

SANITARY SEWER GUIDELINES
FOR
BEAR CREEK TOWNSHIP

Prepared by:

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BEAR CREEK TOWNSHIP SANITARY SEWER GUIDELINES

January, 2008

General

These guidelines are provided to help developers, sewer users, and Bear Creek Township officials understand and apply the Sewer Use Ordinance. The guidelines are developed pursuant to Article 2, Section 1, Paragraph F of the Sewer Use Ordinance. While some Ordinance information is repeated in these guidelines, they are not intended to replace the Sewer Use Ordinance. In case of any possible conflict, the Sewer Use Ordinance controls.

Supplemental information in these guidelines include:

- Narrative Guidelines
- Sewer Service Permit Application Form
- Technical Specifications
- Construction Details

The Township and Sewer Authority reserve the right to impose additional requirements as deemed necessary for each individual project, consistent with the intent of the Ordinance. This includes, but is not limited to: studies, testing, additional review, and inspections. The costs for these requirements shall be paid by the applicant.

Application Process

All connections to the sewer system must be approved by the Township and Sewer Authority. The approval process includes, but is not limited to, the following steps:

1. Provide confirmation that final zoning approval has been obtained.
2. Complete and Submit a Sewer Service Permit Application
3. Submit payment for Connection Charges, Inspection Fees, and Escrow Fees
4. Receive confirmation from the Township and Sewer Authority that capacity is available for the new connection.
5. Provide evidence that Site Plan Approval has been granted.

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Building Sewer Connections (From Building to Public Sewer)

Each commercial/residential building shall have its own separate building sewer from the sanitary sewer to the building. If units within a building are to be separately owned, (i.e. condominium units), then separate sewer services to each unit are required from the sanitary sewer mainline.

If it is desired to combine the services immediately outside of the building, then a Public or Private Sewer will be required to be constructed. The Township reserves the right to require public ownership of any sanitary facilities as necessary to benefit the public.

Two copies of a plan sketch shall be submitted to the Township Sewer Inspector for review of connections.

All service connections shall be constructed in accordance with the technical specifications and details as provided in these guidelines.

No connections shall be put into service without prior written approval from the Township Inspector.

Public Sanitary Sewer Extensions

A Publicly Owned Sewer is a sewer that is owned and controlled by a public authority. Extensions of a Public Sewer may be necessary to serve a new connection to the sewer system, or for applications that serve more than one user. The cost to construct sewer extensions shall be paid by the applicant and the completed Public Sewer shall be turned over to the Township and Sewer Authority for ownership.

In order to accommodate future service areas, the Township may require the applicant to extend the sewer mainline to the applicant's property lines for possible future extensions.

Design

A registered Professional Engineer licensed to perform work within the State of Michigan shall perform all public sanitary sewer mainline design work. The design must meet the requirements of the Sewer Use Ordinance, these Guidelines, and receive a MDEQ Part 41 construction permit. MDEQ permit applications shall be prepared by the applicant and submitted in the name of the Township.

Easements shall be provided to the Township for all public mainlines. Sanitary sewer easements shall be a minimum of 20' wide. Sewers greater than 10 feet deep will require wider easements. The required easement width will be determined by the Township, or the Township designee, on a case-by-case basis.

For sewer projects that will construct a public sewer, Bear Creek Township may have an independent engineer review the submitted plans at the applicant's cost.

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Construction

Full time construction observation shall be provided during construction of the sanitary sewer system. The observation shall be performed under the supervision of a registered professional engineer and the developer shall pay for all costs for construction observation.

Closeout

Upon completion of construction, the following items must be provided to the Township:

1. All testing reports documenting compliance with the approved plans and specifications.
2. Receive final inspection approval from the Township
3. Provide a “Bill of Sale” transferring ownership of the dedicated portion of the system to the Township or the Authority, such sewer lines shall become part of the public sewer.
4. Two sets of the record drawings sealed by a Michigan professional engineer shall be provided to the Township upon completion of the construction. Such drawings shall also be provided in electronic (AutoCAD) format.
5. Service lead reports with a minimum of three ties to objects deemed to be permanent.
6. All sewer lines offered to the Authority as a public sewer shall be located within public right-of-ways or accompanied by a public easement in perpetuity for the purpose of obtaining access to and performing maintenance on the sewer.
7. Any other documents or records requested by the Township in connection with the design, construction, or location of the sewer being dedicated. This shall include, but is not limited to, items such as operation and service manuals, shop drawings, maps, and recorded easement documents and agreements.

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Private Sewer Extensions

If an applicant desires to construct a sewer with more than one parcel or unit of property under separate ownership connected to it, and the line is not located in the public right-of-way, and will not be dedicated to the public, but will be connected to the public sewer, the applicant must comply with the following:

1. The sewage system shall be constructed pursuant to a Part 41, PA 451, construction permit from the Michigan Department of Environmental Quality.
2. Two sets of the record drawings sealed by a Michigan professional engineer shall be provided to the Authority upon completion of the construction. Such drawings shall also be provided in electronic (AutoCAD) format.
3. Submit written verification to the Township from the project engineer certifying that the sewer line has been successfully tested and inspected and meets all requisite requirements.
4. Comply with all applicable state requirements for the issuance of a permit for such a system.

Design

A registered professional Engineer licensed to perform work within the State of Michigan shall perform all private sanitary sewer mainline design work.

For private mainline sewer projects, Bear Creek Township may have an independent engineer review the submitted plans at the developers cost.

Construction

Construction observation shall be provided during construction of the sanitary sewer system. The observation shall be performed under the supervision of a registered professional engineer and the developer shall pay for all costs for construction observation.

Closeout

Upon completion of construction, a registered professional engineer shall certify all sanitary sewer, pumping stations, and service connections as being constructed in accordance with the approved plans and specifications.

Date _____

BEAR CREEK TOWNSHIP
Sewer Service Permit **Application**

Permit No. _____

Applicant Information:

Owners Name _____
Phone _____
Mailing Address _____

Owner's Representative _____
Phone _____
Mailing Address _____

Project Information:

Project Name _____
Project Address (Location) _____
Project Tax ID _____
Contractor _____
Zoning or Site Plan Approval Number _____

Residential Equivalent Units (REU's) requested:

See Sewer Ordinance Table of Residential Equivalent Unit Factors

Type of use	Size or number of units (sqft or each)	REU Factor	Total REU's
Total	-----	-----	

For Industrial or large mixed use projects, provide a separate calculation of REU's

Fee Enclosed: _____**Map/Plans:**

- **Attach copy of map and plans** (indicate North, road, where sewer enters building)
- At a minimum, show structure(s) to be served, right-of-way containing public sewer, distance from structure to right-of-way, north direction indicator, and depth of service at right-of-way
- Additional information may be required depending on complexity of proposed connection

In consideration of the granting of this permit, the applicant agrees to comply with all applicable ordinances, rules, and regulations of the Township or its Sewer Authority and that neither the Township nor the Sewer Authority shall be liable for any damages resulting therefrom. The applicant also agrees to maintain the building sewer at no expense to the Township or Sewer Authority. **The applicant shall notify the sewer inspector when the building sewer is ready for inspection and connection to the public sewer, but before any portion of the work is covered. The inspector can be reached at (231) 347-0592.**

Signed: _____ Dated: _____
(applicant)

To be completed by Bear Creek Township:

Fees and application received by _____
_____ (amount) _____ (date)

Total Approved REU's _____
Total Connection Charge \$ _____
Inspection Fee \$ _____
Water Meter(s) Required _____ (quantity) _____ (size)
Escrow Account Required \$ _____

Permit Approved By _____ **Date** _____

Special Conditions/Notes:

DATE _____ **INSPECTION APPROVED** _____ **SERVICE TO BEGIN** _____
(Sewer Inspector)

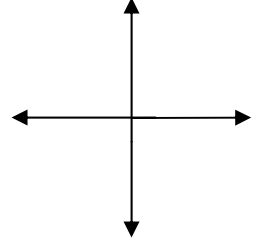
Upon Receipt:☐SewerBd ☐FAX DCUpon Approval:☐ORIGINAL ☐BldgDept ☐Sewer ☐Applicant

BEAR CREEK TOWNSHIP
Sewer Service Permit Application

DRAWING (required):

- Indicate North, road, where sewer enters building
- At a minimum, show structure(s) to be served, right-of-way containing public sewer, distance from structure to right-of-way, north direction indicator, and depth of service at right-of-way
- Additional information may be required depending on complexity of proposed connection

Show NORTH Direction:



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SECTION 01536

SAFETY PRECAUTIONS AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide and maintain adequate facilities for the protection and safety of all persons and property.

1.02 REFERENCED STANDARDS

- A. Unless otherwise specified, the work for this Section shall conform to all State and National laws, ordinances, rules and regulations pertaining to the kind, including but not limited to the following Standard Specifications:
 - 1. State of Michigan "Occupational Safety and Health Act", Act 154 of the Public Acts of 1974 (MIOSHA) as administered by the Michigan Department of Labor and Public Health.
 - 2. MDOT Michigan Manual of Uniform Traffic Control Devices (MMUTCD)

PART 2 PRODUCTS

2.01 SIGNS AND BARRICADES

- A. Provide in accordance with MDOT Michigan Manual of Uniform Traffic Control Devices - Part 6.

2.02 TEMPORARY FENCING

- A. All fencing be strong and durable enough to discourage unauthorized entrance, constructed with the following materials:
 - 1. Posts: Wood or steel
 - 2. Fabric: Snow fence type, wood or plastic, 4 feet high.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide adequate warning signs, barricades, lights, and flagmen as necessary for the protection of the work and safety of the workmen and general public. Control devices shall:
 - 1. Protect workmen and the public from all open trenches and excavations.
 - 2. Provide temporary fencing to discourage unauthorized entrance.
- B. All barricades, signs, lights, and other protective devices shall be installed and maintained in conformance with the transportation authority having jurisdiction.
- C. Designate all streets or roads that are closed with barricades and warning signs. Closing of roads shall be approved by the authority having jurisdiction. Properly notify the local emergency services prior to closing of any road.
- D. Maintain temporary fencing throughout the duration of construction.
- E. Remove temporary fencing at project completion or after permanent fencing is installed.

END OF SECTION

SECTION 01570
TRAFFIC REGULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Provide and maintain traffic control equipment and personnel to protect the work and workmen, and to ensure the least possible obstruction to traffic and inconvenience to the general public.
 - 2. Meet all the requirements of the construction permit issued by the right-of-way owner.

1.02 REFERENCED STANDARDS

MDOT Michigan Manual of Uniform Traffic Control Devices (MMUTCD)

PART 2 PRODUCTS

2.01 GENERAL

All products shall be in accordance with the Michigan Manual of Uniform Traffic Control Devices.

PART 3 EXECUTION

3.01 DETOURS

- A. Contractor shall be solely responsible for acts or omissions resulting in any legal proceedings due to improper or inadequate detour or safety controls.
- B. Submit proposed detour route to the Engineer, the municipality, and all emergency services for approval prior to construction in the detour area.
- C. Keep fire hydrants adjacent to the work accessible to fire fighting equipment at all times.
- D. Keep police, fire, and other emergency services informed of the status of road closings.

3.02 PUBLIC ACCESS

- A. Maintain traffic access in accordance with local laws and regulations having jurisdiction.
- B. Minimize the time that vehicular and pedestrian access to any occupied home, or other building is interrupted. Maintain continuous access to businesses.
- C. Maintain temporary driveways, roadways, and crosswalks in good, usable condition until they are fully restored.

END OF SECTION

SECTION 01650

START-UP SERVICES

PART 1 GENERAL

1.01 TEST OPERATION AND RUN-IN:

- A. Notify the Engineer and test operate the equipment to the Engineer's satisfaction.
- B. Test operate all equipment including controls and associated items, after completion of the electrical and mechanical work.
- C. Run-in and make ready for operation all equipment after test operations.
- D. "Run-in" shall mean sufficient operation to wear in gears, motors, bearings, and any other items in accordance with the manufacturer's recommendations.
- E. "Ready for operation" shall mean fully aligned, tested under full load, adjusted, cleaned, and ready for use.
- F. "Completely installed" shall mean that the installation is complete and ready for final payment.

1.02 FIELD SERVICES:

- A. Secure the services of a qualified equipment manufacturer representative to assist in erection, inspection, make necessary adjustments, initiate the start-up and resolve start-up problems.
- B. Provide a qualified equipment manufacturer's representative for instruction of Owner's personnel in the proper operation and maintenance of the equipment.
- C. Coordinate the training of personnel through the Engineer after "test operation" and "run-in."
- D. Furnish written reports from the equipment manufacturer for each visit. The report shall contain the findings, recommendations, and any pertinent comments, with a signature and title of the representative. At least three (3) copies of the report shall be furnished to the Engineer.

PART 2 PRODUCT - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes providing and maintaining dewatering equipment to dispose of surface water and ground water from all excavations and trenches.

1.02 QUALITY ASSURANCE

- A. Design of the dewatering method shall be the responsibility of the Contractor.
- B. Comply with the Soil Erosion and Sedimentation Control Act, and other state and local codes that govern dewatering activities.

1.03 DESIGN REQUIREMENTS

- A. Dewatering system shall be capable of lowering the static water table a minimum of 12 inches below all excavations.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PERFORMANCE REQUIREMENTS

- A. Duration of dewatering:
 - 1. Continuously until the structure or pipe is installed.
 - 2. Prevent damage from hydrostatic pressure, flotation, or other causes.
- B. Reliability:
 - 1. Monitor the dewatering system at frequent intervals to insure proper operation.
 - 2. Provide stand-by equipment as necessary to avoid equipment or power failure.
- C. Discharge:
 - 1. Prevent sand and silt from discharging into sewer drains or natural waterways.
 - 2. Provide silt fencing, sediment traps, or other methods to protect surface water discharges.
 - 3. Remove all sediment deposits created as a result of the dewatering process.
 - 4. Do not interfere with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other Contractors.
- D. Surface water runoff:
 - 1. Divert surface water from entering excavated areas or trenches.
 - 2. Protect adjacent property from damage.
 - 3. Repair any damage from dewatering activities at no additional cost to the Owner.
- E. Remove all dewatering wells and equipment after project completion.

END OF SECTION

SECTION 02150

SHORING AND BRACING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish, install, and maintain sheeting, shoring, bracing, and trench boxes as required to support the sides of the excavation.
- B. Prevent movement of earth that would damage the Work or existing structures, or cause injury to workmen.

1.02 QUALITY ASSURANCES

Comply with all standards set forth in the Federal and State Occupational Safety and Health Act.

PART 2 PRODUCTS - Not used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide sheeting, shoring, trench box, or bracing to prevent caving or sliding, and to protect workmen and adjacent structures and facilities.
- B. Fill and compact voids outside the sheeting.
- C. Prevent concentrated loads on any structure or pipe within the excavation.

3.02 REMOVAL

- A. Remove sheeting without damage to the installed structure or pipe, and adjacent utilities or structures.
- B. Fill all voids caused by withdrawal of sheeting with clean compacted sand.

3.03 SHEETING LEFT IN PLACE

Sheeting may be left in place with the permission of the Owner.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Excavating and backfilling for pipe trenches

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe Bedding:
 - Granular material meeting requirements of ASTM D2321

PART 3 EXECUTION

3.01 EXCAVATING, BACKFILLING, AND COMPACTING FOR SEWER

- A. Trench excavation:
 - 1. Conduct excavation in a safe and orderly manner at all times, in compliance with all applicable safety regulations.
 - 2. Use hand tools where mechanical equipment will cause damage to adjacent trees, structures, or utilities.
 - 3. Excavate trench to the cross-section shown on the trench detail.
 - 4. Do not excavate the trench ahead of the pipe laying operation more than the Contractor can reasonably expect to backfill by the end of the work day.
 - 5. Support and protect all existing utilities encountered within the trench.
 - 6. Place excavated material where it will not obstruct sidewalks, driveways, roadways, or the work of others.
 - 7. Undercutting
 - a. In the event clay or stone is encountered at the bottom of the excavation, undercut the bottom a minimum of 6 inches.
 - b. Undercut the trench a minimum of 6 inches for plastic water main or sanitary sewers in all soils.
 - c. If muck or other deleterious material is encountered, remove this material suitable soil, unless modified by the Engineer.
 - d. Backfill to proposed pipe grade with material meeting ASTM D2321 compacted to 95% Modified Proctor density.
- B. Pipe bedding:
 - 1. Grade trench bottom to provide uniform, firm, and stable surface, free from rocks and other unsuitable materials.
 - 2. Provide a tamped sand bedding for the full length of the pipe barrel, with recesses excavated for the joints.
 - 3. Bedding material shall meet requirements of ASTM D2321.
 - 4. Place bedding simultaneously on each side of the pipe for the full width of the trench, to a depth of 1 foot above the pipe.
 - 5. Place bedding in 9 inch layers and compact to 95% Modified Proctor Density, being careful not to displace the pipe laterally.
- C. Trench backfill, critical areas:
 - 1. Class II material in areas under or within 10 feet of structures or improved surfaces.
 - 2. Place in layers not exceeding 9 inches and compact each layer, by mechanical means, to 95% Modified Proctor density.

3. If trench settles greater than 1 inch within the one year following Owner's acceptance of project, the Contractor shall bring the trench back to grade and restore the surface at no additional cost to the Owner.
- D. Trench backfill, non-critical areas:
1. Class III material approved by the Engineer, free from frozen soil, vegetation, and debris.
 2. Place in layers not exceeding 12 inches and compact each layer by mechanical means to a minimum of 90% Modified Proctor density.
- E. Pipe protection:
1. Mound and compact additional granular backfill over pipe, if required, to provide a minimum cover depth of 3 feet to protect pipe while construction equipment is operating on site.
 2. Remove additional backfill when grading to achieve finished grade.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes excavating and backfilling for pipe trenches and related work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe Bedding:
Granular material meeting requirements of Section 8.02.06 of the MDOT Standard Specifications for construction.

