

**ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN**

STANDARD CONSTRUCTION REQUIREMENTS



TABLE OF AMENDMENTS

New updates above the older updates with the date as shown below
Updated 08/2026

SECTION	SUBSECTION	DESCRIPTION
01 10 00.01 – CHECKLIST	NA	Updated Project Checklist
01 10 00.02 – CHECKLIST	NA	Updated Utility Connection Checklist – Commercial & Industrial Checklist
02 00 00 – GENERAL REQUIREMENTS	1.04.B.12	Added hydrant inspection letter to engineer requirements
02 00 00 – GENERAL REQUIREMENTS	1.04.B.10	Added staking requirements
02 00 00 – GENERAL REQUIREMENTS	1.46.B	Added site cleanliness requirements
31 23 23 – FLOWABLE FILL	3.04.I	Updated pump requirements
33 05 24 – HORIZONTAL DIRECTIONAL DRILLING	NA	Hydrostatic testing requirements
33 05 24 – HORIZONTAL DIRECTIONAL DRILLING	NA	Electrical Continuity
33 05 24.02 – HDPE INSTALLATION PROCEDURES	NA	Section Added
33 05 24.03 – ELECTROFUSION INSPECTION	NA	Section Added
33 05 24.04 – BUTT FUSION INSPECTION	NA	Section Added
33 11 00 – WATER MAINS	1.03.A.5	Submittals must be approved prior to the Pre-Construction Meeting
33 11 00 – WATER MAINS	1.04.I	Added reference to staking requirements in General Requirements
33 11 00 – WATER MAINS	2.06.D	Hydrant Flags to be ej#99840085
33 11 00 – WATER MAINS	2.03	Joint section reorganized
33 11 00 – WATER MAINS	2.07.A	Corp and curb stop product numbers updated
33 11 00 – WATER MAINS	2.07.C	Curb stop boxes maximum height updated to 66"
33 11 00 – WATER MAINS	3.02.E.4.d	Locate hydrants per road commission 1' off sidewalk for private roads
33 11 00 – COPPER SERVICE LEAD CONNECTIONS/SAMPLE POINT	N/A	Installation details updated for new product numbers
33 11 00.10 – HDPE JOINT	N/A	Updated compaction requirements to 95%
33 31 00 – SANITARY SEWERS	1.03.A.4	Submittals must be approved prior to the Pre-Construction Meeting
33 31 00 – SANITARY SEWERS	1.04.F	Added reference to staking requirements in General Requirements
33 31 00 – SANITARY SEWERS	2.01.e.A	No Inserta tees are permitted
33 31 00 – SANITARY SEWERS	2.01.A-E	Updated ASTM references to current ASTM standards
33 31 00 – SANITARY SEWERS	2.02.I.1	Added bolt requirement for bolt down covers
33 31 00 – SANITARY SEWERS	3.02.A.6.b	Added additional 0.05% slope requirement for top end runs
33 31 00 – SANITARY SEWERS	3.02.C.08.c	Updated requirement for concrete placement around manhole
33 31 00 – SANITARY SEWERS	3.02.C.08.d	Updated requirement for concrete placement around manhole

33 31 00 – SANITARY SEWERS	3.02.F.6	Main riser may be allowed where cover exceeds 13 feet mainline
33 31 00 – SANITARY SEWERS	3.02.D.2	Include reference to Flowable Fill specification
33 31 00 – SANITARY SEWERS	3.03.B.4	Updated requirements for structure backfill
31 23 33 – EXCAVATION, BACKFILLING AND COMPACTING	3.02.A.3	Unsuitable material or encroachment abandonment to be determined by Township
33 05 24 – HORIZONTAL DIRECTION DRILLING	1.0.7.E	Contractor to submit corrective action plan
33 05 24 – HORIZONTAL DIRECTION DRILLING	3.12	Hydrostatic testing modified to fit ASTM F2164
33 31 00 - RISER DETAIL	N/A	No peastone is permitted for bedding of mainline risers
33 32 05 – SUBMERSIBLE DUPLEX PUMP STATIONS	2.01.A.7	Minimum wet well diameter of 7'
33 32 05 – SUBMERSIBLE DUPLEX PUMP STATIONS	N/A	Cabinet ratings updated to NEMA 3R
33 32 05 – MASTER LIFT STATION DRAWING	N/A	Dual leaf safety grate & 7' minimum wet well diameter
33 34 00 SANITARY FORCE MAINS	1.03.A.4	Submittals must be approved prior to the Pre-Construction Meeting
33 34 00 SANITARY FORCE MAINS	1.04.C	Added reference to staking requirements in General Requirements
33 31 00 – SANITARY SEWERS	3.02.C.7.a	Construct flow channels with concrete per the Sanitary Manhole detail unless otherwise directed by Township and slope towards center of manhole
33 31 00 – SANITARY SEWERS	3.03.D	Plastic Pipe Deformation testing is required for all sewer.
33 31 00 – SANITARY SEWERS	Standard Sanitary Manhole Detail	Flow channels shall be shaped to the full height of the crown of the outlet sewer.
DIVISION 01 – GENERAL REQUIREMENTS	1.07.C	If any previously obtained permits (I.E. EGLE, OCRC, OCWRC, etc.) have expired, the project must undergo a renewed plan review and approval by the Township before construction may commence

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SECTION 01 10 00

EXECUTIVE SUMMARY

PART 1 – GENERAL

1.01 SUMMARY:

- A. This document includes Standard Construction Requirements and Development Standards.
- B. The purpose of having Standard Construction Requirements is to ensure the use of uniform, adequate and acceptable construction methods, and materials on all public improvements or private connecting to or adding to in the Township. Uniformity is important to minimize the Township's future operations and maintenance costs. Standard Construction Specifications are included for the following:
 - 1. Flowable Fille
 - 2. Excavating, backfilling, and compacting
 - 3. Concrete sidewalks and sidewalk ramps
 - 4. Shared Use Paths
 - 5. Surface Protection and Restoration
 - 6. Pedestrian Bridges
 - 7. Cleaning and Televising of Sanitary Sewers
 - 8. Horizontal Directional Drilling
 - 9. Boring and Jacking
 - 10. Cured-in-Place Pipe
 - 11. Water Mains
 - 12. Sanitary Sewers
 - 13. Submersible Duplex Pump Stations
 - 14. Sanitary Force Mains
- C. The purpose of having Development Standards is to ensure that development projects and their related improvements are completed in a uniform, acceptable manner. The Development Standards include (but are not limited to) the following:
 - 1. Agreements with the Developer outlining responsibilities
 - 2. Guarantee provisions
 - 3. Insurance requirements to minimize the Township's liability
 - 4. Development Fee to cover the Township's cost of plan review, design engineering, construction observation and administration
 - 5. Plan review process
 - 6. Appendices are included to outline the following:
 - a. Plan submittal process
 - b. Development Fees
 - c. Standard easement forms
 - d. Development Agreement and Letter of Credit form
 - e. Payback Agreement
 - f. Oversizing Policy and Agreements
 - g. Pre-construction Meeting Agenda
- D. The following were involved in preparing these requirements:
 - 1. Township Supervisor
 - 2. Township Superintendent of Public Utilities
 - 3. Township Engineer
 - 4. Township Attorney

1.02 PURPOSE OF THE DOCUMENT

- A. The purpose of this document is to provide Developers, Consulting Engineers, and Contractors working in the Township with the general requirements and standard construction requirements required by the Township for water main, sanitary sewer system, pedestrian bridge, sidewalk, and shared use path improvements.
- B. These standard construction requirements shall be incorporated by reference as part of the contract documents for the acquisition and construction of water main, sanitary sewer, pedestrian bridge, sidewalk, and shared use path improvements in Allendale Charter Township. Michigan Department of Transportation (MDOT), Ottawa County Road Commission (OCRC), Ottawa County Water Resources Commission (OCWRC), and National Fire Protection Association (NFPA) specifications and standard plans referenced throughout the specifications shall be superseded by the most current version.
- C. It is expected and required that each Developer, Consulting Engineer and Contractor will review this document and be familiar with its content and requirement, prior to design of all projects.
- D. These standard construction requirements are applicable to any and all site improvements that are made regardless of existing conditions – known or unknown - regarding water main, sewer main and any of the appurtenances mentioned herein.

END OF SECTION

Allendale Charter Township Project Checklist

Name:	Expected Completion:	DATE
1. Initiation of Project:		
Plans submitted for review		
Send FYI to Ottawa County Water Resource Commission of Submittal		
Send FYI to Ottawa County Road Commission		
Planning Commission Public Hearing		
Planning Commission Approval Special Conditions Yes No		
Board Public Hearing		
Board Approval		
2. Prior to submitting plans to EGLE for permits:		
Development fee paid		
Construction plans reviewed approved by Township DPU and/or Township Engineer		
Approved construction plans delivered to Township. Provide 3 plan sets for water sewer, or 3 plan sets for both. One PDF under 500 MB for Water and Sewer.		
Development agreement signed		
3. PRIOR TO SCHEDULING pre-construction meeting, the following items must be provided:		
Evidence of insurance coverage		
Copy of EGLE permits:		
Water		
Sewer		
Construction Approval From:		
Ottawa County Road Commission		
Ottawa County Water Resources Commission		
Michigan Department of Transportation		
Soil Erosion and Sedimentation Control		
Executed easements		
Submittals for Construction Materials Approved		
Final Signed Plans (Signed by PC Chair)		
Draft stormwater maintenance document with OCWRC		
4. Pre-construction meeting scheduled and held:		
5. Prior to Substantial Completion:		
Water main pressure test and chlorination passed		
Connection to water system made		
Hydrant and valve operation inspection complete		
Sanitary sewer air testing and video inspection passed		
Grouting and Manhole inspection		
Rough grading complete		
Adjust sanitary manhole castings to pavement grade		
Force main pressure testing passed		
Pump station testing passed		
All water and sewer laterals marked per spec		
Letter of credit for uncompleted work (Water, Sewer & Lud Coordinator)		

Substantial completion approved in writing by Township.	
6. Transfer of Ownership Requirements	
Franchise Utilities Installed	
Approved Record Drawings (as-builts)	
Easements Recorded and filed with project	
Guarantee period agreement signed	
OCRC Final Approval (road and stormwater collections - Special Services Engineer)	
MDOT Approval	
Bill of sale signed	
Engineer's certificate signed	
Street Signs installed (LUD Coordinator)	
Private Road Completed (LUD Coordinator)	
Developer sidewalk complete (LUD Coordinator)	
Streetlights installed (LUD Coordinator)	
Punch list items competed (Water & Sewer)	
7. Prior to Final Approval and Project Closure:	
Copy of executed stormwater maintenance document (433) with OCWRC	
Adjustments on water and sewer made to finish grade (Water & Sewer)	
Site Grading complete (LUD Coordinator through PCI)	
OCWRC Final Approval (LUD Coordinator)(OCWRC Development Coordinator)	
PCI Inspection for site requirements (LUD Coordinator)	
Finance informed to start street light assessment (LUD Coordinator)	
SESC permit is finalized	
Special Conditions met if applicable	
8. Project Closed:	
Development fee escrow returned	
General fund escrow returned	

**Utility Connection Checklist - Commercial & Industrial
(No Part 41 or 399 permits required)**

Name:	Expected Completion:	DATE
1. Initiation of Project:		
Plans submitted for review Resubmittal		
Send FYI to Ottawa County Road Commission		
Send FYI to Ottawa County Water Resources Commission		
Planning Commission Public Hearing		
Planning Commission Approval Special Conditions Yes No		
Rezoned if Applicable		
Board Approval		
Final Signed Plans		
2. Prior to Plan Review:		
Entire Construction inspection fee paid		
Site construction and plumbing plans submitted for review		
3. PRIOR TO Building Permit and Pre-Con SCHEDULING the following items must be provided:		
Approved construction plans delivered to Township. Paper Copies and 1 PDF		
Non-Domestic User Form Submitted		
Evidence of insurance coverage		
Copy of approval letters from:		
Ottawa County Road Commission		
Ottawa County Water Resources Commission		
Michigan Department of Transportation		
Soil Erosion and Sedimentation Control		
Submittals for Construction Materials: Water and Sanitary pipe fittings Engineer, Construction Management, and contractors contact Information		
Connection Fees Paid		
4. Pre-construction meeting scheduled and held: (after receipt of all permits)		
5. Plumbing Permit in place prior to water and sewer work		
6. Prior to Substantial Completion:		
Backflow testing report received		
Rough grading complete		
All water and sewer laterals marked per spec		
Substantial completion approved in writing by Township.		
7. Prior to Final Approval and acceptance by Township:		
Approved record drawings (i.e. As-Builts)		
Guarantee period agreement signed		
All adjustments on water and sewer made to finish grade		
Punch list items competed		
Paving, grading complete		
Sidewalk Complete		
Non-Domestic User Form Completed		
Cross Connection Control Device Inspection Completed		
Special Conditions met if applicable		

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DEFINITIONS

PART 1 - GENERAL

1.01 DEFINITIONS:

- A. Agreement – The written contract between the Owner and Contractor covering the work to be performed.
- B. Certificate of Final Approval – The Developer has met all requirements of the Township and the Township has accepted the project as completed
- C. Contractor – The person, partnership, corporation, or other legal entity with whom the Owner has entered into an agreement to construct the work.
- D. Contract Documents – Agreement, plus any or all of the following additional documents, if they exist: addenda (which pertain to the Contract Documents), contractor's bid (including documentation accompanying the bid and any post bid documentation submitted prior to the notice of award) when attached as an exhibit to the Agreement, the notice to proceed, bonds and insurance certificates, general conditions, supplementary conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all written amendments, change orders, work change directives, field orders and Owner's Engineer's written interpretations and clarifications. THESE STANDARD CONSTRUCTION REQUIREMENTS SHALL BE INCORPORATED BY REFERENCE AS PART OF THE CONTRACT DOCUMENTS.
- E. Development Agreement – A written agreement between the Owner (Developer) and the Township covering various items regarding the Project.
- F. Owner – The person, partnership, corporation, or other entity (Developer) for whom the Work is being constructed and with whom the Contractor has entered into an Agreement.
- G. Owner's Engineer – The Consulting Engineer, licensed in the State of Michigan, employed by the Owner for the Project.
- H. Plans – The drawings which show the scope, extent and character of the Work to be furnished and performed by Contractor and which have been approved by the Township and Township's Engineer and are referred to in the Contract Documents.
- I. Property Owner – The owner of an individual parcel within the development.
- J. Project – The water system, sanitary sewer system, storm sewer, pedestrian bridge, sidewalk, and/or shared use path improvements, along with all appurtenances and other improvements necessary to protect the integrity of the facilities such as asphalt, final grading, restoration, cleaning, televising, access roads and similar items.
- K. Provide – Furnish and install.
- L. Specifications – Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

- M. Substantial Completion - The stage of the project where building permits can be issued and building connections are allowed to the Public Utilities
- N. Township – Allendale Charter Township, Ottawa County, Michigan.
- O. Township's Engineer – The person, firm or corporation used by the Township for consulting engineering purposes.
- P. Work – The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

END OF SECTION

GENERAL REQUIREMENTS

DIVISION 01

GENERAL REQUIREMENTS

PART 1 – GENERAL REQUIREMENTS

1.01 AGREEMENT

- A. The Agreement shall incorporate by reference these Standard Construction Requirements and shall provide that the Township is a third-party beneficiary of the Agreement and that all provisions of the Agreement in favor of the Owner and/or Township may be enforced by the Township. The Agreement shall be submitted to the Township for approval prior to its execution.
- B. The Township shall require a Development, Watermain or Sanitary Sewer Agreement between the Owner/Developer and the Township.

