodically to retain test level as it is reaching its maximum absorption and entrapped air is escaping.
5. After 12 hours, refill line to test level and let stand for 1-hour test period.
6. Measure and record loss of water in gallons per hour.
7. Subtract manhole loss as previously determined, to get actual line loss.
8. Repair and retest until results of final test hour are within allowable leakage limits.

D. Exfiltration shall be limited to 8.34 gallons per hour per inch diameter per mile of pipe.

3.04 STANDARD PRESSURE AND LEAKAGE TEST FOR PRESSURIZED PIPELINES

A. Measure drop in pressure and leakage from liquid filled and pressurized pipelines.

B. Conditions to prevail before commencement of test.
1. Disinfect all testing equipment and fittings.

2. Backfill to at least minimum 4 feet compacted backfill material.
3. Length of pipeline tested shall not exceed 2,000 feet.
4. Reaction backing to be in place a minimum of;
    a. Thirty-six hours if concrete thrust backing has been cast with high early cement.
    b. Seven days if concrete thrust blocking has been cast with standard cement.
5. Fill with water.
    a. Fill each valved section with water slowly, expelling air completely from the pipeline, valves, and hydrants.
    b. Where permanent air vents are not located at all high points or dead ends, Contractor shall install corporation cocks at such points so that air can be expelled as the line is filled with water.
        1) Close all these corporation cocks before applying pressure or leakage tests.
        2) At the conclusion of the leakage and pressure test, the corporation cocks shall be removed and plugged, or left in at the discretion of the Owner.
6. Pressurize to normal working pressure.
    a. After test connections are made and pipeline is filled with water, the pipeline shall be subjected to water pressure normal for that segment of the system being tested.
    b. Examine system for any visible leakage at this stage.
        1) Repair any visible leaks.
        2) Re-pressurize to normal working pressure and continue to repair and re-pressurize until all visible leaks have been stopped.

C. Pressure Test
1. Test pressure shall be not less than 150 lbs. per sq. inch at the lowest point of elevation of the segment being tested.
    a. The minimum test pressures specified above may require that the installed system be tested in several segments in order to attain the proper pressure.
    b. If test pressures other than indicated above are called for in the sections for Materials and Methods of Construction, those pressures shall be used.
2. Pressurize the system being tested to pressure required above by adding water with high-pressure test pump.
3. Repair any visible leaks occurring due to test pressure application.
4. Repeat pressurizing of system to test pressure until no visible leaks can be found.
5. Duration of pressure test.
    a. Test period shall be two continuous hours with no visible leaks occurring.
    b. Pressure during test period shall be sustained.
6. Contractor shall provide pressure gauge with 4-inch face and snubber. Pressure shall read in one-pound increments.
7. If it is found unnecessary to add water during the duration of the pressure test, the leakage test may be waived with the approval of the Engineer.

D. Leakage Test
1. Leakage test shall be conducted after completion of the pressure test.
2. At the option of the Contractor, pressure and leakage tests may be run concurrently.
    a. This option must have the approval of the Engineer.
    b. If this option is agreed upon, then the test procedures required for pressure tests shall prevail for both pressure and leakage tests.
3. When leakage test is conducted after satisfactory completion of the pressure test, the test section shall be subjected to 100 pounds per square inch gauge pressure at the lowest elevation of the section of the main being tested.

a. If leakage test pressures other than indicated above are called for in the sections for Materials and Methods of Construction, those pressures shall be used.

4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled.
   a. Pressure during test period shall be sustained within plus or minus 5 lbs. of the required test pressure by adding water with test pump.
   b. Meter the amount of water added.
5. Leakage shall not exceed the number of gallons per hour as determined by the following formula:

$$GPH = ND\sqrt{P/7400}$$

When:
GPH = Gallons Per Hour
N = Number of Joints Under Test
D = Nominal Pipe Dia. in Inches
P = Average Test Pressure in lbs/sq. in.

6. When the section under test contains various diameters of pipe, the available leakage will be the sum of the computed leakage for each size of pipe.
7. Should any test section fail to meet the leakage test, the Contractor shall immediately make the necessary repairs at his own expense.
8. Duration of final leakage test shall be one continuous hour with leakage within the allowable limits during the test hour.

E. Contractor shall provide all equipment required to perform the test.

3.05 LOW PRESSURE AIR TEST

A. Contractor shall perform a low-pressure air test on gravity pipelines in lieu of infiltration or exfiltration tests when pipeline is not submerged in groundwater. Test shall conform to ASTM C828.

B. Contractor shall provide all equipment required to perform the test.

C. Testing Procedure
1. Determine test time as follows:
   a. Test times for pipeline segments with uniform pipe size shall be taken from test timetable list below.
   b. Test times for pipeline segments longer than those shown and/or of non-uniform pipe size shall be calculated utilizing appropriate formulas in ASTM C828.

Test Timetable

PIPE DIAMETER "D" IN INCHES

	8	10	12	15	18	21	24	27	30	36	42
25	0.30	0.37	0.45	0.52	0.60	0.74	0.89	1.04	1.19	1.50	1.82
50	0.59	0.74	0.89	1.04	1.20	1.49	1.78	2.08	2.39	3.01	3.64
75	0.89	1.11	1.34	1.57	1.80	2.23	2.67	3.12	3.58	4.51	5.45
100	1.19	1.48	1.78	2.09	2.40	2.97	3.56	4.16	4.77	6.01	7.27
125	1.48	1.86	2.23	2.61	3.01	3.72	4.45	5.20	5.96	7.51	9.09
150	1.78	2.23	2.67	3.13	3.61	4.46	5.34	6.24	7.16	9.02	10.91
175	2.08	2.60	3.12	3.65	4.21	5.21	6.23	7.28	8.35	10.52	12.73
200	2.37	2.97	3.56	4.17	4.81	5.95	7.12	8.32	9.54	12.02	14.54

	8	10	12	15	18	21	24	27	30	36	42
225	2.67	3.34	4.01	4.70	5.41	6.69	8.01	9.36	10.73	13.52	16.36
250	2.97	3.71	4.45	5.22	6.01	7.44	8.90	10.40	11.93	15.03	18.18
275	3.26	4.08	4.90	5.74	6.61	8.18	9.79	11.44	13.12	16.53	20.00
300	3.56	4.45	5.34	6.26	7.21	8.92	10.68	12.48	14.31	18.03	21.81
325	3.86	4.82	5.79	6.78	7.81	9.67	11.58	13.52	15.50	19.53	23.63
350	4.16	5.19	6.23	7.30	8.41	10.41	12.47	14.56	16.70	21.04	25.45
375	4.45	5.57	6.68	7.83	9.02	11.16	13.36	15.60	17.89	22.54	27.27
400	4.75	5.94	7.12	8.35	9.62	11.90	14.25	16.64	19.08	24.04	29.09
425	5.05	6.31	7.57	8.87	10.22	12.64	15.14	17.68	20.27	25.54	30.90
450	5.34	6.68	8.01	9.39	10.82	13.39	16.03	18.72	21.47	27.05	32.72
475	5.64	7.05	8.46	9.91	11.42	14.13	16.92	19.76	22.66	28.55	34.54
500	5.94	7.42	8.90	10.43	12.02	14.87	17.81	20.80	23.85	30.05	36.36
525	6.23	7.79	9.35	10.96	12.62	15.62	18.70	21.84	25.04	31.55	38.18
550	6.53	8.16	9.79	11.48	13.22	16.36	19.59	22.88	26.24	33.06	39.99
575	6.83	8.53	10.24	12.00	13.82	17.10	20.48	23.93	27.43	34.56	41.81
600	7.12	8.90	10.68	12.52	14.42	17.85	21.37	24.97	28.62	36.06	43.63

c. Specified test time (minutes) required for pressure drop from 3-1/2 to 2-1/2 psi when testing one pipe diameter only.

d. Interpolate test times for segment lengths not specifically listed.

2. Pressurize pipeline to 4.0 psi and allow to stabilize (stabilization of air temperature may cause pressure drop).

3. When pressure has stabilized, start test at 3.5 psi and record time.

4. If pressure drops more than 1.0 psi during the determined test time, the test will be considered failed.

3.06 TELEVISING OF PIPELINES

A. Televising of pipelines shall be in accordance with Section 33 01 30.16, Sewer Cleaning and Televising.

3.07 DEFLECTION TEST

A. Perform deflection tests on all PVC and HDPE gravity pipelines.

B. Not less than 30 days after the installation and backfilling of sewers, including any service connections, the Contractor shall, in the presence of the Engineer, test deflection of the pipe with a mandrel (Go-No-Go device). The mandrel shall be hand-pulled. All pipe with deflections in excess of 5% of the base internal diameter, as determined by ASTM D 3034, ASTM F 679, or ASTM F 794, shall be excavated, rerounded, backfilled and retested after an additional period of at least 30 days. Mandrels shall have nine ribs and be only hand-pulled through the test section. The Contractor shall furnish the mandrels. The length of the minimum radius portion of the mandrel shall not be less than one-third of the nominal diameter of the pipe tested. The pipe shall be flushed and cleaned by the Contractor prior to testing. No flow will be permitted in the pipe while testing for deflections.

1. All expense for trenching, backfill, compaction, paving, and related work that is required because of failure to meet deflection test requirements shall be borne by the Contractor.

2. Acceptance of plastic pipe sewers shall be made only after these deflection test requirements have been met.

C. Mandrel sizes shall be in accordance to the following:
   1. PVC (5% Deflection)

Nominal Size (Inches)	Base ID	SDR35/PS46 5% Deflection Mandrel Size (Inches)	Base ID	SDR26/PS115 5% Deflection Mandrel Size (Inches)
4	3.895	3.70	3.811	3.62
6	5.742	5.45	5.612	5.33
8	7.665	7.28	7.488	7.11
10	9.563	9.08	9.342	8.87
12	11.361	10.79	11.102	10.55
15	13.898	13.20	13.575	12.90
18	16.976	16.13	16.586	15.76
21	20.004	19.00	19.545	18.57
24	22.48	21.36	21.964	20.87
27	25.327	24.06	24.744	23.51
30	29.132	27.68	28.461	27.04
36	34.869	33.13	34.120	32.41

3.08 REPLACEMENT AND REPAIRS

A. The Contractor shall replace or repair any section of pipeline found to be defective so that the pipeline meets the requirements of the specification.

3.09 DISINFECTION

A. The following shall be disinfected in accordance with AWWA C651:
   1. New watermain construction.
   2. Existing watermain when cut into or repaired.

B. The lines shall be disinfected and flushed until the system is safe.

C. At least one sample shall be collected from every 1,200 feet of watermain, plus one set of samples from the end of each main and a minimum of one from each new branch.

D. The Contractor shall provide the Owner with two copies of lab test results certifying that the water sampled is free of contamination tests shall be done prior to standard pressure and leakage test for pressurized pipelines and after completion of pressure and leakage test.

3.10 TRACER WIRE TESTING

A. Contractor shall test all tracer wire.

B. A power source shall be provided which will transmit a measurable amount of DC current the length of the tracer wire or length of the test area. Current readings shall be taken with the test current "off', then "on" to differentiate between test current and stray current.

C. If continuity is not achieved, the Contractor shall perform required repairs and repeat the test.

3.11 BASIS OF PAYMENT

A. Testing of pipe segments in considered to be incidental to the work and payment for testing the piping segments is included in the cost to provide and install the pipe.

– END OF SECTION –

ATTACHMENT TO FORM

EXAMPLE CALCULATION SHEET

GIVEN: P_i = 10 psig
T_i = 21.1 °C = 70°F

and at time t = 60 minutes

P_t = 10.05 psig
T_t = 23.0 °C = 73°F

Calculate Corrected Initial Pressure

$$P_c = \frac{(10.0 + 14.7)\,(23.0 + 273)}{(21.1 + 273)} - 14.7$$

P_c = 24.85 - 14.7 = 10.15 psig

Calculate Percent Pressure Loss

$$\% \text{ Pressure Loss} = \frac{10.15 - 10.05}{10.15} \times 100 = 0.98\% < 1\% \text{ ok}$$

Note: The difference between the corrected pressure reading (P_c) and the gauge reading (P_t) cannot differ by more than 1% of the corrected pressure reading (P_c) (i.e., .105 @ 10.5 psig) over a time interval of 60 minutes.

SANITARY SEWER LOW PRESSURE AIR TEST

PROJECT: _____ CONTRACTOR: _____

LOCATION: _____ DATE: _____

Test Location	Test Location
MH # To MH #	MH # To MH #
Length of Main Size of Main	Length of Main Size of Main
Length of Lateral Size of Lateral	Length of Lateral Size of Lateral
Length of Main	Length of Main
Length of Lateral	Length of Lateral
Type of Pipe	Type of Pipe
Req'd Holding Time	Req'd Holding Time
Start Pressure	Start Pressure
End Pressure	End Pressure
Test: Pass Fail	Test: Pass Fail
No Go	No Go
Witnessed By	Witnessed By

Test Location	Test Location
MH # To MH #	MH # To MH #
Length of Main Size of Main	Length of Main Size of Main
Length of Lateral Size of Lateral	Length of Lateral Size of Lateral
Length of Main	Length of Main
Length of Lateral	Length of Lateral
Type of Pipe	Type of Pipe
Req'd Holding Time	Req'd Holding Time
Start Pressure	Start Pressure
End Pressure	End Pressure
Test: Pass Fail	Test: Pass Fail
No Go	No Go
Witnessed By	Witnessed By

HYDROSTATIC TEST REPORT

Project: _____ Contract: _____

Location of Watermain: _____

Date of Test: _____ Tested By: _____

TEST SECTION:

Size (in.)	No. of Joints	Elevation		Allowable Leakage[a] (GPH)
		High	Low	
			Total	

Type of Pipe and Joints: _____

Average Length of Pipe Sections: _____ ft. Total Length: _____ ft.

Pressure applied at:[b] _____

PRESSURE TEST:

Initial Test Pressure: _____ psi Duration of Pressure Test: _____ hrs

Final Test Pressure: _____ psi Pressure Drop During Test: _____ psi

Remarks:[c] _____

_____

LEAKAGE TEST:

Pressure During Test: _____ psi Duration of Leakage Test _____ hrs

Allowable Leakage of Test Section _____ GPH (Total from above)

Actual Leakage _____ GPH

Percent of Allowable _____

Leakage shall not exceed the number of gallons per hour as determined by the following formula:

$$GPH = ND\sqrt{P/7400}$$

When:
GPH = Gallons Per Hour
N = Number of Joints Under Test
D = Nominal Pipe Dia. in Inches
P = Average Test Pressure in lbs/sq. in.

b. Describe location and elevation of point of application of pressure

c. Include results of inspection of the test section and description of repair of any defects

COMMENTS: PASS _____ FAIL _____

_____

_____

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes providing temporary services. Temporary services and be included in total price of contract and maintained until final completion of project.

B. Related Sections and Divisions: Applicable provisions of the General Conditions shall govern the work in this section.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 TEMPORARY HEAT

A. Provide temporary heat required by construction activities for:
   1. Curing or drying of completed installations.
   2. Protection of installed construction from adverse affects of low temperatures or high humidity.
   3. Maintain a minimum temperature of 60°F in permanently enclosed portions of the building and areas where finished work has been installed.

B. Select safe equipment that will not have harmful effects on completed installations or elements being installed.

C. Coordinate ventilation requirements to produce ambient conditions required.

D. Except where use of the permanent system is authorized, provide vented, self-contained LP gas or fuel oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open flame or salamander type heating units or any units that discharge products of combustion into the space being heated is prohibited.

E. When the permanent heating system is tested and ready for operation, it may be used on a temporary basis for heating and building until final acceptance:
   1. Contractor shall be responsible for cost of operation and fuel.
   2. The Owner will assume responsibility for operation and fuel costs on the date of final acceptance of the contract.
   3. Prior to final acceptance, clean entire unit and replace all filters.

3.02 TEMPORARY ELECTRICAL SERVICE

A. Provide a temporary, weatherproof, grounded electric service and distribution system of size and capacity needed for construction including:
   1. Meters.
   2. Transformers.

3. Overload protected disconnects.
4. Automatic ground-fault interrupters.
5. Main distribution switchgear.

B. Permanent service may be used during construction when available.

C. Contractor shall be responsible for the costs of consumed power furnished through temporary or permanent service until final acceptance of project.

3.03 TEMPORARY WATER SERVICE

A. Provide temporary water service for construction operations.

B. If water service is available from the municipal water utility, the Contractor shall arrange for a temporary metered water service.
1. Size of temporary service shall be minimum of 1 inch.
2. Provide hose bibs as needed.
3. Provide backflow protection as required by DCOMM plumbing code.

C. If water service is not available from a public utility, the Contractor shall be responsible for providing water from some other source.

D. The Contractor shall be responsible for costs of providing temporary service and water usage regardless of source.

3.04 SANITARY FACILITIES

A. Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation or combustion type, properly vented and fully enclosed with a fiberglass reinforced polyester shell or similar non-absorbent material.

B. Use of Owner’s sanitary facilities is prohibited.

3.05 FIRST AID

A. Provide first aid equipment complying with governing regulations.

3.06 FIRE EXTINGUISHERS

A. Provide temporary fire extinguishers at project site until Owner occupation or final acceptance, whichever occurs first.

B. Provide hand-carried, portable UL rated, Class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable UL rated, Class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classed for the exposures.

C. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

3.07 REMOVAL OF TEMPORARY FACILITIES

A. Contractor shall remove temporary materials, equipment, services and construction as soon as practicable but not later than final completion.

B. Clean and repair damage caused by temporary facilities and restore to original condition.

C. Temporary facilities, which interfere with Owner's operation, shall be removed at the end of each work period.

- END OF SECTION -

SECTION 01 57 14

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section consists of construction and maintenance of temporary erosion and sediment control measures to be performed prior to and during construction.

B. Related Sections and Divisions:

1. Applicable provisions of the General Conditions shall govern the work in this section.
2. All related construction sections.
3. Erosion Control and Storm Water Management Plan.
4. Section 01 32 19, Submittals.

C. Unless shown otherwise, the contractor shall be responsible for selecting method of erosion and sediment control.

D. The Contractor's erosion control measures must comply with the approved Erosion Control and Storm Water Management Plan, Wisconsin DNR Conservation Practice Standards, Latest Edition, WisDOT Product Acceptability List, Latest Edition, and local erosion control ordinances.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:

1. Material samples upon request or owner's representative.
2. Manufacturer's certification that materials delivered comply with requirements of this section.

PART 2 - PRODUCTS

A. Products used for implementing the Erosion Control and Storm Water Management Plan and for conformance to WDNR Conservation Practice Standards, Latest Edition shall conform to the WisDOT Product Acceptability List, Latest Edition.

PART 3 - EXECUTION

A. All installations shall conform to requirements of the WDNR Conservation Practice Standards, Latest Edition.

B. The Contractor shall maintain a written record of all implemented erosion control practices as required by the WDNR. A suggested format is WDNR Form 3400-187, latest revision (see attached). The written record shall be maintained throughout final completion. Copies shall be forwarded to the Engineer upon request and with each pay request.

C. Inspections of implemented erosion and sediment control best management practices must be performed weekly and within 24 hours after a precipitation event 0.5 inches or greater which results in runoff.

D. Installed erosion control measures shall be removed from the site after 70% revegetation has been achieved, and all remaining disturbed areas shall be seeded, fertilized, and mulched.

PART 4 – PAYMENT

A. Payment shall be based on the following:

PROJECT MANAGER—CHOSE ONE OF THE FOLLOWING

1. Erosion control shall be paid for at the contract price bid in accordance with the bid form.

Or

1. Erosion Control shall be incidental to the appropriate bid item.

- END OF SECTION –

Notice: Use of this specific form is voluntary, but the information contained on this form must be collected and kept by the permittee under s. NR 216.48(4), Wis. Adm. Code, for a construction site covered under the General WPDES Construction Site Storm Water Discharge Permit, Permit No. WI-0067831-2. This form is provided for the convenience of the permittee to meet the requirements of s. NR 216.48(4), Wis. Adm. Code. Multiple copies of this form may be made to compile the inspection report.

Inspections of implemented erosion and sediment control best management practices must be performed weekly and within 24 hours after a precipitation event 0.5 inches or greater which results in runoff.

Weekly written reports of all inspections conducted by or for the permittee must be maintained throughout the period of general permit coverage.

The information maintained in accordance with s. NR 216.48 (4) must be submitted to the Department upon request.

Name of Permittee:	
Construction Site Name (Project):	**Construction Site ID No.: (WDNR #)**
Location:	**County:**
Contractor:	**Field Office Phone:**

Note: Weekly inspection reports, along with erosion control and storm water management plans, are required to be maintained on site and made available upon request.

Date of inspection (mm/dd/yy): ___ **Time of inspection: Start: ___ a.m./p.m.** **End: ___ a.m./p.m.**	**Type of inspection: ☐ Weekly ☐ Precipitation Event** **☐ Other (specify)** _____ **Name(s) of individual(s) performing inspection:**

Weather:

Description of present phase of construction:

Modifications Required	Yes	No	Not Applicable	**Comments/Recommendations** about the overall effectiveness of the erosion and sediment control measures. **Note**: For each item checked "Yes", complete the follow-up information on page 2.
Ditch Checks	☐	☐	☐	
Erosion Control Plan	☐	☐	☐	
Erosion Mat	☐	☐	☐	
Grading Practices	☐	☐	☐	
Inlet Protection	☐	☐	☐	
Mulch	☐	☐	☐	
Offsite Sediment	☐	☐	☐	
Permanent Seeding	☐	☐	☐	
Schedule / Phasing	☐	☐	☐	
Silt Fence	☐	☐	☐	
Silt Screen	☐	☐	☐	
Sod	☐	☐	☐	
Stabilized Outlet	☐	☐	☐	
Temp. Diversion Channel	☐	☐	☐	
Temp. Settling Basin	☐	☐	☐	
Temporary Seeding	☐	☐	☐	
Tracking Pads	☐	☐	☐	
Turbidity Barrier	☐	☐	☐	
Other (specify) ___	☐	☐	☐	

Use the space below for detailed follow-up action items.

Name of Permittee:		
Construction Site Name (Project):		**Construction Site ID No.: (WDNR #)**
Exact place of erosion/sediment control inspected	**Type of erosion/sediment control and its observed condition**	**Description of any necessary maintenance or repair to erosion/sediment control, including anticipated date of completion**

SECTION 01 60 00

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 01 32 19, Submittals.

1.02 MATERIALS - QUALITY ASSURANCE

A. It is the intent of these specifications to procure a quality product by an established manufacturer of the latest design. All components of systems shall be engineered for long, continuous, uninterrupted service. The cost of the equipment shall include all royalties and costs arising from patents and licenses associated with furnishing the specified equipment.

B. All materials shall be designed to withstand stresses encountered in continuous operation, fabrication and erection. All equipment shall be of corrosion-resistant materials or shall be suitably protected by the supplier with corrosion-resistant industrial coatings. Provisions shall be made for ease of lubrication, adjustment and replacement of parts.

C. Material for which no detailed specifications are given shall:
   1. Meet the particular industry standard for the material used.
   2. Meet the specifications of ASTM, ANSI or SAE for metals and plastics for the use intended.
   3. Not be used unless it has previously been used for a like purpose for a sufficient length of time in the field or under field-simulated laboratory conditions to demonstrate its successful use.

D. Source Limitations

To the fullest extent possible, provide products of the same kind from a single source.

   1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Engineer/Architect to determine the most important product qualities to consider before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

E. Compatibility of Options

When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Provide equipment and personnel to handle products by methods that avoid soiling or damage.
4. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that quantities are correct, products are undamaged, and properly protected. Inform the Engineer or Owner before the inspection occurs, so that they may participate in the inspection if so desired.
6. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units. Seals and labels shall be intact and legible.
7. Store products in accordance with manufacturer's instructions. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
8. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
9. Arrange for fabricated items or products stored outside to be placed on sloped supports above the ground. Items subject to deterioration shall be covered by weather proof sheet covering which is ventilated to prevent condensation.
10. Store loose granular materials on solid surfaces which are well drained and prevent contamination by foreign matter.
11. Arrange for periodic inspection of stored materials to insure that materials remain undamaged and are maintained under required conditions.
12. All shipment, delivery and storage charges shall be at the expense of the contractor.

1.04 MAINTENANCE OF STORAGE

A. Contractor shall periodically inspect stored products on a scheduled basis.

B. Contractor shall verify that storage facilities comply with manufacturer’s product storage requirements, and verify that manufacturer required environmental conditions are maintained continually.

C. Contractor shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.

D. Contractor shall perform scheduled maintenance of equipment in storage as recommended by the manufacturer. A record of the maintenance shall be kept and turned over to Engineer when the equipment is installed.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
   1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

3.02 INSTALLATION REQUIREMENTS

A. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditions as directed by the respective manufacturers, unless otherwise specified.

B. After installation, Contractor shall protect all materials and equipment against weather, dust, moisture, and mechanical damage.

C. Contractor shall be responsible for all damages that occur in connection with the care and protection of all materials and equipment until completion and final acceptance of the work by Owner. Damaged material and equipment shall be immediately removed form the site.

3.03 FIELD QUALITY CONTROL

A. Qualifications of Manufacturers Field Personnel
   1. Personnel shall be authorized by the manufacturer to erect start-up and initiate warranty of the equipment provided.
   2. Personnel shall come to the site with the required tools and electrical instruments.
   3. Personnel shall have full knowledge of electrical controls pertaining to the equipment and control panels furnished.
   4. Failure to provide personnel with full qualifications shall be cause for service trip to be disqualified as part of the requirements and may because for reimbursement for costs incurred by the Owner due to services required for a qualified start-up inspection.

- END OF SECTION -

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section includes project requirements for project completion, record document submittal and closeout procedures.

B. Related Sections:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Specific requirements for individual units of work are included in appropriate technical sections.

1.02 DEFINITIONS

A. Time of Closeout:
1. Directly related to "Substantial Completion," may be either a single time period for entire work or series of time periods for individual elements of work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to other provisions of this section.

1.03 PREREQUISITES TO PARTIAL COMPLETION

A. General Requirements:
1. Complete before requesting Engineer's inspection for certification of substantial completion for each phase of work. List known exceptions in request.

B. Substantial Completion:
1. Administrative actions and submittals to precede or coincide with Substantial Completion include.
   a. Incomplete Work:
      1) List of incomplete work.
      2) Value of incomplete work.
      3) Reasons for work being incomplete.
   b. Monetary:
      1) Progress payment request coinciding with, or first request following date substantial completion is claimed showing 100 percent complete or list incomplete work.
      2) Submit statement of changes to contract sum.
   c. Regulatory Requirements:
      1) Obtain, submit releases enabling Owners' full, unrestricted use of work and access to services and utilities. Where required, include occupancy permits, operating certificates, similar releases.
   d. Bonding and Insurance:
      1) Request partial release of retainage.
      2) Advise Owner of pending insurance change-over-requirements (if Builders Risk Insurance is provided by Contractor).

C. Inspection Procedures:

1. When prerequisites are complete, submit request in writing to Engineer stating that all requirements are satisfied, and requesting inspection. Upon receipt of Contractor's request for inspection, Engineer will either proceed with inspection or advise Contractor of unfilled prerequisites.
    a. Following initial inspection, Engineer will either prepare certificate of substantial completion, or advise Contractor of work which must be performed before certificate will be issued. Engineer will repeat inspection when requested and when assured that work has been substantially completed.
    b. Results of completed inspection will form initial "punch list" for final acceptance.

1.04 PREREQUISITES TO FINAL ACCEPTANCE

A. General Requirements:

1. Complete punch list items, before requesting Engineers inspection for final acceptance and final payment as required by General Conditions. List known exceptions, if any, in request.

B. Final Payment Application:

1. Administrative actions and submittals which must precede or coincide with submittal of final payment application for payment include:
    a. Completion of Work:
        1) Completion of Project requirements.
        2) Completion of items specified for completion after Substantial Completion.
        3) Assurance that work not complete and accepted will be completed without undue delay.
        4) Final cleaning.
    b. Transfer of Site to Owner:
        1) Removal of temporary facilities and services.
        2) Removal of surplus materials, rubbish, similar elements.
    c. Submittals:
        1) Consent of Surety (if Performance Bond provided).
        2) Assurance that unsettled claims will be settled.
        3) Transmittal of required project construction records (as-built drawings, etc.) to Owner.
        4) Certified copy of Engineers final punch list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by Engineer.
        5) Evidence of final, continuing insurance coverage complying with insurance requirements.
    d. Final payment request including certificates of insurance for products and completed operations where required.
        1) Updated final statement, accounting for final additional changes to Contract Sum.
        2) Final liquidated damages settlement statement, acceptable to Owner.

C. Reinspection Procedure:

1. Engineer will reinspect work upon receipt of notice that work, including punch list items resulting from earlier inspections, has been completed, except for items whose completion has been delayed because of circumstances that are acceptable to Engineer

will either prepare a certificate of final acceptance, or will advise Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance. If necessary, reinspection procedure will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

A. Record Drawings:

1. Submit to Engineer a set of record prints marked to show "As-Built" conditions for work of contract.

2. Contractor shall clearly mark each item to record actual construction including:
   a. Measured horizontal and vertical locations of underground utilities and appurtenances.
   b. Field changes of dimension and detail.
   c. Details not contained in original contract documents.
3. Contractor shall ensure record documents are complete and accurate enabling future reference by the Owner.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

SECTION 01 78 36

WARRANTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

B. Related Sections
1. Applicable provisions of the General Conditions shall govern terms of the Contractor's special warranty of workmanship and materials.
2. Section 01 77 00, Closeout Procedures.
3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 through 16.

C. Disclaimers and Limitations
Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.02 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.03 WARRANTY REQUIREMENTS

A. Starting date for all warranties shall be the date of Substantial Completion as indicated on Certificate of Substantial Completion, except that warranties for work completed after the date of substantial completion shall begin on date of acceptance of such work by the Owner.

B. Related Damages and Losses
When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. Replacement Cost
Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Document. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse
Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

A. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Prepare warranties as various components of the project are completed.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

- END OF SECTION -

02

DIVISION 02

EXISTING CONDITIONS

SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: All demolition, removal, and salvage work as shown on the drawings or specified herein.

B. Related Sections and Divisions
1. Applicable provisions of Division 1 shall govern work in this section.
2. Section 01 11 00, Special Provisions.
3. Section 01 32 19, Submittals.
4. Section 02 41 13.23, Abandonment and Grouting Existing Pipelines.
5. Section 31 05 13, Soils and Aggregates.
6. Section 40 05 13.10, Buried Piping and Appurtenances.
7. Section 40 05 15, Methods and Materials for Process Piping: Exposed.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals
1. Permits and notices, if required, authorizing building demolition.

1.03 QUALITY ASSURANCE

A. Contractor shall perform demolition, removal, and salvage in conformity with applicable federal, state, and local safety practices and code requirements.

1.04 SEQUENCE

A. No demolition, removal, or salvage work shall commence until approval to proceed has been granted by Owner. Such work shall be completed in accordance with the construction sequence included in Section 01 11 00, Special Provisions and in accordance with the construction phases of this project and work to be done by other contractors.

B. Contractor shall proceed with demolition in a systematic manner to ensure the continuing operation and protection of all utilities and mechanical and electrical equipment. All electrical and instrumentation equipment shall remain in operation unless noted in Section 01 11 00, Special Provisions.

PART 2 - PRODUCTS

2.01 GENERAL

A. Compacted fill shall meet the requirements of Section 31 05 13, Soils and Aggregates.

B. Pipe fittings and materials shall meet the requirements of Section 40 05 13.10 - Buried Piping and Appurtenances and Section 40 05 15 – Methods and Materials for Process Piping Installation: Exposed.

PART 3 - EXECUTION

3.01 PRECAUTIONS

A. Conduct demolition, operations and removal of debris to ensure minimum interference with streets, walks, and other adjacent occupied or used facilities.

B. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the governing agencies and/or the Engineer. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Provide barricades to ensure the safe passage of persons around the area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, trees and shrubbery not noted to be removed.

D. Provide interior and exterior shoring, bracing, or other support to prevent movement, settlement, or collapse of the structures to be removed and to protect the adjacent facilities, which are to remain.

E. The Contractor shall be responsible for having the appropriate utility turn off all services before demolition.

F. Maintain existing utilities not noted to be removed. Keep them in service and protect against damage during demolition.

G. Use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air, to the lowest level of air pollution practical for the condition existing prior to the start of the work. Prevent construction debris from entering any tankage, drains, or piping adjacent to the work. Tankage drains and piping shall be promptly cleaned of any debris.

3.02 BREAKING DOWN AND REMOVING STRUCTURES

A. General

1. All existing structures, with all attached parts and connections, shown on the drawings or specified to be removed, or that interfere with the new construction, shall be entirely removed within the limits shown or specified, unless otherwise provided.
2. When a portion of an existing structure is to be retained, Contractor shall take care during construction operations so as not to impair the value of the retained portion.
    a. Complete all operations necessary for the removal of any existing structure, which might endanger the new construction, prior to the construction of the new work.
    b. Do not use any equipment or devices, which might damage structures, facilities, or property which are to be preserved and retained.
    c. Existing reinforcing steel shall be removed to 1-inch below surface and repaired with non-shrink grout plug surfacing to match existing.

B. Pavement, Curb, Gutter, Sidewalk, Driveways, Crosswalk, and Similar Structures

1. Where portions of the existing structure are to be left in the surface of the finished work, Contractor shall remove the structure to an existing joint, or saw and chip the structure to a true line with a face perpendicular to the surface of the existing structure.
2. Sufficient removal shall be made to provide for proper grades and connections in the new work.

C. Manholes, Inlets, and Catch Basins
1. Any live sewers connected with them shall be rebuilt and properly reconnected, unless otherwise provided.
2. Satisfactory by-pass service shall be maintained during construction operations.

D. Walls, Piers, Surface Drains, Foundations, and Similar Masonry Structures
1. Remove entirely or break down to an elevation at least 2 feet below the earth subgrade within the areas of a road bed and elsewhere to 2 feet below the finished slopes or natural ground, as the case may be.
2. Remove existing construction as required to clear new construction.

E. Pipe Culverts
1. Remove entirely all culverts that are to be removed.
2. Remove sidewalls or substructure units in water to an elevation no higher than the elevation of the natural stream or lake bed.
   a. Where grading of the channel is required, remove such units to the proposed finished grade of the stream or lake bed.
   b. Remove all other endwalls or substructure units down to at least 2 feet below natural or finished ground line, as the case may be.
3. Where existing culverts are to be extended or otherwise incorporated into the new work, remove only such part or parts of the existing culvert as necessary to provide a proper connection to the new work.
4. Remove pipe culverts designated for salvage in a manner that will preclude damage to the culverts.

3.03 ABANDONING STRUCTURES

A. Tanks, Manholes, Catch Basins, and Inlets:
1. Contractor shall thoroughly clean structures to be abandoned.
2. Contractor shall plug existing pipe connections with brick or concrete block masonry or with any grade of concrete having a 28-day compressive strength in excess of 2000 psi.
3. Contractor shall remove the walls of the structures to an elevation at least 2 feet below the finished grade line, or to such elevation that may be designated on the drawings or as necessary to clear new construction.

3.04 ABANDONING AND REMOVING UTILITIES AND UNDERGROUND PROCESS PIPING

A. Contractor shall be responsible for the turning off or unhooking of all utilities and process piping before starting the demolition work. Remove all utility lines, including electrical services and process piping that are shown or specified to be removed. Remove utility lines and process piping that are to be abandoned as needed to clear new construction.

B. Utility lines and process piping shown or specified to be abandoned that are exposed by excavation shall be abandoned in accordance with Section 40 05 13.10.

3.05 WELL ABANDONMENT

A. Wells, test wells, and temporary wells to be abandoned either temporarily or permanently shall be sealed with material and procedures required by governing authority.

B. A report shall be made to the governing authority for every well which has been abandoned or temporarily removed form service and include:
   1. Detailed description of location, construction, and geologic features.
   2. Method of sealing.

3.06 EQUIPMENT

A. Contractor shall remove all equipment specified herein or indicated.

B. Contractor shall remove associated exposed conduit, power wiring, controls, switches, instrumentation, control wiring, control boxes, appurtenances and their supports serving equipment to be removed. Electrical items shall be removed to their junction with motor control center, control panel, or their junction with conduit serving other equipment that is to remain.

C. Contractor shall remove all piping and appurtenances and their supports serving equipment indicated to be removed. Piping shall be removed to its junction with the main service header serving other equipment that is to remain or new equipment as indicated. Remaining piping and tubing shall be fitted with an appropriate blind flange or plug and insulated as required.

D. Contractor shall remove equipment bases, anchor bolts and other supports serving equipment to be removed. Concrete bases shall be removed to 1-inch below floor elevation and repaired with non-shrink grout plus surfacing to match existing.

E. Contractor shall patch floors, walls and ceilings as required to match existing or as indicated where equipment, piping, electrical, bases, or any supports are removed.

3.07 INTERIOR PIPING AND APPURTENANCES

A. Contractor shall remove all piping and appurtenances serving and part of the major equipment and systems indicated on the drawings. The location and elevations of existing piping are approximate.

B. Contractor shall remove all supports for piping and appurtenances indicated to be removed. Re-piping and connections to new piping shall be as specified for new piping. Remaining piping and tubing, not reconnected for new piping, shall be fitted with an appropriate blind flange or plugged and insulated as required.

C. Contractor shall patch all holes resulting from removal of piping, appurtenances and their supports. Patching of concrete shall be with non-shrink grout and as indicated ' Patching of masonry shall be with matching material toothed in. Patch other material, as indicated.

3.08 SALVAGE

A. Owner has first right of refusal to all material, piping, and equipment removed.

B. All equipment, material, and piping except as specified hereinafter, within the buildings and structures to be demolished and additional items as noted shall be removed by Contractor. Contractor shall inspect each structure and determine the type and amount of equipment, materials, and piping to be removed.

C. All equipment, material and piping except as specified hereinafter, within the limits of the demolition, and additional items noted to be removed will become the property of Contractor, if Owner does not claim under first right of refusal, and shall be removed from the project site.

3.09 BACKFILL

A. Contractor shall fill all abandoned structures and excavations resulting from removal of structures and utilities with compacted fill using Soil Class D-3.

B. Prior to filling, Contractor shall break one opening in the floor or wall near the base of each compartment to allow groundwater to freely migrate through the structure.

3.10 ASBESTOS REMOVAL

A. Demolition, removal and disposal of all asbestos material will require special procedures. The Contractor shall comply with all Federal, State and Local Codes, regulations or ordinances that regulate or control the demolition, removal and disposal of asbestos materials, including but not limited to, Codes of Federal Regulations of 40 CFR s.61.22.(d), 40 CFR Part 763, and 29 CFR 1926.58. Disposal of asbestos materials shall be limited to State of Wisconsin, Department of Natural Resources licensed landfills.

3.11 DAMAGES

A. As directed by the Engineer and at no cost to the Owner, promptly repair damages caused to adjacent facilities, landscaping, or properly by the demolition operations.

3.12 CLEAN-UP

A. Contractor shall remove from the site all debris, rubbish and other materials resulting from the demolition operation. Storage or sale of removed materials will not be permitted on site.

B. Do not burn materials from demolished structures on site.

- END OF SECTION -

SECTION 02 41 13.23

ABANDONMENT AND GROUTING EXISTING PIPELINES

PART 1 – GENERAL

1.01 SUMMARY

A. Work Included: This section provides for grouting of existing pipelines to be abandoned in place, as shown on the drawings.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 01 32 19, Submittals.
   3. Section 31 05 13.20, Soils and Aggregates.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards.

B. American Concrete Institute (ACI) Standards.

C. State of Wisconsin Department of Transportation, Division of Highways; Standard Specifications for Highway and Structure Construction, latest edition.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals including the following:
   1. The contractor shall submit manufacturer's data for all cement grout mixtures.
   2. One copy of all test reports.

PART 2 - PRODUCTS

2.01 CEMENT

A. Portland Cement shall conform to ASTM C150.

B. Portland cement shall be Type I, Type II, or Type III Portland Cement.

2.02 AGGREGATE

A. Aggregate shall conform to ASTM C33.

B. Aggregate shall consist of clean, hard, durable sand and crushed rock, crushed gravel, or gravel. Coarse aggregate shall conform to Soil Class B-3.

2.03 MIX DESIGN

A. All grout shall have a compressive strength of not less than 2000 psi at 28 days when tested in accordance with ASTM C109 or ASTM C579, as applicable.

B. Minimum bags of cement/cubic yard: 2.25

C. Slump: Sufficient to fill all voids.

PART 3 – EXECUTION

3.01 PLACEMENT

A. Contractor shall notify Engineer of grout placement schedule one day in advance of pour to allow for scheduling of inspection.

B. All abandoned pipelines shall be completely filled with grout.

C. Once placing operation commences, it shall be carried out as a continuous operation until a section is completed.

D. The Contractor shall be required to prepare the ends of pipes with pipe caps, vents, and fill pipes.
   1. The low end of the pipe shall be capped and provided with a 4-inch diameter vent to permit the escape of air while filling. The ends shall be adequately restrained to support the head of grout during filling and curing.
   2. The upper end of the pipe shall be capped and provided with a vertical fill pipe and minimum 4-inch diameter vent.

E. Placing should be carried on in such manner that the grout in the pipeline is still plastic and can be integrated with fresh grout.

F. Grout shall not be placed in water. Water level shall be removed or lowered in a manner approved by Engineer.

G. Grout shall be placed before initial set has occurred. Excess water will not be permitted.

H. Where chutes are used to transport grout, they shall be of metal or wood with metal lining. They should have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials. The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the fill pipe.

I. Grout shall not fall freely more than 4 feet. Elephant trunks and/or tremies shall be used to prevent free fall of the grout and to allow the grout to be placed.

J. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity.

3.02 CURING AND PROTECTION

A. All freshly placed grout shall be protected from damaging effects of the elements such as freezing, rapid drop in temperature and loss of moisture.

PART 4 MEASUREMENT AND PAYMENTS

4.01 Work under this section shall be incidental to the project or paid for as shown in the bid schedule.

- END OF SECTION -

03

DIVISION 03

CONCRETE

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section covers the work necessary to furnish and install, complete, concrete formwork as specified herein.

1.02 SUBMITTALS

A. Shop Drawings: Furnish the following:
   1. Alternate Form Ties – Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.
   2. Samples: Prior to start of work, submit one sample each as follows:
      a. Form liners.
      b. Form ties.

1.03 SEQUENCING AND SCHEDULING

A. Schedule work for embedded, buried, or other items of work that affects form layout before completing concrete formwork.

PART 2 – PRODUCTS

2.01 FORM MATERIAL

A. Wall Forms:
   1. General:
      a. Form Surfaces: In "new and undamaged" condition of either plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel of sufficient strength and surface smoothness to produce specified finish.
      b. Concrete Finish Requirements: As specified in Section 03 31 13, Concrete.
      c. Design joints in forms to remain watertight and withstand placing pressures without bulging outward or creating surface patterns.
      d. Do not use formwork that leaks mortar.
      e. Where poor formwork is used and finish obtained is less than specified, upgrade finish to an acceptable finish at no additional cost.
      f. Panel Deflections: Limit as required to achieve tolerances specified herein.
   2. Circular Structures:
      a. Forms shall conform to circular shape of structure.
      b. Straight panels may be substituted for circular forms if they do not exceed 2 feet in width and in addition to the requirements, each panel does not provide an angular deflection more than 3-1/2 degrees per joint, and do not conflict otherwise with these Specifications and/or Drawings.
   3. Rustications and Corner Strips: Non-absorbent material, compatible with form surface, fully sealed on all sides, to prohibit loss of paste or water between the two surfaces.
   4. Form Sealer:
      a. Manufacturer:
         1) Burke Co., Burke Uni-Kote.

2) Grace construction Materials Co., FormFilm.
3) Sternson Construction Products, Formaseal.
4) Or equal.

B. Column Forms:
1. Rectangular Columns: As specified for walls.

C. All Other Forms: Materials as specified for wall forms, unless otherwise approved by Engineer.

2.02 FORM DESIGN AND WINDOWS

A. General:
1. Design formwork prior to fabrication, placing order, or use on jobs.
2. Design shall account for tolerances, form ties, finishes, architectural features, rebar supports, construction joint locations, and other non-structural formwork requirements specified.
3. Design formwork strong enough to hold high liquid heads without form distortion and to meet tolerances as specified herein. Coordinate form design with admixture company information and concrete slump.
4. Forms for walls shall contain pouring and observation windows to allow placement of concrete through windows or staged to allow visual observation at all times of fresh concrete to ensure correct placement and vibration.
5. Free Fall Limit of Concrete: As specified in Section 03 31 13, Concrete.
6. Structurally design forms, falsework, shoring, and other structural formwork and meet applicable safety regulations, current OSHA regulations, and other codes.
7. An engineer registered in State of Wisconsin shall prepare formwork, falsework, and shoring designs to meet these Specifications and to meet all federal and state requirements.
8. Make designs available to any governing agency upon request.
9. Meet applicable portions of ACI 347, ACI 318 current edition, and these specifications.

2.03 REINFORCING SPACERS AND REBAR SUPPORTS

A. Columns:
1. Provide a positive plastic tipped or stainless steel spacer between column reinforcing and column forms to ensure adequate cover.

B. Walls: Provide a positive spacer between wall reinforcing and wall forms to ensure adequate cover.

C. Floors and beams: Provide a positive plastic tipped or stainless steel support between reinforcing and slab or beam forms. Provide supports with sand plates supporting reinforcement for slabs on grade.

2.04 FORM TIES

A. General:
1. Inserts:
a. Conical or spherical type inserts.
b. Fixed so they remain in contact with forming material.
c. Construct so no metal is within 1 inch of concrete surface when forms, inserts, and tie ends are removed.

2. Do not use wire ties.
3. Ties shall withstand form pressures and limit form deflection to specified tolerances.
4. Flat bar ties for panel forms shall have plastic or rubber inserts with minimum 1-inch depth and sufficient dimensions to permit proper patching of tie hole.

B. Water Stop Ties:
1. Provide for water-holding structures or dry structures with access such as basements, pipe tunnels, etc., that are below finish grade or whose wall is common to water holding basin or channel.
2. Ties shall have either an integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie, or neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2 diameter of snap tie, or a molded plastic water stop of comparable size.
3. Flat snap ties meeting these Specifications may be provided.
4. Water Stop: Considerably larger in area than tie cross sectional area, oriented perpendicular to tie and symmetrical about center of tie.
5. Construct ties to provide positive means of preventing rotation or disturbance of center portion of tie during removal of ends and prevent water leaking along tie.

C. Alternate Form Ties – Through-Bolts:
1. Form ties consisting of tapered through-bolts as shown with minimum 1 inch in diameter at smallest end, or through-bolts utilizing a removable tapered sleeve of same minimum size may be provided as an option. Through hole requires preparation of concrete surface prior to patching; see detail.
2. Elastic Vinyl Plug:
   a. Size to allow insertion using insertion tool to elongate plug, place it at correction location, and allow plug to return to original length and diameter upon removal to form watertight seal.
   b. Manufacturer:
      1) Dayton Sure-Grip and Shore Co., Miamisburg, OH, Dayton Sure Plug.
      2) Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:
1. Notify engineer one full working day prior to concrete placement so forms can be inspected.
2. Correct deflective work found in Engineer's inspection, prior to delivery of concrete.

B. Wall Forms:
1. Do not reuse form surfaces that have been damaged and are no longer in smooth "new and undamaged" condition unless otherwise approved in writing.
2. Provide specified smooth form surfaces meeting tolerance requirements prior to each reuse.

C. Forms to Support Form Liners For Architectural Concrete:
1. Build of materials and in a manner that is sufficiently rigid and strong to withstand, without excessive deflection, movement, or leakage, high hydraulic pressures resulting from rapid filling and heavy-high frequency vibration.

2. Limit deflection in formwork to 1/360 of each component span and tolerances specified herein.
3. Lay out form joints in a uniform pattern or as shown.

D. Form Ties:
1. Locate on exposed surfaces in uniform pattern or as shown.
2. Construct so tie remains embedded in wall, except for removable portion at each end.

3.02 FORM TOLERANCES

A. General:
1. Surface, design, and construct forms to meet ACI 318 and the following minimum tolerances for specified finishes.
2. Failure of forms to produce specified tolerances will be grounds for rejection of concrete work. Upgrade concrete finish or replace to meet specification requirements.

B. Wall Tolerances:
1. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance as specified herein.
2. Surface Finish: As specified in Section 03 31 13, Concrete.
3. Wall Type W-T1:
   a. Plumb within 1/4 inch in any 10 feet or within 1 inch in entire height from top to bottom for walls over 40 feet high.
   b. Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in any direction or at any location.
   c. Wall Thicknesses: Maximum 1/4-inch minus or 1/2 inch plus from dimension shown.
4. Wall Type W-T2:
   a. Plumb within 1/4 inch in any 10 feet or within 1/2 inch in entire height from top to bottom for walls over 20 feet high.
   b. Depressions In Wall Surface: Maximum 1/8 inch when 10-foot straightedge is placed on high points in any direction or at any location.
   c. Wall Thicknesses: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.

C. Slab Tolerances:
1. Exposed Slab Surfaces: Comprise of flat planes as shown or as required within tolerances specified herein.

2. Slab Finish Tolerances and Slope Tolerances: Floor surface shall not have crowns so high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow a block of twice the tolerance in thickness to pass under the supported 10-foot straightedge.
   a. Slab Type S-T1: Steel gauge block thicknesses shall equal 5/16 inch.
   b. Slab Type S-T2: Steel gauge block thicknesses shall equal 1/8 inch.
3. Slab Type S-F1 and S-F2:
   a. Finish Slab Elevation: Within 1/2 inch of elevation specified except slabs which are designed and detailed to drain to floor drain or gutter shall adequately drain regardless of tolerances.
   b. Repair floor slopes in an approved manner if necessary to provide complete drainage.
   c. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown.

D. Beams and Columns Tolerances:
   1. Exposed Straight Horizontal and Vertical Surfaces: Flat planes within specified tolerances.
   2. Beam Type B-T1:
      a. Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
      b. Elevations: Within 1/2 inch plus or minus except where tops of beams become part of finished slab. In this case, refer to slab tolerances.
   3. Column Type C-T2:
      a. Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
      b. Plumb within 1/4 inch in any 10 feet with maximum 1/2 inch out-of-plumb at top with respect to bottom.

E. Forms for Sidewalks and Driveways:
   1. Standard steel forms or wood forms constructed and fastened to prevent movement.
   2. Set forms to true lines and grades, and securely stake in position.

3.03 FORM SURFACE PREPARATION

A. Thoroughly clean form surfaces in contact with concrete of previous concrete, dirt, and other surface contaminants prior to coating surface.

B. Exposed Wood Forms in Contract with Concrete: Apply two full coats of specified form sealer.

C. Steel Forms:
   1. Sandblast or otherwise remove mill scale and other ferrous deposits from contact surface of forms.
   2. Coat contact surfaces of forms with release agent.
   3. Release Agent: Prevent discoloration of concrete from rust, and nontoxic after 30 days.

3.04 BEVELED EDGES (CHAMFER)

A. Form 3/4-inch bevels at concrete edges, unless otherwise shown.

B. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Engineer's approval of size prior to placement of bevel form strip.

3.05 FORM REMOVAL

A. Contractor shall assume responsibility for damage resulting form improper and premature removal of forms.

B. Satisfy applicable OSHA requirements with regard to safety of personnel and property.

C. Leave forms and shoring for elevated structural slabs or beams in place in accordance with ACI 318, Chapter 6, and until concrete has reached compressive strength equal to specified 28-day compressive strength as determined by test cylinders.

D. Do not remove supports and reshore prior to obtaining adequate field cured cylinder results.

3.06 CONCRETE FINISHES

A. As specified in Section 03 31 13, Concrete.

3.07 BACKFILL AGAINST WALLS

A. Do not backfill against walls until concrete has obtained compressive strength equal to specified 28-day compressive strength.

B. Place backfill simultaneously on both sides of wall, where, required to prevent differential pressures.

3.08 FIELD TESTS

A. Wall Finish Tolerances: Test for compliance with tolerances as specified.

B. Slab Finish Tolerances and Slope Tolerances:
   1. Floor flatness measurements will be made the day after floor is finished and before shoring is removed, to eliminate effects of shrinkage, curling and deflection
   2. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
   3. Compliance with designated limits in four of five consecutive measurements is satisfactory unless obvious faults are observed.
   4. A check for adequate slope and drainage will also be made to confirm compliance with these Specifications.

3.09 MANUFACTURER'S SERVICES

A. Form Liner Manufacturer: Provide manufacturer's jobsite representative to assist with proper methods of application and use of form liner.

PART 4 – MEASUREMENT AND PAYMENT

4.01 LUMP SUM ITEMS

A. Payment for work in this Section will be included as part of the lump sum bid.

- END OF SECTION -

SECTION 03 21 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Work includes furnishing, fabricating, and erecting all steel and fibers required for reinforcement of cast in place concrete as shown on the drawings.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 03 31 13, Cast In Place Concrete.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM A82 Steel Wire, Plain, for Concrete Reinforcement
2. ASTM A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
3. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. American Concrete Institute (ACI):
1. ACI 315 Manual of Standard Practices for Detailing Reinforced Concrete Structures.
2. ACI 318 Building Code Requirements for Structural Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI Manual of Standard Practice

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
1. Before proceeding with the fabrication of the reinforcement, submit shop drawings showing the number, size, length, bending and arrangement of the reinforcement.
2. All shop drawings shall be in accordance with ACI 315.
3. Quality control submittals, when requested shall consist of a certified copy of each heat analysis performed by producer and certified copies of reinforcement strength tests.

1.04 PRODUCT HANDLING

A. Delivery:
1. The reinforcement shall be delivered to the site bundled, tagged and marked.
2. Metal tags indicating the bar size, lengths, and other pertinent information corresponding to markings shown on placement drawings shall be used.

B. Storage:

1. The reinforcement shall be stored at the site in a manner to prevent damage and accumulation of dirt and excessive rust.
2. Protect reinforcing steel and welded wire fabric from surface contamination and from distortion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing bars shall comply with ASTM A615, Grade 60, deformed. Reinforcing bars required to be welded shall be ASTM A 706 low alloy.

B. Steel wire shall conform with ASTM A82, plain, cold-drawn steel.

C. Welded wire fabric shall comply with ASTM A 185, welded steel wire fabric.

D. Reinforcement supports including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement shall be:
1. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI manual.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
4. When the supports bear directly on the ground and it is not practical to use steel bar supports, precast concrete blocks may be used to support the bottom lift of the reinforcement. The precast blocks must be solid and of a higher strength than the concrete being placed. The blocks must provide adequate support to the reinforcement and be of proper height to provide reinforcing cover. The use of face brick, hollow concrete block, rocks, wood or other unapproved objects will not be permitted.

E. Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs shall comply with ASTM C1116, Type III. Fibers shall be not less than ¾-inch long or greater than 1½-inch long as manufactured by Fibermesh or equal.

2.02 FABRICATION

A. General:
1. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances which comply with CRSI manual.
2. In case of fabrication error, do not rebend or straighten reinforcement in a manner that will weaken the material.
3. Unless otherwise noted, all end hooks dimensions shall conform with ACI standard hooks.

B. Reinforcement with any of the following defects will not be permitted:
1. Bar lengths, depths, and bends exceeding the specified tolerances.
2. Bend or kinks not indicated on the drawings or final shop drawings.
3. Bars with reduced cross section due to excessive rusting or other causes.

C. Fabricate to dimensions shown on plans and ACI 318.

PART 3 - EXECUTION

3.01 PLACING REINFORCEMENT

A. General
Comply with the CRSI Manual's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
1. Avoiding cutting or puncturing vapor retard/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
2. Bars partially embedded in concrete shall not be field bent except as shown on the plans or permitted by the Engineer.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Polypropylene fiber reinforcement for slabs may be used in lieu of WWF with engineer’s approval. Use fiber reinforcement at a minimum rate of 1.5 pounds fiber per batch yard of concrete or greater if required by fiber manufacturer.

- END OF SECTION -

SECTION 03 21 10

EXPANSION AND CONTRACTION JOINTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes providing expansion and contraction in joints in cast-in-place concrete.

B. Related sections and divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 01 32 19, Submittals.
   3. Section 03 31 13, Cast-In Place Concrete.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. ASTM D1752 Spec. for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. American Concrete Institute (ACI):
   1. ACI 302.1 Guide for Concrete Floor and Slab Construction

1.03 QUALITY ASSURANCE

A. Material Testing
   1. Production testing.
      a. Contractor shall require the joint producer to perform the necessary testing of joint fillers to demonstrate conformity with applicable specifications.
      b. All costs associated with production testing shall be considered incidental to furnishing of joint filler and as such will not be paid for separately.
   2. Field testing.
      a. The Contractor shall furnish all samples and shall afford such facilities as may be required for forwarding them for testing without charge to Owner.
      b. All laboratory costs associated with testing shall be paid for by Owner except as follows in which case they will be the responsibility of the Contractor.
         1) Failure of the material to meet the job specification, thus necessitating a retesting.
         2) Additional testing because of a change in material that may have previously been tested and accepted.
         3) Testing to be performed by an independent testing agency approved by Owner.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
   1. Provide two (2) copies of producer's certification that supplied materials meet requirements of applicable specifications.
   2. Materials.

a. Submit samples of each type of joint filler to be used, when requested by Owner's Representative.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Joint Fillers
   1. ASTM D1752, Type I and II as shown on the plans.

B. Expansion joints shall have ½-inch thick cork expansion joint filler meeting ASTM D1752 – Type 1 or 111 produced by W. R. Meadows, or equal.

C. Expansion joints in exterior concrete walks, slabs on grade, and other structures shall be ½-inch thick asphalt expansion joint filler meeting ASTM D994 produced by W. R. Meadows, or equal.

PART 3 - EXECUTION

3.01 EXPANSION JOINTS

A. Location and geometry of expansion joints shall be as shown on plans, or according to the following criteria.
   1. At right angle or tee intersections.
   2. At walkway and stoop intersections.
   3. Where walkways adjoin vertical surfaces.
   4. Where walkways adjoin existing pavements.
   5. Maximum spacing 100 feet unless otherwise noted on plans.
   6. At 300 feet intervals and points of radius on curb and gutter.
   7. Where depth of concrete changes.

B. Extend filler full width and depth of concrete, with top slightly below finished surface of concrete.

3.02 CONTRACTION JOINTS

A. Location
   1. Locate contraction joints where shown on plans, or according to the following criteria for non-structural slabs:
      a. Floors.
         1) Column spacing 25 feet or less - maximum 25 feet spacing each way.
         2) Column spacing more than 25 feet - maximum 15 feet spacing each way.
         3) Joints shall be laid out from column to column with diamond shape at columns in center of floor or triangle at column at end of floor.
      b. Slabs on grade.
         1) Slab width 20 feet or less - use slab width as maximum allowable spacing.
         2) Slab width more than 20 feet - maximum 20 feet spacing each way.
      c. Locate no contraction joint less than 5 feet from any other joint.
      d. Locate joints to match like joints in previously constructed adjacent slabs.
         1) If joints are formed in section, there shall be no offsets or concrete struts between adjacent joints.
         2) Take into consideration location of equipment bases and similar separately placed sections.

3) Unless shown otherwise on plans, joints shall not deviate more than five degrees from a right angle measured at intersecting joints and at slab edges.
4) No joint shall deviate more than ½ inch from a straight line.

2. Locate contraction joints every 10 lineal feet of curb and gutter.

B. Dimensions of Contraction Joints.
1. Depth.
a. Minimum 1 inch or 1/5 of slab depth, whichever is greater.
2. Width.
a. Minimum 1/8 inch for sawed joints, ¼ inch for other types.
b. Maximum ¼ inch for sawed joints, 3/8 inch for other types.

C. Criteria for Joint Selection.
1. Sealed joint.
a. Methods.
1) Tooled joint.
2) Strip-formed joint.
b. Use sealed joints only where shown on plans.
2. Open joint.
a. Methods.
1) Tooled joint.
2) Sawed joint, only where shown on plans.

D. Formation of Tooled Joints
1. Insert a metal parting strip into concrete after it has been struck off and consolidated, and while concrete is still plastic.
2. Remove strip when concrete is able to retain its shape.

E. Formation of Sawed Joints
1. Conform to ACI 302.1.
2. Saw joints as soon as practicable after concrete has set sufficiently to preclude raveling during sawing and before any shrinkage cracking takes place in concrete.

F. Formation of Strip-Formed Joints
1. Use plastic joint former with removable top portion.
2. Remove upper portion of strip, after concrete has sufficiently hardened, in such a manner as to prevent damage to surface of slab.

- END OF SECTION -

SECTION 03 31 13

CAST-IN-PLACE CONCRETE--STRUCTURES

PART 1- GENERAL

1.01 SUMMARY

A. Work Included:
1. All cast-in-place concrete materials and work.
2. Concrete admixtures.
3. Formwork for cast-in-place concrete.
4. Cleaning and finishing of formed surfaces.
5. Required testing and submittals.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern work in this section.
2. Section 01 32 19, Submittals.
3. Section 03 11 00, Concrete Form Work.
4. Section 03 21 00, Concrete Reinforcement.
5. Section 03 21 10, Expansion and Contraction Joints.
6. Section 03 15 13, Waterstops.
7. Section 03 36 00, Watertightness Test for Cast-In Place Concrete Tanks.
8. Section 03 60 00, Grout.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1.	ACI 211.1	Selecting Proportions for Normal and Heavy Weight Concrete.
2.	ACI 301	Specification for Structural Concrete for Buildings.
3.	ACI 302.1	Guide for Concrete Floor and Slab Construction.
4.	ACI 304	Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
5.	ACI 305	Hot Weather Concreting.
6.	ACI 306	Cold Weather Concreting.
7.	ACI 308	Standard Practice for Curing Concrete.
8.	ACI 309	Standard Practice for Consolidation of Concrete.
9.	ACI 318	Building Code Requirements for Reinforced Concrete.
10.	ACI 347	Recommended Practice for Concrete Formwork.

B. American Society for Testing and Materials (ASTM):

1.	ASTM C31	Making and Curing Concrete Test Specimens in the Field.
2.	ASTM C33	Concrete Aggregates.
3.	ASTM C39	Compressive Strength of Cylindrical Concrete Specimens.
4.	ASTM C42	Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5.	ASTM C94	Ready-Mixed Concrete.
6.	ASTM C143	Test for Slump of Portland Cement Concrete.
7.	ASTM C150	Portland Cement.
8.	ASTM C158	Test for Water Retention by Concrete Curing Materials.
9.	ASTM C171	Standard Specification for Sheet Materials for Curing Concrete.

10. ASTM C172 Standard Test Methods for Sampling Fresh Concrete.
11. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C164 Test Methods for Temperature of Freshly-Mixed Portland Cement Concrete.
13. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C260 Air Entraining Admixtures for Concrete.
15. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C494 Chemical Admixtures for Concrete.
17. ASTM C618 Fly Ash and Raw or Calcified Natural Pozzolans for Using Portland Cement Concrete.
18. ASTM C1107 Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
19. ASTM D994 Preformed Expansion Joint Filler for Concrete.
20. ASTM E329 Standard Recommended Practice for Inspection Testing Agencies for Concrete, Steel, and Bituminous Materials as used in Construction.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 32 19, Submittals.

B. Submit the following information:
1. Gradation of fine and coarse aggregate – ASTM C33.
2. Specific gravity and dry rodded density of each aggregate.
3. Test of deleterious substances in fine and coarse aggregate – ASTM C33.
4. Design mix for all mixes.
5. 7 and 28-day compressive strengths for each concrete mix proposed.
6. Certified mill test results for cement identifying brand, type, and chemistry of cement.
7. Brand, type, principal ingredients and amount of each admixture.
8. Field quality control test results.

PART 2 - PRODUCTS

2.01 FORMWORK

A. Form work shall be as specified in Section 03 11 00, Concrete Formwork.

2.02 PORTLAND CEMENT

A. Portland cement shall conform to ASTM C150 and shall be Type I. Type III may be used only when approved by the Engineer. All Portland cement shall be from one supplier and mill.

2.03 FLY ASH

A. Fly ash shall conform to ASTM C618, Class C or F. Loss on ignition shall not exceed 5 percent.

2.04 ADMIXTURES

A. No admixtures shall contain calcium chloride, thiocyanates or more than 0.05% chloride ions. Written certification of these requirements by the admixture manufacturer shall be submitted to the Engineer for approval with the mix design.

B. Air-Entraining Admixture

ASTM C260 for exterior permanently exposed normal weight concrete and for all vehicular use areas; 5% to 7.5% as measured with air meter conforming to ASTM C173 or ASTM C231.

C. Water-Reducing Admixture

Use ASTM C494 Type A. To be used unless noted. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water and shall be limited to produce no detrimental effect on other components, such as metal deck, reinforcing, metal conduit, and shall be verified by supplier. Follow the manufacturer's recommendations. Products shall be equal to:

"Pozzolith 220 N", Master Builders
"WRDA 82", W. R. Grace

D. Water-Reducing Retarding Admixture

ASTM C494 Type D. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water. Use only if acceptable to the Engineer. Products shall be equal to:

"Pozzolith 220 N", Master Builders
"Daratard 17", W. R. Grace

E. Non-Corrosive, Non-Chloride Accelerator

ASTM C494, Type C or E. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water. Product shall have been subjected to long-term testing (3 years duration, minimum), using an acceptable accelerated corrosion test method such as that using electrical potential measures. Use only if acceptable to the Engineer. Products shall be equal to:

"Pozzutec 20", Master Builders
"Daraset 20", W. R. Grace

F. High Range Water Reducing Admixture (Superplasticizers)

ASTM C494 Type F or G. Chloride ion content of admixture shall not exceed chloride ion content of municipal drinking water and shall be limited to produce no detrimental effect on other components, such as metal deck, reinforcing, metal conduit, and shall be verified by supplier. Use only if acceptable to the Engineer. Products shall be equal to:

"Rheobuild 1000", Master Builders
"Daracem-100", W. R. Grace

2.05 WATER

A. Water shall be clean and free from deleterious amounts of acids, oils, alkali, organic matter and mineral substances.

2.06 WATERSTOPS

A. Polyvinyl chloride (PVC) waterstops shall be as specified in Section 03 15 13.

2.07 CURING MATERIALS

A. Liquid Applied
   1. Liquid Membrane –Sonneborn Kure-N-Seal 25LV or equal. Apply upon completion of concrete finishing or form removal.

B. Sheet or Membrane
   1. Plastic film, ASTM C171:
      a. 10 mil thickness
      b. White during warm weather.
      c. Black during cold weather.
   2. Reinforced paper, ASTM C 17 1.
   3. Cotton mats, FS DDD-M-148.

2.08 CONCRETE SPECIALTIES

A. Vapor Barrier
   1. Vapor barrier shall be 6 mil polyethylene with joints lapped 6 inches and taped with a waterproof tape.

B. Bonding Agents
   1. Epoxy resin bonding compounds shall be Concresive liquid LPL for horizontal applications and paste LPL for vertical applications, as applicable and as manufactured by Adhesive Engineering; or Sikadur 32, Hi-Mod as manufactured by the Sika Chemical Corporation, or equal.
   2. Use of all bonding compounds shall be as shown on the drawings or as specified. Application shall be as recommended by the manufacturer.

C. Epoxy Anchoring System

Epoxy anchoring system shall be a two-part system thoroughly blended in a disposal mixing nozzle attached to the cartridge. Systems shall be Epcon by ITW Ramset, Anchor-It, or equal.

2.09 CONCRETE MIXES

A. Test Mixes
   1. Have an approved commercial testing laboratory prepare design mixes for each class of concrete specified for use on job.
      a. Design mixes in accordance with ACI 318 and ACI 211.1.
      b. Laboratory shall make, cure, and test all specimens required by the applicable standards.
      c. Design job-mixed concrete on the basis of water - cement ratio.

d. Mixes shall be homogeneous, readily placeable, and uniformly workable.

2. Mixes shall conform to the following requirements:

Class	28-day Comp. Str. (PSI)	Max. Size Aggregate	ASTM C33 Aggregate	Min. Cement Content ** (Bags/C.Y.)	Air Content (%)*	Slump
A1	4000	1-1/2 inch	Size No. 4	5.5	5±1	3-inch - 4-inch
A2	4000	3/4 inch	Size No. 67	6.0	6±1	3-inch - 4 inch
A3	4000	3/8 inch	Size No. 8	6.0	7-1/2±1	3-inch - 4-inch
A4	4000	No. 16	Fine	7.0	8±1	6-inch Max.
B1	3000	1-1/2 inch	Size No. 4	4.5	5±1	3-inch - 4-inch
B2	3000	3/4 inch	Size No. 67	4.75	6±1	3-inch - 4-inch

*Required only where concrete is used for liquid containment or subject to freeze/thaw cycles.
**Minimum cement content applies to concrete in direct contact with earth or water.

3. When strength data from field experience or trial batches are not available, maximum permissible water-cement ratios shall be:
   a. Non-air-entrained:
      1) Class A: 0.44
      2) Class B: 0.58
   b. Air-entrained:
      1) Class A: 0.35
      2) Class B: 0.46
4. Maximum water/cement ratio when strength data from field experience or trial batches as required by ACI 318 are available:
   a. Class A: 0.44
   b. Class B: 0.58
5. Concrete which is to have a trowel-finished surface, maximum air content shall be 3%.
6. Fly ash may be substituted for cement on an equal weight basis up to a maximum of 20%.

B. Structural Concrete Mix Proportioning
1. Proportions of aggregate to cement shall be such as to produce a readily workable mixture with method of placement employed on job, but without allowing materials to segregate, or excess free water to collect on surface.
2. Combined aggregates shall be such that weight of fine aggregate shall not be less than 30 percent nor more than 45 percent of total.
3. Maximum size for coarse aggregate.
   a. Not larger than one-fifth of narrowest dimension between sides of forms.
   b. Not larger than one-third depth of slab.
   c. Not larger than three-fourths of minimum clear spacing between reinforcing bars.
   d. Not larger than 1-½ inch.

C. Concrete Usage
1. Class A4: Coating hardened concrete at construction joints, coating precast concrete plank prior to placement of bonded concrete topping, and optional first lift in forms with congested reinforcement and/or waterstop.
2. Class A: All locations except where Class B is specified.
3. Class B: Slabs reinforced with welded wire fabric, equipment bases, fence post footings, fillets in tanks, and where specifically stated in plans or specifications.

D. Mixing
   1. Measure materials by weight in conformance with ASTM C94 and ACI 304.
   2. Mix and deliver concrete in ready-mix equipment conforming to ASTM C94 and ACI 304.

PART 3 - EXECUTION

3.01 FORM WORK

A. Form work shall be as specified in Section 03 11 00, Concrete Formwork.

3.02 INSTALLING EMBEDDED ITEMS

A. Encase pipes, anchor bolts, electrical conduits, steps, castings, and other inserts as shown on plans or as specified and finished by other trades.