PART 3 EXECUTION

3.01 EXCAVATING, BACKFILLING, AND COMPACTING FOR SEWER

- A. Trench excavation:
 - 1. Conduct excavation in a safe and orderly manner at all times, in compliance with all applicable safety regulations.
 - 2. Use hand tools where mechanical equipment will cause damage to adjacent trees, structures, or utilities.
 - 3. Excavate trench to the cross-section shown on the trench detail.
 - 4. Do not excavate the trench ahead of the pipe laying operation more than the Contractor can reasonably expect to backfill by the end of the work day.
 - 5. Support and protect all existing utilities encountered within the trench.
 - 6. Place excavated material where it will not obstruct sidewalks, driveways, roadways, or the work of others.
 - 7. Undercutting
 - a. In the event clay or stone is encountered at the bottom of the excavation, undercut the bottom a minimum of 6 inches.
 - b. Undercut the trench a minimum of 6 inches for plastic water main or sanitary sewers in all soils.
 - c. If muck or other deleterious material is encountered, remove this material suitable soil, unless modified by the Engineer.
 - d. Backfill to proposed pipe grade with material meeting ASTM D2321 compacted to 95% Modified Proctor density.
- B. Pipe bedding:
 - 1. Grade trench bottom to provide uniform, firm, and stable surface, free from rocks and other unsuitable materials.
 - 2. Provide a tamped sand bedding for the full length of the pipe barrel, with recesses excavated for the joints.
 - 3. Bedding material shall meet requirements of ASTM D2321.
 - 4. Place bedding simultaneously on each side of the pipe for the full width of the trench, to a depth of 1 foot above the pipe.
 - 5. Place bedding in 9 inch layers and compact to 95% Modified Proctor Density, being careful not to displace the pipe laterally.
- C. Trench backfill, critical areas:
 - 1. Class II material in areas under or within 10 feet of structures or improved surfaces.
 - 2. Place in layers not exceeding 9 inches and compact each layer, by mechanical means, to 95% Modified Proctor density.
 - 3. If trench settles greater than 1 inch within the one year following Owner's acceptance of

project, the Contractor shall bring the trench back to grade and restore the surface at no additional cost to the Owner.

- D. Trench backfill, non-critical areas:
 - 1. Class III material approved by the Engineer, free from frozen soil, vegetation, and debris.
 - 2. Place in layers not exceeding 12 inches and compact each layer by mechanical means to a minimum of 90% Modified Proctor density.
- E. Pipe protection:
 - 1. Mound and compact additional granular backfill over pipe, if required, to provide a minimum cover depth of 3 feet to protect pipe while construction equipment is operating on site.
 - 2. Remove additional backfill when grading to achieve finished grade.

END OF SECTION

SECTION 02270

EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

Section includes, work necessary for effective temporary and permanent soil erosion and sedimentation control.

1.02 QUALITY ASSURANCES

Perform all Work in accordance with the Michigan Soil Erosion and Sedimentation Control Act, Part 91 of Act 451, P.A. 1994, and with the requirements of the local agencies having jurisdiction over the Work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Seed, fertilizer, and mulch: Provide as specified in Section 02900 LANDSCAPING.
- B. Provide temporary and permanent structures and materials in accordance with the Michigan Department of Management and Budget Keying System.
- C. Mulch blanket:
 - 1. Materials: 100% straw sewn into a lightweight, photo degradable netting.
 - 2. Model: S75.
 - 3. Straw content: 0.5 pounds per square yard.
 - 4. Manufacturer: North American Green.
- D. Geotextile filter fabric:
 - 1. Materials: Mechanically bonded, non-woven geotextile.
 - 2. Manufacturer: Amoco
 - 3. Model: CEF 4553
 - 4. Tensile strength: 203 lbs. (ASTM D-4632).
 - 5. Tensile elongation: 50% min. (ASTM D-4632).
 - 6. Tear strength: 80 lbs. (ASTM D-4533).
 - 7. Puncture strength: 130 lbs. (ASTM D-4833).
 - 8. Apparent opening size: 100 sieve (ASTM D-4751).
- E. Rip rap stone: (4-6")
 - 1. Material: native fieldstone from local gravel pits, exhibiting sound structure and strength for the intended use.
 - 2. Size: 1" to 6" stone.
 - 3. Gradation:
 - a. $D_{100} = 6$ inch
 - b. $D_{50} = 4$ inch
 - c. $D_{10} = 2$ inch
- F. Rip rap stone: (10-12")
 - 1. Material: native fieldstone from local gravel pits, exhibiting sound structure and strength for

- the intended use.
- 2. Size: 6" to 12" stone.
- 3. Gradation:
 - a. $D_{100} = 12$ inch
 - b. $D_{50} = 10$ inch
 - c. $D_{10} = 8$ inch
- G. Silt fence:
 - 1. Conforming to Michigan Department of Transportation Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

Conduct site evaluation with the Engineer and the soil erosion control officer prior to starting work.

3.02 TEMPORARY EROSION CONTROL

- A. Minimize the area of earth disturbed at any one time.
- B. Provide berms or ditches to divert storm runoff from the construction area when steep slopes or highly erodible soils are present.
- C. Contain all sedimentation on site by using straw bales, filter fence, or sedimentation basins.

3.03 PERMANENT EROSION CONTROL

- A. When final grades have been established, provide topsoil, seed, fertilizer, and mulch.
- B. Water all seeded areas as necessary to establish proper vegetative cover.
- C. Should erosion occur within the guarantee period, regrade and reseed the disturbed area at no additional cost to the Owner.

3.04 MULCH BLANKET

- A. Provide mulch blanket on all slopes 3:1 or steeper, that are disturbed during construction or as indicated on the plans.
- B. Prepare soil prior to placing mulch blanket with topsoil, seed and fertilizer.
- C. Place mulch blanket from top of slope down so overlap seams run parallel to slope.
- D. Overlap seams a minimum of 2" on parallel seams, and six inches, shingle style, on perpendicular splices.

END OF SECTION

SECTION 02300

BORING AND JACKING

PART 1 GENERAL

1.01 SECTION INCLUDES

Provide all labor, tools, equipment necessary for the installation of boring and jacking pipe and/or pipe casings.

1.02 REFERENCED STANDARDS

Unless otherwise specified the work for this section shall conform to the applicable portions of the following standard specifications:

MDOT - Michigan Department of Transportation
ASTM - American Society for Testing and Materials
American Welding Society Standards

1.03 SUBMITTAL

Submit a complete set of shop drawings and product data to ENGINEER for review and approval, prior to ordering any materials.

PART 2 PRODUCTS

2.01 CASING PIPE

- A. All casing pipe shall be made of steel, with a minimum yield strength of 35,000 psi. The steel pipe shall meet the requirements of either:
 - 1. ASTM A53, Type E or S, Grade B
 - 2. ASTM A-139 Grade B
 - 3. ASTM A-106 Grade B or C
 - 4. API-5L, Grade B
 - 5. API-5L Grades X42 through X56.
- B. The ends of the steel pipe to be jacked shall be prepared for field welding at joints.
- C. The nominal outside diameter and wall thickness, in inches, for steel pipe, shall be as shown on the project plans.
- D. The casing pipe shall have welded joints and be free of holes or gaps throughout its entire length.

2.02 CASING FILLER

- A. The pipe filler shall be peastone with a MDOT 28B or 28C gradation.

PART 3 EXECUTION

- A. Jacking pit:
 - 1. Adequate to accommodate at least one section of pipe and to provide adequate space for the jacking equipment and blocking.

2. Place temporary concrete barriers or beam guardrails around jacking pits within 30 feet of freeway pavements or 15 feet from road pavements when the engineer determines that it is warranted.
 3. Protect jacking pit with suitable fencing and MDOT Type II barricades. Equipment will not be used in lieu of fencing to barricades.
 4. Support will be required at the front of all jacking pits to prevent loss of material during construction.
- B. Ground water control:
1. Provide a dewatering method in accordance with Section 02140 DEWATERING.
- C. Jacking and boring:
1. Provide a minimum of two guide rails or sills to support the pipe at the plan lines and grades during the jacking operations. Coat guides with suitable lubricants.
 2. Casing shall be installed in a straight line throughout its length.
 3. Provide a backstop, cribbing, or other approved means, to withstand the thrust developed during jacking. A jacking head consisting of bearing blocks shall be used to transfer the pressure uniformly from the jacks to the perimeter of the pipe. During jacking, do not exceed design compressive strength of the pipe used.
 4. Bentonite, or other suitable lubricant, may be applied at the front face of the lead pipe simultaneously with the jacking operation. A steel cutting ring may be installed on the leading edge of the first pipe.
 5. Weld pipe sections airtight, using a full penetration weld around the entire circumference. Welds shall not increase the outside diameter by more than $\frac{3}{4}$ " total. Weld joints in accordance with the American Welding Society Standards.
 6. The leading edge of the casing shall precede the auger by a length equal to or greater than $\frac{1}{2}$ the diameter of the casing.
 7. The face of the cutting head shall minimize the free flow of soft or poor material.
 8. The use of compressed air, water, or other fluids to facilitate casing placement is prohibited.
 9. Prior to jacking and boring, determine the elevation of all existing utility lines that intersect the proposed casing alignment. Vertically clear all utility lines by a minimum of 6 inches.
 10. If the bore and jack cannot be completed, abandon the casing in place, and backfill with peastone or clean sand. The casing shall be filled too within 1 inch of the top, and then the ends of the casing shall be sealed with a 1 foot bulkhead of concrete, or approved alternate.
- D. Installation of carrier pipe:
1. The carrier pipe shall be pushed or jacked into the completed casing.
 2. Using compressed air, blow pea stone to completely fill the annular space between the casing and carrier pipe.
 3. After installing the pea stone, seal the annular opening between the carrier pipe and the casing with a concrete or mortar plug. The plugs shall be sufficient to prevent material from entering or leaving the annular space.
- E. Boring method for small diameter pipe (4" or less):
1. An acceptable pneumatic underground piercing tool or portable auguring mole may be used for small diameter pipe borings in lieu of the above boring and jacking methods where approved by governing authorities.
 2. The Contractor shall submit complete plans and details of said alternate boring operations to the Engineer for approval before commencing work.
 3. Under no circumstances will jetting with water or other liquids be allowed to facilitate placement of pipe.

END OF SECTION

SECTION 02310

DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

Provide all labor, tools, equipment necessary for directional drilling of piping shown on plans. This section is provided for directional drilling of forcemain only.

1.02 CONTRACTOR QUALIFICATIONS

- A. The contractor shall have at least 5 years experience in directional drilling and familiarity in drilling subsurface and site conditions.
- B. The contractor shall familiarize himself with the site conditions, work limits, subsurface conditions, weather conditions, existing facilities, and access restrictions.

PART 2 PRODUCTS

2.01 HDPE (High Density Polyethylene) Piping

- A. Type: SDR-11, ASTM 3035 for PE 3408
- B. Fittings: Provide HDPE adapter at each end of directional drill.

PART 3 EXECUTION

- A. Ground water control:
 - 1. Provide a dewatering method in accordance with Section 02140 DEWATERING.
- B. Directional drill method:
 - 1. The Contractor shall submit complete plans and details of directional drill operations to the Engineer for approval before commencing work.
 - 2. The plans shall include proposed location of drilling machinery, type of machinery, and proposed cross section which meets plan requirements.
 - 3. Jetting with water or other liquids be allowed to facilitate placement of pipe will not be allowed.

END OF SECTION

SECTION 02511

BITUMINOUS PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes all labor, materials, tools and equipment necessary for complete restoration and construction of bituminous surfaces.
- B. Related Sections:
 - Section 02200 EARTHWORK

1.02 QUALITY ASSURANCES

- A. Provide and place in accordance with the Township and Emmet County Road Commission, including all testing and compaction requirements.
- B. Furnish weight slips for all bituminous material.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Base material: MDOT 22A Aggregate, pulverized bituminous surfaces salvaged from the project site or other material as approved by the Engineer, Township, and Emmet County Road Commission.
- B. Leveling and Wearing Course: As approved by the Engineer, Township, and Emmet County Road Commission.
- C. Bond Coat: MDOT SS-1h, if required by the governing agencies above.

PART 3 EXECUTION

3.01 AGGREGATE PAVING BASE

- A. Place at a minimum depth, compacted in place, as approved by the Engineer, Township, and Emmet County Road Commission.
- B. Compact to 95% maximum density, or as otherwise accepted.
- C. Grading:
 - 1. Finish grade base to the elevations and cross sections shown on the Standard Details.
 - 2. Do not place paving until the Engineer has approved the base.

3.02 BITUMINOUS SURFACE

- A. Apply bituminous paving in an acceptable number of courses as indicated by the Engineer, Township, and Emmet County Road Commission.
- B. Compact to 95% maximum density, or as otherwise accepted.

- C. If required, apply bond coat at a rate of 0.10 gal/syd between each pavement course.

3.03 PRESERVATION OR REMOVAL OF PAVEMENT SURFACES

- A. Minimize the amount of existing pavement which must be removed.
- B. Protect pavement outside of the removal limits.
- C. Repair any damage to pavement surfaces outside of the removal limits at no cost to the Township.
- D. Saw cut pavement to full depth at removal limits.

3.04 TEMPERATURE AND SEASONAL LIMITATIONS

Refer to Section 4.00.14 and Table 4.00-2 of MDOT Specification 4.00.

3.05 PAVEMENT PATCHING

- A. Trench preparation: Place and compact backfill as specified in Section 02200 EARTHWORK.
- B. Joint preparation:
 - 1. Saw cut pavement a minimum of 1 foot beyond the damaged area.
 - 2. Sweep adjacent road surfaces clean of all dirt and debris.
 - 3. Apply a bond coat at a rate of 0.10 gal/syd on all saw cut edges of the existing pavement.
 - 4. Butt joint new pavement to existing pavement.
- C. Removal limits:
 - 1. Trench crossing road:
 - a. A distance equal to the excavation depth plus the diameter of the pipe; measured perpendicular to and extending to both sides of the pipe line.
 - 2. Trench longitudinal to road:
 - a. $\frac{1}{4}$ of pavement width to be replaced if less than $\frac{1}{4}$ is removed.
 - b. $\frac{1}{2}$ of pavement width to be replaced if more than $\frac{1}{4}$ but less than $\frac{1}{2}$ is removed.
 - c. full width to be replaced if more than $\frac{1}{2}$ of pavement is removed.
- D. Place aggregate paving base and bituminous surface as specified in paragraph 3.01 and 3.02.

END OF SECTION

SECTION 02513
CONCRETE SURFACES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes, all materials, labor, tools, and equipment necessary for the construction of concrete surfaces, including sidewalks and curb and gutter.
- B. Related Sections:
 - 1. Section 02200 EARTHWORK

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete reinforcement:
 - 1. Conform to MDOT Section 8.05.
- B. Concrete:
 - 1. Conform to MDOT Section 6.08, 6.09, and 7.01.
 - 2. MDOT Grade 35P, 3500 psi concrete mix.
- C. Joint filler:
 - 1. Fiber joint filler conforming to ASTM D-1751.
- D. Sand base:
 - 1. Provide compacted sand base as specified in Section 02200, EARTHWORK.

PART 3 EXECUTION

3.01 EARTHWORK

- A. Perform all earthwork necessary to conform to the finish grades shown on the Plans.
- B. Prepare base as specified in Section 02200, EARTHWORK.
- C. Backfill and compact all voids remaining after forms are removed.

3.02 CONCRETE PAVEMENT

- A. Construct concrete pavement as shown on plans in conformance with Section 4.50 of the MDOT Standard Specifications.
- B. Dimensions:
 - 1. Length: As required to replace existing, or as shown on Plans.
 - 2. Width: Meet existing, or as shown on Plans.
 - 3. Thickness: 9" minimum or greater if required to meet existing.
 - 4. Slope: Meet existing, slope to drain.

- C. Joints:
 - 1. Concrete pavement joints shall be placed in a pattern as shown in MDOT Standard Plan II-42 series, Sheet 5 of 6, "Joints for Concrete Pavement Widening".
 - 2. Transverse construction joints, Symbol C, shall be placed to match joints in the existing pavement.
- D. Reinforcement:
 - 1. Wire fabric reinforcement shall be placed in all concrete pavement in accordance with MDOT Standard Plan II-45 series.
- E. Finish: Finish surface in accordance with MDOT Specification 4.50.

3.03 SIDEWALKS

- A. Construct in conformance with Section 6.11 of the MDOT Standard Specifications.
- B. Dimensions:
 - 1. Length: As shown on the Plans.
 - 2. Width: As noted on Plans.
 - 3. Thickness:
 - a. 4" except where thickened at drive approaches.
 - b. 6" at drive approaches as detailed on plans.
 - 4. Slope: $\frac{1}{4}$ " per foot toward curb.
- C. Joints:
 - 1. Expansion joints:
 - a. Provide $\frac{1}{2}$ " expansion joints as shown on the Plans and as follows:
 - i. At ends of thickened sidewalk.
 - ii. At a maximum spacing of 50 feet.
 - iii. Around permanent structures in sidewalk.
 - iv. Between back of curb and sidewalk.
 - v. Sidewalk ramps meet back of curb.
 - 2. Plane of weakness joints:
 - a. At intervals equal to the sidewalk width, or at a maximum 10 feet.
 - b. In thickened sidewalk at outer edges of driveways.
 - c. Where permanent structures are located in sidewalk.
- D. Finish: Finish surface in accordance with MDOT Specification 6.11.

3.04 CURB AND GUTTER

- A. Construct curb and gutter in accordance with Section 6.09 of the MDOT Standard Specifications.
- B. All new curb and gutter shall be the Type, shown on the Plans.
- C. Curb openings as detailed on Plans, installed at existing driveways at the location of existing curb openings.
- D. Depressed curbs to 1" height at sidewalk ramps and driveway openings.
- E. Joints:
 - 1. Provide 1" expansion joints at:
 - a. Saw cut curb ends.
 - b. Curb radius spring points.
 - c. Approximately 10 feet each side of all catch basins.
 - 2. Provide contraction joints at:
 - a. Opposite all transverse contraction joints in concrete pavement.
 - b. At 40 foot maximum intervals.
 - 3. Joints shall confirm with MDOT Standard Plan II-30 series.

- F. Finish: Finish surface in accordance with MDOT Specification 6.09.