1.02 STANDARDS/ORDINANCES

- A. All work shall conform to these Standard Construction Requirements and all applicable Township ordinances and rules and regulations.
- B. The Owner, the Owner's Engineer, and the Contractor shall keep themselves fully informed of and shall, at all times, comply with all local, state, and federal laws, rules, and regulations applicable to the Project.

1.03 THE PROCEDURE FOR GRANTING OF EXCEPTIONS TO THESE STANDARD CONSTRUCTION REQUIREMENTS PURSUANT TO PARAGRAPH 1.48 IS:

- A. A written request for an exception shall be prepared and filed by the Owner or Owner's Engineer with the Township. This written request shall include sufficient information for the Township review and shall be signed by both the Owner and the Owner's Engineer.
- B. The Township will consider the exception request and consult with the Township Engineer as necessary. The Township will then give a written notice to the Owner stating the Township's decision on the exception request. The Township's decision shall be final and binding on the Owner.
- C. Field changes must be approved prior to installation and documented within 24-hours.

1.04 REQUIREMENTS FOR PROJECT RELATED PUBLIC IMPROVEMENTS

- A. Infrastructure
 - 1. All infrastructure (i.e. sanitary sewer, water main, sidewalk and ramps, shared use paths, pedestrian bridges, storm sewer and street improvements) shall be extended and constructed adjacent to, across the frontage of, and within (as required by Township site plan approval) proposed developments in accordance with these Standard Construction Requirements and applicable Township, Ottawa County Road Commission (OCRC), Ottawa County Water Resources Commissioner (OCWRC), Michigan Department of Transportation (MDOT), and Michigan Department of Environment Great Lake and Energy (EGLE), International Fire Code, and MIOSHA.

B. Engineer Requirements

1. Plan and profile must match station numbers to be in alignment horizontally, one above the other.
2. Plan and profile must be in a straight line. Do not straighten out around a curve. Start a new P&P.
3. A preplan meeting is required for all Commercial projects. It is also highly recommended for residential.
4. Plans and As-Builts shall be in NAVD 88 state plane coordinates and submitted to the Township.
5. A minimum of 5' of cover must be maintained through the project. Avoid the need for hydrant extensions and or larger depth of bury hydrants.
6. All changes made to the first plans must be noted in a contrasting color or format and noted in a cover letter.
7. Verify all sanitary lateral inverts for a minimum of 2% slope.
8. Do not submit a second plan for review until all utilities and or Governing bodies have submitted their reviews.
9. An address application form, located in Appendix G, shall be completed after plans have been submitted and sent for permits.
10. Staking:
 - a. Provide inverts and stakes for each sanitary manhole, and pipe inverts 25', 50', and 100' downstream of each manhole. Additional pipe inverts shall be provided at 100' spacing or less between structures.
 - b. Provide inverts and stakes for all water main fittings and offsets. Pipe inverts and stakes shall be provided at 100' spacing.
 - c. Hydrants shall have an elevation and offset shown with a finish grade mark.
 - d. If deflection is used to adjust alignment, these areas must also be staked. These shall be marked on offset stakes by the surveyor to serve as benchmarks for the field inspector.
11. For Commercial sites, the layout of the fire suppression system and domestic connections must be submitted with the site plans. Allendale Public Utilities will review and require backflow preventor testing as outline in our Cross Connection Standards prior to substantial completion.
12. Submit a hydrant inspection letter than includes verification of both horizontal and vertical locations of each hydrant.

1.05 PLAN REVIEW PROCESS

A. For watermain and sanitary sewer:

1. The Owner's Engineer shall act as the Owner's agent. Copies of all correspondence shall be sent to the Owner's Engineer.
2. The Owner's Engineer shall submit a preliminary site plan for the Project to the Township's Public Utility Department, Fire Department, and Maintenance Department concurrent with submittal to the Township Planning Commission for review of any preliminary plat, preliminary planned unit development plan, rezoning request, preliminary site condominium approval request, site plan or any other planning approval document pertaining to the Project. No water or sanitary sewer Project shall be undertaken unless in conformance with the Township's Sanitary Sewer System and Water System Master Plans or otherwise approved by the Township.
3. After Planning Commission and/or Township Board approval, the Owner/Developer's Engineer shall submit two sets and one electronic PDF of the Construction Plans and Specifications to the Township and one electronic PDF of plans, specifications and drainage calculations to the Township's Engineer. If easements are proposed, the proposed easement documents shall be submitted to the Township and Township Engineer for review and approval.

4. After receipt of the plans, a Development fee will be calculated. This fee shall be paid to the Township prior to plan review.
5. For a commercial property, an escrow account will be established to cover the incurred costs for construction plan review and any relevant water and sewer field inspections
6. After review of the Plans and Specifications, the Township and the Township Engineer will issue joint review letter(s) to the Owner's Engineer.
7. Gather all governing bodies (Allendale Charter Township, OCRC, OCWRC and MDOT) prior to submitting another set. All changes shall be called out clearly (cloud or different color) and noted in a cover letter. Any changes required must be made and the final plans (and easement documents, if any) shall be submitted for final review. Also, the Development Agreement shall be signed, prior to submitting the Plans and Specifications to the Township for construction permits. Approval by the Township and Township Engineer will be for general conformance to current standards and requirements and does not relieve the Owner's Engineer of professional responsibility to the Owner. The Owner's Engineer shall submit the required number of sealed plans and specifications and one copy of the Act 399 and Part 41 of Act 451 permit applications to the Township. Total sets of Plans and Specifications required are: One (1) paper copy and one electronic copy (PDF for review and AutoCAD for record). Prior to scheduling a preconstruction meeting, a copy of all permits must be submitted to the Township.

B. For storm sewer / storm water management:

1. As required by the current Ottawa County Water Resources Commissioner Standards & Specifications and Storm Water Management Policy. The Ottawa County Water Resources Commissioner, Ottawa County Road Commission, Michigan Department of Transportation, Inland Waters if applicable, must approve storm sewer and storm water management plans prior to construction. A copy of all submittals and approval letters shall be sent to Allendale Charter Township. The Township Engineer will also review the grading plan and comment as necessary. All storm water operation and maintenance agreements will be managed by Ottawa County Water Resources Commission and Ottawa County Road Commission.

C. For sidewalks, sidewalk ramps, shared use paths and ramps, and pedestrian bridges:

1. Submit plans to the Township, OCRC and OCWRC, if applicable, for review and approval. Pedestrian bridges meeting Section 32 34 13.01 of the Specifications shall be provided on open channel drain crossings.
2. Construction details for sidewalks, shared use paths, and ramps shall be included on the plans. Provide shared use paths meeting Section 32 13 14.01 of the Specifications in locations indicated on the Township Master Plan for Shared Use Paths.

1.06 MASTER PLANS

- A. The Township's master plans for water system, sanitary sewer system, sidewalks, and shared use paths shall be followed by the Owner's Engineer in the design of the Project. It is recommended that prior to any design being completed, that a meeting be scheduled and held with the Township and Township Engineer to review these master plans. Looping of water main may be required.

1.07 PERMITS AND APPROVALS

- A. No construction work on the Project shall commence nor shall a pre-construction meeting be scheduled until all of the below required permits/approvals which are applicable have been obtained, the Development Agreement has been signed, A bond signed and received (if applicable), any necessary agreements with the Township have been signed and

delivered, all required easements have been signed and delivered to the Township, appropriate evidence that all required insurance is in force and has been filed with the Township, and the Township has reviewed and approved the Agreement.

- B. Prior to scheduling a preconstruction meeting and commencing construction of the Project, the following permits/approvals shall be obtained (if applicable) by the Owner's Engineer:
 - 1. Township Building & Zoning Administrator and Township Fire Department.
 - 2. Township Public Utility Department and Township Engineer. Including submittals
 - 3. Ottawa County Road Commission.
 - 4. Ottawa County Water Resources Commissioner – storm sewer and Soil Erosion Sedimentation Control (Part 91 of PA 451). Note: Storm water detention may be required.
 - 5. Michigan Department of Environment, Great Lakes, and Energy
 - a. Water main construction permit (Act 399).
 - b. Sanitary sewer construction permit (Part 41 of Act 451).
 - c. Inland Lakes and Streams (Part 301 of Act 451).
 - d. Soil Erosion and Sedimentation Control (Part 91 of Act 451).
 - e. Wetlands (Part 303 of Act 451).
 - f. Storm Water Discharge (Part 31 of Act 451).
 - 6. Michigan Department of Transportation.
- C. If any previously obtained permits (I.E. EGLE, OCRC, OCWRC, etc.) have expired, the project must undergo a renewed plan review and approval by the Township before construction may commence

1.08 INDEMNITY/INSURANCE

- A. Indemnity – General:
 - 1. The Contractor shall agree in the Agreement that as a condition of performing the Work, the Contractor agrees to assume all liability for and protect, indemnify, save and hold harmless the Township, Ottawa County Road Commission, Ottawa County Water Resources Commissioner (including Road Commissioner's, Water Resources Commissioner's and Township's respective consulting engineers), their agents, consultants, officers, board members and employees, from and against all actions, claims, demands, judgments, losses, expenses of suits or actions and attorney fees for injuries to, or death of, any person or persons and loss or damage to the property of any person, or persons, whomsoever, and the Contractor's agents, contractors, subcontractors, officer and employees, arising in connection with or as a direct or indirect result of entering into and performance of the Work, whether or not due to or arising out of the acts of the Contractor or its agents, contractor, subcontractors, officers and employees, or by or in consequence of any negligence or carelessness in connection with the same or on account of liability of obligation imposed directly or indirectly upon any of the above named indemnified parties by reason of any law of the State of Michigan or the United States, now existing or which shall hereinafter be enacted, imposing any liability or obligations, or providing for compensation to any person or persons on account of or arising from the death of, or injuries to employees. The Contractor shall pay, settle, compromise, and procure the discharge of any and all such claims and all such losses, damages, and expenses. The indemnified parties shall have the option to retain their own attorney or attorneys and the reasonable expense thereof shall be paid by the Contractor.
- B. Insurance Requirements:
 - 1. The Agreement shall provide that prior to commencing the Work, the Contractor) shall file with the Township, Ottawa County Road Commission and Ottawa County Water

Resources Commissioner a certificate of insurance acceptable to the Township as proof that the Contractor has secured the types and amounts of insurance required by this subsection for the Project. The Township shall have the right, in its sole discretion and at any time(s), to require the Contractor to file with the Township certified copies of any policies of insurance required by this subsection.

2. The Contractor shall provide Owners and Contractors General Liability insurance coverage for the project in the amount of \$2,000,000 (general aggregate) and \$1,000,000 (each occurrence) naming the Township, Ottawa County Road Commission and Ottawa County Water Resources Commissioner (including the Water Resources Commissioner's, the Road Commission's and the Township's respective consulting engineers), if the work is within their service area, of each of the above-named public entities. The named insureds shall include all officers, consultants, agents, employees, and board members.
3. The certificate or certified policies filed with the Township shall provide for giving the Township no less than 30 days' prior written notice of any cancellation, material change in coverage or non-renewal of the insurance.
4. The furnishing by the Contractor of any insurance policies and/or insurance certificates and their acceptance or approval by the Township shall not release the Contractor from the obligation to provide sufficient insurance coverage as set forth herein and shall not waive liability of the Contractor to provide indemnification as provided above.

1.09 PRE-CONSTRUCTION MEETING

- A. A pre-construction meeting shall be held with the Township, the Ottawa County Road Commission, the Ottawa County Water Resources Commission, the Township's Engineer, the utility companies, and other agencies affected by the proposed construction. The Township's inspection procedures will be reviewed with regards to water main, sanitary sewer, pedestrian bridge, sidewalk, and shared use path improvements. Once all requirements have been met as outlined in paragraph 1.04, the Owner's Engineer shall schedule and preside at the pre-construction meeting to be held at the Township Hall or Water Resource Recovery Facility. An agenda out-line to be used at the pre-construction meeting is included in Appendix H. The Owner's Engineer shall prepare and distribute minutes of the meeting to the attendees/invitees.

1.10 ASSESSMENTS/CHARGES/FEES

- A. Water and sanitary sewer assessments/charges/fees include, but are not limited to, stub water services/meters, and Plan review and inspection fees (development fees). These assessments/charges/fees will be as established by the Township Board by resolution. It is the responsibility of the Owner to make inquiry as to the amount of assessments, charges and fees applicable to the Project. Payment terms, if any, shall be as agreed upon in writing with the Township.

1.11 CONNECTIONS/ACCEPTANCE AND FINAL APPROVAL

- A. Prior to acceptance of the Project, substantial completion of the Project shall be obtained. In order to obtain substantial completion, the following shall occur:
 1. Water main pressure testing, and chlorination passed
 2. Connection to water system made
 3. Services marked correctly
 4. Asphalt installed to minimum of base grade
 5. Sanitary sewer castings set to asphalt grade, base as a minimum
 6. Sanitary sewer air testing, manhole inspection and video inspection passed
 7. Rough grading complete prior to service inspections

8. Laterals marked correctly
 9. Force main pressure testing passed
 10. Pump station testing passed
 11. Letter of credit to be provided to the Township to complete the improvements identified on the approved plans
 12. Hydrant and valve inspection completed
 13. Certificate of Substantial Completion accepted by Township
- B. Prior to final approval of the Project by the Township, the following shall occur or be submitted to the Township:
1. All private utilities must be installed
 2. A final inspection scheduled, and any punch list items corrected.
 3. Provide the Township one (1) printed set and a PDF file, and the Township Engineer 1 electronic file in AutoCAD format of record drawings (as-builts) with as-constructed dimensions and witnesses. (in State Plain)
 4. Copy of recorded easements.
 5. Copy of recorded plat and restrictive covenants, or Site Condominium Master Deed documents showing dedicated easements once received by the Developer.
 6. Signed Guarantee Period Agreement (form included at the end of this section).
 7. Ottawa County Water Resources Commission approval.
 8. Signed Engineer's Certificate for Water System, Sanitary Sewer System, Storm Sewer, Pedestrian Bridge, Sidewalk, and/or Shared Use Path Improvements (form at the end of this section).
 9. Executed Bill of sale (required form is included at the end of this section).
 10. Certificate of Final Approval accepted by Township.