B. Place inserts in advance of pouring and brace to prevent movement during pouring process.

C. Embedded conduits and pipes shall not be larger in outside dimension than one-third the overall thickness of wall, beam or slab.

D. Embedded conduits and pipes shall not be spaced closer than 3 diameters or widths on center.

3.03 PLACEMENT OF CONCRETE

A. Environmental Requirements
   1. Hot weather concreting.
      a. Follow ACI 305 whenever mean surrounding air temperature equals or exceeds 80 degrees F (27 degrees C).
      b. Do not place concrete whenever air temperature equals or exceeds 90 degrees F (32 degrees C).
   2. Cold weather concreting.
      a. Follow ACI 306 whenever mean surrounding air temperature is below 40 degrees F (4.5 degrees C).
   3. Do not place concrete during rain, sleet, or snow, unless protection is provided.

B. Placement of Concrete
   1. Conveying concrete.
      a. Convey concrete from mixer to place of final deposit by methods that will prevent separation or loss of materials.
      b. Equipment for chuting, pumping, or pneumatically conveying concrete shall be capable of providing a supply of concrete at site of Work without separation of ingredients and without interruptions sufficient to permit loss of plasticity between successive placements.
      c. Unless otherwise approved, conform to ACI 304.
   2. Depositing concrete.
      a. Deposit concrete as nearly as practicable to its final position to avoid segregation due to rehandling or flowing to its final position. Concrete shall not be dropped more than 6 feet unless a suitable chute or tube is used.
      b. Carry on concreting at such a rate that concrete is at all times plastic, and flows readily into spaces between reinforcing.

c. Do not deposit concrete that has partially hardened or that has been contaminated by foreign materials.
d. Do not use retempered or remixed concrete.
e. After concreting is started, it shall be carried on as a continuous operation until placing of a panel or section is completed.
f. Top surfaces of vertically formed lifts shall be generally level.
g. Thoroughly consolidate concrete by suitable means during placement, and thoroughly work concrete around reinforcement and embedded fixtures, and into corners of forms.
h. Vibrators may be used to aid placement, provided they are used under experienced supervision and forms have been designed to withstand their action.
i. Unless otherwise approved, conform to ACI 304.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be located as shown on plans, or if not located, locate so as to not impair strength and appearance. Construction joints shall be perpendicular to main reinforcement and reinforcement shall be across the joint.

B. Clean surface of hardened concrete and remove laitance and standing water. Roughen surface of concrete to 1/4-inch amplitude.

C. Wet construction joints and coat with Class A4 concrete immediately before new concrete placement.

3.05 CURING

A. Maintain concrete surfaces moist for the first 7 days after placement.

B. Under hot weather conditions, conform to ACI 305.

C. Under cold weather conditions, conform to ACI 306.

D. When a liquid-membrane-forming compound is used, protect exposed steel, key-ways or concrete to be surfaced from curing compound.

E. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shock, and vibration.

F. Formed Surfaces
1. Ceilings, walls, columns and beam sides may be cured by leaving forms in place, by wet cure, or by use of a liquid curing compound.
a. Spray surface of forms left in place during curing period as frequently as drying conditions may require to keep concrete surfaces moist. For vertical surfaces, apply water to run down on inside of forms, if necessary, to keep concrete surfaces moist.
b. Apply liquid curing compound immediately after form removal. Apply at rate recommended by manufacturer.

G. Slabs (Flatwork)

1. Start curing activities as soon as free water has disappeared from surface of concrete after placing and finishing.
2. Wet cure slabs, which are to be covered with bonded concrete topping.
3. Cure other flatwork using a liquid curing compound or wet cure.
    a. All floor surfaces shown in the room finish schedule to be exposed concrete shall receive 2 coats of sealing and hardening compound applied in strict accordance with manufacturers recommendations. The first coat is applied upon completion of finishing the concrete. The second coat is applied upon completion of final cleanup. All areas shall be clean and free from laitance, dust, grease or oil. Contractors shall verify compatibility of sealing-hardening compound with any previously applied curing compounds. All floor surfaces to receive finishes shall be water cured.

3.06 CONCRETE WALL FINISHES

A. Type W-1:
1. Fill snap-tie holes with non-shrink, non-metallic grout.
2. Knock off projections.
3. Patch honeycomb areas and rock pockets. Small air holes (less than 1/2 inch) do not require patching.

B. Type W-3:
1. Fill snap-tie holes with approved non-shrink, non-metallic color matched grout.
2. Grind off projections, fins, and rough spots.
3. Repair other defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reasons with color matched non-shrink grout.
4. Where surfaces are required to be painted as shown on the painting schedules, the surfaces shall be sandblasted in addition to steps 1 through 3.

C. Type W-4, Rubbed Wall Finish:
1. Only water curing will be permitted on walls being rubbed unless an approved dissipating curing compound is approved.
2. Grind off projections, fins, and rough spots.
3. Repair defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reasons.
4. Perform rubbing immediately upon completion of curing operation, and finish no later than 5 days after curing has been completed.
5. The mortar shall be a mixture of cement and silica sand in proportions used in concrete being finished.
    a. Spread mortar uniformly over entire surface using a sponge float, filling air voids and imperfections level with adjacent concrete surface. It is the intent to provide a light texture finish on the concrete surface without “plastering” the surface. Finish wall uniformly by floating in a circular motion or pattern.

D. Type W-5, Abrasive Blast – Sandblast:
1. Intent of this procedure is to remove surface skin to a depth no more than 1/16 inch, and expose only fine aggregate and air holes near the surface, thus producing a uniform texture and matching approved sample or mockup panel.
2. Perform sandblasting within 7 days after end of curing period of concrete.
3. Sandblast areas at same age or within +2 days of same age.
4. The same person shall accomplish sandblasting on one structure.

5. Abrasive: Use clean silica sand free of foreign material sand supplied in sealed sacks.
6. Blast surface with 100 psi air pressure at rate of 2 to 3 square feet per minute with nozzle held approximately 2 feet from surface and perpendicular thereto.
7. Modification of procedure will acceptable if proven on sample and mockup panel.

3.07 CONCRETE SLAB FINISHES

A. General:
1. Do not excessively use “jitterbugs” or other special tools designed for the purpose of forcing coarse aggregate away from the surface and allowing a layer of mortar to accumulate.
2. Do not dust surfaces with dry materials.
3. Thoroughly compact slabs and floors by vibration.
4. Round off all edges of slabs and tops of walls with a steel edging tool, except where a cove or chambered finish is shown. Steel edging tool radius shall be 1/4-inch for all slabs subject to wheeled traffic.
5. After applying the final floor finish and after curing as specified in Section “Curing,” cover slabs with Visqueen or other material to keep floor clean and protect it from material and damage due to other construction work.

B. Type S-1, Concrete Slab Finish Steel Troweled Finish:
1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation shown.
2. While concrete is still green, but sufficiently hardened to bear a person’s weight without deep imprint, float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on floats to bring moisture to surface.
4. After surface moisture has disappeared, trowel concrete to produce smooth, impervious surface, free from trowel marks.
5. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
6. Do not use dry cement or additional water during troweling. Excessive troweling will not be permitted.
7. Power finishing:
    a. An approved power machine may be used in lieu of hand finishing for finishing concrete floors and slabs in accordance with directions of machine manufacturer.
    b. Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.

C. Type S-2, Slab Finish Float:
1. Finish slabs to receive fill and mortar setting beds by screeding with straightedges to bring surface to required finish plane.
2. Float slab to compact and seal surface.
3. Remove all laitance and leave surface clean.

D. Type S-3, Ceilings:
1. When forming is removed, grind off projections on underside of slab, repair rock pockets and honeycomb area defects including small shallow air pockets.
2. If underside of slab is exposed to view finish as per W-4 or W-5.

E. Type S-6, Sidewalk & Exterior Slab Finish:

1. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float to a true plane.
3. Broom surface at right angles to direction of traffic.
4. Lay out surfaces in blocks with an approved grooving tool sawcut as shown or as directed by Engineer.

F. Type S-7 for Clarifier
1. Finish.
2. Provide coarse broom finish for grout as specified or Section 03 60 00, Grout.

G. Concrete Curb:
1. Grade subgrade to proper elevation and compact.
2. Securely stake and brace forms to true line at proper elevation.
3. Place concrete as hereinbefore specified.
4. Float top surface of curb smooth, and finish all discontinuous edges with steel edger.
5. After concrete has taken its initial set, remove front form and give exposed surfaces an S-6 finish.

3.08 CONCRETE FINISHES

A. General
1. Every type of concrete finishes and finish tolerances are listed even though some of the finishes are not used in this project so that the Contractor can see by comparison how each of required finish fits into the progressive finishes.

B. Schedule of Concrete Finishes: The following schedule of concrete finishes is not intended to cover all areas of concrete finish, but to show some of the major areas of different types of finishes and tolerances.

SCHEDULE OF CONCRETE FINISHES

Area	Type of Finish	Required Form Tolerances
EXTERIOR WALL SURFACES		
Above grade when using a form liner (above a point 6" below finish grade)	W-5	W.B.
Above grade (above a point 6" below finish grade)	W-4	W.B.
Backfilled (below a point 6" below finish grade)	W-1	W.A.
INTERIOR WALL SURFACES		
Wet wells, basins, channels, and tanks	W-3	W.A.
Interior building walls	W-4	W.A.
EXTERIOR SLABS		
Roof slab (exposed and traffic use)	S-6	S.B.
Roof slab (backfilled above)	S-2	S.A.
Sidewalks, exterior slabs	S-6	S.A.
Stairs treads and landings	S-6	S.B.
INTERIOR SLABS		
Floor slab (building)	S-1	S.B.
Wet well, aeration basin, and channel	S-1	S.A.
Clarifiers	S-7	S.A.
Stairs and landings	S-6	S.A.
Ceilings	S-3	S.A.
BEAMS AND COLUMNS		
Beams	B-1 or B-2	B.A.
Columns	C-1 or C-2	C.A.
MISCELLANEOUS SURFACES		
Curbs	S-6	W.A.
Equipment pads (interior and exterior)	S-1 Horizontal Surfaces W-4 Vertical Surfaces	S.A.
Non-accessible wall surfaces	W-1	W.A.

3.09 BEAMS AND COLUMN FINISHES

A. Type B-1:
   1. Knock off all fins and projections.
   2. Repair all rock pockets and honeycomb areas.

B. Type B-2; exposed to view
   1. Grind beams to remove all form marks.
   2. Repair all rock pockets and honeycomb areas.
   3. Finish as per type W-4.

C. Type C-1:
   1. Knock off all fins and projections.
   2. Repair all rock pockets and honeycomb areas.

D. Type C-2; Exposed to view
   1. Grind column to remove all form marks.

2. Repair all rock pockets and honeycomb area.
3. Finish as per type W-4.

3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Sampling and testing for quality control during concrete placement shall conform to ASTM E329 and shall include the following:
   1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
      a. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
      b. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
      c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees F (4 degrees C) and below, when 80 degrees F (27 degrees C) and above, and one test for each set of compressive-strength specimens.
      d. Compression Test Specimen: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
      e. Compressive-Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
   2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch, if fewer than five are used.
   3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
   4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

C. Nondestructive Testing
   Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests

The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

E. The cost of testing services shall be included in the lump sum base bid price.

3.11 WATER TEST

A. Refer to Section 03 36 00, Watertightness Test for Cast-In Place Concrete Tanks for testing requirements.

B. The structure has failed the test when any of the performance requirements of Section 03 36 00 are not met. The structure failing the test shall be repaired and re-tested.

C. Properly dispose of water used for testing at the Contractor's expense.

3.12 REPAIR OF LEAKS

A. If leaks are observed, they shall be repaired as follows:
   1. Locate and mark leaking areas.
   2. The leaking areas shall be inspected for recommendations by a representative of a manufacturer that specializes in concrete repair systems.
   3. Recommendations shall be submitted for approval of the type of concrete repair method required to correct the leaking areas for the life of the tank.
   4. Upon approval of the concrete repair methods and materials, repair the leaking areas accordingly.
   5. After repair, the structure shall be re-tested as above. Testing and repair shall continue until all leaks or moist spots have disappeared to the satisfaction of the Engineer.

- END OF SECTION -

SECTION 03 33 03

CAST IN PLACE CONCRETE – STREET WORK
PAVEMENT, CURB AND GUTTER, SIDEWALK, AND DRIVEWAY

PART 1 – GENERAL

1.01 SUMMARY

A. Work Included: This section provides cast-in place concrete for street work.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 31 23 16.10, Earthwork Roadway Construction.
4. Section 32 11 23, Crushed Aggregate Basecourse.
5. Section 03 21 00, Concrete Reinforcement.
6. Section 03 21 10, Expansion and Contraction Joints.
7. Section 03 35 19, Colored and Stamped Concrete.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1.	ASTM Al85	Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
2.	ASTM C31	Making and Curing Concrete Test Specimens in the Field.
3.	ASTM C33	Specification for Concrete Aggregates.
4.	ASTM C39	Test for Compressive Strength of Cylindrical Concrete Specimens.
5.	ASTM C94	Specification for Ready-Mixed Concrete.
6.	ASTM C143	Test for Slump of Portland Cement Concrete.
7.	ASTM C150	Specification for Portland Cement.
8.	ASTM C172	Sampling Fresh Concrete.
9.	ASTM C231	Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
10.	ASTM C309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
11.	ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Lb (44.5-N) Rammer and 18-in. (457 mm) Drop.
12.	ASTM D1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type).
13.	ASTM E329	Standard Recommended Practice for Inspection Testing Agencies for Concrete, Steel, and Bituminous Materials Used in Construction.

B. American Concrete Institute (ACI).
1 ACI 304 Institute ACI Measuring, Mixing, Transporting, and Placing
2. ACI 305 Concrete, Recommended Practice for Hot Weather.
3. ACI 306 Concreting, Recommended Practice for Cold Weather.
4. ACI 347 Concreting, Recommended Practice for Concrete Formwork.

C. State of Wisconsin Department of Transportation, Division of Highways; Standard Specifications for Highway and Structure Construction, latest edition.

D. Wisconsin Concrete Pavement Association, Concrete Pavement Specification Guide, Latest Edition.

1.03 SUBMITTALS

A. Submit shop drawings and test reports in accordance with Section 01 32 19, Submittals

B. Submit the following information:
   1. Concrete Mix Design.
   2. Gradation of fine and course aggregate – ASTM C33
   3. Test of deleterious substances in fine and course aggregate – ASTM C33
   4. Specific gravity and dry rodded density of each aggregate.
   5. 7-day and 28-day compressive strengths for each concrete mix proposed.
   6. Certified mill test results for cement identifying brand, type, and chemistry of cement.
   7. Brand, type, principal ingredients, and amount of each admixture.
   8. Field quality control results.

1.04 QUALITY ASSURANCE

A. Contractor shall contract with an established independent testing agency to provide testing services as follows:
   1. Material Acceptance Testing:
      a. Design mix.
   2. Installation Testing:
      a. Slump.
      b. Air-entrainment.
      c. Compressive strength test.
   3. Additional Testing:
      a. Perform under following circumstances:
         1) Material failure.
         2) Change in ready-mix source.
         3) Design mix changes requested by Contractor.

B. The following shall be in accordance with the stated references:
   1. Inspection and Testing: ASTM E329.
   2. Sampling: ASTM C172.
   3. Slump: ASTM C143.
   4. Air-Entrainment: ASTM C231.
   5. Compressive Strength Test: ASTM C31 and C39.

C. Perform slump, air entrainment, and compressive strength tests required by this section with the following frequency:
   1. Two tests daily or one per 100 cubic yards placed, whichever number is greater.

D. Compressive strength test shall consist of four standard test cylinders made from a single batch of concrete:
   1. Test one cylinder at 7 days.
   2. Test two cylinders at 28 days.
   3. Remaining cylinder shall be tested in the event prior tests fail.
   4. Compressive strength tests shall be considered satisfactory when 28-day tests meet the following:
      a. Test results equal or exceed specified compressive strength.

b. No individual test falls more than 500 psi below specified compressive strength.

5. Failure of compressive strength tests shall result in following additional testing:
   a. Provide two core samples of each portion of work affected and perform compressive strength tests.
   b. Replace work if core samples do not equal or exceed specified compressive strength.
6. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections to the tested work during the warranty period.

E. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

F. Nondestructive Testing
Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests
The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

H. The cost of testing services shall be included in the lump sum base bid price.
1. Submit two (2) copies of the composition and strength testing results for design mix.

PART 2 - PRODUCTS

2.01 CEMENT

A. Portland cement shall be Type I, Type II, or Type III Portland Cement conforming to the requirements of ASTM Designation C150 or Type IA, Type IIA, or Type IIIA Air-Entraining Portland Cement conforming to the requirements of ASTM Designation C175.

2.02 AGGREGATE

A. Aggregate shall conform to ASTM C33.

B. Aggregate shall consist of clean, hard, durable sand and crushed rock, crushed gravel, or gravel. Coarse aggregate shall meet the grading requirements for size No. 57, 67 or 467 (Wis/DOT Standard Size No. 1 or mixture of Size No. 1 and 2). Ratio of coarse aggregate to fine aggregate shall not be less than 1: 1 nor more than 2: 1.

2.03 AIR-ENTRAINING ADMIXTURE

A. Air-Entraining Admixture shall conform to ASTM C260.

2.04 WATER-REDUCING, SET-CONTROLLING ADMIXTURES

A. Water-Reducing, Set-Controlling Admixtures shall conform to ASTM C494, Type A for water-reducing, Type D for water-reducing and retarding, and Type E for water-reducing and accelerating.

2.05 CURING AGENT MATERIALS

A. Curing Agent Material shall be a liquid membrane-forming curing compound conforming to ASTM C 309 Type 2, white pigmented for standard concrete and clear for colored concrete. The material shall be composed of a blend of boiled linseed oil and high viscosity, heavy-bodied linseed oil emulsified in a water solution.

2.06 REINFORCEMENT BARS

A. All reinforced concrete to meet or exceed the minimum requirements of ACI 318.

B. Reinforcement shall conform to Section 03 21 00 Concrete Reinforcement.

C. Reinforcement shall be ASTM A615, Grade 60.

D. Fabric shall be 6 inches by 6 inches – W2.0 x 2.0 WWF

E. Polypropylene fibers shall comply with ASTM C1116, Type III.

2.07 EXPANSION JOINT

A. Expansion joints shall conform to Section 03 21 10, Expansion and Contraction Joints.

B. Thickness shall be 1/2-inch.

2.08 MIX DESIGN

A. Concrete mixes shall be designed on the basis of compressive strength by methods specified in ACI 211.1, ACI 318, and ASTM C94 containing no less than the specified minimum cement content. Concrete mix designs complete with sample test results shall be submitted to the Engineer for approval prior to placing any concrete.

2.09 CONCRETE CLASSES

A.

Classes	A	B	C	D	E
Minimum compressive strength (psi)	28-day 4,000	28-day 2,000	28-day 3,000	3-day 3,000	8-hour 3,000
Minimum cement (bags/c.y.)	6	4.5	5.5	7	9
Air content, (%) by volume	6 ±1.5	2-4	2-4	6 ±1.5	6± 1.5
Maximum slump (inches)	3	4	4	3	3
Use	Pavements, curbs, walks, structures, end walls	Pavement base, cradles & inlet walls	Manhole bases,	High early strength special const.	Special high early strength, special const.

Note: Slip formed concrete shall contain 7.0% air entrainment ±1.5%.

B. Contractor may submit for approval alternate mix designs for non-water retaining concrete. Compressive strength of mix shall be verified. Contractor shall be responsible for removing and replacing all concrete not meeting required compressive strength.

C. Maximum aggregate size ¾-inch.

2.10 ADMIXTURES

A. Admixtures may be added to achieve a desired result provided such admixture does not adversely affect strength and durability of the concrete. Admixtures shall be utilized in conformance with State of Wisconsin Department of Transportation, Division of Highways' Standard Specifications for Highway and Structure Construction, Latest Edition.

B. Calcium chloride will not be permitted.

2.11 DETECTABLE WARNING FIELDS

A. Detectable Warning Fields shall be provided by Meta Dome, LLC; Neenah Foundry; Advantage Tactile Systems; or equal.

B. Warning field size shall be as noted on plans.

C. Warning field shall be stainless steel or cast iron and provide a dark on light or light on dark color contrast. Coating shall be skid-resistant.

PART 3 - EXECUTION

3.01 BATCHING

A. During hot weather, the temperature of the concrete shall be less than 90ºF. Work shall be in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting."

B. During cold weather, no frozen materials or materials containing ice shall be used. Temperatures of materials, including mixing water, shall not exceed 140º. When placed in forms the concrete shall have a temperature between 50ºF and 90ºF. Work shall be in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting."

3.02 MIXING AND DELIVERY

A. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 and ACI 304. The production facilities shall comply with the requirements of the National Ready Mixed Concrete Association Certification Plan as regards materials storage and handling, batching equipment, central mixer, truck mixers, agitators, non-agitating units, ticketing system, etc.

B. Concrete shall be delivered to the site of the work and the mixed concrete discharged completely within 1-1/2 hours after water has been added to cement. In hot weather, or under conditions contributing to quick stiffening of concrete, this time may be reduced by the Engineer.

C. No water shall be added on the job unless authorized by the Engineer; the amount of water, if added, shall be recorded on all copies of the delivery ticket hereinafter required. If water is permitted to be added to mixed concrete upon arrival at the job, an additional mixing of 30 revolutions of the drum shall be required.

D. Concrete delivered shall arrive at the site having a temperature not less than 50ºF nor greater than 90ºF unless otherwise permitted by the Engineer.

E. Truck-mixed concrete; mix each batch for 70 or more revolutions at the manufacturer designated mixing speed. Do not exceed 300 total revolutions per batch, the sum of the revolutions at mixing and agitating speeds. Begin mixer revolutions only after all materials, including mixing water are in the mixer.

3.03 DELIVERY TICKETS

A. With each load of concrete delivered to the job there shall be furnished by the ready-mixed concrete producer duplicate delivery tickets, one for the Contractor, and one for the Engineer/Architect. Delivery tickets shall provide the following information:
   1. Date and serial number of ticket;
   2. Name of ready-mixed concrete plant;
   3. Job location;
   4. Contractor;
   5. Type and brand name of cement;
   6. Mix number or specified cement content in bags per cubic yard of concrete;
   7. Truck number;
   8. Time dispatched stamped by a time clock;
   9. Amount of concrete in load in cubic yards;
   10. Admixtures in concrete, if any;
   11. Maximum size of aggregate;
   12. Water added at job, if any;
   13. Slump of concrete ordered

3.04 PREPARATION OF THE SUBGRADE

A. Excavate subgrade to line and grade shown on plans and details.

B. Thoroughly compact the subgrade and finish to a trim surface. All soft or unsuitable material shall be removed and replaced with specified materials.

C. Provide crushed aggregate base course to thickness as shown on the plans and details.

D. Compact to minimum 95 percent Modified Proctor density, ASTM D1557.

E. Surplus material may be used in fill areas.

F. Excess material shall be disposed at a site provided by Contractor.

3.05 FORMING

A. Conform to ACI 347.

B. Forms shall result in a final structure that conforms to shapes, lines, and dimensions of slabs as required by plans and specifications.

C. Forms shall be properly braced to maintain position and shape.

D. Clean and coat forms with clear, non-staining mineral or paraffin base form oil.

E. Reinforcement, forms, and ground with which concrete will be in contact shall be free from frost and debris.

F. Soak subgrade before placement of concrete slabs on grade.

G. Remove laitance and other unsound material before additional concrete is placed against hardened concrete.

H. Have equipment on hand to protect newly placed concrete from rain, freezing, and hot weather until it has hardened sufficiently to resist damage.

I. Unless noted otherwise, furnish the following minimum thicknesses:
   1. Sidewalks: 4-inch
   2. Driveways and sidewalks through driveways: 6-inch

3.06 SLIP FORMING

A. Coordinate mixing, delivering, and placing of the concrete to provide a uniform progress with the stopping and starting of the machine held to a minimum.

B. Slip form machine shall be capable of placing the specified concrete section with an adequate amount of vibration to preclude the possibility of honeycomb formation.

3.07 PLACING

A. Contractor shall notify Engineer of concrete placing schedule one day in advance of pour to allow for inspection of reinforcing and forms.

B. Once placing operation commences, it shall be carried out as a continuous operation until a section is completed.

C. Placing should be carried on in such manner that the concrete in the form is still plastic and can be integrated with fresh concrete.

D. Concrete shall not be placed in water. Water level shall be removed or lowered in a manner approved by Engineer.

E. Concrete shall be placed before initial set has occurred. Excess water will not be permitted. Powdering a mixture with cement to absorb excess water will not be permitted.

F. Dump trucks may be used for transporting mixed concrete to the desired location. If segregation of the concrete becomes evident, the use of dump trucks will not be permitted.

G. Where chutes are used to transport concrete, they shall be of metal or wood with metal lining. They should have a slope not exceeding one vertical to two horizontal and not less than one vertical to three horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials. The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the form.

H. Concrete shall not fall freely more than 4 feet. Elephant trunks and/or tremies shall be used to prevent free fall of the concrete.

I. Concrete shall be deposited in approximately horizontal layers not to exceed 18 inches in height to avoid segregation due to re-handling and flowing.

J. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity. Loss of slump in pumping shall not exceed 1-1/2 inches.

K. The concrete shall be thoroughly compacted by means of an approved vibrator, with the period of vibration being not less than 2 seconds nor more than 5 seconds at any one point.

3.08 PLACEMENT OF DETECTABLE WARNING FIELDS

A. Physical characteristics of the concrete shall be consistent with the contract specifications.
   1. Concrete shall be poured and finished, to required dimensions and slope prior to placement.
   2. Cast-in-place tiles shall be tamped or vibrated into fresh concrete to ensure field of tile is flush to the adjacent concrete surface and all voids under tile are filled. Maximum tolerance for elevation differences between tile and adjacent surface is 1/16”.
      a. Concrete shall be troweled around the tile perimeter to the field level of the tile.
      b. Following placement and approved placement slope and location, before the concrete sets two suitable weights of 25 lbs each shall be placed on each tile to ensure solid contact to concrete.
      c. Following curing of concrete, protective plastic wrap shall be removed from the tile face.

3.09 PLACEMENT OF HANDICAP RAMPS

A. Place handicap ramps where shown on plans or as directed by Owner’s Representative.

B. Detectable warning fields shall be placed to within 6 inches of each side of any handicap ramp opening.

3.10 FINISHING

A. Finish concrete true to required level and grade to a tolerance of:
   1. True plane within ¼-inch in 10 feet.

B. Float as follows:
   1. Tamp concrete to force aggregate away from surface.
   2. Screed with straight edges and bring to required line.
   3. Float surface to a true and uniform plane with no coarse aggregate visible.
   4. Do not dust surface with dry materials to remove excess water.

C. Broom at right angles to traffic.

D. Face surfaces of the curb and gutter shall be troweled and finished smooth.

E. Round exposed edges with an edger having ¼-inch radius.

F. Point honeycombed areas with mortar composed of three parts sand and one part Portland cement immediately after the curb and gutter has been placed.

3.11 ENVIRONMENTAL REQUIREMENTS

A. Follow ACI 305 whenever mean surrounding air temperature equals or exceeds 80ºF (27ºC).

B. Do not place concrete whenever air temperature equals or exceeds 90ºF (32ºC).

C. Follow ACI 306 whenever mean surrounding air temperature is below 40ºF (4.5ºC).

D. Do not place concrete during rain, sleet, or snow unless protection is provided.

3.12 EXISTING CONCRETE FLATWORK

A. When abutting to existing flatwork, provide the following:
   1. Saw cut existing concrete at construction limits.
   2. Install expansion joints between existing and new construction.

3.13 CONTRACTION JOINTS

A. Sawcut curb and gutter at 10-foot intervals to a minimum depth of 2 inches.

B. For sidewalks, use sidewalk width as maximum spacing or 5 feet, whichever is greater. Do not use less than 3 feet or greater than 12 feet of spacing.

C. Sawcut pavement as shown on the pavement joint details.

D. Saw joints as soon as practical after concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracks occur.

3.14 EXPANSION JOINTS

A. Place as follows:
   1. 300-foot maximum spacing on tangent sections curb and gutter and sidewalk.

2. Where radial curb and gutter meet tangent sections.
3. Adjacent to existing joints in abutting concrete paving.
4. Place at right angles to the flowline and surface of the gutters.
5. Expansion joint material shall be one piece and extend the full depth and width of the curb and gutter or concrete section.
6. Place expansion joint in pavement sections as shown on the plans and details.

3.15 REINFORCEMENT BARS

A. Provide (2) #4 x 20-foot long rebar at each utility trench crossing.
1. Center reinforcement on centerline of trench.
2. Accurately position, support, and secure reinforcement against displacement. Reinforcement shall be supported 3 inches clear to basecourse by metal chairs, bolsters, or concrete brick.

B. Place reinforcement and dowel bars for pavement sections as shown on the plan details.

3.16 RESTORATION

A. Backfilling
1. Backfill low areas with soil that meets Engineer's prior approval.
a. Between concrete structure and property line.
b. Shape to line and grade to permit landscaping.

B. Landscape areas disturbed by construction in accordance with section: "Landscaping."

C. Contractor shall be responsible for all trees and shrubs damaged during construction and will be obligated to make restitution for said damage.

D. If Contractor fails to complete restoration or provide maintenance prescribed, the Owner reserves the right to complete this work and deduct it from moneys due.

3.17 CURING AND PROTECTION

A. Use a white pigmented curing agent conforming to ASTM C309, Type 2.

B. Apply curing agent at a rate of one gallon per 200 feet.

C. Hot Weather Conditions: Conform to ACI 305.

D. Cold Weather Conditions: Conform to ACI 306 & WisDOT Standard Specifications Latest Edition 415.3.15.2 Protection Covering.

E. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shock, and vibration.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Cast-in-place concrete - street work shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Form.

1. Cast-in-Place Concrete - Street Work. Unit Price. When so provided, payment for cast-in-place concrete-street work shall be made at the contract unit price bid as specified for concrete pavement, curb and gutter, concrete sidewalk, steps and driveways.
    a. Payment for cast-in-place concrete - street work shall include all base preparation and grading as specified for concrete pavement, curb and gutter, concrete sidewalk, steps and driveways.
    b. Payment for cast-in-place concrete - street work shall include minimum compacted thickness of base course and sub base course material as specified for pavement, concrete curb and gutter, concrete sidewalk, steps and driveways.

B. Measurement
1. Measurement shall be made along the edge of concrete for pavement, sidewalks, and driveways. Square feet will be calculated based on actual length and width. Irregular shaped areas will be calculated based on average length and width.
2. Lineal measurement shall be made in the flow line for curb and gutter.

C. Payment
1. Payment shall be made at the unit price per square feet or per lineal as indicated in the bid schedule.
2. Unit price shall include:
    a. Removal of existing.
    b. Foundation preparation.
    c. Forming.
    d. Placing and finishing concrete.
    e. Labor, equipment and material.

D. Detectable warning field shall be paid for at the contract unit price.

E. Adjusting utility appurtenances in or adjacent to concrete pavement, curb and gutters, sidewalks, steps, driveways and retaining walls will be considered inclusive to payment for work associated with concrete pavement, curb and gutter, sidewalks, steps, and driveway construction and no additional compensation will be allowed unless indicated in the Bid Form.

F. Compressive Strength Deficiency
1. Compressive strength shall be evaluated by averaging two 28-day test results.
2. Should the average 28-day test result fall below the specified strength, the Owner may accept the deficient work in accordance with the terms of Section 00 72 00, Standard General Conditions of the Construction Contract. Payment will be made at an adjusted price as specified in the following table:

COMPRESSIVE STRENGTH BELOW SPECIFIED MINIMUM	PAYMENT FACTOR (PERCENT OF CONTRACT PRICE)
From 100 PSI to 250 PSI inclusive	90%
From 250 PSI to 500 PSI inclusive	80%
From 500 PSI to 1,000 PSI inclusive	65%

3. If the specified compressive strength is greater than 1000 PSI, the material shall be removed and replaced and, when acceptably replaced, will be paid for at the contract unit price.

G. Thickness Deficiency

1. Thickness deficiency shall be verified using cored samples. Sample locations to be determined by the Engineer.
   a. Thickness shall be measured by averaging four (4) samples.
   b. The unit price will be computed proportional to the average thickness of four cores as follows:

Deficiency in Thickness Determined By:

Cores in Inches	Percent of Unit Price Allowed
0.00 to 0.125	100%
0.126 to 0.25	85%
0.251 to 0.375	70%
0.376 to 0.50	55%

   c. If the thickness deficiency is greater than 0.50 inches. The material shall be removed and replaced and when acceptably replaced, will be paid for at the contract unit price.

H. Slump deficiency

I. Slump deficiency shall be verified in the field at the time of placement.

Deficiency in Slump Determined By:

0.25” out of specification	2% price reduction
0.50” to 0.75” out of specification	5% price reduction
1.00” to 1.75” out of specification	25% price reduction
2” or more out of specification	Remove & Replace

J. Air Content Deficiency
1. Air content shall be verified in the field at the time of placement.

Deficiency in Air Content Determined By:

0.5% or more above specification	10% price reduction*
0.1% to 0.4% above specification	5% price reduction*
0.1% to 0.5% below specification	20% price reduction
0.6% to 1.0% below specification	30% price reduction
More than 1.0% below specification	Remove & Replace
	~ or ~
With Engineer Approval	50% price reduction

* If compressive strength is acceptable, do not take a price reduction for high air content. (Subject to Engineer approval)

- END OF SECTION –

SECTION 03 35 19

COLORED CONCRETE AND STAMPED COLORED CONCRETE

PART 1 – PRODUCTS

1.01 SUMMARY

A. Work Included: This section contains provisions for cast-in place colored concrete and/or stamped colored concrete.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 31 23 16.10, Earthwork Roadway Construction.
4. Section 32 11 23, Crushed Aggregate Basecourse.
5. Section 03 21 00, Concrete Reinforcement ASTM Standards.
6. Section 03 21 10, Expansion and Contraction Joints.
7. Section 03 33 03, Cast-In-Place Concrete—Street Work.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards.

B. American Concrete Institute (ACI) Standards.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals including the following:
1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
2. Product literature for available colors and patterns that apply to the bid price.
3. One copy of all test reports.

B. Samples shall be submitted for approval of color and texture.

C. Samples of tool pattern shall be submitted for selection by Owner.

D. Samples of color hardener/release agent combination shall be submitted for selection by Owner.

1.04 JOB MOCK-UP

A. Prior to installation of colored concrete Contractor shall provide an 8’ x 8’ mock-up at the job site. Owner shall approve color, texture and workmanship of the mock-up, then retained as a standard for judging completed work.

PART 2—PRODUCTS

2.01 MATERIALS

A. Provide Class A concrete in accordance with Section 03 33 03, Cast In Place Concrete – Street Work.

B. Stamped Concrete Tools
   1. Stamped Concrete Tools shall be as manufactured by INCRETE Systems, Brick Form, or equal.

C. Integrally color the concrete using non-fading synthetic iron oxides conforming to ASTM C979 at a minimum percent loading of 6% and a maximum percent loading of 8% by weight of the cementitious materials in the mix.

D. Concrete Color
   1. Color shall be as chosen by the Owner or as shown on the drawings.
   2. Add integral concrete colorant according to manufacturer's instructions.
   3. Maintain mix characteristics for all colored concrete requiring a matching finish. Use the same source, brand, type, and color of Portland cement, supplementary cementitious materials, aggregates and admixtures for colored concrete throughout the project. Use constant cement content, supplementary cementitious material content and water/cementitious materials ratio in the concrete mix to maintain consistent color.

E. Tool Pattern
   1. Tool Pattern shall be selected by the owner.

F. Admixtures
   1. Use admixtures designed for use and compatible with colored concrete pigments. Do not use calcium chloride or admixtures containing chlorides.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Concrete shall be placed and screeded to the desired grade, and then floated, using standard concrete practices.
   1. Produce colored concrete in full cubic yard increments.
   2. Produce consistent colored concrete mixes. Once colored concrete placement has started, the engineer will not allow variations in the amounts, types, or source of materials with the exception of minor adjustments of water and air-entraining agent as necessary. Other changes require the contractor to repeat the mix approval process.
   3. Colored concrete mixes for matching colored items shall be consistent. If the contractor chooses to provide mixes with high early strength concrete, then all colored concrete abutting matching colored items shall be provided as high early strength concrete.
   4. Schedule colored concrete placement to minimize exposure to rapid drying conditions, wind and full sun, before curing materials are applied. Do not place colored concrete if rain, snow, or freezing temperature is forecast within 24 hours.
   5. Cover and protect adjacent construction and concrete from discoloration and spillage during placement and curing of colored concrete. Remove and replace discolored concrete as directed by the engineer.

6. Perform finishing operations consistently to avoid discoloration in the finished colored concrete. Do not begin finishing until bleed water has left the surface. Addition of surface water for aiding in finishing is not allowed. If water is added to the surface of the colored concrete once concrete is in place, the engineer will reject the colored concrete. During final finishing and texturing, apply all strokes in the same direction.
7. Protect colored concrete from premature drying and excessive cold or hot temperatures by prompt application of curing materials. Do not allow plastic sheeting to come in contact with colored concrete.
8. Protect the colored concrete from damage. Do not permit construction traffic or material storage on colored concrete. Exclude other foot traffic from colored concrete for at least 24 hours after placement.

B. While concrete is still in its plastic state, apply the desired tool pattern where shown on plans to the surface of the concrete. Tools shall be properly tamped into the surface to achieve the desired texture.

C. Control joints shall be cut at pre-determined areas no later than 12 hours after the concrete has been placed. Excess Release Agent shall also be removed at this time.

- END OF SECTION -

31

DIVISION 31

EARTHWORK

SECTION 31 05 13

SOILS AND AGGREGATES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included:
This section includes all material, labor, and equipment necessary to produce, haul, place, and compact the specified soil or aggregate.

B. Related Sections and Divisions:
1. The applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 31 23 33, Trenching, Backfilling and Compaction.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1.	ASTM C33	Spec. for Concrete Aggregates.
2.	ASTM C88	Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
3.	ASTM C117	Test for Material Finer than No. 200 Sieve in Mineral Aggregates by Washing.
4.	ASTM C131	Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
5.	ASTM C136	Sieve Analysis of Fine and Coarse Aggregates.
6.	ASTM C144	Spec. for Aggregate for Masonry Mortar.
7.	ASTM C207	Spec. for Hydrated Lime for Masonry Purposes.
8.	ASTM C535	Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
9.	ASTM C602	Spec. for Agricultural Liming Materials.
10.	ASTM D75	Sampling Aggregates.
11.	ASTM D422	Particle Size Analysis of Soils.
12.	ASTM D448	Spec. for Standard Sizes of Coarse Aggregate for Highway Construction.
13.	ASTM D1140	Test for Amount of Material in Soils Finer than the No. 200 Sieve.
14.	ASTM D1241	Spec. for Materials for Soil-Aggregate Subbase, Base, and Surface Courses.
15.	ASTM D2216	Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
16.	ASTM D2487	Classification of Soils for Engineering Purposes.
17.	ASTM D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity of Soils.

1.03 QUALITY ASSURANCE

A. No soils and aggregates furnished under this section shall be frozen.

1.04 MATERIAL TESTING

A. Contract with an independent testing laboratory to provide testing services required by this section. Contractor shall be responsible for the cost of all testing required for submittals.

B. To establish acceptability of material, tests shall be performed for each soils class in accordance to the following standards:
   1. Soils Class A and C:
      a. ASTM C88.
      b. ASTM C131 (for coarse aggregates smaller than 1½ inches).
      c. ASTM C136.
      d. ASTM C535 (for coarse aggregates 1½ inches and larger).
      e. ASTM C 117 (use when aggregate contains materials finer than No. 200 sieve).
   2. Soils Class B:
      a. ASTM C88.
      b. ASTM C117.
      c. ASTM C136.
   3. Soils Class D:
      a. ASTM C117.
      b. ASTM C136.
      c. ASTM D1241.
      d. ASTM D2487.
   4. Soils Class E:
      a. ASTM C136 (test when gravel content is present).
      b. ASTM D422.
      c. ASTM D1140.
      d. ASTM D2216.
      e. ASTM D4318
   5. Soils Class F:
      a. ASTM D2487.
   6. Soils Class G:
      a. ASTM D2487.

C. In addition to the above, furnish a soil analysis of Soil Class F:
   1. Analyze for the following:
      a. pH
      b. Phosphorus
      c. Potassium
      d. Soluble Salts
      e. Calcium
      f. Magnesium

D. Source sample all soils and aggregates in accordance with ASTM D75.

E. Perform one (1) acceptable test for each type of material at each source.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals.
   1. Test reports.
   2. Soils analysis including recommendations for fertilizer type and application.
   3. Daily delivery tickets with each load.

PART 2 - PRODUCTS

2.01 ENGINEERED SOILS AND AGGREGATES (SOIL CLASS A)

A. General

1. Material shall be clean, sound, hard, dense, durable, field or quarry stone which is free from seams, cracks, or other structural defects. It shall be angular material from shot rock (blasted) or crushed rock having substantially all face of which have resulted from artificial crushing.
2. Loss due to sulfate soundness test shall not exceed 10 percent.
3. Loss due to abrasion test shall not exceed 40 percent.

B. Gradation

1. Extra-Heavy Riprap

Average Dimension Range For Each Riprap Inches	Fraction of Gross In-Place Volume Occupied by Stones Inches
>30	0%
22-25	10%-14%
18-22	15%-21%
8-18	20%-28%
<8	5%-7%
<1	2% or less

2. Heavy Riprap

Average Dimension Range For Each Riprap Inches	Fraction of Gross In-Place Volume Occupied by Stones Inches
>25	0%
18-20	10%-14%
14-18	15%-21%
6.5-14	20%-28%
<6.5	5%-7%
<1	2% or less

3. Medium Riprap

Average Dimension Range For Each Riprap Inches	Fraction of Gross In-Place Volume Occupied by Stones Inches
>20	0%
14-16	10%-14%
11-14	15%-21%
5-11	20%-28%
<5	5%-7%
<1	2% or less

4. Light Riprap

Average Dimension Range For Each Rip Rap Inches	Fraction of Gross In-Place Volume Occupied by Stones Inches
>16	0%
11-13	10%-14%
9-11	15%-21%
4-9	20%-28%
<4	5%-7%
<1	2% or less

5. Soil Class A-3 (Breaker Run Rock or 6" Crushed Rock)

Sieve Size	% Passing by Weight
7-inch	100
6-inch	90
4-inch	75
3-inch	10

6. Soil Class A-5 (2½-inch Crushed Rock - ASTM D448-No.2)

Sieve Size	% Passing by Weight
3-inch	100
2½-inch	90-100
2-inch	35-70
1½-inch	0-15
¾-inch	0-5

7. Soil Class A-6 (1½-inch Crushed Rock - ASTM D448-No. 4)

Sieve Size	% Passing by Weight
2-inch	100
1½-inch	90-100
1-inch	20-55
¾-inch	0-15
3/8-inch	0-5

8. Soil Class A-7 (¾ -inch Crushed Rock - ASTM D448-No. 67)

Sieve Size	% Passing by Weight
1-inch	100
¾-inch	90-100
3/8-inch	20-55
No. 4	0-10
No. 8	0-5

9. Soil Class A-8 (3/8-inch Crushed Rock Chips - ASTM D448-No. 8)

Sieve Size	% Passing by Weight
½-inch	100
3/8-inch	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.02 ENGINEERED SOILS AND AGGREGATES (SOIL CLASS B)

A. General
1. Shall be hard, strong, durable particles free from seams, cracks, and other structural defects.
2. Rounded to subangular.
3. Free from organic impurities and debris.

B. Gradation
1. Soils Class B-1 (Coarse Aggregate - ASTM C33 - No. 3)

Sieve Size	% Passing by Weight
2½-inch	100
2-inch	90-100
1½-inch	35-70
1-inch	0-15
½-inch	0-5

2. Soil Class B-2 (Coarse Aggregate - ASTM C33 - No. 7)

Sieve Size	% Passing By Weight
¼-inch	100
½-inch	90-100
3/8-inch	40-70
No. 4	0-15
No. 8	0-5

3. Soil Class B-3 (Fine Aggregate - ASTM C33)

Sieve Size	% Passing by Weight
3/8-inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

4. Soil Class B-4 (Masonry Sand - ASTM C144)

	Percent Passing	
Sieve Size	Natural Sand	Manufactured Sand
No. 4	100	100
No. 8	95 to 100	95 to 100
No. 16	70 to 100	70 to 100
No. 30	40 to 75	40 to 75
No. 50	10 to 35	20 to 40
No. 100	2 to 15	10 to 25
No. 200	---	0 to 10

2.03 ENGINEERED SOILS AND AGGREGATES (Soil Class C)

A. General

1. Shall be hard, durable, granular material of uniform quality resulting from crushed rock or crushed bank run sand and gravel.
2. Shall be free from clay lump, organic matter, shale, excess, elongated, or flat pieces, and other deleterious substances.
3. Forty-five percent of the particles retained on a No. 4 sieve shall have at least one fractured face.
4. Wear shall not exceed 50 percent.
5. Loss due to sulfate soundness test shall not exceed 18 percent by weight.
6. Total moisture content shall not exceed 7 percent.
7. Filler for blending shall have a maximum liquid limit of 25 percent and a maximum plasticity index of six.

B. Gradation

1. Soil Class C-1 (Crushed Stone)

Sieve Size	% by Weight Passing
1½-inch	100
3/8-inch	30-65
No. 4	25-55
No. 10	15-40
No. 200	2-12

2. Soil Class C-2 (Crushed Stone)

Sieve Size	% by Weight Passing
1-inch	100

3/8-inch	40-75
No. 4	25-60
No. 10	15-45
No. 200	3-12

3. Soil Class C-3 (Crushed Stone)

Sieve Size	% by Weight Passing
1-inch	100
¾-inch	95-100
3/8-inch	50-90
No. 4	35-70
No. 10	15-55
No. 200	5-15

4. Soil Class C-4 (Crushed Gravel)

Sieve Size	% by Weight Passing
1½-inch	100
1-inch	75-100
3/8-inch	40-75
No. 4	30-60
No. 10	20-45
No. 40	10-30
No. 200	3-10

5. Soil Class C-5 (Crushed Gravel)

Sieve Size	% by Weight Passing
1-inch	100
3/8-inch	50-85
No. 4	35-65
No. 10	25-50
No. 40	10-30
No. 200	3-10

6. Soil Class C-6 (Crushed Gravel)

Sieve Size	% by Weight Passing
1-inch	100
¾-inch	95-100
3/8-inch	50-90
No. 4	35-70
No. 10	20-55
No. 40	10-35
No. 200	8-15

2.04 BANK RUN SOILS

A. Soil Class D-1 and D-2

1. Shall be rounded or subangular material resulting from pit run or crushed material.
2. Shall be free from clay lumps, organic matter, and deleterious substances.
3. One hundred percent by weight shall pass a 3-inch sieve.
4 Maximum liquid limit shall be 25 percent and maximum plasticity index shall be six.
5. The portion of material, which passes a No. 4 sieve, shall conform to the following gradation:

	Maximum % by Weight Passing	
Sieve Size	Grade D-1	Grade D-2
No. 4	100	100
No. 40	75	---
No. 100	15	30
No. 200	8	15

B. Soil Class D-3 (Sand)

1. Well graded, unwashed bank run or crushed bank run, which is free from clay lumps, organic matter, and other deleterious substances with gradation as follows:

Sieve Size	% Passing by Weight
¼-inch	100
No. 4	90-100
No. 10	45-90
No. 40	15-45
No. 200	0-10

C. Soil Class E-1 (Clay Soil)

1. Minimum 50 percent by weight passing the No. 200 sieve.
2. For the fraction passing the No. 40 sieve, the minimum plasticity index shall be 15.
3. Minimum Atterberg liquid limit of 30.
4. Free from organic material, boulders, cobbles, excessive amounts of gravel (greater than 1/4-inch), and other deleterious substances.

D. Soil Class F-1 (Topsoil)

1. Topsoil shall be defined as the upper soil horizon consisting of mineral layers of maximum humus (organic) accumulation.
2. Topsoil shall:
   a. Have adequate mineral content to support the growth of the vegetation intended to be established.
   b. Have one of the following SCS (Soil Conservation Service) soil textures: loam, sandy loam, silt loam, silty clay loam, or clay loam.
   c. Be free from herbicides, which would be detrimental for the intended use.
   d. Have adequate fertility for quick establishment of vegetation.
   e. Shall be neither excessively acid nor excessively alkaline.
   f. Shall be free from deleterious substances.

E. Soil Class G-1 (Clean Earth Fill)

1. Soil Class G-1 shall be any soil material excavated on the project site or obtained from borrow areas.
2. Soil materials unsuitable and, therefore, not approved for this classification are:
   a. Soils with high organic contents such as: topsoil, peat, muck, organic silts, and clays, marls, etc.
   b. Macadam or rubble filled soils containing such materials as: foundry sand, fly ash cinders, asphalt, and concrete rubble, etc.
   c. Silty soils such as: rock flour, loess, etc.
   d. Soils with gravel larger than 3-inch.
   e. Silty clay or clays with a high plasticity (CH soils as defined in ASTM D2487).
   f. All soil contaminated with hazardous waste materials as defined by the EPA.

F. Soils Class G-2 (Clean Earth Fill)

1. Same as G-1 above except shall not contain gravel larger than 3-inch.

2.05 MANUFACTURED AND SPECIAL SOILS

A. Soil Class J-1 (Agricultural Limestone)
   1. Conform to ASTM C602.
   2. Ground or crushed limestone.
   3. Neutralization index of not less than 40 or more than 109.
   4. Meet the following gradation:
      a. Passing a No. 4 sieve - 100 percent.
      b. Passing a No. 10 sieve - 90 to 100 percent.
      c. Passing a No. 50 sieve - 50 to 100 percent.

B. Soil Class J-2 (Hydrated Lime)
   1. Shall consist of essentially calcium, hydroxide, or a mixture of calcium hydroxide, magnesium oxide, and magnesium hydroxide.
   2. Dry powder obtained by treating quick lime with enough water to satisfy its chemical affinity for water under the conditions of its hydration.
   3. Hydrated lime shall conform to the requirements of ASTM C207, Type N or S.

PART 3 - EXECUTION

3.01 APPLICATION

A. Use the soil classification name as called for in specifications or on drawings.

B. Place material in accordance with the plans and appropriate specification sections for the type of work being performed.

- END OF SECTION -

SECTION 31 05 19.13

NON-WOVEN GEOTEXTILE

PART 1 – GENERAL

1.01 SUMMARY

A. Work Included: This section consists of everything necessary to deliver and install a non-woven geotextile as specified in the contract documents.

B. Related Sections:
1. Applicable provisions of the General Condition and Special Conditions of the Contract shall govern the work in this section.
2. Section 01 32 19, Submittals
3. Section 31 23 33, Trenching, Backfilling and Compacting
4. Section 31 05 13.42, Earthwork
5. Section 31 05 19.16.3, Linear Low Density Polyethylene Geomembrane
6. (Project specific per Engineer/Designer)

1.02 DELIVERY, STORAGE, AND PROTECTION

A. Transportation of the geotextile is the responsibility of the Contractor. All handling on site is the responsibility of the Contractor. The Engineer will monitor the Contractor as it relates to:
1. The on-site handling equipment being sufficiently adequate to minimize risk of damage to the geotextile;
2. The Contractor's personnel handling the geotextile with care.
3. Upon delivery at the site, the Contractor, in the presence of the Engineer (acting as an observer), will inspect exposed roll surfaces for defects and/or damage. This visual observation should be conducted without unrolling (unfolding) rolls unless defects or damages are found on the surface or suspected. The Engineer will document the following:
    a. That the rolls are tagged with the proper identification, including roll numbers and applicable testing methods;
    b. Rolls or portions thereof, which in the opinion of the Engineer should be rejected and removed from the site because of visually obvious flaws;
    c. Rolls that include flaws, which may be repairable.

B. The Contractor will provide the Engineer with all relevant information from the tags that have been attached to each roll.

C. On-site geotextile storage is the responsibility of the Contractor. Storage space will be reasonably protected from theft, vandalism, passage of vehicles, etc., but the Contractor is solely responsible for the security and quality of the geotextile until the geotextile is accepted by the Owner.

D. During shipment and storage, geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

E. Consistent with these objectives, geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings. The Contractor shall be responsible for proper on-site storage of geosynthetic materials.

1.03 WORK SEQUENCE

A. The Contractor shall be responsible for determining the best sequence for installing the geotextile. The Contractor shall submit this sequence to the Engineer for review and approval a minimum of 30 days prior to installing the geotextile.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
   1. Manufacturer technical and catalog data, including assembly procedure and materials of construction.
   2. Installation procedures
   3. Two (2) 8" x 10" samples of each type of geotextile fabric to be used.

PART 2 - PRODUCTS

2.01 GEOTEXTILE

A. Geotextile
   1. Geotextile materials shall be the weights shown on the contract drawings and shall meet the requirements of Table 1.

PROJECT MANAGER COORDINATE FABRIC WEIGHT WITH BID SCHEDULE

Table 1
Geotextile Properties and Minimum Test Frequency

Property	Test Method	Minimum Result					
Fabric	ASTM D5261	4 oz/sy (nominal)	6 oz/sy (nominal)	8 oz/sy (nominal)	10 oz/sy (nominal)	12 oz/sy (nominal	16 oz/sy (nominal)
Grab Tensile Strength	ASTM D4632	110 lbs.	160 lbs.	230 lbs.	305 lbs.	350 lbs.	500 lbs.
Grab Elongation	ASTM D4632	60%	60%	60%	60%	60%	70%
Puncture Strength	ASTM D4833	50 lbs.	80 lbs.	100 lbs.	130 lbs.	150 lbs.	195 lbs.
Mullen Burst Strength	ASTM D3786	190 psi	285 psi	380 psi	510 psi	550 psi	780 psi
Trapezoidal Tear Strength	ASTM D4533	40 psi	60 psi	80 psi	100 psi	120 psi	150 psi
UV Light Resistance	ASTM D4355	Yes	Yes	Yes	Yes	Yes	Yes

B. Selected samples of the stored geotextile sheet material may be obtained by the Engineer for laboratory testing to document that the geotextile material tested satisfies the minimum material property requirements established in this section.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. The Contractor shall prepare the subgrade for the geotextile. Once complete, the Engineer shall examine the surface, and verify the adequacy of the subgrade. When the Engineer deems the surface acceptable, the Contractor may proceed with the placement of overlying materials.

B. At any time during installation of the geotextile, the Engineer shall inform the Owner of any subgrade areas that are unacceptable. Such defects in the subgrade shall be promptly corrected by the Contractor such that repaired areas meet the project specifications and/or manufacturer's requirements.

3.02 ROLL INSPECTION

A. Prior to placement, rolls shall be inspected for damage and defects by both the Engineer and Contractor.

3.03 ROLL DEPLOYMENT

A. Geotextiles shall be handled in such a manner as to ensure they are not damaged. On slopes, geotextiles shall be anchored in the anchor trench; then rolled down the slope in such a manner as to minimize wrinkles.

B. In the presence of wind, the materials shall be weighted with sandbags until final covers are installed. Care shall be taken to ensure that any underlying liners/layers are not damaged during placement of geotextiles.

C. Care shall be taken to ensure that stones, mud, dirt and debris are not entrapped beneath the geotextile during placement and seaming operations that cause damage.

D. The geotextile shall be placed over the entire area identified on the drawings.

E. Geotextiles shall be cut using a geotextile cutter (hook blade) only. If in place, special care shall be taken to protect other materials from damage that could be caused by the cutting of the geotextiles.

F. A visual examination of the geotextile shall be carried out over the entire surface, after installation, to verify that no potentially harmful foreign objects, such as needles, are present.

3.04 SEAMING

A. Geotextile shall have a minimum 12-inch overlap.

B. Contractor shall ensure that no earth cover material could be inadvertently inserted beneath the geotextile.

C. The Engineer shall observe and document that the panel overlap meets the project specifications and that there are no excessive folds or wrinkles in the geotextile.

3.05 DAMAGE AND REPAIRS

A. Any holes or tears in geotextiles shall be repaired by patching with the same geotextile materials. The patch shall be a minimum of 24 inches larger than the area to be repaired in all directions.

B. Care shall be taken to remove any soil, object, or and other material which penetrated or tore the geotextile.

C. The Contractor shall document that any holes or defects were repaired.

- END OF SECTION -

SECTION 31 11 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes all work associated with site clearing.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 31 05 13.20, Soils and Aggregates.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil as referred to in this section shall be a soil material as defined by Soil Class F-1, in accordance with Section 31 05 13.20, Soils and Aggregates.

PART 3 - EXECUTION

3.01 PREPARATION

A. Contractor shall identify existing plant life to remain and tag accordingly in the presence of the Engineer.

3.02 PROTECTION

A. Contractor shall protect from damage utilities and structures that are to remain.

B. Contractor shall protect all trees, plants and features designated to remain as final landscaping.

C. Protect all survey monuments.

3.03 CLEARING, GRUBBING, AND DISPOSAL

A. Select Clearing
Remove all brush, shrubs, stumps, and trees to within 4 inches of the existing ground surface where designated by the Owner's representative.

B. Grubbing
1. Remove all stumps, roots, logs, and timber.
2. Grubbing shall be carried to a minimum depth of 12 inches.

C. Disposal
   1. The Owner reserves right to all excess top soil, if desired.
   2. Contractor is responsible for the following:
      a. Disposal of all material removed under clearing and grubbing if not wanted by the Owner.
      b. Furnishing of a disposal site.
      c. Obtain and conform to all necessary, federal, state, and local permits for burning and/or burial of material.
      d. Conform to all requirements for disposal of diseased trees.
      e. If permits are not required, Contractor shall comply with the following requirements:
         1) Open burn in a manner as not to damage adjacent trees, shrubs, property, impede traffic, or create a nuisance.
         2) Cover disposal material in a manner that shall minimize future cover settlement.
         3) Maintain a minimum of 2 feet of soil cover.

D. Clearing operations shall be completed in a manner so as to prevent obstruction of traffic and to protect all remaining trees, shrubs, and other vegetation from injury.

3.04 TRIMMING

A. With permission from the Engineer, the Contractor may trim overhanging branches or limbs that interfere with the construction operation. All branches damaged during construction shall be neatly trimmed.

3.05 STRIPPING AND STOCKPILING TOPSOIL

A. Stripping
   1. Remove all topsoil beneath:
      a. Structures.
      b. Roadways.
      c. All paved areas.
   2. Remove topsoil to a depth of 6 inches in:
      a. Areas disturbed by utility construction.
      b. Areas requiring cuts or significant fills (significant fills are fills which cannot be obtained by the addition of topsoil only).

B. Stockpiling
   1. Contractor shall stockpile topsoil obtained in the stripping operation for replacement.
      a. For areas where topsoil is to be replaced after underground utility construction.
      b. For areas involving site grading where topsoil is to be replaced in order to sustain vegetative growth.
   2. In areas where topsoil will not be required as specified above, Contractor shall remove and dispose of excess material as defined in other sections.

- END OF SECTION -

SECTION 31 23 16.10

EARTHWORK
(ROADWAY CONSTRUCTION)

PART 1 – GENERAL

1.01 SUMMARY

A. Work included: This section shall include everything necessary for earthwork for roadway construction.

B. Related Section and Divisions:
   1. Applicable provisions of the general conditions shall govern as work in this section.
   2. Section 01 32 19, Submittals.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1.03 SUBMITTALS

A. Submit two (2) copies of test reports performed by Contractor in accordance with section 01 32 19, Submittals.

PART 2 - PRODUCTS

2.01 CLEAN EARTH FILL

A. Soil used for borrow, fill, and backfilling shall meet the requirements of soil class as called for on plans or in specifications.

B. Clean earth fill shall be void of the following:
   1. Stones or rocks larger than 3-inches.
   2. Organic content.
   3. Silty clays with high plasticity.
   4. Man-made rubble.
   5. Contaminated or hazardous waste.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Clear and grub site and dispose of vegetation.

B. Strip and stockpile topsoil. Topsoil not used in the project shall be stockpiled and remain on the property of the owner unless otherwise noted.

C. Excavate to elevation, grade and section as shows on the plans

D. Excavate for any proposed structure as follows:
   1. Remove any unstable material from under structures.
   2. Undercut material shall be removed and replaced with compacted backfill sloped 1:1 at its perimeter.
   3. Removal of unstable material shall be done only with the owner's approval.

3.02 SUBGRADE COMPACTION IN CUTS

A. Compact subgrade to a density of not less than 95 percent of modified proctor.

3.03 SUBGRADE COMPACTION IN FILL AREAS

A. Contractor shall scarify and compact existing ground prior to placing fill material.

B. Compact fill in layers not exceeding 8 inches in thickness.

C. Compact subgrade to a density of not less than 95 percent of modified proctor.

3.04 MOISTURE REQUIREMENTS

A. Proper soil moisture contents for compaction shall be maintained in all soils.
   1. Optimum moisture content as determined by Modified (ASTM D1557) Proctor shall be used to determine acceptable moisture contents for soil compaction.

3.05 DEWATERING

A. The Contractor shall be responsible for the following:
   1. Determination of groundwater conditions.
   2. Providing and maintaining necessary means and methods to dewater excavations.
   3. Disposal of water.
   4. Prevention of runoff and discharge from entering excavations & subgrade.
   5. Securing permits from all regulatory, governmental agencies governing dewatering.
   6. Providing pumping equipment, generating equipment, and/or power.
   7. Maintaining dewatering operation and prevention of water from entering the work area until backfilling, placement of fill, base course, and compaction procedures are completed.

3.06 DISPOSAL OF SURPLUS MATERIAL

A. The Owner shall have prior claim to all surplus excavated material. If such claim is exercised by the Owner, the material shall be deposited at such points as may be directed by the Engineer at the expense of the Contractor, the haul not to exceed two (2) miles. If Owner does not desire to claim surplus excavated material, the Contractor shall be totally responsible for obtaining a disposal site. No material shall be disposed of in a flood plain, wetland or waterway.

B. After delivery to any designated location, such material shall be leveled off by the Contractor.

3.07 FINISH GRADING

A. Grade, trim, and shape subgrade to required grade and section.
   1. Adjust slopes by grading so that transition is smooth and gradual.
   2. The crests of cut banks shall be rounded and shaped.

3. Washouts and ruts shall be refilled, regraded, and properly compacted.
4. Remove all stones 3 inches or larger from grading limits.

B. Grade shall be finished within 0.05 feet at required line and grade.

3.08 TESTING

A. Contract with an independent testing laboratory to provide testing services required by this section. Contractor shall be responsible for the cost of all testing required for submittals.

B. The following testing services shall be provided:
1. Source Testing:
   a. Test all soils for acceptance as required by Section 31 05 13, Soils and Aggregates for Soils.
   b. Test all aggregate for acceptance as required by Section 32 11 23, Crushed Aggregate Base Course.
2. Installation Testing:
   a. Determine maximum density and optimum moisture content for compaction in accordance with ASTM D1557 (one test for each type of material for each source).
   b. Conduct field density tests in accordance with ASTM D1556 and/or D2922 and D3017.
3. Perform additional testing when:
   a. Densities do not meet project requirements.
   b. Change in material source.
   c. Change in compaction methods.
4. Minimum frequency for field density testing shall be two (2) acceptable tests per project or as follows, whichever number is greater:
   a. Perform one (1) density test per 350 square yards per lift or every 100 lineal feet of roadway in accordance with ASTM 1556 and/or D2922.

C. The provisions of the above testing requirements may be waived by the Engineer in lieu of the following testing methods.
1. The subgrade condition and elevation shall be checked by the Engineer prior to placement of basecourse material. The subgrade will be proof rolled using a tandem axle dump truck fully loaded with basecourse material to the maximum legal weight limit. The basecourse condition and elevation shall be checked by the Engineer prior to placement of the asphalt binder material.

D. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections to the tested work during the warranty period.

PART 4 – MEASUREMENT AND PAYMENT

A. Excavation
1. Work under this section shall be incidental to the project or paid for as shown in the bid schedule.
2. Payments for excavation shall include:
   a. Hauling and grading.
   b. Compaction of grade.
   c. Backfilling and compacting around structure.

d. Disposal of surplus material off site as necessary.
e. Finish grading.
f. Testing.
g. Clearing and grubbing.
h. Stripping and stockpiling topsoil.
i. Erosion Control

- END OF SECTION -

SECTION 31 23 16.20

CUTTING AND PATCHING (ROADWAYS)

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section shall consist of the replacement and repair of pavement, including any existing patching or surfacing materials disturbed by construction. Work covered by this section shall include but not limited to the following:
   1. Sawcutting of pavement edges.
   2. Removal of sidewalks, driveways and curb and gutter.
   3. Excavation, removal, and disposal of pavement material.
   4. Replace and compact subbase material.
   5. Replacement of pavement material in kind.

B. Related Sections and Divisions:
   1. Applicable provisions of the general conditions shall govern the work in this section.
   2. Section 31 23 16.10, Earthwork (Roadway Construction).
   3. Section 32 11 23, Crushed Aggregate Base Course (Roadway Construction).
   4. Section 32 12 16, Asphaltic Concrete Pavement.
   7. Section 03 21 00, Concrete Reinforcement.
   8. Section 03 21 10, Expansion and Contraction Joints.
   9. Section 03 33 03, Cast-In-Place Concrete, Street Work.

C. All replacement of pavement material shall be performed by a contractor whose primary business is concrete or bituminous roadwork. The contractor shall be listed on the subcontractor list, included with the bid & approved by the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bituminous pavement, concrete and base material shall be equal in quality and kind as to the materials removed, unless otherwise specified.

B. Materials shall be approved prior to installation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform cutting and patching without injury to remaining adjacent pavement and concrete

B. Unless indicated otherwise, roadway shall be kept open to all traffic during performance of work.

C. Remove pavements, sidewalks, driveways and curb and gutter to the construction limits.

D. Sawcut vertically all pavement, sidewalks, and driveways to a minimum depth of 3 inches prior to breaking.

E. Remove all curb and gutter and sidewalks to nearest joint outside work area.

F. Sheet and brace trench walls if necessary to maintain cutting and patching within limits.

G. At a minimum, replacement shall be a full-lane width patch.

H. Subbase, base, pavement, sidewalks, driveways, and curb and gutter shall be prepared and placed in accordance with the plans and applicable specifications.

I. Minimum thickness shall be as follows:
   1. Bituminous pavement shall be 3” unless otherwise shown on plans.
   2. Concrete pavement in roadways shall be 6” unless shown otherwise on plans.
   3. Concrete pavement in sidewalks shall be 4” unless shown otherwise on plans.

PART 4 – MEASUREMENT AND PAYMENT

A. Work under this section shall be incidental to the project or paid for as shown in the bid schedule.

- END OF SECTION -

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 -GENERAL

1.01 SUMMARY

A. Work Included:
   1. Rock removal during excavation for structures and roads.
   2. Rock removal during excavation for utility trenches.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 31 23 33, Trenching, Backfilling and Compaction.

1.02 SUBMITTALS

A. Prior to blasting, submit the following to the Engineer:
   1. One copy of blasting permits.
   2. Structure survey including:
      a. Video tape or photographs of existing structure defects.
      b. Written report.

1.03 DEFINITIONS

A. Rock Excavation: All hard, solid rock ledges, bedded deposits and unstratified masses and all conglomerate deposits or any other material so firmly cemented that, in the opinion of Engineer, it is not practical to excavate and remove same, with a nominal 75,000 pound backhoe equipped with rock points or similar approved equipment, except after continuous drilling and blasting or rock trenching. Rock excavation shall also include all rock boulders necessary to be removed having a volume of one cubic yard or more. Soft or disintegrated rock, shales, hard pan, masonry and concrete rubble, boulders less than two (2) cubic yard, which can be removed with a pick; loose, shaken or previously broken rock; and rock which may fall into the excavation from outside the limits of excavation will not be classified as rock excavation.

1.04 QUALITY ASSURANCE

A. Employ a seismic survey firm if explosives are to be used. Seismic survey firm shall be a company specializing in seismic surveys with five years documented experience.

B. If explosives are to be used, Contractor shall have five years experience or shall employ a firm with five years experience with use of explosives.

C. Blaster shall hold necessary licenses for the type of work performed.

D. Contractor shall be solely responsible for damage to any work or property due to the rock removal operations.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable federal, state, and local codes for explosive disintegration of rock.

B. Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

C. No explosives shall be used without written permission from Owner.

D. Comply with OSHA, State and Local requirements.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 STRUCTURE SURVEY

A. Prior to blasting or rock trenching, the Contractor shall conduct a survey of all structures, utilities, and existing surfaces that are within destructive range of the rock blasting or rock trenching area.

B. The survey shall include structures, utilities, and existing surfaces within a minimum radius of 300 feet of the blasting or rock trenching area, and with the actual limits to be determined by the licensed Contractor.

C. Structures include but are not limited to:
1. Buildings (interior and exterior).
2. Bridges.
3. Walkways and retaining walls.
4. Concrete and masonry structures.

D. Contractor shall be responsible for arranging access to building, property, etc.

E. Survey shall include:
1. Video tape or photographs depicting all existing interior and exterior defects of structures.
2. Written report which provides a narration of the videotapes or photographs.
3. The Contractor shall receive written acknowledgement of any observed defects from property owners and utilities that may be affected by the drillling and blasting or rock trenching work.

3.02 EXCAVATION IN ROCK

A. General
1. When rock is encountered, it shall be stripped of earth and shale and the Engineer notified in order that he may measure or cross-section the same. In lieu of stripping the earth overburden prior to blasting, the Engineer and the Contractor may mutually agree on a method to define the vertical limits of the rock. Any rock excavated, before such measurement or agreement is made, will not be estimated, allowed or paid for.

2. All sewers, watermain, and lateral trenches shall be blasted or trenched to 10’ beyond the end of the proposed main or lateral stub.

B. Drilling and Blasting-

1. Drilling and blasting work shall only be performed between the hours of 7:00 A.M. and 7:00 P.M. Blasting mats, or other established method, shall be used to prevent flying debris resulting from the blasting operation.
2. Not less than one-half hour before blasting, the Contractor shall notify residences and businesses in the vicinity of the work of the Contractor’s intent to blast.
3. The Contractor shall comply with all provisions of the “Special Provisions Applicable to Blasting and Associated Works”, revised January 24, 1984, as provided by the Wisconsin Department of Transportation, pages 1-3.
4. In areas where drilling or blasting is adjacent to or downwind of existing structures, dust control shall be used in the drilling operations. The control shall be by water spray or vacuum, and shall be approved by the Engineer and Owner during initial field operating conditions.
5. Blasting near structures, utilities, or any other appurtenances that exist in the construction area shall be at the sole discretion of the Contractor. If the Contractor believes that blasting in certain areas will or may cause damage, he shall select another alternative to accomplish the excavation. There will be not extra compensation for this type of work, and the cost thereof shall be included in the appropriate bid item.