3.05 SIDEWALK RAMPS

- A. Construct MDOT ADA sidewalk ramps with detectable warning strips (tactile strips) at all locations where new sidewalks meet curbs.
- B. Construct in accordance with MDOT Special Detail R-28-F and Section 803 of the MDOT Standard Specifications.
- C. Dimensions:
 - 1. Length: As shown on the Plans.
 - 2. Width: 4 feet, unless noted otherwise.
 - 3. Thickness:
 - a. 6" unless otherwise noted on Plans.
 - b. Special thickness requirements are noted on the Plans.
- D. Joints:
 - 1. Provide control joints at 5 feet on center.
 - 2. Provide expansion joints at intervals not exceeding 50 feet and between all abutting buildings and structures.
- E. Finish: Finish surface in accordance with MDOT Standard Specification Section 803.

END OF SECTION

SECTION 02731

BUILDING SEWER SERVICES

PART 1 GENERAL

1.01 REFERENCED STANDARDS

Unless otherwise specified, the work for this Section shall conform to the applicable portions of the following Standard Specification:

ASTM -American Society for Testing and Materials

PART 2 PRODUCTS

2.01 BUILDING SEWER PIPE

- A. PVC sewer service pipe and fittings:
 - 1. Design standard: ASTM - D 3034.
 - 2. Wall thickness: SDR-35.
 - 3. Joints: Push on joint with elastomeric gasket meeting ASTM - D 3212.
 - 4. Schedule 40 pipe and joints meeting ASTM – D 1785 & D2466
 - 5. Minimum Pipe Size: 4" residential, 6" commercial (4" may be approved for commercial depending on use).

2.02 CUT IN WYES

- A. Ductile Iron, Clay, & PVC mainline
 - 1. Cast Iron – Romac – Style "CB" sewer saddle
 - 2. Design standard: ASTM 536, ASTM 240, ASTMD2000 MBA 710
 - 3. Stainless Steel: Straps, bolts, nuts, washers
 - 4. Follow all manufacturer recommendations for installation.
- B. PVC or ABS mainline
 - 1. PVC Saddle Tees with stainless bands
 - 2. Design Standard: ASTM D3034, F1336, & F679
 - 3. Follow all manufacturer recommendations for installation.

PART 3 EXECUTION

3.01 BUILDING SEWER SERVICE LEADS

- A. General:
 - 1. Place service leads from service wyes to property line or as indicated on the plans.
 - 2. Provide minimum depth of cover of 6 feet within roadway or parking lots.
 - 3. Provide 1" Blueboard frost barrier in areas less than 6'.
 - 4. As applicable, install a watertight plug in the end of each lead until final hook up.
 - 5. Install cleanouts at bends greater than 45 degrees and maximum spacing of 100'. If (2) 45 degree bends are used rather than a 90 degree bend, then a minimum of 3' must be placed between 45 degree bends.
 - 6. Check with plumbing inspector for possible check valve requirements on basement services.
- B. Earthwork: Perform all trench excavation, pipe bedding, and backfilling in accordance with

Section 02200 - Earthwork.

- C. Pipe Laying:
 - 1. Lay all pipe in a straight line and grade between structures and fittings.
 - 2. Minimum Grade: 4" - 1/4" per foot; 6" - 1/8" per foot.
- D. Marker post:
 - 1. Install a pressure treated 4" x 4" x 8' marker post at the end of each service lead that will not be immediately hooked up.
 - 2. Set bottom of marker post level with the service lead invert.
 - 3. Cut the post to 24 inches above finished grade after recording the elevation of the marker post top.
- E. Air pressure test service or provide TV inspection if required by Inspector in accordance with Section 02732.

END OF SECTION

SECTION 02732

SANITARY SEWERS

PART 1 GENERAL

1.01 REFERENCED STANDARDS

The work for this Section shall conform to the applicable portions of the following Standard Specification:

ASTM -American Society for Testing and Materials

The work must also be designed in accordance with:

- Township Inspector guidelines and specifications
- Michigan Department of Environmental Quality requirements
- Recommended Standards for Wastewater Facilities (10 State Standards)
- General Engineering standards of the area.

PART 2 PRODUCTS

2.01 SANITARY SEWER MAIN

- A. PVC sewer main and fittings:
1. Design standard: ASTM - D 3034.
 2. Wall thickness: SDR-35.
 3. Joints: Push on joint with elastomeric gasket meeting ASTM - D 3212.
 4. Schedule 40 fittings and wyes meeting ASTM D 2466 may be used in lieu of the Push on Joint.
 5. Minimum Pipe Size: 8"
- B. PVC sewer main and fittings:
1. Design standard: ASTM - D 2680, PVC Truss pipe.
 2. Joints: Push on joint with elastomeric gasket meeting ASTM - D 3212.
 3. Bury Depth: Truss pipe required on installations >12' deep.

2.02 4 FOOT DIAMETER MANHOLES

- A. Sections: All sanitary sewer manholes shall be a minimum of 4' in diameter.
1. 4 foot diameter, precast section conforming to ASTM C-478.
 2. Rubber gasket joints conforming to ASTM C-443.
 3. Bottom slab and walls shall be cast integrally.
 4. Top section:
 - a. manholes less than 4 feet deep: flat top.
 - b. manholes greater than 4 feet deep: eccentric cone.
 5. Manhole to pipe connections: Kor-N-Seal neoprene boot with stainless steel bands.
- B. Castings: East Jordan Iron Works #1040 with Type A cover.
- C. Steps: Manufacturer - MA Industries, Inc.
- a. PS1-PF-Precast manhole.
 - b. PS1-B-Block manhole.

PART 3 EXECUTION**3.01 GRAVITY PIPE INSTALLATION**

- A. Earthwork: Perform all trench excavation, pipe bedding, and backfilling in accordance with Section 02200 - Earthwork.
- B. Line and grade controls:
 - 1. Lay all pipe in a straight line between manholes and structures.
 - 2. Maintain grade by the use of laser beam.
 - 3. Establish line and grade control from bench marks and site coordinate lines.
 - 4. Promptly report any alignment conflicts to the Inspector.
 - 5. Minimum Grade: 0.40% (0.4' drop every 100' for 8" sanitary sewers)
 - 6. Minimum Bury Depth: Typical 6' bury depth on pipe installations <12'. Truss pipe required on installations >12' deep.
- C. Pipe laying:
 - 1. Each section of pipe shall rest upon the pipe bed for the full length of the pipe barrel.
 - 2. Recess bedding to accommodate joints.
 - 3. Maintain pipe and joints in a clean condition.
 - 4. Provide concrete pipe anchors at all joints of pipe laid at slopes greater than 15 percent.
 - 5. Lay pipe from downstream end to upstream end.

3.02 MANHOLES

- A. Installation:
 - 1. Construct base, sections, top cone, and castings in accordance with the detail shown on the Plans. Maximum manhole spacing shall not exceed 400'.
 - 2. Place manhole base on 4 inches sand or aggregate leveling base.
 - 3. Compact sand base and backfill in accordance with Section 2200 – EARTHWORK.
 - 4. Set manhole base and sections plumb.
 - 5. Install rubber gasket between each manhole section and lubricate according to the manufacturers specifications.
 - 6. Coat exterior walls with coal tar waterproofing in wet areas or if required by inspector.
 - 7. Seal all joints and lift holes with non-shrink grout.
- B. Flow Channel
 - 1. Construct concrete flow channel as shown on the plans for each manhole.
- C. Removal of Existing
 - 1. All existing manholes and sanitary sewer shall remain in service until the final connection and acceptance of the replacement sewer.
 - 2. Provide temporary pump and discharge piping or hose to maintain sewage flows where necessary.
- D. Connect to Existing
 - 1. Use a coring machine to cut hole in existing manhole.
 - 2. Install a flexible boot and adjust flow channel as needed.

3.03 TESTING

- A. General:
 - 1. All gravity main piping shall be subject to air (leakage) testing, deflection testing, and television inspection prior to acceptance by the Owner.
 - 2. Conduct all testing only while the Engineer is present.
 - 3. Notify the Engineer at least 24 hours prior to testing.
 - 4. If any section of pipe fails to pass a test, the Contractor shall repair and retest the section at

- no additional cost to the Owner.
 - 5. The tests shall be repeated until satisfactory results are obtained.
 - 6. No connections shall be made on new pipe until all tests have passed.
- B. Air testing:
- 1. Perform low pressure air test according to ASTM F1417.
 - 2. Test each section of pipe from manhole to manhole or structure to structure.
 - 3. A pipe section shall be considered as failed if the leakage exceeds the amount allowed by ASTM F 1417. (See table 1).
 - 4. Initial pressure of 4 psi greater than the average back pressure of the groundwater above the pipe shall be maintained for 2 minutes to equalize air temperature.
- C. Deflection testing:
- 1. Perform deflection testing no earlier than 30 days after final backfill has been placed.
 - 2. Maximum allowable deflection is 5% as determined by ASTM D3034-89.
 - 3. Perform testing by pulling a properly sized "go, no-go" mandrel between manholes.
 - 4. Failure to pass the mandrel will indicate an unacceptable deflection, requiring re-excavation and replacement of the failed section at no additional cost to the Owner.
 - 5. Repeat the test until satisfactory results are obtained.
 - 6. Deflection testing is not required for truss pipe.
- D. Television inspection:
- 1. Conduct test with closed circuit television.
 - 2. Record inspection on DVD or CD video format file.
 - 3. Provide the Engineer with one copy of the inspection video disk within 15 days of televising.
 - 4. The recorded inspection shall include audio or visual aids which indicate the exact location of the video camera.
 - 5. All defects in the sewer shall be noted during the inspection.
 - 6. Provide written log of all observations.
 - 7. Repair all defects at no cost to the Owner and re-televising until satisfactory results are obtained.

END OF SECTION

SECTION 02733

SANITARY SEWER FORCE MAIN

PART 1 GENERAL

1.01 REFERENCED STANDARDS

Unless otherwise specified, the work for this Section shall conform to the applicable portions of the following Standard Specification:

ANSI -American National Standards Institute
ASTM -American Society for Testing and Materials
AWWA -American Water Works Association
NSF -National Sanitation Foundation

PART 2 PRODUCTS

2.01 DUCTILE IRON FORCE MAIN

- A. Design standard: AWWA C151
- B. Thickness: AWWA C150, Class 52
- C. Exterior coating: Bituminous, AWWA C151, 51-8.1
- D. Interior coating: AWWA C104
- E. Joints: AWWA C111

2.02 PVC FORCE MAIN

- A. Design standard: AWWA C900
 - 1. Pressure rating: 150 psi
 - 2. Thickness: SDR-18
 - 3. Joints: Rubber joint rings - ASTM D3139
- B. Design standard: ASTM D2241
 - 1. Pressure rating: 200 psi
 - 2. Thickness: SDR 21
 - 3. Joints: Rubber rings - ASTM 3139

2.03 FITTINGS

- A. Ductile iron pipe:
 - 1. Material: Cast Iron, Class 250 or Ductile Iron, Class 350
 - 2. Design standards: AWWA C110, C153
 - 3. Exterior coating: Bituminous, AWWA C151, 51-8.1
 - 4. Interior coating: AWWA C104
 - 5. Joints: AWWA C111, Mechanical Joint
- B. Other pipe:
 - 1. Material: Cast Iron, Class 250 or Ductile Iron, Class 350
 - a. Design standards: AWWA C110, C153
 - b. Exterior coating: Bituminous, AWWA C151, 51-8.1
 - c. Interior coating: AWWA C104

- d. Joints: AWWA C111, Mechanical Joint with transition gasket, if required.
- 2. Material: PVC
 - a. Design standard: PVC ASTM D1785
 - b. Pressure rating: Schedule 40
 - c. Joints: Rubber rings - ASTM 3139

2.04 RESTRAINED JOINTS

- A. Ductile iron pipe:
 - 1. Push-on joint:
 - a. Design standard: AWWA C111
 - b. Thickness: AWWA C151, Class 52
 - c. Manufacturers:
 - i. Clow: Super-Lock
 - ii. U.S. Pipe: TR FLEX
 - iii. American: Fast-Grip
 - 2. Mechanical joint:
 - a. Retainer Gland Safety Factor: 2:1
 - b. Design requirement: Twist-off nuts to assure actuating restraint
 - c. Manufacturers:
 - i. EBAA Iron: MEGALUG, Series 1100
 - ii. Standard International
 - 3. Ball joint:
 - a. Design standard: AWWA C151
 - b. Thickness: AWWA C150, Class 54
 - c. Exterior coating: Bituminous, AWWA C151, 51-8.1
 - d. Interior coating: AWWA C104
 - e. Joints: AWWA C110
 - f. Manufacturers:
 - i. U.S. Pipe: USIFLEX Pipe
 - ii. Clow: Ball and Socket Pipe
- B. PVC pipe:
 - 1. Design standard: UNI-B-13
 - 2. Gland design standard: ASTM A536
 - 3. Retainer gland safety factor: 2:1
 - 4. Design requirement: Twist-off nuts to assure actuating restraint
 - 5. Manufacturers: EBAA Iron: MEGALUG, Series 2000 PV

2.05 GATE VALVE AND BOX

- A. Gate valves:
 - 1. Design standard: AWWA C509, Resilient Wedge
 - 2. Opening: Counter-clockwise
 - 3. Non-rising stem with 2" square operating nut
 - 4. Joint: AWWA C111, mechanical joint
 - 5. Interior coating: AWWA C550
 - 6. Exterior coating: AWWA C550
- B. Box:
 - 1. Cast iron three piece screw type, adjustable box
 - 2. Cover marked "SEWER"
 - 3. Shaft: 5 1/4" internal diameter

2.06 SEWAGE AIR RELEASE AND VACUUM VALVE

- A. Body and cover: Cast Iron, ASTM A126 Gr.B

- B. Internal linkage, stem: Stainless Steel, Series T300
- C. Float: Stainless Steel, ASTM A240 T304
- D. Needle: Buna-N, Nitrile Rubber
- E. Exterior paint: Phenolic Primer Red Oxide
- F. Manufacturers:
 - 1. Apco/Valve & Primer Corporation, with back flushing accessories
 - 2. Val-Matic

2.07 DETECTABLE UNDERGROUND MARKING TAPE

- A. Minimum width of 3 inches.
- B. Brown colored detectable metallic tape bearing a legend similar to "Caution - Buried Pipeline Below".

2.08 BUILDING SEWER FORCEMAIN TAPPING VALVE

- A. Tapping Sleeve: Stainless Steel; Model 3490 Power Seal Pipeline Products Corporation
- B. Check Valve: F5345 Clow
- C. Tapping Valve: Clow F-6114 R/W tapping Valve
- D. For smaller taps, a bronze check valve and tapping valve may be used with permission from the sewer inspector.

PART 3 EXECUTION

3.01 FORCE MAIN INSTALLATION

- A. Install pipe in accordance with the pipe manufacturer's recommendations including:
 - 1. Unibell PVC Pipe Association.
 - 2. Ductile Iron Pipe Research Association.
- B. Alignment and grade:
 - 1. Lay pipe to the lines and grades established on the plans.
 - 2. Maintain a 10' horizontal separation from water main.
 - 3. Maintain an 18 inch minimum vertical separation from all utility crossings.
 - 4. When crossing water main, locate the force main below the water main. When the minimum separation cannot be met, locate the force main below the water main and position the force main section centered on the water main. Encase crossing in concrete.
- C. Earthwork:
Perform all trench excavation, pipe bedding and backfilling in accordance with Section 2200 - Earthwork.
- D. Pipe laying:
 - 1. Provide a minimum depth of cover, from the top of the pipe to the proposed finish grade, of 6 feet, unless noted otherwise on the plans.
 - 2. Center the pipe within the trench with adequate clearance between the pipe and the trench sidewalls.
 - 3. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate the joints.
 - 4. Thoroughly clean all foreign matter from the pipe and keep the pipe clean during the pipe laying operations by using temporary plugs.
 - 5. Pipe shall not be installed in trenches containing water or mud without the approval of

- the Engineer.
- 6. All pipe ends shall be plugged with a water tight plug when construction stops for an extended period of time or overnight.
- 7. Prevent plugged pipe from floating.
- 8. Damage to linings and coatings shall be cause for rejection of the complete section of pipe.
- 9. Place a detectable tape 24" above the top of pipe.
- E. Joining pipe:
 - 1. Thoroughly clean & lubricate bell, spigot, and gaskets.
 - 2. Only joint lubricants approved by the pipe manufacture will be permitted.
 - 3. Align the pipe and push "Home" without damaging the joint.
 - 4. Conform to AWWA C600.
- F. Joint restraint:
 - 1. Install all manufactured restrained joints in conformance with the manufacturer's recommendations.
 - 2. Provide adequate joint restraint at all tees, plugs, caps, reducers, and bends deflecting 222 degrees or more.
 - 3. Install only where indicated on the plans, in the specifications or where directed by the Engineer.
 - 4. Tie rods:
 - a. Install only where indicated on the plans, in the specifications or where directed by the Engineer.
 - b. Install where adequate earth backing is not available.
 - 5. Concrete thrust blocks:
 - a. Size and Shape: As shown on the plans.
 - b. Placing: Pour concrete only after all connections have been made.
 - c. Location: Thrust block shall extend from the fitting to the undisturbed earth of the trench wall. Keep block behind the bell of fitting.
 - d. Bracing: Support fittings and valves independently of the piping until the concrete has set.

3.02 SETTING VALVES

- A. Set and join valves as specified for pipe sections in paragraph 3.01.
- B. Set and firmly support valve boxes over the valve. Set the box centered and plumb over the valve operating nut. Set the box lid flush with the proposed finish grade.

3.03 FLUSHING

- A. General:
 - 1. All force main shall be flushed to remove dirt and foreign matter prior to connection to the existing sewer system.
 - 2. Water for flushing will be the sole responsibility of the Contractor.
 - 3. Water for flushing shall be from a potable source approved by the Engineer and the Michigan Department of Environmental Quality Drinking Water Division.
 - 4. If water is available from any existing system, the Contractor shall comply with any requirements from the agency who controls the existing water system.
 - 5. All connections to existing water supplies shall be made with a Michigan Department of Public Health approved backflow prevention device.
- B. Method:
 - 1. Flush force mains using a poly pig supplied by the Contractor.
 - 2. Insert the poly pig into the main at a location and using a method approved by the Engineer.