1.12 BUILDING CONNECTIONS

- A. Separate permits will be required for any water service or sanitary sewer lateral connections into buildings. See pertinent Township Ordinances and the Township Water and Sanitary Sewer Rules and Regulations for requirements and regulations pertaining to private water systems, fire lines, sanitary sewer, and storm sewer, as well as these Standard Construction Requirements. Any utility infrastructure outside of Allendale Charter Township must be reviewed, inspected, and tested by Allendale Charter Township and/or their representatives (i.e. Township Engineer, Township Inspector, etc.)

1.13 GUARANTEE

- A. The Agreement shall provide that the Owner (Developer) and the Contractor shall guarantee the completed Work for one year from the date of Final Completion, written acceptance by the Township, unless extended as provided in this Section, and shall promptly repair, replace, restore, or rebuild, as the Township may determine, any finished Work in which defects of materials or workmanship may appear or to which damage may occur (or has occurred) because of such defects during the guarantee period, or damage occurs from the installation of other utilities, i.e. gas, electric, cable. Etc. except where other periods or maintenance and guarantee are provided. The one-year guarantee period shall begin on a date agreed upon in writing by the Owner, Contractor, and the Township (see Guarantee Period Agreement Form). The one-year guarantee period shall be extended for an additional year from the time that any of the finished Work is repaired, replaced, restored or rebuilt pursuant to the guarantee agreement as determined by the Township.
- B. All subcontractors, manufacturer, or supplier warranties and guarantees, expressed or implied, with respect to any material or equipment used in or incorporated as a part of the Work shall be obtained by the Contractor as agent for the Township, and all such

warranties and guarantees shall inure to the benefit of the Township without the necessity of separate transfer or assignment thereof; provided that if required by the Township, the Owner and Contractor shall cause such subcontractors, manufacturers, or suppliers to execute such warranties and guarantees in writing to the Township and, further, that the Agreement shall provide that the Contractor will assign all such warranties and guarantees to the Township on request.

1.14 CONTRACTORS AND SUBCONTRACTORS

- A. The work shall be performed by responsible contractors and subcontractors known to be skilled and regularly engaged in work of similar character and magnitude. The Owner shall receive written approval from the Township of all contractors and subcontractors prior to entering into the Agreement.

1.15 CONTRACTOR RESPONSIBILITIES

- A. General: All the following Contractor responsibilities shall be incorporated as part of the Agreement for themselves and any sub-contractors.
- B. Safety and Protection:
 - 1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - a. the public and all persons on the Work site or who may be affected by the Work; all the Work and materials and equipment to be incorporated therein, whether in storage on or off site; and
 - b. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, driveways, roadways, sidewalks/bike paths, structures, utilities, and underground facilities not designated for removal, relocation, or replacement in the course of construction.
 - 2. The Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The Contractor shall notify owners of adjacent property and of underground facilities and utility owners when construction of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury or loss to any property referred to in this paragraph caused, directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by the Contractor. The Contractors' duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and accepted.
- C. Safety Representative: The Contractor shall designate a qualified and experienced safety representative at the Work site, whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs. This person or their designee shall be available during all working hours via phone, text, and email and is expected to communicate with the Township immediately.
- D. Emergencies: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Owner or the Township, is obligated to act to prevent threatened damage, injury, or loss. The Contractor shall give the Owner and the Township prompt

written notice if the Contractor believes that any significant changes in the Work or variations from the Work have been caused thereby. If the Owner determines that a change in the Work is required because of the action taken by the Contractor in response to such an emergency, with prior written approval of the Township, the Owner may issue a change order or otherwise authorize a change in the Work to account for the consequences of the action taken with respect to the emergency. This person or their designee shall be available at all hours via phone, text, and email and is expected to communicate with the Township immediately.

- E. Supervision and Superintendence: The Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor shall be responsible to see that the complete Work complies accurately with the Plans and Specifications.
 - 1. The Contractor shall keep on the Work at all times during its progress a competent superintendent, who will cooperate fully with the Township at all times, and who shall not be replaced without written notice to the Township. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All communications given to the superintendent shall be binding as if given to the Contractor. The superintendent will be identified at the preconstruction meeting and noted within the meeting minutes. He/she will be proficient in communications including email and letter writing. This person or their designee shall be available during all working hours via phone, text, and email and is expected to communicate with the Township immediately.
- F. Labor, Materials and Equipment:
 - 1. The Contractor shall provide competent, suitably qualified personnel to perform the Work. The Contractor shall at all times maintain good discipline and order at the site.
 - 2. The Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the Work.
 - 3. All materials and equipment shall be of good quality and new, except as otherwise provided in the Plans and Specifications. If required by the Township, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with instructions of the applicable supplier, except as otherwise provided in the Plans and Specifications.
 - 4. All shop drawings including sanitary sewer manhole cut sheets, shall be submitted to the Township and Township Engineer for acceptance.
- G. Construction Records:
 - 1. The Contractor shall provide construction record information for the preparation of as-built drawings by the Owner's Engineer. The Contractor shall also submit sketches, dimensions, witnesses, etc. necessary to accurately locate all buried fittings, lines, valves, reducers, mains, couplings, bends, elbows, etc. For watermain, provide A one line drawing of all mains stubs and hydrant connections (in an accent color) with lengths. Allendale Public Utilities must be allowed access during construction to GPS locate all fittings and top of pipe or inverts at grade changes. Also, provide length and size of services and tap locations if not straight across from curb stop. For sanitary sewer, provide Township access to GPS locate all stubs and lateral ends as well as

bends if not in a straight line .Also, provide lengths and invert elevations for stubs and laterals. Provide measurement from the downstream manhole for all wyes and provide stations and invert elevations for manholes and length between manholes. Provide on title sheet the name, address, and phone number of the Contractor. See Example of Record Drawing (plan and profile) at end of this Section.

H. Utility Marking:

1. The contractor is responsible to locate and properly mark any and all new public or private utilities on the site, for miss dig operations, until the Township or owner signs for ownership; after final inspection and proper paperwork is completed. The Township will locate any existing utilities on the site. The Township will notify the contractors designated Superintendent of the miss dig ticket. The Township will respond to the ticket and advise of the contractor's information for the ticket's designee.
2. The Township is not responsible for any damage done to the new infrastructure installed until such time as the Township takes ownership.

1.16 ASBESTOS, PCB's, PETROLEUM, HAZARDOUS WASTE OR RADIOACTIVE MATERIALS

- A. If, during the course of construction, any asbestos, PCB's, petroleum, hazardous waste or radioactive materials are uncovered or revealed at the Work site which were not shown or indicated on the Plans and Specifications, to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site, the Contractor shall cease operations affecting the find and shall notify the Township and also the Owner in writing, who shall notify the necessary parties. No further disturbance of the materials shall ensue until the Contractor has been notified by the Owner and the Township that the Contractor may proceed.

1.17 PAYMENT

- A. Payment shall be made by the Owner to the Contractor in a timely basis as required in the Agreement. The Township, unless it is the Owner, shall not have any liability to the Contractor for amounts due the Contractor under the Agreement, or for any part of the cost of the Project. The method of payment (lump sum, unit prices, etc.) is between the Owner and the Contractor.

1.18 COST SHARING

- A. All cost sharing agreements (if any) between the Township and Owner shall be in writing and shall be signed and delivered prior to the start of construction.

1.19 WORK SITE

- A. The Contractor shall confine its work to the public rights-of-way, easements and Owner's property. Any other area required for equipment or material storage or for construction operation shall be the Contractor's responsibility.

1.20 ACCESS

- A. The Township and its representatives shall be allowed access to all parts of the Work at all times and shall be furnished such information and assistance by the Contractor as may be required to make inspections.

1.21 INSPECTORS and INSPECTIONS

- A. The Township Inspector or Township Engineer shall be provided 48-hour notice and three (3) workdays to perform major inspections for both water main and sanitary sewer. Major inspections include the following:
 - 1. Filling, flushing, air/pressure testing
 - 2. All taps
 - 3. Substantial Completion
 - 4. Final Completion
 - 5. Fire Protection System Inspection

- B. 24 hour notice must be given for day to day work or changes to day to day schedules. No work will be allowed without this notice. This can be in the form of an email out lining the weeks work. It must be submitted on the morning of the last working day. (submit Friday morning for the following Monday work)

- C. Authority and Duties of Inspectors:
 - 1. Inspectors acting on behalf of the Township, will inform the Township as to the progress of the Work and the quality of the completed Work, and the quality of the materials being used. Inspectors shall not supervise, direct, or have control of the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. Inspectors are not authorized to revoke, alter, enlarge, or relax any of the Specifications nor to change the plans in any way unless approved by the Township Utility Superintendent. Inspectors are not authorized to increase or decrease any Agreement item nor add new items to the Agreement. In no instance, shall any action or omission on the part of the Township inspectors relieve the Contractor of the responsibility for completing the Work in accordance with the Agreement.
 - 2. The Township shall make an inspection of the completed Work, or such portions thereof which are eligible for acceptance, upon notification by the Contractor that the work is complete or substantially complete and that benchmarks/control points have been provided. If the completed Work is not acceptable to the Township at the time of such inspection, the Township shall inform the Owner and the Contractor orally or in writing as to the particular defects to be remedied.
 - 3. Inspection may be done by Township staff or by the Township's Engineer on behalf of the Township. Inspection will consist of daily inspection of water main and sanitary sewer installation, testing of water main and sanitary sewer and **limited assistance in gathering construction record information** of items related to water main and sanitary sewer construction, including sanitary laterals, water services and related appurtenances. Inspection for sidewalks, shared use paths, and pedestrian bridges will consist of daily inspection.
 - 4. All construction staking, compaction testing, concrete testing, off-site materials testing, major field changes, as-built drawings and pay estimates will be the responsibility of the Owner's Engineer. Sufficient staking shall be provided to allow Township inspector to confirm grades and conformance to approved plans. This includes a "bench mark" elevation written on an offset stake at each manhole, water main offset or bend, and at least every 100'. This stake shall be marked in a contrasting manner and at all times be protected during construction.
 - 5. Compaction testing results must be reported to the field inspector when they are completed. The final report must also be submitted to the Township Field Inspector for filing. This is the responsibility of the Contractor to facilitate. Work stoppage may result if this fails to happen.

6. The Owner's Engineer shall periodically review the Work for conformance to the Plans and Specifications and these Standard Construction Requirements. The Owner's Engineer shall complete, sign and submit to the Township the Engineer's Certificate.
7. Township acceptance must be obtained in writing prior to placing water main, sanitary sewer, storm sewer, pedestrian bridge, sidewalk, or shared use path improvements in service. This written approval may include a punch list of additional items or concerns that need to be addressed. Final approval of the Work shall be as provided in Section 1.08 of these Standard Construction Requirements.

D. Compaction Testing:

1. See specification 31 23 33 Excavation, Backfilling, and Compacting for specific requirements for testing.

1.22 DEFECTIVE MATERIALS AND WORK

- A. All materials, which are different than list of submittals approved, or which do not meet the requirements of the Specifications at the times they are to be used, shall be rejected, unless otherwise authorized as acceptable by the Township in writing.
- B. All completed Work that is found to be defective before the final acceptance of the completed Work, or within the warranty period, shall be corrected and replaced immediately in conformance with the Specifications.

1.23 SCHEDULING

- A. The Contractor shall file a construction schedule with the Township and any other Governing body, prior to commencing construction. A weekly email with the next week's schedule shall be sent to all interested parties by noon on the last working day of each week.
- B. Certain projects may require street closings. The Contractor shall coordinate its work with the Ottawa County Road Commission, MDOT and the Township and shall take all necessary precautions required by the Ottawa County Road Commission, MDOT, and applicable standards to minimize traffic interference. All detours must be approved by the Ottawa County Road Commission and MDOT. The Contractor's emergency telephone number shall be filed with the Township.

1.24 MAINTENANCE OF TRAFFIC

- A. When working within the limits of existing streets, the Contractor shall accommodate vehicular traffic in road rights-of-way as approved by the Ottawa County Road Commission and or MDOT. Access to manholes, fire hydrants, water and gas valves shall be maintained at all times during construction.
- B. Where streets are partially obstructed, the Contractor shall place and maintain temporary driveways, ramps, etc., which, in the opinion of the Ottawa County Road Commission and/or the Township, are necessary to accommodate the public.
- C. The Contractor shall inform the Ottawa County central dispatch (1-800-249-0911), the Allendale Township Fire Department (616-892-3121), Ottawa County Sheriff Department (616-892-3123), and schools (616-892-3485) at least 24 hours in advance of street obstruction and detours. Detouring and construction signage shall be in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices and in

accordance with the directions of the Ottawa County Road Commission and Allendale Township Fire Department.

1.25 LIMITATION OF OPERATIONS

- A. When working within the limits of existing streets, the Contractor shall at all times conduct its work so that there is a minimum of inconvenience to the residents and traveling public within the Project area. Working hours for all projects shall be limited to the period of 7:00 am to 7:00 pm. No work shall be performed on Sundays and Holidays, and on special event days designated by the Township.

1.26 PROTECTION OF WORK

- A. The Contractor shall protect the Work until accepted by the Township in writing. Any part of the completed Work that is damaged prior to acceptance by the Township shall be replaced at the Contractor's expense.

1.27 DUST CONTROL

- A. All haul roads, detour roads and other public and private roads (including backfilled trenches), driveways and parking lots used by the Contractor must be maintained in a dust free condition. The control of dust shall be accomplished by the application of dust control materials and methods of application as approved and/or sweeping shall be applied as often as is necessary to control the dust or if directed to do so by the Township (within 12 hours after notification).
- B. Cost of providing dust control and or sweeping shall be considered incidental to the Project and shall not be charged back to the Township. Street cleaning after construction has final approval shall be the responsibility of the Owner and follow the same requirements above. After development has been signed over to HOA or individual owners, the builder assumes the same responsibilities. If any of the above persons do not meet these requirements, the Township will have it cleaned and bill the responsible party. Silt sac maintenance, cleaning and removal are the responsibility of Owner/Developer until the SESC permit is terminated.