C. Disposal (Blasting and Drilling)

1. All excavated rock shall be classified as undesirable backfill material and shall be disposed of in accordance with Section 31 23 33, Trenching, Backfilling and Construction.
2. At the request of the Contractor, the Engineer may allow the Contractor to crush the excavated rock for use as backfill or bedding material.

D. Rock Trenching

1. The trenching machine shall be laser controlled for line and grade and capable of cutting the trench to the required depth and width in a single pass.
2. Multiple passes will be permitted for pipeline structures and appurtenances or common trench construction.
3. Pneumatic tools may be used to assist with utility crossings and other obstacles.
4. Rock trenching work shall only be performed between the hours of 7:00 a.m. and 7:00 p.m.
5. Not less than one-half hour before trenching, the Contractor shall notify residences and businesses in the vicinity of the work of the Contractor’s intent to trench.
6. In areas where trenching is adjacent to or downwind of existing structures, dust control shall be used in the trenching operations. The method of control shall be determined by the Contractor and shall be approved by the Engineer and Owner during initial field operating conditions.
7. Trenching near structures, utilities, or any other appurtenances that exist in the construction area shall be at the sole discretion of the contractor. If the Contractor believes that trenching in certain areas will or may cause damage, he shall select another alternative to accomplish the excavation. There will not be extra compensation of this type of work, and the cost thereof shall be included in the appropriate bid item.

E. Disposal (Rock Trenching)

1. Larger rock, as may be generated from pneumatic tools shall be removed from the site to a disposal area obtained by the contractor.

PART 4 - MEASUREMENT AND PAYMENT

A. Rock Excavation

Rock excavation shall be paid for as hereinafter defined, which price shall be payment in full for completing all work as specified herein including:

1. Drilling and blasting or trenching and removal of rock.
2. Disposal of the unacceptable rock.
3. Backfilling of the void space in the bedding area created by the rock excavation with a suitable bedding material.
4. Backfilling the trench with soil or granular backfill as required.

B. Where there is no bid price for rock excavation, (as hereinafter defined) the Owner will pay for such rock excavation as extra work.

C. The trench in rock excavation shall be excavated to a point six (6) inches below the bell of a bell and spigot type pipe and six (6) inches below the outside of the barrel of a tongue and groove type pipe.

D. Drilling and Blasting

1. Rock excavation shall be paid for per cubic yard as specified herein.
    a) The maximum pay width for rock excavation in a separate trench for sewers and watermains shall be the outside diameter of the pipe plus 12 inches, but not less than 36 inches. The maximum pay width in common trench construction shall not exceed the sum of the outside diameter plus 48 inches.
    b) The maximum pay width for rock excavation in a separate trench for sewer and water laterals shall be the outside diameter of the pipe plus 12 inches, but not less than 36 inches. The maximum pay width in common trench construction shall be the outside diameter of the pipes plus 24 inches, but not less than 36 inches.
    c) The pay quantities for rock excavation for manholes or sewer structures shall be:
        1) For circular structures, a cylinder having a diameter equal to the outside diameter of the structure walls plus six feet and a depth measured from six inches below the base to the top of rock,
        2) For rectangular structures, a prism having length by width dimensions equal to the outside structure wall dimensions plus six feet and a depth from six inches below the base to the top of rock.

E. Rock Trenching

1. Rock excavation shall be paid for per lineal foot as specified herein:
    a) The minimum trench width for rock excavation in a separate trench for sewers and watermains shall be the outside diameter of the pipe plus 12 inches. The minimum trench width in common trench construction shall be the sum of the outside diameter plus 48 inches.
    b) The minimum trench width for rock excavation in a separate trench for sewer and water laterals shall be the outside diameter of the pipe plus 12 inches. The minimum trench width in common trench construction shall be the sum of the outside diameter plus 18 inches, but not less than 24 inches.
    c) The minimum dimensions for rock excavation, for manholes, sewer water, or other structures shall be lump sum as specified herein:
        1) For circular structures, a cylinder having a diameter equal to the outside diameter of the structure wall plus four feet.

2) For rectangular structures, a prism having length by width dimensions equal to the outside structure wall dimensions plus four feet.

PROJECT MANAGER: Add bid item for blasting trench at the end of sewers watermains or laterals. The language shall be as stated below. Verify number of locations.

_____Lineal feet of blasting trench at end of installed utilities at specified trench width, 10 lineal feet, _____ locations, for the unit price of:

Or

_____ Lineal feet of blasting trench at end of common trench installations at specified trench width, 10 lineal feet, __ locations, for the unit price of:

Or

_____ Lineal feet of blasting trench at the end of installed common trench lateral, 10 lineal feet each, _____ locations, for the unit price of:

- END OF SECTION –

SECTION 31 23 33

TRENCHING, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This Section shall include all work required for trenching, backfilling, and compaction of utility trenches.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 33 34 00, Forcemain.
5. Section 40 05 13.10, Buried Piping.
6. Section 40 05 13.53, Ductile Iron Pipe.
7. Section 40 05 13.73, PVC Plastic Pipe.
8. Section 40 05 13.74, Polyethylene Pipe
9. Section 40 05 13.76, PVC Lined RCP Sewer.
10. Section 40 05 13.80, Centrifugally Cast Fiberglass Mortar Pipe.
11. Section 33 41 13, Storm Sewer and Drainage.
12. Section 33 33 13, Sanitary Sewer.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1.	D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
2.	D1140	Test for Amount of Materials in Soils Finer than the No. 200 Sieve.
3.	D1556	Test for Density of Soil in Place by the Sand-Cone Method.
4.	D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Lb (4.54 kg) Rammer and 18 in. (457 mm) Drop.
5.	D2216	Laboratory Determination of Water (moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
6.	D2922	Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7.	D3017	Test for Moisture Content of Soil and Soil-Aggregate by Nuclear Method (Shallow Depth).

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
1. Two (2) copies of testing data of laboratory tests and test performed by Contractor.
2. Two (2) copies of testing data to the Owner’s Representative.
3. Shoring, bracing and sheet piling procedures and details.

1.04 PROJECT/SITE CONDITIONS

A. Do not block or obstruct sidewalks or pavement with excavated materials without approval from Owner.

B. When close sheeting is required, drive to prevent soil from entering trench below or through sheeting.

C. Fill voids remaining after sheeting is pulled with approved material.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 GENERAL

A. It shall be the Contractor's responsibility to comply with all federal, state, and local rules and regulations concerning:
   1. Construction safety including confined entry.
   2. Noise Control
   3. Dust and smoke control

B. Heating
   1. When weather dictates, provide temporary heat to protect work prone to freezing.

C. Access to Public Services
   1. Insure free access to all fire hydrants, valve boxes, manholes, curb stops, fire alarms, police call boxes, etc.
   2. Contractor shall be responsible for notifying police, sheriff, fire department, ambulance services, and school bus services before blocking or partially blocking any public thoroughfare.

D. Protection of Work, Public, and Property
   1. Provide safe passage for local traffic, pedestrian and vehicular.
   2. Provide access to properties abutting street where utilities are being constructed.
   3. Provide all necessary barricades, warning lights, and signs, signals, flagmen, etc. in accordance with federal, state, and local regulations.

E. Work on Streets and Work In Waterways and Wetlands
   1. Work on streets or in waterways and wetlands are subject to provisions of special permits required and issued by governmental agencies having jurisdiction in addition to requirements of specification for this work.
   2. Work shall not commence prior to receiving required permits.
   3. Provide special bonds when required by permit.
   4. Notify controlling authority prior to beginning and after completing any construction in right-of-ways or streams.
   5. Bear all expenses related to permit compliance.

F. Easements

1. Owner will provide all easements. Contractor shall verify easements are in place prior to commencing work.
2. All work on easements will be in strict compliance with the terms of the easements.
3. Owner, easement grantee, Contractor and Engineer shall be in full agreement on the method of execution prior to beginning work.
    a. Only structures, trees, shrubs, and other obstructions are to be removed as mutually agreed.
    b. Restoration shall be equal to original condition or the conditions of the agreement.

G. Protection of Established Property Markers
1. Contractor shall protect all property markers (iron pipe, concrete, or wood posts, steel pins) from movement from original position.
2. Cost of replacement of property markers moved during construction shall be at Contractor's expense**.**

H. Pipeline Installation Sequence
1. Pipeline installation shall commence in order of the deepest utility to shallowest utility. Unless otherwise authorized by the Engineer in writing.

3.02 OBSTRUCTIONS AND CONFLICTS

A. When existing utilities and structures are indicated on the drawings, it should not be assumed that all existing utilities and structures are shown.

B. The locations of existing utilities and structures when given, are plotted on the drawings for the information of the Contractor, but should not be construed as a representation of the exact location.

C. When an underground structure not shown or indicated occupies the alignment of the proposed pipe or structure, the Contractor shall give immediately notice to the Engineer and the Owner of the structure of such conflict. The Owner will issue a change order to remove, relocate or alter the structure, plan, or profile of the proposed structure as required to eliminate the conflict.

D. The Contractor shall be responsible for all damages to any below or above ground utilities and structures encountered during construction.

E. The Contractor shall make arrangements with the utility companies for any relocation of Interfering utilities. No extra cost due to unexpected delays or coordination work shall be incurred by the Owner except for authorized utility alterations performed by the Contractor as provided below.

F. Any underground utilities or other structures that are located outside of the construction limits of this contract which the Contractor wishes to have moved to facilitate construction shall be arranged with the owner of such structures, the Contractor shall pay all costs of the accommodation.

G. Separation of Watermains and Sewers
1. The following separations shall be minimum:
    a. Parallel
        1) Eight feet, measured center to center
    b. Vertical (when pipelines cross)
        1) Watermain below a sewer - 18 inches clear

2) Watermain above a sewer - 6 inches clear

2. When crossing a sewer, center a full length of watermain or sewer to position joints as far as possible from sewer.

H. The Contractor shall be responsible to:

1. Maintain or provide temporary service for water, sewers, gas, culverts, drains, electricity, or other utilities interrupted.
2. Provide temporary connections and outlets for all private and public utilities that are interrupting construction.
3. Provide disposal for all drainage and wastewater resulting from relocations and/or interruptions in accordance with regulations and permits of the controlling governmental agency(s).

I. In the event the Contractor fails to make restitution to any damaged property, the Owner reserves the right to deduct the cost of repairs from monies due him.

J. Obstruction Removal

1. Clear all obstructions from within the construction limits.
2. Remove pavement, curb and gutter, sidewalks and driveways within the trench limits.
3. Construction limits shall be defined as:
   a. Street right-of-ways.
   b. Project site property lines.
   c. Easement limits.

3.03 DEWATERING

A. The Contractor shall meet the requirements of all Wisconsin Department of Natural Resources Storm water Construction and Post-construction Technical Standards.

B. The Contractor shall be responsible for the following:

1. Determination of groundwater conditions.
2. Providing and maintaining necessary means and methods to dewater excavations.
3. Disposal of water.
4. Prevention of runoff and discharge from entering excavation.
5. Securing permits from all regulatory, governmental agencies governing dewatering.
6. Providing all wells, pumping equipment, generating equipment and/or power.
7. Damage caused to private wells due to dewatering.
8. Maintaining a water supply to all wells affected by the dewatering operation.
9. Dewatering to a minimum depth of 12 inches below all excavations.
10. Maintaining dewatering operation until backfilling and compaction procedures are completed.
11. Removing all dewatering equipment and removing/abandoning wells in accordance with regulatory agency requirements.

C. Groundwater Disposal

1. Convey groundwater to point of discharge through pipelines.
   a. Open ditches and trenches are not permitted.
   b. Use of Owner's utilities is not permitted without written consent.
2. Maximum Sediment Content- 10 milligrams per liter.

3.04 TRENCHING

A. Excavate to the depth and width necessary to install the intended pipeline.

B. Contractor shall excavate whatever materials are encountered as required to complete the work. The bottom of the trench shall be leveled off, all loose and disturbed soils removed and hard tamped prior to installation of pipe.

C. Rock Excavation

1. All hard, solid rock ledges, bedded deposits and unstratified masses and all conglomerate deposits or any other material so firmly cemented that, in the opinion of Engineer, it is not practical to excavate and remove same with a nominal 75,000 pound backhoe equipped with rock points or similar approved equipment, except after continuous drilling and blasting, mechanical hammer, or rock trenching. Soft or disintegrated rock, shales, hard pan, masonry and concrete rubble, boulders less than two (2) cubic yards, which can be removed with a pick; loose, shaken or previously broken rock; and rock which may fall into the excavation from outside the limits of excavation will not be classified as rock excavation.

2 Rock excavation shall also include removal and disposal of all boulders having a volume of two cubic yards or greater. Rock boulders two cubic yards or greater shall be paid for at the unit price of $100.00 per cubic yard as measured by the Engineer or the Owners representative.

D. The trench at the crossing of underground utilities in place shall be as narrow as practicable. All underground utilities shall be protected from damage and maintained in service at their original location and grade during the work. Any damage to underground utilities shall be replaced or repaired at no cost to the Owner.

E. Immediately upon backfilling in paved areas, a temporary 3-inch thick bituminous (cold mix) concrete pavement shall be placed and maintained daily to provide a smooth even surface until final surface replacement is made.

F. Pipe bedding shall be in accordance with the standard details shown on the drawings.

3.05 BACKFILLING

A. When backfilling, the Contractor shall insure that the backfill is free of:

1. Stones larger than 3 inches. (Stones larger than 3 inches and up to 6 inches may be used provided a min. of 24 inches of cover material is provided over pipelines).
2. Frozen material.
3. Concrete and rubble.
4. Blasted rock.
5. Vegetation and organic material.
6. Refuse and debris.

B. No backfill shall be placed under water or over unsuitable subgrade conditions as determined by Owner's representative.

3.06 COMPACTION

A. Compact fill in horizontal layers not exceeding 8 inches in thickness.

B. Provide specified compaction through entire lift thickness by mechanical compaction. Compaction with a backhoe bucket is not acceptable.

C. Proper soil moisture contents for compaction shall be maintained in all soils.
   1. Maintain moisture content within ±3 percent of the optimum moisture content, as determined by the Modified proctor (ASTM D1557) method to attain required compaction.

D. Compaction requirements for all fill soils unless specified elsewhere shall be as follows:

Class 1 - Fills supporting structures.
- Subgrade under pavements or floors.
- Backfill under piping and conduits.
- Trench backfill over pipelines.
- Trenches within existing or proposed roadways, sidewalks, driveways, shoulders, and other hard surfaces

Class 2 – Fills which do not support structures.

COMPACTION REQUIREMENTS FOR VARIOUS SOIL CLASSES

	Required Compaction (%) of Modified Proctor Density	
Soil Class	**Class 1**	**Class 2**
B-3 through B-4	95	90
C-1 through C-6	95	90
D-1 through D-3, and G-1 and G-2	95	90
E-1	95	90

E. Pipe backfill shall be in accordance with the standard details shown on the drawings.

F. If the moisture content exceeds +3% or -3% of the optimum moisture content, as determined by the Modified proctor (ASTM D1557) method, and with Engineer approval, testing requirements shall be as follows:
   1. Compaction shall meet or exceed 100% density of adjacent, undisturbed native material, or until no further appreciable compaction is achieved between successive tests.

3.07 TESTING

A. The Contractor shall secure the services of an established independent Soils Engineer/laboratory for services as follows:
   1. The laboratory selection shall be subject to the approval of the Owner's representative.

B. Testing Requirements:
   1. Source Testing:
      a. Test all soils and aggregates for acceptance as required by Section 31 05 13, Soils and Aggregates.
   2. Installation Testing:
      a. Determine maximum density and optimum moisture content for compaction in accordance with ASTM D1557 (one test for each type of material for each source). Maximum density test results shall be submitted to the Engineer within 48 hours after starting construction.
      b. Conduct filed density tests in accordance with ASTM D1556 and/or D2922 and D3017. Provide the Engineer with the preliminary test results at the end of each work day.

c. The Contractor shall provide the Engineer with compaction test results with each application for payment through the date of the application for payment. Failure to provide test results will result in a delay in the release of payment.
d. If the contractor proceeds with backfilling without density testing or without a maximum density test, he does so at his own risk. Any portion of the work that does not meet the contract specifications will be removed and recompacted at the contractor's expense.
e. The contractor shall be responsible for providing and complying with all local, state, and federal safety regulations.

3. Additional testing when:
   a. Densities do not meet project requirements.
   b. Change in material source.
   c. Change in compaction methods.
4. Minimum frequency for field density testing shall be two (2) acceptable tests per project or as follows, whichever number is greater:

Fill Utilized For:	Number of Acceptable Tests:
Trench backfill under paved or surfaced areas greater than 15' depth	1 test per 100 feet of trench or any portion there of, in the lower 1/4, each middle 1/4, and upper 1/4.
Trench backfill under paved or surfaced areas less than 15' depth	1 test per 100 feet of trench or any portion there of, in the lower 1/3, middle 1/3, and upper 1/3.
Lateral trench backfill	1 test per 100 feet of trench with a minimum of 1 test location per trench, in the lower 1/3, middle 1/3, and upper 1/3.
Backfill under structures or floors	1 test per 1,500 square feet, minimum of 1 test per lift.

5. All field density testing shall be performed during trench backfilling and compaction operations. Spot excavation and density testing after backfilling and compaction has been completed is not acceptable.
6. Backfill placed without the required testing shall be removed to within one (1) foot of the top of pipe, replaced, and compacted to meet specified densities. Failure to provide required density testing during pipe laying operations shall result in cessation of pipe laying activities at the discretion of the Engineer.
7. The Contractor shall be responsible for the cost of all testing.
8. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections due to failure of the tested work during the warranty period.

3.08 ENVIRONMENTAL PROTECTION

Phragmites, an invasive species plant, is known to exist within the project limits and in areas that ground disturbance or excavation work is shown in the plans. All soils containing plant or root fragments that will be excavated or salvaged as part of the work within the contract shall be salvaged and used as topsoil within the immediate area of the work or deposited at an engineer approved waste site within the project limits. All waste sites are subject to review and approval by the engineer and shall be suitable for the waste of material containing Phragmites. Waste material shall be placed in upland locations in

the general area where the plan currently exists. For all equipment that comes into contact with Phragmites infested areas, follow the guidelines established under the Environmental Protection, Aquatic Exotic Species Control for inspection and cleaning of equipment prior to leaving the project site. Additional information on this plant can be found at the following website: www.dnr.wi.gov/invasives/plants.asp.

3.09 ENVIRONMENTAL PROTECTION, AQUATIC EXOTIC SPECIES CONTROL.

Exotic invasive organisms such as zebra mussels, purple loosestrife, and Eurasian water milfoil are becoming more prolific in Wisconsin and pose adverse effects to waters of the state. Wisconsin State Statutes 30.715, "Placement of Boats, Trailers, and Equipment in Navigable Waters", details the state law that requires the removal of aquatic plants and zebra mussels each time equipment is put into state waters.

At construction sites that involve navigable water or wetlands, use the following cleaning procedures to minimize the chance of exotic invasive species infestation. Use these procedures for all equipment that comes in contact with waters of the state and/or infested water or potentially infested water in other states.

Ensure that all equipment that has been in contact with waters of the state, or with infested or potentially infested waters, has been decontaminated for aquatic plant materials and zebra mussels prior to being used in other waters of the state. Before using equipment on this project, thoroughly disinfect all equipment that has come into contact with potentially infested waters. Use the following inspection and removal procedures (guidelines from the Wisconsin Department of Natural Resources) for disinfection:

- Prior to leaving the contaminated site, wash machinery and ensure that the machinery is free of all soil and other substances that could possibly contain exotic invasive species;
- Drain all water from boats, trailers, bilges, live wells, coolers, bait buckets, engineer compartments, and any other area where water may be trapped;
- Inspect boat hulls, propellers, trailers and other surfaces. Scrape off any attached mussels, remove any aquatic plant materials (fragments, stems, leaves, seeds or roots), and dispose of removed mussels and plant materials in a garbage can prior to leaving the area or invested waters; and
- Flush boats (inside and outside), barges, and all other water-contacting equipment with hot water of 105º F to 110º F for a period of 30 minutes or hot water of 140º F for a period of five minutes. After flushing, dry all equipment in a sunny location for at least three days.

Complete the inspection and removal procedure before equipment is brought to the project site and before the equipment leaves the project site.

3.10 EXCAVATION OF PHRAGMITES SOIL.

A. This item includes excavation soils containing Phragmites as directed by the engineer, hauling and placing excavated material to the designated waste site, backfilling the excavated area with borrow, and decontamination of equipment.

B. Excavate soils to a minimum depth of 24 inches or as necessary to remove all plant root matter or as directed by the engineer. Haul excavated material to waste site, as directed by engineer, place, and shape material where designated. Decontaminate equipment per Environmental Protection, Aquatic Exotic Species Control article of these special provisions.

3.11 DISPOSAL OF SURPLUS MATERIALS

A. The Owner shall have prior claim to all surplus excavated material. If such claim is exercise by the Owner, the material shall be deposited at such points as may be directed by the Engineer at the expense of the Contractor, the haul not to exceed two (2) miles. If Owner does not desire to claim surplus excavated material, the Contractor shall be totally responsible for obtaining a disposal site. NO material shall be disposed of in a floodplain, wetland, or waterway.

After delivery to any designated location, such material shall be leveled off by the Contractor.

B. Pavement shall be disposed of separately from the soils material.

3.12 SHEETING AND BRACING

A. Contractor shall provide adequate sheeting and bracing to prevent earth from caving or washing into the trench, and shall do all shoring and underpinning to properly support adjacent structures.

B. Trenches and excavations shall be sheeted and braced as required by applicable federal and state code, and as may be determined by the Contractor to be necessary to protect life and property.

C. When close sheeting is necessary, it shall be driven sufficiently to prevent soils from entering the excavation.

D. Sheeting shall be removed during backfilling. Remove sheeting in a manner that will protect the completed pipeline adjacent structures from disturbance.

3.13 TRENCH BOX

A. A trench box shall be used at the Contractor's discretion.

B. Trench box shall conform to the following:
1. Shall not exceed trench limits.
2. Shall be constructed in accordance with governing authorities.
3. Shall be utilized in a manner that will not disturb the pipeline when the trench box is moved.

3.14 RESTORATION

A. Contractor shall clean the site of all surplus excavated material, rubbish and debris, and construction material.

B. Culverts removed for the purpose of installing pipeline shall be reinstalled to their original position. Any culverts damaged during removal or construction activities shall be replaced by the Contractor.

- END OF SECTION -

32

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 11 23

CRUSHED AGGREGATE BASE COURSE (ROADWAY CONSTRUCTION)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This section includes constructing a crushed aggregate base for roadways shouldering, curb and gutter, and parking lots.

B. Aggregates from recycled material may not be used unless required as part of this project.

1.02 REFERENCE STANDARDS

A. ASTM: American Society for Testing and Materials

B. AASHTO: American Association of Highway and Transportation Officials

C. W.D.O.T.: Standard Specifications for Highway and Structure Construction, Latest Edition.

1.03 SUBMITTALS

A. Test results for aggregate materials supplied for use on this project may be from a source which was approved for a previous project, provided the submitted test results were obtained within 6 months previous to this submittal
   1. Source testing report.

B. Submit two (2) copies of testing data of tests performed by Contractor:
   1. Test reports must include location in work where test was taken.

C. Delivery Tickets
   1. Provide delivery tickets daily for each load of crushed aggregate for base course delivered to the work, including:
      a. Date.
      b. Tare and net weight.
      c. Type of material.

D. Samples
   1. Provide material samples needed for required testing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregates
   1. Aggregates shall consist of hard, durable particles of crushed stone or crushed gravel and a filler of natural sand, stone sand or other finely divided mineral matter.
      a. Remove oversize material by screening or by crushing to required sizes.

b. Composite material shall be free from organic matter, shale, and lumps or balls of clay and shall conform to the gradation requirements below.

2. Liquid limit and plasticity index.
   a. Aggregate including any blended filler shall have a liquid limit of not more than 25 and a plasticity index of not more than 6.
3. Fracture Count
   a. At least 45% of particles retained on the No. 4 sieve shall have at least one fractured face.
4. Soundness
   a. When the fraction of aggregate retained on the No. 4 sieve is subjected to five cycles of the sodium sulfate soundness test, weighted loss shall not exceed 18% by weight.
5. Filler for blending
   a. Additional mineral filler require to meet gradation requirements or for satisfactory binding of material shall be uniformly blended with base course material at the screening plant.
   b. Mineral fillers shall be free from agglomerations or lumps and shall contain not more than 15% of material retained on a No. 4 sieve
6. Moisture content: Shall not exceed 7%.

2.02 GRADATION REQUIREMENTS

A. Gradation No. 1

% By Weight Passing

Sieve Size	Crushed Gravel	Crushed Stone
1½-inch	100	100
1 inch	75-100	--
3/8-inch	40-75	30-65
No. 4	30-60	25-55
No. 10	20-45	15-40
No. 40	10-30	--
No. 200	3-10	2-12

B. Gradation No. 2

% By Weight Passing

Sieve Size	Crushed Gravel	Crushed Stone
1-inch	100	100
3/8-inch	50-85	40-75
No. 4	35-65	25-60
No. 10	25-50	15-45
No. 40	10-30	--
No. 200	3-10	3-12

C. Gradation No. 3

% By Weight Passing

Sieve Size	Crushed Gravel	Crushed Stone
1-inch	100	100
¾- inch	95-100	95-100
3/8-inch	50-90	50-90
No. 4	35-70	35-70
No. 10	20-55	15-55
No. 40	10-35	--
No. 200	8-15	5-15

D. Gradation No. 4
% By Weight Passing

Sieve Size	% By Weight Passing
1¼-inch	95 – 100
¾-inch	70 – 93
3/8-inch	45 – 80
No. 4	30 – 63
No. 10	20 – 48
No. 40	8-28
No. 200	2.0 – 12.0

E. Breaker Run Base Course (Light)

Sieve Size	% By Weight Passing
3-inch	90- 100
1½-inch	60 – 85
¾-inch	40 – 65
No. 4	15 – 40
No. 10	10 – 30
No. 40	5 – 20
No. 200	2 – 12

F. Breaker Run Base Course (Heavy)

Sieve Size	% By Weight Passing
4-inch	100
3½-inch	90 – 95
2½-inch	50 – 90
1½-inch	30 – 60
¾-inch	15 – 30
No. 4	0 – 5

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Preparation of subgrade for crushed aggregate base course shall be in accordance with requirements of Section 31 23 16.10, Earthwork for Roadway Construction.

B. Do not place the base course on a subgrade that is soft or spongy or one that is covered by ice or snow.

C. Do not place base course material on a dry or dusty subgrade when existing condition would cause rapid dissipation of moisture from base course material and hinder or preclude its proper compaction.
   1. Apply water to such dry foundations and rework or recompact as necessary.

3.02 AGGREGATE USAGE

A. Lower Layer Of Roadways and Shoulders: Breaker Run (Heavy).

ENGINEER / PROJECT MANAGER, CHOOSE THE GRADATION BELOW:

B. Top Layer of Roadways: Gradation No. 3 or Gradation No. 4.

C. Top Layers of Shoulders: Gradation No. 2.

3.03 CONSTRUCTION METHODS

A. Place crushed aggregate base course to the width and thickness shown on plans.
   1. Maximum compacted thickness of any one layer shall not exceed six (6) inches.
      a. When multiple courses are required, they shall be composed of approximately equal thicknesses.

B. Spreading Base Material
   1. The work shall proceed so that the hauling equipment will travel over the previously placed material.
   2. No hauling shall be permitted on the subgrade.
   3. Route hauling equipment as uniformly as possible over all portions of the previously constructed layers of the base course.

C. Compaction
   1 . After a layer of course has been placed and spread to the required thickness, width, and contour, it shall be compacted.
   2. If the material is deficient in moisture content, add moisture during compaction operations by means of appropriate equipment.
   3. Each layer or course of subbase or base placed shall be compacted to a minimum of 95% Modified Proctor.
   4. Areas where proper compaction cannot be obtained due to segregation of materials, excess fines or other deficiencies shall be reworked or the material be removed and replaced with material that will yield the desired results.
   5. Maintain line and grade during compaction operations.

D. Maintenance
   1. The Contractor shall be responsible for and maintain the base course until surface paving is complete.

E. Dust Control
   1. Contractor shall maintain dust control until paving is completed.
   2. Dust control shall be by the application of water or an approved dust control material.

3.04 SHOULDERING

A. Construct shoulders with base course material and conform with the elevation and section shown on the plans.

B. When the finish course of bituminous paving is not placed immediately after the binder course, shouldering shall be placed flush with the surface of the binder.

C. The remainder of the shouldering shall be completed after the finish bituminous course is placed.

D. Shouldering equipment shall be capable of placing shouldering material without marring or damaging pavement or appurtenance.

E. Littering of the pavement with base material shall be corrected by brooming.

3.05 TESTING

A. Contractor shall secure the services of an established independent laboratory for soil testing services as follows:
   1. Source testing
      a. Sampling: AASHTO T2
      b. Sieve Analysis
         1) AASHTO T27 for aggregates including fracture count
         2) AASHTO T37 for mineral fillers
      c. Liquid test: AASHTO T89
      d. Plasticity index: AASHTO T90
      e. Soundness: AASHTO T104 using sodium sulfate
      f. Standard Proctor: ASTM D698
   2. Installation testing
      a. The basecourse condition and elevation shall be checked by the Engineer prior to placement of subsequent basecourse or bituminous material. The basecourse will be proof rolled using a tandem axle dump truck fully loaded with basecourse material to the maximum legal weight limit.

B. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections to the tested work during the warranty period.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

A. Work under this section shall be incidental to the project or paid for as shown in the bid schedule.

B. Base Course
   1. Measurement shall be by the square yard in place.

   2. Payment shall include:
      a. Labor, material and equipment.
      b. Hauling and placing.
      c. Compacting and grading.
      d. Dust control.
      e. Adjusting manholes and valves.
      f. Testing.

C. Shouldering
   1. Shall be incidental.

- END OF SECTION -

SECTION 32 12 16

ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes the material requirements for aggregates and bituminous materials for utilization in binder and surface course pavements for light and medium duty streets and parking lots.

1.02 REFERENCE STANDARDS

A. American Society of Testing and Materials (ASTM)

B. American Association of State Highway Officials (AASHTO)

C. Federal Aviation Agency (FAA)

D. Asphalt Institute (AI)

E. Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction. (Latest Edition).

1.03 SUBMITTALS

A. Submit two (2) copies of test results of quality control testing including:
   1. Materials source testing.
   2. Asphaltic concrete pavement installation testing.
   3. Additional testing.

B. Submit one (1) copy of daily weight tickets showing the net weight for each truckload of pavement delivered and placed.

C. The quantity of asphaltic concrete pavement placed shall be confirmed using theoretical tonnage. Tonnage shall be based on the square yards placed at 110# per square yard per inch. Tonnage shall not deviate greater than 5 percent from the theoretical tonnage.

1.04 STORAGE AND DELIVERY

A. Stockpile aggregate to prevent excessive segregation.

B. In-truck storage period for hot mix shall not exceed 2 hours.

C. Store asphalt cement in tanks free of foreign substances and caked asphalt.

PART 2 - PRODUCTS

2.01 AGGREGATE

A. Aggregate shall conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Sections 450 and 460 (latest edition).

2.02 MINERAL FILLER

A. Mineral filler shall conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Section 450.

2.03 ASPHALT MATERIALS

A. Conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Section 455.

2.04 TACK COAT

A. Tack coat shall conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Section 455.

2.05 ASPHALT MIX

DESIGNER, DESIGNATE THE TYPE OF ASHPHALTIC MIX TO BE USED IN THE PROJECT (EXAMPLE BELOW)

E-1	• Collector streets and other roadways • Light industrial lots
E-3	• Local business streets • Major arterial streets • Medium industrial lots and streets

A. Asphaltic mix shall be Type E-1, pg 58-28 OR E-3, PG 64-22 and conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Sections 450 and 460 (Latest Edition).

2.06 EQUIPMENT

A. All equipment shall conform to Wis. DOT Standard Specifications for Highway and Structures Construction, Section 450 (Latest Edition).

B. Trucks shall be covered and insulated adequately to provide a mix temperature of 250° F (121°C) at point of delivery.

PART 3 - EXECUTION

3.01 EQUIPMENT REQUIREMENTS

A. Mixing plants shall conform to AASHTO M156.

B. Bituminous paver shall have following features.
1. Hopper distribution system.
2. Screed assembly shall be capable of heating and adjusting to slope and elevation.
3. Paver shall produce an even finished surface with a smooth, dense texture.

C. Roller shall be in accordance to following:

1. Designed specifically for bituminous compaction.
2. Vibratory with adjustable frequency and amplitude.
3. Compression: 250 pounds per inch of width of drive rollers.
4. Provide device to moisture, and clean rollers

D. Trucks shall be covered and insulated adequately to provide a mix temperature of 250° F (121°C) at point of delivery.

3.02 SURFACE PREPARATION

A. Prepare compacted foundation in accordance with Section 32 11 23, Crushed Aggregate Base Course.

B. Remove loose concrete and protruding joint material.

C. Clean surface joints.

D. Control weeds with herbicide in accordance with state and local regulations.

E. Adjust sanitary and storm manholes to finished pavement grade.

F. Adjust valve boxes to finished pavement grade

G. Fill potholes and depressions with a leveling course of asphaltic mix and compact to required density.

H. Tack coat shall be applied to all new bituminous surfaces which have been driven on, became contaminated, or was placed greater than 12 hours prior to subsequent pavement courses.

I. Remove all joint sealant prior to placement of any new bituminous pavement material.

3.03 BITUMINOUS PAVEMENT PLACEMENT

A. Place to thickness, grade and section shown on plan.
1. When thickness is not shown on plans, pavement thickness shall be 3 inches compacted. **(Type E-1 or E-3) (Engineer, choose between E-1 or E-3 to match 2.05 A. choice.)**
   a. 1¾-inch binder course, Gradation Nominal aggregate size 3/4-inch (19 mm).
   b. 1¼-inch surface course, Gradation Nominal aggregate size 3/8-inch (9.5 mm).
2. Course thickness shall be achieved by placing single or multiple layers of bituminous to the following tolerances:
   a. Minimum thickness: three times the largest aggregate when compacted.
   b. Maximum thickness: 2¼ inches compacted

B. Hand Spreading
1. Will be permitted only in areas inaccessible to finishing machines.
2. Place by means of a shovel and shape with rake or lute.
3. Do not rake over machine spread surfaces.

C. Compaction
1. Roll as soon as mixture will support roller without displacing pavement mat.
   a. Initial pass shall be with drive roller toward paver.
   b. Start at lower unsupported edge and progress toward other edge.

c. Overlap successive trips.

2. Subsequent strips laid; start adjacent to previous laid strip and continue to opposite edge.
3. Roll until:
   a. Roller marks are minimized or eliminated.
   b. Surface is of uniform density.
   c. Required density is obtained.

D. Bonding Joints
1. Clean all joints.
2. Joining new bituminous to existing bituminous:
   a. Saw cut all joints.
3. Joining new bituminous to new bituminous
   a. Saw cut end joint if it has been over 12 hours since the other "new" pavement had been placed.
   b. Tack coat all cold surfaces.

E. Bonding Surfaces
1. Tack all existing and new bituminous surfaces.
2. Tack all abutting concrete or asphalt surfaces.
3. Application rate shall be one-tenth (1/10) gallon per square yard.

3.04 PAVING RESTRICTIONS

A. Do not place bituminous pavement when following conditions exist.
1. Unstable or frozen base.
2. During rain or snow.
3. When air temperature is less than 35°F (1.50°C).

3.05 SURFACE REQUIREMENTS

A. Surface shall be dense and to a true plane of 1/8 inch in 10 feet.

B. Bituminous shall be replaced when the following conditions exist.
1. Pavement has raveling, rutting, or will not set up to receive traffic.
2. At a minimum replacement shall be a full lane width, patching will not be permitted.
3. All joints will be saw cut and tack coated.

3.06 SHOULDERING

A. Shoulder all portions of the street where curb and gutter is not required.

B. Unless shown otherwise, shoulders shall be three (3) feet wide.

C. If the finish bituminous course is not placed immediately after the binder course, shouldering shall be completed in multiple lifts, one lift after each course.

D. Conform with Section 32 11 23, Base Course.

3.07 SPECIFIED DENSITY PROCEDURE (TYPE E-1 OR TYPE E-3)

A. Laboratory density is that which is obtained when samples of the mix from the applicable course is compacted and its weight determined in accordance with W.D.O.T. Test Method 1559, "Superpave Method of Mix Design" for each pavement mix.

B. Ordinary Compaction Method
   1. Course
      a. Leveling
      b. Wedging
      c. Patching
   2. Degree of Compaction
      a. Compact to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment

C. Laboratory Method
   1. Degree of Compaction
      a. Binder course on existing paved surface: 89.5% of laboratory density.
      b. Binder course on crushed aggregate base course: 89.5% of laboratory density.
      c. Surface course: 91.5% of laboratory density.
   2. Acceptance Testing
      a. Perform one (1) density test per 350 square yards per lift or every 100 lineal feet of roadway in accordance with ASTM D2950.
   3. Laboratory density is that which is obtained when samples of the mix from the applicable course is compacted and its weight determined in accordance with ASTM D1559.

D. The Contractor shall secure the services of an established independent testing laboratory to perform all testing; or the contractor may perform testing with their own WisDOT certified personnel with Engineer approval.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

A. Work under this section shall be incidental to the project or paid for as shown in the bid schedule.

B. Measurement and Payment
   1. Square yards shall be computed by measuring the area of bituminous pavement compacted in place.
   2. Payment will be made by the square yard compacted in place.
   3. Payment shall include:
      a. Hauling and placing
      b. Compaction
      c. Tack
      d. Site restoration
      e. Adjusting manholes and valves
      f. Testing

C. Density Deficiency
   1. Density shall be measured by averaging the nuclear density test required for a day's production placed.
   2. Should the average density fall below specified densities, the Owner may accept the deficient work in accordance with the terms of Section 00 72 00, Standard General

Conditions of the Construction Contract. Payment will be made at an adjusted price as specified in the following table:

PERCENT DENSITY BELOW SPECIFIED MINIMUM	PAYMENT FACTOR (PERCENT OF CONTRACT PRICE)
From 0.5 to 1.0 inclusive	98
From 1.1 to 1.5 inclusive	95
From 1.6 to 2.0 inclusive	91
From 2.1 to 2.5 inclusive	85
From 2.6 to 3.0 inclusive	70

3. If the specified density deficiency is greater than 3%, the material shall be removed and replaced with a mixture to the specified density and, when acceptably replaced, will be paid for at the contract unit price.

D. Thickness Deficiency

1. Thickness deficiency shall be verified using theoretical tonnage. (Theoretical tonnage shall be computed as follows; 115 pounds per inch per square yard). If the in place tonnage is greater than 10 percent below the theoretical tonnage the following shall apply.
   a. Thickness shall be measured by averaging four (4) samples taken after the final course has been compacted in place.
   b. The unit price per square yard will be computed proportional to the average thickness of four cores as follows:

Deficiency in Thickness Determined By:

Cores in Inches	Percent of Unit Price Allowed
0.00 to 0.125	100%
0.126 to 0.25	85%
0.251 to 0.375	70%
0.376 to 0.50	55%

   c. If the thickness deficiency is greater than 0.50 inches, no payment will be made until the Contractor corrects the deficiency with additional courses (minimum 1¼ inches compacted per course).

- END OF SECTION -

SECTION 32 90 00

LANDSCAPING

PART 1 -GENERAL

1.01 SUMMARY

A. Work Included: This section includes the following:
   1. Preparation of subsoil.
   2. Placing topsoil.
   3. Testing and correcting soil pH, if necessary.
   4. Seeding, sodding, mulching and fertilizing.
   5. Maintenance.

B. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern work in this section.
   2. Section 01 32 19, Submittals.

1.02 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

B. Association of Official Seed Analysis (AOSA).

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
   1. Fertilizer certification from supplier including brand name and chemical analysis.
   2. Certification of conformance with AOSA attesting to seed mix, age, weed content, purity, and germination.
   3. Sample of mulch material upon request of Owner's representative.
   4. Sample of erosion mat and certification of its properties.

1.04 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners. Submit sod certification for grass species and location of sod source.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration. Do not deliver more sod than can be laid within 24 hours.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil shall consist of the natural loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils adapted to the sustenance of plant life, and such topsoil shall be neither excessively acid nor excessively alkaline.

B. 100 percent of the topsoil shall pass a one-inch sieve and at least 90 percent shall be a No. 10 sieve.

2.02 FERTILIZER

A. Type A fertilizer shall meet the following minimum requirements:
   1. Nitrogen, not less than 16%
   2. Phosphoric Acid, not less than..... 6%
   3. Potash, not less than..... 6%
   4. Sum of nitrogen, phosphoric acid and potash shall be not less than 32 percent. Total nitrogen shall be not less than the sum of the phosphoric acid and soluble potash.

B. Type B fertilizer shall meet the following minimum requirements:
   1. Nitrogen, not less than 16%
   2. Phosphoric Acid, not less than 6%
   3. Potash, not less than 24%
   4. Sum of nitrogen, phosphoric acid and potash shall be not less than 50 percent.

2.03 SEED

A. Conform with the requirements of the governing authority for seeding and for restrictions on noxious weed seed.

B. Seed mixture shall be composed of seeds of the purity, germination, and proportion by weight as follows:

SPECIES	PURITY minimum %	GERMINATION minimum %	MIXTURE PROPORTIONS (in percent)				
			NO. 10	NO. 20	NO. 30	NO. 40	NO. 60
Kentucky Bluegrass	98	85	40	6	10	35	--
Red Fescue	97	85	25	--	35	20	--
Hard Fescue	97	85	--	24	30	20	--
Tall Fescue	98	85	--	40	--	--	--
Salt Grass	98	85	--	--	10	--	--
Redtop	92	85	5	--	--	--	--
Timothy	98	90	--	--	--	--	12
Canada Wild Rye		Pure Live Seed (1)	--	--	--	--	10
Perennial Ryegrass	97	90	20	30	--	--	--
Improved Fine Perennial Ryegrass	96	85	--	--	15	25	--
Annual Ryegrass	97	90	--	--	--	--	30
Alsike Clover	97	90	--	--	--	--	4
Red Clover	98	90	--	--	--	--	4
White Clover	95	90	10	--	--	--	--
Japanese Millet	97	85	--	--	--	--	20
Annual Oats	98	90(1)	--	--	--	--	20

(1) Substitute winter wheat for annual oats in fall plantings started after September 1.

C. Add 1½ bushels of oats per acre if seeded before July 15th or 1½ bushels of winter wheat if seeded after July 15th for cover crop.

2.04 MULCH

A. Mulch shall consist of straw or wood chips, which are free of noxious weeds and other objectionable foreign matter.
   1. If wood chips are used, the mulch area shall be treated with one (1) pound of available nitrogen per 1,000 square feet.

B. Mulch binder shall conform to one of the following:
   1. Emulsified asphalt shall meet the requirements for Type SS-1 AASHTO M140.
   2. Terra Tack 1, or equal.

2.05 SOD

A. The sod shall consist of a dense, well-rooted growth of permanent and desirable grasses, indigenous to the general locality where it is to be used.

B. Sod shall meet the following general requirements:
   1. Free from weeds and undesirable grasses.
   2. Grass length of two (2) inches.
   3. Cut in uniform strips 18" x 72".
   4. Uniform thickness of 1½-inch or more.
   5. Adequately watered to prevent crumbling, breaking or tearing during handling and placement.

2.06 HYDROSEEDING

A. Manufacturer: Central Fiber Corporation, Second Nature Wood fiber blend mulch, or equal.

B. Include specified seed: temporary seed of oats or winter wheat, as specified, fertilizer, and hydroseed mulch

2.07 TEMPORARY EROSION CONTROL BLANKET

A. Manufacturer: North American Green, S75; American Excelsior Company, Curlex; or equal.

B. Material Composition
   1. Single net: 100% photodegradable.
   2. Matrix: 100% agriculture straw.
   3. Thread: degradable.

2.08 PERMANENT EROSION CONTROL BLANKET

A. Manufacturer: North American Green, P300; American Excelsior Company, Recyclex TRM; or equal.

B. Material Composition
   1. Top and bottom net: 100% UV stabilized polypropylene.
   2. Matrix: UV stabilized polypropylene fiber.
   3. Thread: UV stabilized polypropylene.

2.09 LIMESTONE

A. Limestone shall be ground agricultural limestone containing not less than 90% calcium carbonate and shall be ground to such a fineness that 50% shall pass a U.S. Standard Sieve No. 96 and 90% shall pass a U.S. Standard Sieve No. 100.

B. Rates of application shall be as specified or as requested by the Engineer as a result of periodic soil testing and consultation with the district Soil Conservation Service.

2.10 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and delivered to the site in the manufacturer's original containers with name of the material, manufacturer's name and net weight clearly marked on each container. Aluminum sulfate shall be used only in a dry powdery state.

B. Rates of application shall be as specified or as requested by the Engineer as a result of periodic soil testing and consultation with the district Soil Conservation Service.

PART 3 - EXECUTION

3.01 TOPSOILING

A. Topsoil all areas which are required to be seeded. Place topsoil to the following depth:
   1. Seeded areas: 4 inches when settled.

B. Topsoil Placement In Rural Areas

1. Place to required depth.
2. Remove all rocks larger than 1½ inches.
3. Remove all debris.
4. Mechanically break down all clods and lumps.
5. Mechanically level and rake prior to applying seed.

C. Topsoil Placement For Seeding Lawns
1. Mechanically level subgrade to allow uniform placement of topsoil.
2. Remove rocks, roots, clods and other foreign material.
3. Place topsoil to required depth.
4. Mechanically level topsoil.
5. Rake topsoil smooth and remove all lumps.
6. Seed as required.

3.02 FERTILIZING AND LIMING

A. Fertilize all areas to be seeded.

B. Apply any required fertilizer and lime uniformly onto the surface of the prepared seedbed.

C. When hydroseeders are not used, the fertilizer and lime shall be incorporated into the top 3 inches of the soil with suitable tillage equipment.

D. Apply fertilizer at a rate determined as a result of periodic soil testing and consultation with the district Soil Conservation Service.

E. Use type of fertilizer best suited for area.

3.03 SEEDING

A. Selection of seed mixtures, rate of seeding and intended use of the mixtures will be as follows:

Seed Mixture	Rate of Seeding (Lbs. per 1,000 sq. ft.)	Intended Use
No. 10	1½	Average loam or heavy clay soils. All ditches, inslopes grass areas.
No. 20	3	Light, sandy or gravelly soils. All ditches, inslopes.
No. 30	2	In rural areas on cut and fill slopes exceeding 6 to 8 feet.
No. 40	4	In urban area or other areas where a lawn type turf is desired.
No. 60	½	Critical area stabilization. May be used in con-junction with mixture No. 10 and No. 20 on steep slopes.

B. Seeding period shall be as recommended by the seed supplier.

C. Seeding
1. Utilize a machine or combination of machinery, which will produce the following:
a. Apply seed uniformly at the rate specified.
b. Cover seed with approximately ½ inch of topsoil.
c. Roll lightly.
d. Apply seed at right angles to surface drainage.

3.04 HYDROSEEDING

A. Minimum application rate shall be 1,500 lbs per acre.

3.05 MULCHING

A. General
1. Place a straw or hay mulch within 72 hours after seeding.
2. Do not place during high winds.
3. Place loosely enough to allow some sunlight penetration and air circulation, but thickly enough to shade ground, conserve moisture and reduce erosion.

B. The Contractor may elect to perform mulching in accordance with one of the following methods:
1. Method "A"
a. Spread mulch material uniformly by blowing in place to a loose depth of ½ to 1½ inches.
b. Mulching shall begin at tops of slopes and proceed down.
c. Anchor mulch with a biodegradable netting or twine secured with pegs or staples forming a six (6) to ten (10) foot grid.
2. Method "B"
a. Mulch shall be treated with emulsified asphaltic material and blown in place in one operation.
b. Mulch shall be blown uniformly to a depth of ½ to one inch.
c. Mulch shall be treated with emulsified asphalt at a rate of 75 to 100 gallons per ton.
3. Method "C"
a. This shall be the same as Method "A" except mulch will be anchored by impressing into the soil to a depth of 1½ to 2½ inches with a tiller in a single pass.

3.06 SODDING

A. Placing Sod
1. Moisten topsoil to loosened depth of three (3) inches.
2. Place sod within 24 hours after initially cut.
3. Laying sod strips
a. Lay sod so abutting end joints are not continuous.
b. Sod strips shall abut snugly against each other.
c. Sod shall be level with adjoining turf or grade.
d. Water and roll or lightly tamp sod immediately after placement.
e. At the limits of the sodded area, end strips shall be staggered.
f. At the end of all sod strips, turn sod into soil, cover with topsoil, and compact.
4. Laying sod on slopes and in waterways.
a. In waterways, place sod with longer dimension perpendicular to water flow.
b. On slopes, place sod with longer dimension parallel to the contours the ground.

B. Staking Sod
   1. Stake sod in all waterways and on all slopes steeper than one (1) foot vertical to two (2) feet horizontal.
   2. Stakes shall be wood lath minimum of twelve (12) inches long.

3.07 EROSION CONTROL BLANKET

A. Installation in Ditches (where shown on the plans).
   1. Prepare soil including lime, fertilizer, and seed.
   2. Place a eight (8) foot wide roll centered on ditch flowline.
   3. Roll out blanket in the direction of the water flow and overlap ends six inches in a shingle style.
   4. Anchor edges and ends in a 6" x 6" trench. Backfill and compact trench after stapling.
   5. Stapling:
      a. Install per manufacturer's instructions.

B. Installation on Slopes (where shown on the plans).
   1. Prepare soil including lime, fertilizer, and seed.
   2. Place blankets down or across the slope.
   3. Seams which run down the slope shall be lapped a minimum of two (2) inches.
   4. Seams running across the slope shall be lapped a minimum of four (4) inches shingle style.
   5. Anchor the edges of the blanket in a 6"x 6" trench. Backfill and compact trench after stapling.
   6. Stapling:
      a. Install per manufacturer's instructions.

3.08 APPLICATION

A. The Contractor shall landscape all areas disturbed by construction activities on and adjacent to the construction site including:
   1. Earthen stockpiles.
   2. Equipment parking areas.
   3. Areas disturbed from transporting equipment.
   4. Areas disturbed from storing materials.

B. Apply landscaping procedures as follows:
   1. Lawns
      a. Topsoil
      b. Seed
      c. Fertilize
      d. Mulch and mulch binder
   2. Rural and unmowed areas
      a. Topsoil
      b. Seed
      c. Fertilize
      d. Mulch and mulch binder
   3. Stockpiles: Seed and mulch.

C. Apply erosion control blankets to the following:
   1. Ditch lines disturbed by construction as shown on the plans.

2. Slopes 2:1 or greater.

D. Sod areas as shown on plans.

3.09 MAINTENANCE

A. Maintain all seeded and sodded areas until the following conditions are met:
   1. Seeding has established a stand of grass which is uniform in density and color.
   2. Sodding has established a root system in to the sod bed.
   3. Landscaping is capable of resisting erosion.

B. Watering of turf and repairing erosion shall be included in maintenance.

C. Where vegetation has not been satisfactorily established. CONTRACTOR shall reseed such areas until suitable vegetation has been established.

3.10 MEASUREMENT AND PAYMENT

PROJECT MANAGER – CHOOSE AN "A" BELOW THAT BEST FITS YOUR PROJECT

A. Work under this section shall be paid for at the contract unit price.

OR

A. Landscaping shall be incidental to other work and shall be included in the respective unit price bid item.

- END OF SECTION -

33

DIVISION 33

UTILITIES

SECTION 33 01 30.16

SEWER CLEANING & TELEVISING

PART 1 – GENERAL

1.01 SUMMARY

A. Work included: This section includes cleaning and televising for sanitary sewer lines.

B. Contractor shall submit television inspection logs and DVD recordings.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 - INSTALLATION

3.01 SEWER LINE CLEANING

A. High-Velocity Jet Equipment shall be used on this project. All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. The equipment shall carry its own water tank.

B. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned.

C. Roots shall be removed in the designated sections where root intrusion is a problem. Any work done to remove roots in a section shall be documented in the report. Documentation shall include the locations in the pipe segment where roots were removed and the procedure, which was used to remove the roots.

D. All sludge, dirt, sand, rock, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted. A vacuum truck shall be used to remove accumulations of material.

E. All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of at a site designated by the Owner. All materials shall be removed from the site no less often than at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Owner.

F. If the Contractor requires water for cleaning operations from hydrants, the Contractor shall make arrangements with the local water utility and shall use only fire hydrants designated by the

responsible water utility. The Owner will pay all costs associated with use of this water. The Contractor shall provide backflow preventers at the hydrants to prevent contamination of the water system.

G. Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Owner. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer line until the cleaning is shown to be satisfactory.

3.02 SEWER TELEVISING

A. All designated sewer sections shall be visually inspected by means of closed-circuit color television.

B. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. The camera shall be capable of radial view for inspection of the top, bottom, and sides of pipe and for looking up lateral connections. The camera shall be mounted on adjustable skids, or self propelled, to keep it in the center of the pie. Lighting of the camera shall be supplied by a lamp on the camera, capable of being dimmed or brightened remotely form the control panel. The lighting system shall be capable of lighting the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions and shall have a minimum of 650 lines of resolution and tested at 400 psi. The view seen by the televising camera shall be transmitted to a monitor of not less than 17 inches. The camera, television monitor, and other components of the DVD system shall be capable of producing a picture quality satisfactory to the Engineer; and if unsatisfactory, the equipment shall be removed and no payment will be made for an unsatisfactory inspection.

C. The television camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition but in no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds (or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions) shall be used to move the camera through the sewer line. If, during the inspection operation the television camera will not pass through the entire sewer section, the Contractor shall re-setup his equipment in a manner so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire sewer section, the inspection shall be considered complete and no additional inspection work will be required. All costs for re-setup due to an obstruction in the sewer that will not allow the camera to pass shall be considered incidental. If the camera becomes submerged due to a sag in the pipe, a high velocity jet will be utilized to pull water away from the camera lens.

D. The location meter, for accurately recording the location of the television camera with respect to the reference manhole, shall be a direct reading, above ground, friction clamp device or other suitable equipment. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. The meter shall be capable of reducing readings for reverse movement of the camera and shall be capable of being manually re-zeroed for each new setup. Footage shall be shown on the DVD data view and recorded at all times.

E. The logs shall be typed or computer printed and acceptable to the Owner. Printed location records shall be kept by the contractor and will clearly show the location, in relation to adjacent manholes, of each infiltration point discovered by the television camera. An estimate of the flow rate of observed infiltration points shall be made and recorded. In addition, other points of

significance such as locations of building sewer laterals, joints, unusual conditions, roots, storm sewer connections, collapsed sections, presence of scale and corrosion, and other discernible features will be recorded and two (2) copies of such records shall be supplied to the Owner.

F. The purpose of tape recording shall be to supply a visual and audio record of the condition of the lines that may be replayed both daily and at future presentations. DVD recording playback shall be at the same speed that it was recorded. Upon completion of the work, all discs recorded during the television inspection shall become the property of the Owner. Cost of DVDs shall be included in the unit price bid. A complete recording shall be made of each line televised. A voice recording on DVDs shall make brief and informative comments on the sewer conditions.

1. DVDs shall include the following information:
    a. Visual (on screen in corner):
        1) Report number.
        2) Date of television inspection.
        3) Sewer section and number.
        4) Current distance along reach (tape counter footage).
        5) Printed labels on DVD container and DVD disc with location information, date, format information, and other descriptive information.
    b. Audio:
        1) Date and time of television inspection, operator name, name of overlying or adjacent street, and manhole numbers.
        2) Verbal confirmation of sewer section and television direction in relation to direction of flow.
        3) Verbal description of pipe size, type, and pipe joint length.
        4) Verbal description and location of each service connection and pipe defect.
        5) Type of weather during inspection.
2. Television inspection logs shall include, but are not limited to, the following:
    a. Date, time, city, street, basin, sewer section, reference manhole number, name of operator, inspector, and weather conditions.
    b. Pipe diameter, pipe material, section length, depth of pipe, length between joints, and corresponding DVD identification.
    c. Location of each point of leakage.
    d. Location of each service connection.
    e. Location of any damaged sections, nature of damage, and location with respect to pipe axis.
    f. Deflection in alignment of grade of pipe.

G. Acceptance of televising shall be made upon the successful completion of the project and shall be to the satisfaction of the Owner. If the recordings show the inspection to be unsatisfactory, the Contractor shall be required to re-inspect the sewer line.

SECTION 4 – PAYMENT

A. Payment shall be based on following: Line cleaning and television inspection of the sewer lines shall be incidental to the appropriate bid item.

- END OF SECTION -

SECTION 33 05 23.13

GENERAL PROVISIONS FOR HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 SUMMARY

A. Related Sections and Divisions:
   1. Applicable provisions of the General Conditions shall govern the work in this section.
   2. Section 01 32 19, Submittals.
   3. Section 01 57 14, Erosion Control.
   4. Section 31 23 33, Trenching, Backfilling and Compaction.
   5. Section 33 34 00, Forcemain.
   6. Section 40 05 13.74, Polyethylene Pipe.
   7. Section 33 11 13, Water Main.
   8. Section 33 41 13, Storm Sewer.
   9. Section 33 33 13, Sanitary Sewer.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 32 19, Submittals.

B. Submit proposed construction operations and schedules to the Engineer minimum of 30 days prior to beginning work.
   1. Details shall include types of equipment, construction procedures, material and equipment delivery schedules, type of drilling fluid, Viscosity, weight limits, bit pressures, method of disposal, destination of drilling fluids, and other pertinent information.

1.03 QUALITY ASSURANCE

A. Horizontal directional drilling shall be in accordance with permits issued by the following:
   1. U. S. Army Corps of Engineers
   2. State of Wisconsin Department of Natural Resources.

PART 2 – PRODUCTS

2.01 PIPING

PROJECT MANAGER—SELECT PIPE TYPE.
SEAMLESS PIPE IS REQUIRED FOR WISDOT PROJECTS.

A. Piping shall be in accordance with **Section 40 05 13.74, Polyethylene Pipe OR Section 40 05 13.73, PVC Plastic Pipe, Restrained Joint Pipe**.

2.02 DRILLING FLUIDS

A. Drilling fluids composition shall meet permit requirements and environmental regulations.

2.03 WATER

A. Contractor shall procure, transport, and store water required for his operations.

PART 3 – EXECUTION

3.01 GENERAL

A. Directionally controlled horizontal drilling operation shall consist of drilling a small diameter pilot hole along alignment and at elevations indicated on Drawings; reaming a pilot hole to a diameter suitable for installation of prefabricated forcemain, sanitary sewer main, sanitary sewer lateral or water main; installing forcemain, sanitary sewermain, sanitary sewer lateral, or water main along reamed hole; and coordinating connections from the pull section to the forcemains or sanitary sewer lateral.

B. Contractor shall at all times provide and maintain instrumentation which will accurately locate pilot hole position in X, Y, and Z axis relative to ground surface. Drilling fluid flow rate and pressure shall also be monitored. The Engineer shall have access to this data at all times during the operation.

3.02 PILOT HOLE—FORCEMAIN OR WATER MAIN

A. A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:
   1. Elevation: Plus 0 feet, minus 1 foot
   2. Alignment: Plus or minus 1 foot
   3. Curve Radius: Minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.
   4. Entry Point: At the location shown on Drawings.
   5. Exit Point: Pilot hole shall penetrate ground surface within plus or minus 1 foot of alignment shown on Drawings and within plus 10 feet and minus 10 feet of length shown on Drawings.

3.03 PILOT HOLE – SANITARY SEWERMAIN OR SANITARY SEWER LATERAL

A. A pilot hole shall be drilled along the path shown on the drawings and to the tolerance to allow the pipe to be installed to the grades specified.

3.04 RECORD DOCUMENTS

A. Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 50 feet.
   1. This "as-built" plan and profile shall be updated as pilot bore is advanced.
   2. Submit five copies of the “as-built” plan and profile to the engineer within 10 days of pipeline completion.

3.05 RESTRICTIONS

A. In all cases, right-of-way restrictions shall take precedence over the tolerances listed above.

B. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of pipeline being installed in violation of right-of-way restrictions.

C. In all cases, concern for adjacent utilities and structures shall take precedence over the tolerances listed above.

D. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

E. After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to the Engineer, referenced to drilling entry point, which accurately describes location of pilot hole.

3.06 SANITARY SEWERMAIN

A. General
1. The sewermain shall be constructed so the pipe has a uniform grade as shown on the plans.
2. Alignment shall be as shown on the plans.
3. Upon completion of the pipe installation, the Contractor shall run water in the sewermain from the upstream manhole until the water is present at the downstream manhole.
4. The sewermain shall then be televised and recorded in the presence of the engineer. Any standing water in excess of 1/2-inch will be cause for sewermain rejection.
5. Rejected sewermain shall be replaced at the contractor's expense.

3.07 SANITARY SEWER LATERALS

A. General
1. The lateral shall be constructed so the pipe has a uniform grade of 1/8-inch to 1/4-inch per foot.
2. Grade shall not exceed 1/2-inch per foot.
3. Horizontal alignment shall be plus or minus 2 feet.
4. Upon completion of the pipe installation and before the lateral is connected to the sanitary sewer main, the Contractor shall run water in the lateral until the water is present at the sewer main end of the lateral.
5. The lateral shall then be televised and recorded in the presence of the Engineer. Any standing water in excess of 1/2-inch will be cause for lateral rejection.
6. Rejected laterals shall be drilled at the contractor's expense.

B. The Contractor shall obtain written permission from property owners for any drilling operations on private property. A copy of the written permission shall be submitted to the Engineer before starting the work.

C. All laterals shall be excavated at the property line. Restoration on private property shall be completed within 1 week after the installation of the sanitary sewer lateral.

D. Pilot Hole
1. A pilot hole shall be drilled along the path of the sanitary sewer lateral as shown on the drawings or as directed by the Engineer.
2. Entry and exit points shall be determined by the Contractor as required to provide the required grade of the lateral from the sanitary sewer main to the property line.

3.08 REAMING AND PULL-BACK OPERATION

A. Upon completion of pilot hole drilling, hole shall be enlarged by reaming and preassembled pipeline pull section shall be installed in hole.

1. Pipeline shall be preassembled to provide one continuous pulling operation.
2. Pipeline shall be temporarily capped before pulling operation to prevent any drilling fluid, water, or debris from entering pipeline.

B. Prereaming operations shall be conducted at discretion of Contractor.
1. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.

C. The maximum allowable tensile load imposed on pipeline pull section shall be calculated based on 70 percent of minimum yield strength (SMYS) of the pipe.
1. If more than one value is involved for a given pull section, the lesser value shall govern.
2. Contractor shall maintain accurate records of pull forces at all times for review by the Engineer.

D. A swivel shall be used to connect pipeline pull section to reaming assembly to minimize torsional stress imposed on section.

E. Pull section shall be supported as it proceeds during pull-back so that it moves freely and pipe is not damaged.

F. Pull section shall be installed in reamed hole in such a manner that external pressures are minimized.
1. Any damage to pipe resulting from external pressure during installation shall be the responsibility of Contractor.

G. Buoyancy Modification:
1. Buoyancy modification shall be used at the discretion of Contractor.
2. Any buoyancy modification procedure proposed for use shall be submitted to the Engineer for acceptance.
3. No procedure may be used which has not been reviewed by the Engineer.
4. Contractor will be responsible for any damage to the pipeline resulting from buoyancy modification.

3.09 DRILLING FLUIDS

A. Contractor shall employ his best efforts to minimize excess drilling fluid by recirculating surface returns.
1. This shall include, but not be limited to, provision of a solids control system sized and configured to remove spoil from drilling fluid surface returns so that fluid may be returned to active system without hindering drilling progress.

B. Disposal of excess drilling fluids and spoil shall be the responsibility of Contractor and shall be conducted in compliance with environmental regulations, right-of-way and workspace agreements, and permit requirements.
1. Drilling fluid and spoil disposal procedures proposed for use shall be submitted to the Engineer for acceptance.
2. No procedure may be used which has not been reviewed by the Engineer.

C. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids.
1. Drilling fluid returns at locations other than entry and exit points shall be minimized.
2. In the event that annular circulation is lost, Contractor shall take steps to restore circulation.

3. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand-placed barriers (hay bales, sandbags, silt fences, etc.), and collected using pumps, where practicable.
4. If amount of surface return is not great enough to be collected, affected area shall be flushed with fresh water and fluid shall be allowed to dry and dissipate naturally.
5. If amount of surface return exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used.
6. If amount of surface return exceeds that which can be contained and collected in small sumps, drilling operations shall be suspended until surface return volumes can be brought under control.

3.10 SAFETY AND RELATED MATTERS

A. Comply with all federal, state, and local rules and regulations concerning:
1. Construction safety.
2. Noise control.
3. Dust and smoke control.

B. Access to Public Services
1. Insure free access to all fire hydrants, valve boxes, manholes, curb stops, fire alarms, police call boxes.

C. Protection of Work, Public and Property
1. Provide safe passage for local traffic, pedestrian and vehicular.
2. Provide access to properties where work is being performed.
3. Provide all necessary barricades, warning lights, and signs, signals, flagmen, etc. in accordance with federal, state, and local regulations.
4. Obtain and comply with required permits.
5. Machinery, equipment, and hazards shall be guarded in accordance with federal, state or local regulations.
6. Excavations and trenching shall be made in accordance with safety practices formulated and enforced by federal, state, and local regulations.
7. Notify police or sheriffs department and fire department before blocking off street, highway, alley or public thoroughfare.

3.11 EXISTING UTILITIES AND STRUCTURES

A. When existing utilities and structures are indicated on drawings, it should not be assumed that all existing utilities and structures are shown.
1. The location of existing utilities and structures when given are plotted on the drawings for information to the Contractor, but is not to be construed as a representation of the actual location.
2. Contractor shall be responsible for injuries and damage to any structures, facilities, utilities, and public or private property resulting from construction.

3.12 NOTICE FOR STAKING

A. Notify Engineer at least three working days in advance of the time when staking will be required.

3.13 PROTECTION OF ESTABLISHED PROPERTY MARKERS

A. Protect all property markers (iron pipe, concrete or wood posts, etc.) from movement from original position.

B. Cost of replacement of property markers moved during construction shall be at Contractor's expense.

3.14 CLEANING OF PROJECT SITE

A. Work Site
   1. Keep the site of the work including all private or public property involved in or adjacent to the work, free from any rubbish, surplus or waste materials deposited or which have accumulated as a result of the work.
   2. Remove all materials, tools, and equipment leaving the site of the work clean, unobstructed and ready for use.

PART 4 – MEASUREMENT AND PAYMENT

4.01 HORIZONTAL DIRECTIONAL DRILLING

A. Measurement shall be made horizontally along the centerlines of the pipeline actually installed.

B. Payment shall be made by the unit price per linear foot and include:
   1. Pipe material, equipment, and labor.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Traffic, dust, and erosion control.
   5. Loading, hauling and disposal of street surfacing and curb & gutter in work area.
   6. Dewatering and excavation.
   7. Disposal of all excess drilling fluids.
   8. Loading, hauling and disposal of surplus excavated material.
   9. Backfilling and compaction.
   10. Water.
   11. End caps (sewer laterals).
   12. Location markers (sewer laterals).
   13. Complete restoration and landscaping.
   14. Repair and maintenance of disturbed street surfaces.
   15. Quality control testing.

- END OF SECTION -

SECTION 33 11 13

WATER MAIN

PART 1 -GENERAL

1.01 SUMMARY

A. Work Included: This section includes water main installation, materials, and restoration.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 01 45 24, Testing and Inspection of Pipeline Construction.
5. Section 31 23 33, Trenching, Backfilling and Compaction.
6. Section 31 05 13, Soils and Aggregates.
7. Section 40 05 13.10, Buried Piping and Appurtenances
8. Section 40 05 13.53, Ductile Iron Pipe.
9. Section 40 05 13.73, PVC Plastic Pipe.
10. Section 40 05 13.74, Polyethylene Pipe.
11. Section 32 90 00, Landscaping.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA).

B. American Society for Testing and Materials (ASTM).

C. American Society of State Highway and Transportation Officials (ASSHTO).

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals including the following:
1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
2. One copy of all test reports.

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

A. Ductile Iron Pipe shall conform to Section 40 05 13.53, Ductile Iron Pipe.

B. PVC Pipe shall conform to Section 40 05 13.73, PVC Plastic Pipe.

C. Polyethylene pipe shall conform to Section 40 05 13.74, Polyethylene Pipe.

2.02 HYDRANTS

A. Manufacturer: Waterous Pacer WB-67 or equal, conforming to AWWA C502.

B. Hydrants shall have 5¼-inch main valve opening, 6-inch mechanical joint connection, standard 2-piece pentagon operating nut, two 2½-inch hose connections, and one 4½-inch pumper connection.

C. Hydrants shall be provided with O-ring seals and compression type shut off.

D. All buried bolts on the hydrant body shall be Type 304 stainless steel. All stainless steel threads shall be coated with anti-seize compound prior to assembly.

E. Depth of Bury shall be as required to conform to the hydrant flange elevations as shown on plans or a 7-foot minimum measured from the bottom of inlet to the hydrant ground line. No additional compensation will be allowed for hydrant extensions if required.

F. Color shall be Red.

G. Equip hydrants with a break-away safety flange and coupling at the ground line.

2.03 VALVES

DESIGNER SHALL SELECT GATE VALVE OR BUTTERFLY VALVE. DISCUSS WITH OWNER.

A. Resilient Gate Valve
   1. Manufacturer shall be American Flow Control Series 2500, or equal.
   2. Resilient encapsulating wedge valve shall be used in water main sizes 4-inch through 12-inch.
   3. Valves shall conform with AWWA C515.
   4. Stem shall be non-rising.
   5. Valve body and bonnet shall be epoxy coated inside and out, conforming to AWWA C550. All bonnet bolts shall be Type 304 stainless steel. All stainless steel threads shall be coated with anti-seize compound prior to assembly.
   6. Waterway shall be smooth with no cavities or depressions in seat area.

B. Butterfly Valves
   1. Manufacturer shall be American Flow Control or equal.
   2. Butterfly valve shall be used in water main 14 inches and larger.
   3. Conform with AWWA C504, Class 150-B.
   4. Valve shaft shall be stainless steel.
   5. Valve disc shall be ductile iron.
   6. All buried bolts on the valve body and operator shall be Type 304 stainless steel.

C. Valve Boxes
   1. Manufacturer shall be Clow, Tyler, Sigma, or equal.
   2. Valve boxes shall be cast iron, three-piece, screw-type – Cast Iron.
   3. Shaft shall be 5¼-inch diameter.
   4. Lid shall be diameter drop type, anti-rattle and marked “Water.”
   5. Base shall be round or oval, sized to fit valve.
   6. Provide Valve box hangers, Adaptor Inc., or equal.