3. Retrieve the poly pig at a temporary blow-off assembly constructed by the Contractor, at a location approved by the engineer.
4. Repeat the poly pigging until all foreign matter is removed.

3.04 PRESSURE TESTING

- A. General:
 1. All force mains shall be tested.
 2. Conduct all testing only while the engineer is present.
 3. Notify Engineer at least 24 hours prior to testing.
 4. If any section of pipe fails to pass a test, the Contractor shall determine the source of the failure, repair it, and retest the section at no additional cost to the Owner.
 5. The tests shall be repeated until satisfactory results are obtained.
- B. Test preparation:
 1. Maximum test section: 2000 feet or as approved by the Engineer.
 2. Install temporary caps or pugs where necessary to test sections.
 3. Brace and sufficiently backfill all parts of the pipeline to prevent movement of the pipe.
 4. Water for testing shall be from a source approved by the engineer.
 5. If water is available from any existing system, the contractor shall comply with any requirements from the agency who controls the existing water system.
 6. Expel all air from the pipe prior to testing. If necessary to accomplish this, taps shall be made at the high points using corporation stops approved by the Engineer. No additional compensation will be made for taps of this type.
- C. Testing force main:
 1. Testing equipment:
 - a. Low flow-high pressure pump capable of producing 200 psi.
 - b. 0 to 200 psi gauge with minimum gradations of 10 psi.
 - c. Volume measuring device approved by the Engineer.
 2. Test method: AWWA C-600
 3. Test pressure: 150 psi, with not less than 125 psi at the highest point.
 4. Test period: 2 Hours
 5. Allowable leakage: Defined as the amount of water that must be supplied into the pipe to maintain the test pressure of 150 psi to within ± 5 psi during the test period. Leakage shall not exceed the rates shown below:
 - a. 2 inch pipe: 0.36 gallons per 2 hour per 1000 feet of pipe.
 - b. 3 inch pipe: 0.55 gallons per 2 hour per 1000 feet of pipe.
 - c. 4 inch pipe: 0.74 gallons per 2 hour per 1000 feet of pipe.
 - d. 6 inch pipe: 1.10 gallons per 2 hour per 1000 feet of pipe.
 - e. 8 inch pipe: 1.48 gallons per 2 hour per 1000 feet of pipe.
 - f. 10 inch pipe: 1.84 gallons per 2 hour per 1000 feet of pipe.
 - g. 12 inch pipe: 2.20 gallons per 2 hour per 1000 feet of pipe.
 6. Repair all visible leakage regardless of the amount.
- D. Testing valves:
 1. Test all valves in the closed position.
 2. Apply a net test pressure of 125 psi for a period of 10 minutes.
 3. A valve will be considered to have passed if after 10 minutes the pressure is within ± 2 psi of the net test pressure, and in the opinion of the Engineer, no appreciable amount of leakage takes place during the test period.

END OF SECTION

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Work necessary to restore all disturbed surfaces and facilities to equal or better condition.
 - 2. Provide, establish, and maintain seed, fertilizer, mulch, and erosion control materials.
- B. Related Sections
 - 02200 EARTHWORK
 - 02270 EROSION CONTROL

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Provide topsoil as specified in Section 02200 EARTHWORK.
- B. Seed: Provide seed mixture composed of the following proportion by weight:

Creeping Red Fescue	35%
Kentucky Blue Grass	15%
Perennial Rye Grass	50%
- C. Fertilizer:
 - 1. Provide chemical fertilizer with a 12-12-12 mixture of Nitrogen (N), Phosphoric Acid (P_2O_5), and Potash (K_2O).
 - 2. Provide net weight of contents and guaranteed analysis.
- D. Mulching: Provide straw, hay, or other material conforming to MDOT Specification 8.21.11, as approved by the Village.
- E. Mulch Mat: Provide netted mulch mat of 100% straw sewn into a lightweight, photo degradable netting.

PART 3 EXECUTION

3.01 TOPSOIL PREPARATION

- A. General:
 - 1. Prepare topsoil after finish grading of surfaces.
 - 2. Prepare soil to a friable condition by discing, harrowing, or otherwise loosening the soil to a depth of 3 inches.
 - 3. Break up all lumps of soil.
 - 4. Rake out all rocks and debris.

3.02 FERTILIZING

- A. Apply evenly on the prepared surface at a rate of 240 pounds per acre.
- B. Drill or broadcast method, placed no deeper than 1 inch.

3.03 SOWING

- A. Sow grass at a minimum rate of 150 pounds per acre.

- B. Method:
 - 1. Sow the seed following or in conjunction with the fertilizer.
 - 2. Sow only while soil is in a friable condition.
 - 3. Do not sow through mulch.
 - 4. Sow seed mixture by drill or broadcast method.
 - 5. Float seed sown by broadcast method so that 50% of the seed is mixed with the top ½ inch of the soil.
- C. Hydroseeding:
 - 1. Apply seed, fertilizer, and mulch in one application.
 - 2. Mulch shall be a wood fiber material.
 - 3. Apply at a rate of 1440 pounds per acre.
- D. Watering:
 - 1. Water all seeded areas to establish a smooth and full vegetative cover.
 - 2. Should erosion occur or the seed not grow within the guarantee period, regrade and reseed the disturbed area at no additional cost.
- E. Erosion control:
 - 1. Provide measures necessary to establish well rooted vegetation on slopes and ditch bottoms.
 - 2. Protect seeded slopes with netted mulch blankets or other suitable methods.
- F. Seasonal limitations:
 - 1. Apply seed between May 1 and October 1.
 - 2. Dormant seeding:
 - a. Permitted in limited areas to complete a project.
 - b. Apply after November 1, but not on frozen ground.

3.04 MULCHING

- A. Apply at a rate of 2 bales per 1000 square feet.
- B. Method:
 - 1. Apply immediately after seeding.
 - 2. Apply evenly and loose enough to allow sunlight and air to penetrate, but thick enough to reduce the rate of evaporation and erosion.
 - 3. Apply mulch adhesive as necessary at a rate of 150 gallons per acre.
- C. Netted Mulch Mat:
 - 1. Apply netted mulch mat to all slopes 4:1 or steeper, in all ditch bottoms, or in locations indicated by the Engineer.
 - 2. Prepare soil prior to placing mulch blanket with topsoil, seed and fertilizer.
 - 3. Place mulch blanket from top of slope down so overlap seams run parallel to slope.
 - 4. Overlap seams a minimum of 2" on parallel seams, and six inches, shingle style, on perpendicular splices.

END OF SECTION

SECTION 11306

FACTORY-BUILT ABOVE GROUND SUBMERSIBLE OR SUCTION LIFT
PUMP STATION AND VALVE PACKAGE

1.01 DESCRIPTION

- A. The Township recognizes the uniqueness of each individual pumping station and no one specification will cover all needs and applications. Plans must be developed by a registered professional engineer and submitted to the Township for review and approval. This may also require review by the maintenance authority.
- B. Consider the best type of pumping station needed for the application and review with the Township for approval prior to final design.
- C. Features:
 - 1. Provide a complete factory built, automatically controlled, appropriately valved wastewater pumping station as herein specified.
 - 2. All discharge piping, valves, flow meters, and controls must be above grade inside a protective enclosure.
 - 3. Provide submersible or suction lift pumps depending on the application. The Township will review the specific details of each application and determine the appropriate style.
 - 4. The system shall include but shall not necessarily be limited to the following:
 - A minimum of Two- (2) sewage handling pumps
 - One-piece molded fiberglass enclosure or custom built enclosure
 - Stainless steel guide rail system, stainless steel lift cable or chain, and discharge elbow on submersible stations
 - Aluminum hatch cover
 - Duplex control panel with starters, two variable frequency drives and associated electrical circuitry, circuit breakers, alarm system with dialer, alarm system battery back-up, level control system and floats and associated power pedestal for meter and transfer switch and additional conduit from pedestal to control panel, backup power receptacle, grounding and all associated electrical work.
 - 5. An on-site emergency generator may be required depending on the station sizing and location, as determined by the Township.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Fluid to be pumped is raw sewage.
- B. Pump performance:
 - 1. Each pump must be able to deliver a flow greater than or equal to the design peak inflow rate to the pump station at a total dynamic head that occurs at that pumping rate.
 - 2. Pump performance curve shall have a continuous rise from the duty point to shutoff head.
 - 3. Minimum shutoff head of 10 feet above the total dynamic head at the pump duty point
 - 2. Maximum pump speed shall be 1800 rpm.
 - 3. Pump shall be capable of handling raw, unscreened sewage and be able to pass a 3 inch diameter sphere. Pump suction connections shall have a minimum diameter of 4 inches.

1.03 FUNCTIONAL INTENT OF CONTROL SYSTEM

A. General:

The style and complexity of controls will vary depending on the pump station sizing. These specifications are offered as a general guide. The Township will establish the details of the control system functional intent on a case-by-case basis. Larger pump station control systems will be required to meet the control specification found in Section 16941 – Pump Station Controls and Instrumentation for Stations with PLC Control.

1. The control system shall be capable of operating manually or automatically (either VFD driven or level activated for lower flows).
2. The level control system shall start and stop the pump motors in response to changes in wet well level when set in the automatic mode.
3. The control system shall use intrinsically safe mercury float switches for high water and low water levels only in conjunction with a pressure transducer system or a bubbler system as specified in this section of the specifications.

B. Sequence of operation:

1. Operation Mode 1: Each pump shall be run by a variable frequency drive. The pumps shall be driven at a speed equivalent to match the incoming flow to the wet well. Each pump shall be required to operate for no less than 24 hours before the second pump is ramped up to a speed to match the incoming flow. The first pump shall then be shut down until the next cycle is to be started. These actions shall constitute one pumping cycle. Should the wet well level continue to rise to a point where an additional pump needs to be operated, the second pump for that cycle shall start and run until the first pump is capable of handling the flows coming into the wet well.
2. Operation Mode 2: Upon operator selection of this automatic operation, the "lead pump on" shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", indication shall be relayed to the pump to stop. These actions shall constitute one pumping cycle. Should the wet well level continue to rise to a point where an additional pump needs to be operated, the "lag pump on" shall start the second pump when the liquid reached the "lag pump start level" so that both pumps are operating. This operation shall be field adjusted during startup and approved by the OWNER and ENGINEER.
3. The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of each pumping cycle.
4. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
5. Manual operation:
Each pump shall be capable of being operated manually, independent of level settings and water level.

C. High and low water alarms:

1. In the event that the wet well liquid reaches a preset high or low water alarm level, the output relay shall energize a signal relay. The signal relay shall complete a 115-volt AC circuit for an external alarm light and the alarm dialer.
2. Activation of the low water alarm shall activate an emergency pump(s) shut off.
3. Either the high or low water alarm, power failure alarm, pump failure alarm, or pump seal failure alarms shall energize an alarm light and audio alarm on the master control panel and it shall announce an audio alarm through the dialer system.

- D. Power failure:
 - 1. In the event of a power failure, the battery back-up system will activate the dialer to announce a power failure.
 - 2. The battery back-up system will also activate the alarm light on the control panel if an alarm condition occurs. The battery back-up shall be capable of operating the dialer and the alarms for a minimum of one hour after normal power is interrupted.
 - 3. An onsite generator may be required to provide back up power.

1.04 SUBMITTALS

- A. Provide submittals listed below.
- B. Performance data:
Provide performance curves with pump efficiencies and horsepower requirements.
- C. Shop drawings:
Submit Shop Drawings showing dimensions and details of construction and installation.
- D. O & M manuals:
Submit operation and maintenance manuals for pumps and control panel.
- E. Manufacturer's Guarantee:
 - 1. Guarantee the equipment will perform its intended service and that any defective design or workmanship shall be corrected or replaced at no expense to the Owner.
 - 2. The guarantee period of the manufacturer's guarantee shall be five-years or 10,000 hours of operation from the date of final acceptance of the project by the Owner, unless specified otherwise. Other than normal wear and tear items, the manufacturer's warranty shall cover failures due to defects and workmanship as noted in E.1 above.

1.05 QUALITY ASSURANCE

- A. For installation of the work of this Section, use only personnel completely trained and experienced in installation of the materials and equipment, and thoroughly familiar with the design and approved Shop Drawings.
- B. Pump manufacturer shall have a minimum of 10 years of experience in the manufacture of submersible wastewater pumps.
- C. Control Panel manufacturer shall have 5 years experience in the manufacture and design of control panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND TYPES

- A. Modular Submersible Pump Station:
The modular submersible pump station shall be factory built and accessories shall be the Gorman-Rupp Aboveground Submersible Valve Packaged (ASVP) with JS series pumps.
- B. Modular Suction Lift Pump Station:
The modular suction lift pump station shall be factory built and accessories shall be the Gorman-Rupp Aboveground Packaged lift station with Super T series self priming pumps.

C. Dialer:

The dialer shall be a solid state component capable of dialing up to 16 phone numbers, each up to 24 digits in length. Phone numbers and standard pulse dialing of Touch Tone DTMF dialing are user programmable via the system's keyboard or touch tone phone. The manufacturer supplied dialer shall be covered by a three- (3) year warranty. Manufactured by Chatterbox or Sensaphone.

D. Magnetic Flow Meter:

The magnetic flow meter shall be a UniMag by TeleDyne ISCO with multiple sensor technology. The size and location shall be as shown on the plans. Electrodes shall be stainless steel. Flow transmitter shall be mounted in or near the station control panel.

E. Variable Frequency Drives:

The variable frequency drives shall be capable of continuous and efficient operation, and shall allow direct power by pass in the event of failure. Manufacturer shall be Allen Bradley, Square D, or Toshiba, and be locally serviced and stocked.

F. Control Panel:

The control panel shall be as manufactured by Magnum Electric.

2.02 MATERIALS AND FABRICATION – SUBMERSIBLE STATIONS

A. General:

1. Each pump in the system shall be identical in materials and performance.
2. Pumps and control panel shall be furnished by the same supplier.

B. Pump construction:

1. The pump impeller shall be made of corrosion resistant gray cast iron and shall be non-clogging, dynamically balanced and keyed to the motor shaft.
2. The pump volute shall be made of gray cast iron with smooth internal surfaces free of rough spots or flashing.
3. All exposed fasteners or washers shall be stainless steel.
4. The pump shaft shall be made of stainless steel.
5. Both the upper and lower shaft bearing shall be a permanently lubricated.
6. The pump shaft shall be sealed against leakage with a tandem double mechanical seal. The seals shall be lubricated and cooled with oil from an oil filled reservoir between the pump and motor. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when the pump is run dry. The seal shall not require the pumped liquid as a lubricant.
7. Seal failure warning system: An electrical probe shall be provided in the oil chamber for detecting the presence of water. A solid-state device mounted in the pump control panel shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber the probe shall close an electrical circuit and energize a warning light on the face of the control panel. A separate seal failure alarm shall be provided for each pump.

C. Motor and cable:

1. Provide ____ Hp, 480 volt, three phase, 60 hertz motors.
2. The motor shall be of the sealed submersible type.

3. Motors shall be rated as explosion proof meeting NEC requirements for Class 1, Division 1, Group D locations. Submergence will not be considered as an acceptable substitute for an NEC explosion proof rating.
 3. The pump motor shall be housed in an air filled watertight housing of gray cast iron. All moisture seals shall be of the "O" ring type.
 4. The motor shall be air filled and shall have moisture resistant Class F insulation rated for 155°C. Oil filled motors shall not be considered equal to the dry air filled type and are not acceptable.
 5. Each phase of the motor shall contain a bimetallic electromechanical temperature monitor embedded in the motor windings. The monitors shall be connected in series and coupled to the control circuit of the pump control panel. The pump must shut down should any one of the monitors detect high temperature. The temperature setting of the temperature monitors shall be 140°C $\pm$ 5°C and shall automatically reset once the stator temperature returns to normal.
 6. Power cables shall be 30 feet long of the Ozoflex plus or SO type construction suitable for submersion in sewage. The power cables shall meet requirements of NEC for flexible cords in wastewater pump stations and be rated for extra hard usage and be rated for NEC Class 1 Division 1 Group D locations. Strain reliefs shall be provided at each cable entry into the pump.
- D. Discharge elbow:
1. The discharge elbow shall be gray iron. The vertical discharge leg shall be a standard 125 lb. flanged end. Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well. The design must insure an automatic and firm connection of the pump to the discharge piping when lowered into place.
 2. The horizontal inlet leg shall be provided with a flat machined face compatible with the pump discharge connection.
 3. The elbow shall be provided with an integral base for anchoring and support of piping and pump to the wet well floor.
 4. Base and fittings shall be painted with a coal-tar epoxy coating.
- E. Guide rail system:
1. Guide rails shall be Schedule 40 stainless steel pipe of suitable diameter to provide the intended service for each pump.
 2. Guide rails shall be anchored as per the manufacturer's recommendations.
 3. All bolts, machine screws, nuts, washers, and lockwashers for complete assembly of access cover, guide rails, and discharge elbow shall be stainless steel.
 4. The lift cable shall be 316 stainless steel chain and shall be permanently attached to the pump. Provisions shall be made to attach the upper end of the lift cable to the wet well access frame.
- F. Wet well access cover:
1. The wet well access cover shall be provided by the pump manufacturer and be fabricated of aluminum.
 2. A single hinged door shall be provided over both pumps. The hinged door shall be 1/4" thick with non-skid diamond tread on the upper surface.
 3. The access door shall lock open in the vertical position and be provided with a locking hasp, or some similar means for discouraging unauthorized entry.
- G. Control panel and appurtenances:
1. The pump control panel shall be provided at 480V, 3 ϕ , 3Wire.