1.28 MATERIAL HAUL ROADS

- A. Any spillage on public roadways used as haul roads shall be cleaned daily.
- B. Gravel roads shall only be used by the Contractor when permission is given to the Contractor in writing by the Ottawa County Road Commission and only if the Contractor assumes responsibility of maintenance, dust control and restoration of the gravel roads to the satisfaction of the Ottawa County Road Commission.

1.29 VIDEOTAPING

- A. The entire Project area involving existing streets may be videotaped by the Ottawa County Road Commission. These videos will be available to the Contractor, Owner, and the Township during construction of the project.

1.30 MAILBOXES

- A. The Contractor shall temporarily relocate mailboxes interfering with the construction so that mail service is not interrupted. Mailboxes shall be replaced in a condition and location equal to that prior to construction or as required by the U.S. Postal Service.

1.31 TREES/CLEARING AND GRUBBING

- A. Trees marked "REMOVE" on the Plans shall be taken down and removed from the right-of-way or easement in a manner that does not endanger the adjoining property or persons, or traffic using the right-of-way. The wood shall become the property of the adjoining property owner when in an existing right-of-way, or the property owner who granted the easement. If the adjoining property owner or property owner granting the easement does not want the wood, it shall become property of the Contractor. Burning or burying will not be permitted.
- B. Existing stumps and stumps of trees which are removed shall not be ground down but shall be completely removed.
- C. Because of the special concern for Preservation of trees in the Township, only those trees, which have been indicated for removal on the Plans, may be removed. All other trees are to be preserved unless prior written permission for removal is obtained from the Township and the property owner. Selective pruning of trees will be permitted to allow operation of the Contractor's equipment. Tree branches and roots shall be pruned neatly, and the scars shall be covered with an approved tree dressing.

1.32 DEWATERING

- A. Where dewatering is required, the Contractor shall limit the dewatering operation to the minimum time and depth required for construction. The Contractor will be required to furnish and maintain temporary water service to property owners whose wells may be affected by the dewatering operations. The Contractor shall also be responsible for any necessary repairs to existing wells required to place them back in operation after construction is completed. If the Contractor does not provide temporary water in a timely manner, the Township will cause temporary water to be provided and the Contractor or Owner shall promptly reimburse the Township for all of its expenses. Dewatering discharge shall be in accordance with the specifications and EGLE requirements.

1.33 USE OF SLAG

- A. No slag shall be permitted for use below the normal water table.

1.34 EXISTING UTILITIES

- A. There is no guarantee that the location shown for existing utilities and underground structures on the Plans is accurate, nor that additional underground utilities or structures may not be encountered.
- B. The Contractor shall notify MISS DIG for utility locations before starting any open cut or tunnel construction or before drilling holes for construction purposes. The Contractor shall cooperate with the utility companies in any repair, relocation, or other work to be performed on the utility caused by the construction of the Project.
- C. The Contractor shall be fully responsible for the location, protection, relocation, replacement, etc., for all existing underground utilities, which may reasonably be expected in any area, regardless of whether or not such utilities are shown on the Plans. Items in this category shall include, but not necessarily be limited to water mains and services, sanitary sewer and laterals, forcemains, gas mains and services, storm sewer and catch

basin leads, telephone, electric, and cable TV wire, etc. Such work shall be considered incidental to the major items of construction unless otherwise noted on the Plans.

D. Water Mains:

1. Construction on water mains is limited to construction site temperatures above 25°F as determined by Allendale Township or their inspector.
2. It shall be the responsibility of the Contractor to uncover such mains for a reasonable distance ahead of his construction operation to permit field adjustments where such might be made in grade, location or alignment of the proposed sanitary sewer and water main and/or appurtenances.
3. An existing water main, including water services, shall be raised to pass over the sanitary sewer (where the elevation of the water main conflicts with the elevation of the sanitary sewer), provided a minimum cover of five feet is maintained from the top of the water main to final grade. The existing water mains may be lowered where the elevation of the water main conflicts with the elevation of the sanitary sewer. The raising or lowering of existing water mains shall be accomplished by using vertical bends properly anchored. Report as soon as the conflict is encountered and build only after approval by the Township. A sand cushion shall be provided between the water main and the sanitary sewer. The Contractor shall notify the Township before any work on existing water mains is begun. The Township shall approve the configuration of the bends and thickness of the sand cushion. (A minimum of 18" vertical separation between watermain and any sewer is required).

E. Sewers (Sanitary, Storm, Culverts, Under drains and Force mains):

1. All existing sewers crossing or parallel to proposed sewers and water mains (even if not shown on the Plans) shall be replaced or repaired by the Contractor if damaged during construction, unless otherwise indicated on the Plans. Existing castings shall be adjusted if a different grade is established. This shall be done in accordance with the sanitary sewer section requirements. If excavation or trench cave in occurs within 5' of existing sanitary sewer. This section shall be televised 30 days after backfilling is restored, including compaction testing. All costs be considered incidental unless otherwise noted on the plans.
2. Existing manholes catch basins and inlets shall be saved and protected unless otherwise indicated on the Plans to be removed. Catch basins and inlets shall be reconstructed if damaged during construction. Costs for rebuilding, removing and/or repairing existing sewer, manholes, catch basins, inlets, house leads, headwalls, etc., shall be considered incidental unless otherwise noted on the construction Plans or in the Specifications.
3. A manhole shall be placed at the end of an existing sanitary sewer stub if necessary, to accommodate change in grade and / or alignment, or if in a submerged condition.

F. Electric Services:

1. Consumers Energy and Great Lakes Energy operate electric systems in the Township.

G. Gas:

1. DTE / Michcon and SEMCO provide natural gas services in the Township.

H. Telephone:

1. AcenTek and AT&T / SBC / Ameritech provide telephone service in the Township.

I. Cablevision:

1. Charter Communications and AcenTek provide cable TV service in the Township.

J. MISS DIG:

1. The Township and other local units of government, Consumers Energy Company, Great Lakes Energy, DTE / Michcon, SEMCO, AcenTek, AT&T / SBC / Ameritech and Charter Communications are members of a utility communications system called "MISS DIG" that provides service to participating units of governments and utilities. The Contractor shall contact "MISS DIG" not less than three (3) business days before starting construction for assistance in locating utilities or for any work to be done on utilities. The toll-free number is 811

K. Utilities:

1. The Contractor shall notify other units of government and the utility companies of the Contractor's schedule and obtain any necessary permits from them. These units of government and companies include the Township, Consumers Energy, Great Lakes Energy, DTE / Michcon, SEMCO, AcenTek, AT&T / SBC / Ameritech, and Charter Communications.
2. The Contractor shall pay for any charges by the units of government and utility companies for permits, inspections, or similar charges required to construct the project as shown on the Plans.

L. Water and Sewer:

1. The Township operates and maintains the water and sanitary sewer systems in the Township service area.

M. City of Grand Rapids Water Transmission Line:

1. The City of Grand Rapids operates and maintains a 46-inch water transmission line along M-45 and a 60-inch water transmission line along Fillmore Street.

N. Ottawa County / City of Coopersville Water Transmission Line:

1. Ottawa County, on behalf of the City of Coopersville, operates and maintains a 16-inch water transmission line along 60th Avenue north of M-45. As the Township watermain in 60th Avenue is extended north, any water services that may be connected to the Coopersville transmission line shall be reconnected to the Township water main.

1.35 UTILITY POLES

- A. When necessary, the Contractor shall shore and brace utility poles that interfere with construction. Shoring and bracing shall be such that sinking or excessive tilt does not take place. All relocation or removing and replacing of power poles, light poles and telephone poles should be done in accordance with the pole owner's standards and all expenses shall be paid for by the Contractor. All arrangements for pole relocations shall be completed by the Contractor with the pole owner at least 72 hours prior to need for relocations.

1.36 TELEPHONE

- A. An emergency telephone system (listing of number) shall be set up and given to the Township so that the Contractor may be immediately notified of any unsafe conditions or emergencies encountered during times that the Contractor is not working on the Project.
- B. The Contractor shall provide a local number and a local employee so that the Contractor may be contacted at any time (including weekends and holidays) 24 hours a day.

1.37 EXISTING PRIVATE FACILITIES

- A. Existing wells, septic tanks, tile fields, lawn irrigation systems and sump pump discharge lines which are or are not on the Owner's property which are disturbed or damaged by the Contractor, shall be repaired and restored to working condition before the end of that working day. Under no circumstances will such interruptions be extended overnight. The Contractor shall take necessary precautions not to allow any discharge from the above to enter any lake, stream, or canal along the line of work. Costs for repairs or temporary service caused by the Contractor shall be at the Contractor's sole expense whether shown on the Plans or not.
- B. All precautions necessary shall be taken to ensure no damage occurs to homes, including basements.

1.38 CASTING OR STRUCTURE GRADE ADJUSTMENTS

- A. Casting adjustments on existing and proposed manholes, water main valve boxes, hydrants, etc., that are required in order to meet the new/restored grade, shall be made by the Contractor in compliance with current specifications.

1.39 MATERIAL TESTING

- A. The Township reserves the right to sample and test any of the materials required for the proposed construction, either before or after delivery to the Project and to reject any material represented by any sample which fails to comply with the minimum requirements specified.
- B. The Contractor shall furnish all materials reasonably required by the Township for sample testing and analysis necessary for the testing of materials as required by the Specifications.
- C. If any material fails to meet the specified requirements, all material represented by the sample shall be rejected unless the Contractor can demonstrate through additional tests, at the Contractor's sole expense, that the remainder of the material is satisfactory.
- D. As a minimum requirement, the following shall be submitted to the Township by the Contractor (at no cost to the Township).
 - 1. Pipe: Certified test reports for strength from the manufacturer.
 - 2. Product Data: Valves, pipe, hydrants, etc., by type and manufacturer.

1.40 BONDS OR LETTER OF CREDIT

- A. The Township will require a Letter of Credit from the Developer to guarantee completion of public improvements and to secure the site. If the Developer desires to connect the Project to the Township's water and/or sewer systems after substantial completion but in advance of this final inspection and written approval, Developer shall provide to the Township an irrevocable letter of credit issued by a bank in favor of the Township in such amount and duration as the Township shall reasonably determine is necessary to pay all costs and expenses related to completing the Project. The letter of credit to be provided shall be in such form and with such provisions as the Township shall reasonably require. The amount of the Letter of Credit shall be based on an engineer's estimate for the remaining construction costs to finish the project plus a 25% contingency amount. This estimate will be prepared by the Owner's Engineer and approved by the Township Engineer.

- B. Bonds will be required for the full contract value when the Township is the Owner and the amount of construction exceeds \$50,000.
- C. The improvements identified are to include all construction necessary to protect and preserve the integrity of the public infrastructure. Such improvements are expected to include but not be limited to items such as
 - 1. Water and sanitary sewer mains
 - 2. Final grading
 - 3. Structure adjustments (i.e. fire hydrants, valve boxes, P.I.V.'s, manhole castings, curb stop boxes, etc.)
 - 4. Roadway and paving (i.e. wearing course)
 - 5. Applicable sidewalks, non-motorized paths
 - 6. Restoration
 - 7. Flushing, cleaning, testing, and televising
 - 8. Access lanes
 - 9. Storm sewers

1.41 BUILDING OCCUPANCY INSPECTION

- A. Before a certificate of occupancy can be issued for any structure or portion thereof, the Township shall perform an occupancy inspection to ensure water and sanitary mains, services, and appurtenances have been installed, approved, and accepted into service.

1.42 AUTHORITY OF THE TOWNSHIP AND THEIR AUTHORIZED REPRESENTATIVES

- A. The Township and their authorized representatives have the authority to verify that the Project is being constructed in accordance with the Plans and Specifications, the Standard Construction Requirements, the Township's Rules and Regulations and the Development Agreement.
- B. The Township and their authorized representatives also have the authority to suspend and/or terminate work as provided in Section 1.40 below.

1.43 DISPUTES

- A. All disputes between the Owner and the Contractor or Owner's Engineer shall be reviewed and resolved in a prompt manner so that the completion date is not compromised or extended.

1.44 SUSPENSION OF WORK AND TERMINATION

- A. The Township and their authorized representatives reserve the right to suspend the Work until all disputes between the Owner and the Contractor or Owner's Engineer are resolved. The Township and their authorized representatives may also suspend the Work when the Township or their authorized representatives make a determination under Section 1.38 above that the Project or Work is not being constructed in accordance with the Plans and Specifications or methods previously submitted or these Standard Construction Requirements.

1.45 CONTRACT AMENDMENTS/CHANGE ORDERS/NOTIFICATION/CONCURRENCE

- A. When necessary, the Owner or the Owner's Engineer will prepare for the Township's prior written approval, agreement amendments and change orders.

1.46 SITE CLEANLINESS

- A. The Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land areas identified in and permitted by the Plans and Specifications and other land and areas permitted by law, rights-of-way, permits and easements, and shall not unreasonably encumber the Work premises with construction equipment or other materials or equipment. The Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work.
- B. The contractor shall secure and dispose of all construction wastes, including but not limited to concrete, wood, metal, insulation, asphalt, glass, brick, plastics, and packaging. Daily maintenance and upkeep of the site, including sweeping the roadway and gutter line, shall be maintained. Additional cleanup shall be performed if requested by Allendale.