D. Valve Box Hangers: Manufacturer shall be Adaptor Inc. or equal.

2.04 FITTINGS

A. Conform with AWWA C153.
   1. All fittings shall be the product of one manufacturer

B. Mechanical Joint 3-inch through 24-inch:
   1. Class 52.
   2. Rated Pressure 350 psi.

C. Coating and Lining:
   1. Exterior Coating: Asphaltic Coating, minimum of 1-mil. thick.
   2. Interior Lining: Standard thickness of cement-mortar conforming with AWWA C104.

2.05 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall conform with AWWA C105.

B. Polyethylene encasement shall be Class C Black, Type 1 and Grade E-1.

C. Thickness shall be 8 mils minimum.

2.06 WATER SERVICE MATERIAL

PROJECT MANAGER – VERIFY COPPER OR POLYETHYLENE WITH CLIENT. CHOOSE AN "A" BELOW.

A. Copper Tubing
   1. Type "K" conforming with AWWA C800.

OR

A. Polyethylene Tubing
   1. Copper tubing size (CTS), 200 psi.
   2. SDR-9, PE-3608 conforming with AWWA C901 and NSF No. 14.
   3. Polyethylene tubing shall be marked in accordance with the above governing standards.
   4. Provide stainless steel pipe stiffeners at all connections.

B. Corporation Stops
   1. Manufacturer shall be Mueller H-15008, McDonald 4701 Q, Ford F-1000Q, or equal.
   2. Corporation stops shall conform with AWWA C800.
   3. Inlet shall have AWWA standard thread.
   4. Outlet shall be compression.

C. Curb Stops
   1. Manufacturer shall be Mueller B-25155, McDonald 6104 Q, Ford B44-444MQ, or equal.
   2. Curb stops shall conform with AWWA C800.
   3. Inlet and outlet shall be compression.

D. Curb Boxes
   1. Curb boxes shall be Mueller H-10300, McDonald 5614 or Ford EM2-70-56 for ½ to 1-inch curb stops, H-10302 or McDonald 5614 for 1¼-inch, and H-10300, McDonald 5615 or Ford EM2-70-57 for 1½-inch and 2-inch curb stops or equal.
   2. Minneapolis pattern with 1¼-inch upper section.
   3. Lid shall be plug style with pentagon bolt and marked "WATER."
   4. The curb boxes shall extend 7 feet and be complete with minimum 4-foot long stainless steel stationary rods and stainless steel pin.
   5. Base size shall match curb stop size.
   6. Two curb box keys and wrenches per contract or one per thirty curb boxes, whichever number is greater.

E. Service Saddles
   1. Manufacturer shall be Romac 306, Smith Blair 372, Cascade CSC2, Ford FS 313, or equal.
   2. Service saddles shall be used when tapping PVC water main.

F. Fittings
   1. Fittings for copper water service piping shall be of cast brass having an alloy of 85% copper, 5% zinc, and 5% lead.
   2. Fittings shall have a uniform wall thickness and strength, and shall be free of defects, which may affect their serviceability.
   3. Fittings shall be of the flared and compression type only.
   4. Unions shall be extra heavy 3-part type.

2.07 TRACER WIRE

A. Provide the following:
   1. Tracer wire shall be No. 12 AWG, stainless steel, single conductor with Type UF insulation rated for direct burial service for all borings.
   2. Tracer wire shall be No. 10 AWG, copper, or No. 12 AWG stainless steel, single conductor, with Type UF insulation rated for direct burial service for open cut.

B. Tracer wire splices shall be made soldered. The soldered connection shall be coated with 3M Scotchkote electricians coating and then securely taped in a tee configuration.

C. Tracer wire signal connection box shall be three-piece, 5¼-inch cast iron valve box with top marked, “Water” as manufactured by Clow, Tyler, or equal.

2.08 PIPE BEDDING AND BACKFILLING

A. Trenching, backfilling and compaction shall be in accordance with Section 31 23 33, Trenching, Backfilling and Compaction and standard details on the drawings.

2.09 THRUST BLOCKING

A. Thrust blocks shall be constructed of concrete having a minimum 28-day compressive strength of 2,000 psi. Hardwood blocking may be used, if approved by the Engineer.

B. The minimum cement content shall be 4½-pound bags of cement per cubic yard of concrete. The allowable slump shall be 4 to 5 inches

C. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown or required by the Engineer.

D. The blocking shall, unless otherwise specified or required, be placed so that the pipe and fitting joints will be accessible for repair.

E. A piece of 15-pound building paper or other approved material shall be placed between the cap or plug and the concrete.

2.10 JOINT RESTRAINT MATERIAL

A. Rods shall be ¾-inch diameter, Type 304, or 316 Stainless Steel.

B. Underground clamps shall conform to the following:
   1. ½-inch x 2 inches flat bar stock clamps, Astral Corp., or equal.
   2. Clamps shall include retainer washer.

C. T-bolts shall be Type 304 or 316 stainless steel.
   1. All stainless steel threads shall be coated with nickel based anti-seize compound prior to assembly.
   2. In lieu of anti-seize compound, a green fluoropolymer coated stainless steel nut may be substituted. The coating shall be FlourKote#1 manufactured by Metal Coatings Corporation.

D. Megalugs, by EBAA iron, Sigma "One-Lok", Ford, or equal may be used for joint restraint.

2.11 BUILT UP MASTIC COATINGS

A. Materials shall be applied in full accordance with manufacturer's recommendations. Coating shall be Tapecoat, TC Mastic, or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Before excavation of trenches begins, the Contactor shall uncover the end of the existing water main to which the new main is to be connected. This will permit adjustments in line and grade to avoid using extra fittings. The exposed end of an existing main must be protected and blocked by the Contractor to prevent the blowing out of the plug or cap at the end of the main.

B. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings to prevent breakage and coating damage. Any significant damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped into the trench or so handled as to receive hard blows or jolts. All mud or concentration of dirt shall be removed prior to installation.

C. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.

D. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means accepted by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

3.02 PIPE INSTALLATION

A. Pipe installation shall conform with Section 31 23 33, Trenching, Backfilling and Compaction and bedding details shown on the drawings.

B. Lay pipe to line and depth shown on plans. Unless otherwise stated, pipe shall be laid with the bell ends facing the direction of laying. When grade exceeds two feet per hundred feet, the bells shall face upgrade.

C. When the depth is not shown on the plans, bury the pipe with 6.5 feet of cover as determined from the top of pipe to the finished ground elevation.

D. Keep pipe, fittings, and hydrants free of debris and foreign matter. The interior of all pipes shall be clean before being installed. The Contractor shall provide the necessary means to wipe, brush, swab, or air blast to remove foreign matter.

E. Assemble all joints in accordance with manufacturer's recommendations.

F. Utilize full lengths of pipe, except at fittings.

G. Provide thrust blocking or restraints at the following locations:
   1. Bend deflecting 11½ degrees or more.
   2. Hydrants.
   3. Valves and tees.
   4. Plugs and caps.

H. When it is necessary to interrupt an existing system to complete construction, adhere to the following:
   1. No valves, controls, or appurtenances shall be operated by the Contractor.
   2. Operation of existing valves, controls, and appurtenances for interruption of existing service shall be done by Owner personnel at the Owner's convenience and normal working schedule.
   3. Contact owner a minimum 24 hours prior to an anticipated interruption.

3.03 HYDRANTS

A. General
   1. Hydrants shall be set on hardwood blocking and in concrete thrust blocks as shown in the detail. Immediately before installation of hydrants, the following operation shall be performed:
      a. The hydrant shall be thoroughly inspected and cleaned on the interior.
      b. The hydrant shall be opened and closed as many times as necessary to determine if all parts are in proper working order.

B. Location and Position
   1. Hydrants shall be located as shown or as required to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.
   2. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 18 inches nor more than 24 inches from the gutter face of the curb, unless otherwise shown on drawing details.
   3. When set in the lawn space between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 6 inches of the sidewalk.
   4. All hydrants shall stand plumb within ¼-inch, 3 feet in all directions, and shall have their nozzles parallel with, or at right angles to the curb, with the pumper nozzle facing the

curb, except that hydrants having two hose nozzles 90 degrees apart shall be set with each nozzle facing the curb at an angle of 45 degrees. Hydrants shall be set to the established grade, with nozzles at least 18 inches above the ground as shown or as required by the Engineer.

C. Hydrant

1. Drainage shall be provided by placing crushed stone around the hydrant as shown on the detail. The minimum amount of crushed stone shall be 6 inches above the waste opening in the hydrant, and 1 foot around the hydrant.

3.04 VALVES

A. Install as shown on the drawings.

B. Provide gate valves for sizes through 12 inches.

C. Provide butterfly valves for sizes 14 inches and larger.

D. Install valve boxes plumb, and centered over valve operating nut:

1. Install in a manner that will prevent shock loads and stress being transmitted to the valve and water main.
2. After backfill has been placed and compacted, demonstrate to the Engineer that all valves are operable.

3.05 POLYETHYLENE ENCASEMENT

A. Wrap all below ground metal in accordance with AWWA C105, including:

1. Ductile iron pipe.
2. Fittings, valves, and valve boxes.
3. Corporations, curb stops, and curb boxes - their entire length.
4. All portions of hydrants below grade.
5. Copper water services.
6. All metal restraining devices.

3.06 WATER SERVICES

A. Water services shall conform with all plumbing codes.

B. Terminate services at the property line or easement line as shown on the plans.

C. Unions may not be used unless approved by Owner’s Representative.

D. Connection to water main/

Water services shall be made by tapping the water main for the corporation stop unless use of a service saddle is required. The corporation stop connection shall be a minimum of 1 foot from any pipe or fitting joint and must have a minimum of 1 foot between connections and stagger 30° around the circumference of the water main.

E. All polyethylene water services shall have tracer wire brought up and cable wrapped with zip ties to the outside of the curb box. Tracer wire shall be extended to the termination point of the service.

F. All connections to water main shall be under system pressure when the water services are installed as part of relay construction. All connections to water main during new construction shall be under system pressure and tested when the water main is tested.

G. Corporation Stops, Curb Stops, and Curb Boxes
Unless specified otherwise, the Contractor shall provide and install one corporation stop, curb stop, and curb box, at each water service. Corporation stop and curb stop shall be service line size unless specified otherwise.

H. Position and Grade
In common trench construction, the water service shall be run parallel and a minimum of 12 inches above the sanitary sewer lateral. The water service shall be laid with a minimum cover of 6 feet or shall be insulated with acceptable material. The curb stop shall be placed between 6 and 7 feet below established or proposed grade.

I. Setting the Curb Box
The curb box shall be centered over the curb stop and shall be brought to proper grade. The legs of the service box shall rest firmly upon a 2-inch x 5-inch x 8-inch hardwood board or 4-inch x 8-inch x 16-inch solid concrete block. Clearance shall be provided so that the service box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, such support shall be finished by the use of a 2-inch by 6-inch plank placed across the building sanitary sewer trench and firmly supported in each bank.

The curb box shall be plumbed and braced so it will remain vertical throughout the backfilling. Sufficient excavation shall be made for the curb box installation to ensure proper setting and backfilling around the curb box.

Before placing backfilling around the curb service box, the Contractor shall wrap polyethylene around the base, and bedding material shall be tamped in place from a point above the main to a point 6 inches above the blocking to prevent entrance of backfill materials into the openings at the base.

After backfill has been placed and compacted, demonstrate to the Engineer that all curb stops are operable.

J. Protection of Curb Stop and Service Pipe
A copper disc shall be inserted in the curb stop coupling on the building side. The open end of copper water services shall be closed by peening the end.

3.07 TRACER WIRE

A. Run tracer wire along pipe from hydrant to hydrant.

B. Tape wire to each length of pipe at a minimum of two points.

C. A maximum of one splice will be allowed between each hydrant.

D. Tracer wire shall be tested for continuity prior to acceptance of project.

3.08 PROTECTION OF BURIED METAL SURFACES

A. All steel clamps, rods, bolts, and other metal accessories using reaction anchorage or joint harness and all mechanical pipe fittings installed underground shall be protected with a built-up mastic coating and covered with a polyethylene in accordance with this section.

B. Surfaces shall be cleaned by wire brushing immediately prior to application of the mastic.

C. The mastic shall be molded firmly to encase all bolts, nuts, clamps, straps and flanges, and built-up to a uniform surface over the entire fitting.

3.09 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall be of the flanged outlet type designed for attachment to the flanged inlet end of the tapping valve. Sleeve shall be rated for 150-psi working pressure.

B. Tapping sleeves shall be of cast iron or of Type 304 stainless steel construction.

C. With the exception of valve ends and oversize seat rings to permit entry of the drilling machine cutters, tapping valves shall conform to the requirements of AWWA C509.

D. Each tapping valve shall be provided with a flanged inlet end for attachment to the outlet flange of the tapping sleeve, and with an outlet end suitable for attachment of a drilling machine and the type of pipe used. Unless otherwise specified, each tapping valve shall be arranged to turn left (counterclockwise) to open and shall be provided with a 2-inch operating nut and valve box.

E. Each tapping sleeve and valve assembly shall be furnished and installed complete with gaskets as required and with all bolts for the sleeve and for the flanged connection between the sleeve and valve, in strict conformity with the directions and instructions of the manufacturer of the tapping sleeves and valves furnished.

F. The Contractor shall submit details of proposed sleeve and valve for the Engineer's review. Sleeve and valve shall be as manufactured by Kennedy Valve Mfg. Co., Clow Corporation, Dresser Industries, Romac Industries, or equal.

3.10 JOINING PIPE OF DIFFERENT MATERIAL OR OUTSIDE DIAMETER

A. Where specified or required, pipes of different material or outside diameter shall be joined with mechanical pipe couplings.

B. Couplings shall be suitable for the intended service and shall be installed in accordance with the manufacturer's instructions.

C. The Contractor shall submit details of proposed coupling for Engineer's review.

D. Mechanical pipe couplings shall be Dresser Style 162 or equal.

3.11 CONTRACTOR RECORD KEEPING

A. Measure and record the following:
   1. Service locations: Point of origin and terminus.
   2. Valve and fitting locations.

3. Water main locations.

3.12 DISINFECTION

A. The following water main shall be disinfected:
   1. New water main.
   2. Existing water main when cut into or repaired.
   3. Disinfect and flush system until samples test safe.

B. Contractor will perform sampling and have an independent laboratory (certified by the Department of Natural Resources) perform bacteriological testing to certify that water is free of coliform bacteria. Supply engineer with copy of test results.

C. Tablet Method: AWWA C651
   1. Place 5-gram calcium hypochlorite tablets each section of pipe as determined by the following table:

Number of Tablets Per Section of Pipe

Pipe Diameter (inches)	**Length of Pipe section (feet)**		
	13 or less	**18**	**20**
4	1	1	1
6	1	1	1
8	1	2	2
10	2	3	3
12	3	4	4
16	4	6	7

   2. Place one tablet in each hydrant, hydrant lead, and other appurtenance.
   3. Attach tablets with a food-grade adhesive to the top inside surface of the pipe:
      a. Adhesive shall be USDA for contact with edible products.
      b. Adhesive shall be Permatex Form-A-Gasket No. 2, Permatex Clear RTV Silicone, or equal.
      c. Permatex Form-A-Gasket No. 1 is not acceptable.
   4. Fill main in a manner such that the water velocity within the main will not exceed 1 fps.
   5. Water shall remain in pipe for a minimum of 24 hours, if water temperature is less than 40^{o} F, it shall remain in pipe a minimum of 48 hours.
   6. For pipe diameters larger than 16 inches, refer to AWWA C651 for correct calcium hypochlorite dosage.

3.13 PIPE TESTING

A. Perform pipe testing in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.
   1. After disinfection testing has been completed.
   2. Disinfect all testing equipment and fittings.

PART 4 - MEASUREMENT AND PAYMENT

DELETE PART 4 IF BID IS LUMP SUM.

A. Water main
   1. Measure water main along the centerline of the water main as installed, with no deductions for fittings and valves.
   2. The unit price per linear foot shall include:
      a. Labor, material and equipment.

b. Clearing and grubbing.
c. Removal, hauling, and disposal of all street surfacing and curb and gutter in the trench area.
d. Excavation and dewatering.
e. Traffic control.
f. Erosion control.
g. Installation of water main pipe materials, fittings, including pipe bedding and cover material.
i. Poly-wrap fittings, valves, valve boxes, valve box hangars, hydrants and curb stops.
j. Reaction blocking.
k. Joint restraints.
l. Backfilling and compacting.
m. Loading, hauling and disposal of surplus excavated material.
n. Dust control.
o. Restore all facilities damaged or destroyed during construction.
p. Landscaping.
q. Maintenance and repair of all disturbed street surfacing.
r. Leakage and pressure testing.
s. Sterilize and flush the lines until a satisfactory test can be obtained from a certified laboratory.
t. Provide bacteriological testing.
u. Tracer wire.
v. Tracer wire testing.

B. Valves
1. Measure valves on a per each unit price for each size and type installed.
2. Unit price per valve shall include:
a. Labor, material and equipment.
b. Valve box.
c. Valve box hangers.

C. Fire Hydrants
1. Measure hydrants on a per each unit price for each hydrant installed.
2. Unit price per hydrant shall include:
a. Labor, material, and equipment.
b. Excavation, dewatering, and backfilling.
c. Tie rods, restraint clamps, and reaction blocking.
d. Drainage stone.

D. Water Service Connection Sets
1. Measure water service connection sets on a per each unit price for each connection set installed, which includes:
a. Corporation stop, curb stop and curb box.
b. Tapping saddles.

2. Unit price per connection set shall include:
a. Labor, material, and equipment.
b. Tapping the water main.
c. Providing location marker at the curb stop.

3. Curb Box Extensions

a. Shall be paid for by the vertical foot installed (when ordered by Owner).
b. Shall include coupler.

E. Water Service
1. Measure water service on a direct line from the corporation stop to the curb stop with no allowances for loops or routing around obstacles.
2. Unit price per linear foot shall include:
a. Labor, material, and equipment.
b. Removal, hauling and disposal of all street surfacing, and curb and gutter in the trench area.
c. Excavation, dewatering, and backfilling.
d. Traffic, dust, and erosion control.
e. Restoration and landscaping.
f. Leakage and pressure testing.
g. Tracer wire where required.

F. Water Service (Tunnel)
1. Measure water service based on the actual amount of water service tunneled in place.
2. The unit price per linear foot shall include labor, material, and equipment.

G. Boring & Jacking Casing Pipe
1. Measurement for the casing pipe shall be made along the centerline of the casing pipe as installed.

2. Payment shall be made by the unit price per linear foot installed and include:
a. Labor, equipment, and material necessary to install the casing pipe.
b. Blocking and supports necessary to anchor the water pipe inside the casing pipe.
c. Placing a sand slurry, pea gravel, or fly ash slurry to completely fill the annular space between the casing and sewer pipe.
d. The water pipe placed inside of the casing.

- END OF SECTION -

SECTION 33 33 13

SANITARY SEWER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This section shall include furnishing all materials for the sanitary sewer work as shown on the drawings and as specified herein.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 01 45 24, Testing and Inspection of Pipeline Construction.
5. Section 31 23 33, Trenching, Backfilling and Compaction.
6. Section 31 05 13, Soils and Aggregates
7. Section 32 90 00, Landscaping.
8. Section 33 41 13, Storm Sewerage and Drainage.
9. Section 40 05 13.10, Buried Piping and Appurtenances.
10. Section 40 05 13.53, Ductile Iron Pipe.
11. Section 40 05 13.73, PVC Plastic Pipe.
12. Section 40 05 13.84, Polypropylene High Performance Sanitary Sewer Pipe.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM), Current Annual Book of Standards.

B. American Association of State Highway and Transportation Officials (AASHTO).

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 32 19, Submittals including:
1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
2. One copy of all test reports.

1.04 PROTECTION OF PROPERTY MARKERS

A. Contractor shall protect all property marker from movement from original position.

B. Cost of replacement of property markers during construction shall be at the contractor's expense.

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

A. PVC Sewer pipe shall be in accordance with Section 40 05 13.73, PVC Plastic Pipe.

B. Ductile iron pipe shall be in accordance with Section 40 05 13.53, Ductile Iron Pipe.

C. Concrete Reinforced Pipe shall be in accordance with Section 33 41 13, Storm Sewerage and Drainage.

D. Polyethylene pipe shall be in accordance with Section 40 05 13.74, Polyethylene Pipe.

E. Polypropylene pipe shall be in accordance with Section 40 05 13.84, Polypropylene High Performance Sanitary Sewer Pipe.

2.02 MANHOLES

A. Precast Manholes
1. Manholes and drop manholes shall conform with ASTM C478 for precast components.
2. Base section shall have a 6-inch minimum thick integral floor slab with 4-inch thickness for walls and riser sections. Base section shall be cast monolithically.
3. Joints shall conform with ASTM C443.
3. Gasket shall be 1¼ -inch thick butyl conforming with AASHTO M198.
4. Manhole top shall be pre-cast eccentric cone.

B. Cast-In-Place Manholes
1. Conform with drawing details.
2. Use only where called for on drawings.

C. Pipe Seals
1. Seals shall be flexible, watertight gasketed for pipe entrance holes.
2. Acceptable manufacturers shall be A-Lok Products or equal.

D. Manhole Steps
1. Manhole shall be a ½-inch diameter grade 60 steel reinforcement rod encapsulated in copolymer polypropylene.
2. Steps shall be as manufactured by M.A. Industries, Inc., or equal.

E. Castings
1. Castings shall conform to ASTM A48, Class 35.
2. Shall be AASHTO H-20 rated.
3. Lid shall be a non-rocking with concealed pick holes and self-seal neoprene “T” gasket.
4. Use Neenah R-1500 or equal.
5. Use Neenah R-1916C or equal when watertight castings where shown on the plans.

F. Sewer Joint Compound
1. Sewer joint compound shall be as manufactured by Pure Asphalt Company or equal.

G. Adjusting Rings
1. Concrete adjusting rings shall be:
   a. Minimum 4 inches thick.
2. Rubber adjusting rings shall be Infra-Riser as manufactured by GNR Technologies or equal.

H. Adjusting Ring & Casting Sealant
1. Multi-purpose manhole and septic joint seal as manufactured by American Infrastructure Technologies, Inc.

2.03 CLEAN-OUTS

A. Light duty: In earth or grass foot-traffic areas, provide a frost sleeve for DCOMM 82.35 (S)(A)2 Requirements.

B. Heavy Duty: In vehicle traffic areas use top loading rated heavy duty, ASME A112.36.2M, round, cast-iron housing with clamping device and round secured, scoriated cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.

C. Frost sleeve shall be same material as specified for sanitary sewer piping.

2.04 WYES, RISERS, AND FITTINGS

A. Shall be the same type and class as the sewer service pipe.

2.05 INSULATION BOARD

A. Extruded polystyrene conforming with ASTM C578.

B. Insulation shall be a minimum 1-inch thick.

C. Provide where required by plans.

2.06 PIPE BEDDING AND BACKFILLING

A. Pipe bedding and haunch shall be compacted to a minimum of 90% of modified proctor to the springline of the pipe prior to placement of initial backfill.

B. Subsequent backfilling shall be in accordance with the standard details in the drawings and conform with Section 31 23 33, Trenching, Backfilling, and Compacting.

PART 3 - EXECUTION

3.01 SEWER MAIN INSTALLATION

A. Pipe Installation
   1. Lay pipe upgrade with spigot pointing in direction of flow.
   2. When any portion of a section of PVC sewer between manholes has a bury depth equal to or greater than 25 feet, SDR-26 pipe shall be installed.
   3. When the entire section of PVC sewer between manholes is less than 25 feet of bury depth, SDR-35 may be installed.

B. Grade and alignment shall be established with laser equipment.
   1. Sewers shall be laid with straight alignment between manholes.
   2. Slope between manholes shall be uniform with no ponding water.
   3. Laser alignment shall be checked a minimum of every 100 feet.

C. Water/Sewer Line Crossing

1. Wherever the sanitary sewer crosses above watermain with less than a clear vertical separation of 18 inches (outside of pipe to outside of pipe) or below the watermain with less than a clear vertical separation of 6 inches (outside of pipe to outside of pipe), the sewer shall be constructed equal to watermain pipe. One full pipe length shall be centered on the watermain crossing and shall be pressure tested.
2. The type of pipe material and/or joints shall not change between manholes.

D. Maintaining Sanitary Sewer Service
1. The Contractor shall provide adequate equipment and facilities to provide bypass pumping for all elements of work requiring interruption to flow in the sanitary sewer. Provide backup or standby capabilities satisfactory to the Owner. The Contractor shall be responsible for damages to private or public property due to sewer backup while controlling sewage flow.
2. Under no circumstances will bypassing of untreated wastewater to any storm drainage facility or surface water course be allowed.
3. The Contractor shall notify the Owner and Engineer seven (7) days in advance of sewer sections, which will not be useable in order to allow time for the Owner to notify residents. Interruptions shall then be verified at least 24 hours in advance.
4. Interruptions of service shall be limited to eight (8) hours.
5. All existing sanitary laterals shall be permanently reconnected within two days after initial disconnection of the main line sewer bypass. These existing sanitary laterals shall be temporarily reconnected if the permanent reconnection cannot be accomplished immediately after disconnection.
6. All costs for flow control, temporary pumping, etc., shall be inclusive to the unit price bid for sanitary sewer.
7. All costs associated with connecting proposed sewers to existing sewers or manholes, manhole removal and abandonment, sanitary sewer removals and abandonment, shall, be included in the unit price bid for sanitary sewer.

3.02 SERVICE CONNECTIONS

A. Unless indicated otherwise, terminate services at the property line.

B. Services shall conform with all plumbing codes for depths and installation. Service depth shall be twelve (12) feet deep at the property line, or as deep as sewer main allows, or as shown on plans.

C. Clean-outs required by the plumbing code or ordinances shall be incidental to the service installation.

D. When a service is not immediately connected.
1. Mark in accordance with details. The Contractor shall record the location, length and depth for record drawings.
2. Provide a watertight cap on end of service.

E. Install wye branches where directed
1. New sewers: Utilize a factory made wye.
2. Existing sewers- Utilize a solvent welded saddle type wye with stainless steel straps.
3. Wyes connected to concrete pipe shall be core drilled and installed with a flexible watertight connector, which can be mechanically expanded into the cored opening.
4. Wyes shall be oriented at a ten (10) or two (2) o'clock position from the main.

F. Riser Installation

1. Install where requested by Owner's Representative.
2. Conform with appropriate details.
3. Bends shall be 45°.
4. Place risers on a minimum of 6-inches of Soil Class A-7 compacted to 95% Modified Proctor Density.
5. Risers shall be installed at maximum 45° from horizontal. (Standard service lateral or deep service lateral).
6. Risers shall be installed at maximum 67.5° from horizontal (Optional deep service lateral).

3.03 MANHOLES

A. Installation

1. Place manholes on a minimum of 6 inches of Soil Class A-7 compacted to 95% Modified Proctor Density.
2. Establish flow line and rim elevations from grade stake provided.
3. Furnish 4-foot diameter manholes (standard diameter) when dimensions are not shown on the plans.
4. Manholes shall be precast construction, unless shown otherwise.
5. Provide manhole riser sections in a combination of lengths, which will minimize the number of joints.
6. Seal manhole joints with 1¼-inch Butyl-Lok preformed tape or equal, conforming the AASHTO M-198.
7. Adjusting rings:
   a. Manhole casting shall be centered, brought to grade and embedded in a 3/4-inch to 1-inch bead of adjusting ring and casting sealant.
   b. A minimum of 4 inches of adjusting rings shall be used between the manhole cone and casting, and set in a 3/4-inch to 1-inch bead of adjusting ring and casting sealant.
   c. All adjusting rings less than four inches shall be rubber, a maximum of 3½-inch rubber rings shall be used. Two-inch concrete adjusting rings are not allowed.
   d. For manholes located in roadways, the upper two inches shall be rubber adjusting rings.
   e. For manholes located in traffic lanes, use tapered rubber adjusting rings.
   f. Maximum height of adjusting rings shall be 12 inches.
   g. Coat outside of adjusting rings only with sewer joint compound per manufacturer’s instructions.
   h. When watertight castings are shown on the plans, casting shall be anchored to the manhole structure.
8. Pipe shall enter manholes through a flexible, watertight gasket or connector manufactured in accordance with ASTM C443 or C923.
   a. Whenever practical, pipe opening shall be factory made using A-Lok or equal.
9. The following shall be filled with mortar and finished smooth
   a. Lift holes.
   b. Annular space around pipes: Interior bottom half only.

B. Inverts

1. Furnish precast manholes with shop manufactured inverts
2. Shape and slope flow line of invert to match largest connecting pipe.
3. Slope invert bench upward to manhole wall.

C. Precast Drop Manholes
   1. Coat outside of adjusting rings only with sewer joint compound per manufacturer's instructions.
   2. Furnish where shown on plans and conform with plan details.

3.04 CLEAN-OUTS

A. Install clean-outs and riser from sanitary sewer pipe to clean-out at grade. Install piping so clean-outs open in direction of flow.

B. Set clean-outs frames and covers in unpaved areas flush with finished grade.

C. Set clean-outs frames and covers in paving with tops flush with surface paving.

D. Set clean-out frames and covers in pavement in a cast-in-place concrete block, 18-inch x 18-inch x 12-inch deep. Slope top of concrete away from clean-out.

3.05 PIPE TESTING

A. Pipe testing shall be in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.

3.06 REPAIRS

A. Contractor shall repair all visible leaks, defects, and pipeline, which have failed testing.

B. After repairs are made, re-test and re-televise repaired sections.

PART 4 - MEASUREMENT AND PAYMENT

4.01 SANITARY SEWER

A. Measurement shall be made horizontally along the centerlines of the pipeline actually installed with no deductions for manholes.

B. Payment shall be made by the unit price per linear foot and include:
   1. Pipe material, equipment, and labor.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Traffic, dust and erosion control.
   5. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
   6. Dewatering and excavation.
   7. Pipe bedding and initial cover material.
   8. Loading, hauling and disposal of surplus excavated material.
   9. Backfilling and compaction.
   10. Wye's or Tee's for sewer services.
   11. Complete restoration and landscaping.
   12. Repair and maintenance of disturbed street surfaces.
   13. Quality control testing.

4.02 SEWER SERVICE

A. Measurement shall be made horizontally along the centerline of the pipe from the centerline of the sewer main to the end of the sewer service.

B. Payment shall be made by the unit price per lineal foot and include:
1. Pipe material, equipment, and labor.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Traffic, dust and erosion control.
5. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
6. Dewatering and excavation.
7. Pipe bedding and initial cover material.
8. Loading, hauling and disposal of surplus excavated material.
9. Backfilling and compaction.
10. Riser pipes.
11. All fittings including end caps.
12. Location markers.

4.03 MANHOLES

A. Measurement shall be made from the invert to the rim as installed.

B. Payment shall be made by the unit price per vertical foot installed and shall include:
1. Dewatering and excavation.
2. All pre-cast components, steps and frame and cover.
3. Gasketed pipe openings and joint seals.
4. Adjusting rings and sewer joint compound.
5. Drop manholes shall include the pre-cast drop.
6. Chimney seals, when specified.

4.04 BORING AND JACKING CASING PIPE

A. Measurement for the casing pipe shall be made along the centerline of the casing pipe as installed.

B. Payment shall be made by the unit price per linear foot installed and include:
1. Labor, equipment, and material necessary to install the casing pipe.
2. Blocking and supports necessary to anchor the sewer pipe inside the casing pipe.
3. Placing a sand slurry, pea gravel, or fly ash slurry to completely fill the annular space between the casing and sewer pipe.
4. The sewer pipe placed inside of the casing.

- END OF SECTION –

SECTION 33 34 00

FORCEMAIN

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes furnishing and installing all pipe and fittings for the forcemain as shown on the contract drawings, as specified, and as directed by the Engineer.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 01 45 24, Testing and Inspection of Pipeline Construction.
5. Section 31 23 33, Trenching, Backfill and Compaction.
6. Section 40 05 13.10, Buried Piping and Appurtenances.
7. Section 40 05 13.53, Ductile Iron Pipe.
8. Section 40 05 13.73, PVC Plastic Pipe.
9. Section 40 05 13.74, Polyethylene Pipe.
10. Section 32 90 00, Landscaping.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

B. American Water Works Association (AWWA).

C. American National Standards Institute (ANSI).

1.03 SUBMITTALS

A. Submit the following in accordance with Section 001 32 19, Submittals including:
1. Product literature and catalog cuts of materials to be supplied to relate these materials to the specifications.
2. One copy of test reports.

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

A. Ductile Iron Pipe shall conform to Section 40 05 13.53, Ductile Iron Pipe.

B. PVC Pipe shall conform to Section 40 05 13.73, PVC Plastic Pipe.

C. Polyethylene pipe shall conform to Section 40 05 13.74, Polyethylene Pipe.

2.02 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall conform with AWWA C105.

B. Polyethylene encasement shall be Class C Black, Type 1, and Grade E-1.

C. Thickness shall be 8 mils minimum.

2.03 TRACER WIRE

A. Provide the following:
   1. Tracer wire shall be No. 12 AWG, stainless steel, single conductor with Type UF insulation rated for direct burial service for all borings.
   2. Tracer wire shall be No. 10 AWG, copper, or No. 12 AWG stainless steel, single conductor, with Type UF insulation rated for direct burial service for open cut.

B. Tracer wire splices shall be made soldered. The soldered connection shall be coated with 3M Scotchkote electricians coating and then securely taped in a tee configuration.

C. Tracer wire signal connection box shall be three-piece, 5¼-inch cast iron valve box with top marked, "Sewer" as manufactured by Clow, Tyler, or equal.

2.04 PIPE BEDDING AND BACKFILLING

A. Trenching, backfilling and compaction shall be in accordance with Section 31 23 33, Trenching, Backfilling and Compaction and standard details on the drawings.

2.05 THRUST BLOCKING

A. Thrust blocks shall be constructed of concrete having a minimum 28-day compressive strength of 2,000 psi. Hardwood blocking may be used if approved by the Engineer.

B. The minimum cement content shall be 4½ bags of cement per cubic yard of concrete. The allowable slump shall be 4 to 5 inches

C. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown or required by the Engineer.

D. Thrust blocks shall, unless otherwise specified or required, be placed so that the pipe and fitting joints will be accessible for repair.

E. A piece of 15-pound building paper or other approved material shall be placed between the cap or plug and the concrete.

2.06 JOINT RESTRAINT MATERIAL

A. Rods shall be ¾-inch diameter, Type 304, or 316 Stainless Steel.

B. Underground clamps shall conform to the following:
   1. ½-inch x 2 inches flat bar stock clamps, Astral Corp., or equal.
   2. Clamps shall include retainer washer.

C. Bolts shall be 5/8-inch diameter, stainless steel.

D. Megalugs, by EBAA iron may be used for joint restraint.

2.07 PIPE COUPLINGS

A. Mechanical pipe couplings shall be Desser Style 162, or equal.

2.08 BUILT UP MASTIC COATINGS

A. Coating shall be Tape coat, TC Mastic, or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Before excavation of trenches is begun, the Contactor shall uncover the end of the existing main to which the new main is to be connected. This will permit adjustments in line and grade and avoid the use of extra fittings. The exposed end of an existing main must be protected and blocked by the Contractor to prevent the blowing out of the plug or cap at the end of the main.

B. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings to prevent breakage and coating damage. Any significant damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped into the trench or so handled as to receive hard blows or jolts. All mud or concentration of dirt shall be removed prior to installation.

C. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.

D. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means accepted by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

3.02 PIPE INSTALLATION

A. Pipe installation shall conform with Section 31 23 33, Trenching, Backfilling and Compaction and bedding details shown on the drawings.

2. Lay pipe to line and depth shown on plans. Unless otherwise stated, pipe shall be laid with the bell ends facing the direction of laying. When grade exceeds two feet per hundred feet, the bells shall face upgrade.

3. When the depth is not shown on the plans, bury the pipe with 6.5 feet of cover as determined from the top of pipe to finished ground elevation.

4. Keep pipe and fittings free of debris and foreign matter. The interior of all pipes shall be clean before being installed. The Contractor shall provide the necessary means to wipe, brush, swab, or air blast to remove foreign matter.

5. Assemble all joints in accordance with manufacturer's recommendations.

6. Utilize full lengths of pipe, except at fittings.

7. Provide thrust blocking and restraints at the following locations:
1. Bend deflecting 11½ degrees or more.
2. Valves and tees.
3. Plugs and caps.

H. When it is necessary to interrupt an existing system to complete construction, adhere to the following:
1. No controls or appurtenances shall be operated without the Owner's consent or direction.
2. Work requiring interruption of existing service shall be done at the Owner's convenience and normal working schedule.

3.03 POLYETHYLENE ENCASEMENT

A. Wrap all below ground metal in accordance with AWWA C105, including:
1. Ductile iron pipe.
2. Fittings, valves, and valve boxes.
3. All metal restraining devices.

3.04 TRACER WIRE

A. Run tracer wire along pipe when PVC or polyethylene pipe is used.

B. Tape wire to each length of pipe at a minimum of two points.

C. Tracer wire shall be tested prior to acceptance of project.

D. Maximum distance for tracer wire shall be 2,000 feet.

3.05 PROTECTION OF BURIED METAL SURFACES

A. All steel clamps, rods, bolts, and other metal accessories using reaction anchorage or joint harness and all mechanical pipe couplings, flanges, and sleeves installed underground shall be protected.

B. Surfaces shall be cleaned by wire brushing immediately prior to application of the mastic.

C. The mastic shall be molded firmly to encase all bolts, nuts, clamps, straps and flanges, and built-up to a uniform surface over the entire fitting.

D. The built-up surface shall be applied in full accordance with manufacturer's recommendations.

E. All buried metal surfaces with built up mastic protection shall be wrapped with polyethylene encasement.

3.06 JOINING PIPE OF DIFFERENT MATERIAL OR OUTSIDE DIAMETER

A. Where specified or required, pipes of different material or outside diameter shall be joined with mechanical pipe couplings.

B. Couplings shall be suitable for the intended service and shall be installed in accordance with the manufacturer's instructions.

C. The Contractor shall submit details of proposed coupling for Engineer's review.

3.07 CONTRACTOR RECORD KEEPING

A. Measure and record the following:
   1. Service locations: Point of origin and terminus.
   2. Valve and fitting locations.

3.08 PIPE TESTING

A. Perform pipe testing in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.

3.09 CUTTING OF PIPE

A. Pipe shall be cut at right angles to the centerline of the pipe. Cutting shall be done in a neat workmanlike manner without damage to the pipe and to leave a smooth end. All pipes shall be cut for use with rubber gasket joints shall be tapered by grinding or filling about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.

3.10 OBSTRUCTION IN LINE OR GRADE

A. Whenever it becomes necessary to lay a main over, under or around a known obstruction, the Contractor shall furnish and install the required fittings. The laying of such fittings will be paid for at the unit price bid for each size of main. No additional compensation will be paid to the Contractor for any expenses incurred because of such obstruction.

B. When an unknown underground structure interferes with the work and an alteration of the plan is required, the Engineer will issue a written order for such altered work, specifying the basis of payment or credit for such altered work.

PART 4 - MEASUREMENT AND PAYMENT

A. Forcemain
   1. Measure forcemain along the centerline as installed, with no deductions for fittings and valves.
   2. The unit price per linear foot shall include:
      a. Labor, material, and equipment.
      b. Clearing and grubbing.
      c. Removal, hauling, and disposal of all street surfacing and curb and gutter in the trench area.
      d. Excavation and dewatering.
      e. Traffic control.
      f. Erosion control.
      g. Installation of pipe materials, fittings, including pipe bedding and cover material.
      i. Poly-wrap fittings, valves, and valve boxes.
      j. Reaction blocking.
      k. Joint restraints.
      l. Backfilling and compacting.
      m. Loading, hauling and disposal of surplus excavated material.
      n. Dust control.
      o. Restore all facilities damaged or destroyed during construction.
      p. Landscaping.
      q. Maintenance and repair of all disturbed street surfacing.
      r. Leakage and pressure testing.
      s. Tracer wire testing.
      t. Tracer wire.
      u. Tracer wire box.

B. Boring and jacking casing pipe.
   1. Measurement for the casing pipe shall be made along the centerline of the casing pipe as installed.

   2. Payment shall be made by the unit price per linear foot installed and include:
      a) Labor, equipment, and material necessary to install the casing pipe.
      b) Blocking and supports necessary to anchor the sewer pipe inside the casing pipe.
      c) Placing a sand slurry, pea gravel, or fly ash slurry to completely fill the annular space between the casing and sewer pipe.
      d) The sewer pipe placed inside of the casing.

- END OF SECTION -

SECTION 33 41 13

STORM SEWER AND DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes storm sewer installation, materials and restoration.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control
4. Section 01 45 24, Testing and Inspection of Pipeline Construction.
5. Section 31 23 33, Trenching, Backfilling and Compaction.
6. Section 31 05 13, Soils and Aggregates.
7. Section 40 05 13.10, Buried Piping and Appurtenances.
8. Section 40 05 13.73, PVC Plastic Pipe.
9. Section 32 90 00, Landscaping.

1.02 REFERENCE STANDARDS

A. ASTM: American Society for Testing and Materials

B. AASHTO: American Association of State Highway and Transportation Officials

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals including the following:
1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
2. One copy of all test reports.

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

A. PVC Sewer Main
1. Sizes 8" through 15": ASTM D3034, SDR 35.
2. Sizes 18" through 27": ASTM F679.
3. Joints: Elastomeric conforming with ASTM D3212.

B. PVC Sewer Service
1. Conform with ASTM D1784 and D1785.
2. Sizes 6”: Schedule 40.
3. Joints: Solvent weld conforming to ASTM D2855.

C. Concrete Reinforced Pipe Sewer Main
1. Conform to ASTM C76.
2. Use "B" wall.

3. Joints: Bell and spigot conforming to ASTM C443 with rubber O-ring or rubber profile gaskets.
4. Provide Inserta Tee, Kor-N-Tee or equal for lateral connections.

D. Flared End Sections
1. Conform with ASTM C76.

2.02 MANHOLES

A. Precast Manholes
1. Conform with ASTM C478 for precast components.
2. Joints: Conform with ASTM C443.
3. Gasket: 1¼-inch by 1¼-inch thick butyl preformed tape conforming with AASHTO M198 for barrel sections.

B. 3/8-inch x 1/2-inch butyl preformed tape conforming with AASHTO M198 for adjusting rings.

C. Cast-In-Place Manholes
1. Conform with drawing details.
2. Use only where called for on drawings.

D. Manhole Steps
1. ½-inch diameter grade 60 steel reinforcement rod encapsulated in copolymer polypropylene.
2. As manufactured by M.A. Industries, Inc., or equal.

E. Castings
1. Conform to ASTM A48, Class 35.
2. Manhole castings
a. Use Neenah R-1500 or equal.
b. Lid shall be non-rocking with open pick holes.

F. Manhole components shall be suitable for AASHTO H-20 loadings.

G. Sewer Joint Compound
1. Sewer joint compound shall be as manufactured by Pure Asphalt Company or equal.

2.03 INLETS

A. Precast Components: Conform with ASTM C478.

B. Joints: Mortar conforming to ASTM C91, Type M.

C. Castings
1. Conform to ASTM A48, Class 35
2. Inlet grates shall be bicycle safe.
3. Provide inlet castings as follows:
a. 2'x3' rectangular: Neenah R-3246, or R3067, or equal with Type L grate.
b. 30" interior diameter round, with curb & gutter: Neenah R3075, or equal with type L grate. (At driveway openings, use Neenah NF 10996 grate).
c. 30” interior diameter round, without curb & gutter: Neenah R2500 or equal.
d. 30” interior diameter round with mountable curb & gutter: Neenah R3501-L1A

e. Yard inlet: Neenah R4360-D or equal.
f. Manhole inlets: Neenah R-3275 or equal with Type A grate, or R3246A, or R3067, or equal with Type L grate.

D. Inlet components shall be suitable for AASHTO H-20 loadings.

E. Underdrain
1. Drainage pipe, Corrugated polyethylene tubing, AASHTO designation M252.
2. Tubing sock
a. Fabric: Knitted polyester
b. Mullen burst: 100 (lbs./ft^2)
c. Water flow rate: 350 (gpm/min/ft^2 at 3-inch head)
3. Filter fabric (stone wrap)
a. Fabric: Knitted, woven or non-woven fibers of polyester, polypropylene, stabilized nylons, polyethylene or polyvinylidene chloride (slit film woven fabrics shall not be used)
b. Mullen burst: 60 min (lbs/in^2) (Method ASTM D3786)
c. Water flow rate: 100 min (gal/min/ft^2 at 50 mm constant head) (Method 2)
d. Grab tensile strength: 35 min (Method ASTM D4632)
e. Equivalent opening size: 30-140 (Method Corps of Engineers CW-02215-77)
f. Drainage pipe bedding and pipe cover: ASTM D448 - No. 67

2.04 FILTER FABRIC

A. Conform with the following minimums:
1. Weight: 6 Oz./SY
2. Thickness: 100 mils
3. Grab strength/elongation: 175 Lbs./50%
4. Puncture strength/burst strength: 95 Lbs./375 psi
5. Permeability: 0.4 cm/sec.

2.05 RIPRAP

A. As shown on plans and in accordance with Section 31 05 13, Soils and Aggregates.

2.06 SCOUR PROTECTION MAT

A. As manufactured by American Green or equal.

2.07 PERMANENT TURF REINFORCEMENT MAT (TRM)

A. North American Green SC 250, American Excelsior, Recylex TRM-V or equal.

2.08 PIPE BEDDING

A. Pipe bedding shall be soil class A-7 compacted to 95% of Modified Proctor.

B. Loss due to sulfate soundness test shall not exceed 10%.

C. Loss due to abrasion test shall not exceed 40%.

PART 3 - EXECUTION

3.01 SEWER MAIN INSTALLATION

A. Pipe Installation
   1. Pipe installation shall conform with Section 31 23 33, Trenching, Backfilling and Compacting.
      a. Lay pipe upgrade with spigot pointing in direction of flow.
      b. Pipe bedding and backfilling shall conform with the standard details as shown on the drawings.

B. Grade and alignment shall be established with laser equipment.
   1. Sewers shall be laid with straight alignment between manholes.
   2. Slope between manholes shall be uniform with no ponding water.
   3. Laser alignment shall be checked a minimum of every 100 feet.

C. Water/Sewer Line Crossing
   1. Where ever the storm sewer crosses above watermain with less than a clear vertical separation of 18 inches (outside of pipe to outside of pipe) or below the watermain with less than a clear vertical separation of 6 inches (outside of pipe to outside of pipe), the sewer shall be constructed equal to watermain pipe. One full pipe length shall be centered on the watermain crossing.
   2. The type of pipe material and/or joints shall not change between manholes.

3.02 SERVICE CONNECTIONS

A. Unless indicated otherwise, terminate services at the property line.

B. Services shall conform with all plumbing codes for depths and installation. Service depth shall be sufficient to accommodate the lowest service point.

C. When a service is not immediately connected:
   1. Mark in accordance with details. The Contractor shall record the location, length and depth for record drawings.
   2. Provide a watertight cap on end of service.

D. Install wye or tee branches where directed.
   1. New PVC sewers 6-inch through 15-inch: Utilize a factory made wye or tee.
   2. New PVC sewers 18-inch through 30-inch; Utilize a solvent welded saddle type wye or tee.
   3. Existing sewers: Utilize a solvent welded saddle type wye or tee.
   4. Wyes or tees connected to concrete pipe shall be core drilled and installed with a flexible watertight connector which can be mechanically expanded into the cored opening.

3.03 MANHOLES

A. Installation
1. Place manholes on a minimum of 6 inches soil class A-7, compacted to 95% Modified Proctor Density.
2. Establish flow line and rim elevations from grade stake provided.
3. Furnish manholes in 4-foot diameter (standard diameter) when dimensions are not shown.
4. Manholes shall be precast construction, unless shown otherwise.
5. Provide manhole riser sections in a combination of lengths which will minimize the number of joints.
6. Seal manhole joints with 1¼-inch Butyl-Lok preformed tape or equal.
7. Set casting frames and adjusting rings on preformed tape.
    a. Pitch castings to match street crowns.
8. Adjusting rings:
    a. Manhole casting shall be centered, brought to grade and embedded in a 3/4-inch to 1-inch bead of adjusting ring and casting sealant.
    b. A minimum of 4 inches of adjusting rings shall be used between the manhole core and casting, and set in a 3/4-inch to 1-inch bead of adjusting ring and casting sealant.
    c. All adjusting rings less than four inches shall be rubber. Two-inch concrete adjusting rings are not allowed.
    d. For manholes located in roadways, the upper two inches shall be rubber adjusting rings.
    e. For manholes located in traffic lanes, use tapered rubber adjusting rings.
    f. Maximum height of adjusting rings shall be 12 inches.
    g. Coat outside of adjusting ring sonly with sewer joint compound per manufacturer's instructions.
    h. When watertight castings are shown on the plans, casting shall be anchored to the manhole structures.
9. Pipe shall enter manholes through a flexible, watertight gasket or connector manufactured in accordance with ASTM C443 or C923.
    a. Whenever practical, pipe opening shall be factory made using A-Lok or equal.
10. The following shall be filled with mortar and finished smooth:
    a. Lift holes
    b. Annular space around pipes: Interior bottom half only.

B. Inverts
1. Furnish precast manholes with shop manufactured inverts.
2. Shape and slope flowline of invert to match largest connecting pipe.
3. Slope invert bench upward to manhole wall.

C. Flared End Sections
1. Flared end sections shall be installed with splash pads constructed of riprap placed on filter fabric.
2. If a dimension is not shown on the drawings, the splash pad shall be a minimum of 10 feet by 10 feet.
3. End section restraints (where shown on the plans).
    a. End sections shall be; anchored with two (2) three-quarter (3/4) inch rods and three-quarter (3/4) inch eye bolts.
    b. End sections shall be anchored to the second pipe back.

D. Contractor shall furnish the Owner two (2) manhole cover removing tools per contract.

3.04 INLETS

A. Installation
   1. Place inlets on a minimum of six inches of soil class A-7, compacted to 95% Modified Proctor Density.
   2. Establish line and grade from grade stakes provided.
   3. Minimum inlet height from top of base to top of curb shall be four feet.
   4. Provide type of inlet as shown on the plans.
   5. Provide underdrains where shown on plans.
   6. Underdrains shall be polyethylene tubing encased in a geo-textile sock and installed as follows:
      a. Embed tubing in clean stone and wrap stone with filter so that no water can enter the stone without passing through the fabric.
      b. Fabric shall not be exposed to direct sunlight more than 24 hours.
      c. Dead ends of the tubing shall be tightly capped.
      d. Discharge ends of tubing shall enter the inlet through a tight fitting penetration which was core-drilled or casted in the inlet wall.

3.05 FIELD QUALITY CONTROL

A. Pipe testing shall be in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.

PART 4 - MEASUREMENT AND PAYMENT

A. Storm Sewer
   1. Measurement shall be made along the centerlines of the pipeline actually installed with no deductions for manholes.
   2. Payment shall be made by the unit price per linear foot and include:
      a. Pipe material, equipment and labor.
      b. Clearing and grubbing.
      c. Stripping and stockpiling topsoil.
      d. Traffic, dust and erosion control.
      e. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
      f. Dewatering and excavation.
      9. Pipe bedding and initial cover material.
      h. Loading, hauling and disposal of surplus excavated material.
      i. Backfilling and compaction
      j. End caps (sewer services).
      k. Location markers (sewer services).
      l. Complete restoration and landscaping.
      m. Repair and maintenance of disturbed street surfaces.
      n. Field quality control.

B. Sewer Service Lateral
   1. Measurement shall be based on each lateral installed.
   2. Payment shall be made at the unit price per each and include:
      a. Labor and material.
      b. Adaptors if needed.
   3. Service taps (in manholes and inlets)

a. Taps shall be incidental to sewer service laterals.
    1) Labor and material.
    2) Core drilling pipe, manholes or inlets
    3) Flexible watertight connector with adaptor

C. Manholes
1. Measurement shall be made from the lowest pipe invert to the rim as installed.
2. Payment shall be made by the unit price per vertical foot installed and include:
    a. Dewatering and excavation.
    b. All pre-cast components, steps and frame and cover.
    c. Gasketed pipe openings and joint seals.
    d. Adjusting rings and sewer joint compound.
    e. Sump depth as shown on plans.
    F. Chimney seals.

D. Inlets
1. Measurement shall be based on each inlet installed.
2. Payment shall be made at the unit price per each and include:
    a. Dewatering and excavation.
    b. Pre-cast components, frame and grate.
3. Payment for inlets with underdrains shall be made at the unit price per each and include:
    a. Dewatering and excavation.
    b. Pre-cast components, frame and grate.
    c. Drain tubing with:
        1) Sock filter.
        2) Granular bedding and cover.
        3) Filter fabric wrapped around granular bedding and backfill.
        4) Tubing and caps.
    d. Sump depth as shown on plans.
4. Chimney seals.

E. Inlet Lead
1. Measurement shall be made along the centerlines of the lead from center of structure to center of structure.
2. Payment shall be made at the unit price per linear foot and include:
    a. Pipe material, equipment and labor.
    b. Traffic, dust and erosion control.
    c. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
    d. Loading, hauling and disposal of surplus excavated material.
    e. Dewatering and excavation.
    f. Pipe bedding and initial cover material.
    g. Backfilling and compaction.
    h. Repair and maintenance of disturbed street surfaces.
3. Perforated inlet lead shall be subject to the above and additionally include:
    a. Pipe perforations.
    b. Filter fabric wrap.
    c. Stone backfill to the road base course.

F. Flared End Sections
1. Measurement shall be based on each end section installed.
2. Payment shall be made at the unit price per each and include
    a. Labor and material.

b. Riprap and filter fabric.
c. Restraint rods.

- END OF SECTION -

SECTION 33 42 13

CORRUGATED METAL CULVERT PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: This section includes furnishing and installing corrugated metal pipe and fittings.

B. Size of pipe, gage, fittings, and coatings required shall be as shown on the drawings.

1.02 REFERENCE STANDARDS

A. Standards listed in this section refer to latest revision.

B. American Society for Testing and Materials (ASTM)
   1. A760 – Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drawing.

C. American Association of State Highway and Transportation Officials (AASHTO)
   1. M36 – Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Draws.

1.03 QUALITY ASSURANCE

A. Inspections
   1. Inspections shall be made to reject pipe that fails to conform to these specifications.
   2. Pipe and fittings shall be inspected by the Contractor before use.
   3. Pipe and fittings shall be available for inspection by Engineer at place of manufacture, jobsite, or any other point of delivery.

B. Pipe shall be rejected for any of the following:

   1. Uneven laps.
   2. Variation from a straight centerline of more than ½ inch.
   3. Ragged or diagonal sheared edges.
   4. Loose bolts or rivets.
   5. Fasteners which are unevenly lined.
   6. Poorly formed seams.
   7. Illegible brand marking.
   8. Poorly formed seams
   9. Dents or bends in the metal.
   10. Elliptical shape on round pipe.
      a. The average inside diameter of the pipe shall not vary more than ½ inch or 1 percent, whichever is greater. Measurement shall be on the inside crest of the corrugations.

C. Replace all rejected pipe.

D. Rejected pipe shall be clearly marked “REJECTED” with OSHA yellow paint.

1.04 PRODUCT DELIVERY

A. Marking

The following shall be painted on each piece of pipe:

1. Manufacturer's name or trademark.
2. Date of manufacture.
3. Pipe size.

B. Shipping

1. Pipe and fittings shall be packaged to prevent damage during shipping.
2. Fittings shall be on pallets.
3. All loading or unloading shall be done with lifts to avoid shock.
4. No materials shall be dropped.

C. Storage

1. Provide safe storage for material.
2. Interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter.
3. Fittings shall be stored in a manner that will allow them to drain and protect them from freezing.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:

1. Shop drawings for sectional plate pipe, sectional plate arches, or sectional plate pipe arches consisting of shop details, erection, and other working plans showing dimensions, sizes of material fittings, details, and other information necessary for the complete fabrication and erection of the metal work.
2. A certificate setting forth the name or brand of metal to be furnished and a typical or average analysis showing the percent of carbon, manganese, phosphorus, sulfur, silicon, copper, and any other elements specified for the particular kind of base metal.

PART 2 - PRODUCTS

2.01 MANUFACTURE

A. All pipe, fittings, and joints shall be manufactured per Standard M36.

B. Unless otherwise specified, dimensions, sheet thickness and minimum sheet gage for galvanized steel round pipe shall be as follows:

Project Manager, In Bid Item And Special Requirements, Specify Corrugated Metal Pipe Or Corrugated Aluminum Coated (Type 2) Pipe.

CORRUGATED METAL PIPE DIMENSIONS AND GAGES

Nominal Size (Inches)	Minimum Gage Number	Sheet Thickness (Inches)	Area-Square Feet
6	18	0.052	0.20
8	16	0.064	0.35
10	16	0.064	0.55
12	16	0.064	0.79
15	16	0.064	1.23
18	16	0.064	1.77
21	16	0.064	2.41
24	16	0.064	3.14
30	14	0.079	4.91
36	14	0.079	7.07
42	12	0.109	9.62
48	12	0.109	12.57
54	12	0.109	15.90
60	10	0.138	19.64

C. Unless otherwise specified, dimensions, sheet thickness, and minimum sheet gage for galvanized steel arch pipe shall be as follows:

CORRUGATED METAL PIPE ARCH DIMENSIONS AND GAGES

Pipe Arch Size (Inches)	Equivalent Diameter (Inch)	Span (Inch)	Rise (Inch)	Minimum Gage No.	Sheet Thickness (Inch)	Area-Square Feet
14x19	12	14	9	16	0.064	-
17x13	15	17	13	16	0.064	1.1
21x15	18	21	15	16	0.064	1.5
24x18	21	24	18	16	0.064	2.2
28x20	24	28	20	14	0.079	2.8
35x24	30	35	24	14	0.079	4.4
42x29	36	42	29	12	0.109	6.4
49x33	42	49	33	12	0.109	8.7
57x38	48	57	38	12	0.109	11.4
64x43	54	64	43	12	0.109	14.3
71x47	60	71	47	10	0.138	17.6

D. Unless otherwise specified, dimensions, sheet thickness and minimum sheet gages for aluminum coated (type 2) round pipe shall be as follows:

CORRUGATED ALUMINUM COATED (TYPE 2) PIPE
DIMENSIONS AND GAGES

Nominal Size (Inches)	Minimum Gage Number	Sheet Thickness (Inches)	Area-Square Feet
6	18	0.048	0.20
8	16	0.060	0.35
10	16	0.060	0.55
12	16	0.060	0.79
15	16	0.060	1.23
18	16	0.060	1.77
21	16	0.060	2.41
24	14	0.075	3.14
30	14	0.075	4.91
36	12	0.105	7.07
42	12	0.105	9.62
48	12	0.105	12.57
54	12	0.105	15.90
60	8	0.167	19.64

E. Unless otherwise specified dimensions, sheet thickness and minimum sheet gage for aluminum coated (type 2) arch pipe shall be as follows:

CORRUGATED ALUMINUM COATED (TYPE 2) PIPE
ARCH DIMENSIONS AND GAGES

Pipe Arch Size (Inches)	Equivalent Diameter (Inch)	Span (Inch)	Rise (Inch)	Minimum Gage No.	Sheet Thickness (Inch)	Area-Square Feet
17x13	15	17	13	16	0.060	1.1
21x15	18	21	15	16	0.060	1.5
24x18	21	24	18	16	0.060	2.2
28x20	24	28	20	14	0.075	2.8
35x24	30	35	24	14	0.075	4.4
42x29	36	42	29	12	0.105	6.4
49x33	42	49	33	12	0.105	8.7
57x38	48	57	38	12	0.105	11.4
64x43	54	64	43	12	0.105	14.3
71x47	60	71	47	10	0.167	17.6

2.02 MATERIALS

A. Culverts and Underdrain
   1. Materials shall meet Standard M218.
   2. All rivets, bolts, and nuts shall be hot dip galvanized.
   3. All rivets shall conform to Standard A31 Grade A.
   4. Pipe Seams:
      a. Bolts shall conform to Standard A449.

b. Nuts shall conform to Standard A563 Grade C.

5. Connecting band bolts shall conform to Standard A307 Grade A.

B. Field Assembled Structures

1. Materials shall meet Standard M167.
2. Bolts shall meet Standard M164.

C. Couplers

1. Couplers shall be made of the same material as the pipe.
2. Coupler thickness shall not be less than 0.052 inch nor more than 0.109 inch.
3. The coupler corrugations shall mesh with the pipe corrugations.
4. Coupler width shall be:
   a. Greater than 7 inches for 30-inch diameter and smaller.
   b. Greater than 12 inches for 36-inch to 96-inch diameter.
   c. Greater than 24 inches for 102-inch to 120-inch diameter.

D. Fittings shall be manufactured to the standard dimensions shown in Figures 38 and 39 of the Installation Manual of the National Corrugated Steel Pipe Association.

E. Coatings

1. Bituminous coating, (when shown on plans) shall be applied per Standard M190.
2. Polymeric coatings, (when shown on plans) shall be applied per Standards M245 and M246.

PART 3 - EXECUTION

301 INSTALLATION

A. Installation shall be made per the recommendations of the Installation Manual for Corrugated Steel Drainage Structures of the National Corrugated Steel Pipe Association.

B. Bedding and backfilling shall be performed in accordance with Section 31 23 33, “Trenching, Backfilling and Compacting.”

3.02 COATINGS

A Field applied coatings shall meet Standard M243.

B. Where the spelter coating has been damaged by cutting or welding, the damaged area shall be wire brushed and painted with two coats of zinc dust-zinc oxide paint.

- END OF SECTION -

40

DIVISION 40

PROCESS INTEGRATION

SECTION 40 05 13.10

BURIED PIPING AND APPURTENANCES

PART 1 – GENERAL

1.01 SUMMARY

A. Related Sections and Divisions:
1. Applicable provisions of the General conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 02 41 00, Demolition.
5. Section 02 41 13.23, Abandonment and Grouting Existing Pipelines.
6. Section 31 23 33, Trenching, Backfilling and Compaction.
7. Section 40 05 13.53, Ductile Iron Pipe.
8. Section 40 05 13.73, PVC Pipe.
9. Section 40 05 13.74, Polyethelene Pipe.
10. Section 40 05 13.76, PVC Lined R.C.P. Sewer.
11. Section 40 05 13.80, Centrifugally Cast Fiberglass Mortar Pipe.
12. Section 33 11 13, Watermain.
13. Section 33 33 13, Sanitary Sewer.
14. Section 33 41 13, Storm Sewer.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 32 19, Submittals:
1. General arrangement drawings of 3-inch or larger piping shall be submitted to Engineer for approval. Drawings shall include proposed length, location and elevation of pipe, fittings, valves and appurtenances.

PART 2 – PRODUCTS

2.01 MATERIALS OF CONSTRUCTION

A. Size and Type:
1. All materials shall conform to the size and type shown on the drawings or called for in the specifications.
2. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event standard fittings are not available, the method of joining shall be standard selected by Contractor and submitted for review and approval by Engineer.

B. Piping appurtenances shall be made of the materials specified. All appurtenances not designated as to type shall be selected by Contractor and submitted for review and approval by Engineer.

2.02 STEEL CASING PIPE

A. Minimum yield strength of 35,000 psi.

B. Minimum wall thickness for steel casing pipe for E-80 loading:

Pipe Size	Coated
14 and under	.188
16	.219
18	.250
20 and 22	.281
24	.312
26	.344
28	.375
30	.406
32	.438
34 and 36	.469
38	.500
40	.531
42	.563
44 and 46	.594
48	.625
50	.656
52	.688
54	.719
56 and 58	.750
60	.781
62	.813
64	.844
66 and 68	.875
70	.906
72	.938

C. When the casing is installed without the benefit of a protective coating, and said casing is not cathodically coated. The wall thicknesses shown above shall be increased to the next standard size, which is a minimum of 0.063 inches greater than the thickness shown except for diameters under 12¾-inch.

D. Field and shop welds of the casing pipes shall conform with American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than ¾-inch, nor shall there be intrusion of the weld metal into the bore of the casing.

2.03 CASING SPACERS

A. Casing spacers shall be as manufactured by Cascade Waterworks Manufacturing or equal and conform to the following:

1. Spacers shall be bolt on style with a shell made in two sections of minimum 14 gauge T-304 stainless steel and shall be PVC lined with a minimum thickness of 0.90 inches with 85-90 durometer.
2. Nuts and bolts shall be 18-8 stainless steel.
3. Runners shall be made of ultra high molecular weight polymer with high abrasion resistance and a low coefficient of friction.
4. Runners shall be supported by risers made of minimum 14 gauge T-304 stainless steel, MIG welded to the shell and all welds shall be passivated.

5. Height of supports and runners combined shall be sufficient to keep the carrier pipe at least 2 inches clear of the casing pipe wall at all times.
6. The spacers shall have restraining style positioning.

B. The following carrier/casing size shall be used (unless shown otherwise on the plans) for PVC, C900 and ductile iron pipe. Verify Carrier size with Engineer for concrete pipe.

4-inch Carrier into 10-inch casing	18-inch Carrier into 30-inch Casing
6-inch Carrier into 12-inch casing	20-inch Carrier into 30-inch Casing
8-inch Carrier into 14-inch casing	24-inch Carrier into 36-inch Casing
10-inch Carrier into 16-inch casing	30-inch Carrier into 42-inch Casing
12-inch Carrier into 20-inch casing	36-inch Carrier into 48-inch Casing
14-inch Carrier into 24-inch casing	42-inch Carrier into 54-inch Casing
16-inch Carrier into 24-inch casing	

2.04 CONCRETE

A. All concrete work under this Contract, unless shown or specified otherwise, shall conform to the requirements of Division 3.

PART 3 – INSTALLATION

3.01 INSTALLATION

A. Pipe bedding shall be in accordance with the standard details shown in the drawings.

B. Thrust blocking shall be in accordance with the standard details shown in the drawings.

3.02 BORING AND JACKING CASING PIPE

A. Install casing pipe to the limits and elevation which will allow the carrier pipe to be installed to the required line and grade.

B. Fit the carrier pipe with casing spacers which shall:
1. Allow grade adjustments.
2. Prevent floating and buckling of the carrier pipe.
3. Provide a low friction coefficient so the carrier pipe can be slid into place without splitting bells.

C. Plug the annular space between the casing pipe and carrier pipe to a point a minimum of two feet and a maximum of three feet in from the end of the casing pipe with flowable grout. Provide the Engineer with a shop drawing of the proposed method of construction.

3.03 CASING SPACER INSTALLATION

A. Place size and type of spacer as follows:

Type of Pipe	Carrier Pipe Size	Maximum Spacer Interval	Length of Spacer	Spacer Type
Ductile Iron, Steel, Asbestos Cement and PVC C-900	Up to 24 Inches	10 Foot	8 Inch	Restrained
Ductile Iron Steel, Asbestos Cement and PVC C-900	24-inch to 48-inch	6 Foot	12 Inch	Restrained
PVC SDR-35, PVC Schedule 40 and PVC Schedule 80	All Sizes	6 Foot	8 Inch	Restrained

B. At a minimum, provide spacers at each side of each pipe joint and the center of each pipe.

3.04 FIELD QUALITY CONTROL

A. Contractor shall include the cost of all testing, cleaning and disinfection in the bid.

B. All work shall be inspected, tested, and approved in accordance with federal, state and local rules and regulations. All work shall also be tested as specified in this section. Unless indicated in writing before testing begins, all tests shall be witnessed by Engineer and others as necessary. Test results shall be recorded and reports or appropriate certificates shall be submitted to Engineer in triplicate.

C. All new piping shall be tested. All underground piping shall be backfilled or properly secured to avoid damage during testing. Should underground piping fail test, Contractor shall be responsible for removal and replacement of backfill. All piping, interior or exposed, shall be subject to test before being covered with insulation, or paint. All piping and appurtenances shall be watertight or airtight and free from visible leaks.

D. All piping shall be flushed or blown out after installation prior to testing. Contractor shall provide all necessary piping connections, water, air, test pumping equipment, water meter, bulkheads, valves, pressure gauge and other equipment, materials and facilities necessary to complete the specified tests. Contractor shall provide all temporary sectionalizing devices and vents for testing.

E. Pressure tests shall be performed in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.

3.05 CLEANING AND DISINFECTION

A. All equipment and materials shall be clean before installation. Contractor shall disinfect and flush the potable water system before it is put online. Watermain shall be disinfected according to AWWA C651.

3.06 REPAIR AND RESTORATION

A. Unless otherwise specified, Contractor shall replace all bituminous and concrete pavement removed or damaged during performance of the work. Concrete pavement replacement shall conform to Division 3. Bituminous pavement replacement shall conform to Division 2.

B. Clean-up:

1. Upon completion of the work, all improvements disturbed by Contractor's operations shall be repaired or replaced. Broken concrete, rubble fill, and other excess material shall be removed from the site and wasted.
2. All areas for the storage of materials or the temporary deposit of excavated earth shall be leveled off and cleaned up. All surplus material, tools, and equipment shall be removed, and the premises shall be left free of everything of the kind.
3. All pipes and manholes shall be flushed until clean and all debris and mud shall be removed.

3.07 CLEANING OF WORK

A. Pipelines

1. Interiors of all pipelines (including existing) affected by construction procedures shall be free of all extraneous materials.
2. Pipelines shall be left clean at the completion of work.

B. Final Clean up and Inspection

1. Contractor shall remove all of the following:
   a. Temporary offices and storage structures.
   b. Temporary fencing and roads.
   c. Surplus material and rubbish.
   d. Material (liquid or solid) resulting from cleaning operations.
2. The Engineer and Owner may make final inspection of the work during the progress of the final cleaning and repairing. Any portion of the work accepted by the Owner shall be kept clean by the Contractor until final acceptance of the entire project.
3. When the contractor has completed the final cleaning operation, he shall notify the Engineer in writing that he is ready for final inspection.
4. After written notification to the Contractor, the owner may elect to remove from the work site and/or adjacent properties, all rubbish, surplus or waste materials which the contractor has neglected or refused to remove, and deduct the costs of removal from any monies due the contractor.

3.08 DEMOLITION

A. All exterior piping removals, including manholes and appurtenances and abandonment, shall be by Contractor. The locations and elevations of existing piping are approximate. Where necessary, existing piping shall be exposed prior to installing new piping. Any changes in pipe location or elevation shall be approved by Engineer.

B. Contractor shall remove or abandon all existing piping and appurtenances as noted. Unless otherwise shown or specified, the owner shall have the right of first refusal for all, piping and appurtenances to be removed shall be removed from the site for salvage or disposal. Unless otherwise shown or specified, piping shown or specified to be abandoned shall be filled with a 3' concrete plug. Concrete shall be as specified in Division 3. Wherever excavations cross piping to be abandoned, piping shall be removed to the limits of the excavation and the ends shall be filled as specified above.