2. The complete control circuitry and transformer shall operate on 120 Volt, 60 Hertz, capable of operating all controls plus 1-120v, 20A, duplex GFCI outlet.
3. The electrical control equipment shall be mounted within a 60"x48"x14" Nema 1 stainless steel, dead front type control enclosure. The enclosure door shall be hinged and sealed with a neoprene gasket. It shall include a removable plated steel back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Operator controls shall be mounted on the enclosure door. The enclosure shall be mounted within the fiberglass valve enclosure. The control panel shall be equipped with vapor emission type corrosion inhibitors.
4. The control panel shall contain the following items:
 - Manual fused disconnect for each pump, or manual thermal magnetic molded case circuit breaker for each pump
 - Magnetic motor starter, NEMA rated, for each pump equipped with under voltage release and overload protection (manual reset)
 - Hand-Off-Automatic selector switch for each pump
 - Pump alternator relay
 - Control circuit breaker
 - Automatic reset thermal overload shutdown switch
 - Seal failure light for each pump
 - Two- (2) float level intrinsically safe control system for high and low water alarms
 - Liquid Level Control System (Air Bubbler or Ultrasonic transmitter type) to be submitted as part of shop drawings
 - Emergency pump(s) off at low water
 - Pump run lights for each pump (green)
 - Elapsed time meter for each pump, 6 digit, non-resettable, in hours and tenths of hours
 - Motor overload reset button (door mounted)
 - Red alarm light, exterior mount
 - Alarm dialer
 - Time delay relay to prevent simultaneous starting of pumps
 - Thermostatically controlled electric heater
 - Power failure battery back-up system for the alarms and dialer
 - Three phase voltage monitor
 - Transient voltage surge suppressor
 - 7.5kVa step-down transformer with the primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer.
5. A terminal strip with box-type connector shall be supplied to make all power and control connections for the pump. All terminals shall be marked for each identification. A ground terminal strip shall also be provided.
6. Intrinsically safe relays shall be Warrick, Dennison or Engineer approved equal. DeLaval "Safe Paks" are not acceptable.
7. Toggle-type switches and miniature lights will not be acceptable for seal failure and pump running lights.
8. Two- (2) mercury float switches with brackets capable of holding five- (5) switches shall be provided. Brackets shall be corrosion-resistant aluminum or stainless steel. Mercury switches shall be encapsulated in solid urethane foam floats. A weight shall be provided with each float switch. Each float shall be equipped with a sufficient length of cable to eliminate the need for splicing cables. Provide additional support as necessary to prevent tangling of the float lines.
9. Electrical junction boxes, if required, shall be located outside of the wet well basin. A minimum 3-inch conduit shall be provided through the side of the basin for power cables. A gas tight electrical conduit seal meeting NEC requirements for Class 1, Division 1,

Group D locations shall be provided between the basin and the electrical panel or any electrical junction boxes.

10. 1-120V GFCI weatherproof duplex outlet mounted per plan and powered through the control panel.
11. Manual transfer switch as noted on the plans.

H. Concrete wet well:

1. Wet well diameter shall be sufficient to allow installation of pumps, rails and appurtenances in accordance with manufacturer's recommendations. Minimum diameter shall be sized to meet manufacturer recommendations. The wet well access shall be fabricated from welded aluminum sections. A hinged aluminum door shall be provided for each pump. The hinged door shall be fabricated from 1/4" thick aluminum with non skid diamond tread on upper surface. All hardware on access assembly shall be stainless steel with a flush upper surface without protrusions. For safety, the door shall have a 300 lbs/sq.ft. rating and be fitted with a recessed staple for padlock. Door shall be furnished with a flush aluminum drop handle and automatic hold open arm.
2. Top slab: As provided, if any, by the manufacturer, otherwise contractor shall provide per plan.
3. Wet well sections: Standard precast reinforced concrete manhole sections with thicknesses as shown on plans. The sections shall conform to ASTM C-478 with premium joints conforming to ASTM C-443.
4. Base: Base shall be cast integrally with bottom section and shall be manufactured as specified for wet well sections.
5. The inlet and outlet pipe openings shall be a "KOR-N-SEAL" type gasket, or equal. All openings with pipe or conduit passing through the wall shall be sealed with a mechanically compressed elastomeric gasket such as "Link-Seal" or equal.
6. The exterior walls of the wet well shall be waterproofed with a coal-tar epoxy or equal. All joints between sections and lifting holes shall be plugged with a water-proofing agent such as "Water Stop" or equal.
7. The wet well shall be vented with a 4 inch diameter, cast iron pipe with 180 degree bend, as shown on the plans. The vent pipe shall be sealed at the wet well top with a "link-seal" or equal to prevent infiltration, or cast integrally with the top slab. The vent opening shall be screened with 1/4 inch hardware cloth. The outside vent opening shall be 24 inches above finish grade.
8. The Contractor shall cast in place a concrete hopper to channel solids towards the pumps. The hopper shall be formed from the wet well bottom at the pump base plate, to the wet well side wall, rising at a slope noted on the plans.
9. Provide concrete ballast as required to resist hydrostatic uplift of wet well. Ballast may be placed either at the bottom of the wet well or in a concrete slab above the wet well.

I. Discharge piping:

1. Discharge piping shall be ductile iron, AWWA C150, Class 53.
2. Joints: Flanged, AWWA C111, Class 125.
3. Fittings: Ductile iron, class 350, AWWA C110.
4. Coatings: Pipe manufacturer's suggested interior and exterior coatings for pipe submerged in wastewater.

J. Discharge Piping:

1. Discharge piping shall include the following piping and appurtenances:
 - a. Plug valve for each pump discharge line.
 - b. Check valve for each pump discharge line.
 - c. Tee or wye to combine the two pump discharge lines.
 - d. Hose connection to allow bypass pumping (see below).

e. Pressure gauge on discharge line.

K. Discharge Bypass Piping

1. The station header pipe shall incorporate a 2-way plug valve to permit emergency access to the pump station force main after isolation of the pumps. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip-tight shutoff plug mounted in stainless steel or teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface.
2. The header pipe shall penetrate the station side wall and terminate with a male OPW type quick connect fitting (this shall be verified with the OWNER).

2.03 MATERIALS AND FABRICATION – ABOVE GROUND SELF PRIMING STATIONS

2.3.1 Station Enclosure

A. The station enclosure shall provide sufficient inside area for maintenance personnel to perform normal operation and maintenance inside, sheltered, and free from foul weather. The enclosure shall consist of a base to support the pumps and a cover that can be moved without lifting. Minimum dimensions of the enclosure shall be seven feet by ten feet and six feet in height.

B. The station enclosure shall be manufactured of molded fiberglass reinforced orthophthalic polyester resins with a minimum of 30% fiberglass, and a maximum of 70% resin. Glass fibers shall have a minimum average length of 1¼ inches. Resin fillers or extenders shall not be used. Major design considerations shall be given to structural stability, corrosion resistance, and water tight properties. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long maintenance free life. They must be impervious to micro organisms, mildew, mold, fungus, corrosive liquids, and gases which can reasonably be expected to be present in the environment surrounding the wet well.

C. All interior surfaces of the housing shall be gel coated with a polyester resin. It shall be of suitable thickness and formulated to provide:

1. Maintenance free service
2. Abrasion resistance
3. Protection from sewage, greases, oils, gasoline, and other common chemicals.
4. Color fastness
5. Gloss retention

D. Interior surfaces of the enclosure cover and end panels shall be white for maximum light reflectivity. The base shall be of a darker color to de emphasize the presence of dirt, grease, etc. Colors used for both portions shall be approved by the Township.

E. The outside of the enclosure shall be coated with a suitable pigmented resin compound to insure long, maintenance free life. The fiberglass enclosure shall be a regular product of the pump station manufacturer.

F. Station base shall be constructed with a completely encapsulated structural steel frame for corrosion protection. Frame shall provide adequate structural support for pumps, motors, and piping. The encapsulated frame shall extend to lift points provided and assure adequate strength to resist deformation of structure during shipping, lifting, or handling. The structural steel base shall be completely encapsulated within a molded fiberglass reinforced polyester base shell. Wall thickness

shall be a minimum of 3/16 inch and base height a minimum of 5 inches to provide natural drainage of pump station floor to concrete pad. Interior of base shall be filled with a foamed in place rigid polyurethane structural foam. Foam shall be of closed cell type with a minimum density of 2.5 Pounds/cubic feet to give adequate floor support for maintenance personnel and for handling of equipment.

G. Holes through the base shall be provided for suction and discharge lines, air release lines, and level control line. Holes for the suction and discharge lines shall be provided with a grout dam incorporated in a grout retention cavity which the contractor shall fill at installation with suitable grout to seal each pipe to base joint against the entrance of hazardous gases from the wet well.

H. Station base shall incorporate a suitable flange designed for securing the pump station to the concrete pad in accordance with the station plans.

I. The enclosure cover shall be movable without lifting to permit overhead access to either half of the station interior and shall be completely removable. A hasp and staple locking device shall be provided to secure the enclosure over the station base. Suitable gasketing shall be provided between the enclosure cover and end panels and base for protection from the elements.

J. The enclosure cover shall be provided with a hinged fiberglass reinforced access door. Minimum dimensions of the door shall be 27 inches wide by 56 inches high for access by maintenance personnel to station interior. Door shall be a minimum 5/8 inch thick and shall be hinged with a full length stainless steel piano hinge to a full perimeter aluminum door casing secured to the enclosure cover. Such door casing shall incorporate a suitable drip shield over the opening. Door shall be furnished with a locking handle connected to a three point latching mechanism. Latch shall engage door casing at top, side and bottom for maximum security against vandalism. All mounting hardware for door casing and door must be concealed or of such type as to prevent vandalism with ordinary tools.

K. A duplex ground fault indicating utility receptacle providing 115 volts, single phase, 60 hertz shall be mounted inside the pump station. Receptacle shall be NEMA 5 15r configuration, heavy duty, specification grade and fitted with a weatherproof cover. The receptacle shall be protected by normal duty circuit breaker.

L. A shuttered exhaust fan with a minimum capacity of 500 CFM to change the air in the enclosure once every minute, shall be mounted in one end wall. In the wall approximately opposite to this end panel shall be mounted an air intake. Both intake and exhaust opening shall be equipped with a screen and cowl suitably designed to prevent the entrance of rain, snow, rocks, and other foreign material. Fan circuit shall be protected by a normal duty circuit breaker.

M. An enclosed and gasketed 200 watt light fixture shall be provided. The fixture shall be vapor tight, universal type. The fixture shall be centrally located to provide adequate light to all parts of the station and shall not constitute a physical hazard to inspection or service personnel. Light circuit shall be protected by a normal duty circuit breaker and shall be provided with a disconnect switch.

N. Pump station shall be provided with a 1300/1500 watt, 115 volt electric heater with cord and grounding plug. The heater shall be provided with an adjustable thermostat. Ungrounded heaters shall not be acceptable.

O. The pump station shall be furnished with 1" thick foam insulation which shall be applied to the cowl, door, and end panels to achieve an R-6 insulation factor. A gasketed seal around the door shall also be included.

2.3.2 Pump Design

- A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage.
- B. The manufacturer of the pumps must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
- C. Materials and Construction Features
 - 1. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
 - a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
 - b. Fill port coverplate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
 - c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.
 - 2. Coverplate: Coverplate shall be cast iron Class 30. Design must incorporate following maintenance features:
 - a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
 - b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.
 - c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.
 - d. Two O-rings of Buna-N material shall seal coverplate to pump casing.
 - e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
 - f. Easy-grip handle shall be mounted to face of coverplate.
 - 3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:
 - a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.
 - 1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level

and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

c. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive

pressure. Removal or installation of the check valve must be accomplished through the coverplate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

6. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

D. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs by incorporating the following features.

2. No special tools shall be required for replacement of any components within the pump.

E. Spare Parts Kit:

1. The following minimum spare parts shall be furnished with the pump station:

- a) One spare pump mechanical seal (complete with shaft sleeve)
- b) One cover plate O-Ring
- c) One rotating assembly O-Ring
- d) One set of rotating assembly spacers
- e) One set V Belts for each pump

2.3.3 Valves and Piping:

A. Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. Plug valves shall be of the non lubricated, tapered type. Valve body shall be semi steel with flanged end connection drilled to ANSI 125 lb. Standard. Valves shall have ports designed to pass spherical solids equal to the pumps capability. Valves shall be furnished with a drip tight shutoff plug mounted in stainless steel or teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface.

C. Automatic air release valves:

1. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure, and shall operate solely

on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.

4. Valves shall be field adjustable for varying discharge heads.

5. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge Kit

1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

F. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.3.4 Drive Unit

A. Motors

1. Pump motors shall be ____ HP, 3 phase, 60 hertz, 480 VAC, horizontal ODP, 1,800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with Class F insulation and 1.15 service factor for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

2.3.5 Drive Transmission

A. Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

B. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

C. The pump manufacturer shall submit power transmission calculations which document the following:

1. Ratio of pump/motor speed.
2. Pitch diameter of driver and driven sheaves.
3. Number of belts required per drive.
4. Theoretical horsepower transmitted per belt, based on vendor's data.
5. Center distance between pump and motor shafts.
6. Arc-length correction factor applied to theoretical horsepower transmitted.
7. Service factor applied to established design horsepower.
8. Safety factor ratio of power transmitted/brake horsepower required.

D. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.

1. Guards must be completely removable without interference from any unit component, and shall be securely fastened and braced to the unit base.
2. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.
3. The guard shall be finished in accordance with Section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.3.6 Electrical Control Components

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

1. Pump station components and controls shall conform to third party safety certification. The station shall bear a UL label listed for "Packaged Pumping System". The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The pump station components, panel enclosure, and all components mounted on the sub panel or control cover shall conform to UL descriptions and procedures.

B. Panel Enclosure

1. Electrical control equipment shall be mounted within a common NEMA 1 stainless steel, dead front type control enclosures. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.
2. All control devices and instruments shall be mounted using threaded fasteners, and shall be clearly labeled to indicate function.

C. Branch Components

1. Motor branch components to be of highest industrial quality, secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; Self-tapping screws shall not be used to mount any component.
2. Circuit Breakers and Operating Mechanisms
 - a. A properly sized heavy duty circuit breaker, with RMS interrupting rating of _____ amperes at _____ volts, shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.
 - b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.
3. Motor Starters
 - a. An open frame, across the line, NEMA rated magnetic starter with under voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "O", "OO", or fractional size are not acceptable. Power contacts to be double break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.
 - b. Overload relays shall be solid state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re establishing a control circuit. Trip setting shall be governed by solid state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.

c. A reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the door.

d. Provide Transient Voltage Surge Suppressor

e. Provide Three Phase Voltage Monitor

D. Control Circuit

1. A normal duty thermal magnetic circuit breaker shall protect all control circuits by interrupting control power.

2. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be oil tight design with contacts rated NEMA A300 minimum.

3. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.

4. Six digit elapsed time meter (non reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". Separate pilot lights shall be provided to indicate which motor is energized and should be running.

5. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing. If casing temperature rises to a level sufficient to cause pump damage, the high pump temperature protection circuit shall interrupt power to the pump motor. A visible indicator, mounted through the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

6. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.

7. The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer shall be protected by a thermal magnetic circuit breakers, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until primary circuit breaker is in "OFF" position.

a. Provide 5KVA Auxiliary Power Transformer

b. Provide Pump Start Delay controls

c. Provide Panel Heater

8. Wiring

- a. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the main entrance terminal blocks and final connections to remote alarm devices.
 - b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).
 - c. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:
 - 1) Line and Load Circuits, AC or DC power.....Black
 - 2) AC Control Circuit Less Than Line Voltage.....Red
 - 3) DC Control Circuit.....Blue
 - 4) Interlock Control Circuit, from External Source.....Yellow
 - 5) Equipment Grounding Conductor.....Green
 - 6) Current Carrying Ground.....White
 - 7) Hot With Circuit Breaker Open.....Orange
 - d. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.
 - e. Motor branch and other power conductors shall not be loaded above the temperature of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.
 - f. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.
9. Factory installed conduit shall conform to following requirements:
- a. All conduit and fittings to be UL listed.
 - b. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
 - c. Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
 - d. Conduit shall be sized according to the National Electric Code.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. General:
Install all equipment in strict accordance with the manufacturer's recommendations and Shop Drawings as approved by the Engineer.
- B. Wet well:
 - 1. The wet well base section shall be placed on 12 inches of bedding material or approved excavated material. The base bedding shall be compacted to 95% Modified Proctor Density. The base bedding shall present a smooth, uniform, and level surface.
 - 2. All work in setting the wet well shall be done under dry conditions. Dewatering by use of well pointing or other approved method shall be performed as necessary.
 - 3. Backfill material shall be placed around the wet well in layers not more than 12 inches deep. Each layer shall be compacted to 95% Modified Proctor Density by hand tamping or mechanical means.

3.02 ELECTRICAL WORK

- A. Power service:
The CONTRACTOR will be responsible for paying for the electrical service to the pump station and the CONTRACTOR is responsible for the coordination of the electrical service to the pump station location where the wiring is done at the meter socket.

3.03 MANUFACTURER'S FIELD SERVICES

- A. The equipment manufacturer shall provide field services as needed or as specified in Section 01650. Minimum instruction time shall be six (6) hours. If all issues have not been resolved by that time, manufacturer's representative shall provide additional time sufficient to resolve the issues.

3.04 TESTING

- A. Wet well leaks:
 - 1. Before placing the wet well into service, the contractor shall request the Engineer to perform a visual inspection of the wet well after the wet well has been backfilled and the water table has returned to its normal position.
 - 2. The inside of the wet well shall be completely dewatered 24 hours prior to Engineer's inspection.
 - 3. All visible infiltration leaks shall be eliminated using approved patching methods.
- B. Pump performance test:
 - 1. After the pumping units have been erected, performance tests, conducted by the pump manufacturer's representative shall be conducted.
 - 2. The Contractor shall provide the electricity, lubricating oil, and the water for the test when these items are available.
 - a. Contractor shall comply with any requirements from the local municipality for obtaining water for testing.
 - b. All connections to the local municipality's water supply shall be made with a Michigan Department of Environmental Quality approved backflow prevention device.