1.47 SUBSURFACE CONDITIONS

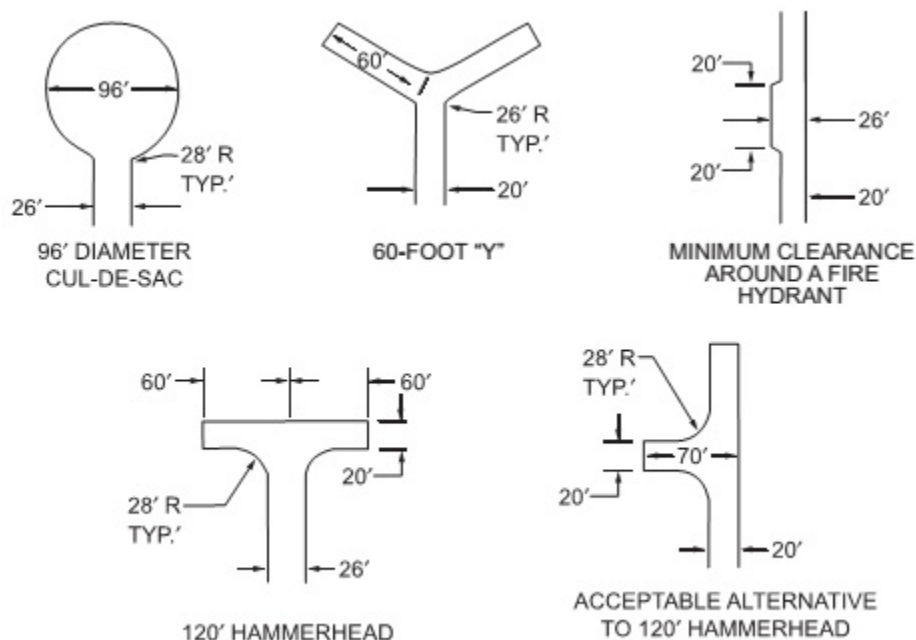
- A. The Contractor shall make a conscientious effort and shall provide reasonable assistance to the Township as may be required to verify the locations and/or elevations of all existing utilities, which may be affected by the proposed construction.
- B. At points where the Contractor's operations are near the properties of railroad, telephone and power companies, or are near existing underground utilities, damage to which might result in considerable expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.
- C. The Contractor shall protect, shore, brace, support and maintain all utilities affected by its operations. The Contractor shall be responsible for all damage to utility properties or facilities and shall make arrangements satisfactory to the Owner, with the agency or authority having jurisdiction thereover, concerning repair or replacement or payment of costs incurred with said damage.
- D. In the event of interruption to water or other utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the Township or other utility owner and shall cooperate with the Township and/or such owner in the restoration of service. If water service or other essential service is interrupted, repair work, (including flush/ cleaning, and testing) shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the Township Fire Department.

1.48 WATER MAIN VALVE TURNING AND SANITARY SEWER PLUGS

- A. The Township shall operate all valves in the water and sanitary sewer systems. No such valves shall be operated by the Contractor unless authorized by the Township.
- B. Where connection to the existing sanitary sewer system is proposed, the existing sanitary sewers or the proposed sanitary sewer shall be plugged to prohibit dirt and foreign material from entering the existing sanitary sewer system. The plugs used shall be approved by the Township and shall not be removed until authorization is received in writing from the Township. The plugs shall be provided, installed and removed by the Contractor at its sole cost and expense, as directed by the Township.

1.49 SANITARY SEWER PUMPING STATIONS

- A. Plans and Specifications for all sanitary sewer pumping stations will be prepared by the Township Engineer and provided to the Owner's Engineer. The Owner's Engineer shall coordinate and incorporate the Plans and Specifications prepared and provided by the Township's Engineer into their documents prior to submitting for approval and permits. Fee structure is included in Appendix B – Development Fee.
- 1.50 ROOF DRAINS/FOOTING DRAINS/SUMP PUMP DISCHARGES
 - A. All buildings and other structures shall provide for positive points of discharge for roof drains, footing drains, and sump pumps.
 - B. These shall not be connected to the sanitary sewer.
- 1.51 EASEMENTS
 - A. All easements to be granted to the Township shall be on forms included in the Appendix. Utility easements shall be minimum width of 20 feet centered on the utility unless otherwise directed by the Township. Sidewalk and Shared Use Path easements shall be of width directed by the Township. A survey sketch depicting the easement and easement description shall be included as an Exhibit. All easements must be executed and delivered to the Township Engineer prior to construction of the Project.
- 1.52 ALLENDALE FIRE DEPARTMENT REQUIRED ACCESS FOR FIRE FIGHTING AND WATER SUPPLY FOR FIRE PROTECTION
 - A. The Allendale Fire Department enforces the most recent edition of the International Fire Code including but not limited to:
 - 1. Fire Apparatus Access Roads:
 - a. Facilities, buildings, or portions of buildings hereafter constructed shall be accessible to fire department apparatus by way of an approved fire apparatus access road with an asphalt or concrete driving surface capable of supporting the imposed load of fire apparatus weighing at least 75,000 pounds.
 - b. Where a fire hydrant is located on a fire apparatus access road, the minimum road width shall be 26 feet exclusive of shoulders. Dead end fire apparatus access road turnarounds shall be limited to the following configurations:



- c. Where building heights exceed 30 feet, approved fire apparatus access roads shall be provided. Aerial fire apparatus access roads shall have a minimum unobstructed width of 26 feet, exclusive of shoulders, in the immediate vicinity of the building. At least one of the required access routes shall be located within a minimum of 15 feet and a maximum of 30 feet from the building and shall be positioned parallel to one entire side of the building. The side of the building on which the road is positioned shall be approved by the fire code official. Overhead utility and power lines shall not be located over the fire access road or between the road and the building.
- d. Multiple-family residential projects having more than 100 dwelling units shall be equipped throughout with two separate and approved fire apparatus access roads. Projects having up to 200 dwelling units may have a single approved fire apparatus access road when all buildings, including nonresidential occupancies are equipped throughout with approved automatic sprinklers systems. Multiple-family residential projects having more than 200 dwelling units shall be approved with two separate and approved fire apparatus access roads regardless of whether they are equipped with an approved automatic sprinkler system.
- e. Developments of one or two-family dwellings where the number of dwelling units exceeds 30 shall be provided with two separate and approved fire apparatus access roads. Where more than 30 dwelling units on a single public or private fire apparatus access roads and all dwelling units are equipped throughout with an approved automatic sprinkler system, access from two directions shall not be required.
- f. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one-half length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.
- g. An approved water supply for fire protection, either temporary or permanent, shall be made available prior to the arrival of combustible material on the site. All fire department access road(s), fire hydrants and valves must be operational and pass Township inspection prior to the arrival of combustible materials on site. Fire hydrants must be turned "on". A second inspection of the fire hydrants and valves must be performed and approved as a requirement for Certificate of Occupancy.

- h. Water supplies must meet the required minimum fire flow for the building(s).
- 2. Fire Hydrants:
 - a. All fire hydrant placement shall be determined by Allendale Fire Department's Fire Inspector as part of the plan review process.
 - b. To be useful, fire hydrants must be accessible. To ensure this, a clear space of not less than ten feet (10') shall be provided in front of and around each fire hydrant. A clear space is required to be free of all obstructions such as parked cars, landscaping, utilities, service vehicles, construction work, snow and all other blockages.
- 3. Road Closure:
 - a. Any and all road closures must be called into Central Dispatch (616.842.2299), and to Allendale Fire Chief, not less than 24 hours in advance. Also notify the Township inspector. Any detour or "bypass" must be approved by the Allendale Fire Department. If the road is a last-minute necessity, it must be approved by the Fire Department.

1.53 EXCEPTIONS

- A. Exceptions to these Standard Construction Requirements may be granted in writing by the Township. Exceptions shall only be approved by the Township when applied for in writing and in circumstances where compliance with the Standard Construction Requirements is impossible or would cause extreme hardship. All requests for exceptions shall be in writing and signed by the Owner and Owner's Engineer. The exception request shall include all relevant supporting documentation and information, including information supplied by the Owner's Engineer. The burden of proof shall be on the Owner to provide convincing proof that the exception is necessary because it is impossible to comply with the Standard Construction Requirements or compliance will cause extreme hardship. Additional cost is not justification for the granting of an exception. If granted, the exception shall be granted in writing by the Township, endorsed by each affected department (such as Public Utility Dept., fire dept., etc.). The decision of the Township shall be final.
- B.

**ENGINEER'S CERTIFICATE
FOR WATER MAIN, SANITARY SEWER, STORM SEWER,
PEDESTRIAN BRIDGE, SIDEWALK, AND/OR SHARED USE PATH IMPROVEMENTS**

Date: _____

Project Name: _____

Township of ALLENDALE Section: _____

County of OTTAWA, State of Michigan

I hereby state that the construction of the Project is complete.

Exception(s): _____

and that to the best of my knowledge and belief:

- (1) The Work has been installed and completed in accordance with the approved Plans and Specifications and the Allendale Charter Township Standard Construction Requirements.
- (2) The construction materials meet the approved Specifications.

(Seal)

Signed: _____
Registered Professional Engineer

BILL OF SALE

_____, whose address is _____, (hereinafter referred to as "Seller") for and in consideration of One Dollar (\$1.00) and other good and valuable consideration, does hereby grant, dedicate, transfer, and deliver to ALLENDALE CHARTER TOWNSHIP, whose address is 6676 Lake Michigan Drive, Allendale, Michigan 49401, (hereinafter referred to as the "Township")

Seller hereby warrants and represents to the Township that the Improvement has been acquired, constructed and completed in accordance with the Plans and Specifications prepared by _____ and dated _____ for the Improvement previously approved by the Township, with only those change orders approved in writing by the Township, and that no claim, action, or liability exists with respect to the Improvement and its construction and installation.

Seller further warrants and represents to the Township that it is the lawful owner of the Improvement, and that the Improvement is free of all liens and encumbrances of any kind. Seller further represents that it has the authority to transfer the Improvement and that the Seller will warrant and indemnify the Township against all claims asserted by any entity or person arising out of the installation, construction and completion of the Improvement. Seller also warrants that the Improvement is free from defects in material and workmanship. All warranties and guarantees pertaining to the Improvement are hereby assigned and transferred to the Township.

Witnesses:

DEVELOPER:

(1) _____ (LS) By: _____ (LS)

Its: _____

Dated: _____, 20____

ALLENDALE CHARTER TOWNSHIP:

(1) _____ (LS)

By: _____ (LS)

Its: Supervisor

Dated: _____, 20____

(2) _____ (LS)

By: _____ (LS)

Its: Clerk

Dated: _____, 20____

GUARANTEE PERIOD AGREEMENT

It is hereby agreed between the undersigned Developer, Contractor and Township that a one-year guarantee period is in place for the improvements described as

and completed by the Contractor under Agreement with the Owner (Developer). The Contractor shall guarantee the completed work for a one-year period commencing on the date of Final Completion by the Township (in writing), in accordance with paragraph 1.10 of the General Requirements of the Allendale Charter Township Standard Construction Requirements. This one-year guarantee period shall be extended for an additional one-year period from the time that any of the finished Work is repaired, replaced, restored or rebuilt pursuant to the guarantee agreement as determined by the Township.

IN WITNESS WHEREOF, the parties have executed this Agreement.

Witnesses:

DEVELOPER:

(1) _____ (LS) By: _____
 _____ (LS)

Its: _____
 Dated: _____, 20____

CONTRACTOR:

(1) _____ (LS) By: _____
 _____ (LS)

Its: _____
 Dated: _____, 20____

ALLENDALE CHARTER TOWNSHIP:

(2) _____ (LS) By: _____
 _____ (LS)

Its: Supervisor
 Dated: _____, 20____

COST ESTIMATE EXAMPLE for LETTER OF CREDIT for ALLENDALE CHARTER TOWNSHIP								
Project Name:								
Engineer:						Developer:		
Water main system								
Description					Quatity	LF/Each	Cost	Total
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
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								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
Sanitary Sewer System								
Description					Quatity	LF/Each	Cost	Total
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
Storm Sewer System								
Description					Quatity	LF/Each	Cost	Total
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
								\$0.00
Applicable Sidewalk								
Description					Quatity	LF/Each	Cost	Total
								\$0.00
								\$0.00
								\$0.00
Roadway and Paving								
Description					Quatity	LF/Each	Cost	Total
								\$0.00
								\$0.00
								\$0.00
								\$0.00
SUB TOTAL								\$0.00
CONTINGENCY								\$0.00
TOTAL							\$0.00	

SUBSTANTIAL COMPLETION

This document serves as official date of approval

Prior to Substantial Completion or any building connections the following actions must be completed and approved in writing by the Township:

- Water main pressure test and chlorination passed 33 11 00 Section 3.03 and 3.05
- Connection to water system made 33 11 00 Section 3.02
- Services marked correctly 33 11 00 Section 3.02
- Asphalt installed to minimum of base grade
- Sanitary sewer castings set to asphalt grade, base as a minimum 33 31 00 Section 3.02
- Sanitary sewer air testing, manhole inspection and video inspection passed 33 31 00 Section 3.03
- Rough grading complete
- Laterals marked correctly 33 31 00 Section 3.02
- Force main pressure testing passed 33 34 00 Section 3.03
- Pump station testing passed
- Letter of credit to complete the improvements identified on the approved plans 02 00 00 Section 1.37, Appendix D
- Hydrant and valve inspection complete

DATE:

Project:

Chad E. Doornbos
Superintendent of Public Utilities

Jon Currier
Public Utilities Field Inspector

ALLENDALE CHARTER TOWNSHIP

CERTIFICATE OF SUBSTANTIAL COMPLETION

REQUEST BY OWNER (DEVELOPER) AND CONTRACTOR:

OWNER (Name and Address) _____

CONTRACTOR (Name and Address) _____

Project (description of public improvements), or portion thereof: _____

In relation to the above described Project (public improvements), or portion thereof, the applicable Items a) thru f) in the first paragraph of Section 1.08 of the General Requirements of the Township's Standard Construction Requirements have occurred. Therefore, the OWNER and CONTRACTOR request the Township to certify Substantial Completion of the above described Project (public improvements), or portion thereof, at this time.

☐ A reduced Letter of Credit in the amount of \$_____ and expiration date of _____ is proposed to guaranty completion of the uncompleted work.

☐ A reduced Letter of Credit is not proposed.

OWNER (DEVELOPER)

By: _____
(signature)

Printed Name: _____

Its: _____

Date: _____

CONTRACTOR

By: _____
(signature)

ACCEPTANCE BY TOWNSHIP:

The Township certifies that the Work to which this Certificate of Substantial Completion applies has been reviewed and has been found to be substantially complete. The date of Substantial Completion of the Project, or portion thereof, designated above is hereby declared.

Date of Substantial Completion

The following documents are attached and made part of this Certificate of Substantial Completion:

This Certificate of Substantial Completion does not constitute final approval of the Project.

Recommended by TOWNSHIP ENGINEER

Date

ALLENDALE CHARTER TOWNSHIP

By: _____
(Signature)

(Date)

Printed Name: _____

Its: _____

CERTIFICATE OF FINAL APPROVAL

REQUEST BY OWNER (DEVELOPER) AND CONTRACTOR:

OWNER (Name and Address) _____

CONTRACTOR (Name and Address) _____

Project (description of public improvements): _____

In relation to the above described Project (public improvements), the applicable Items a) thru h) of the second paragraph of Section 1.08 of the General Requirements of the Township's Standard Construction Requirements have occurred or have been approved.

OWNER (DEVELOPER)

CONTRACTOR

By: _____
(signature)

Printed Name: _____

Its: _____

Date: _____

FINAL APPROVAL BY TOWNSHIP:

The Township certifies that Final Approval of the Project designated above is hereby declared.