C. Valve boxes and exposed valves and operators on piping to be abandoned shall be removed. All concrete surfaces to remain shall be patched as required to provide a smooth surface. Re-piping and connections to new piping shall be as specified for new piping.

D. It is the responsibility of the Contractor to remove or abandon all piping and appurtenances, as shown or specified, and patch all holes resulting therefrom unless specified or shown otherwise. The intent of these specifications is to require that the removal of materials, patching of all existing holes and repiping be done in a workmanline manner. All costs shall be included in the bid.

-- END OF SECTION --

SECTION 40 05 13.53

DUCTILE IRON PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This section includes material and performance requirements for ductile iron pipe and fittings.

B. Related Sections and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 45 24, Testing and Inspection of Pipeline Construction.
4. Section 31 23 33, Trenching, Backfilling and Compaction.
5. Section 33 34 00, Forcemain.
6. Section 40 05 13.10, Buried Piping and Appurtenances.
7. Section 33 11 13, Watermain.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1.	AWWA C104	Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water
2.	AWWA C110	Gray Iron and Ductile Iron Fittings, 3-in. through 48-in. for Water and Other Liquids
3.	AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
4.	AWWA C115	Flanged Ductile-Iron Pipe with Threaded Flanges
5.	AWWA C150	Thickness Design of Ductile-Iron Pipe
6.	AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids
7.	AWWA C153	Ductile-Iron Compact Fittings 30-in. through 16-in., for Water and Other Liquids
8.	AWWA C600	Installation of Ductile-Iron Watermains and their Appurtenances

1.03 MARKING, HANDLING AND STORAGE

A. Marking
1. Conform with AWWA C151.
2. Markings shall include:
   a. Weight.
   b. Class or thickness.
   c. Manufacturer's mark.
   d. Where casted.
   e. Year produced.

B. Handling and Storage
1. Conform with AWWA C600.
   a. Pad lifting equipment to prevent damage to exterior coatings.
   b. Do not drop, skid, or roll pipe.
   c. Store so pipe remains free of dirt and foreign material.

d. Any significant damage to coatings shall be repaired before installation.
e. Under no circumstances shall pipe or fittings be dropped into the trench or so handled to receive hard blows or jolts.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
1. Submit manufacturer's certification that materials delivered comply with the requirements of this section.

PART 2-PRODUCTS

2.01 PIPE

A. Conform with AWWA C150 and C151.
1. All pipe shall be the product of one manufacturer.

B. Coating and Lining:
1. Exterior Coating: Asphaltic coating, minimum of 1 mil thick.
2. Interior Lining:
a) Cement Lining
1) Standard thickness of cement-mortar conforming with AWWA C104.
2) Completely fused above 1,400 degrees F, 6 mils to 10 mils thick, defects which expose base metal not greater than 0.01 percent of total lined surface, hardness greater than 5 on the Mohs scale, lining bonded sufficiently to withstand a metal strain of 0.001 inch/inch without damage to the glass lining, finished lined pipe not to deviate more than 0.0125 inch per foot of length from the centerline perpendicular to the flange face or square end of the pipe.
b) Glass Lining

C. Pipe Class and Rating for Push-on, Push-on Lock Joint, and Mechanical Joint:
1. 3-inch through 24-inch:
a. Class 52.
b. Rated pressure 350 psi.

D. Pipe Class and Rating for Flanged Joint Pipe:
1. Class 53 minimum.
2. Rated pressure 250 psi.

DELETE IF THERE IS NO SLUDGE PIPING

E. All 4-inch sludge piping shall be internally glass lined.

2.02 PIPE JOINTS

A. Push-on:
1. Conform with AWWA C111.
2. Gaskets
a. Plain rubber for sewer and water to temperatures not exceeding 150°F.
b. For air piping, gaskets shall be rated for a minimum of 248°F.

B. Push-on Lock Joint:
   1. Conform with AWWA C111.
   2. Joints shall be held in place with a boltless locking ring.
   3. Gaskets: Plain
      a. Plain rubber for sewer and water to temperatures not exceeding 150°F.
      b. For air piping, gaskets shall be rated for a minimum of 240°F.

C. Mechanical Joint:
   1. Conform with AWWA C111.
   2. Joints shall include:
      a. Ductile or gray iron follower gland.
      b. T-bolts shall be Type 304 or 316 stainless steel. All stainless steel threads shall be coated with anti-sieze compound prior to assembly.
      c. Plain rubber gasket for sewer and water to temperatures not exceeding 150°F.
      d. Joint restraints shall be MEG-A-LUG by EBBA Iron.

D. Flange Joint:
   1. Conform with AWWA C115.
   2. Joints shall include:
      a. Ductile iron flanges.
      b. Bolts with nuts.
      c. Sheet rubber gaskets, full face, minimum 1/8 inch thick.
      d. For air piping, gaskets shall be rated for a minimum of 240°F.

E. Grooved Joint:
   1. Conform with AWWA C-606.
   2. Joints shall include:
      a. Couplings.
      b. Transition couplings when needed.
      c. Gaskets & bolts.
      d. For air piping, gaskets shall be rated for a minimum of 240°F.
      e. Transition couplings when needed.

2.03 PIPE JOINT RESTRICTIONS

A. The use of lead or asbestos in the gasket material is prohibited.

2.04 FITTINGS

A. All fittings shall be the product of one manufacturer.

B. For use below grade:
   1. Compact ductile iron mechanical joint conforming to AWWA C153.

C. For use within manholes, structures or above grade:
   1. Standard gray iron or ductile iron flanged joint conforming to AWWA C110.

D. For use within structures:
   1. Ductile iron grooved joint conform with AWWA C-606.

E. Coatings and Linings

1. Exterior Coating: Asphaltic coating, minimum of 1 mil thick.
2. Interior Lining: Lined same as pipe.

F. Gaskets: Conform with AWWA C111.

2.05 POLYETHYLENE ENCASEMENT

A. General Requirements
1. Meet AWWA C105.
2. Type: 1
3. Class: "C" (black).
4. Grade: "E-1"
5. Thickness: 8 mils

PART 3 - EXECUTION

3.01 POLYETHYLENE ENCASEMENT

A. All underground ductile iron pipe, valves, valve boxes and fittings shall be polyethylene encased.

3.02 APPLICATION

A. Install piping in accordance with the plans and appropriate specification sections for the type of work being performed.

3.03 CLEANING AND PROTECTION OF PIPE

A. The interior and exterior of all pipe shall be clean and free from all foreign material before being installed. The Contractor shall provide the necessary means to wipe, brush, swab, or air blast to remove any foreign material from the interior of the pipe as required by the Engineer.

B. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering they pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

C. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means accepted by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

3.04 ACCEPTANCE TEST

A. General
All pipelines and sewers shall be tested. Test pressure, duration, and media shall be as specified in the piping system specification sheets. Care should be exercised to isolate equipment not rated for the specified test pressure to avoid damage to the equipment.

B. All pipe shall be tested in accordance with Section 01 45 24, Testing and Inspection of Pipeline Construction.

DELETE IF THERE IS NO AERATION PIPING

C. Underground aeration piping shall have EPDM gaskets designed for a minimum temperature of 225º for mechanical joins or 250º for push-on joints.

- END OF SECTION -

SECTION 40 05 13.73

PVC PLASTIC PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section includes material and performance requirements for (polyvinyl chloride) plastic pipe and fittings.

B. Related Section and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 45 24, Testing and Inspection of Pipeline Construction.
4. Section 31 23 33, Trenching, Backfilling and Compaction.
5. Section 40 05 13.10, Buried Piping and Appurtenances.
6. Section 33 11 13, Water main.
7. Section 33 41 13, Storm Sewer and Drainage.
8. Section 33 33 13, Sanitary Sewer.
9. Section 40 05 15, Methods and Materials For Piping Installations.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1.	ASTM D1784	Spec. for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2.	ASTM D1785	Spec. for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120.
3.	ASTM D2241	Spec. for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
4.	ASTM D2412	Test for External Loading Properties of Plastic Pipe by Parallel-Plate Loading.
5.	ASTM D2466	Spec. for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
6.	ASTM D2467	Spec. for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7.	ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basics for Thermoplastic Pipe Materials.
8.	ASTM D2855	Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
9.	ASTM D3034	Spec. for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
10.	ASTM D3139	Spec. for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
11.	ASTM D3212	Spec. for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
12.	ASTM F438	Spec. for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
13.	ASTM 439	Spec. for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

14. ASTM F441 Spec. for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Schedules 40 and 80.
15. ASTM F477 Spec. for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
16. ASTM F679 Spec. for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

B. American Water Works Association (AWWA):
1. AWWA C900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for water.
2. AWWA C905 Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch.

1.03 QUALITY ASSURANCE

A. Pipe shall be available to Owner's Representative for inspection.

B. Pipe shall be considered defective and will be rejected when:
1. Pitted or cratered.
2. Flaking.
3. Straightness varies more than ½-inch in 10 feet.
4. Any defect that prevents assembly according to manufacturer's recommendations.

C. Material brands and/or pipe classes shall not be mixed.

1.04 PRODUCT DELIVERY

A. Pipe Marking - pipe shall be marked as follows:
1. Manufacturer's name, trademark, or logo.
2. Nominal size.
3. PVC minimum cell classification.
4. Pipe stiffness designation, dimension ratio or schedule size and pressure class.
5. ASTM or AWWA designation.
6. National Sanitation Foundation approval (pipe for potable water).
7. Production date.

B. Storage:
1. Provide a covered storage area.
2. Keep pipe material safe from damage and theft.
3. Protect pipe material from direct rays of the sun.
4. Protect gaskets from sun rays, excessive heat, grease, oil, and electric motors that produce ozone.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 32 19, Submittals:
1. Certification of production date of all materials.
2. Manufacturer's certification that materials delivered comply with requirements of this section.

PART 2 - PRODUCTS

2.01 NON-PRESSURE RATED PIPE

A. Gravity Sewer
1. All pipe shall be the product of one manufacturer.
2. All fittings shall be the product of one manufacturer.
3. Pipe shall be manufactured in accordance with the following standards:
   a. Sizes 8-inch through 15-inch: ASTM D3034.
   b. Sizes 18-inch through 48-inch: ASTM F679 or ASTM F794.
4. Elastomeric Gaskets: Conform with F477
5. Fittings and repair couplings shall be the same class and physical properties as pipe and monolithically molded or extruded.
6. Solvent welded and stainless steel strapped wyes or tees may be used for storm sewer laterals: conform to ASTM D3034 and ASTM F679.
7. Elastomeric Joints: ASTM D3212
8. Solvent Weld Joints: Not permitted.

B. Sewer Services
1. Conform with ASTM D1784 and D1785.
2. Pipe sizes 4-inch and 6-inch: Schedule 40
3. Solvent Weld Joints: ASTM D2855
4. Fittings: Socket type, ASTM D2466

C. Piping System Specification (Section 40 05 15)
1. Conform with ASTM D1784 and D1785.
2. Solvent Weld Joints: ASTM D2855.
3. Threaded Joints: ASTM D2464-06.
4. Fittings: Socket Type, ASTM D2466.

2.02 PRESSURE RATED PIPE

A. Water main
1. All pipe shall be the product of one manufacturer.
2. All fittings shall be the product of one manufacturer.
3. Pipe shall be manufactured in accordance with the following standards:
   a. Pipe sizes 4-inch through 12-inch: AWWA C900, pressure Class 150, thickness Class DR 18.
   b. Pipe sizes 14-inch through 36-inch: AWWA C905, pressure Class 235, thickness Class DR18.
4. Elastomeric gaskets shall be manufactured as defined in ASTM F477.
5. Joints shall conform to ASTM D3139.
6. Solvent weld joints may not be used.

B. Pressure Sewer (3 Inches and Smaller)
1. Pipe and joints shall be manufactured in ASTM D2241, minimum pressure Class 160 and thickness Class SDR 26.
2. Solvent Weld Joints: ASTM 2855

C. Pressure Sewer (4 Inches and Larger)
1. Pipe and joints shall meet one of the following minimums:

a. Pipe sizes 4-inch through 12-inch:
   1) AWWA C900, pressure Class 150, thickness Class DR 18.
   2) ASTM D2241, pressure Class 250, thickness Class SDR 17.
b. Pipe sizes 14-inch through 36-inch: AWWA C905, pressure Class 150, thickness Class DR 18.

2. Elastomeric Joints: ASTM D3139
3. Piping Systems (Plant Piping)

2.03 RESTRAINED JOINT PVC PIPE

A. Water Main or Sanitary Sewer.
1. Acceptable manufacturer is Certanteed Certa-Lok C900/RJ PVC pipe or equal.
2. Pipe shall be manufactured in accordance with the following standards:
   a. Pipe sizes 4-inch through 12-inch: AWWA C900, pressure Class 235, thickness Class DR 18 in right-of-way or easements (non-traffic areas).
   b. Pipe sizes 4-inch through 12-inch: AWWA C900, pressure class 305, thickness Class DR 14 in traffic areas.
3. Restrained Joint Couplings
   a. Non-metallic restrained type couplings. Pipe and couplings shall be designed as an integral system and shall be provided by a single manufacturer for maximum reliability and interchangeability. Pipe and couplings shall be joined using high-strength flexible plastic splines inserted into mating precision-machined grooves, which align when the pipe is fully inserted provided a full 360º restraint with evenly distributed loading. No external pipe-to-pipe restraining devices that clamp onto or otherwise damage the pipe surface as a result of point loading shall be permitted.

PART 3 - EXECUTION

3.01 PVC INSTALLATION

A. Install PVC piping in accordance with manufacturer's written instructions.

B. Refer to applicable section for installation procedures.

- END OF SECTION -

SECTION 40 05 13.74

POLYETHYLENE PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: This section includes material and performance requirements for polyethylene pipe and fittings.

B. Related Section and Divisions:
1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01 32 19, Submittals.
3. Section 01 57 14, Erosion Control.
4. Section 01 45 24, Testing and Inspection of Pipeline Construction.
5. Section 31 05 13.20, Soils and Aggregates.
6. Section 31 23 33, Trenching, Backfilling and Compaction.
7. Section 33 34 00, Forcemain
8. Section 33 11 13, Watermain
9. Section 33 33 13, Sanitary Sewer.
10. Section 40 05 15, Method and Materials for Process Piping Installation: Exposed.

1.02 QUALITY ASSURANCE

A. Pipe shall be available to Owner's Representative for inspection.

B. Pipe shall be considered defective and will be rejected when:
1. Pitted or cratered.
2. Flaking.
3. Any defect that prevents assembly according to manufacturer's recommendations.
4. Not utilized within six (6) months of date of production.

C. Material brands and/or pipe classes shall not be mixed.

1.03 PRODUCT DELIVERY

A. Pipe Marking - pipe shall be marked as follows:
1. Manufacturer's name, trademark, or logo.
2. Nominal size.
3. SDR rating.
4. Production date.

B. Storage:
1. Provide a protected storage area.
2. Keep pipe material safe from damage and theft.
3. Protect pipe material from direct rays of the sun.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 32 19, Submittals, including:
   1. Certification of production date of all materials.
   2. Manufacturer's certification that materials delivered comply with requirements of this section.

PART 2 - PRODUCTS

2.01 GENERAL

A. All pipe and fittings shall be the product of one manufacturer.

2.02 MATERIALS

A. Pipe
   1. Pipe materials furnished under this section shall be high-density polyethylene pipe, D.I.P.S., P.E.-3608, in accordance with ASTM D-1248, Type III, Class C, Category 5, Grade P34.
   2. The polyethylene pipe material shall exceed an environmental stress crack resistance of 1500 hours, Condition C in accordance with ASTM D-1693; shall have a nominal tensile yield strength of 3,500 psi in accordance with ASTM D-638; shall have a minimum Elongation of Break of 600% in accordance with ASTM D-638; and shall have a minimum Modulus of Elasticity of 110,000 psi in accordance with ASTM D-638. The polyethylene pipe shall have an average molecular weight equal to 250,000 psi as per GPC (Contractor shall provide certification).
   3. The polyethylene pipe shall have a manufacturer's recommended hydrostatic design basis of 1,600 PSI determined in accordance with ASTM D-2837. The dimensional characteristics and pressure capabilities shall be in accordance with ASTM F-714. The pipe shall have an SDR of 11 or less for pressurized pipes and SDR of 17 or less for non-pressurized pipes.
   4. The polyethylene pipe shall have an internal pressure rating of 160 psi at 75°F temperature and at a service life of 50 years. The pressure rating shall be calculated in accordance with ISO recommendation ISO-R161.

B. Fittings
   1. Fittings shall be molded or fabricated and shall be of the same type, grade, and class of polyethylene resin as the pipe is manufactured from. Fittings shall be manufactured by the same manufacturer as the pipe or approved supplier.
   2. Fittings for joining polyethylene pipe to other pipe materials shall be molded stub end type with flange back-up ring. All other pipe material fittings shall be M. J. and restrained using Megalugs by EBAA Iron or equal.

C. Joints
   1. Joints shall be butt fused in strict accordance with pipe manufacturer's recommendations. The joints shall develop all strength properties equal to or greater than those of the pipe material.
   2. Ductile iron expansion / contraction joints shall be as manufactured by EBAA Iron or equal and shall allow for a minimum of 12-inch expansion/contraction

D. Flange Joints:
   1. Type 304 stainless steel backup flanges as recommended by the manufacturer.
   2. Type 316 stainless steel nuts and bolts.

3. Flanges and bolt patterns as recommended by the manufacturer.

E. Tracer Wire
1. Tracer wire shall be No. 10 AWG, single conductor with Type UF insulation rated for direct burial service.
2. Tracer wire splices shall be made with 3M Scotch Cats, Ideal Twister DB Plus, or equal.
3. Tracer wire signal connection box shall be three-piece, 5 1/4-inch cast iron valve box with top marked, “Sewer” as manufactured by Clow, Tyler, or equal.

F. Drilling Fluids
1. Drilling fluids composition shall meet permit requirements and environmental regulations.

G. Water
1. Contractor shall procure, transport, and store water required for his operations.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to the Specifications, or:
1. Fractures or cracks passing through the pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of the shipment or delivery.
2. Cracks sufficient to impair strength, durability or serviceability of pipe.
3. Defects indicating improper proportioning, mixing, and molding.
4. Damaged ends, where such damage would prevent making satisfactory joint.

B. Acceptance of fittings, stubs or other specially fabricated pipe sections shall be based on visual inspection at the job site and documentation they conform to these Specifications.

3.02 INSTALLATION

A. Trench, backfill, and compact in accordance with Section 31 23 33.

B. Heat Fusion of Pipe:
1. Weld in accordance with manufacturer's recommendation for butt fusion methods. Qualified fusion operators shall be provided by the Contractor.
2. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by the pipe manufacturer, including but not limited to, temperature requirements, alignment, and fusion pressures.
3. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with the manufacturer's recommendations.
4. Do not bend pipe to a greater degree than minimum radius recommended by the manufacturer for type and grade.
5. Do not subject pipe to strains that will overstress or buckle piping or impose excessive stress on joints.
6. Branch saddle fusions shall be joined in accordance with the manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of size to facilitate saddle fusion within trench.

7. Before butt fusing pipe, inspect each length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe.
8. At end of each working day, cover open ends of fused pipe. Cap to prevent entry by animals or debris.
9. Use compatible fusion techniques when polyethylenes of different melt indexes are fused together. Refer to the manufacturer's specifications for compatible fusion.

C. Flange Jointing:
1. Use on flanged pipe connection sections.
2. Connect stainless steel backup flanges with stainless steel nuts and bolts.
3. Butt fuse fabricated flange adapters to pipe.
4. Observe the following precautions in connection of flange joints.
   a. Align flanges or flange/valve connections to provide tight seal. Provide nitrile-butadiene (hycar) gaskets. Gaskets are required for flange/valve connections.
   b. Place U.S. Standard round washers as may be required on some flanges in accordance with the manufacturer's recommendations. Lubricate bolts in accordance with the manufacturer's recommendations.
   c. Tighten flange bolts in sequence and accordance with the manufacturer's recommendations. CAUTION: Do not overtorque bolts.
5. Pull bolt down by degrees to uniform torque in accordance with the manufacturer's recommendations.
6. Install expansion / contraction joints as shown on the plans.

D. Pipe Placement:
1. Grade control equipment shall be of type to accurately maintain design grades and slopes during installation of pipe.
2. Dewatering: remove standing water in trench before installation of pipe.
3. Unless otherwise specifically stated, install pipe according to the methods and practices in accordance with the manufacturer's recommendations.
4. Maximum lengths of fused pipe to be handled as one section shall be placed according to the manufacturer's recommendations as to pipe size, pipe SDR and topography, so as not to cause excessive gouging or surface abrasion; but not to exceed 400 feet.
5. Cap pipe sections longer than single joining (usually 40 feet) on both ends during placement except during fusing operations.
6. Prevent migration of dirt and debris through perforations during placement. Remove dirt or debris from pipe before backfilling.
7. Notify the Engineer prior to installing pipe into trench and allow time for the Engineer's inspection.
8. Correct irregularities found during inspection.
9. Complete tie-ins within trench whenever possible to prevent overstressed connections.
10. Complete flanged branch saddle connections with trench.
11. Allow pipe sufficient time to adjust to trench temperature prior to testing, segment tie ins, or backfilling activity.
12. Install reducers adjacent to laterals and tees.
13. To reduce branch saddle stress, install saddles at slope equal to and continuous within 4-inch lateral piping.
14. Place in trench by allowing at least 12 in./100 ft. for thermal contraction and expansion.

3.03 FINAL CONNECTIONS

A. No final connections to the pipe and fittings can be made until the pipe has been installed for a minimum of seven days.

B. Engineer must be present for all final connections.

3.04 PIPE TESTING

A. Test pipe sections in accordance with Section 01 45 24.

3.05 TRACER WIRE

A. Provide the following for identification of underground header.
   1. Install tracer wire and tape wire to top of pipe. Wire shall be exposed at all penetrations of the cover and at all vertical risers.

- END OF SECTION -

SECTION 40 05 13.82

FUSIBLE POLYVINYLCHLORIDE PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope

1. This section specifies fusible polyvinylchloride pipe, including acceptable fusion technique and practice, and safe handling and storage.

B. Pipe Description

1. Pipe supplier shall furnish fusible polyvinylchloride pipe conforming to all applicable standards and procedures, and meeting all applicable testing and material properties as described by those standard or within this specification.

1.02 REFERENCE STANDARDS

A. American Water Works Association (AWWA)

	Reference	Title
1.	ANSI/AWWA C110/A21.10	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
2.	ANSI/AWWA C111/A21.11	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3.	AWWA C605	Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
4.	AWWA C651	Standard for Disinfecting Water Mains.
5.	AWWA C900	Standard for Polyvinyl Chloride (PVC Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution
6.	AWWA C905	Standard for Polyvinyl Chloride (PVC Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. for Water Distribution
7.	AWWA M23	AWWA manual of Supply Practices PVC Pipe—Design and Installation, Second Edition
8.	AWWA M28	AWWA Manual – Rehabilitation of Water Mains.

B. American Society for Testing Materials (ASTM)

	Reference	Title
1.	ASTM C495	Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
2.	ASTM C923	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
3.	ASTM D638	Tensile Properties of Plastics
4.	ASTM D1238	Flow Rates of Thermoplastics by Extrusion Plastomer

	Reference	Title
5.	ASTM D1505	Standard Test Method for the Density of Plastics by the Density-Gradient Technique
6.	ASTM D1784-02	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
7.	ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 Test Method for Degree of Fusion of Extruded
8.	ASTM D2122	Determining Dimensions of Thermoplastic Pipe and Fittings
9.	ASTM D2152	Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
10.	ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
11.	ASTM D2466	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
12.	ASTM D2467	Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
13.	ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
14.	ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
15.	ASTM F1057	Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique
16.	ASTM F1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

C. NSF International

	Reference	Title
1.	NSF-14	Plastics Piping System Components and Related Materials
2.	NSF-61	Drinking Water System Components—Health Effects

1.03 QUALITY ASSURANCE

A. Manufacturer Requirements

1. Fusible polyvinylchloride pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in AWWA C900, AWWA C905, and applicable sections of ASTM D2241. Testing priority shall be in conformance with AWWA C900 and AWWA C905.

B. Fusion Technician Requirements

1. Fusion Technician shall be fully qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

C. Specified Pipe Suppliers

1. Fusible polyvinylchloride pipe shall be used as manufactured under the trade names Fusible C-900®, Fusible C-905®, and FPVC™, for Underground Solutions, Inc., Poway, CA, (858) 679-9551. Fusion process shall be as patented by Underground Solutions, Inc., Poway, CA, Patent No. 6,982,051. Owner and Engineer are aware of no other supplier or fusible polyvinylchloride pipe that is an equal to this specified pipe supplier and product.

D. Submittals

1. The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:
    a. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.
    b. Product data and pipe supplier data indicating conformance with this specification and applicable standards, including written documentation regarding any intended variance from this specification and applicable standards. This will include experience of pipe supplier by years and number of projects; warranty information; and independent laboratory testing certification.
    c. Material and pipe property testing in conformance with this specification and applicable standards indicating conformance from the pipe extruder per AWWA C900 and AWWA C905:
        1) Dimensional Checks
        2) Pipe Burst
        3) Flattening
        4) Extrusion Quality (Acetone Immersion)
2. Test results will be prepared and made available from the pipe extruder to the Owner or Engineer upon request, for each extrusion run.
3. Fusion joint data and fusion technician data indicating conformance with this specification and applicable standards, including written documentation regarding any intended variance from this specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.
4. Shop drawings shall also include for each sliplining installation all excavation locations, interfering utilities, excavation dimensions, flow bypass and traffic control schematics.
5. At least two (2) weeks prior to the start of work, the Contractor shall submit his sliplining schedule identifying daily work hours and working dates for each installation.
6. Grout design mixes for the annular space grout to be used, and grout testing reports.
7. Material, pipe property, and dimensional data for casing pipe, if used.
8. The following PRODUCE DATA AND INFORMATION is required form the Contractor and/or horizontal directional drilling Contractor:
    a. Directional drilling equipment information and certification indicating the applicability of equipment commensurate with the size and scope of the project.
    b. Directional drilling operator certification and references, project scope and owners' contact information for the experience commensurate with the size and scope of the project.
    c. Shop drawings--each HDD installation shall include excavation locations, any interfering utilities, bore dimensions, and locations.
    d. A project safety and contingency plan which shall include but shall not be limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, water, wastewater and any other subsurface utility.
    e. at least two weeks prior to the start of work, the Contractor shall submit his HDD or pipe bursting schedule identifying daily work hours and working dates for each installation.
    f. Information about the drilling fluid to be used, including product information, material specifications, and handling procedures; material safety data sheet and special precautions required; methods of mixing and application; and disposal plan.
9. The following PRODUCT DATA AND INFORMATION is required from the Contractor and/or pipe bursting Contractor:

a. Pipe bursting equipment information and certification indicating the applicability of equipment commensurate with the size and scope of the project, including any proposed lubricants to be used in the operation

E. The following AS-RECORDED DATA is required from the contractor and/or fusion provider:
1. Fusion report for each fusion joint performed on the project, including joints that were rejected. Submittals of the Fusion Technician's joint reports are required as requested by the Owner or Engineer. Specific requirements of the Fusion Technician's joint report shall include:
   a. Pipe Size and Dimensions
   b. Machine Size
   c. Fusion Technician Identification
   d. Job Identification Number
   e. Fusion Number
   f. Fusion, Heating, and Drag Pressure Settings
   g. Heat Plate Temperature
   h. Time Stamp
   i. Heating and Cool Down Time of Fusion
   j. Ambient Temperature
2. As-recorded plan and profile data for the actual alignment of the installed pipeline.
   a. The as-recorded plan will reflect horizontal offset form the baseline and depth of cover, a maximum of every 25 feet and at all changes in direction, whichever is less.
   b. All fittings, valves, or other appurtenances will also be referenced and shown.
   c. This document, along with tracking log sheets, should they be used, shall be provided to the Owner and/or the Engineer. Tracking log sheet data, should it be employed, shall include any and all that apply, including position, roll angle, tilt angle, depth, and hydraulic pull back force measured.
   d. As-recorded plans shall show any deviations from the original plans.

PART 2 – PRODUCTS

2.01 FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR POTABLE WATER

A. Fusible polyvinylchloride plastic material for pipe shall conform to AWWA C900 or C905, ASTM D1784, cell classification 12454, and/or ASTM D2241 for IPS standard dimensions if applicable. Compound formulation shall be in accordance with PPI TR-2/2006.

B. Pipe shall be manufactured with 100% virgin resin.

C. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

D. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal lengths.

E. Fusible polyvinylchloride pipe shall be blue in color.

F. Pipe shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
1. Nominal size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule

4. AWWA pressure class or rating
5. AWWA Standard designation number
6. NSF-61 mark verifying suitability for potable water service
7. Extrusion production-record code
8. Trademark or trade name
9. Cell Classification 12454 and/or PVC material code 1120 shall also be included.

G. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

2.02 FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR NON-POTABLE WATER

A. Fusible polyvinylchloride plastic material for pipe shall conform to AWWA C900 or C905, ASTM D1784, and cell classification 12454. Pipe shall be in accordance with ASTM D2241 for IPS standard dimensions as indicated in these specifications. Compound formulation shall be in accordance with PPI TR-2/2006.

B. Pipe shall be manufactured with 100% virgin resin.

C. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

D. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal lengths.

E. Fusible polyvinylchloride pipe shall be purple in color.

F. Pipe shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
1. Nominal size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule
4. AWWA pressure class or rating
5. AWWA Standard designation number
6. "Not for Potable Use" designation
7. Extrusion production-record code
8. Trademark or trade name
9. Cell Classification 12454 and/or PVC material code 1120 may also be included.

G. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

2.03 FUSIBLE POLYVINYLCHLORIDE PRESSURE PIPE FOR WASTEWATER

A. Fusible polyvinylchloride plastic material for pipe shall conform to AWWA C900 or C905, ASTM D1784, and cell classification 12454. Pipe shall be in accordance with ASTM D2241 for IPS standard dimensions as indicated in these specifications. Compound formulation shall be in accordance with PPI TR-2/2006.

B. Pipe shall be manufactured with 100% virgin resin.

C. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the

pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

D. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal lengths.

E. Fusible polyvinylchloride pipe shall be green in color.

F. Pipe shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:
1. Nominal size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule
4. AWWA pressure class or rating
5. AWWA Standard designation number
6. Extrusion production-record code
7. Trademark or trade name
8. Cell Classification 12454 and/or PVC material code 1120 may also be included.

G. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

2.04 FUSION JOINTS

A. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written instructions for this procedure. Joint strength shall be equal to the pipe as demonstrated by testing requirements. All fusion joints shall be completed as described in this specification.

2.05 CONNECTIONS AND FITTINGS

A. Connections shall be defined in conjunction with the linking of project piping, as well as the tie-ins to other piping systems.

B. Ductile Iron Mechanical Fittings
1. Ductile iron fitting shall be as specified in Section 40 05 13.53 Ductile Iron Pipe.
2. or approved equal.

C. Sleeve-Type Couplings
1. Sleeve-type mechanical couplings shall be manufactured for use with PVC pipe, and shall be restrained.
   a. Acceptable sleeve-type mechanical pipe couplings shall include for restrained coupling EBAA Iron Series 3800 or approved equal.

E. Expansion And Flexible Couplings
1. Expansion-type mechanical couplings shall be manufactured for use with PVC pipe, and shall be restrained.
2. Acceptable expansion-type mechanical pipe couplings shall include EBAA Iron EX-TEND 200, or approved equal.
3. Acceptable flexible couplings shall include EBAA Iron FLEX-TEND or approved equal.

F. Connection Hardware
1. T-bolts shall be Type 304 or 316 stainless steel.

a. All stainless steel threads shall be coated with nickel based anti-seize compound prior to assembly.
b. In lieu of anti-seize compound, a green fluoropolymer coated stainless steel nub may be substituted. The coating shall be FlourKote#1 manufactured by Metal Coatings Corporation.

2.06 TRACER WIRE

A. Tracer wire shall be No. 10 AWG, copper, single conductor with Type UF insulation rated for direct burial service.

B. Tracer wire splices shall be made with 3M Scotch Cast, Ideal Twister DB Plus, or equal.

C. Tracer wire signal connector box shall be three-piece 5¼-inch cast iron valve box with top marked, "Water" as manufactured by Clow, Tyler, or equal.

2.07 CONNECTION TO SANITARY SEWER MANHOLES AND STRUCTURES

A. Fusible polyvinylchloride pipe shall be connected to manholes and other structures to provide a leak-free, properly graded flow into or out of the manhole or structure.

B. Connections to existing manholes and structures shall be as specified and shown on the drawings.
1. For a cored or drilled, opening provide a flexible, watertight connection that meets and/or exceeds ASTM C923.

C. Connections to a new manhole or structure shall be as specified and shown on the drawings.
1. A flexible, watertight gasket per ASTM C 923 shall be cast integrally with riser section(s) for all precast manhole and structures.
2. Drop connections shall be required where shown on drawings.
3. Grout internal joint space with non-shrink grout.

2.08 GROUT

A. Grout for use as a filler of the annular space between the fusible polyvinylchloride pipe and the host pipe shall be a low-density, highly flowable mix.
1. Minimum compressive strength shall be 80 psi at 28 days.
2. Maximum cast density shall be 36 pounds per cubic foot.

B. Testing requirements shall be in accordance with these specifications. Contractor may incorporate grout additives to improve its flow properties, provided that the minimum compressive strength requirements are met.

2.09 DRILLING SYSTEM EQUIPMENT

A. General
1. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pullback of the pipe(s), a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the

duration of this project. All required equipment shall be included per the emergency and contingency plan as submitted per these specifications.

B. Drilling Rig

1. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a steer-able drill head. The machine shall be anchored to withstand the pulling, pushing, and rotating forces required to complete the project.
2. The drilling rig hydraulic system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks.
3. The drilling rig shall have a system to monitor and record maximum pull-back hydraulic pressure during pull-back operations.

C. Drill Head

1. The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steer-able drill head.
2. The system must be able to control the depth and direction of the pipe.
3. Drill head shall contain all necessary cutters and fluid jets for the operation, and shall be of the appropriate design for the medium being drilled.

D Drilling Fluid System

1. Drilling Fluid (Mud)
   a. Drilling fluid shall be composed of clean water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean source and shall meet the mixing requirements of the manufacturer.
   b. The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods. No hazardous additives may be used.
   c. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).
   d. Drilling fluid shall be disposed of off-site in accordance with local, state, and federal requirements and/or permit conditions.
   e. No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid as submitted for this project without written consent of the Owner and/or Engineer.
2. Mixing System
   a. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
   b. The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.
   c. The mixing system shall continually agitate the drilling fluid during drilling operations.
3. Drilling Fluid Delivery And Recovery System
   a. The drilling fluid pumping system shall have a minimum capacity to supply drilling fluid in accordance with the drilling equipment pull-back rating at a constant required pressure.
   b. The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.
   c. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding

environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.

d. A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.

2.10 PIPE BURSTING SYSTEM EQUIPMENT

A. General

1. The pipe bursting system shall be designed and manufactured to force its way through the existing line by fragmenting the pipe and compressing the broken pieces into the surrounding soil as its progresses. The bursting unit shall generate sufficient force to burst and compact the existing pipeline and allow for the insertion of the fusible polyvinylchloride pipe.

B. Allowable Types of Pipe Bursting Systems

1. Static Pipe Bursting Systems
   a. Static pipe bursting systems shall be characterized by a tapered or blunt nosed pull head being pulled through the host pipe and breaking the host pipe by applying radial pressure to the host pipe. The host pipe fails by 'hoop' tensile stress applied by the head, and is fragmented and pushed into the surrounding bedding and soil as the pull head progresses.
   b. The pull head shall be followed by an expansion head, which shall further push the fragmented pipe into the surrounding soil and bedding to a diameter that allows the insertion of the fusible polyvinylchloride pipe behind it. Under no circumstances shall the pipe pull head, which is attached directly to the fusible polyvinylchloride pipe, be used to expand or otherwise increase the diameter of the host pipe, or fragmented host pipe.
   c. The pull head may be advanced by a hydraulic or winching mechanism, and may be connected by means of a cable, chain, or rod.
2. Hydraulic Pipe Bursting Systems
   a. Hydraulic pipe bursting systems shall be characterized by a pull head that is equipped with hydraulically actuated 'petals' that break the host pipe by applying radial pressure to the host pipe. The host pipe fails by 'hoop' tensile stress applied by the head, and is fragmented and pushed into the surrounding bedding and soil as the pull head progresses.
   b. The pull head shall be followed by an expansion head, which shall further push the fragmented pipe into the surrounding soil and bedding to a diameter that allows the insertion of the fusible polyvinylchloride pipe behind it. Under no circumstances shall the pipe pull head, which is attached directly to the fusible polyvinylchloride pipe, be used to expand or otherwise increase the diameter of the host pipe, or fragmented host pipe.
   c. The pull head may be advanced by a hydraulic or winching mechanism, and may be connected by means of a cable, chain, or rod.
3. Under No Circumstances Will Pneumatic Or Percussive Bursting Systems Be Allowed.

C. Bursting Lubricants

1. Bursting lubricants shall be used at the request of the pipe bursting Contractor and at the discretion of the Owner and Engineer.

SECTION 3 – EXECUTION

3.01 DELIVERY AND OFF-LOADING

A. All pipes shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Owner or Engineer.

B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or Engineer immediately if more than immaterial damage is found.

C. Each pipe shipment should be checked for quantity and proper pipe size, color and type.

D. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23.

E. A forklift with chisel forks shall be used to off-load the pipe. The fork chisel should be checked to be sure it is not thicker than the gap between the units of pipe strapped together for shipping and handling purposes. Extend forks to remove each top unit from the truck. When unloading 20' lengths, remove back units first. Do not run forks too far under the units, as fork ends striking adjacent units may cause damage. Insure that the forks are fully engaged. The 30' and 40' lengths are shipped in single length units. Because these are longer, the packages will flex or bend more than the 20' length units. If left bundled in units, unloading can be done with a single forklift so long as it is of sufficient capacity to handle the load. If SAG exceeds recommendation (see the table below as to allowable sag), then each piece of pipe should be unloaded individually. The forks should be placed as far apart as possible to provide support to the unit. When unloading individual pieces of pipe, the pipe should be supported at approximately the 1/3 point measured from each end of the pipe.

Sag in Pipe Lengths During Unloading and Moving

Nom. Pipe Size (DIPS)	Segment Height (Sag) 30' Length (inches)	40' Length (inches)
4	13	23 1/2
6	9	16 1/2
8	7	12 1/2
10	5 1/2	10
12	4 1/2	8 1/2
14	4	7 1/2
16	3 1/2	6 1/2
18	3	5 1/2
20	2 1/2	5
24	2 1/2	4
30	2	3 1/2
36	1 1/2	3
42	1	2 1/2
48	1	2

Nom. Pipe Size (IPS)	Segment Height (Sag) 30' Length (inches)	40' Length (inches)
3	18	32 1/2
4	14	25 1/2
6	9 1/2	17
8	7 1/2	13
10	6	10 1/2
12	5	9
14	4 1/2	8
16	4	7
18	3 1/2	6
20	3	5 1/2
24	2 1/2	4 1/2
30	2	3 1/2
36	1 1/2	3
42	1 1/2	2 1/2
48	1	2

F. Sag is the measurement of the pipe ends relative to the pipe center. With a pipe raised on the forklift, a string line can be pulled from the bottom of one end of the pipe to the bottom of the other end of the pipe. The distance in the center from the string to the bottom of the pipe is the sag.

G. If a forklift is not available, a spreader bar with fabric straps capable of handling the load should be used. Recommended lift points when using fabric slings are at the point approximately 1/3 of the length measured from each end of the unit.

H. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

I. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

J. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged.

K. Pipe should be carefully lowered, not dropped, from trucks.

L. In preparation for pipe installation, placement of pipe should be as close to the fusion area as practical.

3.02 HANDLING AND STORAGE

A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be

determined by the Owner or Engineer.

B. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the Owner or Engineer.

C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch, or otherwise abrade the piping in any way. Use of hooks, chains, wire rope, or any other handling device, which creates the opportunity to damage the surface of the pipe, is strictly prohibited.

E. After delivery to the project site, fusible polyvinylchloride pipe shall be stored at ambient temperature and protected from ultraviolet light degradation. If pipe is to be stored for periods of 6 months or longer, the pipe must be shaded or otherwise shielded from direct sunlight. Covering of the pipe, which allows for temperature build-up, is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

F. Racks or dunnage to prevent damage to the bottom of the pipe during storage should support the pipe lengths. Supports should be spaced to prevent pipe bending and deformation. The pipe shall be stored in stacks no higher than that given in the following table:

Pipe Diameter (inches)	Max. No. of Rows Stacked
8 or less	5
12 to 21	4
24 to 30	3
33 to 48	2

3.03 FUSION PROCESS

A. General

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's recommendations.
2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier. Training records for qualified fusion technicians shall be available to Owner or Engineer upon request.
3. Each joint fusion shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Recorded information, in accordance with this specification.
4. The fusible polyvinylchloride pipe will be installed in a manner so as not to exceed the recommended bending radius.
5. Where fusible polyvinylchloride pipe is installed by pulling in tension, the recommended Safe Pulling Force, according to the pipe supplier, will not be exceeded.
6. Only appropriately sized, and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

a. HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches within the pipe circle being fused. Plates shall be clean and free of any contamination. Heater controls shall properly function, and cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's recommendations.

b. CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

c. GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

d. DATALOGGER - The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand held wireless portion of the unit. Datalogger operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

7. Other equipment specifically required for the fusion process shall include the following:

a. Pipe rollers shall be used for support of pipe to either side of the machine.

b. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly, and carriage shall be provided for fusion in inclement and/or windy weather.

c. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

d. Facing blades specifically designed for cutting fusible polyvinylchloride pipe.

B. Joint Recording

1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.04 TV INSPECTION

A. The host pipe shall be inspected by TV prior to the bursting operation in accordance with these specifications.

1. TV inspection of the host pipe shall indicate condition of host pipe and suitability of host pipe for fusible polyvinylchloride pipe insertion by pipe bursting methods.

2. Obstructions such as corporation taps, valves and valve bodies, and collapsed piping shall be remedied prior to bursting and fusible polyvinylchloride pipe insertion.

3. Spot repairs shall be made in accordance with the drawings and these specifications.

3.05 DRILLING OPERATIONS

A. General

1. Grades, radii, and alignment of the proposed HDD installation are presented in the drawings for reference and intended bore path. The path of the bore may be modified based on field and equipment conditions. Entry and exit locations and control-point elevations shall be maintained as shown on the drawings and specified, unless otherwise approved by the Owner or Engineer.

2. Bend radii shown on the drawings are minimum allowable radii and shall not be reduced. Control-point elevations shown on the drawings are minimum allowable cover and/or separation and shall not be reduced.

B. Location And Protection Of Underground Utilities
1. Correct location of all underground utilities that may impact the HDD installation is the responsibility of the Contractor, regardless of any locations shown on the drawings or previous survey completed by the Engineer and/or Owner.
2. Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
3. All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of HDD installation as determined for the project specific site conditions. It is the Contractor and HDD system operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material.

C. Site Location Preparation
1. Work site as indicated on drawings shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made.
2. Contractor shall confine all activities to designated work areas.

D. Drilling Layout And Tolerances
1. The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations within the areas indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.
2. Instrumentation shall be provided and maintained at all times that accurately locates the pilot hole, measures drill-string axial and torsional loads and measures drilling fluid discharge rate and pressure.
3. Entry and exit areas shall be drilled so as not to exceed the bending limitations of the pipe as recommended by the manufacturer.

E. Pilot Hole Bore
1. Pilot hole shall be drilled along bore path. In the event that the pilot bore does deviate from the bore path, Contractor shall notify Owner and Engineer and the Owner and/or Engineer may require contractor to pull-back and re-drill from the location along bore path before the deviation.
2. The Contractor shall limit curvature in any direction to reduce force on the pipe during pullback. Ideally, the directional bore should lie in a vertical plane. The minimum radius of curvature shall be no less than that specified by the pipe manufacturer and as indicated on the drawings.
3. In the event that a drilling fluid fracture, inadvertent returns, or returns loss occurs during pilot hole drilling operations, Contractor shall cease drilling and contact the Owner and Engineer.
4. Owner and/or Engineer shall approve the pilot hole bore alignment prior to back reaming phase and pipe installation.

F. Reaming
1. After successfully completing the pilot hole, the bore hole shall be reamed to a diameter, which meets all local jurisdictional standards and the following table as a minimum:

Nominal Pipe Diameter	Bore Hole Diameter
< 8 inches	Pipe Dia. + 4 inches
8 inches to 24 inches	Pipe Dia. X 1.5
> 24 inches	Pipe Dia. + 12 inches

2. Multiple reaming passes shall be used at the discretion of the Contractor and shall conform to these specifications.
3. A swivel shall be used between the reaming head and the fusible polyvinylchloride pipe to minimize torsion stress on the assembly.
4. In the event of a drilling fluid fracture, returns loss or other loss of drilling fluid, the Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss. Contractor shall immediately inform the Owner and Engineer.

3.06 PIPE PULL-BACK AND INSERTION (HDD)

A. Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous length.

B. Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not over-deflect, buckle, or otherwise become damaged. Damaged portions of the pipe shall be removed and replaced.

C. The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the bore hole.
1. The pipe shall be guided into the bore hole to avoid deformation of, or damage to, the pipe.
2. The fusible polyvinylchloride pipe may be continuously or partially supported on rollers or other Owner and Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during installation.

D Buoyancy modification shall be at the sole discretion of the Contractor, and shall not exceed the pipe supplier's recommendations. Damage caused by buoyancy modifications shall be the responsibility of the Contractor.

E Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole. Except for drill rod removal, pull-back operation shall not cease until the pipe has been completely installed to final position. During the pull-back operations, excessive pullback force shall be reported to Owner and Engineer.

F The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Any damages caused by the Contractor's operations shall be corrected by the Contractor at no cost to the Owner.

3.07 BURSTING OPERATIONS AND PIPE INSTALLATION (PIPE BURSTING)

A. Location And Protection Of Underground Utilities

1. Correct location of all underground utilities that may impact the installation is the responsibility of the Contractor, regardless of any locations shown on the drawings or previous survey completed by the Engineer and/or Owner.
2. Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
3. All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of the burst host pipe as determined for the project specific site conditions. It is the Contractor and pipe burst system operator's responsibility to determine this envelope of safe burial depth and offset from existing utilities. This will include, but is not limited to soil conditions and layering, utility proximity and material, pipe bursting system and equipment, and foreign subsurface material.

B. Surface Upheaval

1. It is the Contractor and pipe burst system operator's responsibility to determine the safe burial depth from the surface and all surface features to assure that no upheaval of the overburden on the existing host pipe will cause deformation and/or damage to such surface and surface features. This will include, but is not limited to soil conditions and layering, depth of bury, pipe bursting system and equipment, and foreign subsurface material.

C. Excavation And Access Pits

1. Access pit length shall be such that the minimum bending radius for the fusible polyvinylchloride pipe, per the pipe supplier is maintained. Sheeting, shoring and bracing requirements shall be in accordance applicable jurisdictional standards.
2. Access pit excavations shall be performed at all points where the fusible polyvinylchloride pipe will be inserted into the existing pipeline. When possible, access pit excavations shall coincide with host pipe lateral connection points or other appurtenance installations.
3. The fusible polyvinylchloride pipe may be continuously or partially supported on rollers or other Owner and Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during installation.

D. Pipe Bursting Operation

1. Any concrete encasements shall be excavated and broken out prior to the bursting operation to allow the steady and free passage of the pipe bursting head.
2. The new fusible polyvinylchloride pipe shall be inserted immediately behind the bursting head in accordance with the pipe supplier's recommended procedures. The bursting equipment shall be specifically designed and manufactured for the type of insertion process being used.
3. It is the Contractor and pipe burst system operator's responsibility to determine safe and feasible upsizing parameters with the existing size of host pipe, and size of proposed pipe bursting pull-in pipe. Under no circumstances shall a pipe greater than one nominal diameter larger than the existing host pipe be installed without the Owner and Engineer's consent.

E. Fusible Polyvinylchloride Pipe Care

1. The fusible polyvinylchloride pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted.
2. Sections of the fusible polyvinylchloride pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and then rejoining.

3.08 INSTALLATION ACCEPTANCE AND CLEANUP (PIPE BURSTING)

A If the final grade of the finished installation is not satisfactory to the Owner, Engineer or other jurisdictional entity, the pipe shall be abandoned, full pressure grouted in place in accordance with the jurisdictional authority, and an alternate installation shall be made. The abandoned pipe shall be properly shown on as recorded drawings to be submitted following conclusion of the construction work.

B The Engineer shall inspect the installed pipe ends for roundness and/or damage. Evidence of significant surface scratching shall be brought to the attention of the Engineer. Gouges or excessive surface damage of more than 10 percent of the wall thickness may be grounds to abandon the bore and have the Contractor redrill another line at no additional cost to the Owner.

C Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted to 95% maximum density. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these specifications and all applicable
jurisdictional laws.

3.09 WORK SEQUENCING (SLIPLINING)

A. The Contractor shall perform the work in the following sequence:

1. Clean the host pipeline.
2. TV inspection of the host pipeline.
3. Proof the host pipeline, if necessary.
4. Spot repairs as required on the host pipeline.
5. Install the fusible polyvinylchloride pipe.
6. Leak test and/or pressure test the fusible polyvinylchloride pipe.
7. Grout annular space.
8. Final TV inspection of sliplined pipeline after grouting.
9. Reconnect to host pipeline, and/or any and all laterals, services, fittings and appurtenances.
10. Leak test connections.

3.10 PIPE CLEANING (SLIPLINING)

A. Host pipe shall be cleaned in accordance with all applicable standards and guidelines.

1. Unless otherwise specified, mechanical cleaning shall be used to clean all corrodible metallic pipelines. Pipelines shall be cleaned with metallic tine scrubbers and followers per applicable jurisdictional standards and AWWA M28.
2. All other interior pipe surfaces shall be cleaned per applicable jurisdictional standards and AWWA M28.

B. Hazardous materials shall be removed and disposed of per all applicable regulations.

C. All pipelines shall be cleaned with as many passes as necessary to create a uniform interior host pipe surface free of all loose material and sharp edges and any potentially deleterious areas of the host pipe are removed or secured in place, prior to the insertion of the fusible polyvinylchloride pipe.

3.11 TV INSPECTION (SLIPLINING)

A. The host pipe shall be inspected by TV after cleaning in accordance with these specifications.
   1. TV inspection after host pipe cleaning shall indicate condition of host pipe and suitability of host pipe for fusible polyvinylchloride pipe insertion.
   2. Obstructions such as corporation taps, valves and valve bodies, and collapsed piping shall be remedied prior to insertion. Spot repairs shall be made in accordance with the drawings and these specifications.

B. The fusible polyvinylchloride pipe shall be TV inspected after installation and grouting in accordance with these specifications.
   1. TV inspection after annular space grouting operation shall indicate whether the fusible polyvinylchloride pipe wall has been damaged or forced out of round through the grouting operation.
   2. The affected portion(s) of the fusible polyvinylchloride pipe shall be replaced and re-grouted at no additional cost to the Owner.

3.12 PIPE PROOFING (SLIPLINING)

A. Following the TV inspection of the host pipe, the Owner or Engineer may require that the Contractor verify that the host pipeline is free of obstructions by pulling a 4-foot piece of fusible polyvinylchloride pipe through the existing pipeline. This shall be known as 'Proofing the Line.' Host pipe proofing shall be required whenever, at the discretion of the Owner or Engineer, the TV inspection indicates an over deflection or possible obstruction in the host pipe that may interfere with the insertion.

B. The proofing fusible polyvinylchloride pipe shall be assembled with at least one field made fusion joint. The proofing fusible polyvinylchloride pipe shall have the same diameter dimensions as the intended pipe for sliplining and shall be fitted with a pulling head and cable on both ends.

C The winch used to pull the proofing fusible polyvinylchloride pipe shall be equipped with a load gauge, which measures the developed winching force. The maximum allowable pulling force on the proofing fusible polyvinylchloride pipe shall be 50% of the safe pulling force for the material, as indicated by the pipe supplier. During proofing, the Contractor shall document all portions of the existing host pipe where the pulling force exceeds 25% of the maximum pull force allowed.

D. Proofing shall be stopped if the winching load reaches the maximum allowed pull force as indicated in the previous subsection, and the proofing section needs to be removed by reversing the pull or by excavation. Where the outside surface of the proofing fusible polyvinylchloride pipe is damaged, the Contractor may be directed by the Owner or Engineer to prepare a new proofing fusible polyvinylchloride pipe. The host pipe shall be considered ready for sliplining when, after proofing the host pipe, the proofing fusible polyvinylchloride pipe shows no evidence of cuts, kinks, gouges, or other damage.

E. Where the host pipe is unacceptable for sliplining, the TV inspection shall be reviewed to determine the location(s) where spot repair(s) or additional cleaning is required. Spot repairs shall be authorized by the Owner or Engineer and performed in accordance with the drawings and these specifications.

3.13 FUSIBLE POLYVINYLCHLORIDE PIPE INSERTION AND INSTALLATION

A. Excavation And Access Pits

1. Access pit length shall be such that the minimum bending radius for the fusible polyvinylchloride pipe, per the pipe supplier is maintained. Sheeting, shoring and bracing requirements shall be in accordance with applicable local and national codes.
2. Access pit excavations shall be performed at all points where the fusible polyvinylchloride pipe will be inserted into the existing pipeline. When possible, access pit excavations shall coincide with host pipe lateral connection points or other appurtenance installations.
3. The fusible polyvinylchloride pipe shall be continuously supported on rollers during joining and insertion.

B Insertion Point

1. Within the dimensions of the access pit, the existing pipeline above the springline shall be cut and removed as necessary for the insertion of the fusible polyvinylchloride pipe. Contractor shall not disturb the existing pipeline below the springline.
2. The point of insertion shall be at a joint in the existing host pipe, or other project driven location, which shall be protected by some means to prevent damage to the fusible polyvinylchloride pipe during insertion.
3. The Owner or Engineer may direct the Contractor to remove and replace fusible polyvinylchloride pipe where damage is evident from contact of the fusible polyvinylchloride pipe and the point of insertion.

C Pulling Equipment

1. A winch-style pulling mechanism, or a hydraulic static pull burst machine shall be used to pull the fusible polyvinylchloride pipe into place within the host pipe. Unless otherwise specified or shown, winch-style pulling mechanisms shall not be used for pipe greater than 12 inches in diameter.
2. The pulling mechanism shall be properly connected to the end of the fusible polyvinylchloride pipe via a pulling head approved by the pipe supplier.
3. The pulling mechanism shall be equipped with a load gauge to read the developing force directly. The force shall be recorded regularly during pulling and at every start and restart. The maximum pulling tension on the fusible polyvinylchloride pipe shall not exceed the pipe supplier's safe pulling force as submitted for this project.
4. Where the pulling force reaches the allowed maximum, the Contractor shall stop fusible polyvinylchloride pipe insertion and excavate a new insertion pit. The location of the pit shall coincide with the position of installed end of the fusible polyvinylchloride pipe and shall be of sufficient dimensions for fusible polyvinylchloride pipe insertion and joining.

D. Fusible Polyvinylchloride Pipe Care

1. The fusible polyvinylchloride pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted.
2. Sections of the fusible polyvinylchloride pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and rejoining.

3.14 TESTING (SLIPLINING)

A. Testing shall comply with all local building codes, statutes, standards, local jurisdiction, and laws.

B. Hydrostatic Testing And Leakage Testing For Pressure Piping.

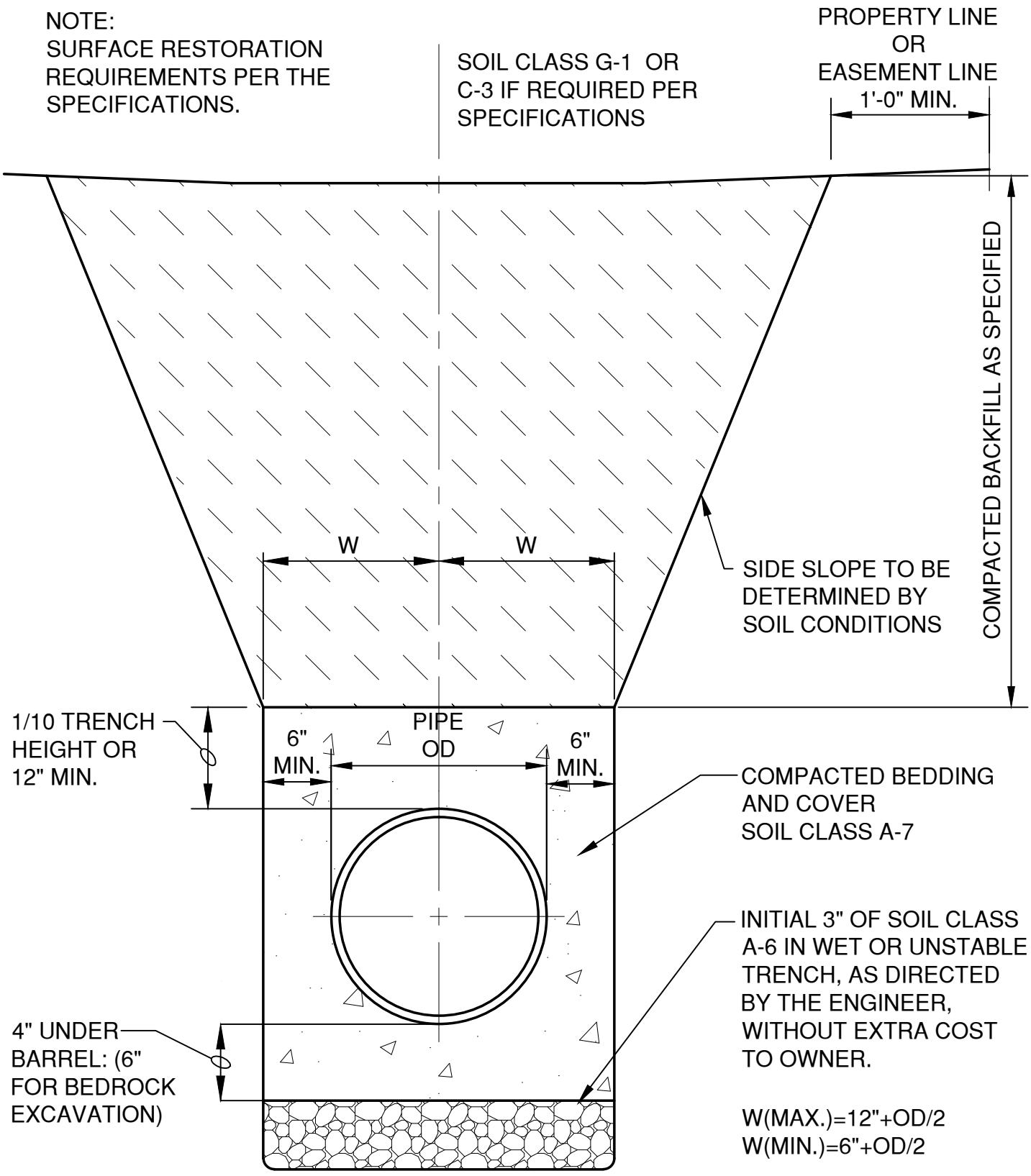
1. Hydrostatic and leakage testing shall comply with Section 01 45 24, Testing and Inspection of pipeline construction.

- END OF SECTION –

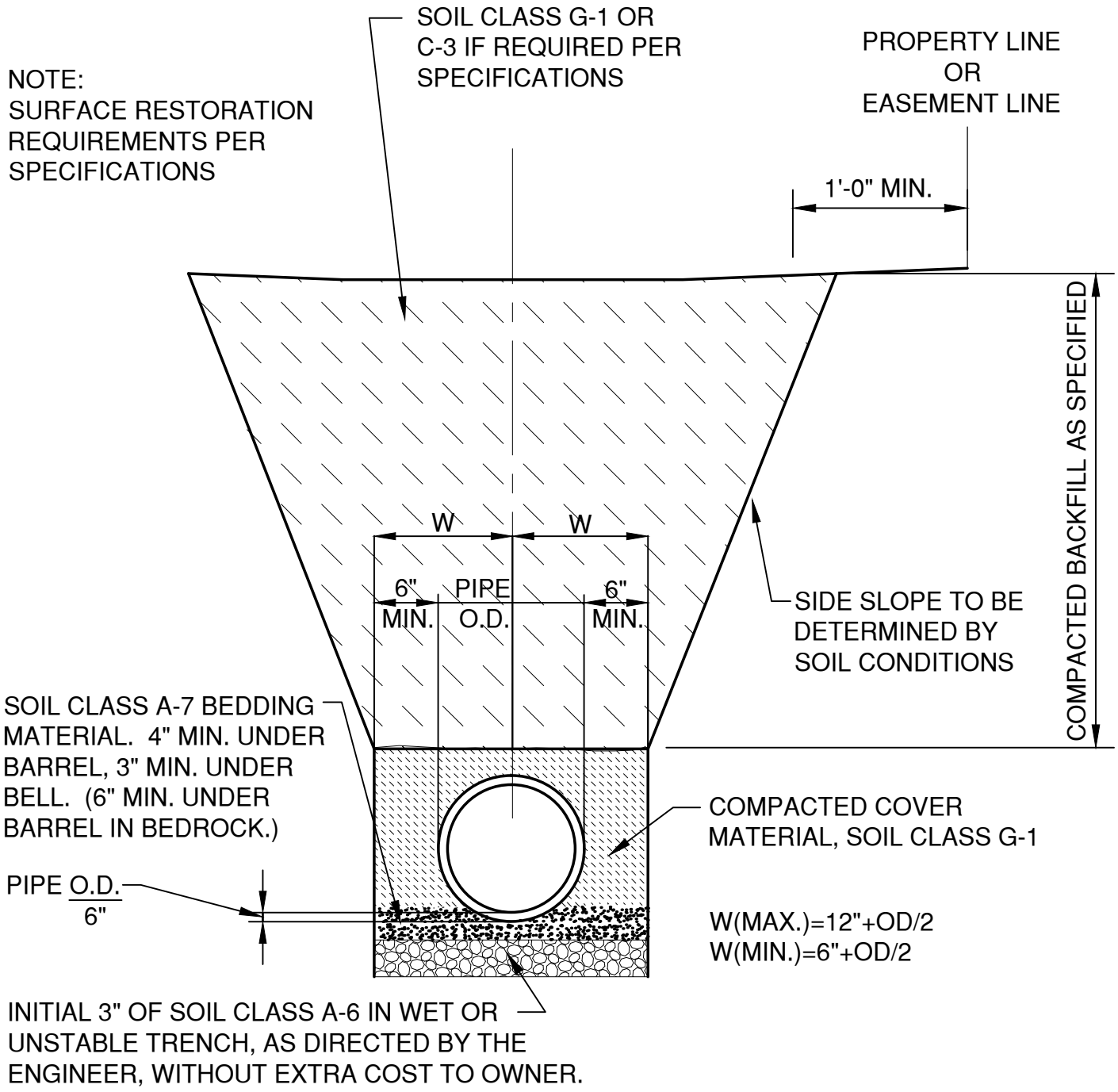
DRAWING DIVISION

DRAWINGS

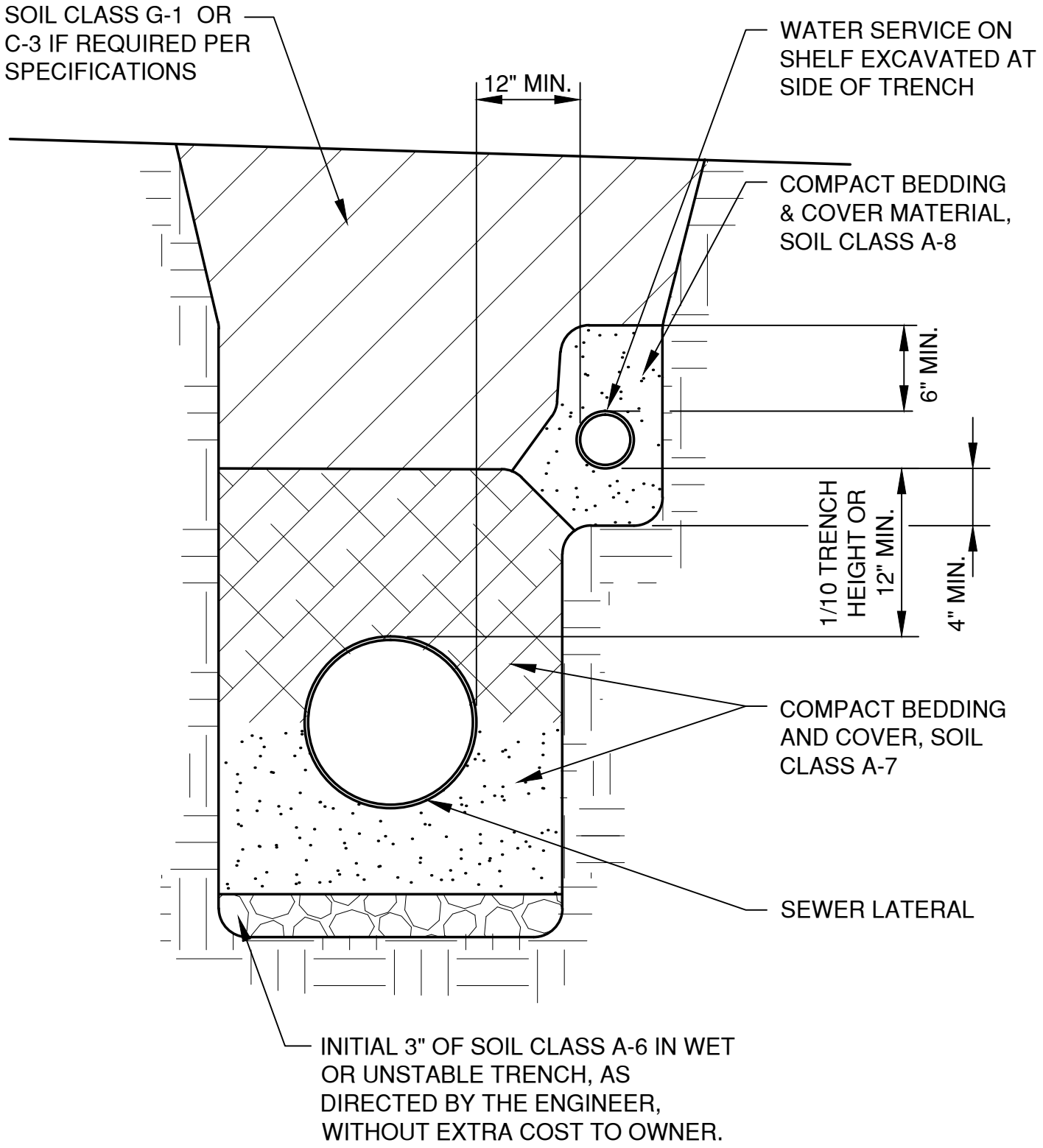
All drawings, which have been prepared on behalf of the Owner, are bound in this section and are hereby made part of this contract.