3. The measurement of the quantity of water pumped is included in the performance test.
4. The performance tests shall be conducted under the observation of the Engineer and the supervision of the municipality or entity that will operate the completed installation and with the cooperation of the manufacturer's factory representative.
5. These tests shall be carried out by operating each pumping unit through the range specified for a continuous period of at least 2 hours, or until it is shown to the satisfaction of the Engineer that all of the equipment is in perfect condition and will meet the requirements specified.

END OF SECTION

SECTION 16941

PUMP STATION CONTROLS AND INSTRUMENTATION
For
STATIONS WITH PLC CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work included:
1. Provide all equipment, supplies, materials, parts, and labor necessary to install the electrical power and control system for the pumping station as herein specified.
 2. The improvements shall include but shall not necessarily be limited to the following:
 - Demolition of existing electrical power panel and pump control panel, if present
 - Provide control panel with starters, circuit breakers, alarm system, and level control system
 - Salvage components requested by the Authority
 3. The new pump station control system shall have the following features:
 - a. PLC based control system with float and relay back up
 - b. Operator interface panel with intuitive and easy to adjust set points

1.02 FUNCTIONAL INTENT OF CONTROL SYSTEM

- A. General:
1. A liquid level control system shall start and stop the pump motors in response to changes in wet well level.
 2. Control system shall use a programmable logic controller for all pump and alarm functions.
 3. Control system shall use a pressure transducer with HWL and LWL intrinsically safe mercury float switches as a redundant backup.
 4. Soft start starters for each pump will be programmed to "ramp up" to the run speed and "ramp down" on pump shut off so as to lessen the stress on the piping system as required.
 5. Status of all pumps shall be monitored via soft start feed back. Should either pump fail to start, or shut off when called to run, a "Pump Fail Alarm" will be initiated and the pump will be placed "Off Line" until manually reset.
- B. Sequence of operations:
1. The control assembly shall be capable of operating either manually or automatically. When in the automatic mode, the pumps shall operate in a lead-lag fashion. A maximum of two pumps shall be run in auto mode at any time. The lead pump shall be selectable by the operator.
 2. Automatic operation:
 - a. Liquid level rises to "lead pump on" level and starts the lead pump.
 - b. Liquid level lowers during pumping to "pump off" level and stops all pumps.
 - c. These actions constitute one pumping cycle.
 - d. Should the liquid level continue to rise above the "lead pump on" to the "lag pump on" level, the lag pump shall also start.
 - e. Should the liquid level continue to rise above the "lag pump on" the high water alarm shall activate.
 - f. Lag pump shall operate on a time delay to avoid simultaneous starting of pumps.
 - g. Application of power to the lag pumps shall not be contingent upon completion of the lead pump circuit.
 3. Manual operation:

Each pump shall be capable of being operated manually, independent of level settlings.
- C. High and low water alarms:

1. If the wet well liquid level reaches a preset "high" or "low" water alarm level, the output relay shall energize an external alarm light and dialer shall activate.
 2. Activation of the low water alarm shall activate an emergency pump(s) shut off.
- D. Telemetry alarm:
1. Alarms will be sent to the Controller (PLC) and the Controller (PLC) will initiate the Autodialer to call one of the four (4) preprogrammed phone numbers to notify HSASDA personnel of the alarm. Any one alarm will initiate the Autodialer to call out on a single channel. The following conditions shall activate a dial out alarm:
 - a. Power outages
 - b. Generator running
 - c. High water alarm
 - d. Low water alarm
 - e. Second lag pump running
 - f. Phase failure
- E. Self diagnosing software with display messaging to aid the operators:
1. All circuit breakers shall have trip contacts.
 2. All overloads shall have trip contacts.
 3. All float relays shall have spare dry contacts.
 4. Three phase monitor shall have two spare contacts.
 5. Integrate all trip conditions with the PLC

1.03 QUALITY ASSURANCE

- A. For installation of the work of this Section, use only personnel completely trained and experienced in installation of the materials and equipment, and thoroughly familiar with the original design and approved Shop Drawings. Prospective bidder must provide documentation to the Owner of prior experience.
- B. Supplier and installer shall build or stock materials locally, provide local product support, and be available to respond within 3 hours for emergency repairs.
- C. One instrumentation integrator shall be responsible for the compatibility and proper functioning of the control system and shall provide all instrumentation and control equipment described in this section.
- D. All instrumentation and control components of the same type shall be the product of the same manufacture. Components shall be readily accessible. Proprietary equipment will not be allowed.
- E. The system integrator shall provide UL listed components, with the finished product meeting all NEC requirements and the approval of the local electrical inspector.
- F. Include all components necessary to achieve the functional intent indicated on the drawings and in these specifications whether listed or not.
- G. The Instrumentation Contractor and the Owner shall jointly own the programming codes. The Owner shall have the right to modify the codes or use elsewhere in their system. The Owner shall also have the right to have the codes modified by programmers not associated with the installer after the initial warranty period has expired. The programming codes shall not be given or sold to third parties without the written consent of the original Instrumentation Contractor and the Owner.
- H. Guarantee:
Submit written 1 year guarantee for materials and 2 year guarantee for workmanship and functionality after the date of startup.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND TYPES

- A. PLC:
 - 1. Manufacturer: Allen Bradley, Digitale, or equal
 - 2. Features:
 - a. Provide required power supply and I/O components.
 - b. Provide a minimum of 10% spare I/O's.
 - c. PLC features EEPROM program storage, 14.8 K of memory, 2 communication ports, Networking port, Real time clock, and built in DC power supply. Must supply programming software with PLC.
- B. Pressure Transducer:
 - 1. Manufacturer: KPSI, Model 70 with KPSI Model 815 Aneroid bellows and Model 009 Lightning Protection, or equal
 - 2. Features:
 - a. Provide a 4-20ma signal proportional to the level in the wet well. The submersible probe / transmitter shall be specially designed for use in sludge applications.
 - b. 24 VDC input, 4-20 ma output. No stilling well needed. Must be able to handle High turbulence and sediment.
 - c. Operating range of 0 – 35 feet.
- C. Soft Start:
 - 1. Manufacturer: Emotron, or equal
 - 2. Features:
 - a. Door operated disconnect with a 480 vac circuit breaker.
 - b. Across the line starter in the enclosure.
 - c. Selector switch for soft start or across the line start.
 - d. Hand / Auto selector switch.
 - e. Run lights, and a Fault light.
 - f. Electronic overload (adjustable).
 - g. Provide variable torque control to provide smooth acceleration and deceleration to stop check valve hammering
 - h. Provide load monitoring to protect the pump incase of check valve failure
- D. Lightning Protection:
 - 1. Provide lightning and surge suppression sufficient to protect installed components.
- E. Alarm Dialer:
 - 1. Manufacturer: RACO, or equal
 - 2. Model: Chatterbox 101CB-8
 - 3. Components:
 - a. Power: 120 Volt
 - b. Backup Power: 6 hour battery backup with integral charger
 - c. Contacts: 8 channel digital inputs
 - d. Phone: Must operate on a standard touch tone phone line

2.02 MATERIALS AND FABRICATION

- A. Panel fabrication:
 - 1. House pump control panel and appurtenant equipment in NEMA 4 panel enclosures manufactured by Hoffman or equal.
 - 2. Provide adequate braces and stiffeners to securely support the panels and all equipment or instrumentation mounted on or in the panels.
 - 3. Ground smooth, prime and paint all openings cut in the panel or projections to match the panel.

4. Finish paint coating: UL approved finish on all surfaces with color approved by the Owner.
 5. Install all piping and wiring in a workmanlike manner, grouped, bundled, supported, and routed horizontally and vertically to provide a neat appearance.
 6. Furnish filler plates for all spare mounting spaces.
 7. Control power for the panel shall require a 120 volt, single phase, 15 ampere, 3 wire power supply.
 8. All wiring entering or leaving the panel shall pass through labeled terminal blocks.
 9. Label all wires at both ends.
 10. Furnish engraved nameplates for all front panel mounted instrumentation. White plate with black lettering.
- B. Functional intent:
1. Control panels: Front access designed to house the controllers, indicators, recorders, totalizers, HOA switches, and any other instrumentation required to achieve the functional intent of the specifications and as indicated on the Drawings.
 2. Control panel: Vertical flat type shape, designed for front access.
 3. The complete panel shall be factory tested prior to shipment and field installation shall consist only of setting the panel in place and making the required electrical connections.
 4. Height of control panels shall not exceed 78 inches.
 5. All panels shall have one disconnect means. All voltages required shall be produced from the panel.
- C. Specification and design:
- Provide U.L. listing on all pre assembled panels to evidence compliance with NEC Article 90-6, 100, and 110-3.
- D. Control panel and appurtenances:
1. The pump control panel shall be provided by one supplier.
 2. The complete control circuitry shall operate on 110 Volt, 60 Hertz, single phase power.
 3. The control panel shall contain the following items:
 - Manual fused disconnect for each pump, or manual thermal magnetic molded case circuit breaker for each pump
 - Magnetic motor starter, NEMA rated at 150% of actual pump horsepower, for each pump equipped with under voltage release and overload protection on all three phases (manual reset)
 - Dead front panel for safety
 - Soft start
 - Operator Interface Keypad
 - Hand-Off-Automatic selector switch for each pump
 - Pump alternator relay
 - Lead pump selector
 - Control circuit breaker
 - Automatic reset thermal overload shutdown switch
 - Seal failure light and shutdown switch (manual reset)
 - Level control system
 - Emergency Pump(s) off at low water
 - Pump run lights for each pump (green)
 - Elapsed time meter for each pump, 6 digit, non-resettable, in hours and tenths of hours
 - Motor overload reset button (door mounted)
 - Alarm light, exterior mount with red globe.
 - Transformer(s), as required
 - Time delay relay to prevent simultaneous starting of pumps
 - Phase failure relay
 - Space heater with thermostat
 - LED indicating lamps
 - Internal lights to illuminate components
 4. Floats and relays shall be 24 volt, with 4 pole indicating relays with manual actuator, or equal.

5. Redundant float switches shall be roto-float by Anchor Scientific or equal.
6. High water and low water alarm relays shall be provided with auxiliary dry contacts for telemetering equipment.
7. The control center shall be equipped with a duplex grounding receptacle. The receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.

2.03 SPARE PARTS

- A. Provide the following spare parts:
1. 1 Pre-programmed Controller
 2. 1 Power supply of each type provided.
 3. 1 Input / Output card of each type provided.
 4. 1 pilot light lens of each color provided.
 5. 1 relay of each type provided
 6. 1 can factory spray touch up paint

PART 3 - EXECUTION

3.01 INSTALLATION

General:

Install all equipment in strict accordance with the manufacturer's recommendations and Shop Drawings as approved by the Owner.

3.02 ELECTRICAL WORK

All electrical work shall be performed as specified in the plans. All work within the wet well shall meet the provisions of the local electrical codes and approval of the local electrical inspector.

3.03 MANUFACTURER'S FIELD SERVICES

The supplier/installer shall provide field start up and training services. Minimum instruction time shall be four (4) hours, if needed.

3.04 TESTING

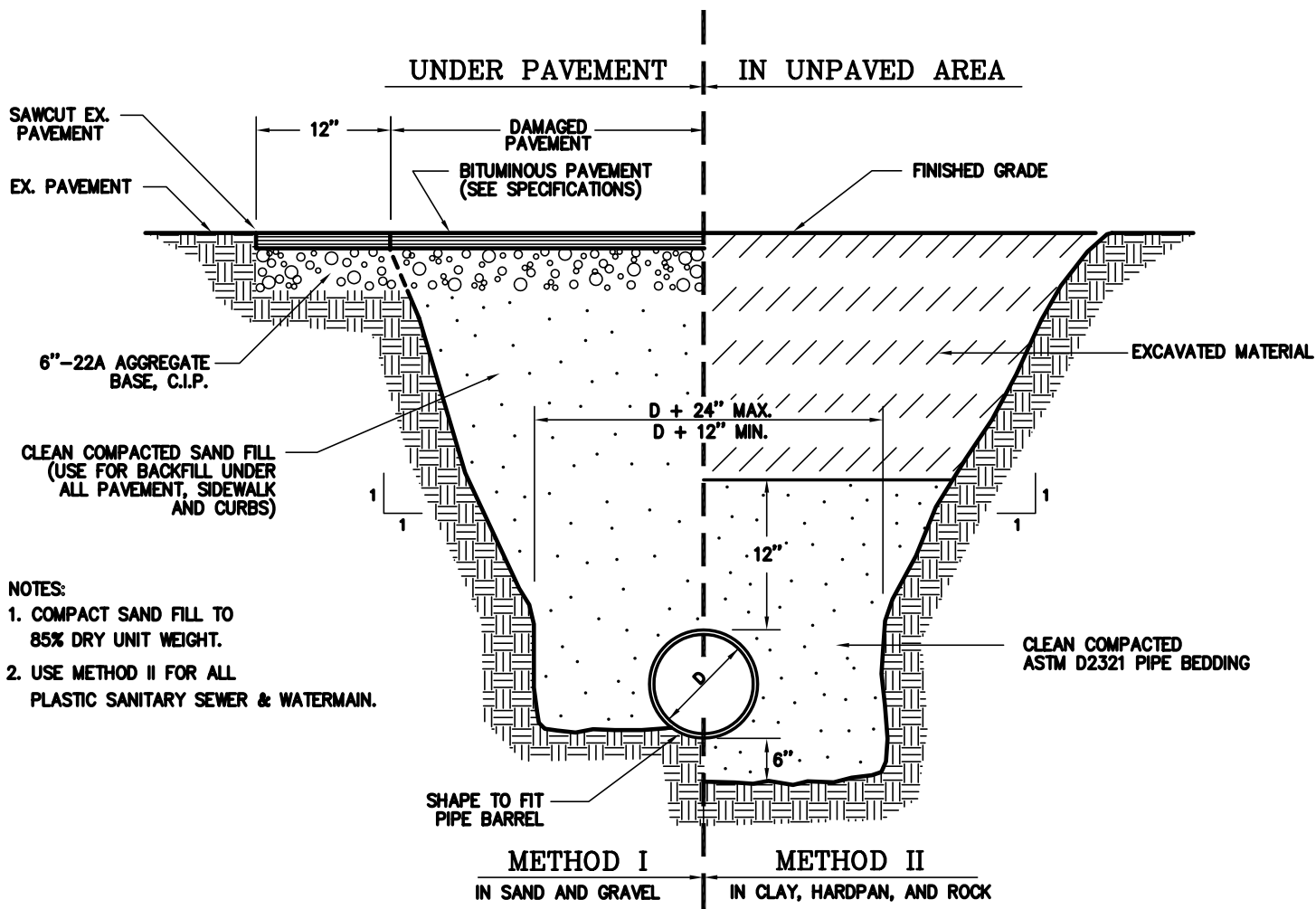
Pump performance test:

1. After the control system has been installed, performance tests shall be conducted.
2. These tests shall be carried out by operating each pumping unit through the range specified for a continuous period of at least 2 hours, or until it is shown to the satisfaction of the Owner that all of the equipment is in perfect condition and will meet the requirements specified.

3.05 CLOSE OUT DOCUMENTS

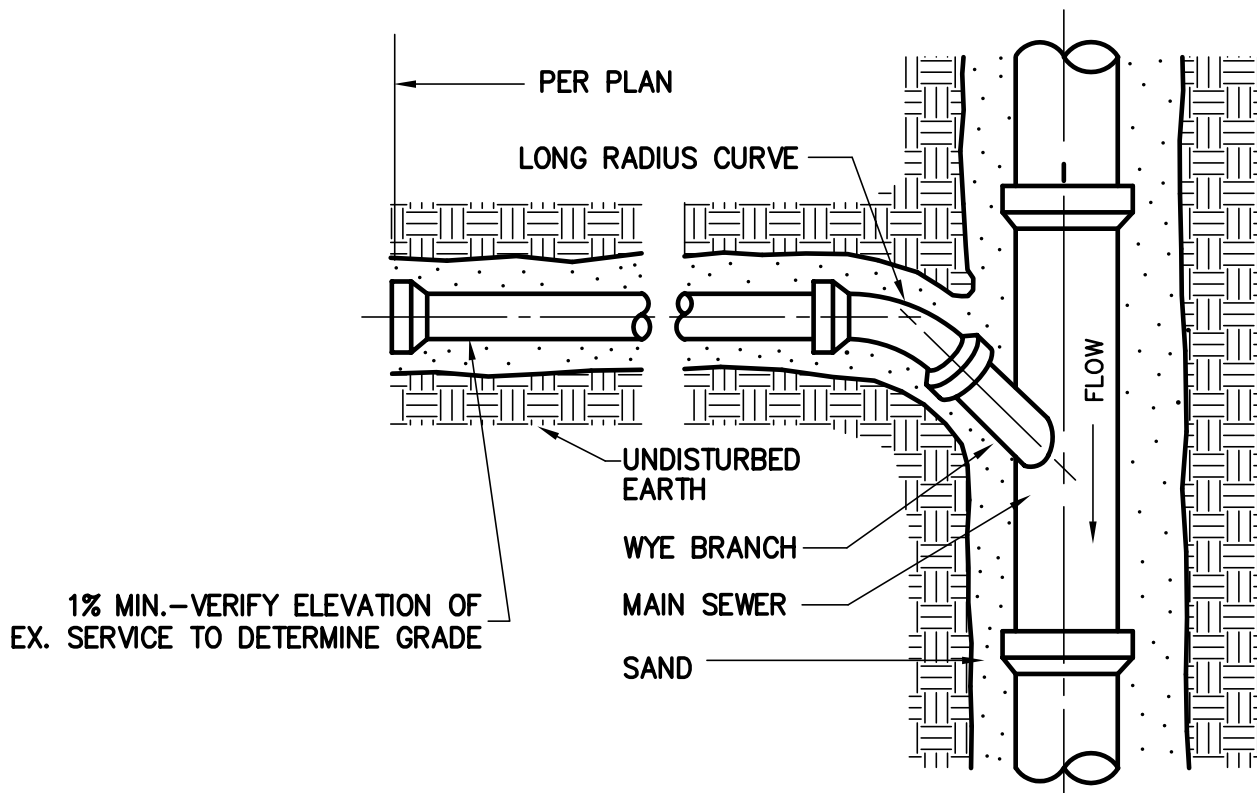
- A. O & M manuals:
 - 1. Submit three copies of operation and maintenance manuals for pumps, level controls, and control panel.
 - 2. Provide O&M manuals within 30 days of start up.
- B. Record Drawings:
 - 1. Provide record drawings documenting all field modifications to the plans and specifications.
 - 2. Update wiring schematics and provide additional copies to be stored within the provided control panels.
 - 3. Provide a hard copy of all programming logic and document all field settings at the time of start up.
 - 4. Provide a digitally stored copy of the software and the PLC program.