Recommended by PUBLIC UTILITIES SUPERINTENDENT

Date

ALLENDALE CHARTER TOWNSHIP

By: _____
(Signature)

(Date)

Printed Name: _____

Its: _____

ALLENDALE CHARTER TOWNSHIP PUBLIC UTILITIES DEPARTMENT

“AS-BUILT PLANS”

Allendale Charter Township’s Construction Standards clearly states the requirements for “as-built” prints. Refer to – General Requirements, Section 1.08 for final approval and acceptance. Paragraph “1.08 and 1.12.07” describes how many copies of what type of print must be provided and to whom they must be provided.

Allendale Public Utilities will be responsible for incorporating GPS coordinates into our GIS Mapping Database. The locations will be gathered at the time of Substantial Completion. This will include:

- Curb Stop Boxes
- Main line valve boxes
- Hydrant Valves
- Hydrants
- End of stubs
- Sanitary sewer stubs and laterals
- Manholes
- Bends

Attached is an example of a correctly completed “as-built” plan.

Water Main

Submit single line drawings of the following:

- All water mains, including bends and deflections (horizontal & vertical) and hydrant leads
- Water services – need length and size and measurement of corp.

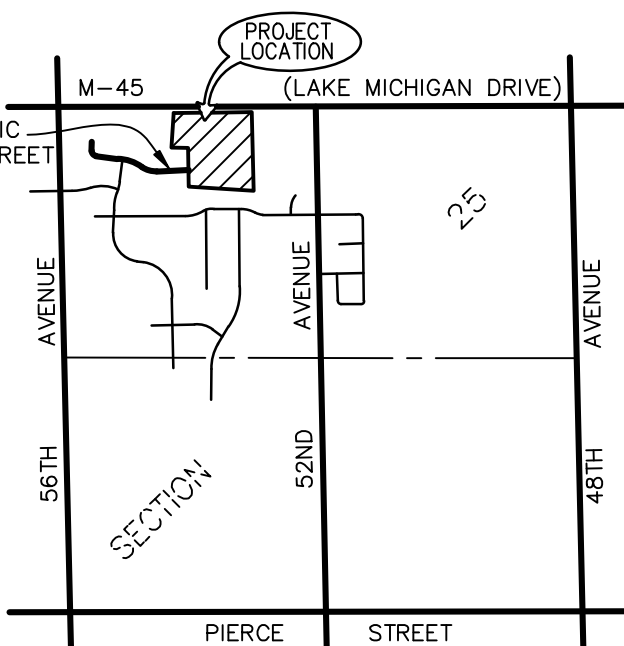
Sanitary Sewer

Submit measurements for the following:

- Stubs and laterals –inverts and lengths
- Wye connections –measurement from downstream manhole
- Manholes –TOWNSHIP manhole number, station numbers and length between manholes, invert elevations prior to setting the cone section, and rim elevations.
 - All elevations shall be in State Plain.
- All markups shall be in a distinct color

Notes on Plan

Include name, address, and phone number of Contractor

[illegible]

excel engineering, inc.
 planners • engineers • surveyors
 5252 Clyde Park, S.W. • Grand Rapids, MI 49509
 Phone: (616) 531-3660 www.exceleengineering.com

W	DRAWN BY: MDW	PROJ. ENG.: TRS	SHEET 2 of 4
W	APPROVED BY: TRS	PROJ. SURV.: BMF	
7	FILE NO.: 182008E	DATE: 05/03/2022	

SECTION 31 23 23**FLOWABLE FILL****PART 1 - GENERAL****1.01 DESCRIPTION:**

- A. Flowable Fill (FF) shall consist of a mixture of (a) Portland cement, fly ash, and water; (b) Portland cement, granular material, fly ash, and water; or (c) fly ash, granular material, and water. All Materials will be as specified in the Standard Specifications or as stated. All flowable fill after setting is intended to be removable by conventional mechanical excavation methods. Flowable fill shall be installed by pressure pump and pressurized within the pipe.

1.02 SUBMITTALS:

- A. Pre-Construction:
1. Flowable Fill Mix Designs:
 - a. Provide a flowable fill mix design submittal for each mix of fill meeting the requirements of MDOT Division 10, prepared by independent lab, two weeks prior to use. Contractor may submit mix designs previously approved by MDOT.
 2. Material Certifications:
 - a. Provide certifications of quality by producer for the following:
 - 1) Cement.
 - 2) Fly Ash.
 - 3) Aggregates.
 - 4) Admixtures.
 3. Batch Tickets:
 - a. In accordance with MDOT 1001.03.A.4.
- B. Post-Construction:
1. Test Specimens:
 - a. Contractor shall deliver acceptance cylinders to the place of inspection and testing.

PART 2 - PRODUCTS**2.01 MATERIALS:**

		<u>Specific Gravities***</u>
Portland Cement	MDOT Section 901	3.15
Fly ash	ASTM C 618(1)*	2.40
Granular material Class II **	MDOT Section 902	2.60
Water	MDOT Section 911	1.00

* Except there is no limit on the loss on ignition.

** Except that 100% shall pass 19mm sieve.

*** Specific gravity values used for mix proportions given. If material used differs from these values appropriate adjustments should be made.

2.02 OPTIONAL FLOWABLE FILL (FF) MIXTURES:

- A. FF Mix Number One*
Cement Stabilized Fly Ash Mixture (Class F Fly Ash)

Portland Cement	100 lb./cyd
Fly ash (Class F)	2,000 lb./cyd
Water	Sufficient water to produce the desired flowability (approx. 3 gal/ cyd)

- B. FF Mix Number Two*
Controlled Density Fill Mixture (Class F Fly Ash)

Portland Cement	50 lb./cyd
Fly ash (Class F)	500 lb./cyd
Granular material	2,850 lb./cyd
Water	Sufficient water to produce the desired flowability (approx. 1 gal/cyd)

- C. FF Mix Number Three*
Controlled Density Fill Mixture (Class C Fly Ash)

(due to the variability of type 'C' fly ash there is no suggested mix)

*NOTE: The ready-mixed concrete producer supplying the flowable fill shall have a 28-day test on the mix option to be used for the trench backfill showing that the compressive strength is less than 1034 kPa for the fly ash from the same source that will be used for the trench backfill.

PART 3 - EXECUTION

3.01 TRANSPORTING AND CONSTRUCTION METHODS:

- A. The temperature of the flowable fill mix as manufactured and delivered shall be at least 50° F.
- B. Mixtures shall be transported to the point of placement in a revolving drum mixer or agitator.
- C. During placement operations around manholes and in utility trenches, care shall be used to avoid dislocating any pipes due to fluid pressure from the flowable fill by even placing of the material. Any pipes within the backfill area should be considered for securing to avoid buoyant effect of flowable fill.
- D. When Flowable Fill (FF) is used in pavement cuts the fill shall be placed to the bottom level of proposed HMA or concrete paving.
- E. Flowable fill shall be installed by pressure pump and pressurized within the pipe.

END OF SECTION

SECTION 31 23 33

EXCVAVTION. BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for trenching, excavating and backfilling, clearing, boring and jacking, special pipe foundations and special work below grade.

1.02 DEFINITIONS:

- A. Maximum Density: Maximum dry weight in pounds per cubic foot of a specific material.
- B. Optimum Moisture: Percentage of water at maximum density.
- C. Rock Excavation: Includes all boulders or rock weighing 400 pounds (approximately one cubic yard) or more and all solid or ledge rock, slate, shale, sandstone, and other hard materials that require continuous use of pneumatic tools, heavy rippers or continuous drilling and blasting for removal. Pavements are not included.
- D. Suitable Excavated Material: Mineral (inorganic) soil free of cinders, refuse, sod, boulders, rocks, pavement, soft or plastic clays, vegetable, or other organic material and capable of being compacted as specified. Moisture content has bearing on the suitability of materials to be used.
- E. Unsuitable material: Any type of debris (surface or buried), excavated rock, bedrock or rocks larger than six (6) inches in diameter.
- F. Granular Material: Coarse grained materials having no cohesion, which derives its resistance to displacement from internal stability.
- G. Cohesive Material: Fine grained material which derives its resistance to displacement by manual attraction between particles of the mass, involving forces of molecular origin (i.e. Clays are considered cohesive).
- H. Grade Terminology: Article 3.07 SCHEDULES.

1.03 REFERENCES:

- A. MDOT - Michigan Department of Transportation, *"Standard Specifications for Construction," Current edition.*
- B. ASTM - American Society of Testing Materials, latest edition.

1.04 JOB CONDITIONS:

- A. Obtain and comply with construction permits from agencies having jurisdiction over the work.
- B. Scheduling: Clean up promptly following utility installation backfilling.
 - 1. Coordinate with street cleaning.

- C. Dust Control: Broom or apply dust palliatives as needed.
- D. Driveway Closing: Eight (8) hour maximum with prior notification to resident. Maintain emergency access to all properties during construction.
- E. Signs, mailboxes, and other movable surface features:
 - 2. Witness location prior to removal. Relocate to accessible location and maintain during construction.
 - 3. Upon completion of construction, replace to original position and condition.
 - 4. Replace regulatory traffic control signs immediately after utilities are placed and backfilled.
- F. Encroachments are prohibited in the ROW. Examples of encroachments include, but are not limited to, rocks, berms, headwalls, private signs, flag poles, abandoned basements, fences, buildings, landscape lighting, privately owned utilities, and unapproved plantings.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Trench Backfill
 - 1. Granular Material shall be MDOT 902.07, Class III limited to 1.0-inch maximum size.
 - 2. Select Granular Material shall be MDOT 902.07, Class II or IIa limited to 1.0-inch maximum size.
 - 3. Concrete Grade 3000 per MDOT Section 1004.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Clearing and Grubbing
 - 1. Perform clearing, grubbing and tree removal required for proposed construction within limits of right-of-way, easement and/or project site.
 - 2. Dispose of tree, stump, and brush material by removing it from the site or as otherwise approved by the Township.
 - 3. Save and protect all trees and vegetation unless identified to be removed.
 - 4. Repair or replace trees, shrubs and other vegetation damaged by Contractor's operation.
- B. Removal of Surface Improvements
 - 1. Remove improved surfaces such as pavement, drives, sidewalk, curb and gutter, lawns, etc. just prior to excavating / trenching operations. Edges of pavements removed shall be saw cut.
- C. Conflicting Utilities
 - 1. Before starting excavation, establish location and extent of existing utilities in work area.
 - 2. Establish potential conflict areas prior to construction.
 - 3. Excavate and expose existing utilities presenting potential conflict to determine their exact location and elevation.
 - 4. Advise Township and Owner's Engineer of conflicts and obtain instructions on how to proceed.

5. Make adjustments in proposed utility location.
6. Make arrangements with Owner of existing utility for relocation, if necessary.
7. Schedule work accordingly.

D. Dewatering

1. Provide and maintain dewatering equipment as necessary to provide dry trench subgrade.
2. Provide temporary water supply to homes interrupted by dewatering operations.

E. Soil Erosion and Sedimentation Control

1. Obtain permit from Ottawa County Water Resources Commissioner.
2. Provide and maintain soil erosion and sedimentation control measures during construction.

3.02 EXCAVATION:

A. General:

1. Dispose of surplus and unsuitable excavated material, including construction debris.
2. Remove, salvage and stockpile topsoil on-site in area designated by Owner's Engineer.
3. Unsuitable material and encroachments encountered in sub-grade or below payment line: Notify Township and Owner's Engineer and obtain instruction on how to proceed.

B. Trenches:

1. Depth: Provide a uniform and continuous bearing and support for proposed utility on solid and undisturbed or compact granular material.
2. Minimum Width: Allow space for jointing and bedding. Meet requirements of AWWA C600 or C605, as applicable, for water main.
3. Maximum Width: The following limitations shall apply at utility crown:
 - a. 6 inch through 10-inch diameter: 30 inches.
 - b. 12 inch through 30-inch diameter: Outside diameter plus 24 inches.
 - c. 30 inch and over diameter: Outside diameter plus 36 inches.
 - d. Elliptical: Outside pipe width plus 36 inches.
4. Shoring: Provide sheeting, shoring, bracing, shelving, etc. in order to protect excavations in accordance with current MIOSHA and OSHA regulations.
5. Over excavation and proper use of stone and fabric may be required to create a dry trench. If stone is required for other than a sump pit, it shall be covered with geotextile fabric. This will require over excavating, stone and fabric placement and sand bedding to proper depth for pipe installation. Stone that is required under all manholes shall have fabric below and above as dictated by OCRC specification. This is in or out of ROW.
 - a. For Structures a sandwich of fabric, stone and fabric will be required.
 - b. For pipe, when using stone as the bed, fabric must go between the stone and the pipe. See SP 33 31 00 Sanitary Sewers.
 - c. If a solid base cannot be found, an engineered solution will be required.

C. Blasting:

1. Obtain and comply with required permits.
2. Perform only during hours approved by Owner and Township.

D. Length of Open Trench shall be 200 feet maximum.

E. Damage to Existing Underground Utilities:

1. Report all damage to Township, Owner's Engineer and Utility Owner.

2. Repair to utility Owner's standard.

3.03 BACKFILLING:

- A. Pipe bedding area and special pipe foundation area: Compact granular material to ninety-five percent (95%) of maximum density according to the Modified Proctor Method or to ninety-five percent (95%) of maximum density using the Michigan Cone Test.
- B. Trench Backfill Area:
 1. Under permanent pavement, shoulder areas and areas within a one on one slope from the shoulder edge:
 - a. Compact granular material in 9.0-inch layers to ninety-five percent (95%) of maximum density according to the Modified Proctor Method or to ninety-five percent (95%) of maximum density using the Michigan Cone Test.
 2. Under nonpermanent pavement: Same as permanent pavement.
 3. Under unimproved right-of-way areas: Compact suitable excavated material to eighty-five percent (85%) of maximum density.
 4. Under landscaped and unimproved areas: Compact suitable excavated material to eighty percent (80%) of maximum density.
 5. Under undercut existing structure: Place concrete.
- C. Structures:
 1. Density requirements: Same as Trenches.
 2. Concrete structure: Place backfill only after seventy-five percent (75%) of concrete design strength has been reached.

3.04 TRENCH UNDERCUTTING AND BACKFILL:

- A. Excavation: Perform to Owner's Engineer instructions.
- B. Backfill: Provide to payment line with granular material compacted in place.

3.05 BORING AND JACKING:

- A. Comply with MDOT, Ottawa County Road Commission, Owner's Engineer and the Township Engineer's requirements.