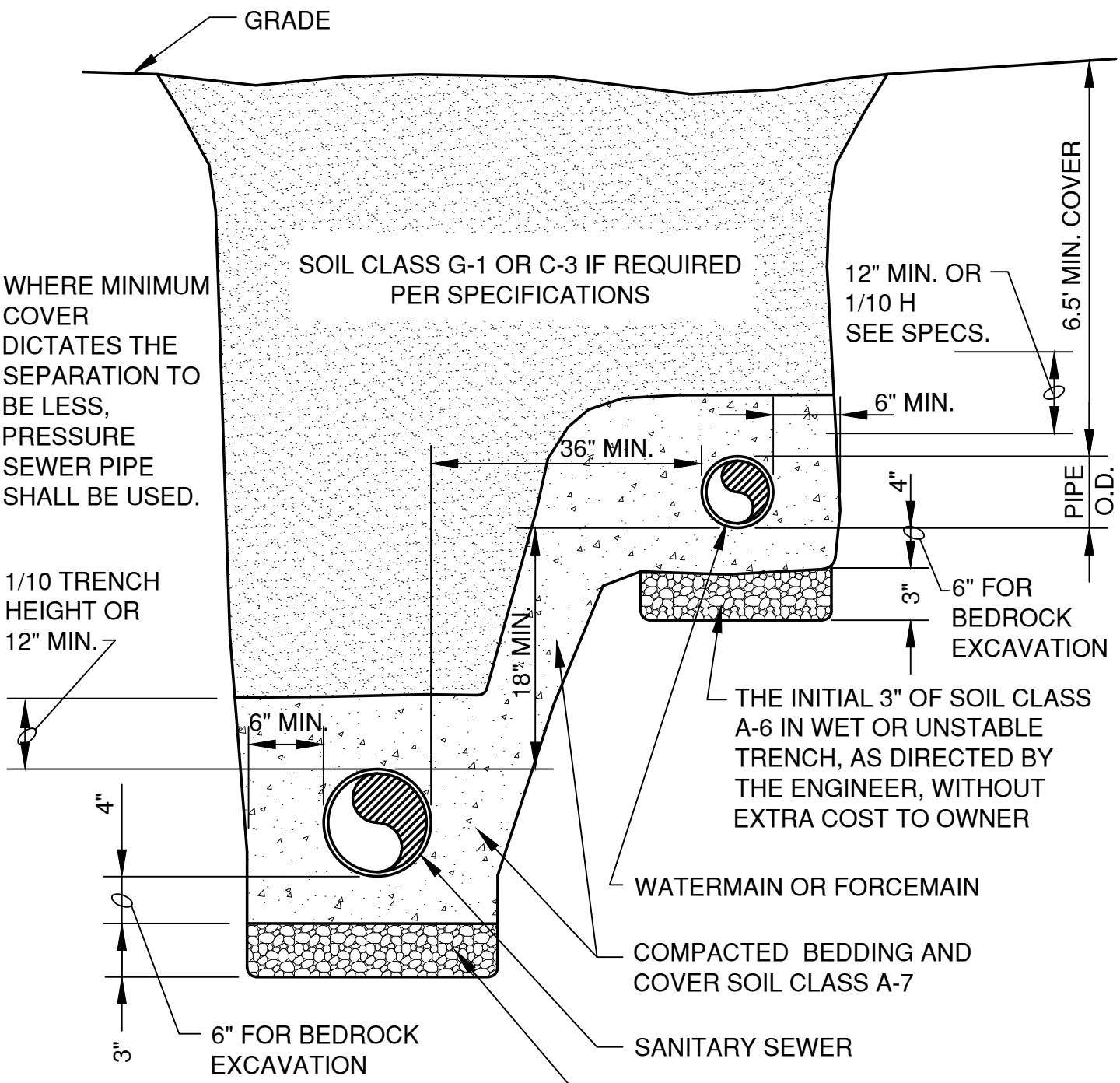
HDPE /PVC SEWER & WATERMAIN & FORCEMAIN BEDDING & TRENCH SECTION



CONCRETE PIPE BEDDING & TRENCH SECTION



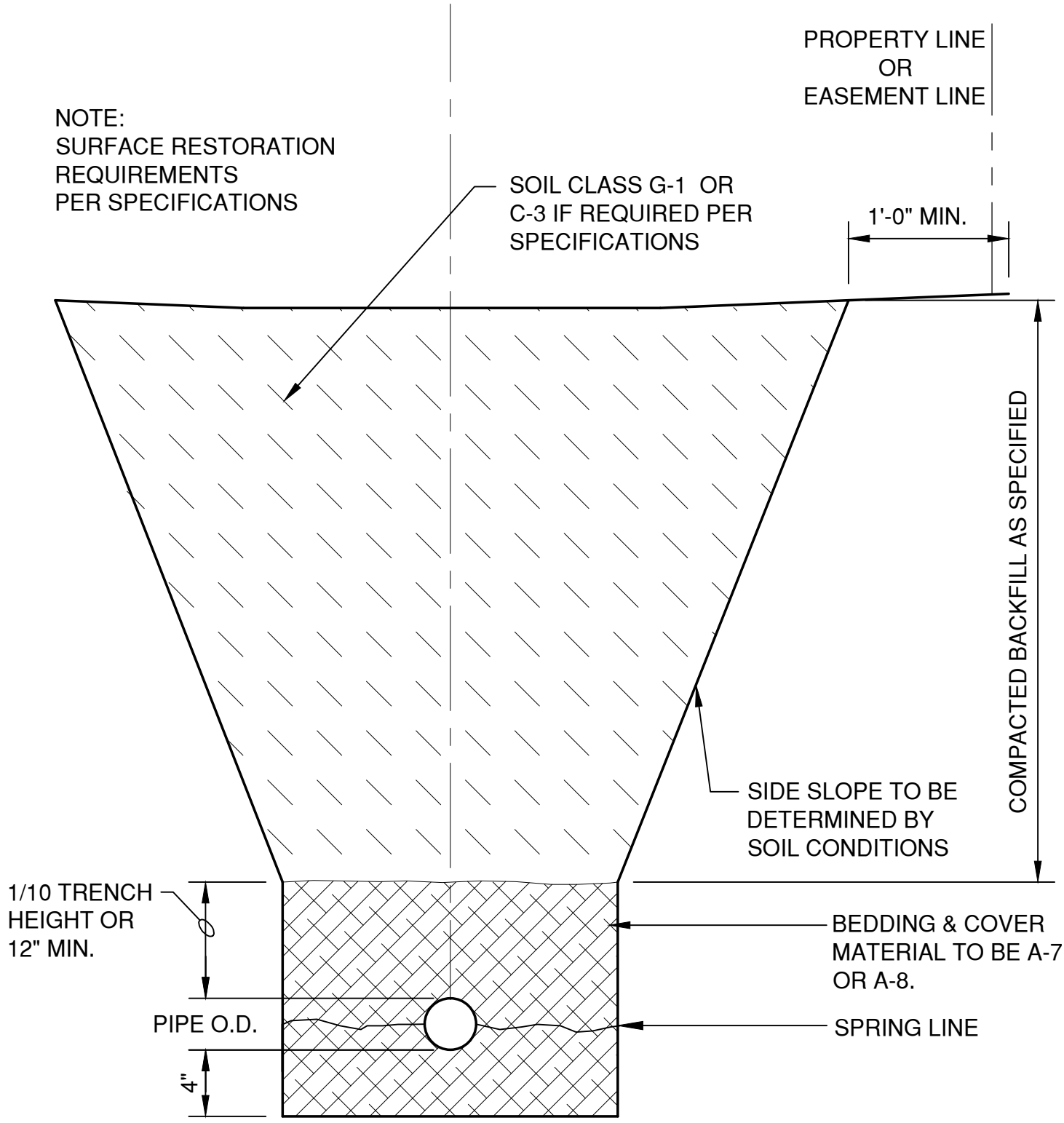
SEWER & WATER LATERALS IN COMMON TRENCH



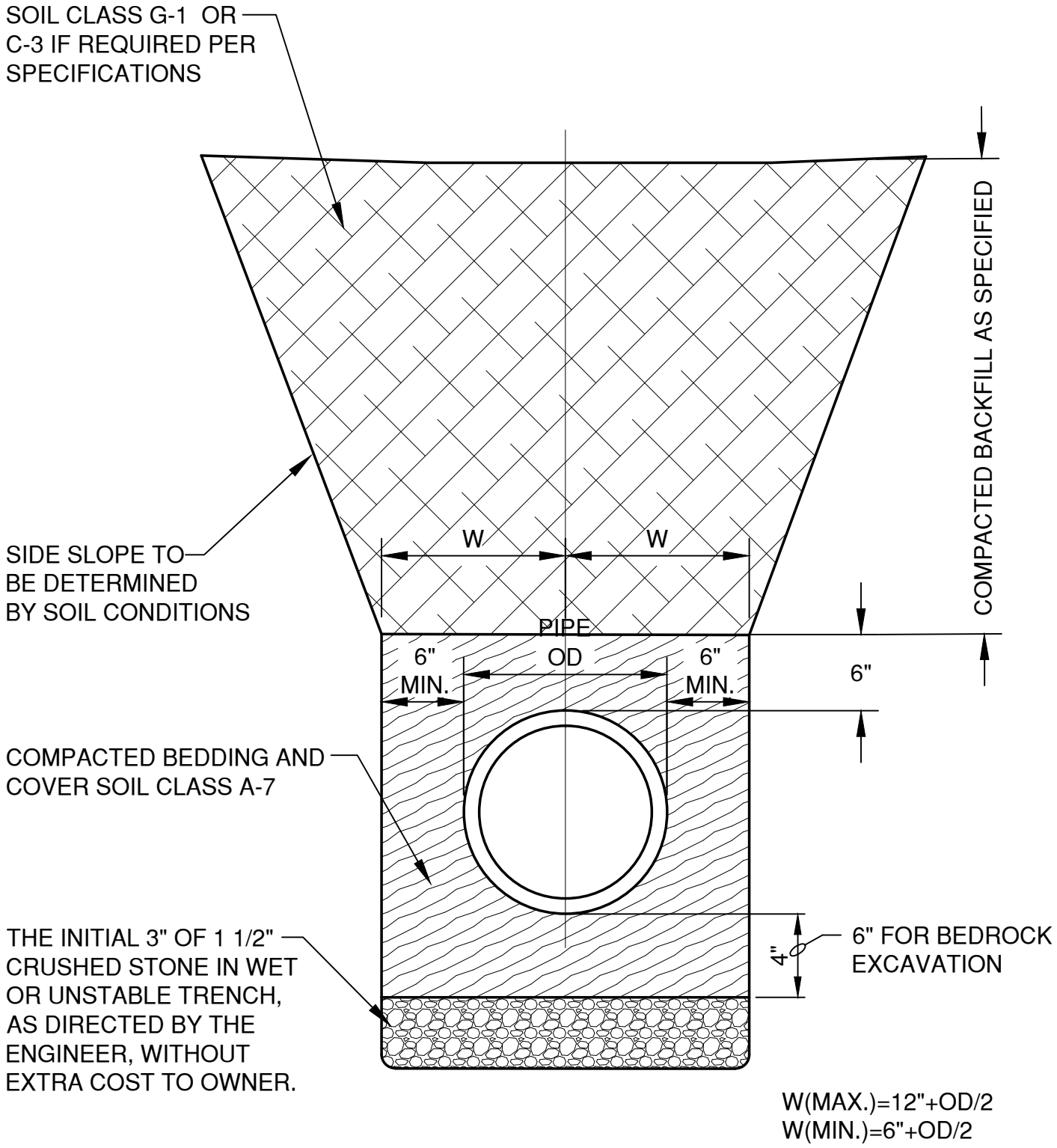
NOTE:

SURFACE RESTORATION REQUIREMENTS PER SPECIFICATIONS

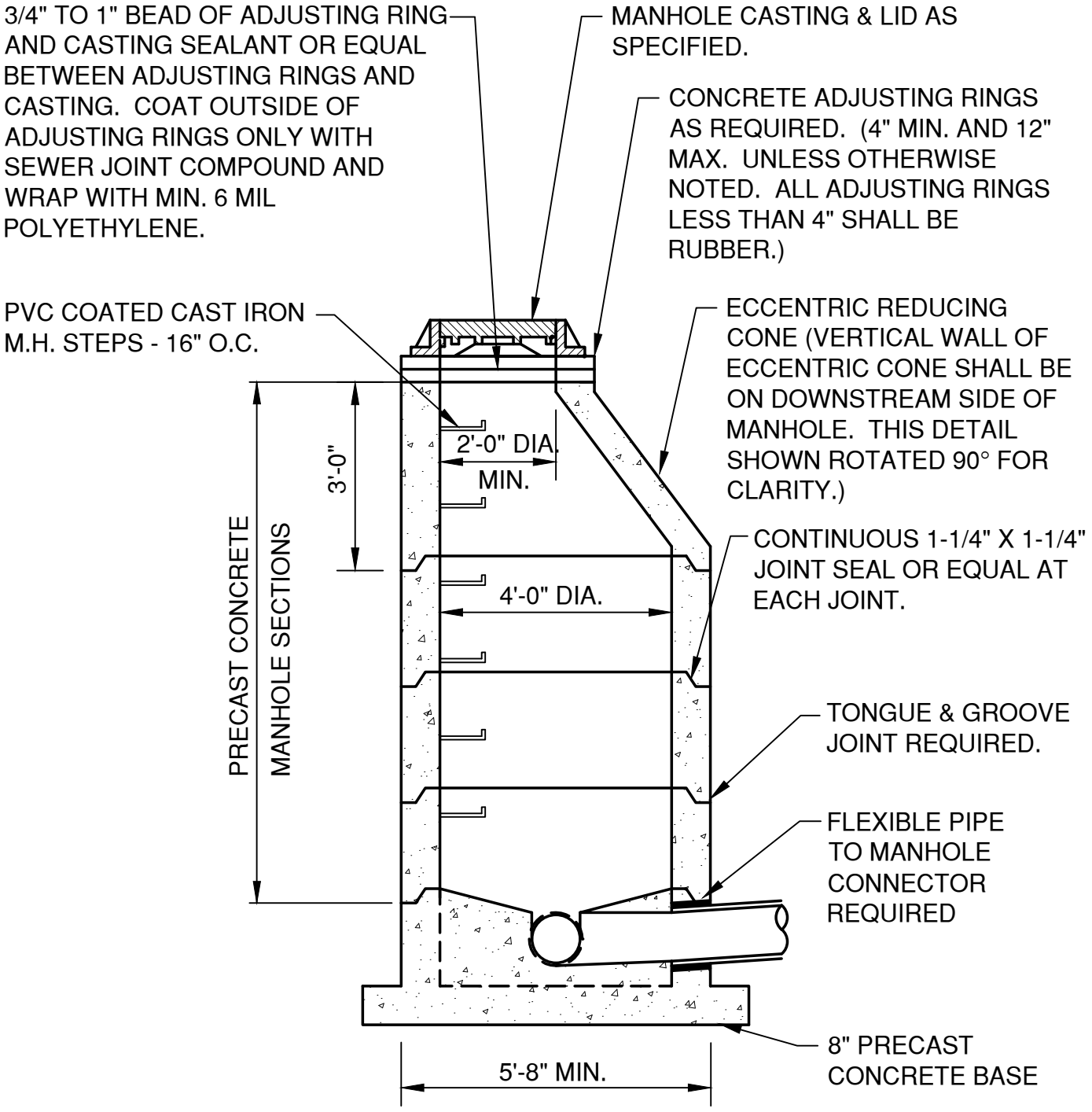
SEWERMAIN & WATERMAIN IN COMMON TRENCH



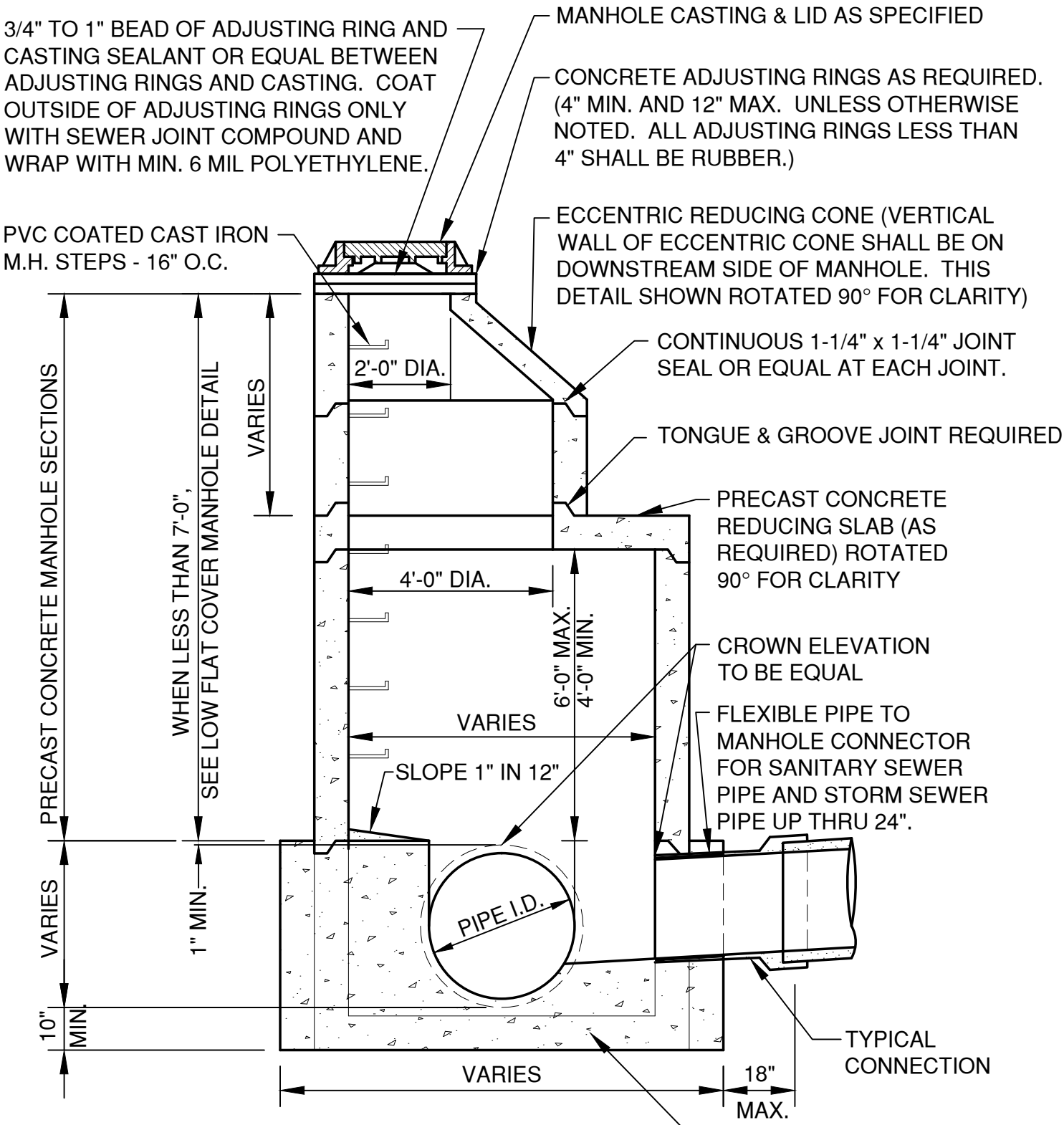
SMALL DIAMETER PIPING (UNDER 4" DIA.)
PVC, COPPER, STEEL, AND POLYETHYLENE



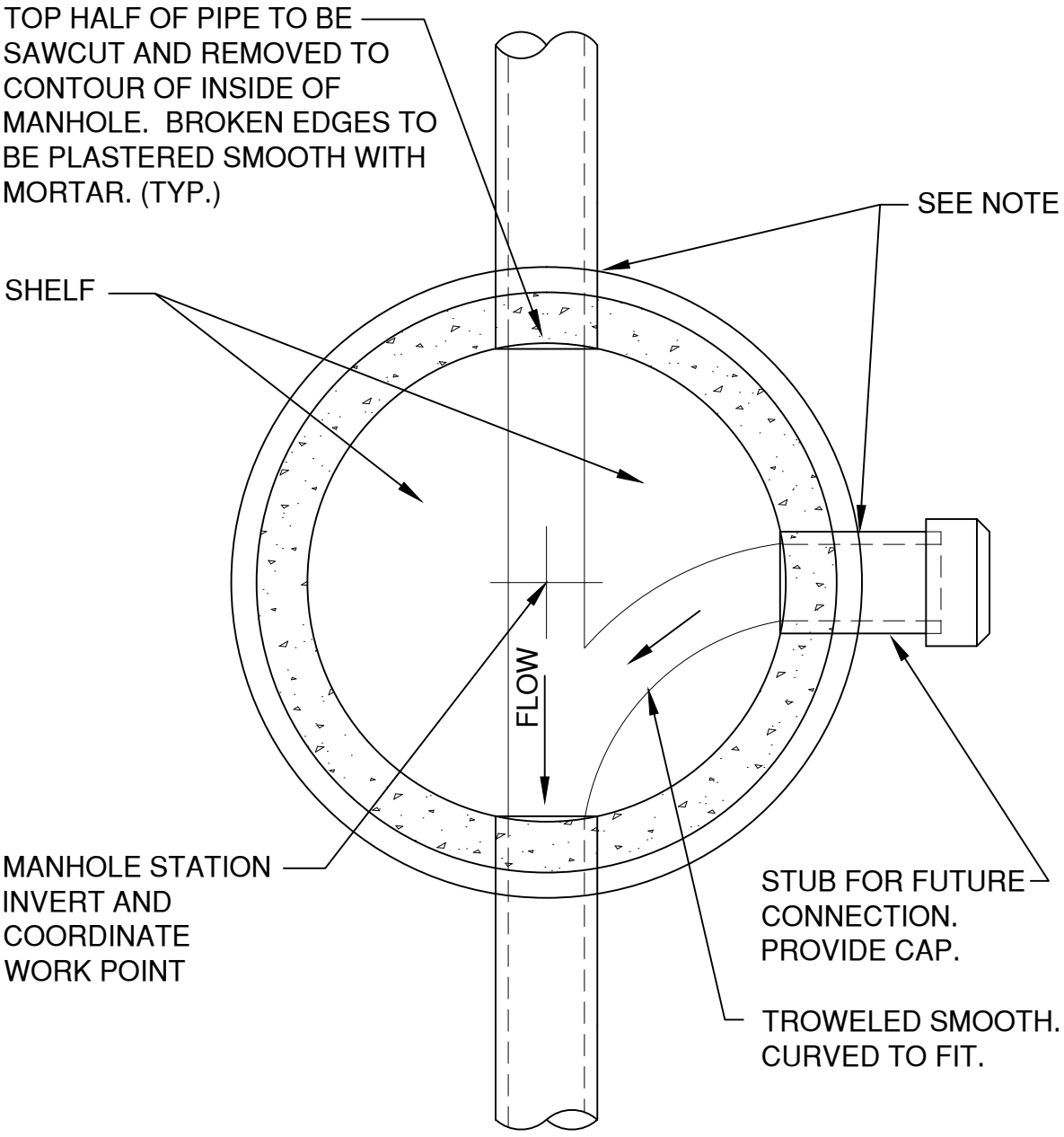
DUCTILE IRON BEDDING & TRENCH SECTION



SANITARY AND STORM STANDARD MANHOLE 8"-24" (INCLUSIVE)

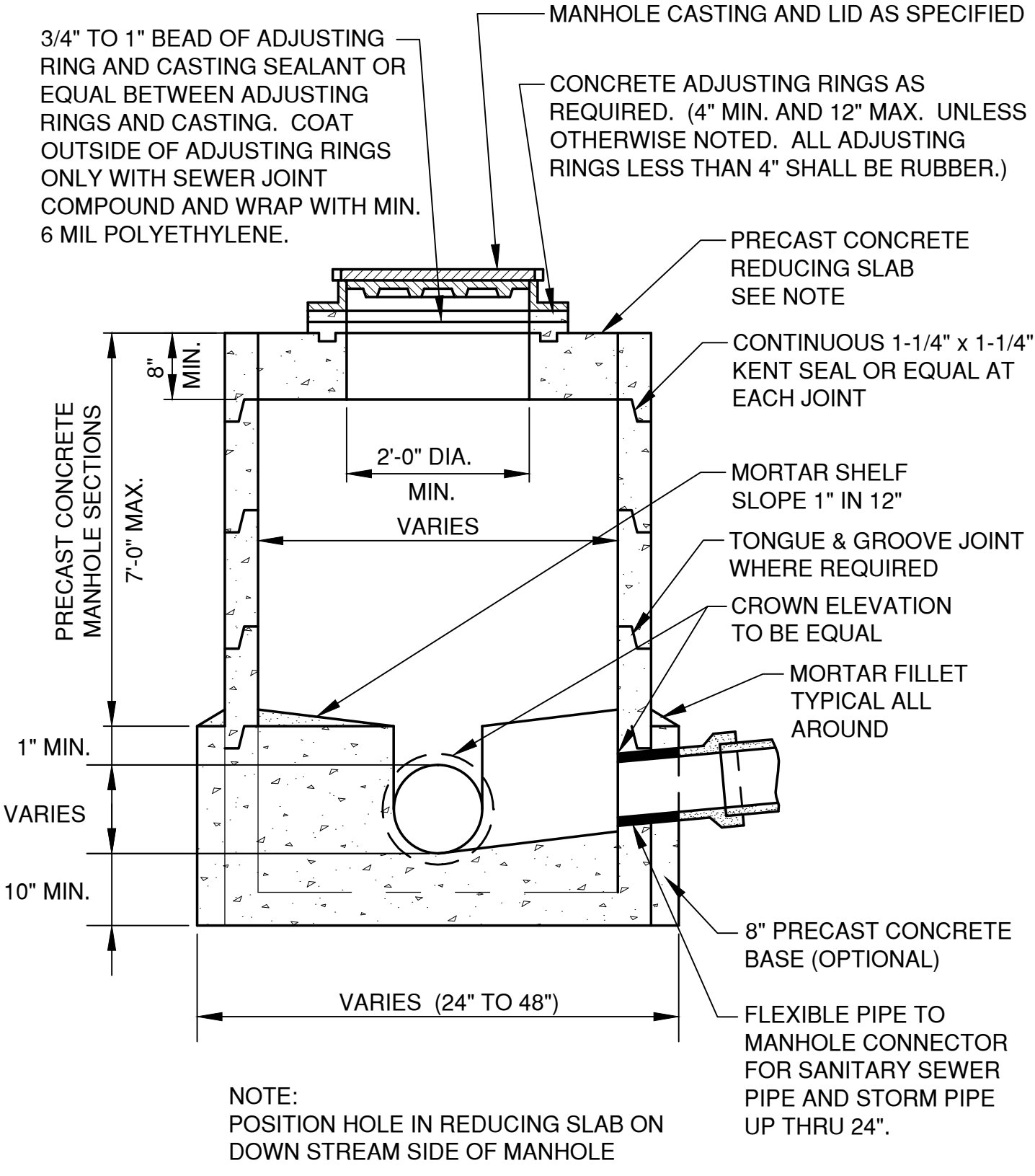


SANITARY AND STORM STANDARD MANHOLE 27" - 60" (INCLUSIVE)



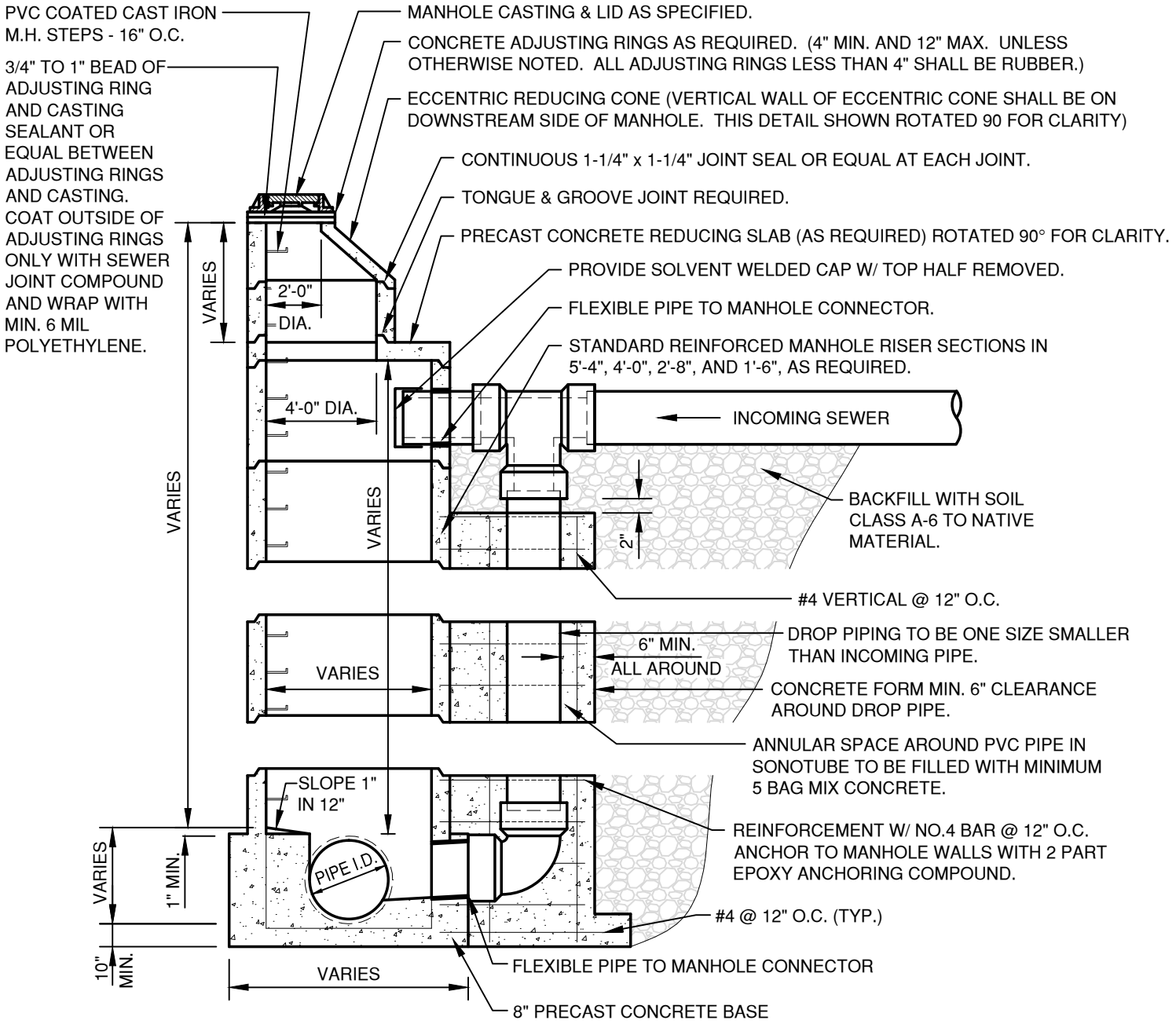
NOTE:
FOR PVC PIPE PROVIDE AN APPROVED FLEXIBLE JOINT.

MANHOLE BASE PLAN
8" - 60" (INCLUSIVE)

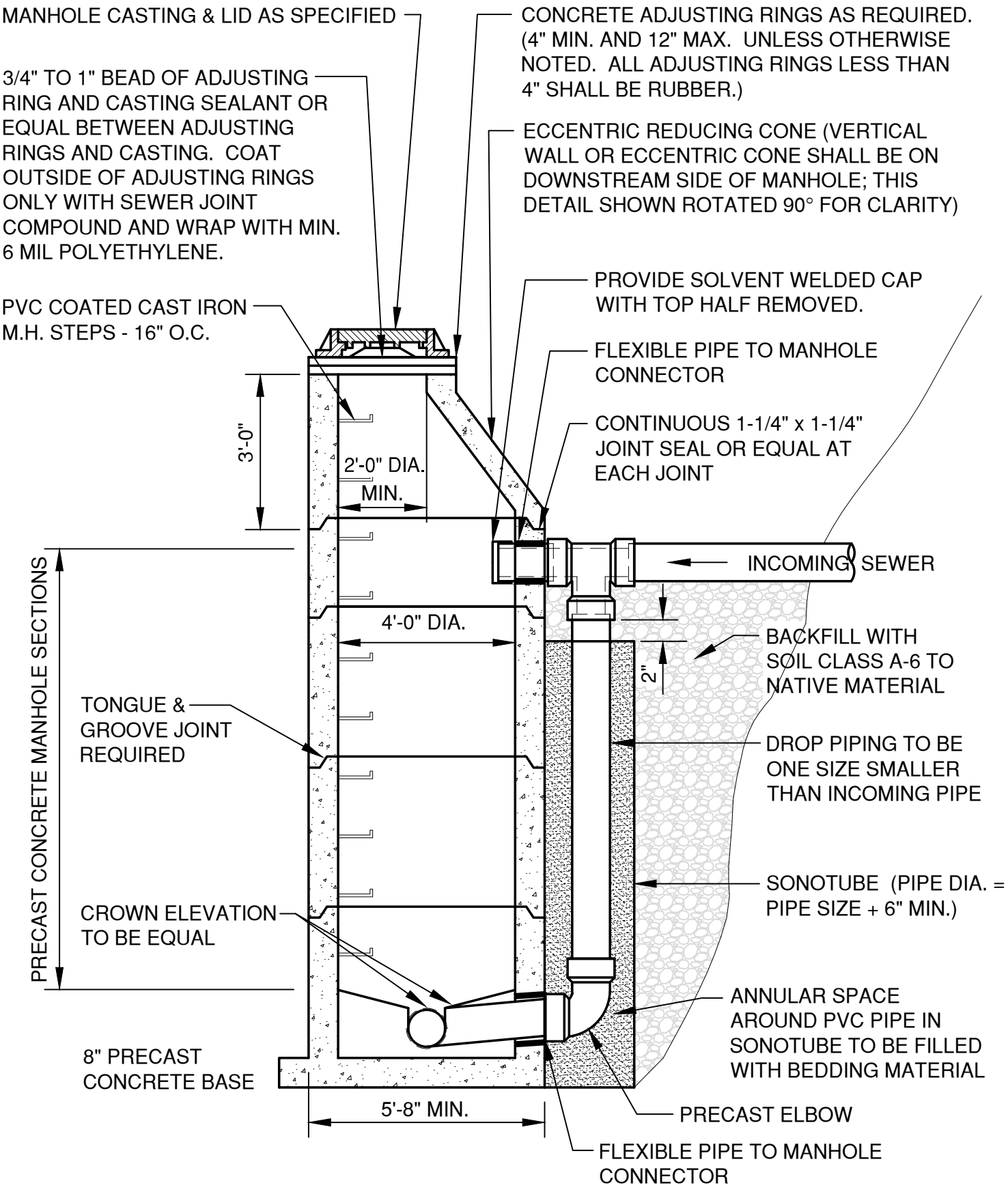


NOTE:
POSITION HOLE IN REDUCING SLAB ON DOWN STREAM SIDE OF MANHOLE

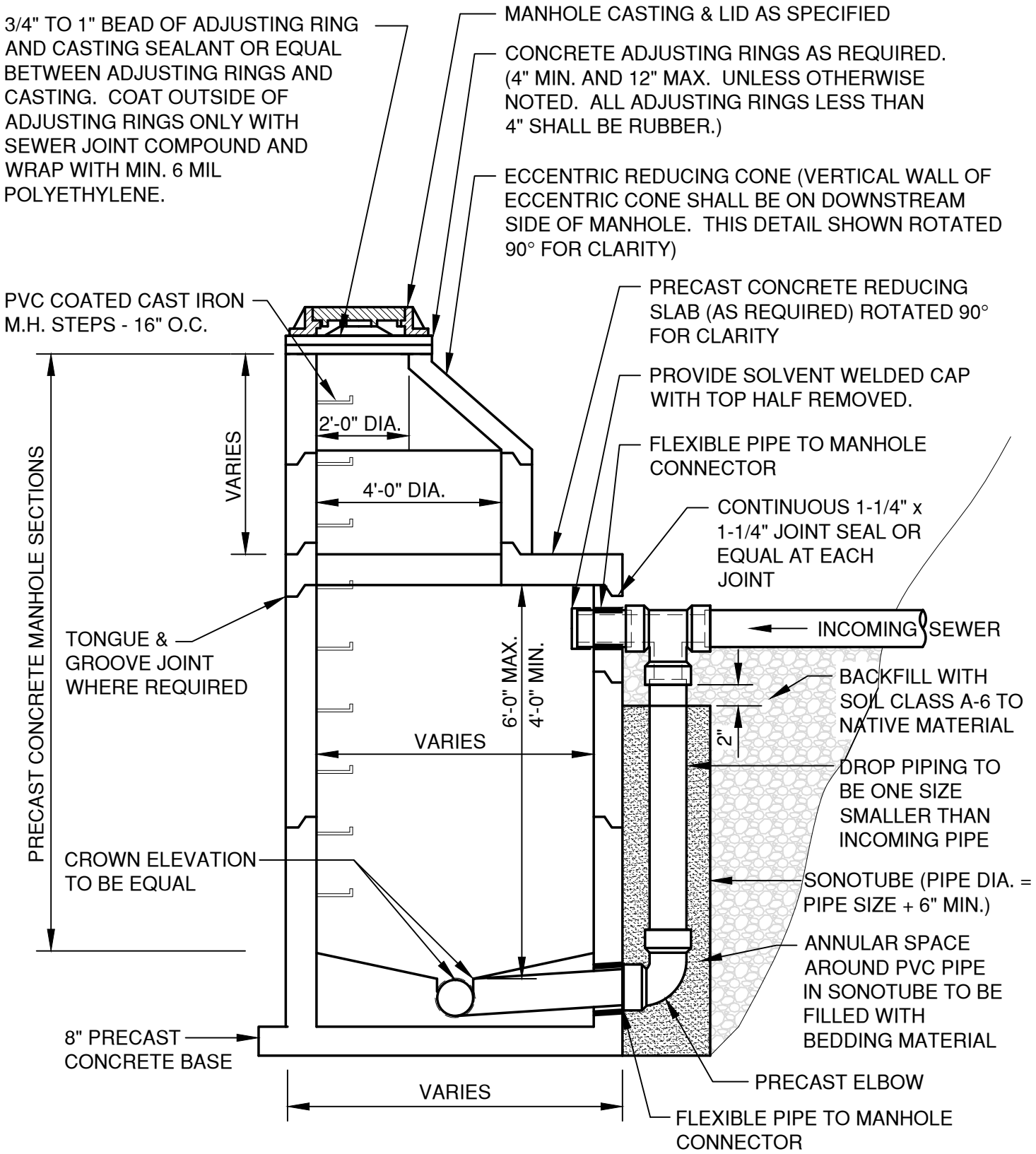
LOW HEADROOM MANHOLE
24" - 48" (INCLUSIVE)



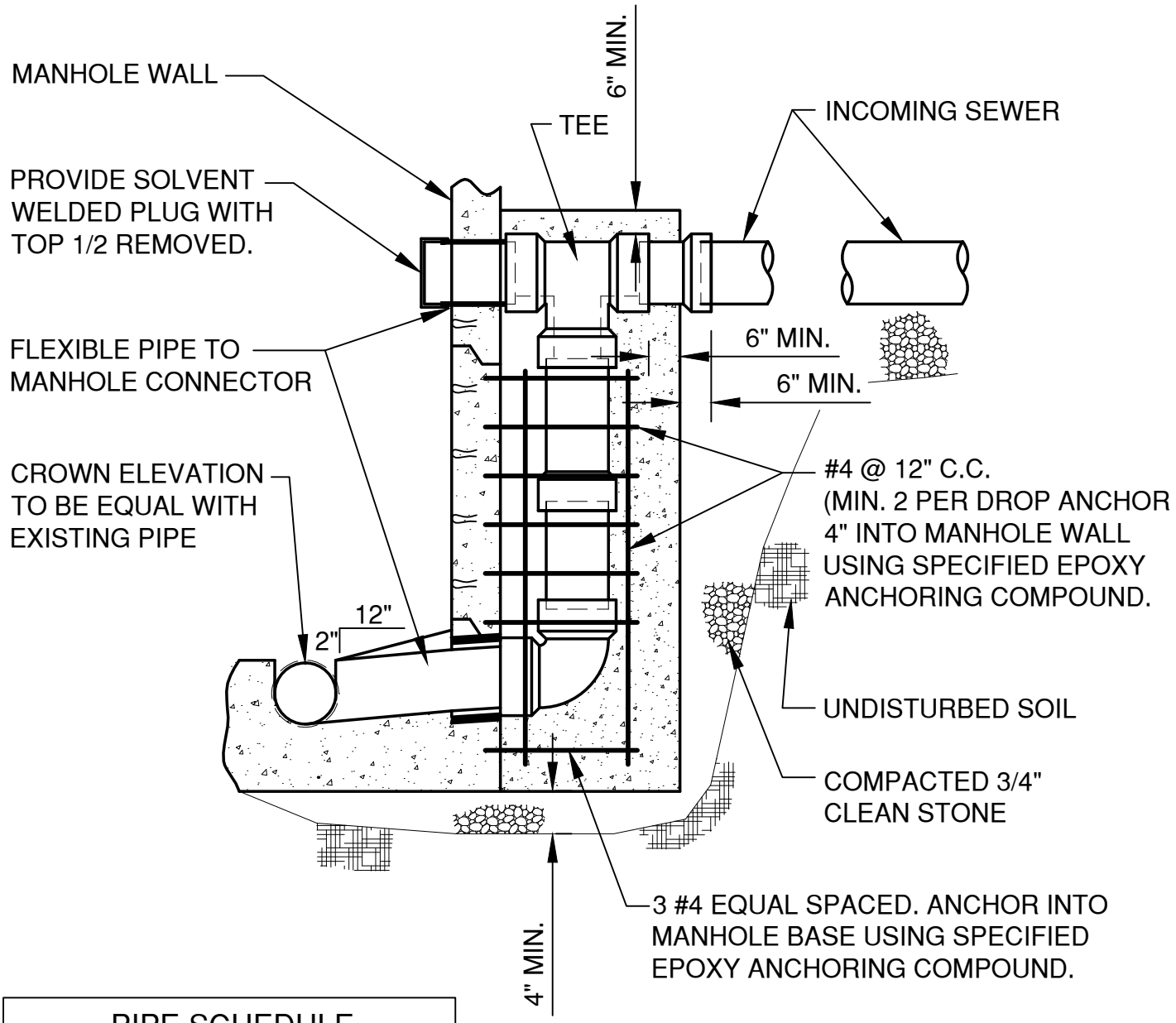
STANDARD PRECAST DROP MANHOLE



STANDARD CAST IN PLACE DROP MANHOLE 8" - 24" (INCLUSIVE)

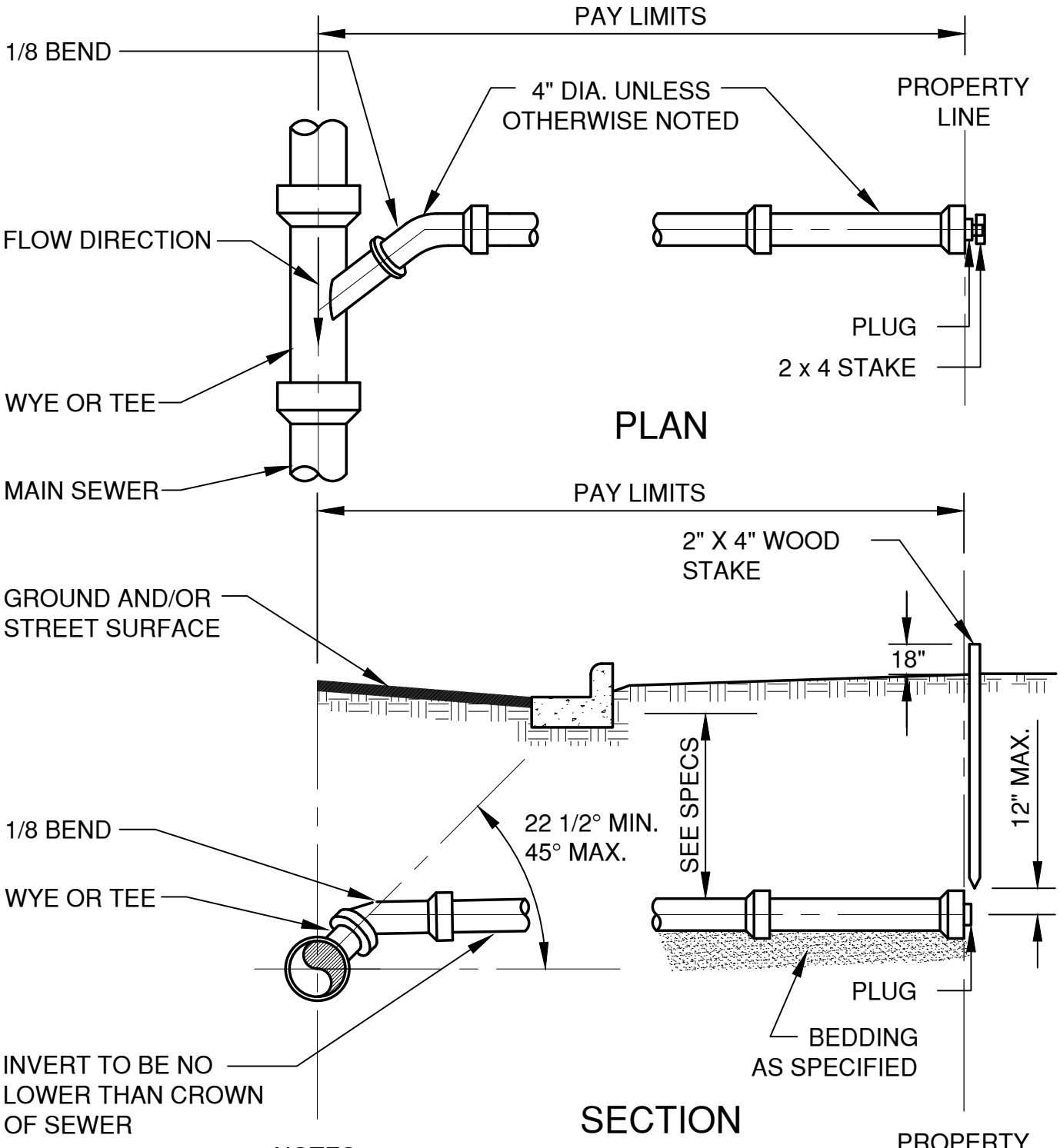


STANDARD CAST IN PLACE DROP MANHOLE 27" - 60" (INCLUSIVE)



PIPE SCHEDULE OUTSIDE DROP MANHOLE	
INCOMING PIPE	DROP PIPE
24"	21"
21"	18"
18"	15"
15"	12"
12"	10"
10"	8"
8"	8"

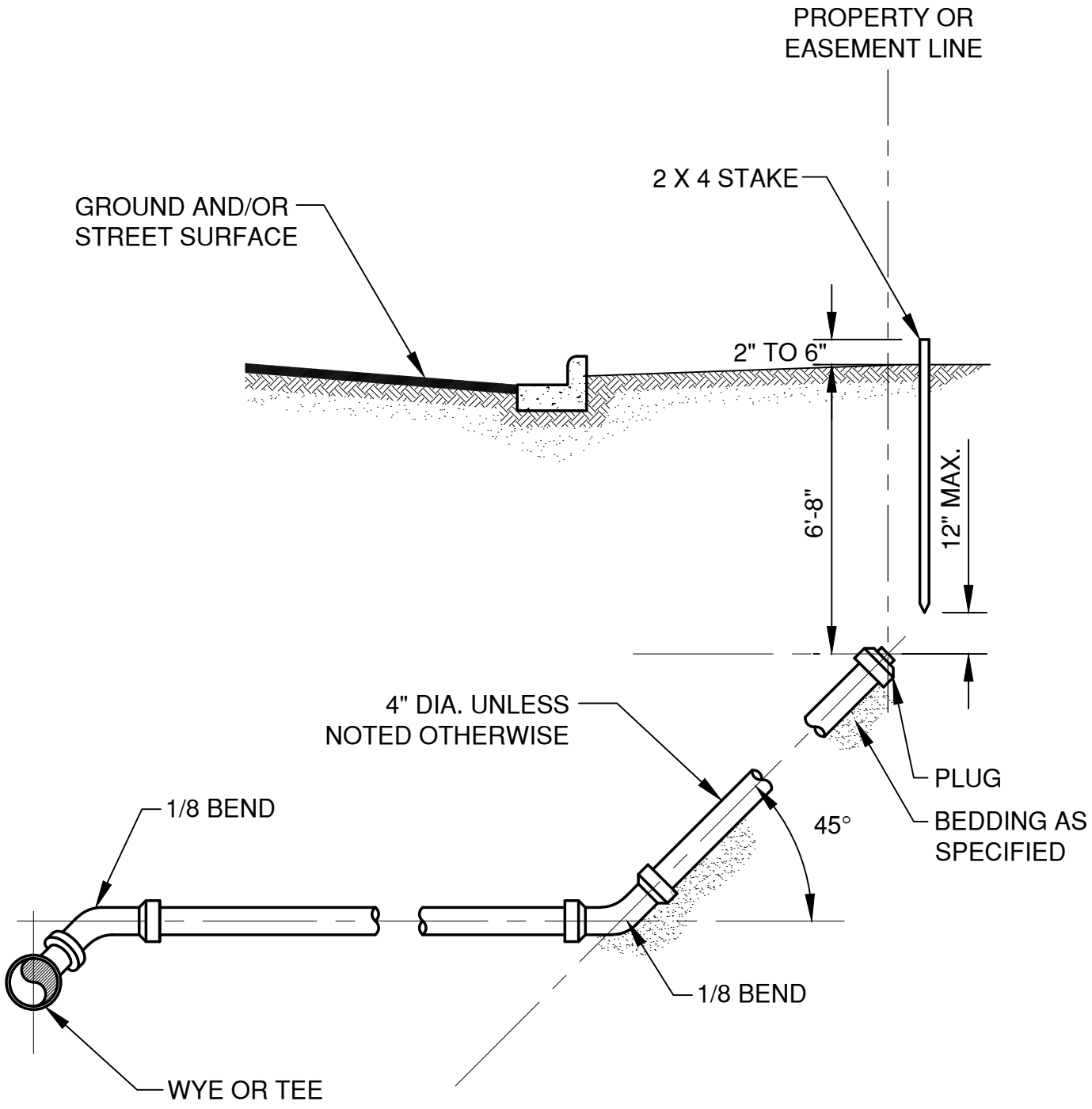
FIELD CONSTRUCTED DROP MANHOLE



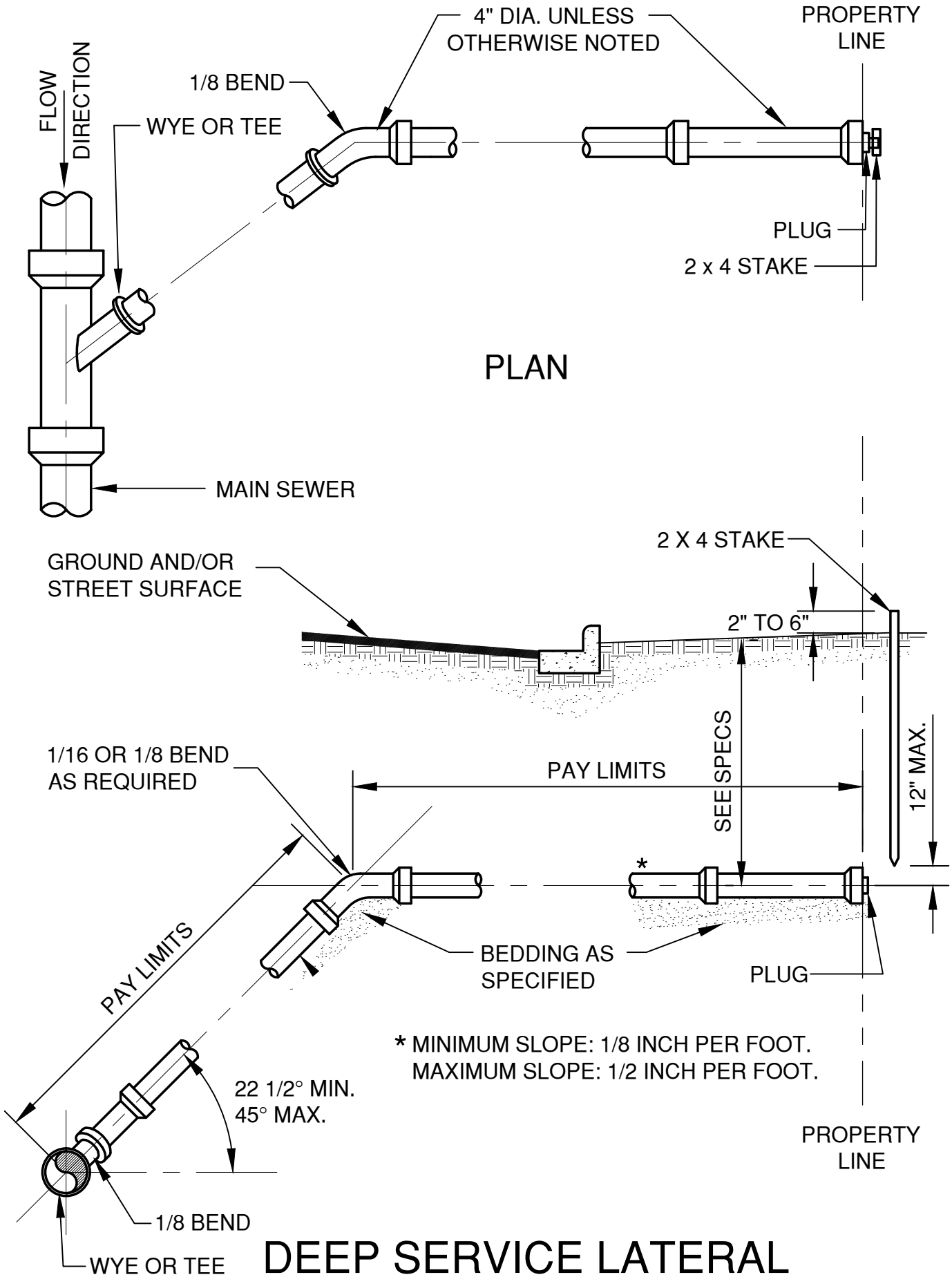
NOTES:

1. SADDLE CONNECTIONS NOT PERMITTED.
2. BACKFILL TO CONFORM TO MAIN SEWER.
3. MINIMUM SLOPE: 1/8 INCH PER FOOT.
4. MAXIMUM SLOPE: 1/2 INCH PER FOOT.

STANDARD SERVICE LATERAL

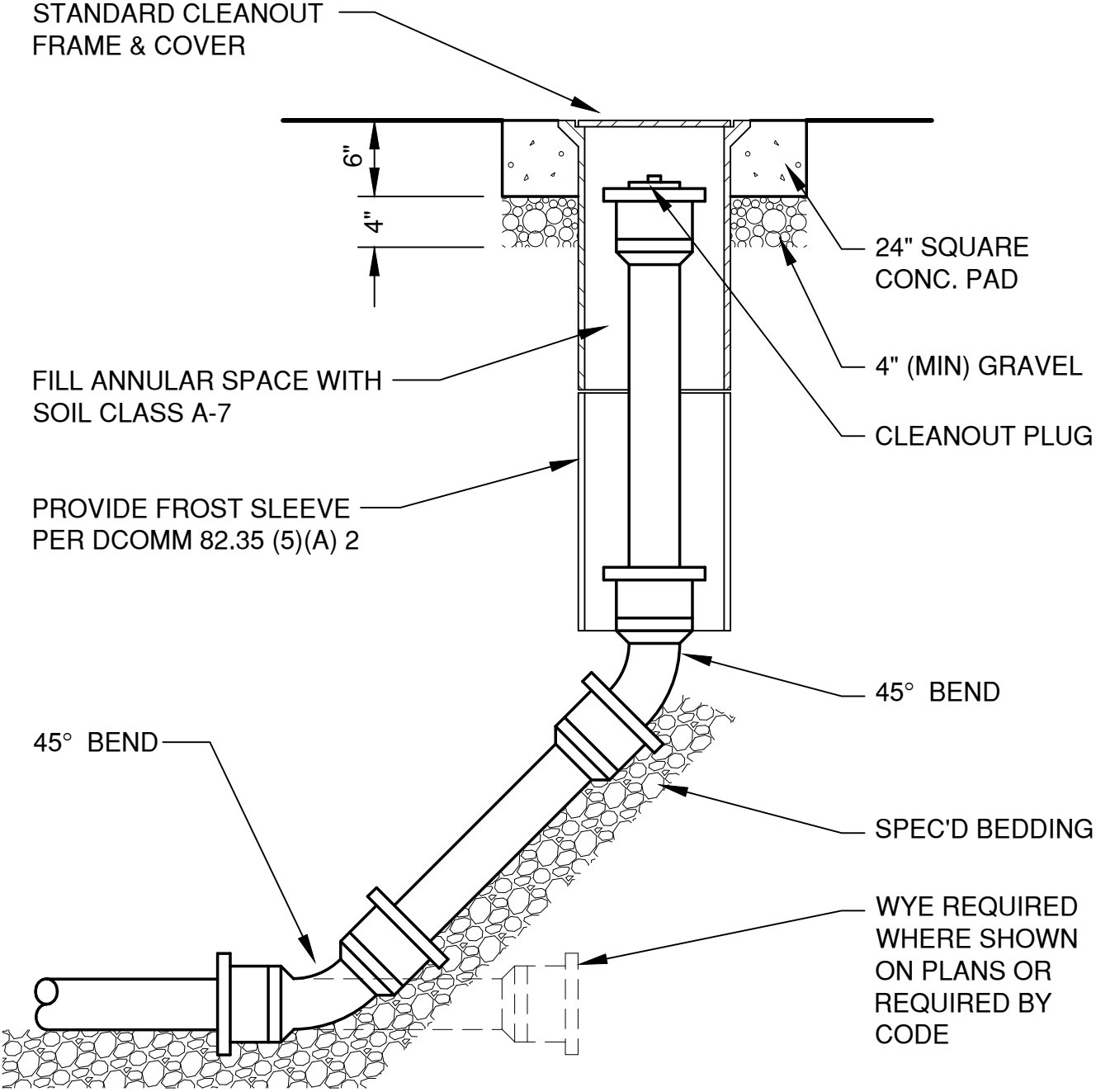


STANDARD SERVICE LATERAL IN BEDROCK



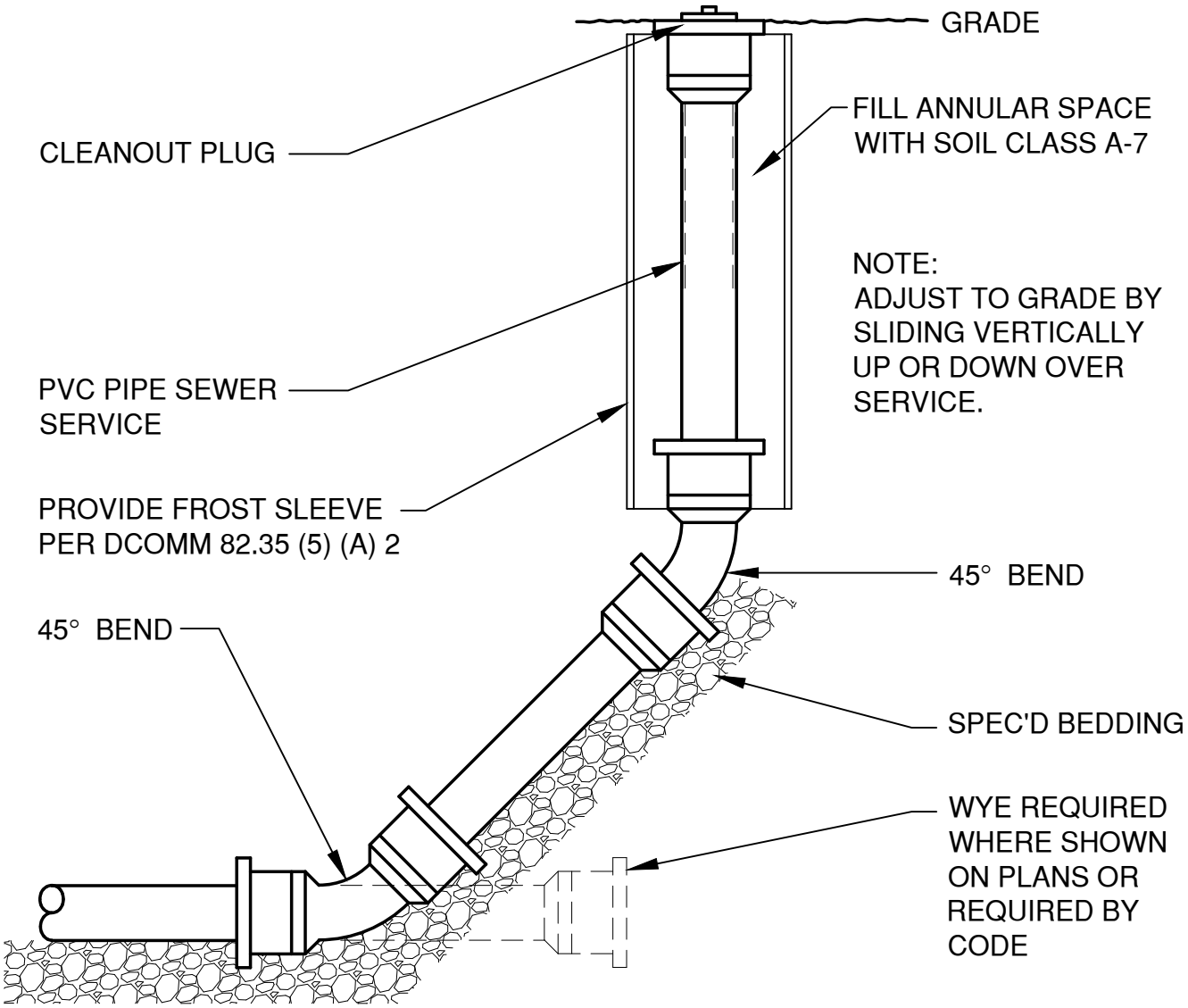
DEEP SERVICE LATERAL

NOTE
CLEANOUT LINE TO BE THE SAME
SIZE & MATERIAL AS SEWER MAIN.



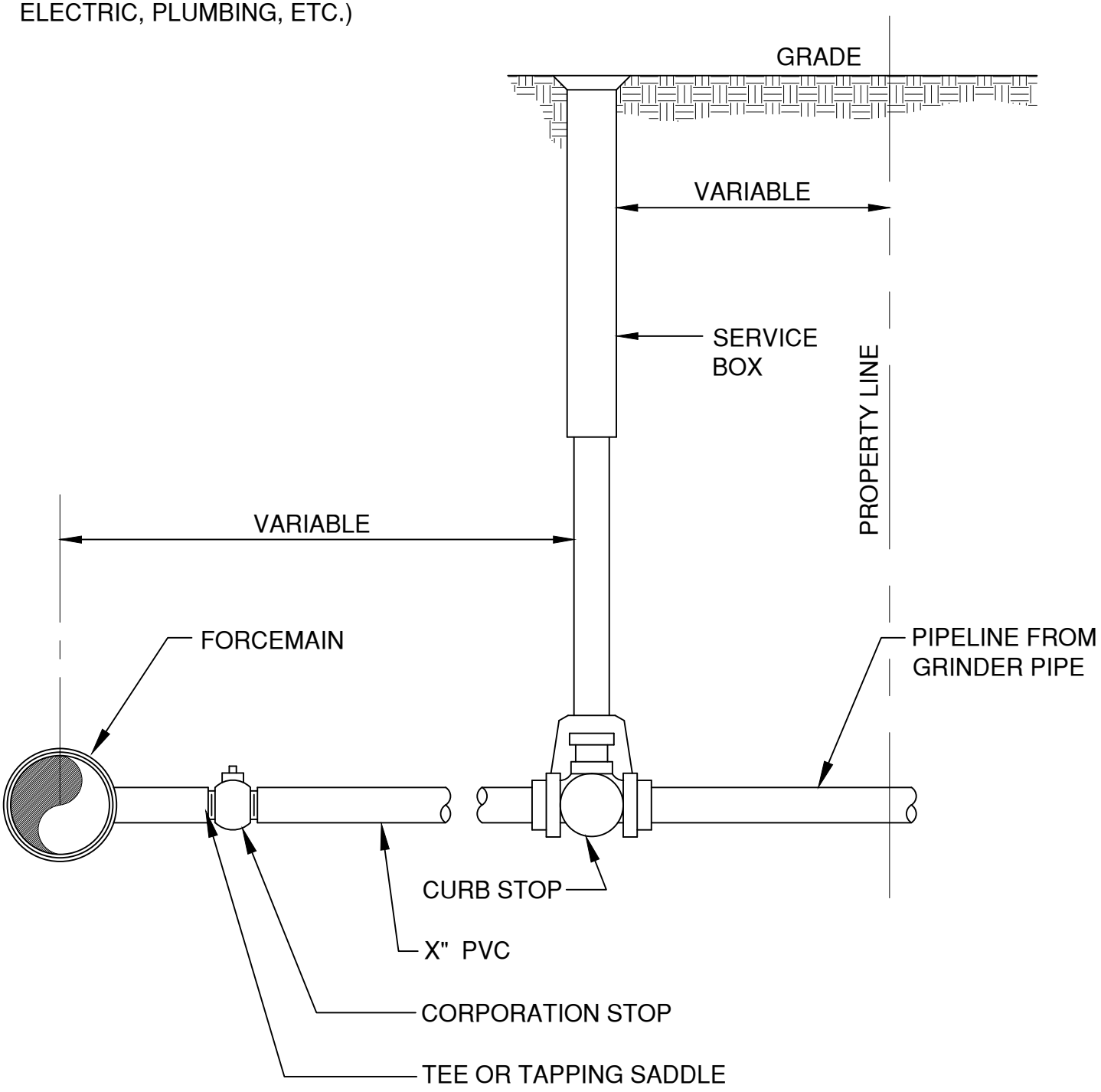
CLEAN-OUT DETAIL
(TRAVELED AREAS)

NOTE: CLEANOUT LINE TO BE THE
SAME SIZE & MATERIAL AS SEWER MAIN

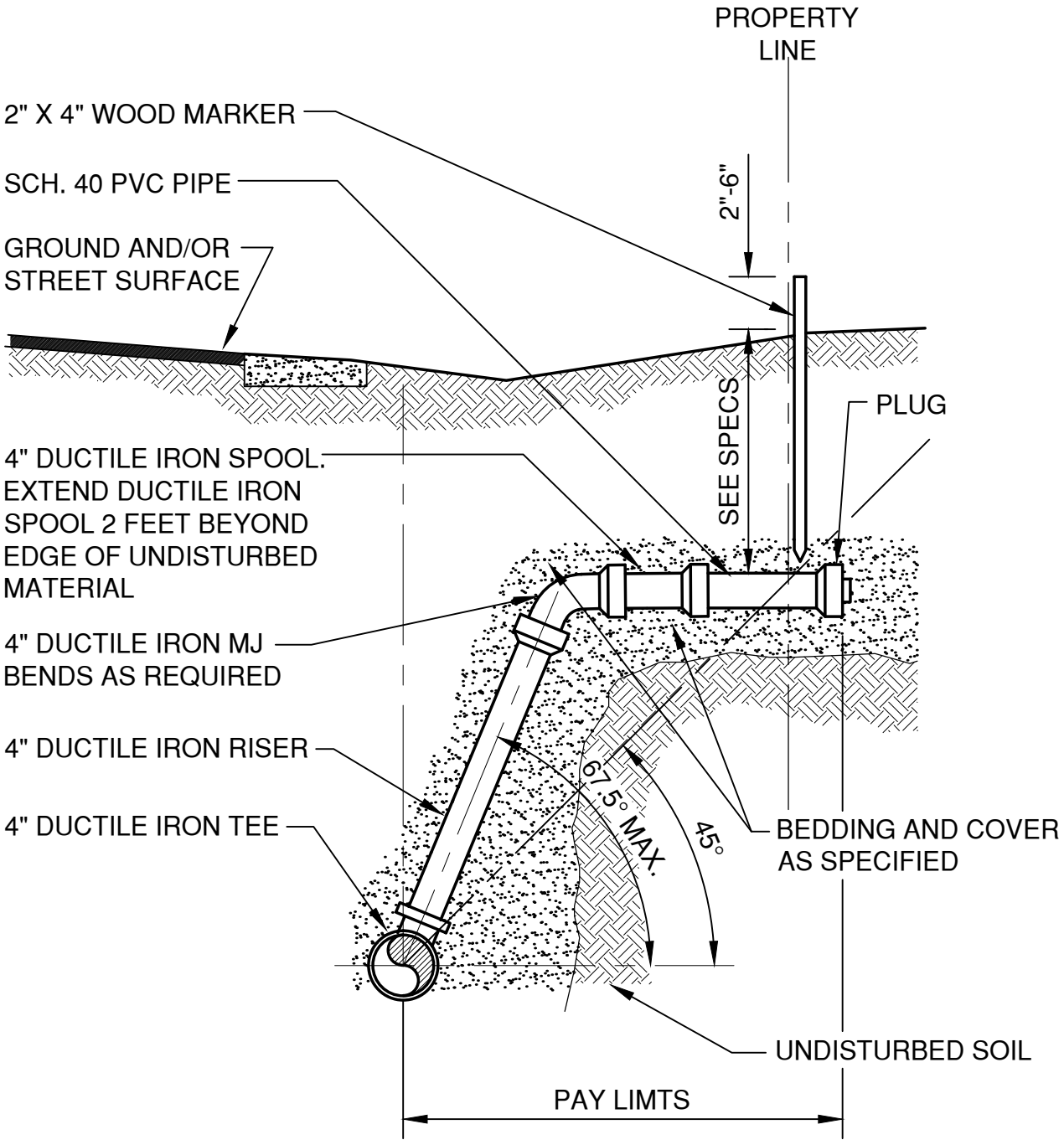


CLEAN-OUT DETAIL
(NON-TRAVELED AREAS)

NOTE:
INSTALLATION MUST CONFORM TO ALL APPLICABLE CODES. (BUILDING, ELECTRIC, PLUMBING, ETC.)

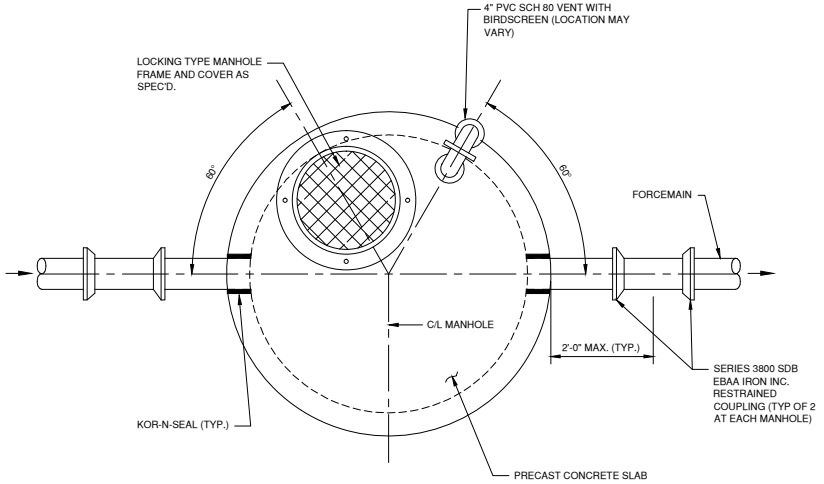


DISCHARGE PIPING TO FORCEMAIN DETAIL



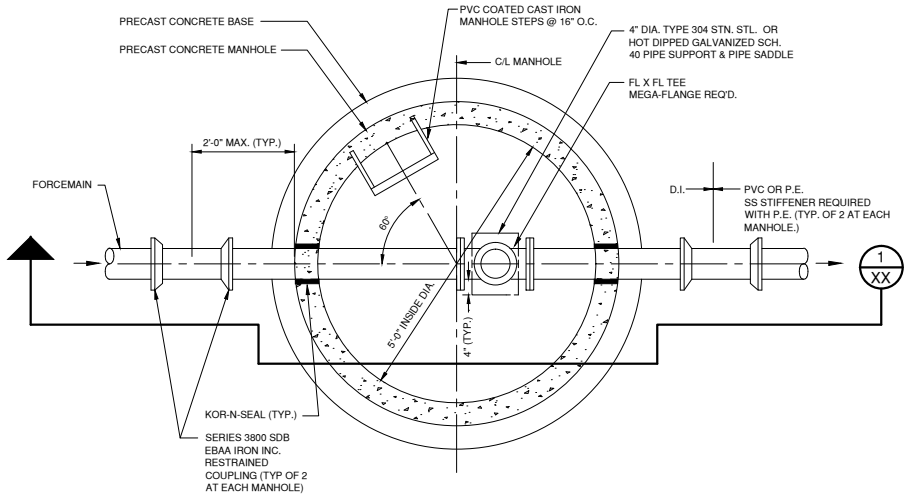
OPTIONAL DEEP SERVICE LATERAL

45° TO 67.5° MAXIMUM ANGLE



TOP PLAN

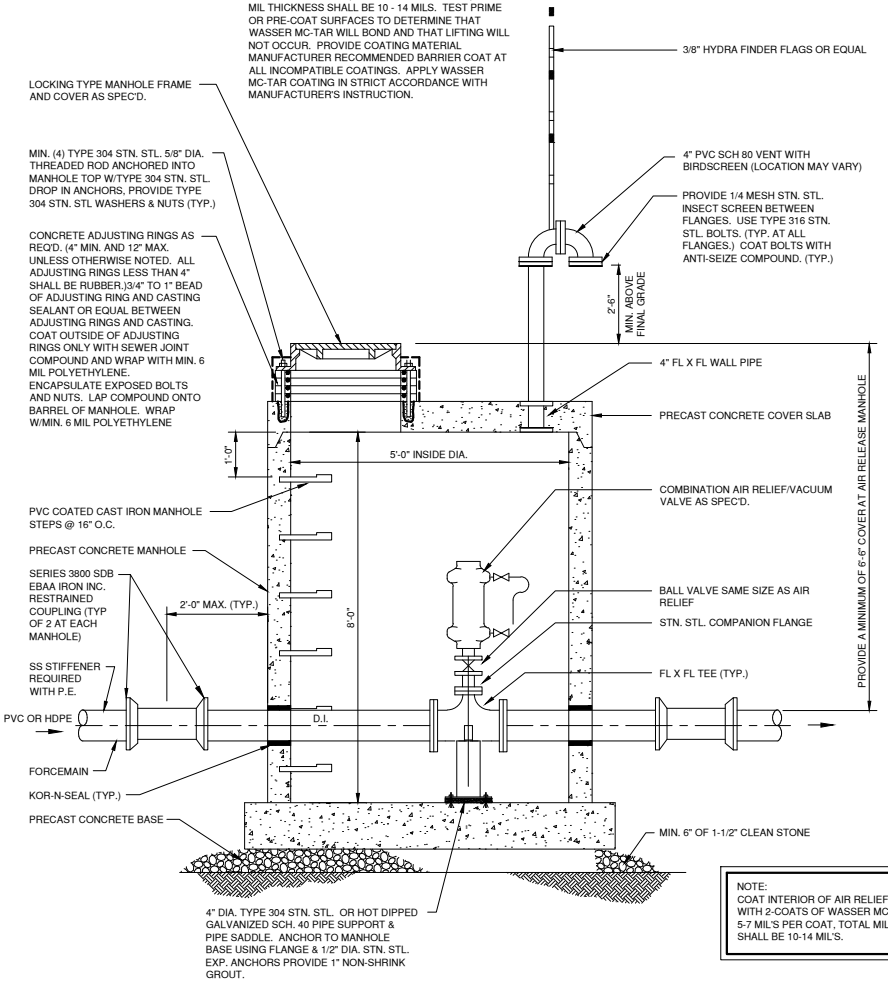
SCALE: 3/4" = 1'-0"



BASE PLAN

SCALE: 3/4" = 1'-0"

NOTE:
COAT ALL STEEL & IRON PIPE, FITTINGS, AIR RELIEF VALVES AND FERROUS FASTENERS WITH 2 COATS OF WASSER MC-TAR, MIN 5-7 MILS PER COAT, TOTAL MIL THICKNESS SHALL BE 10 - 14 MILS. TEST PRIME OR PRE-COAT SURFACES TO DETERMINE THAT WASSER MC-TAR WILL BOND AND THAT LIFTING WILL NOT OCCUR. PROVIDE COATING MATERIAL MANUFACTURER RECOMMENDED BARRIER COAT AT ALL INCOMPATIBLE COATINGS. APPLY WASSER MC-TAR COATING IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTION.