END OF SECTION



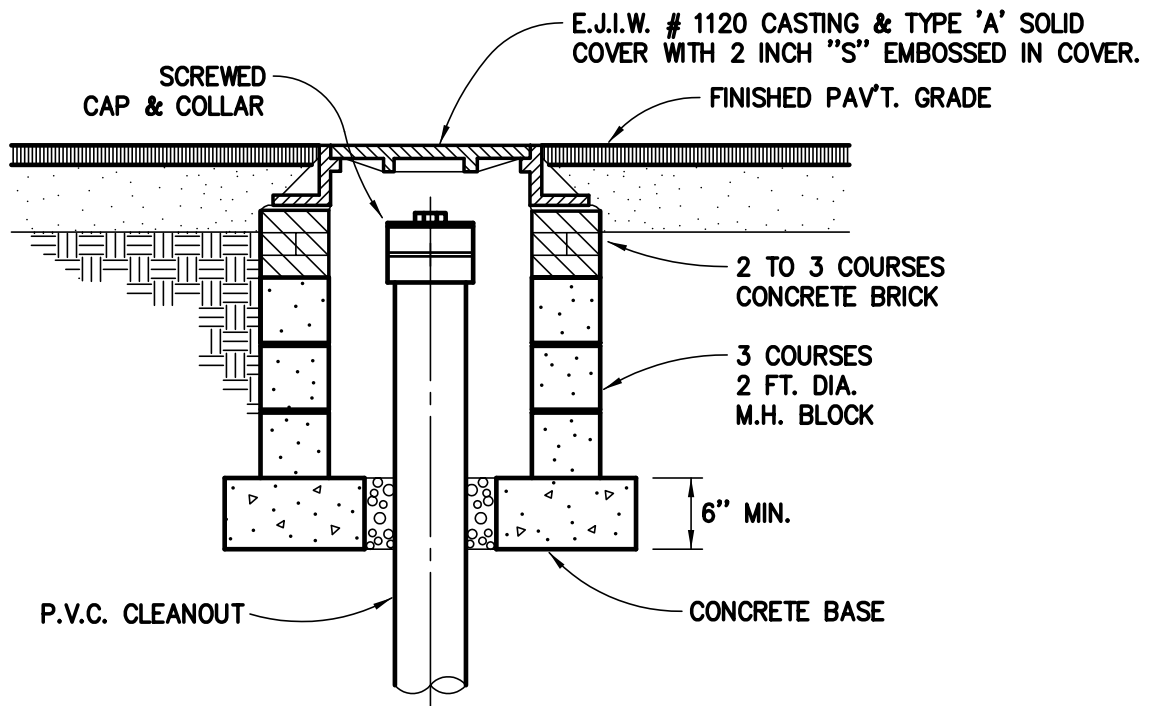
TRENCH DETAIL

NO SCALE



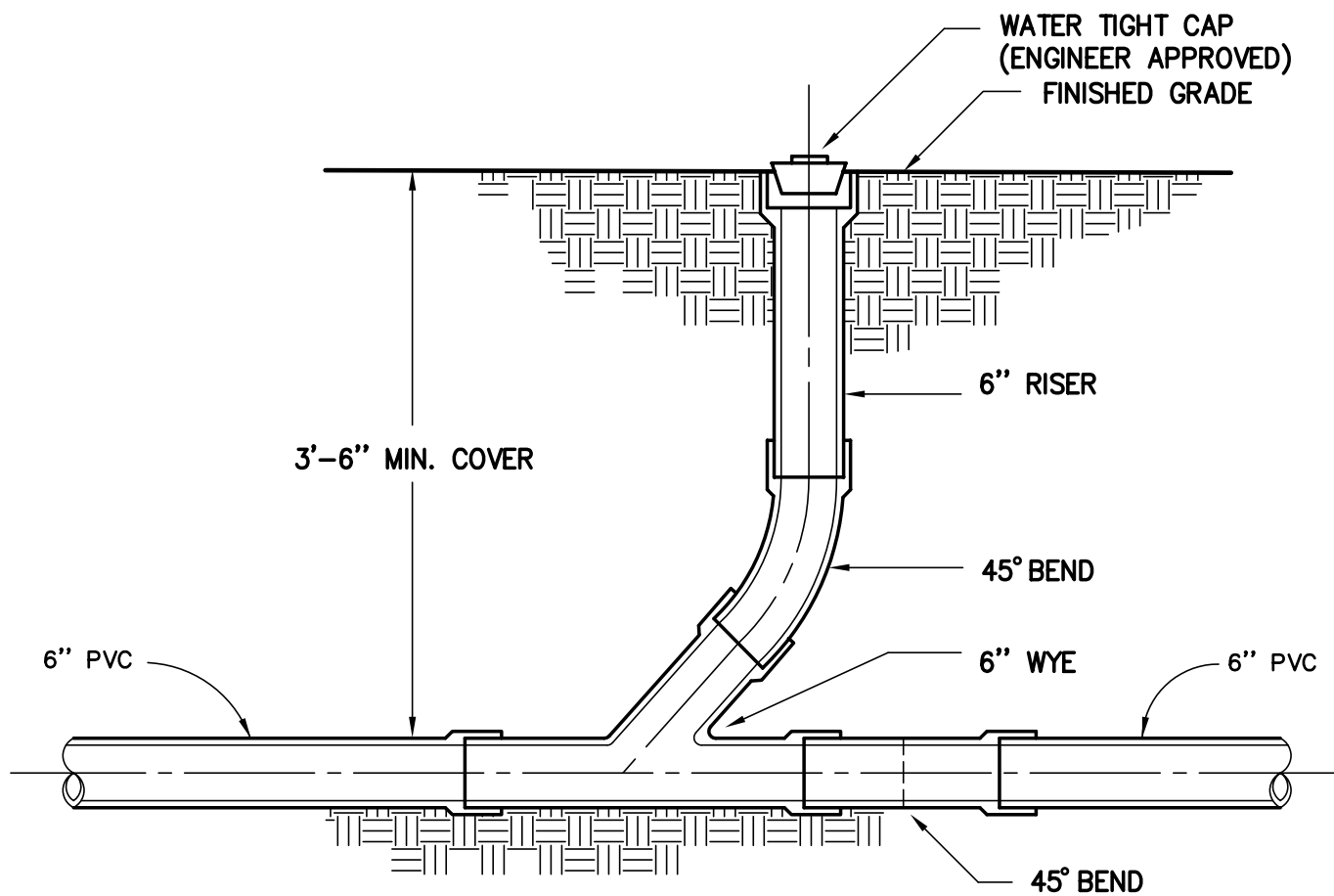
WYE INSTALLATION DETAIL

NO SCALE



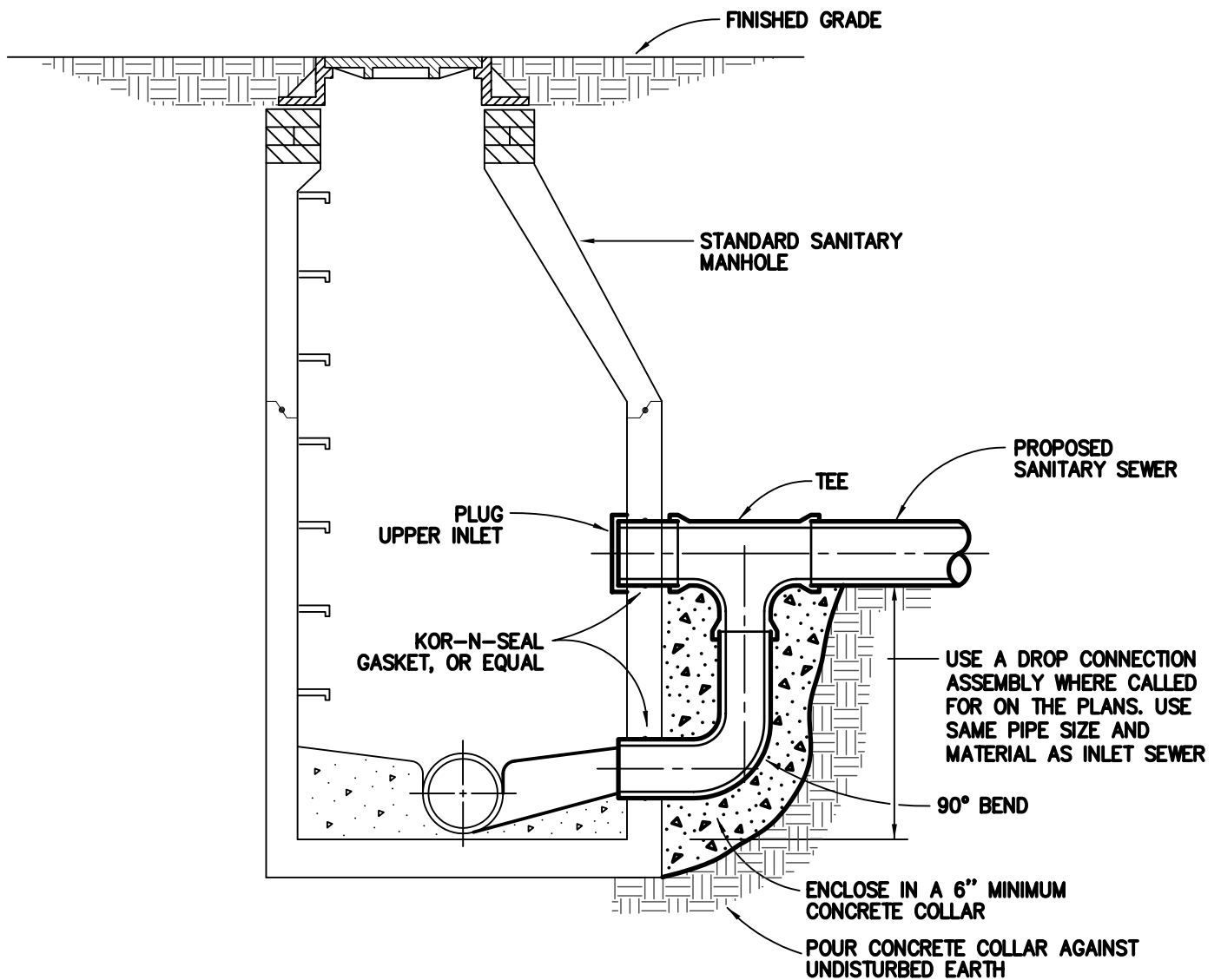
SANITARY CLEANOUT VAULT DETAIL

NO SCALE



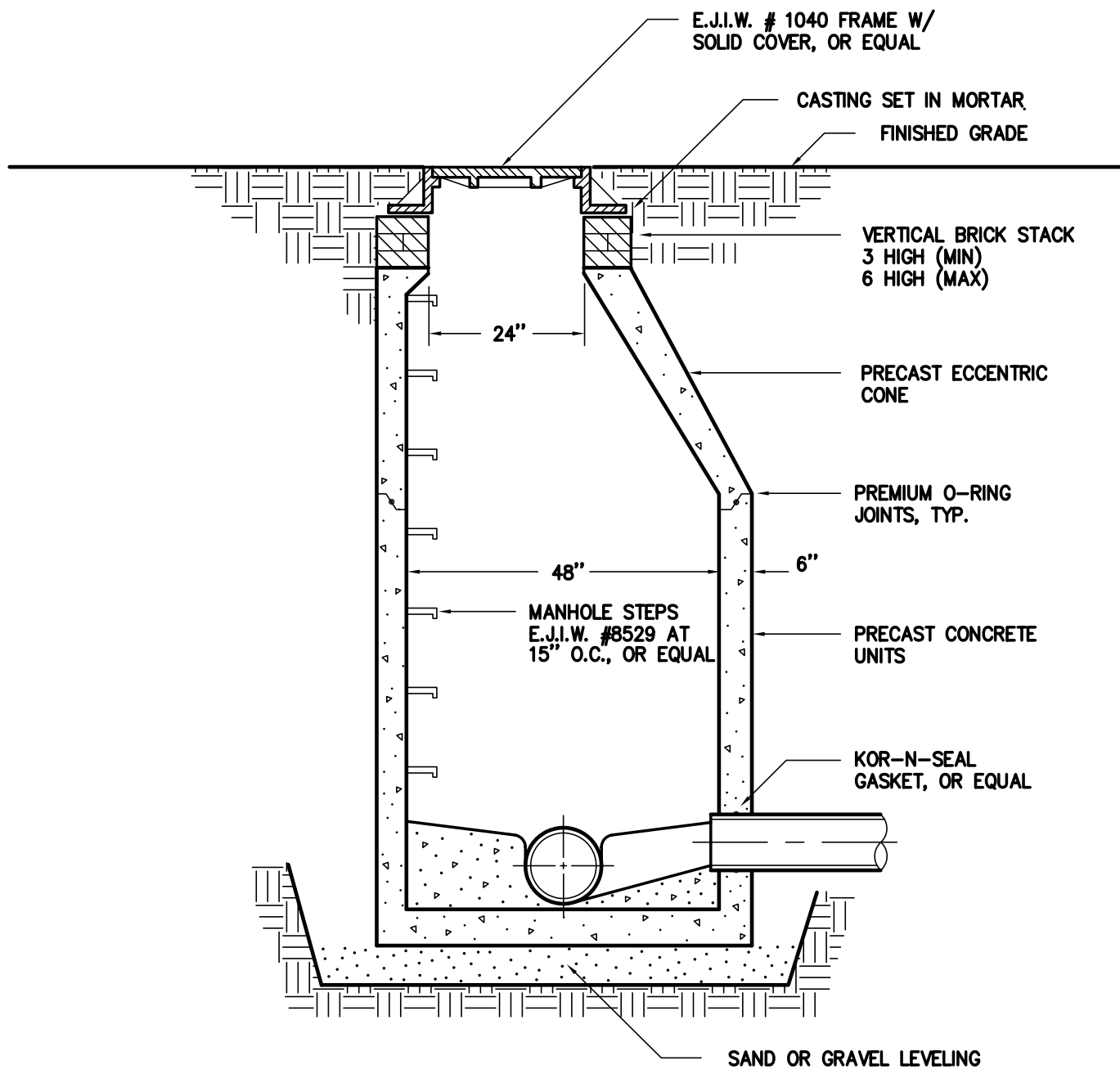
WYE AND CLEAN-OUT DETAIL

NO SCALE



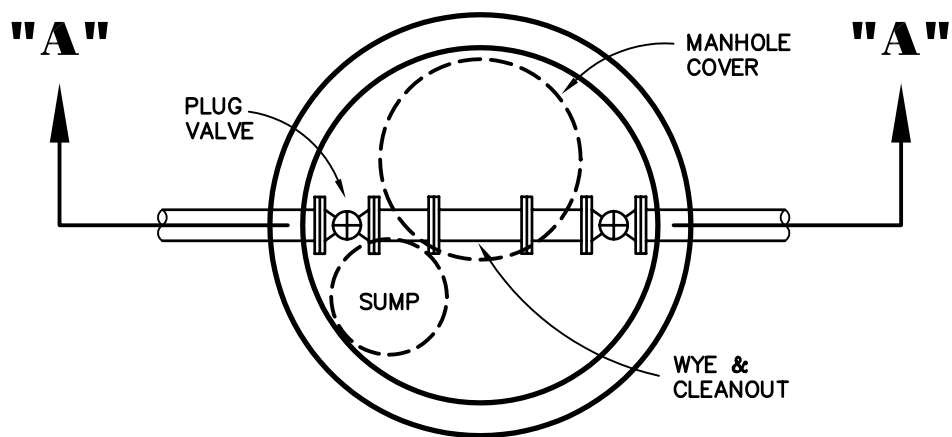
DROP CONNECTION DETAIL

NOT TO SCALE

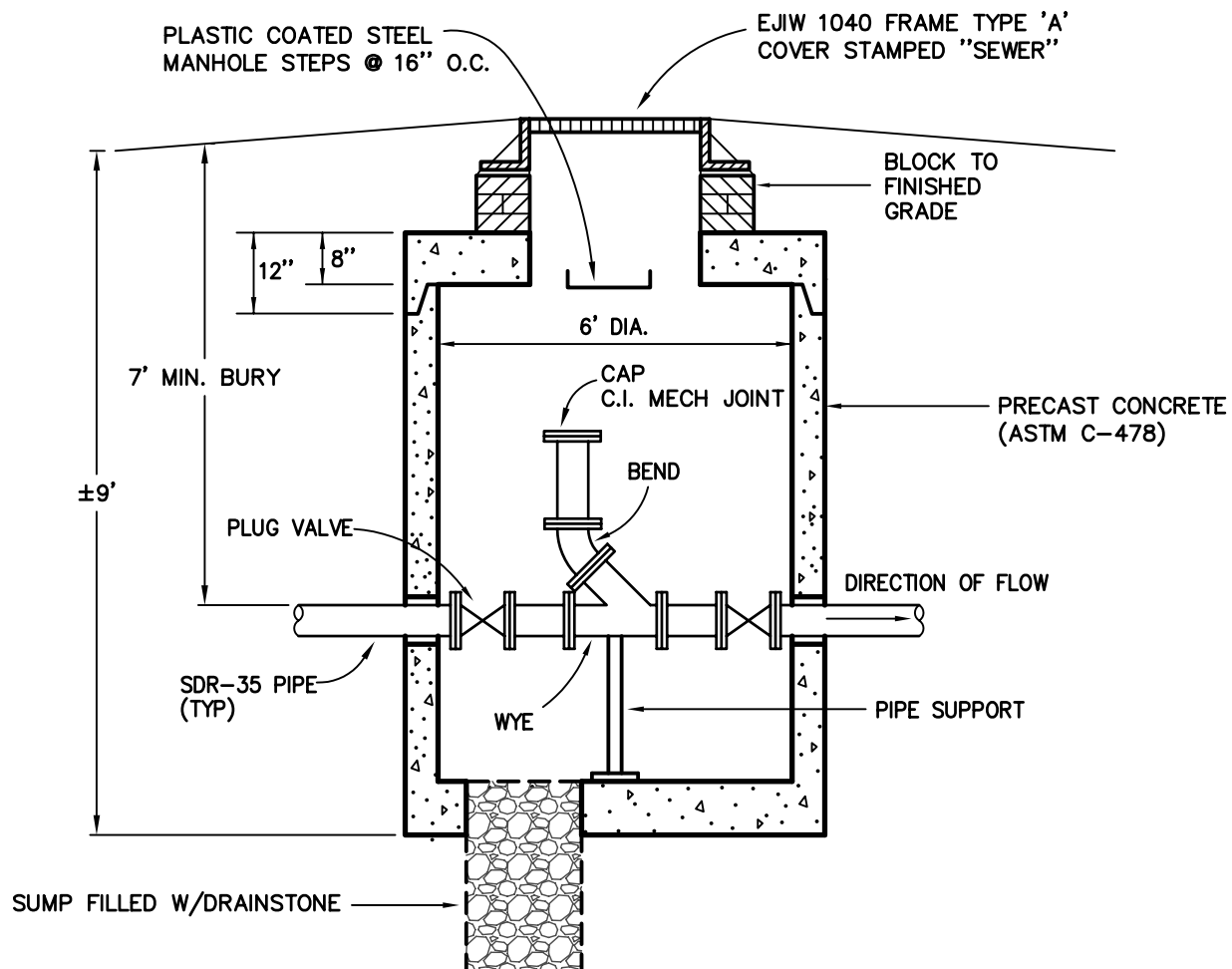


SANITARY MANHOLE DETAIL

NO SCALE



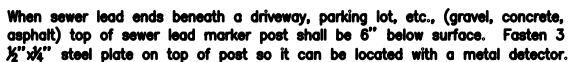
PLAN VIEW



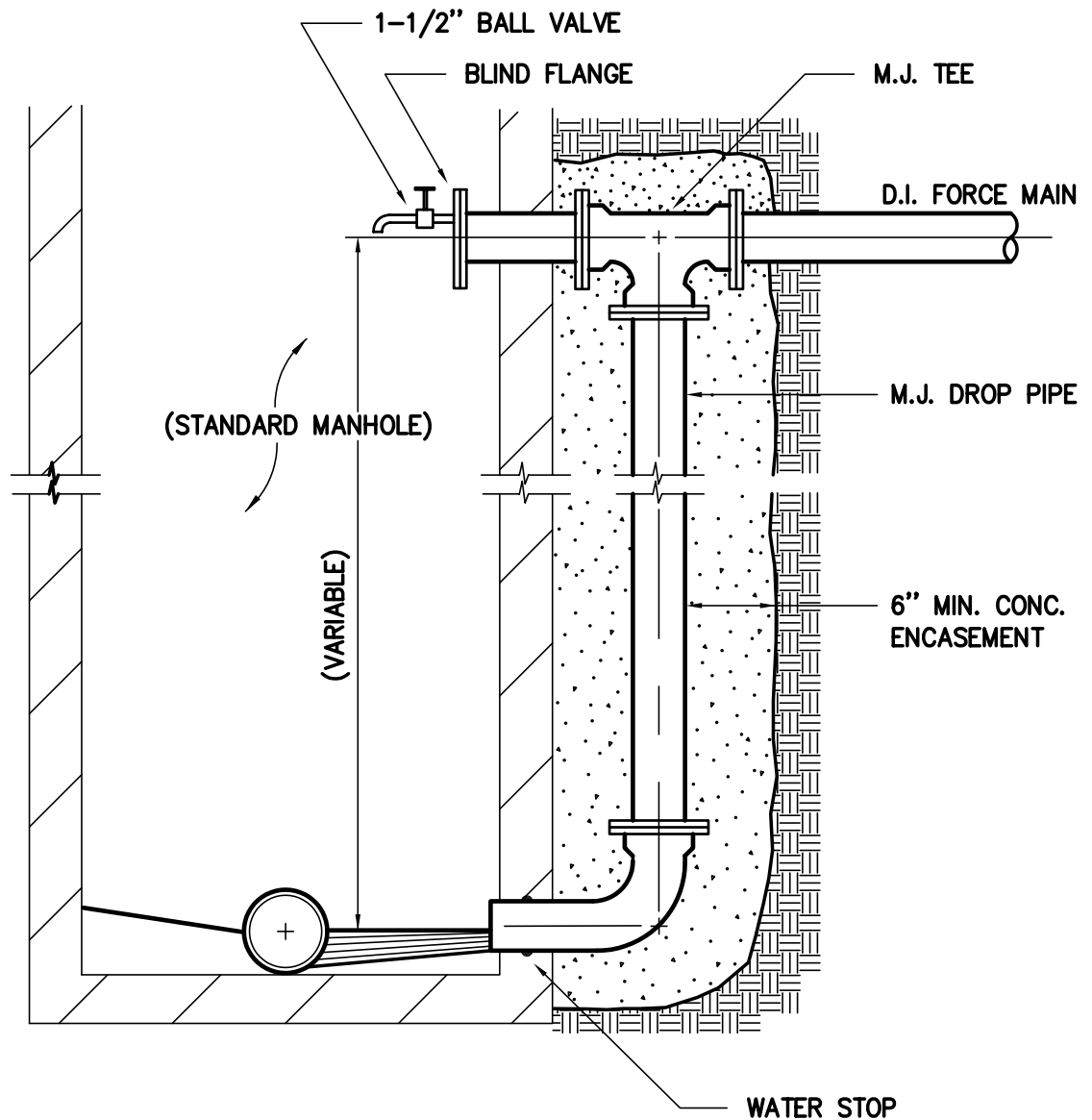
PROFILE-SECTION 'A-A'

FORCEMAIN CLEANOUT & ISOLATION VALVE DETAILS

NOT TO SCALE



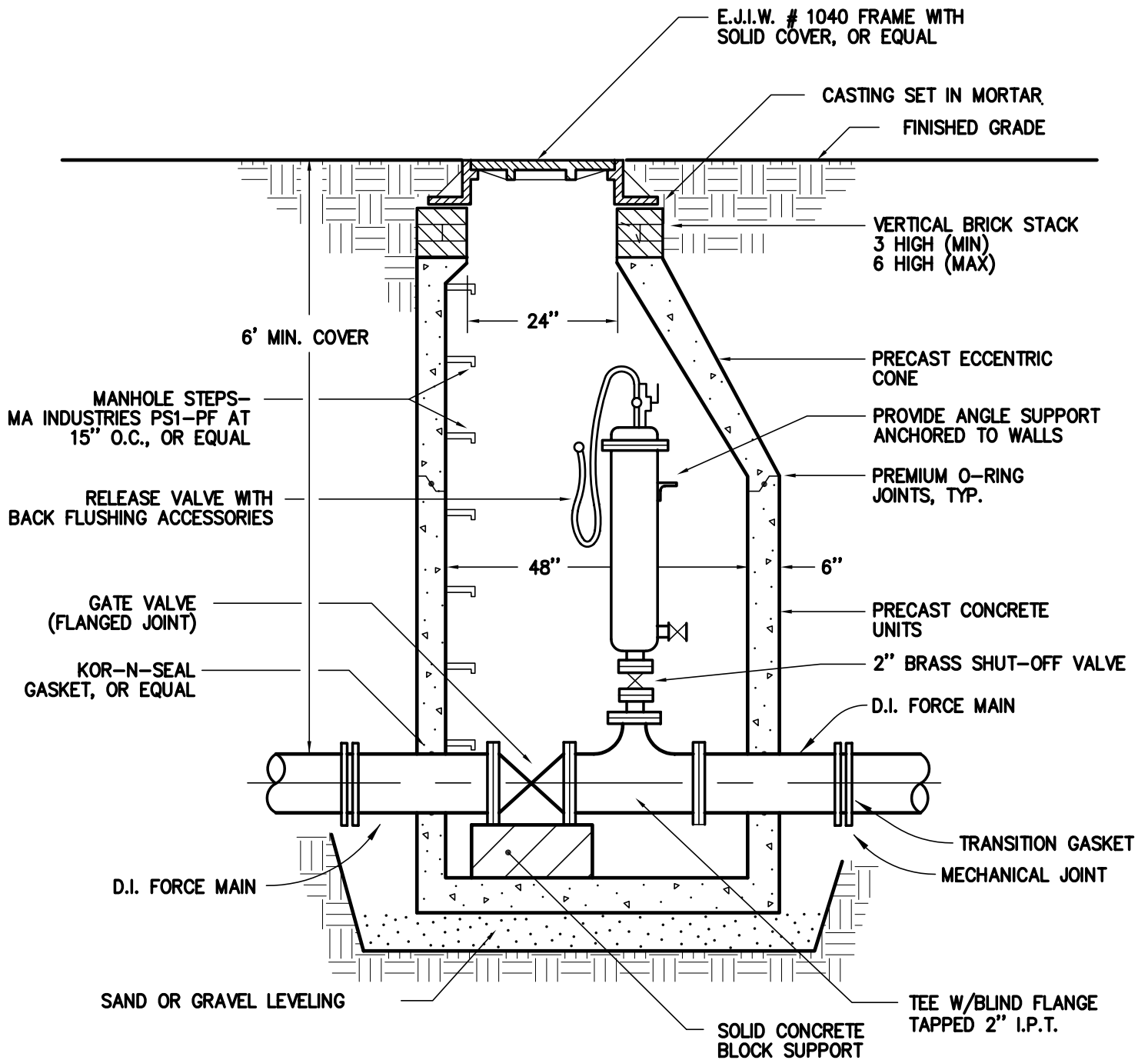
NO SCALE



FORCE MAIN OUTLET DETAIL

NO SCALE

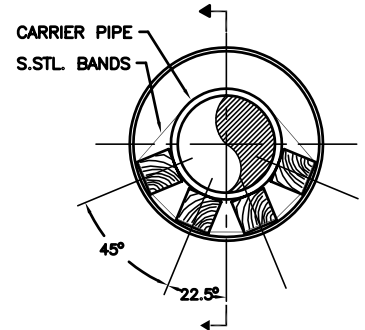
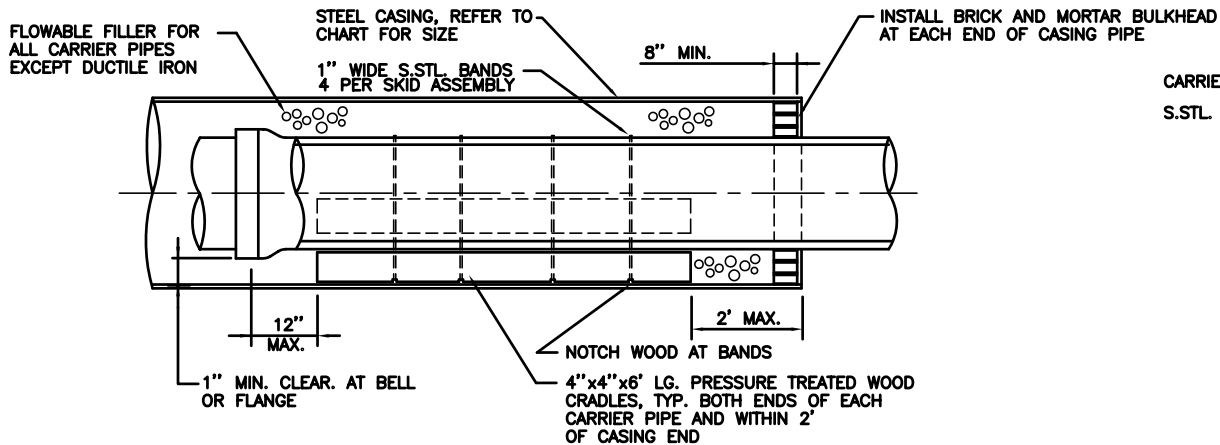
NOTE: TRANSITION TO D.I. FORCEMAIN
A MIN. OF 10' OUTSIDE OF MANHOLE



FORCE MAIN AIR RELEASE VALVE DETAIL

NO SCALE

NOTE: TRANSITION TO D.I. FORCE
MAIN MIN. OF 10' OUTSIDE MANHOLE



Section

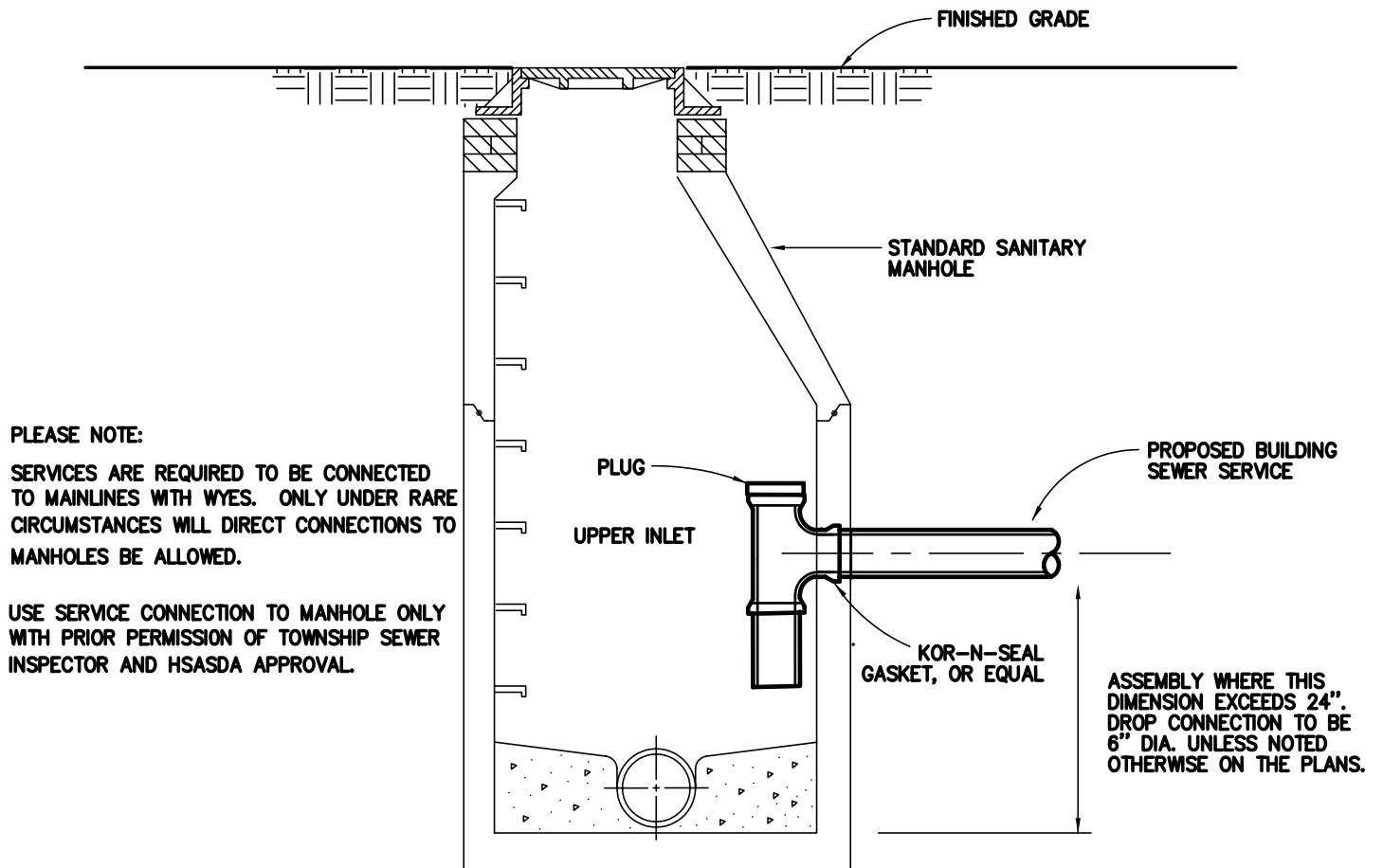