3.06 COMPACTION, TESTING, AND INSPECTION:

- A. Surplus excavated, and unsuitable excavated material shall become the property of the Contractor.
- B. Dispose of surplus excavated or unsuitable excavated materials off-site.
- C. Performance and test equipment will be provided by approved independent laboratory.
- D. Moisture - Density relationships:
 1. Cohesive (clays) soils: Michigan One-Point T99 Test (MTM 404)
 2. Granular (sand and gravel) soils: One-Point Michigan Cone Test
 3. Recycled Aggregates (HMA, concrete) Michigan modified T-180 Test
- E. Field Density:
 1. ASTM D-6938 (Nuclear).

- F. Furnish equipment and personnel to provide access to test location and depth. Density tests will be performed at various levels, as determined, during or after backfilling operation.
- G. Correct any deficiencies resulting from insufficient or improper compaction. Retesting of density in areas of failed tests shall be performed at the Contractor's expense.
- H. Test results shall be given to field inspector daily, when taken. Formal report shall be emailed to the Field inspector when completed.

END OF SECTION

SECTION 32 13 14

CONCRETE SIDEWALK, SIDEWALK RAMPS AND DRIVEWAYS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for concrete sidewalk and sidewalk ramps.
- B. Definitions:
 - 1. Pavement Structure: The combination of the base, subbase and HMA or concrete surface placed on the subgrade. Pavement includes gravel, HMA and concrete surfaced streets and driveways.
 - 2. Subgrade: The portion of the subgrade on which the concrete sidewalk is to be placed.
 - 3. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.

1.02 REFERENCES:

- A. MDOT - Michigan Department of Transportation, *"Standard Specifications for Construction", Current Edition.*
- B. ASTM - American Society of Testing Materials, latest edition.
- C. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
- D. PROWAG – Public Rights-of-Way Accessibility Guidelines

1.03 SUBMITTALS:

- A. Certification of quality by producer for the following:
 - 1. Cement
 - 2. Aggregates
- B. Concrete Test Specimens: Deliver to the place of inspection and testing.
- C. Concrete Mix Design:
 - 1. Provide a concrete mix design for each mix of concrete meeting the requirements of MDOT Division 10, prepared by independent lab, two weeks prior to paving. Contractor may submit concrete mix designs previously approved by MDOT.
- D. Submittal of as-built plans to the Township upon completion of project.

1.04 JOB CONDITIONS:

- A. General Limitations: Concrete shall not be placed between November 1 and April 1, unless authorized by the Township. Concrete shall not be placed when the air temperature in the shade is less than 40 degrees Fahrenheit and falling. Concrete shall not be placed if portions of the base, subbase, or subgrade layer are frozen, or if the grade exhibits poor stability from excessive moisture levels. Chemicals shall not be added to reduce the freezing point. Any deviation from the above, when authorized, will

require protection from freezing until the concrete has attained a compressive strength of at least 1,000 psi (1,000 psi strength will typically be attained after 2 days of curing). Concrete damaged by frost action shall be removed and replaced.

- B. Clean-up promptly following sidewalk installation.
- C. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent sidewalk installation is completed.
- D. Driveway Closing: 24-hour maximum for removal and replacement of concrete plus additional 96 hours (4 days) for curing. Prior to replacement, the removed portion of the driveway shall be brought up to its proposed grade with gravel and/or bituminous.
- E. Protect areas under construction with lighted barricades and reflectorized fencing in accordance with applicable MDOT, MIOSHA, and ASHA regulations.
- F. Number of Crosswalks:
 - 1. Two-way intersections (i.e. – 90-degree intersections) are required to have 2 crosswalks.
 - 2. Three-way intersections to have 3 crosswalks.
 - 3. Four-way intersections to have 4 crosswalks.
 - 4. Each crosswalk shall have 2 concrete ramps.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Subbase: Granular material MDOT class II, MDOT 902.
- B. Concrete:
 - 1. Sidewalk and Sidewalk Ramps:
 - a. Use Concrete Grade 3500 per MDOT Section 1004 modified to 100% limestone aggregate.
 - 2. Driveways:
 - a. Use Concrete Grade 3500 per MDOT Section 1004.
- C. Concrete Joint Filler: Conform to MDOT 914.03.
- D. Forms: Rigid in accordance with MDOT 803.03B, except at curved sections which shall utilize a bendable material to provide a uniform radius, supported at adequate intervals.
- E. Gravel Base: MDOT 902.05, 22A Aggregate.
- F. HMA Patching: HMA Mix 36A.
- G. Bond Coat: MDOT 501.02 and 904.03C.
- H. Brick Pavers: Concrete brick pavers (4" x 8" size) designed for heavy vehicles.
- I. Detectable Warning Surfaces:
 - 1. Cast ductile iron plate with anchor lugs.
 - 2. Slip resistant textured surface.
 - 3. Provide width to match sidewalk ramp width.
 - 4. Meet ADAAG.

5. Manufacturer: East Jordan Iron Works or Neenah Foundry Company.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Removal: Remove or saw cut at the existing joint or line marked by Owner's Engineer in area of removal. Remove adjacent pavement structure necessary to place forms.
- B. Removal of subgrade material to maintain existing sidewalk elevation and meet specified concrete thickness shall be included in the cost of the sidewalk.
- C. Disposal of all removed material shall be performed by the Contractor. Keep all removed material off private property at all times.
- D. For sidewalk crossing bituminous drives: Saw cut existing bituminous and use as forms.
- E. For sidewalk crossing concrete drives: Remove or saw cut at the existing joint or line marked by the Owner's Engineer.
- F. Cut and protect tree roots as directed by the Owner's Engineer.
- G. Excavation: Form subgrade by trenching, excavating, or filling to the required elevation.
- H. Notify Owner's Engineer if unsuitable material exists below subgrade. Remove unsuitable material as directed by Owner's Engineer. If unsuitable material is removed, place a minimum 4-inch sand subbase to elevation required for bottom of concrete. In fill areas, the subbase shall be at least 1 foot wider than the sidewalk width.
- I. Compact subbase to 95% maximum density.
- J. Scheduling: Maximum time between removal and replacement, or between excavation and placement, shall be 7 days.

3.02 PERFORMANCE:

- A. Sidewalk and Ramp Requirements:
 - 1. All sidewalks in residential areas shall be 5 feet in width, with the grade of ¼ inch per foot from the back of sidewalk towards the street, unless otherwise directed. Sidewalks in residential areas shall also be in accordance with the "Residential Sidewalk Specifications" and "Sidewalk Specs Agreement Form" included in Article 3.06 SCHEDULES.
 - 2. Sidewalk ramps shall have a uniform grade except as necessary for short grade changes and shall be in conformance with the Draft PROWAG, ADAAG and these specifications. Detectable warning surfaces shall be provided, unless otherwise directed.
 - 3. Slopes away from the edge of sidewalk must not exceed a 1:4 grade (one vertical foot, four horizontal feet).
 - 4. Where sidewalks are intended to serve a dual purpose as a fire apparatus access road, sidewalk must be 10 feet in width and capable of supporting a load of 90,000 pounds.
 - 5. The elevation at the back of sidewalk shall be 6 inches above the road centerline, unless otherwise approved.

6. All sidewalks shall be a minimum of 4 inches thick except through driveways where they shall be a minimum of 6 inches thick for residential and 8 inches thick for commercial/industrial, with WW mesh reinforcement. Sidewalks shall continue through all driveways.
 7. Sidewalk ramps shall have a uniform grade except as necessary for short grade changes and shall be in conformance with ADAAG and these specifications. Detectable warning surfaces shall be provided.
 8. Sidewalk ramps shall be 8 inches thick with WW mesh reinforcement.
 9. The space behind the curb and between ramps at intersection corners shall be concrete (8-inch thick with WW mesh reinforcement), brick pavers (concrete brick over sand bedding over 6-inch thick concrete with WW reinforcement) or pre-approved landscaping.
 10. Detectable warning surfaces:
 - a. Provide for tactile and visual warning that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light.
 - b. Provide cast ductile iron detectable warning plates embedded into newly cast concrete. Provide same width as sidewalk, minimum. Install in accordance with manufacturer's recommendations, ADAAG and these specifications. Surface applied products will not be allowed. Do not construct detectable warnings by forming or stamping in newly cast concrete.
 - c. Provide detectable warning plates on all sidewalk ramps for sidewalk crossings of public roads, private roads that are stop sign controlled, and commercial driveways that are stop sign controlled or experience high traffic volumes that would warrant a safe sidewalk crossing of the drive. Ottawa County Road Commission requirements for providing detectable warning surfaces on sidewalk ramps on public roads and at commercial drives shall be met.
 11. All water appurtenances shall be wrapped with joint foam prior to pouring concrete. This shall apply to all public and private sidewalks and ramps.
- B. Structure Adjustment: Any utility structures in the sidewalk or ramp not conforming to the finished grade shall be adjusted to ¼" below grade. Conform to MDOT 403.03C and Township specifications.
- C. Concrete Mixing and Delivery: Transit mix concrete conforming to MDOT 601.03E.
- D. Placing and Finishing Concrete:
1. Place concrete on a moist base in one (1) lift to the specified depth. The concrete shall be thoroughly spaded along the faces of the forms before finishing operations are started. The concrete shall be struck off to the required grade and cross section.
 2. All edges and joints shall be slightly broomed transversely to roughen the surface after the concrete has received a float finish. The sidewalk ramps shall be textured with a coarse broom transversely to the ramp slope.
- E. Curing and Protection:
1. Concrete shall be cured and protected as specified under MDOT 602.03M and 602.03T except that pedestrian traffic may be allowed after 48 hours.
- F. Joints:
1. Joints shall be constructed to true line with their faces perpendicular to the surface of the sidewalk and shall not vary more than ¼ inch from their designated position. Transverse joints shall be constructed at right angles to centerline of the sidewalk and longitudinal joints shall be constructed parallel to the centerline unless otherwise required. When sidewalk is constructed in partial width, transverse joints shall be placed in line with like joints in the existing sidewalk.

2. The concrete at the faces of all joints shall be thoroughly spaded or vibrated and compacted to fill all voids and the surface shall be finished smooth and substantially true to grade.
3. One-half ($\frac{1}{2}$) inch transverse expansion joints shall be placed in line with all expansion joints in abutting curb, gutter or combination curb and gutter. When sidewalk does not abut such pavement, $\frac{1}{2}$ inch transverse expansion joints shall be placed at intervals not exceeding 50 feet and at all transitions between 4 inch and 6-inch sidewalk. Expansion joint filler shall extend the full depth of the joint with the top slightly below the finished sidewalk surface. The filler shall be supported temporarily until concrete is poured against it.
4. One-half ($\frac{1}{2}$) inch longitudinal expansion joints shall be placed between the sidewalk and the back of abutting parallel curb or gutter, between the sidewalk and buildings, or other rigid structures.
5. One-half ($\frac{1}{2}$) inch expansion joints shall be placed between sidewalk approaches and the back of curb and gutter, or the edge of pavement, including bituminous driveways.
6. Contraction joints shall be placed at 5 foot intervals. They shall divide sidewalk into areas not more than 36 square feet nor less than 16 square feet. Contraction joints will be produced by slab division forms extending to the full depth of concrete or by cutting joints in the concrete after floating to a depth of not less than $\frac{1}{4}$ the thickness of the concrete. The cut joints shall not be less than $\frac{1}{8}$ -inch or more than $\frac{1}{4}$ inch in width and shall be finished smooth and substantially true to line.

G. Backfilling and HMA patching:

1. After concrete has gained sufficient strength (70% of design), all rails, forms, stakes and supports shall be removed in a manner as not to injure finished concrete and all exposed edges of the concrete shall be backfilled, compacted and leveled immediately.
2. In areas where the sidewalk crosses bituminous drives, saw cut existing bituminous. HMA patching shall be placed and compacted.

H. HMA Patching:

1. Place minimum 4 inches of aggregate base 22A and compact to ninety-five percent (95%) of maximum density.
2. Place minimum 2 inches of HMA Mix 36A.

I. Concrete curb and gutter: Township's, Ottawa County Road Commission's or MDOT's Standard.

1. Match existing curb and gutter.
2. Construction methods: MDOT 802.03.

3.03 TESTING AND INSPECTION:

A. Observation: By Township, Township's Engineer or designated representative.

1. Inspection of forms is required prior to pouring concrete.

B. Acceptance Testing:

1. Cement: Certification of quality by producer.
2. Concrete:
 - a. Sample: ASTM C172
 - b. Frequency: Once for each 50 cubic yards of each class of concrete placed.
 - c. Perform following from sample:
 - (1) Mold three 6-inch cylinder compressive strength specimens: ASTM: C31
 - (2) Slump test: ASTM C143

- (3) Air test: ASTM C231
- (4) Yield test: ASTM C138
- (5) Strength test: ASTM C39
- 3. If initial testing indicates failure or nonconformance to specifications, additional testing shall be paid for by the CONTRACTOR. Replace nonconforming material.

C. Aggregates: Provide certification of approved stockpiled material.

D. Concrete:

- 1. Limestone aggregate.
- 2. Slump: 3-inches maximum.
- 3. Entrained Air: 4 percent to 7 percent.
- 4. Strength: 3500 psi, at 28 days.

3.04 TREE ROOT CUTTING:

- A. The following information shall be used as a guide when trimming tree roots:
 - 1. Excavate as shallow as possible in the area adjacent to the tree root.
 - 2. Make clean cuts with a saw or sharp chisel. Do not bury jagged or torn roots.
 - 3. Do not allow the exposed root ends to dry out. If exposed for more than a day, they can dry out. Cover all exposed roots with soil at the end of the day.
 - 4. Avoid cutting roots larger than 3.5 inches.

3.05 TREE ROOT BARRIER:

- A. Install tree root barrier along the sidewalk adjacent to trees to reduce future damage by tree roots in areas determined by the Township or Township Engineer. Installation shall be in accordance with manufacturer's recommendations.
- B. Install in 4-inch wide trench (with roots removed) adjacent to the sidewalk between the sidewalk and tree to a minimum depth of 30 inches. Secure with pins. Backfill carefully to avoid dislodging the barrier and compact firmly.
- C. Manufacturer: Typar Biobarrier or approved equal.