NOTE:
COAT INTERIOR OF AIR RELIEF MANHOLE WITH 2-COATS OF WASSER MC-TAR, MIN. 5-7 MIL'S PER COAT, TOTAL MIL THICKNESS SHALL BE 10-14 MIL'S.

NOTE: AIR RELEASE VALVE SHOWN OUT OF POSITION FOR CLARITY. SEE PLAN VIEWS FOR CORRECTION.

SECTION 1/XX

NTS

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION

DRAWN
CHECKED
DESIGNED

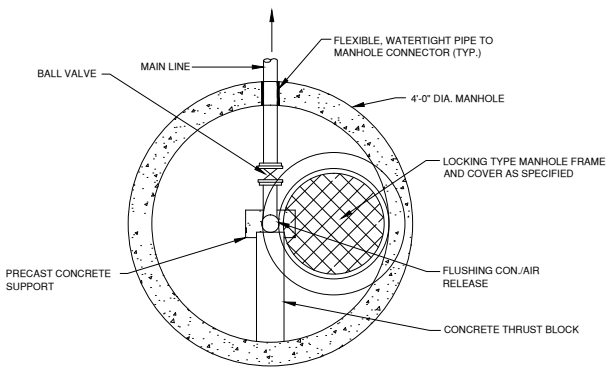
AIR RELEASE MANHOLE DETAILS

DATE
FILE
JOB NO.

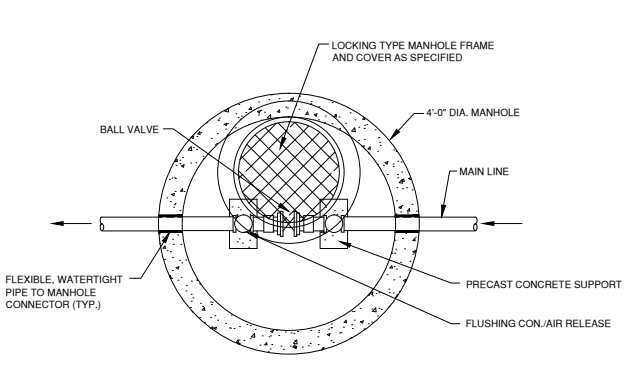
Robert E. Lee & Associates, Inc.
ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES
4664 GOLDEN POND PARK COURT
HOBART, WI 54155 PHONE:(920) 662-9641
INTERNET: www.releeinc.com FAX:(920) 662-9141

SHEET NO.
X
X

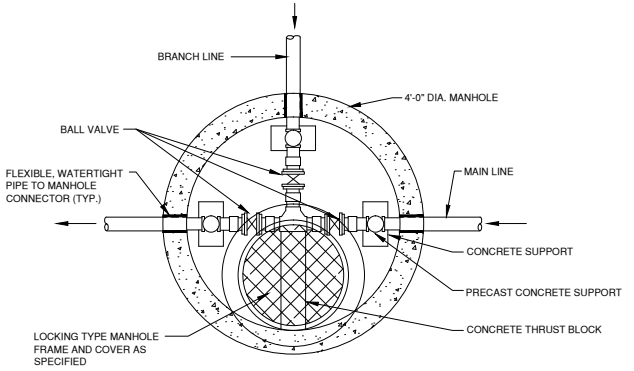
PLAN VIEW PLAN
LAYOUT
LAYOUT1
File: H:\DETAILS\DWGS\DETAIL.dwg
Plot: Mon Mar 18, 2013 9:41pm



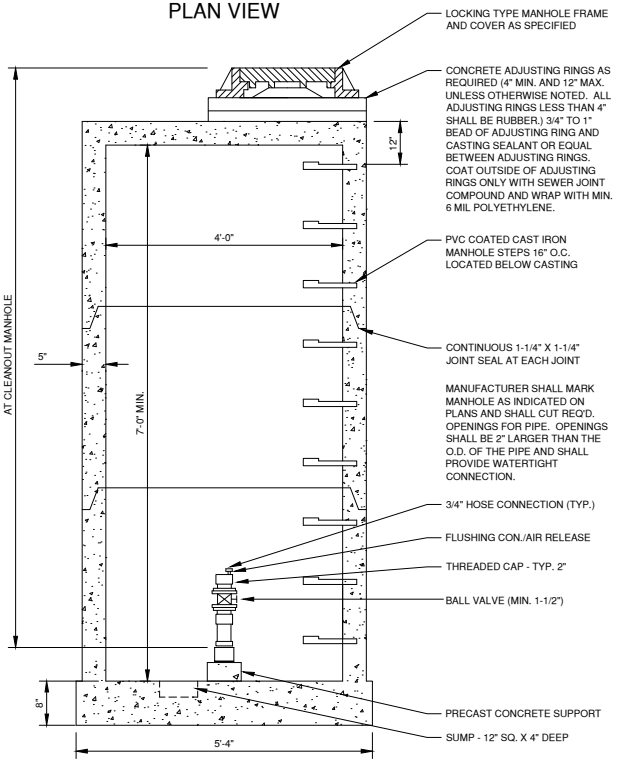
CLEAN OUT MANHOLE TYPE 1
PLAN VIEW



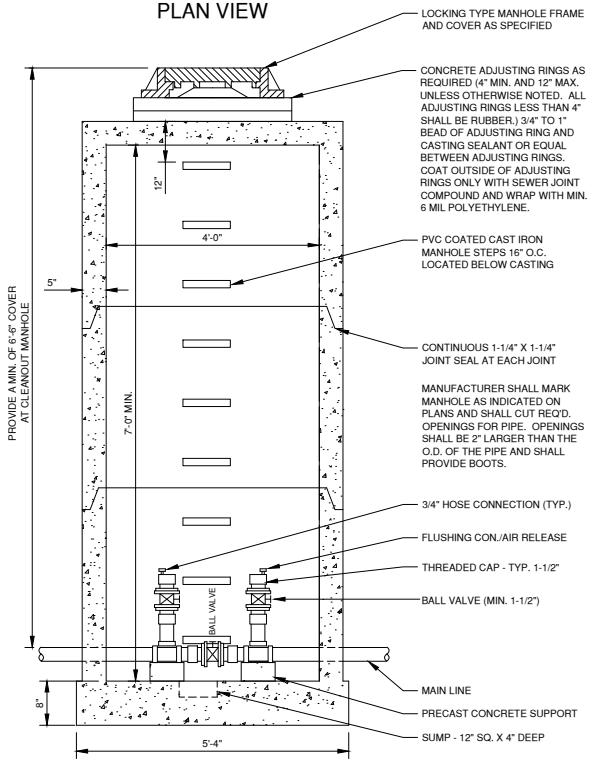
CLEAN OUT MANHOLE TYPE 2
PLAN VIEW



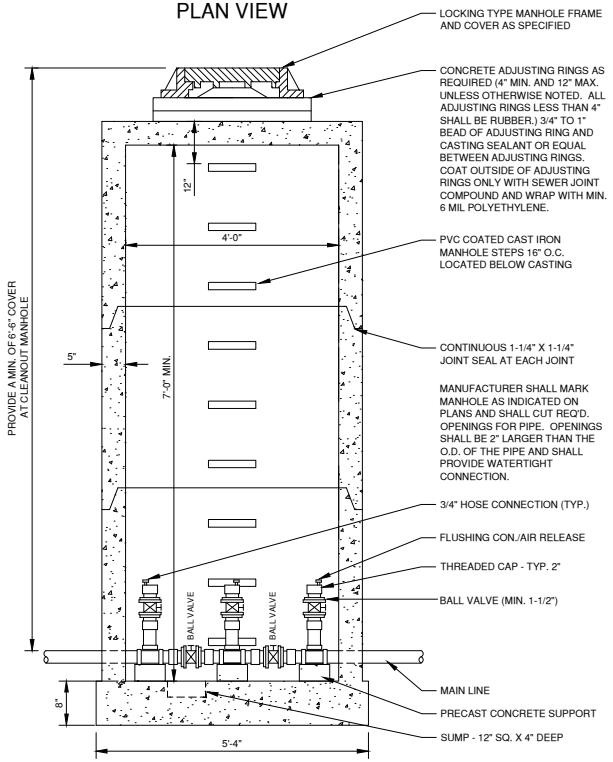
CLEAN OUT MANHOLE TYPE 3
PLAN VIEW



CLEAN OUT MANHOLE TYPE 1
SECTION VIEW



CLEAN OUT MANHOLE TYPE 2
SECTION VIEW



CLEAN OUT MANHOLE TYPE 3
SECTION VIEW

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION

DRAWN
CHECKED
DESIGNED

CLEANOUT MANHOLE DETAILS

DATE
FILE
JOB NO.

Robert E. Lee & Associates, Inc.
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4664 GOLDEN POND PARK COURT
HOBART, WI 54155 PHONE:(920) 662-9641
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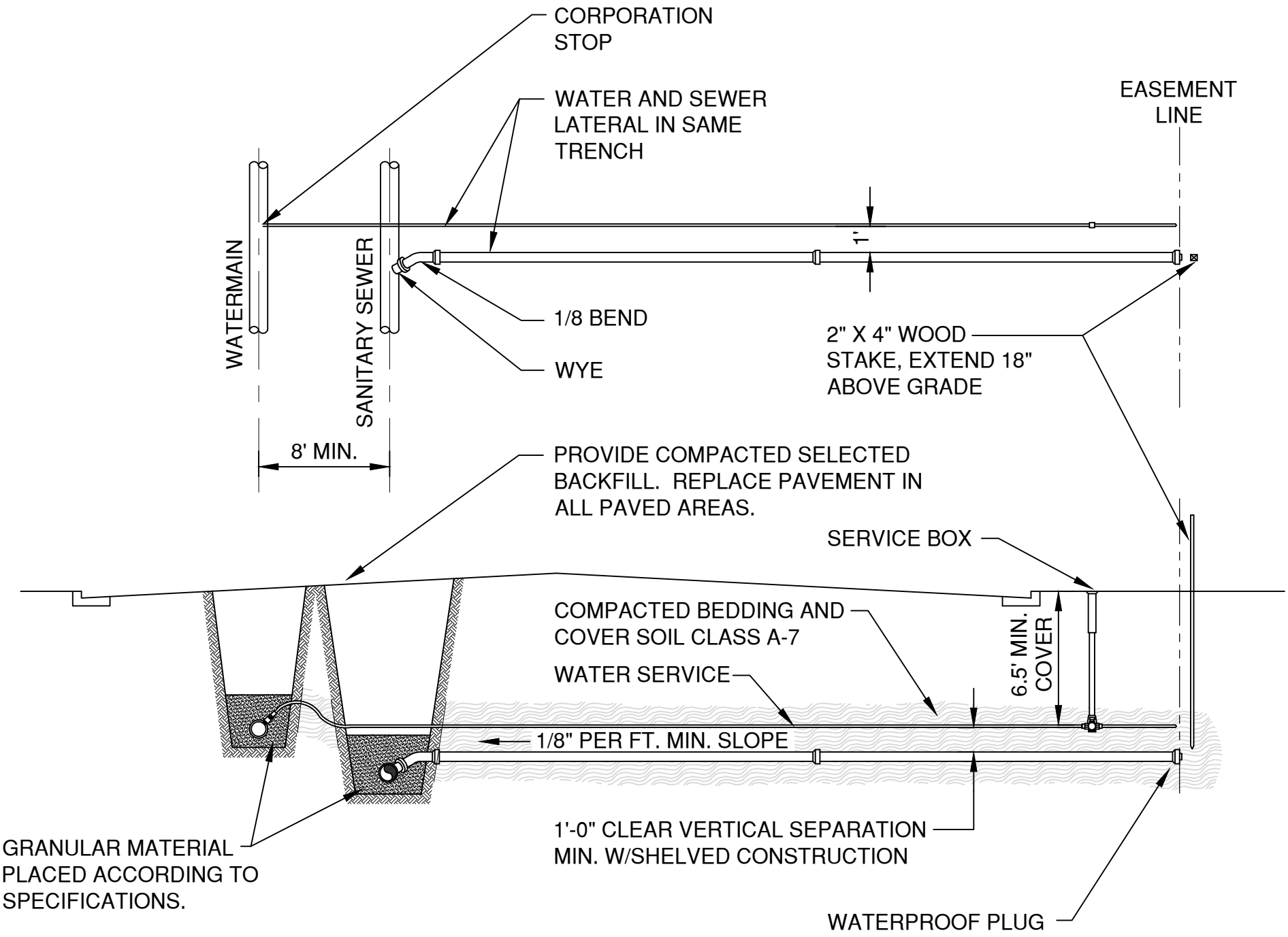
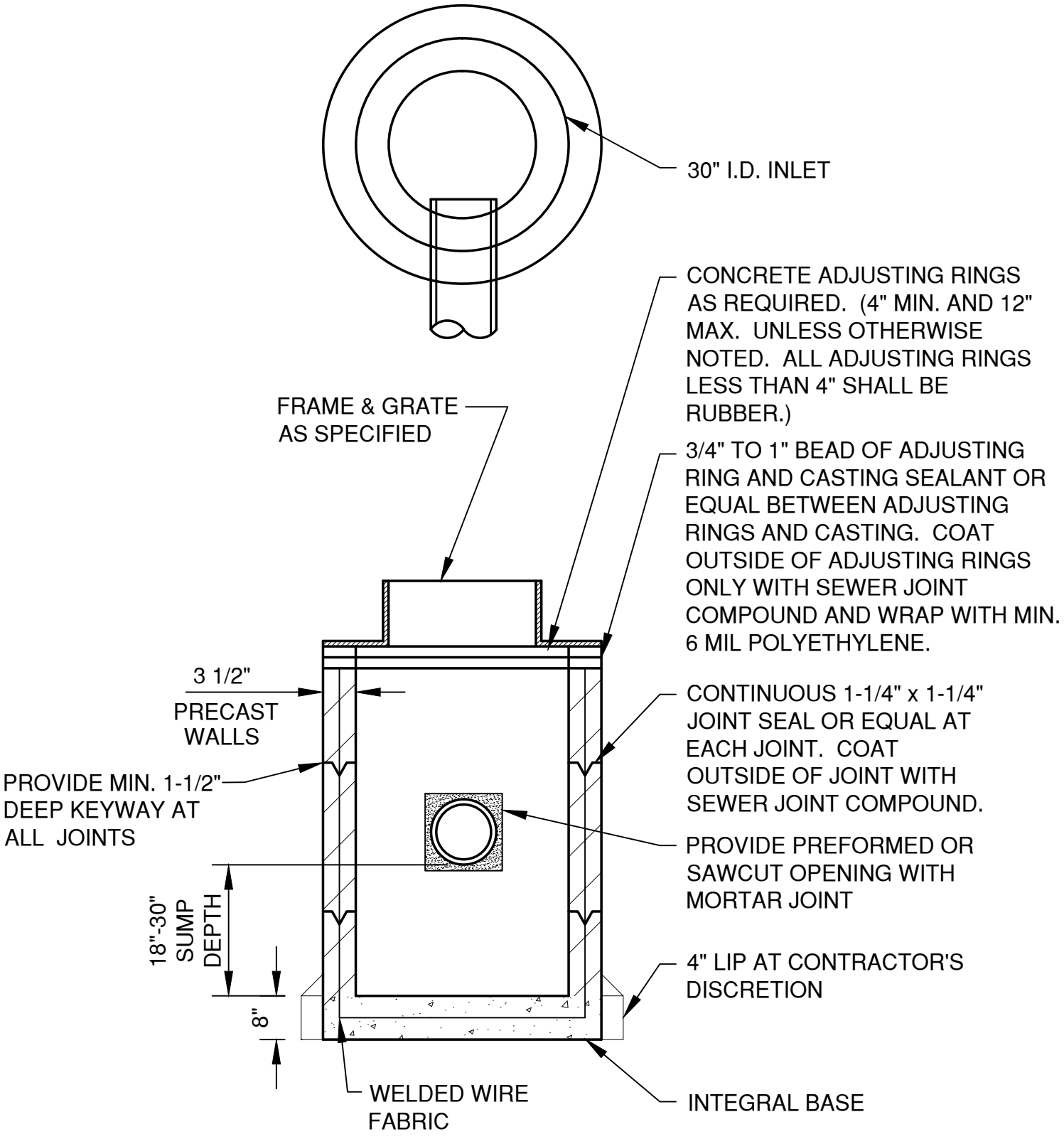
SHEET NO.
X

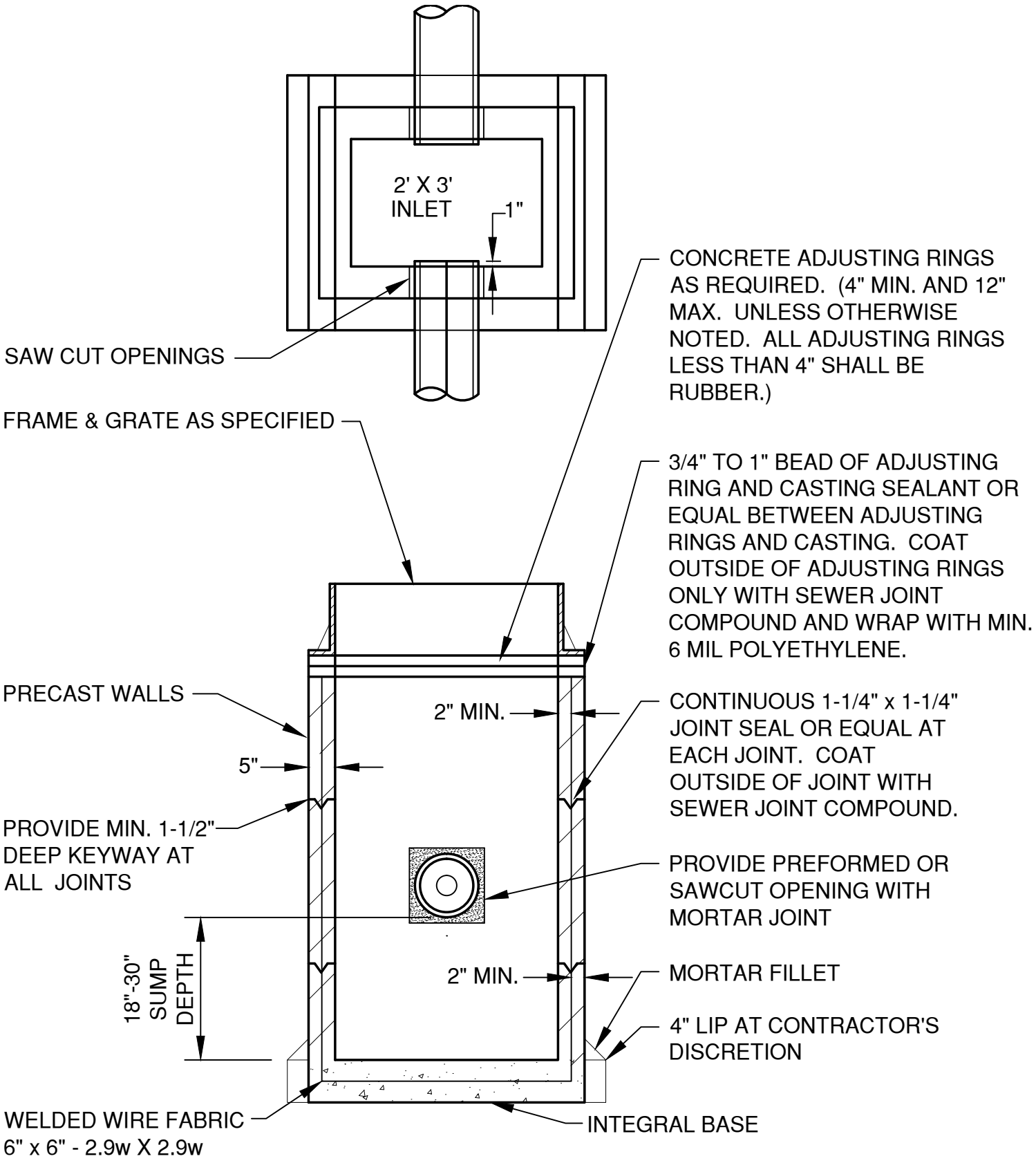


TYPICAL CONNECTION SEWER AND WATER



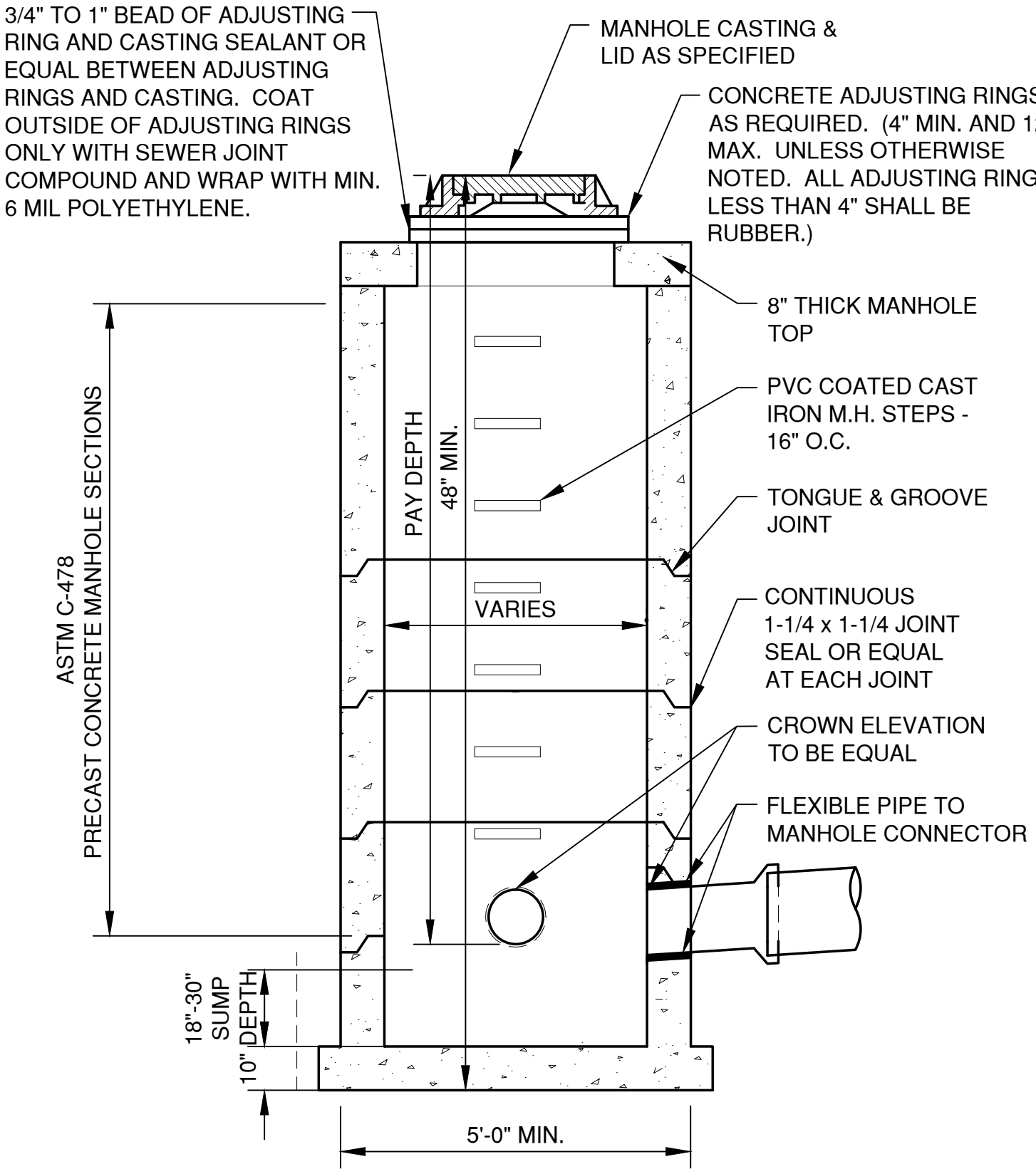
ALL PRECAST INLET UNITS SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF AASHTO DESIGNATION M 199

TYPE 'A' STORM INLET

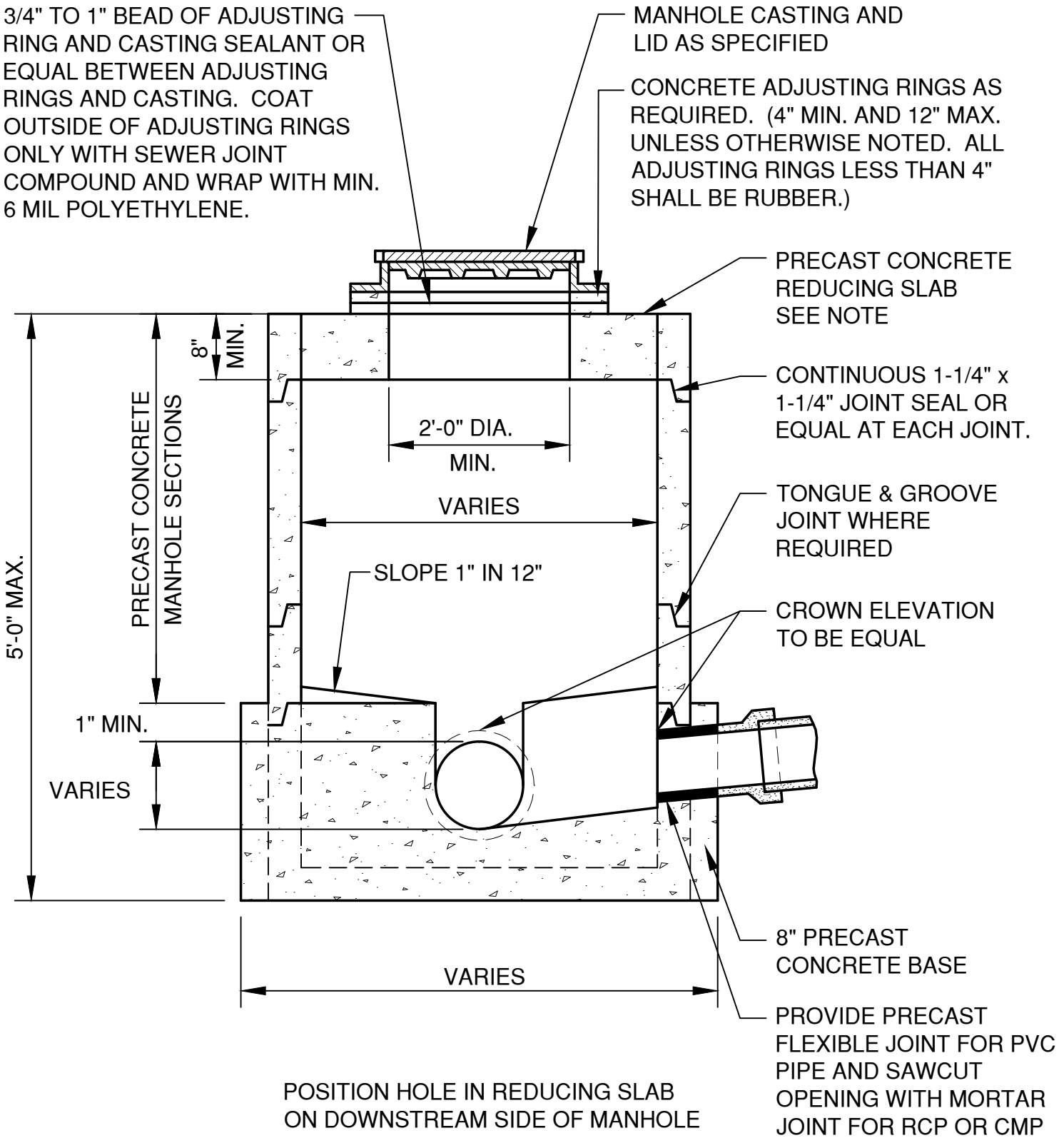


ALL PRECAST INLET UNITS SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF AASHTO DESIGNATION M 199

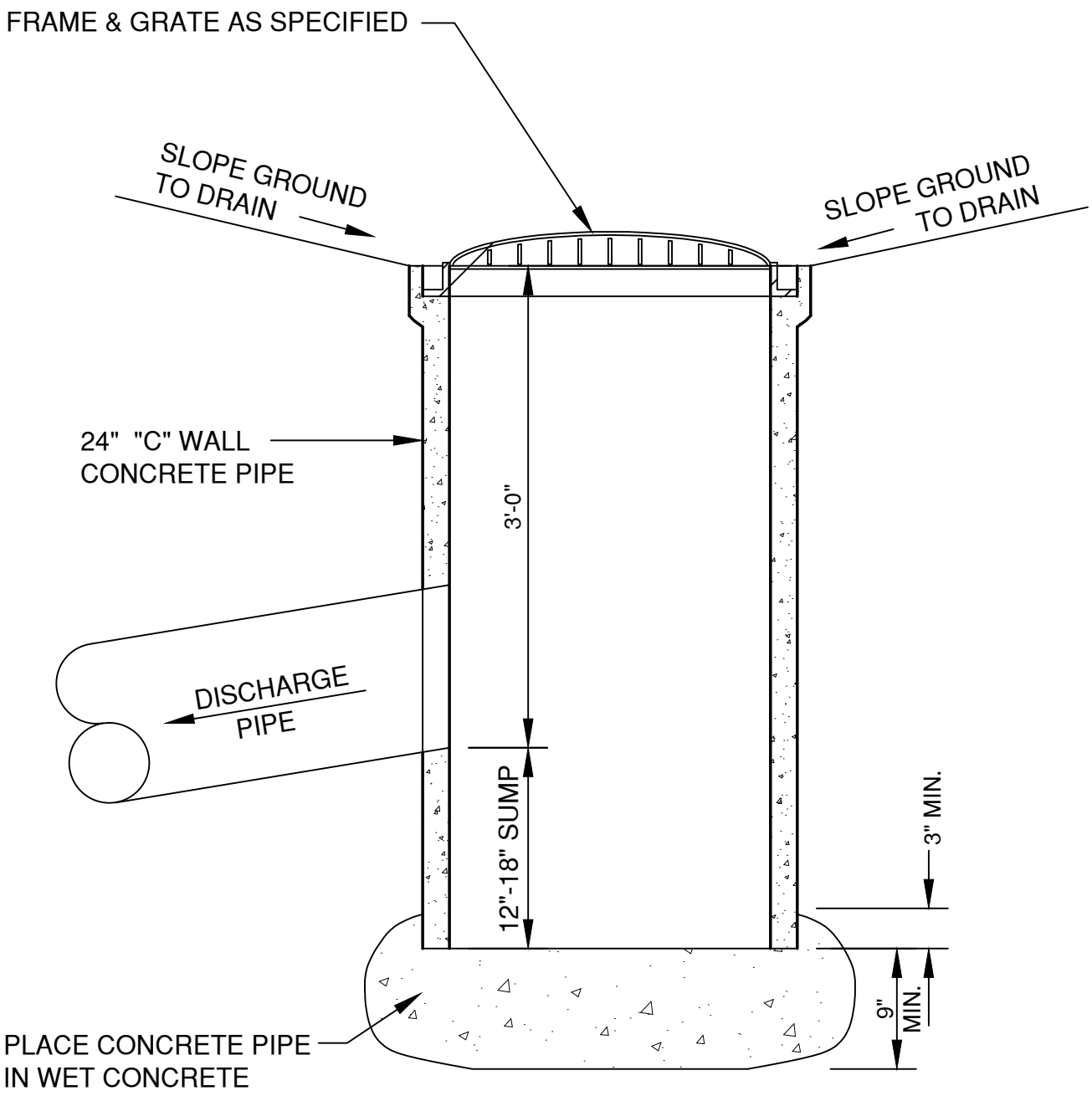
TYPE 'B' STORM INLET



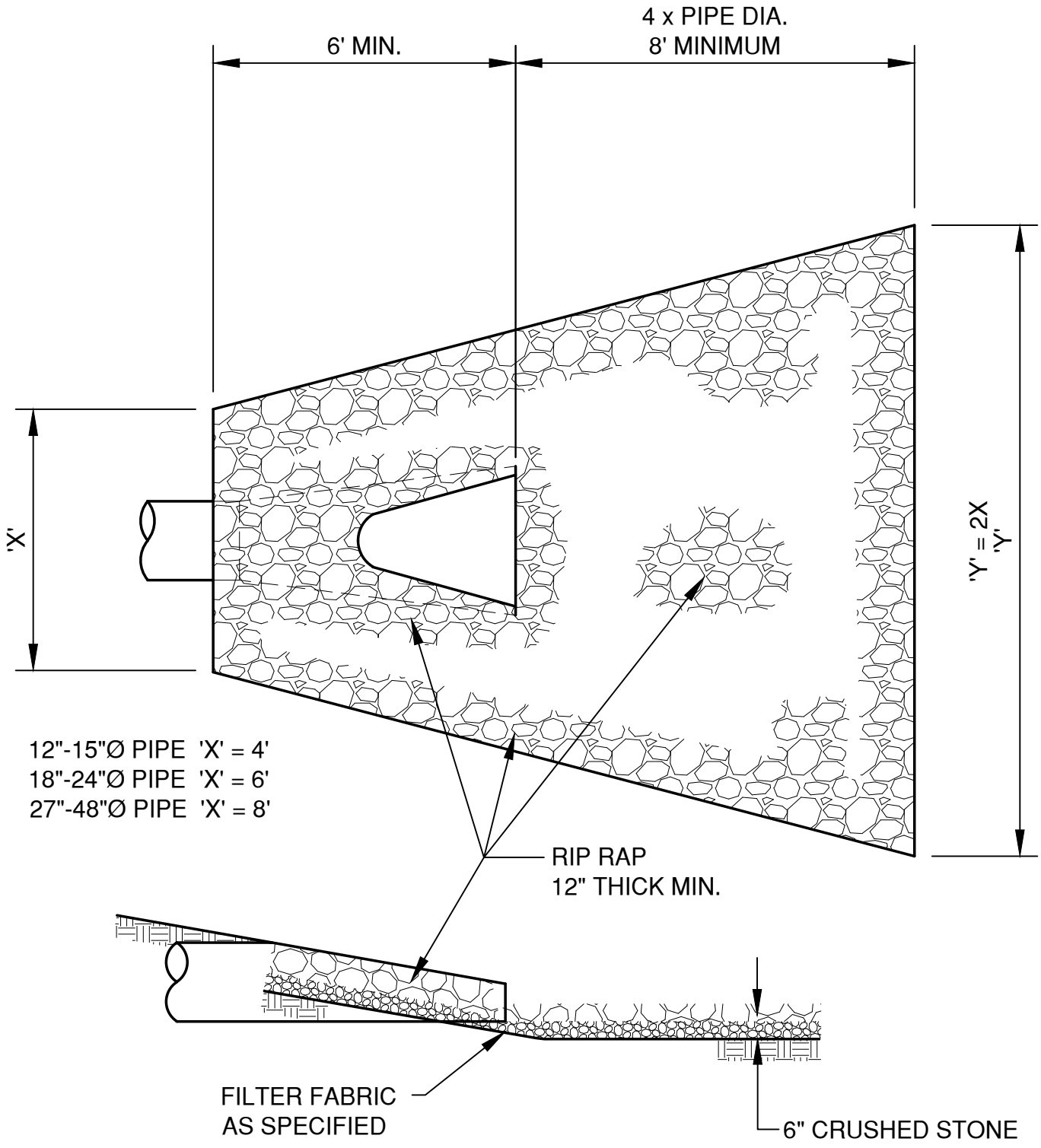
STORM MANHOLE INLET TYPE "A"



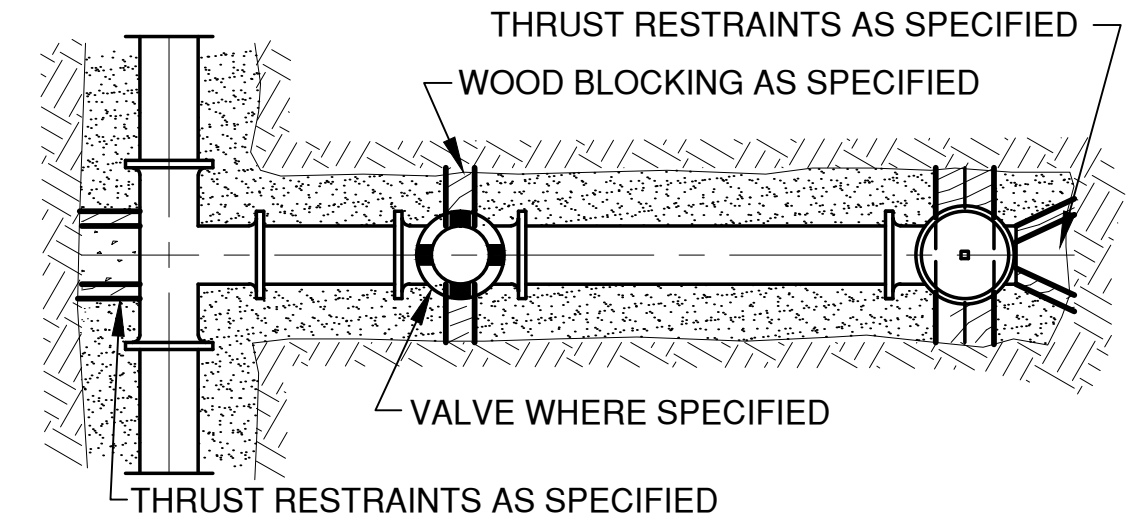
FLAT COVER MANHOLE

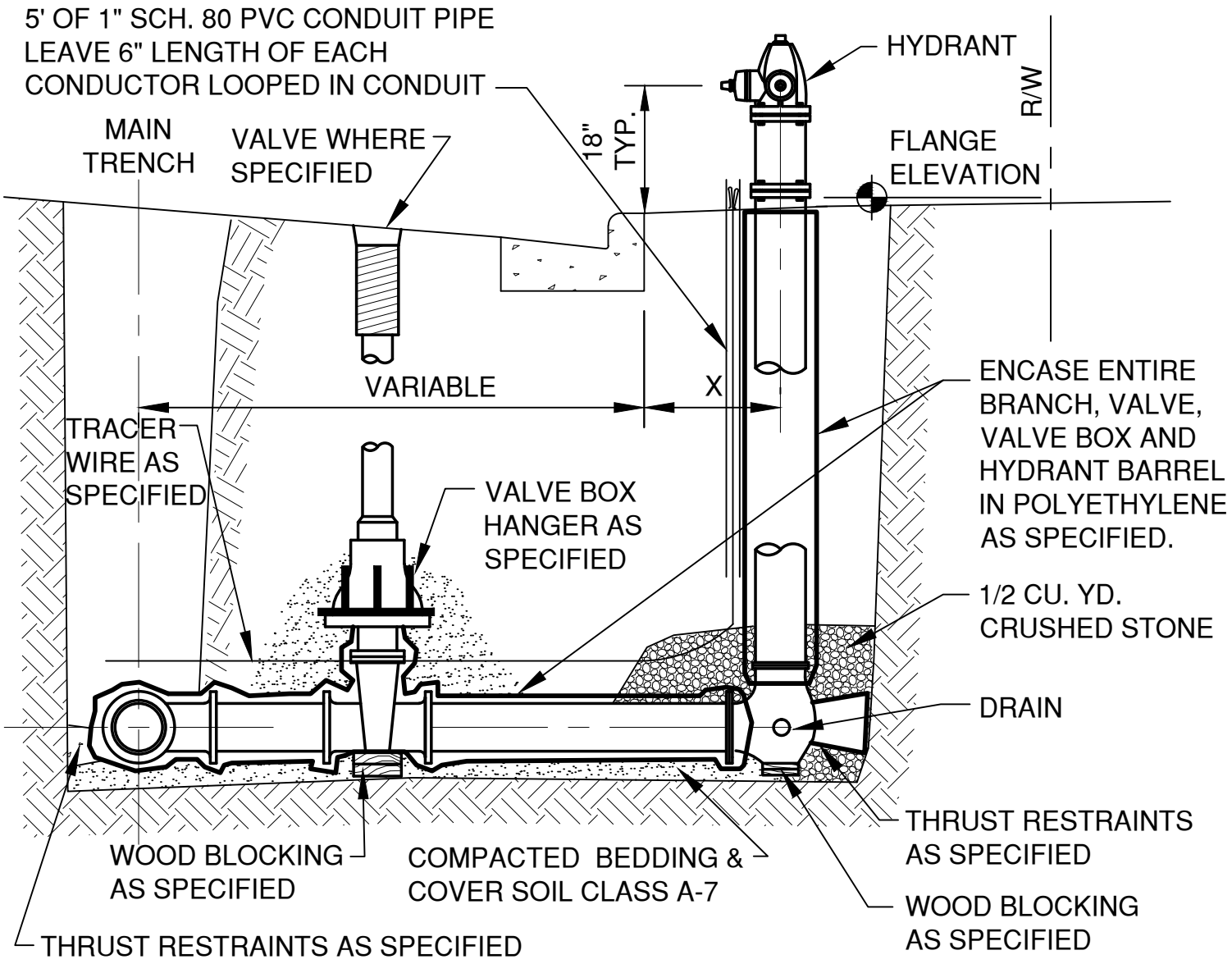


TYPICAL YARD DRAIN WITH SUMP

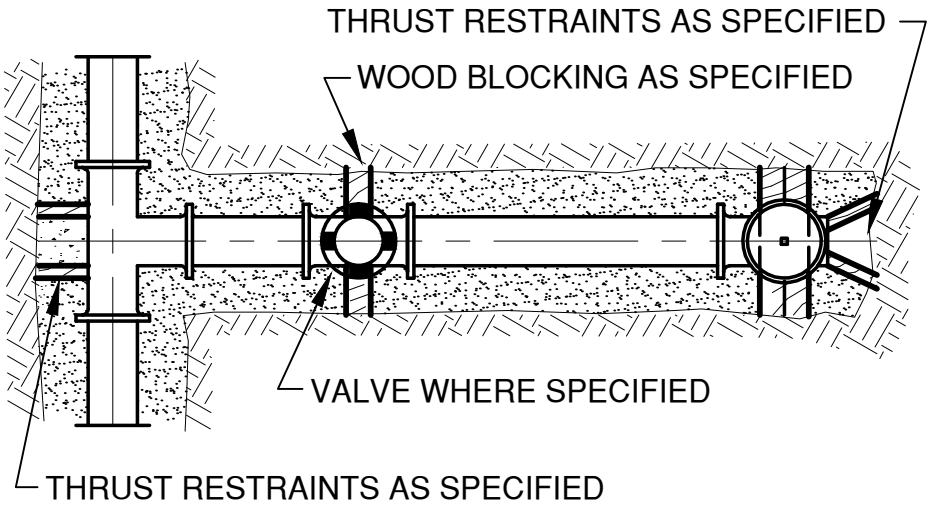


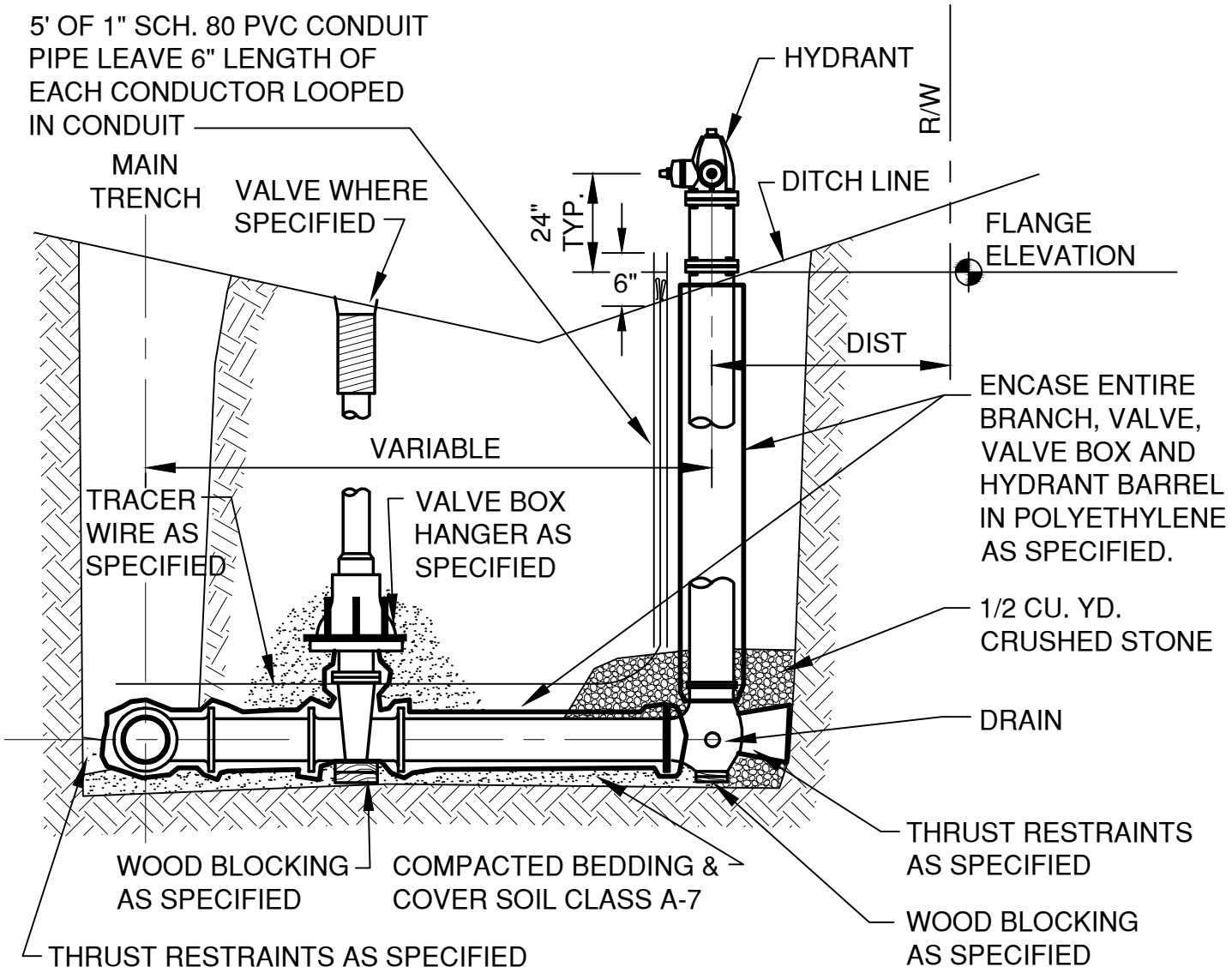
ENDWALL RIP RAP DETAIL



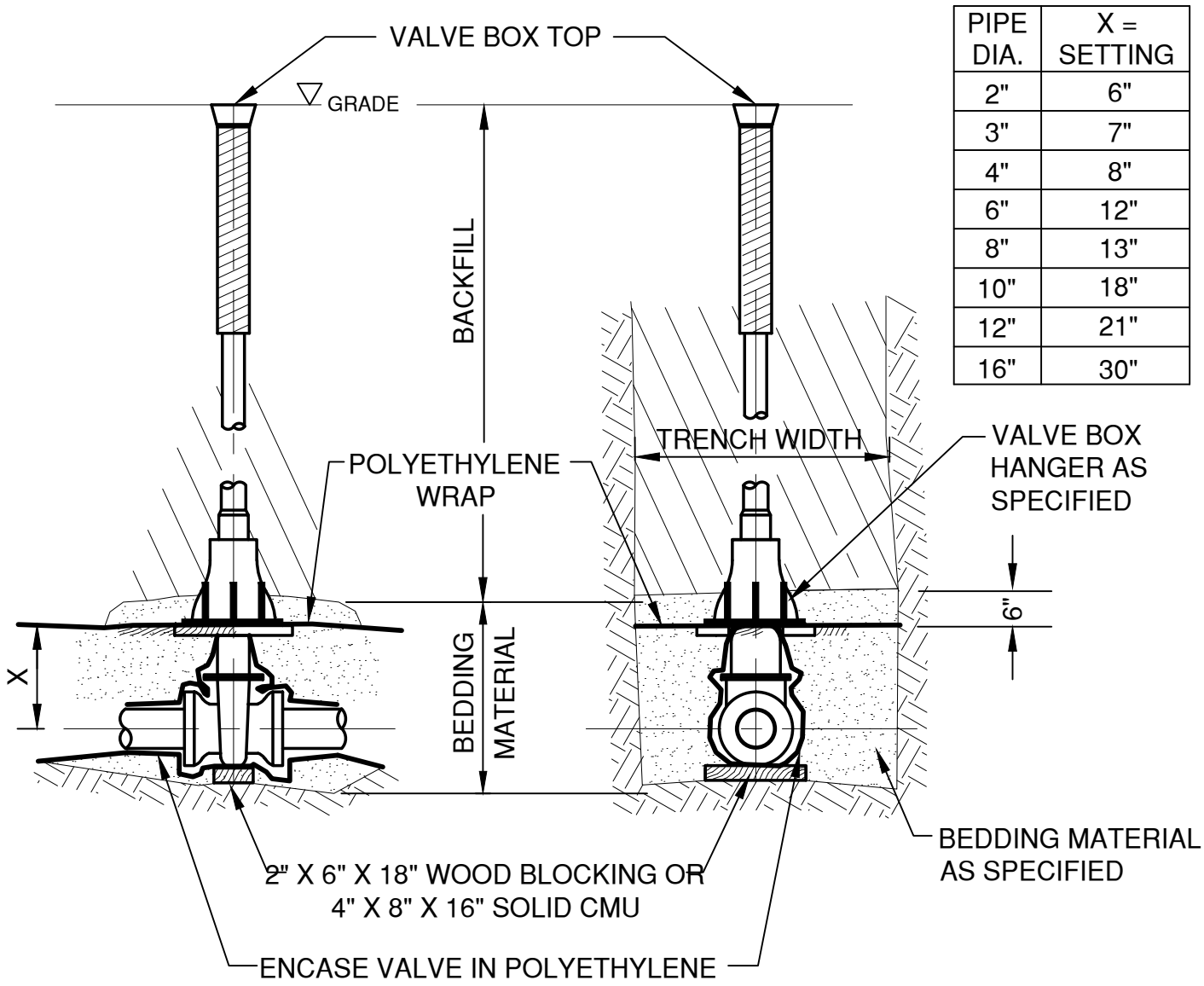


STANDARD HYDRANT SETTING
CURB SECTION





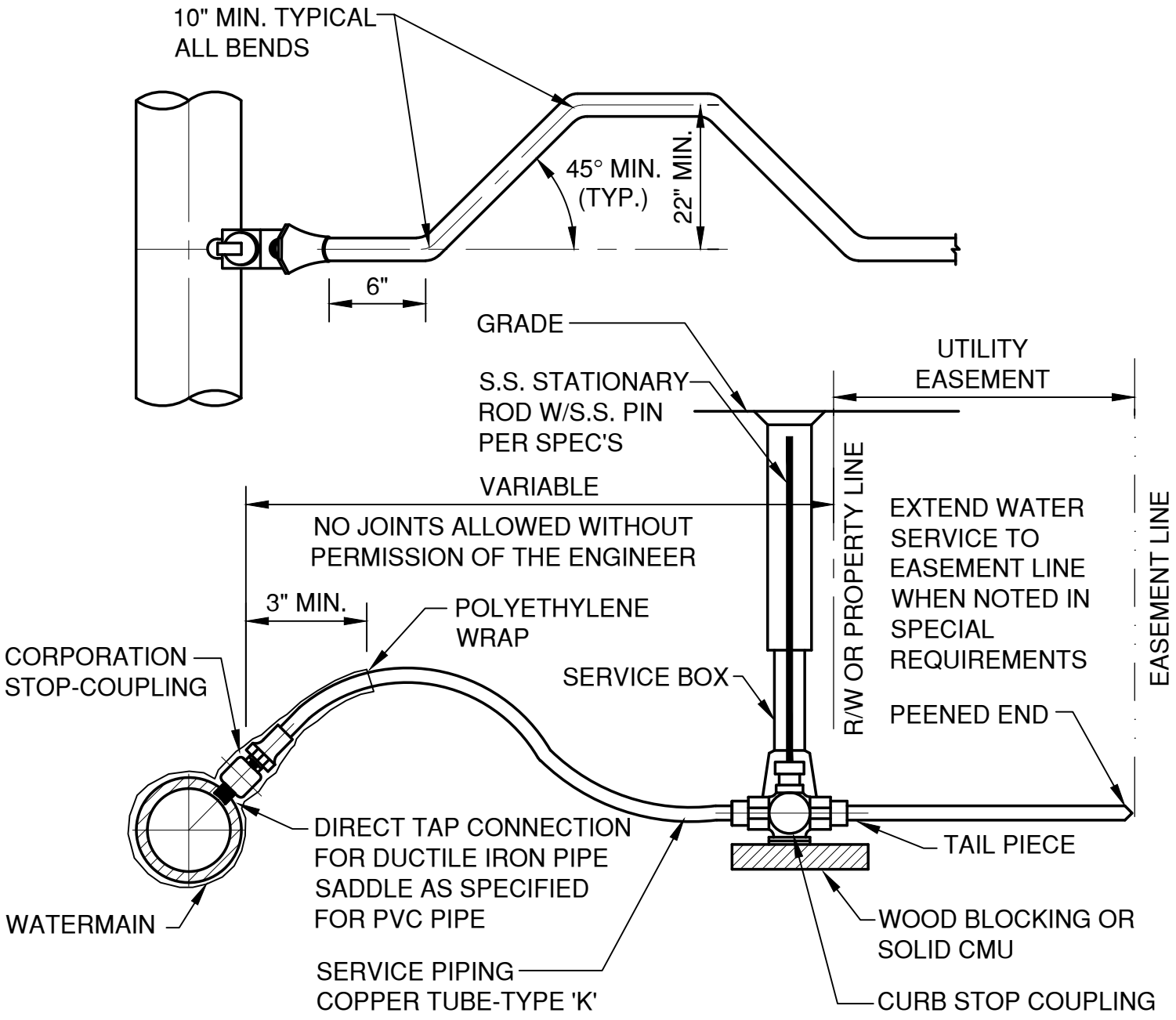
STANDARD HYDRANT SETTING
DITCH SECTION



PIPE DIA.	X = SETTING
2"	6"
3"	7"
4"	8"
6"	12"
8"	13"
10"	18"
12"	21"
16"	30"

SIDE VIEW FRONT VIEW

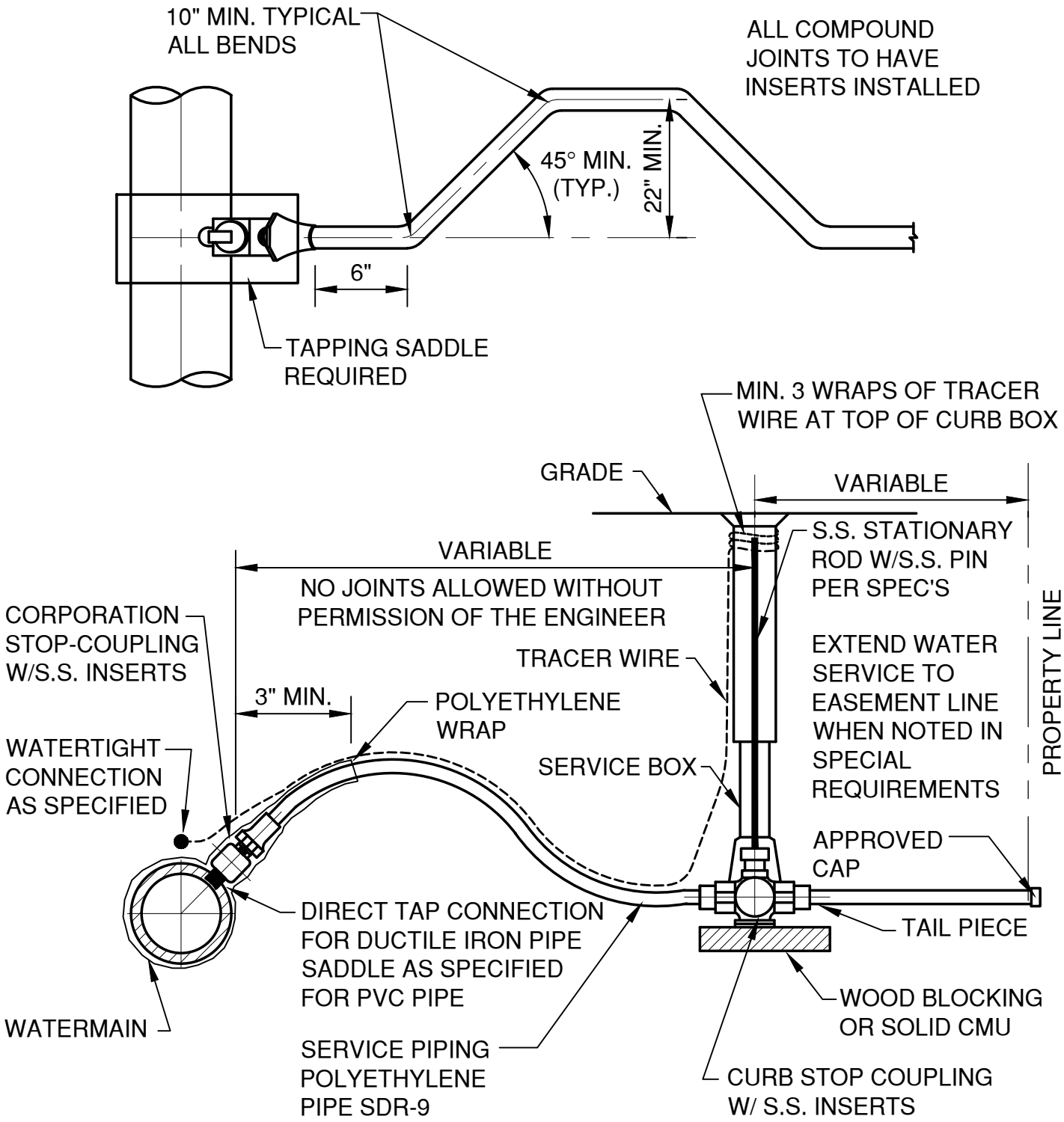
VALVE BOX SETTING



SERVICE PIPE	CORP. STOP	CURB STOP	SERVICE BOX
1"	1"	1"	2-1/2"
1-1/4"	1-1/4"	1-1/4"	3"
1-1/2"	1-1/2"	1-1/2"	3"
2"	2"	2"	3"

FOR A 2" SERVICE TAP ON 6" D.I. WATERMAIN, A SADDLE IS REQUIRED.

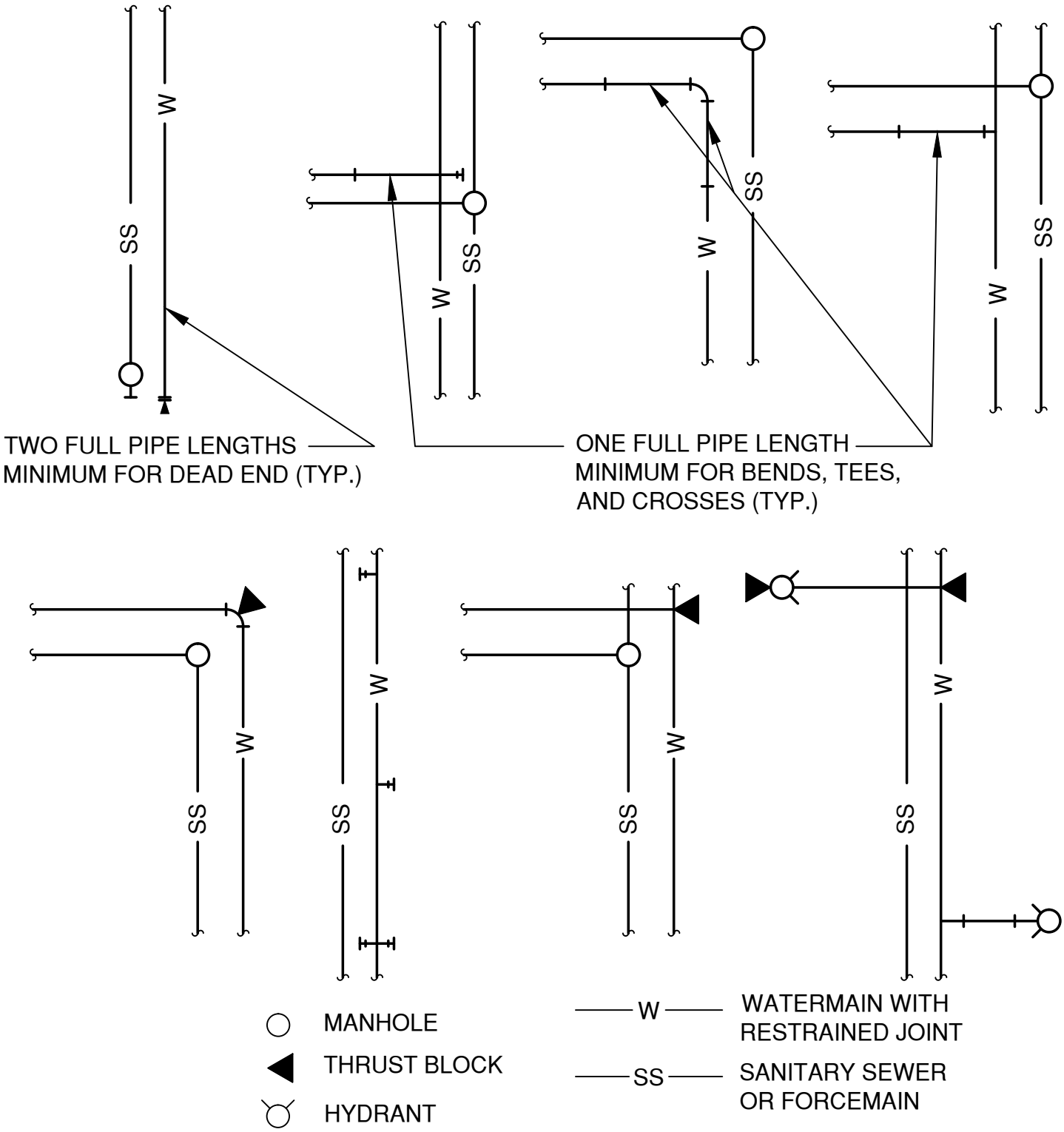
TAP SERVICE PIPING (COPPER)



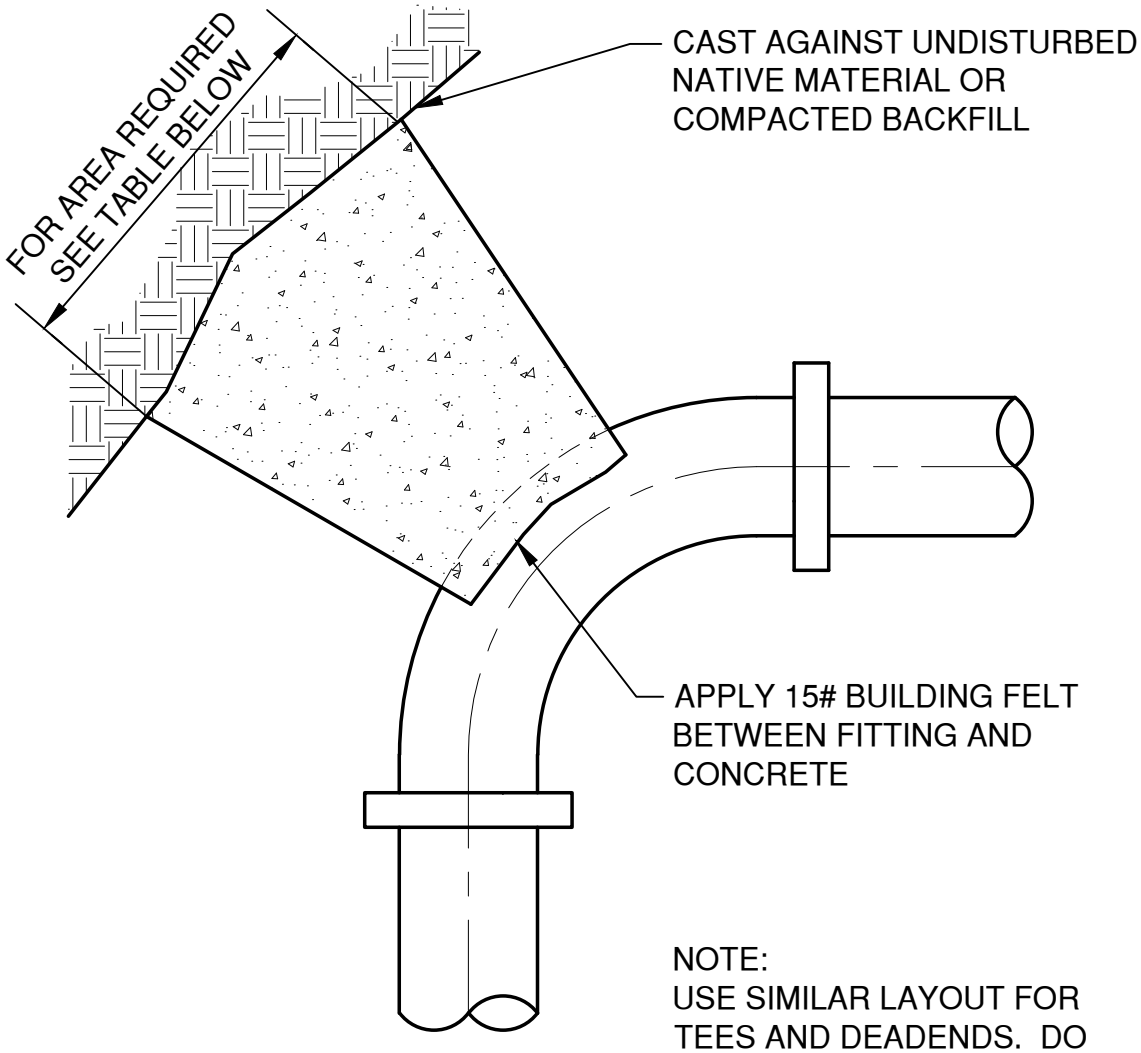
SERVICE PIPE	CORP. STOP	CURB STOP	SERVICE BOX
1"	1"	1"	2-1/2"
1-1/2"	1-1/2"	1-1/2"	3"
2"	2"	2"	3"

FOR A 2" SERVICE TAP ON 6" D.I. WATERMAIN, A SADDLE IS REQUIRED.

TAP SERVICE PIPING (POLYETHYLENE)



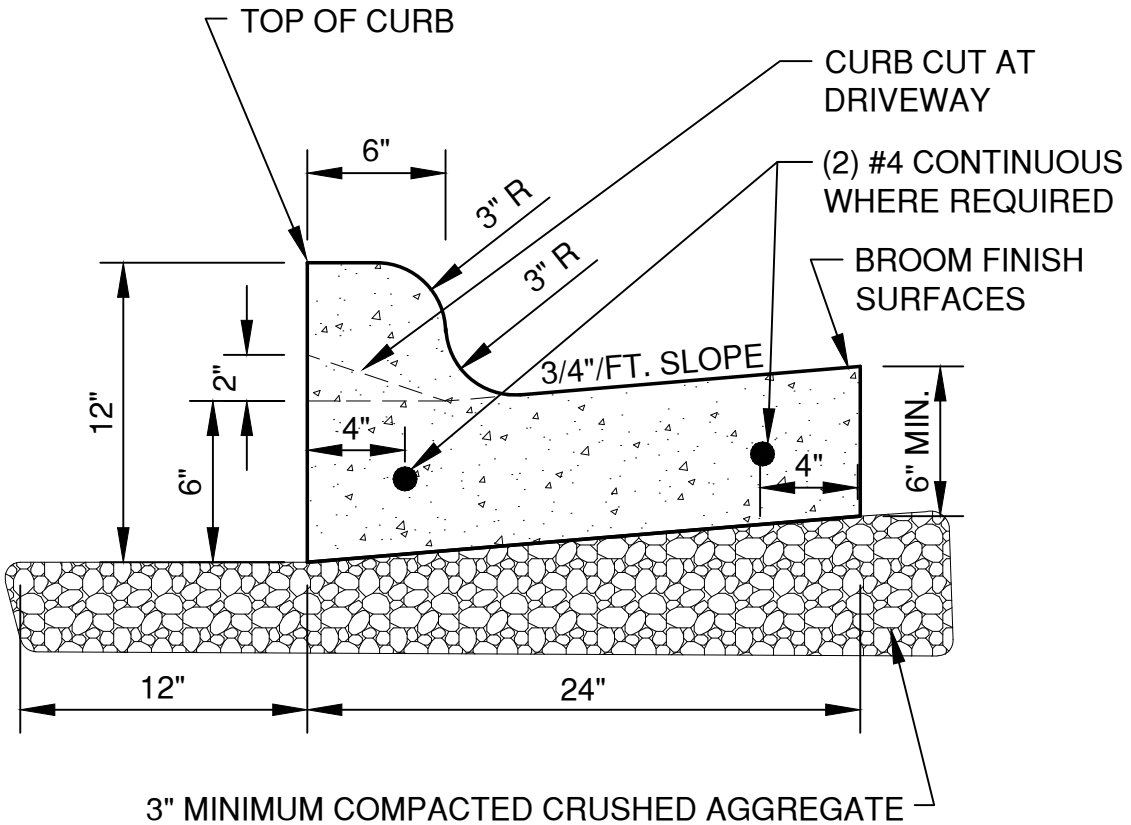
TYPICAL WATERMAIN RESTRAINT REQUIREMENTS FOR COMMON TRENCH CONSTRUCTION



NOTE:
USE SIMILAR LAYOUT FOR TEES AND DEADENDS. DO NOT ENCASE FITTINGS OR JOINTS.