Notes

CARRIER PIPE NOMINAL SIZE	CASING PIPE SIZE—ROAD		CASING PIPE SIZE—RAILROAD	
	MIN. O.D.	MIN. WALL THK.	MIN. O.D.	MIN. WALL THK.
4"	12"	0.250"	12"	0.250"
6"	14"	0.250"	14"	0.281"
8"	16"	0.250"	16"	0.281"
10"	20"	0.250"	20"	0.344"
12"	22"	0.250"	22"	0.375"
14"	24"	0.250"	24"	0.406"
16"	26"	0.312"	26"	0.438"
18"	28"	0.312"	28"	0.469"
20"	30"	0.312"	30"	0.469"
24"	36"	0.375"	36"	0.562"
30"	42"	0.500"	42"	0.562"
36"	48"	0.500"	48"	0.688"
42"	56"	0.500"	56"	0.875"
48"	60"	0.500"	60"	0.875"

1. 14" AND LARGER CARRIER PIPES REQUIRE 4-4"x4" WOOD SKIDS PER SET, SPACED AS SHOWN ABOVE.
2. 12" AND SMALLER CARRIER PIPES REQUIRE ONLY 2-4"x4" WOOD SKIDS PER SET, SPACED 30° AWAY FROM THE BOTTOM OF THE CARRIER.
3. SKID SIZES MAY VARY WITH LARGER SIZE CARRIER PIPES.
4. MINIMUM CASING SIZE BASED ON DUCTILE IRON PUSH-ON JOINT PIPE. CONTRACTOR SHALL VERIFY MINIMUM CLEARANCE REQUIREMENTS FOR THE TYPE OF CARRIER PIPE SPECIFIED AND INSTALL LARGER THAN MINIMUM CASING SIZE FOR REQUIRED CLEARANCE.

CASING/CARRIER PIPE DETAIL

NO SCALE



BUILDING SEWER CONNECTION DETAIL

NO SCALE