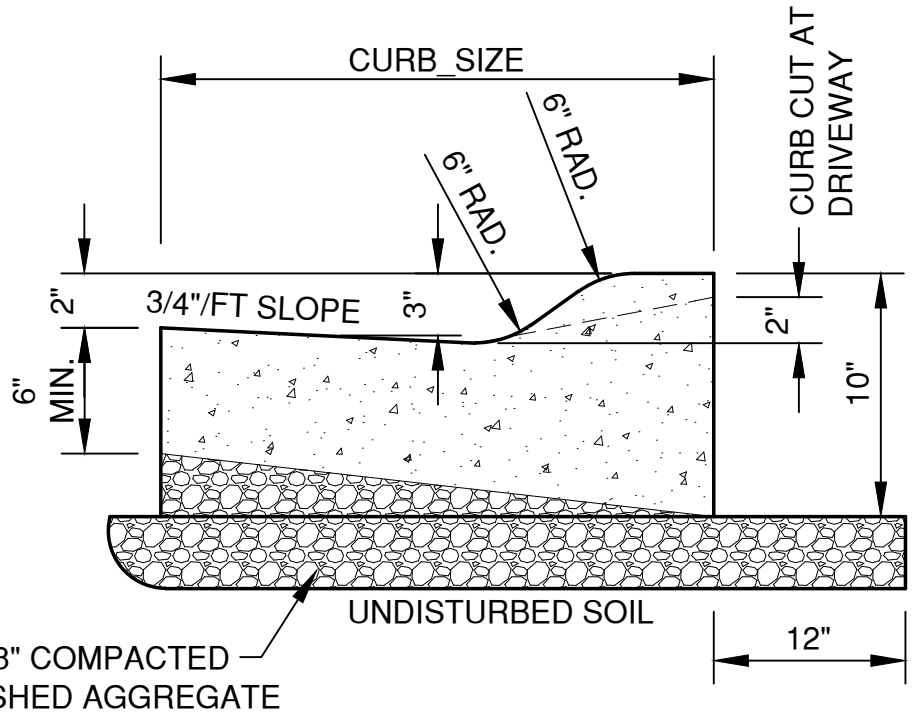
THRUST BLOCK AREA REQUIREMENTS, SQ. FT.				
DEGREE OF BEND	4" PIPE	6" PIPE	8" PIPE	10" PIPE
5° TO 22.5°	0.5	0.5	1.0	1.5
23° TO 45°	0.5	1.0	2.0	3.0
46° TO 90°	1.0	2.0	4.0	6.0
TEE OR DEAD END	1.0	2.0	4.0	6.0

TYPICAL THRUST BLOCK



NOTE:
PROVIDE 1" EXPANSION JOINTS AT 300' INTERVALS AND 3 FEET EACH SIDE OF INLET CASTINGS OR AS SPECIFIED.
PROVIDE CONTRACTION JOINTS EVERY 10' OR AS DIRECTED.

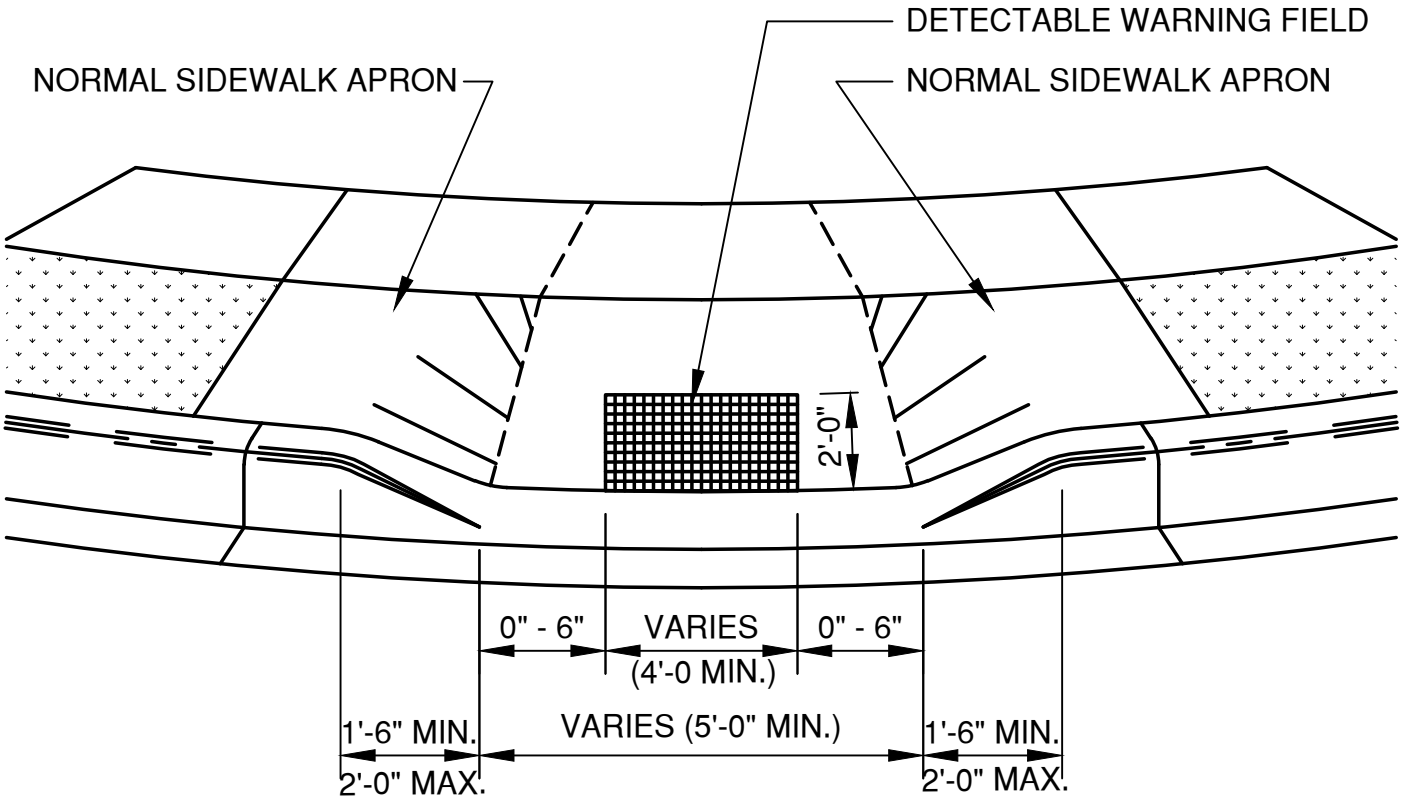
STANDARD CURB & GUTTER

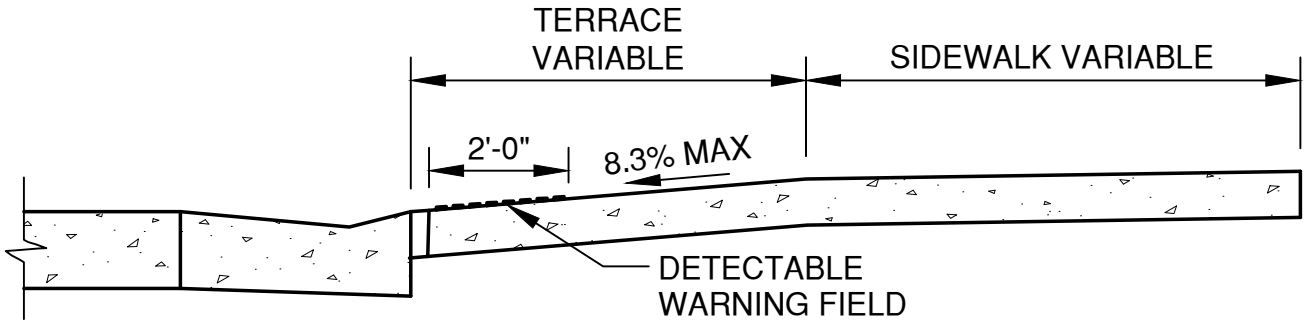


MIN. 3" COMPACTED CRUSHED AGGREGATE BASE COURSE MATERIAL, GRADATION NO. 2

NOTE:
PROVIDE 1" EXPANSION JOINTS AT 300' INTERVALS AND 3 FEET EACH SIDE OF INLET CASTING OR AS SPECIFIED. PROVIDE CONTRACTION JOINTS EVERY 10' OR AS DIRECTED.

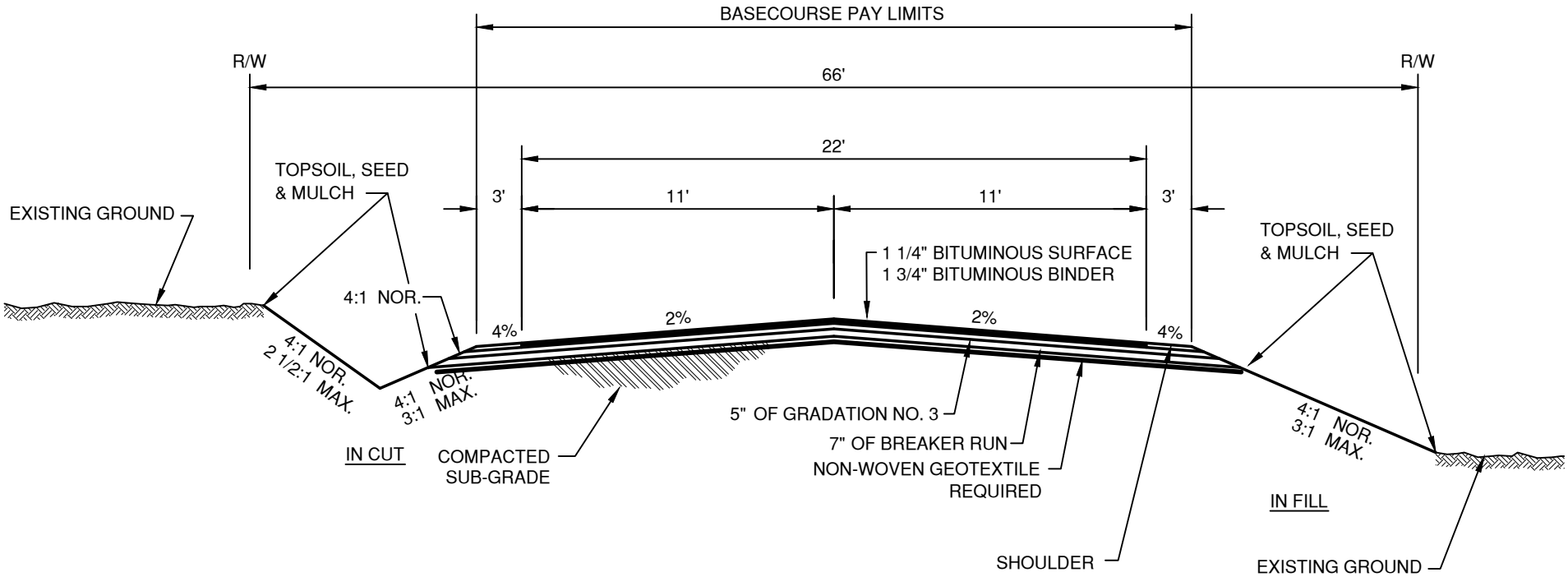
MOUNTABLE CURB AND GUTTER



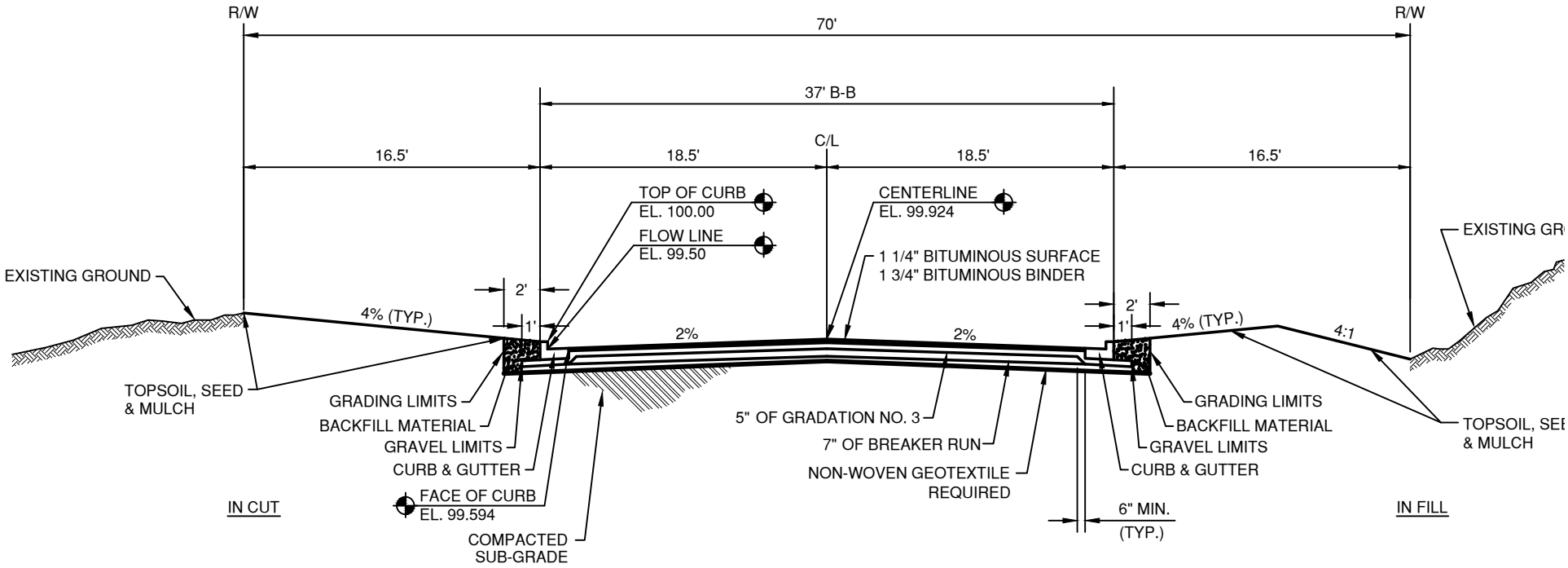


SECTION PARALLEL TO
CENTERLINE OF RAMP

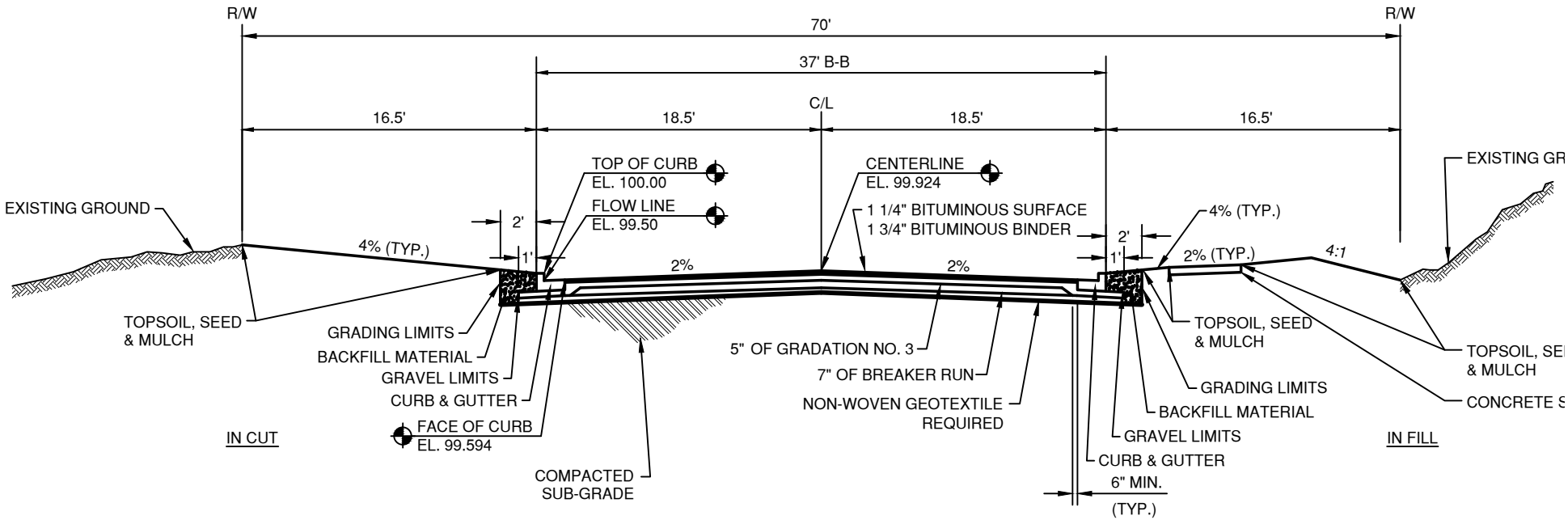
TYPE I HANDICAPPED CURB RAMP



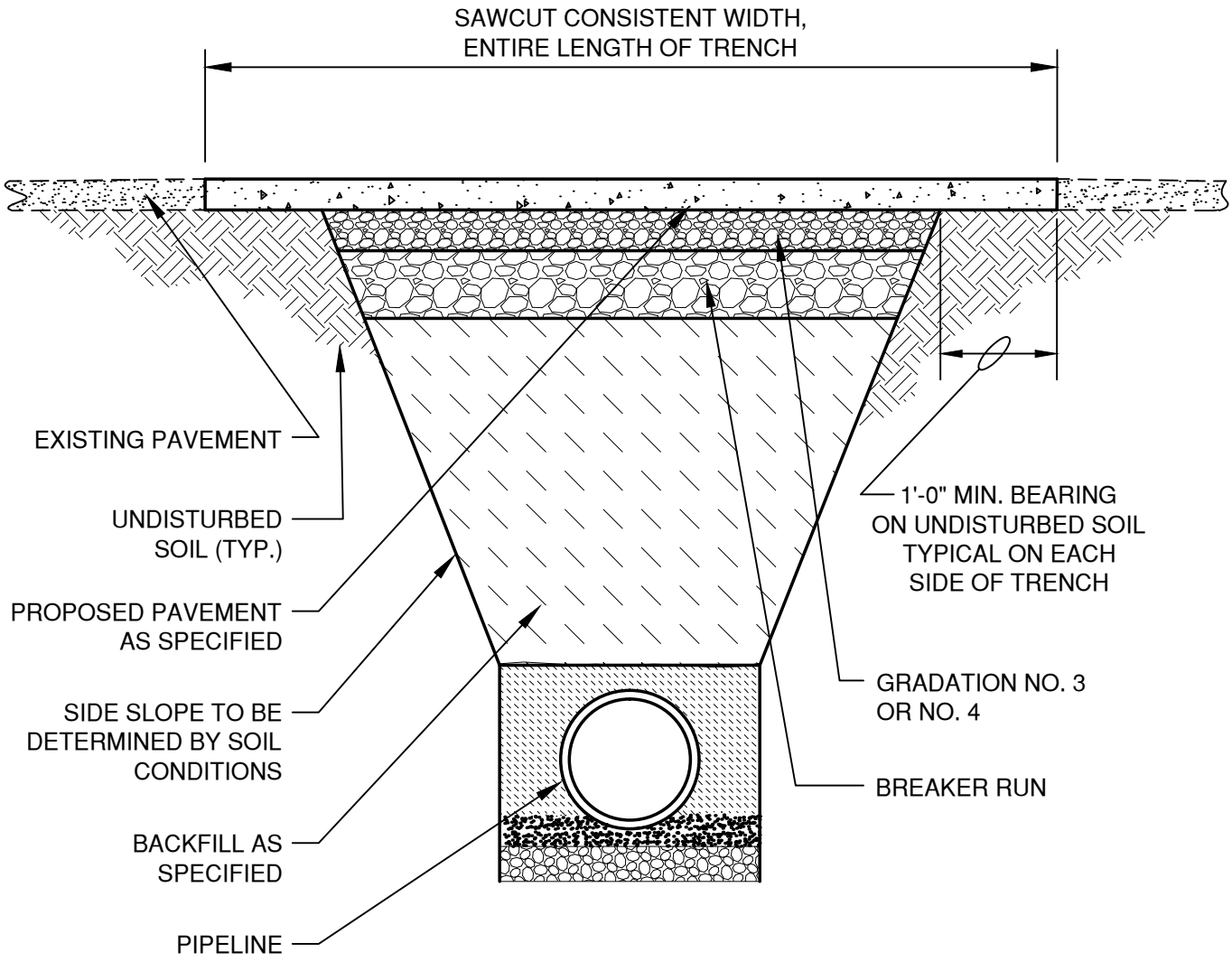
TYPICAL RURAL STREET CROSS SECTION



TYPICAL URBAN STREET CROSS SECTION



TYPICAL URBAN STREET WITH SIDEWALK CROSS SECTION

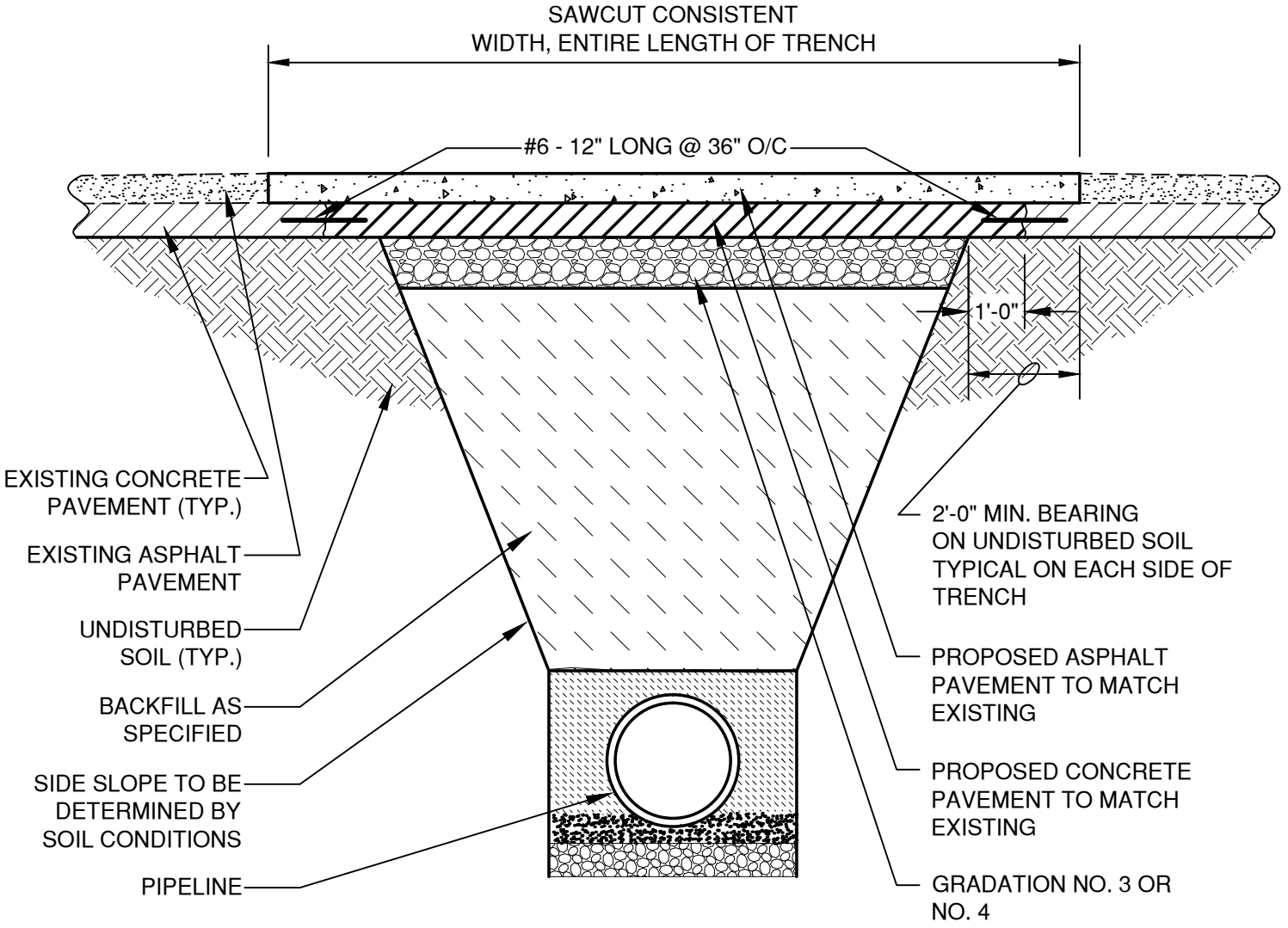


UTILITY TRENCH
PAVEMENT RESTORATION

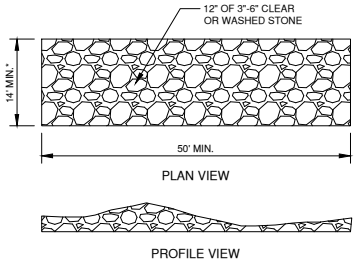
NOTE:

NO. 6 x 12" DEFORMED BARS SPACED 3' -0" C-C, INSTALLED ON 6:1 SKEW HORIZONTALLY. DIRECTION OF SKEW ALTERNATING AFTER EVERY ONE OR TWO BARS.

THE HOLE FOR THE BAR SHALL BE DRILLED TO A DEPTH OF 7" AND TO SUCH A DIAMETER AS TO PROVIDE A TIGHT DRIVEN FIT.



UTILITY TRENCH RESTORATION WITH CONCRETE



*14' MIN. OR FULL WIDTH OF THE EGRESS POINT.
REFERENCE WDNR TECHNICAL STANDARD 1057.

TRACKING PAD DETAIL
(IF APPLICABLE)

INLET PROTECTION NOTES:

MANUFACTURED ALTERNATIVES APPROVED AND LISTED ON THE WDOT PRODUCT ACCEPTABILITY LIST MAY BE SUBSTITUTED.

WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED ON THE GEOTEXTILE FABRIC DOES NOT FALL INTO THE INLET. ANY MATERIAL FALLING INTO THE INLET SHALL BE REMOVED IMMEDIATELY.

① FINISHED SIZE, INCLUDING FLAP POCKETS WHERE REQUIRED, SHALL EXTEND A MINIMUM OF 10" AROUND THE PERIMETER TO FACILITATE MAINTENANCE OR REMOVAL.

② FOR INLET PROTECTION, TYPE C (WITH CURB BOX), AN ADDITIONAL 18" OF FABRIC IS WRAPPED AROUND THE WOOD AND SECURED WITH STAPLES. THE WOOD SHALL NOT BLOCK THE ENTIRE HEIGHT OF THE CURB BOX OPENING.

③ FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2"X4".

INSTALLATION NOTES:
TYPE "B" & "C"

TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE.

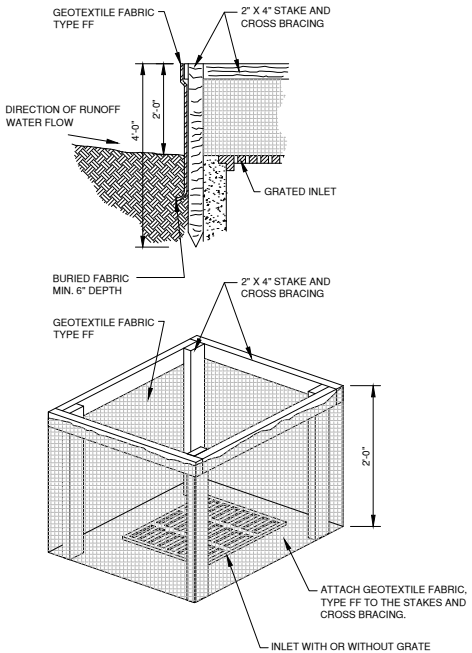
THE CONTRACTOR SHALL DEMONSTRATE A METHOD OF MAINTENANCE, USING A SEWN FLAP, HAND HOLDS OR OTHER METHOD TO PREVENT ACCUMULATED SEDIMENT FROM ENTERING THE INLET.

TYPE "D"

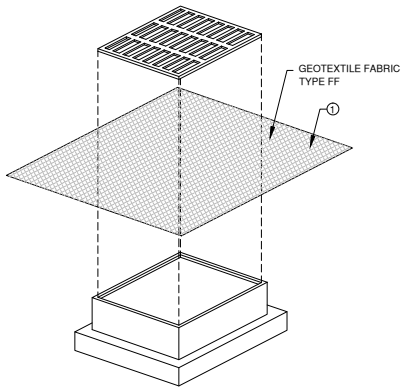
DO NOT INSTALL INLET PROTECTION TYPE D IN INLETS SHALLOWER THAN 30" MEASURED FROM THE BOTTOM OF THE INLET TO THE TOP OF THE GRATE.

TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE.

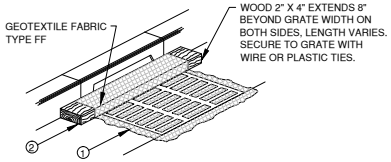
THE INSTALLED BAG SHALL HAVE A MINIMUM SIDE CLEARANCE, BETWEEN THE INLET WALLS AND THE BAG, MEASURED AT THE BOTTOM OF THE OVERFLOW HOLES, OF 3". WHERE NECESSARY THE CONTRACTOR SHALL CINCH THE BAG, USING PLASTIC ZIP TIES, TO ACHIEVE THE 3" CLEARANCE, THE TIES SHALL BE PLACED AT THE MAXIMUM OF 4" FROM THE BOTTOM OF THE BAG.



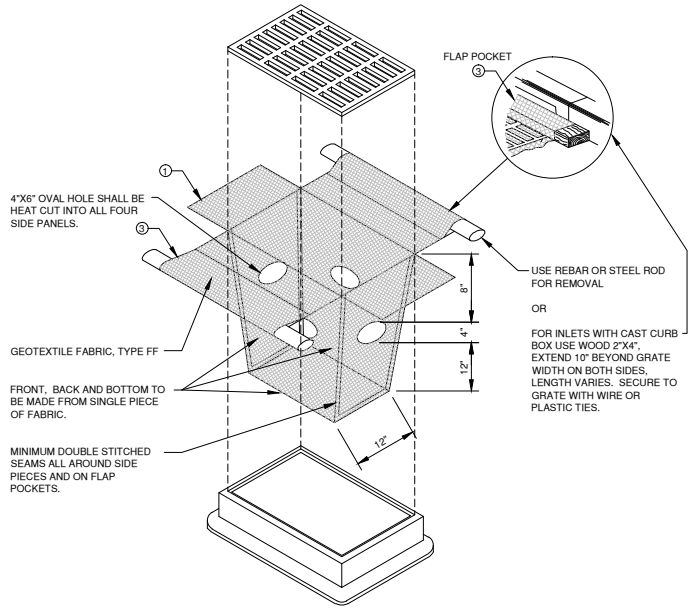
INLET PROTECTION, TYPE A



INLET PROTECTION, TYPE B
(WITHOUT CURB BOX)
(CAN BE INSTALLED IN ANY INLET WITHOUT A CURB BOX)

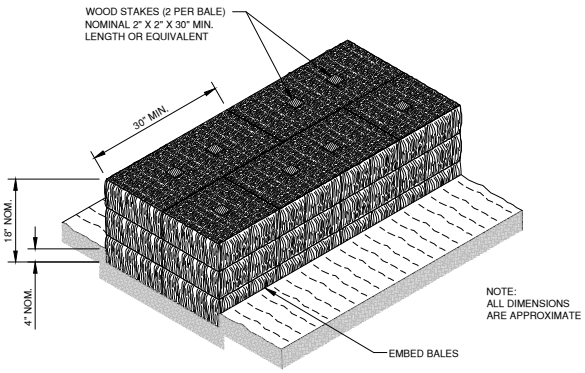


INLET PROTECTION, TYPE C
(WITH CURB BOX)

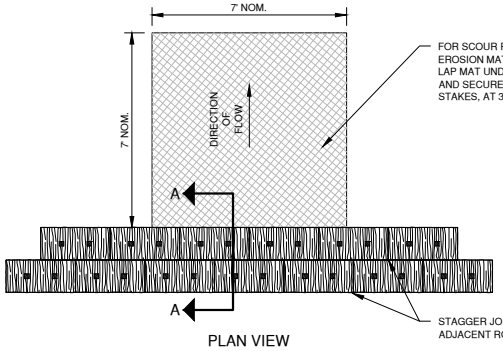


INLET PROTECTION, TYPE D
(CAN BE INSTALLED IN ANY INLET TYPE WITH OR WITHOUT CURB BOX AS PER NOTE "2")

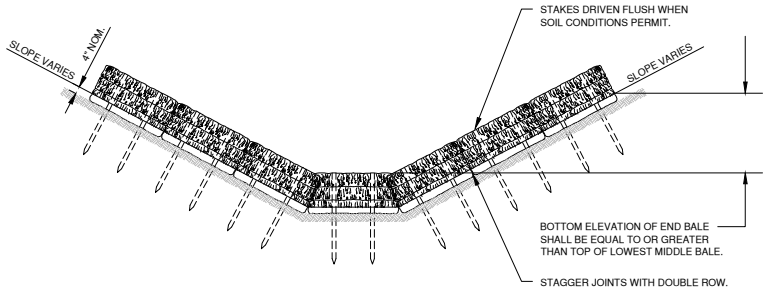
NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION	DRAWN AAA / CHECKED BBB / DESIGNED CCC	CONTRACT NO. PROJECT NAME VILLAGE, TOWN OR CITY COUNTY, WISCONSIN	EROSION CONTROL INLET PROTECTION AND MISCELLANEOUS DETAILS	DATE DDD / FILE EEE / JOB NO. FFF	Robert E. Lee & Associates, Inc. ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES 4664 GOLDEN POND PARK COURT HOBART, WI 54155 PHONE:(920) 662-9641 INTERNET: www.releeinc.com FAX:(920) 662-9141	SHEET NO. X



SECTION A-A

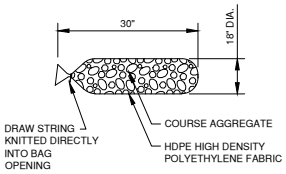


PLAN VIEW



FRONT ELEVATION

TEMPORARY DITCH CHECK USING EROSION BALES
TYPE A



FILTER BAG DETAIL

COURSE AGGREGATE INFORMATION

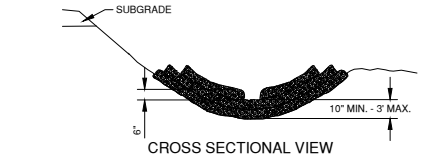
SIEVE SIZE	SIZE NO. AASHTO No. 67 (1)
2 INCH (50 mm)	-
1 1/2 INCH (37.5mm)	-
1 INCH (25.0 mm)	100
3/4 INCH (19.0mm)	90-100
3/8 INCH (9.5mm)	20-55
No. 4 (4.75mm)	0-10
No. 8 (2.36mm)	0-5

(1) SIZE No. ACCORDING TO AASHTO M 43

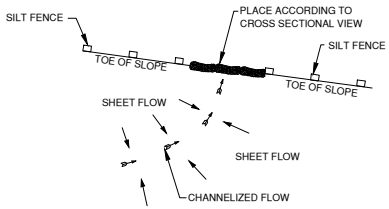
NOTES:

18" X 30" ROCK FILLED FILTER BAG SHALL BE COMPRISED OF THE FOLLOWING:
HDPE HIGH DENSITY POLYETHYLENE
HDPE HIGH DENSITY POLYETHYLENE DRAW STRING KNITTED DIRECTLY INTO BAG OPENING.
80% FABRIC CLOSURE WITH APPARENT OPENING SIZE NO LARGER THAN 1/8 " X 1/8 "
ROLLED SEAM USING A MINIMUM OF 480 DENIER POLYESTER SEWING YARN FOR STRENGTH AND DURABILITY.

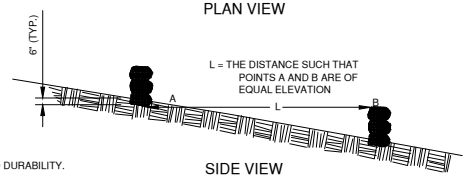
USE WELL GRADED COURSE AGGREGATE CONFORMING TO THE FOLLOWING GRADATION REQUIREMENTS



CROSS SECTIONAL VIEW



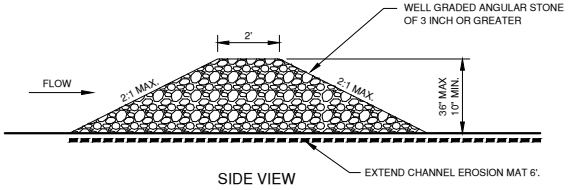
PLAN VIEW



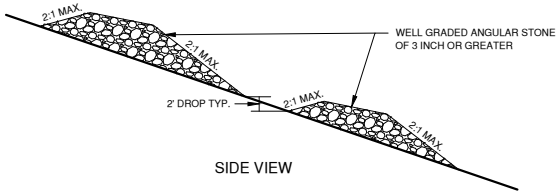
SIDE VIEW

DITCH CHECK DETAIL

ROCK FILLED EROSION CONTROL BAGS
TYPE B



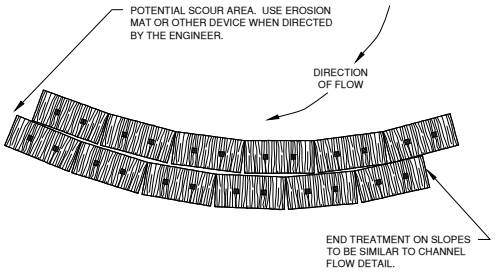
SIDE VIEW



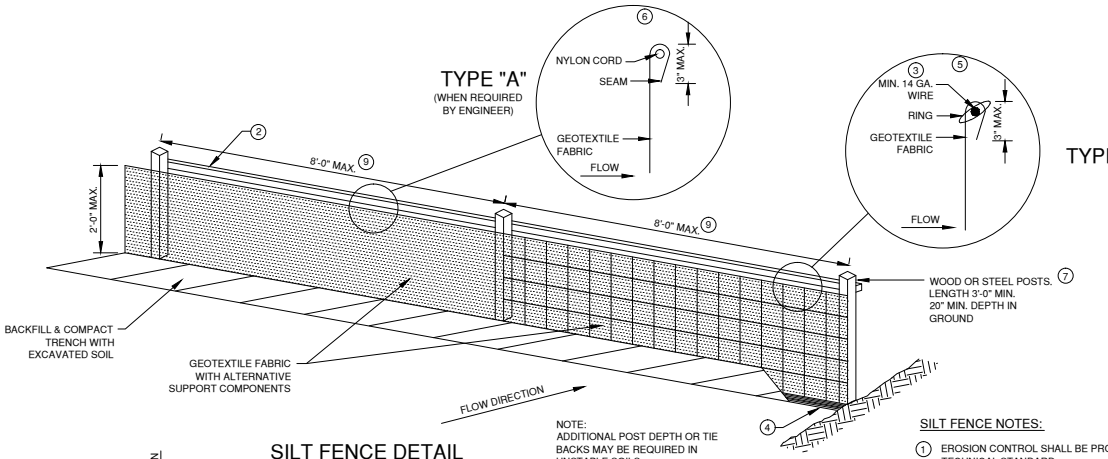
SIDE VIEW

TEMPORARY DITCH CHECK USING STONE
TYPE C

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION	DRAWN AAA / CHECKED BBB / DESIGNED CCC	CONTRACT NO. PROJECT NAME VILLAGE, TOWN OR CITY COUNTY, WISCONSIN	EROSION CONTROL DITCH CHECK DETAILS	DATE DDD / FILE EEE / JOB NO. FFF	Robert E. Lee & Associates, Inc. ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES 4664 GOLDEN POND PARK COURT HOBART, WI 54155 PHONE:(920) 662-9641 INTERNET: www.releeinc.com FAX:(920) 662-9141	SHEET NO. X

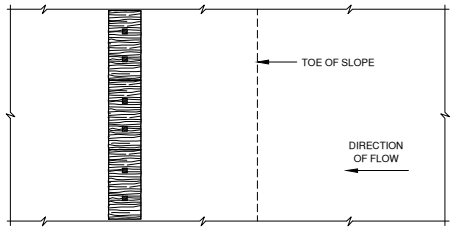


PLAN VIEW
(WHEN ALTERING THE DIRECTION OF FLOW)

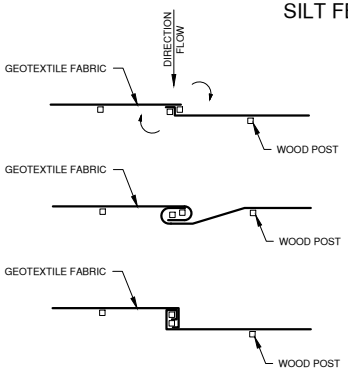


SILT FENCE DETAIL

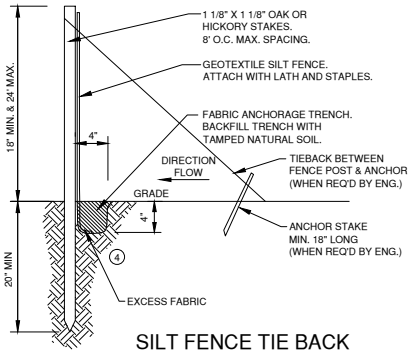
NOTE:
ADDITIONAL POST DEPTH OR TIE BACKS MAY BE REQUIRED IN UNSTABLE SOILS.



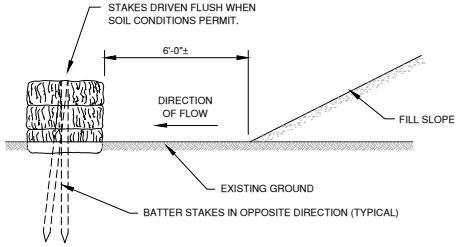
PLAN VIEW



TWIST METHOD ⑧

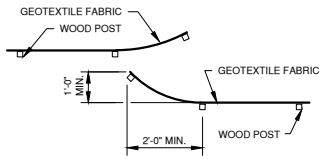


SILT FENCE TIE BACK



FRONT ELEVATION
WHEN EXISTING GROUND SLOPES AWAY FROM FILL SLOPE

EROSION BALES FOR SHEET FLOW



HOOK METHOD ⑧

JOINING TWO LENGTHS OF SILT FENCE

SILT FENCE NOTES:

1. EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH WDNR TECHNICAL STANDARD.
2. CROSS BRACE WITH 2" X 4" WOODEN FRAME OR EQUIVALENT AT TOP OF POSTS AS DIRECTED BY THE ENGINEER.
3. MINIMUM 14 GAUGE WIRE REQUIRED, FOLD FABRIC 3" OVER THE WIRE AND STAPLE OR PLACE WIRE RINGS ON 12" C.C.
4. EXCAVATE A TRENCH A MINIMUM OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.
5. WIRE SUPPORT FENCE SHALL BE 14 GAUGE MINIMUM WOVEN WIRE WITH A MAXIMUM MESH SPACING OF 6". SECURE TOP OF GEOTEXTILE FABRIC TO TOP OF FENCE WITH STAPLES OR WIRE RINGS AT 12" C.C. (TYPE B)
6. GEOTEXTILE FABRIC SHALL BE REINFORCED WITH AN INDUSTRIAL POLYPROPYLENE NETTING WITH A MAXIMUM MESH SPACING OF 3/4" OR EQUAL. A HEAVY DUTY NYLON TOP SUPPORT CORD OR EQUIVALENT IS REQUIRED. (TYPE A)
7. STEEL POSTS SHALL BE STUDDED "TEE" OR "U" TYPE WITH A MINIMUM WEIGHT OF 1.28 LBS./LIN. FT. (WITHOUT ANCHOR) FIN ANCHORS SUFFICIENT TO RESIST POST MOVEMENT ARE REQUIRED. WOOD POSTS SHALL BE A MINIMUM SIZE OF 1 1/8" X 1 1/8" OF OAK OR HICKORY.
8. CONSTRUCT SILT FENCE FROM A CONTINUOUS ROLL, IF POSSIBLE, BY CUTTING LENGTHS TO AVOID JOINTS. IF A JOINT IS NECESSARY, USE ONE OF THE FOLLOWING TWO METHODS: A.) TWIST METHOD -- OVERLAP THE END POSTS AND TWIST, OR ROTATE, AT LEAST 180 DEGREES, B:) HOOK METHOD -- HOOK THE END OF EACH SILT FENCE LENGTH.
9. THE MAXIMUM SPACING OF POSTS FOR WOVEN FABRIC SILT FENCE SHALL BE 8 FEET AND FOR NON-WOVEN FABRIC, 3 FEET.

EROSION CONTROL SHEET FLOW NOTES:

1. ANY SOIL STOCKPILED THAT REMAINS FOR MORE THAN 7 DAYS SHALL BE COVERED OR TREATED WITH STABILIZATION PRACTICES SUCH AS TEMPORARY OR PERMANENT SEEDING AND MULCHING.
2. A MINIMUM OF 4 INCHES OF TOPSOIL MUST BE APPLIED TO ALL AREAS TO BE SEEDED OR SODDED.
3. ALL WASTE AND UNUSED BUILDING MATERIALS (INCLUDING GARBAGE, DEBRIS, CLEANING WASTES, WASTEWATER, TOXIC MATERIALS, OR HAZARDOUS MATERIALS) SHALL BE PROPERLY DISPOSED OF AND NOT ALLOWED TO BE CARRIED OFF-SITE BY RUNOFF OR WIND.
4. ALL OFF-SITE SEDIMENT DEPOSITS OCCURRING AS A RESULT OF CONSTRUCTION WORK OR A STORM EVENT SHALL BE CLEANED UP BY THE END OF EACH DAY. **FLUSHING SHALL NOT BE ALLOWED.**
5. ANY SOIL EROSION THAT OCCURS AFTER FINAL GRADING AND/OR THE APPLICATION OF STABILIZATION MEASURES MUST BE REPAIRED AND THE STABILIZATION WORK REDONE.
6. FOR ANY DISTURBED AREA THAT REMAINS INACTIVE FOR GREATER THAN 7 WORKING DAYS, OR WHERE GRADING WORK EXTENDS BEYOND THE PERMANENT SEEDING DEADLINES, THE SITE MUST BE TREATED WITH TEMPORARY STABILIZATION MEASURES SUCH AS SOIL TREATMENT, TEMPORARY SEEDING AND/OR MULCHING.
7. ALL TEMPORARY EROSION CONTROL PRACTICES SHALL BE MAINTAINED UNTIL THE SITE IS STABILIZED WITH 70% VEGETATION AND A NOTICE OF TERMINATION HAS BEEN APPROVED BY THE DNR.
8. WIND EROSION SHALL BE KEPT TO A MINIMUM DURING CONSTRUCTION. WATERING, MULCH OR A TACKING AGENT MAY NEED TO BE UTILIZED TO PROTECT NEARBY RESIDENCES/WATER RESOURCES.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL THE EROSION CONTROL MEASURES IN CONFORMANCE WITH THE WDNR CONSERVATION PRACTICE STANDARDS, LATEST EDITION.
10. UPON COMPLETION OF STORM INLET CONSTRUCTION, THE CONTRACTOR SHALL INSTALL STORM DRAIN INLET PROTECTION FOR CONSTRUCTION SITE AS SPECIFIED.
11. FINE SEDIMENT ACCUMULATIONS SHALL BE CLEANED FROM STREETS, PRIVATE DRIVES, OR PARKING AREAS BY MANUAL OR MECHANICAL SWEEPING A MINIMUM OF ONCE PER WEEK AND BEFORE ALL IMMINENT RAINS.
12. EROSION AND SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED WEEKLY AND WITHIN 24 HOURS OF RAINFALL OF 0.5 INCH OR MORE.

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION

DRAWN AAA | CHECKED BBB | DESIGNED CCC

CONTRACT NO.
PROJECT NAME
VILLAGE, TOWN OR CITY
COUNTY, WISCONSIN

EROSION CONTROL
SHEET FLOW DETAILS

DATE DDD | FILE EEE | JOB NO. FFF

Robert E. Lee & Associates, Inc.
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4664 GOLDEN POND PARK COURT
HOBART, WI 54155 PHONE:(920) 662-9641
INTERNET: www.releeinc.com FAX:(920) 662-9141

SHEET NO. X

PLAN VIEW SHEET FLOW | LAYOUT1 SHEET FLOW | Plot: 10/11/2012 10:11:00 AM | Plot By: MARTIN VOSS

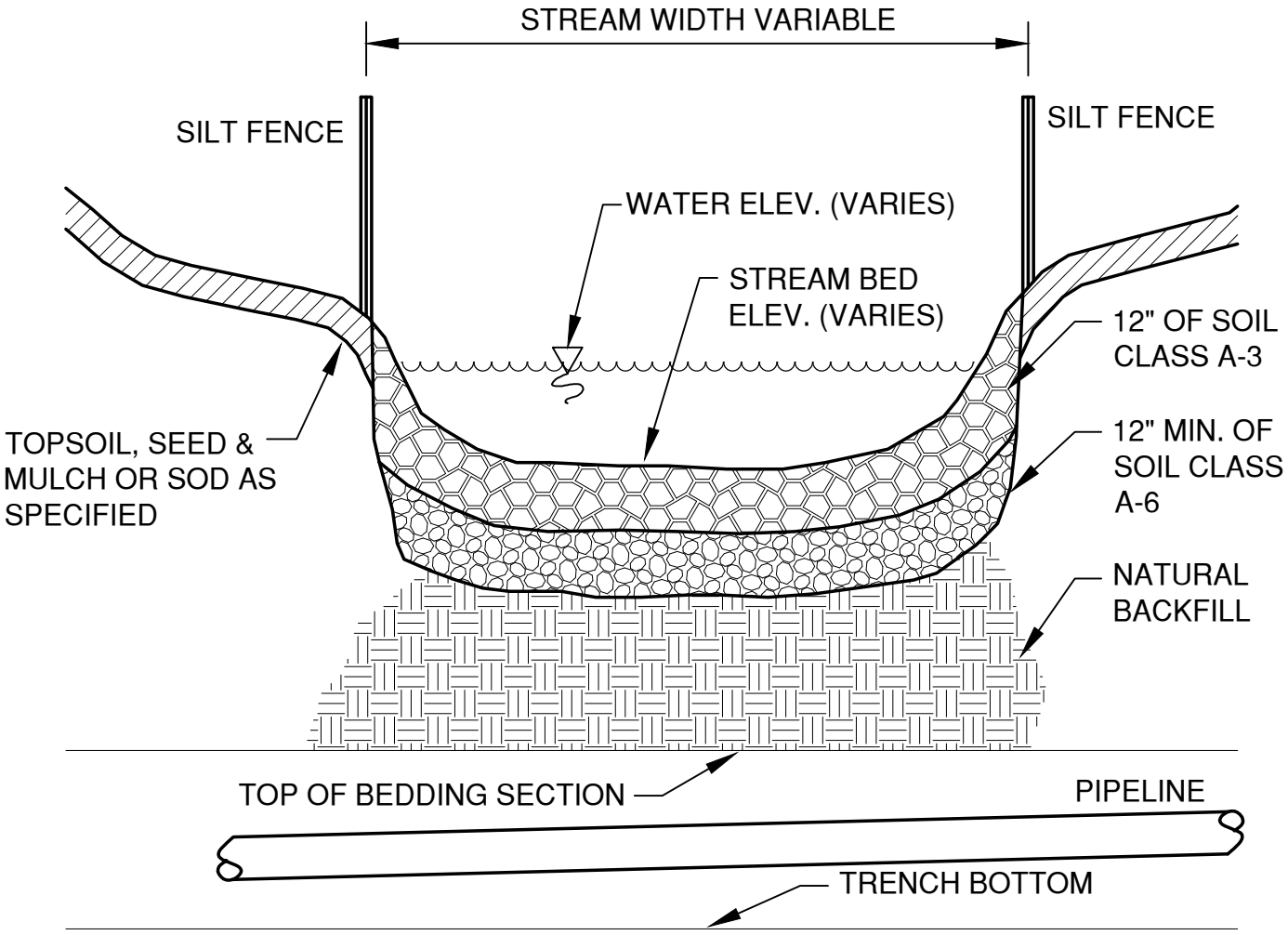
NOTES: IF TOP OF PIPELINE TO THE STREAM BED ELEVATION IS LESS THAN 2'-0", PROVIDE SPECIFIED COVER MATERIAL TO 6" ABOVE TOP OF PIPE. THEN POUR A CONCRETE CAP 3 TIMES THE PIPE WIDTH TO THE EXISTING STREAM BED ELEVATION. CONCRETE SHALL EXTEND ±5' BEYOND STREAM WIDTH. CONCRETE SHALL BE CLASS "B".

THE OWNER WILL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED WDNR AND U.S. ARMY CORPS OF ENGINEERS PERMITS.

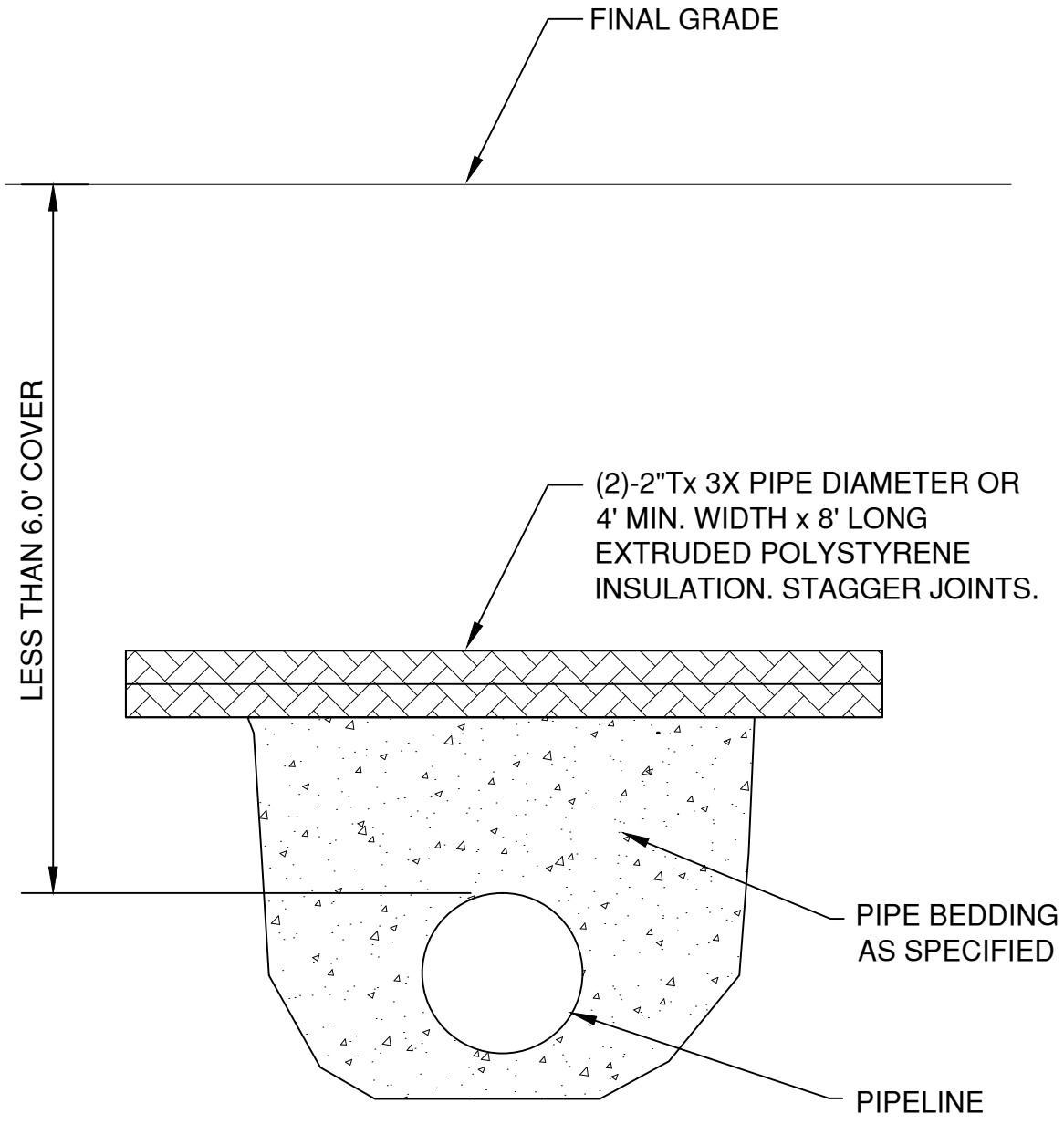
CONTRACTOR SHALL BE RESPONSIBLE FOR MEETING ALL PERMIT REQUIREMENTS.

CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PUMPING AND DISCHARGE PERMITS.

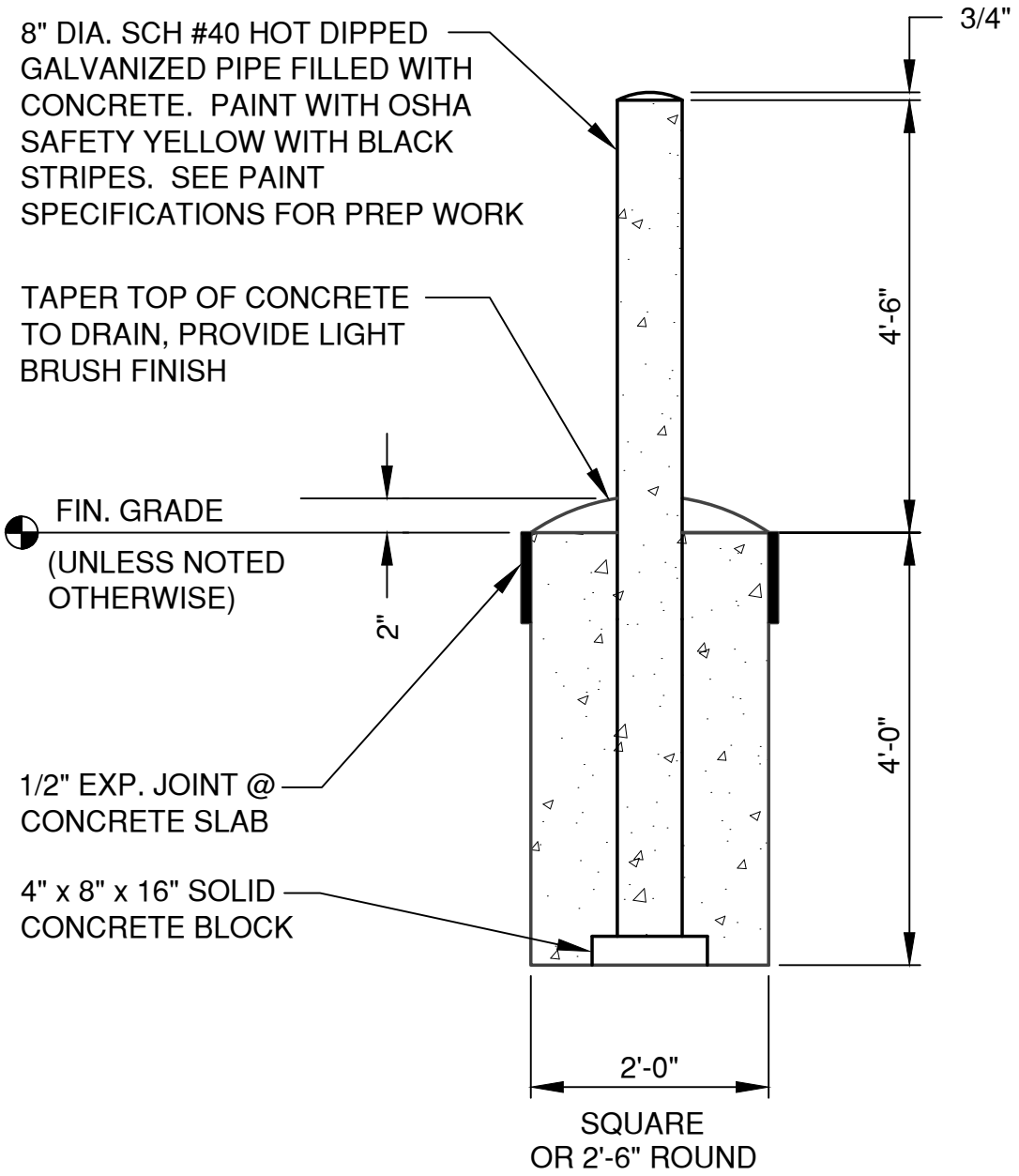
CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST AND MAINTENANCE OF ALL BYPASS PUMPING ASSOCIATED WITH CONSTRUCTION THROUGH CREEK CROSSINGS.



TYPICAL OPEN CUT STREAM CROSSING

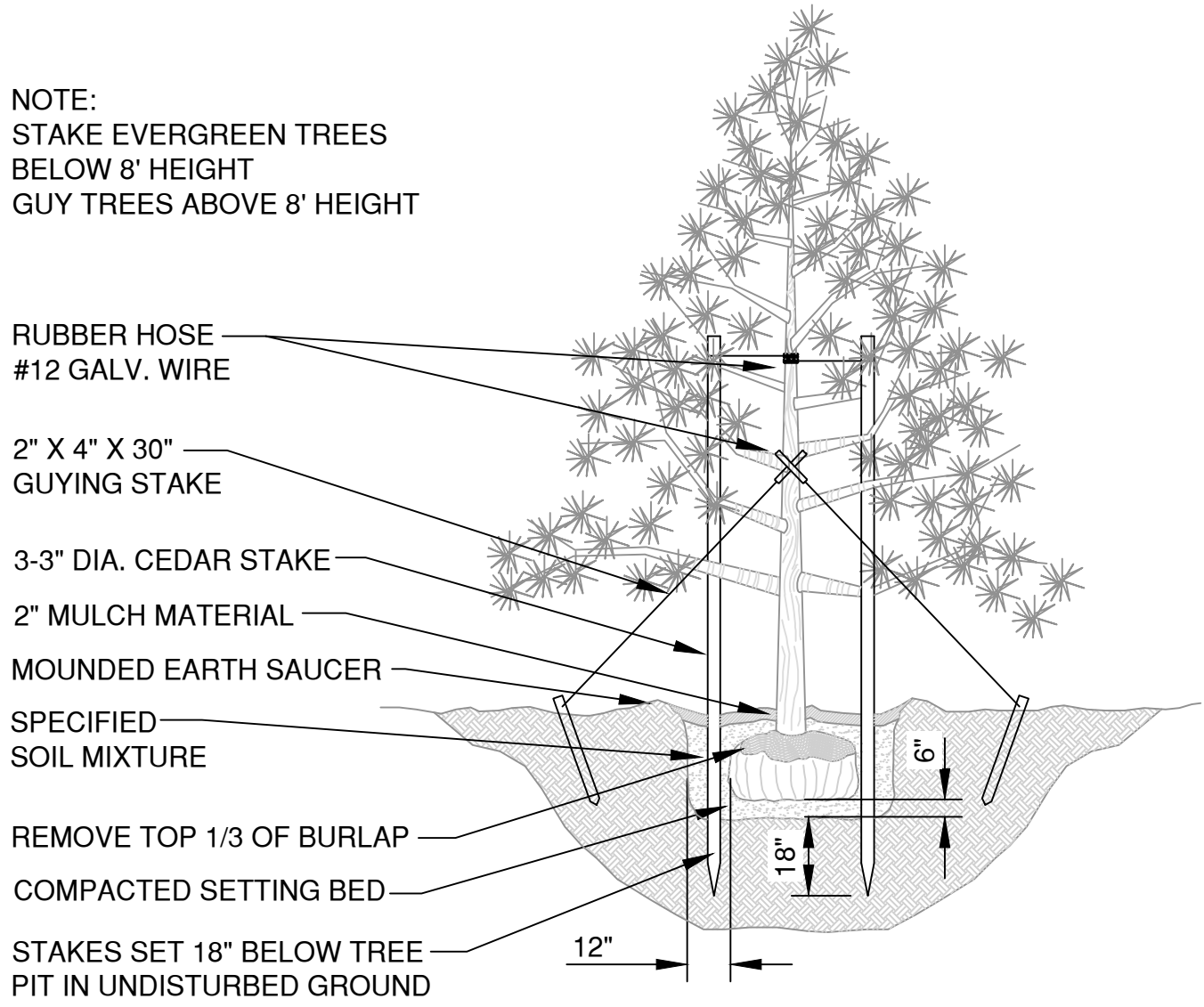


PIPE INSULATION DETAIL



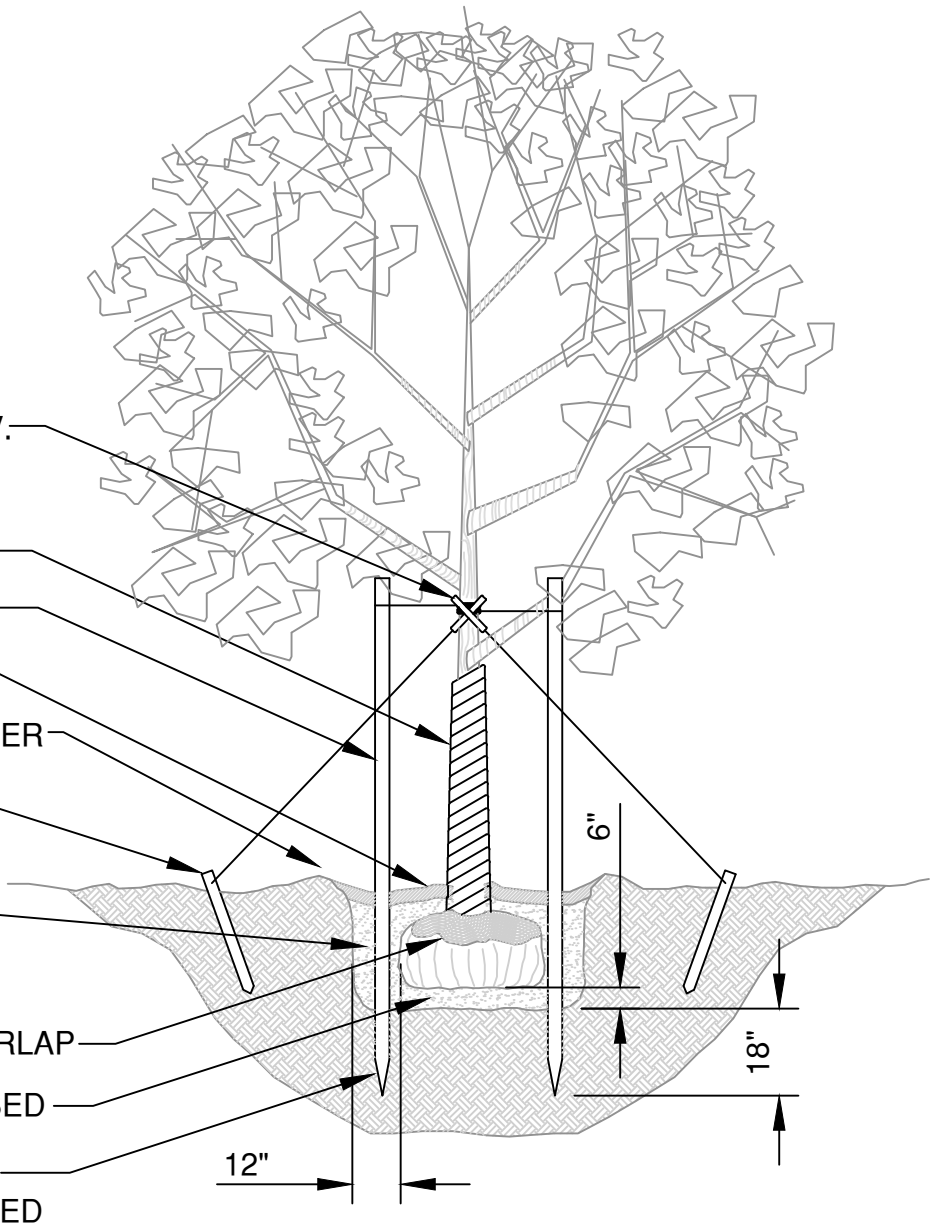
TYPICAL GUARD POST

NOTE:
STAKE EVERGREEN TREES
BELOW 8' HEIGHT
GUY TREES ABOVE 8' HEIGHT



TYPICAL PLANTING, GUYING & SPIKING EVERGREEN TREE DETAIL

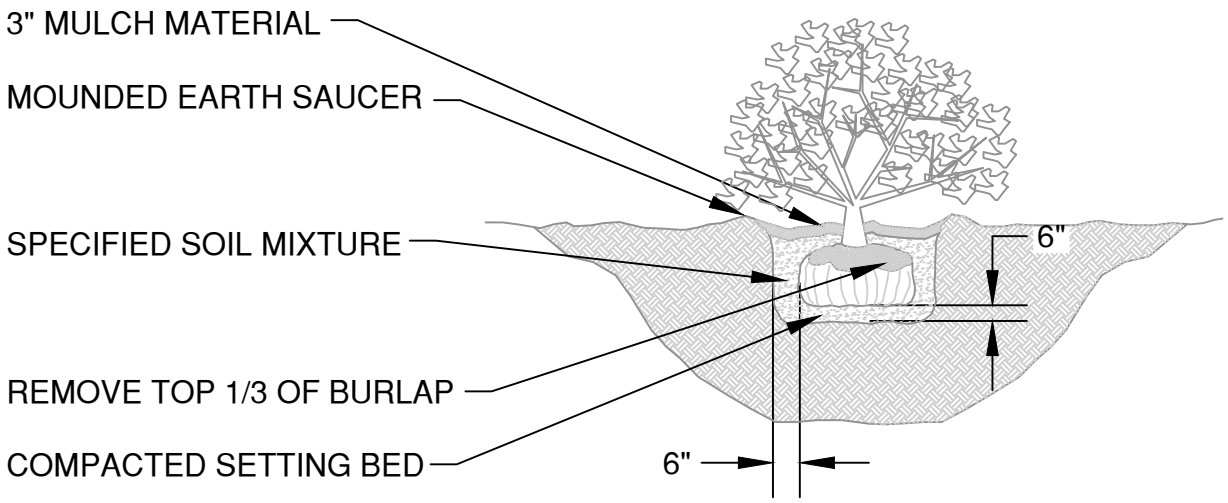
NOTE:
STAKE TREES UNDER 3" CALIPER. GUY TREES OVER 3" CALIPER



TYPICAL PLANTING, GUYING & SPIKING DECIDUOUS TREE DETAIL

NOTE:
PRUNE 20% OF BRANCHES OF DECIDUOUS SHRUBS ONLY. RETAINING NORMAL PLANT SHAPE.

SHRUB SHALL BEAR SAME RELATION TO FINISH GRADE AS IN NURSERY.



TYPICAL SHRUB PLANTING DETAIL