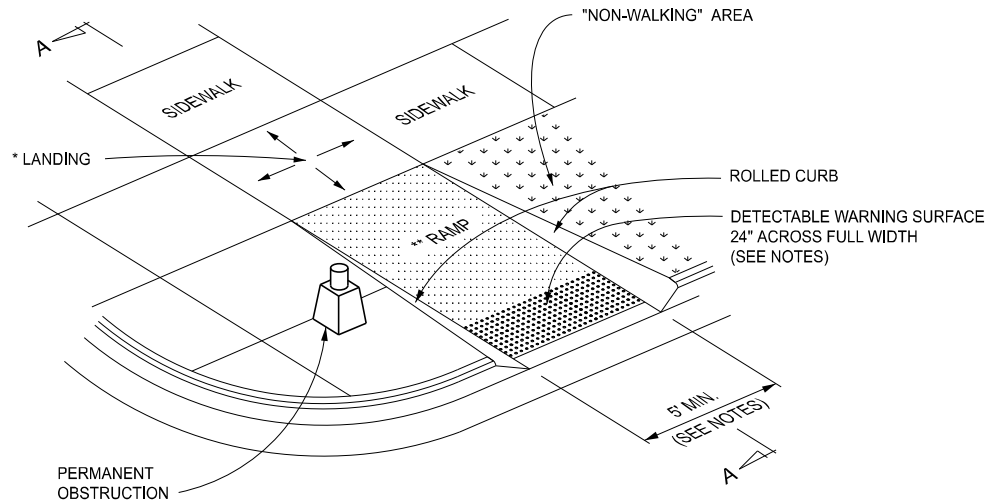
3.06 SCHEDULES:

- A. MDOT Standard Plan R-28-J SIDEWALK RAMP AND DETECTABLE WARNING DETAILS (7 sheets).
- B. MDOT Standard Plan R-29-I DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK (4 sheets).
- C. Typical Sidewalk Requirements (2 sheets).
- D. Residential Sidewalk Specifications and Sidewalk Specs Agreement Form (2 sheets).

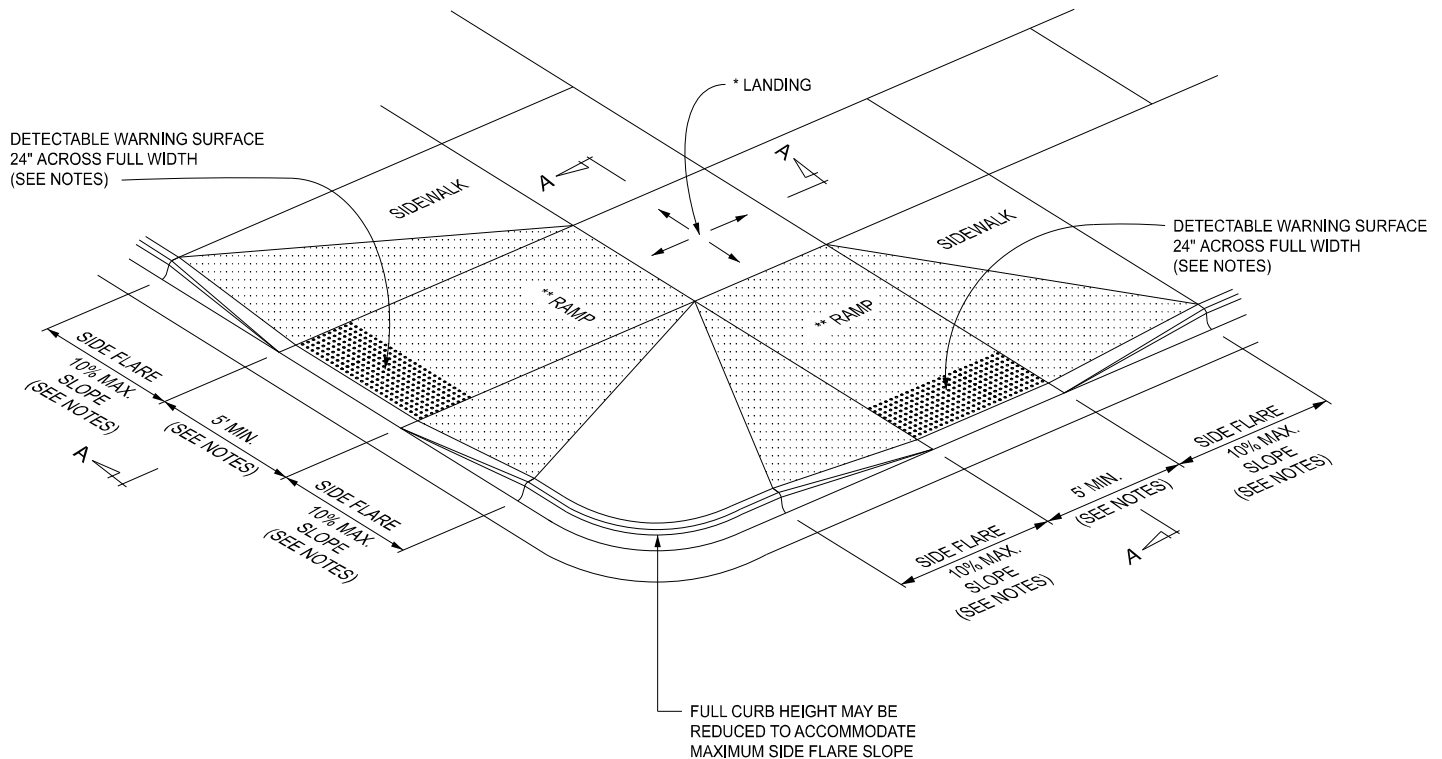
END OF SECTION

* MAXIMUM LANDING SLOPE IS 2.1% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.1%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



CURB RAMP TYPE R
(ROLLED SIDES)



CURB RAMP TYPE F
(FLARED SIDES, TWO RAMPS SHOWN)

APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

STANDARD PLAN FOR
**CURB RAMP AND
DETECTABLE WARNING DETAILS**

(SPECIAL DETAIL)
FHWA APPROVAL

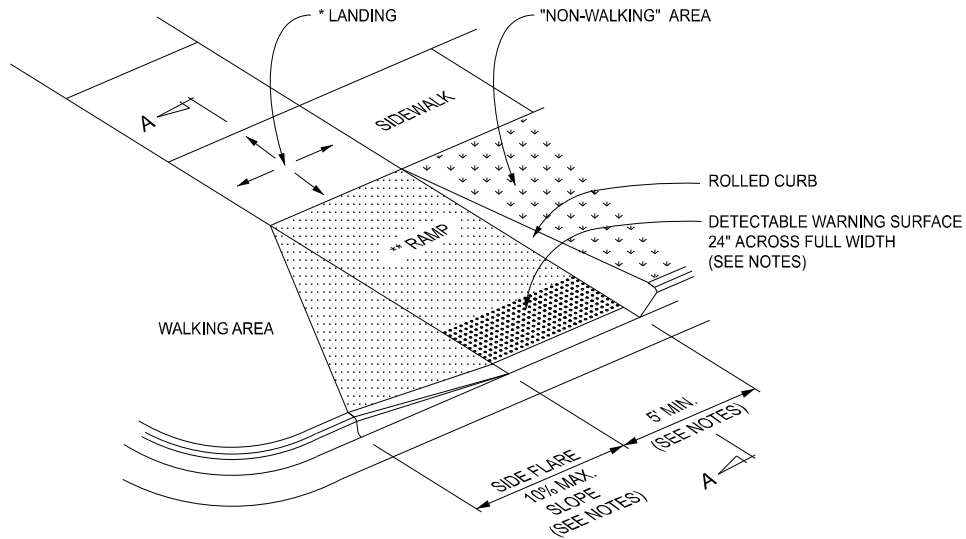
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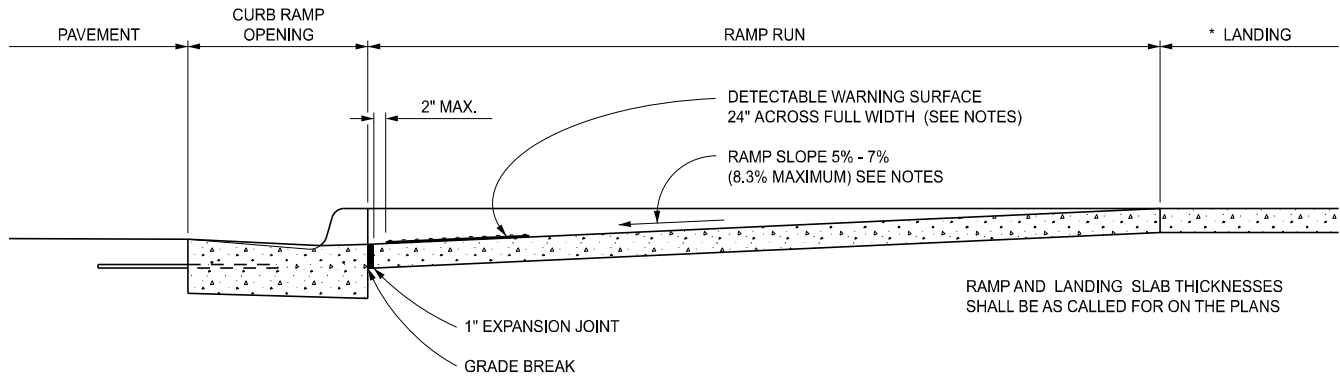
SHEET
1 OF 7

* MAXIMUM LANDING SLOPE IS 2.1% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.1%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



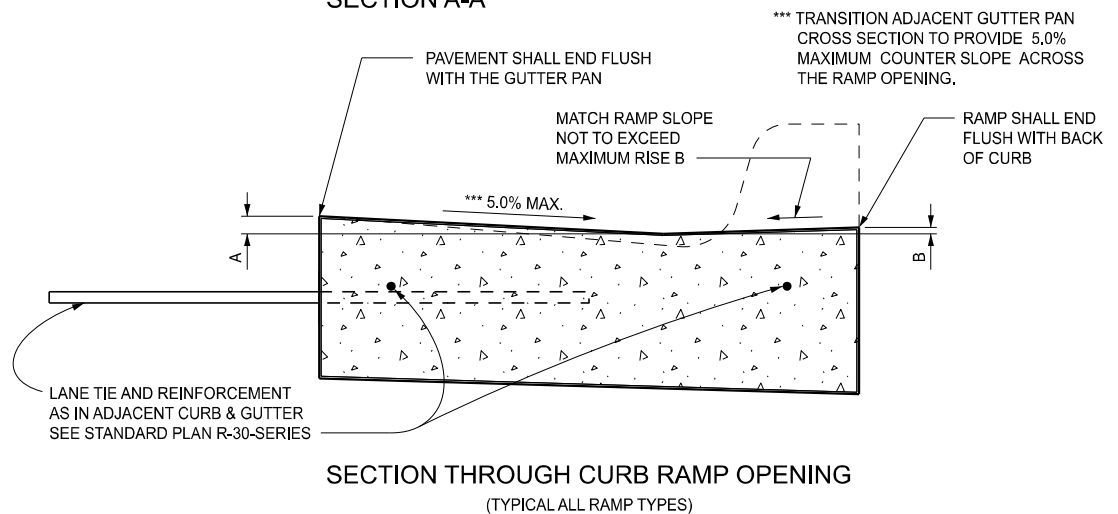
CURB RAMP TYPE RF
(ROLLED / FLARED SIDES)



SECTION A-A

CURB TYPE	MAXIMUM RISE (INCHES)	
	A	B
B1	$\frac{3}{4}$	1
B2	$\frac{3}{4}$	1
B3	$\frac{3}{4}$	1
D1	$\frac{3}{4}$	1
D2	$\frac{3}{4}$	1
D3	$\frac{3}{4}$	1
C1	$\frac{1}{2}$	$\frac{1}{2}$
C2	$\frac{1}{2}$	$\frac{1}{2}$
C3	$\frac{3}{4}$	$\frac{1}{2}$
C4	$\frac{3}{4}$	$\frac{1}{2}$
C5	1	$\frac{1}{2}$
C6	1	$\frac{1}{2}$
F1	$\frac{1}{2}$	$\frac{1}{2}$
F2	$\frac{1}{2}$	$\frac{1}{2}$
F3	$\frac{3}{4}$	$\frac{1}{2}$
F4	$\frac{3}{4}$	$\frac{1}{2}$
F5	1	$\frac{1}{2}$
F6	1	$\frac{1}{2}$

FOR CURB TYPES SEE
STANDARD PLAN R-30-SERIES



SECTION THROUGH CURB RAMP OPENING
(TYPICAL ALL RAMP TYPES)



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

STANDARD PLAN FOR
**CURB RAMP AND
DETECTABLE WARNING DETAILS**

(SPECIAL DETAIL)
FHWA APPROVAL

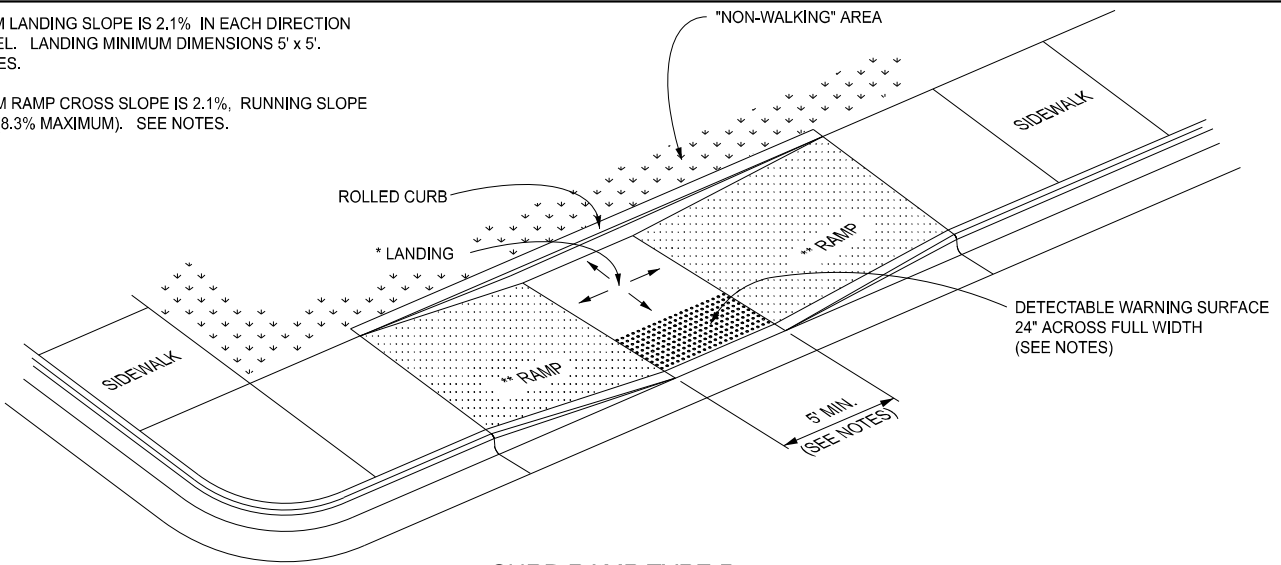
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PLAN DATE

R-28-K

SHEET
2 OF 7

* MAXIMUM LANDING SLOPE IS 2.1% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

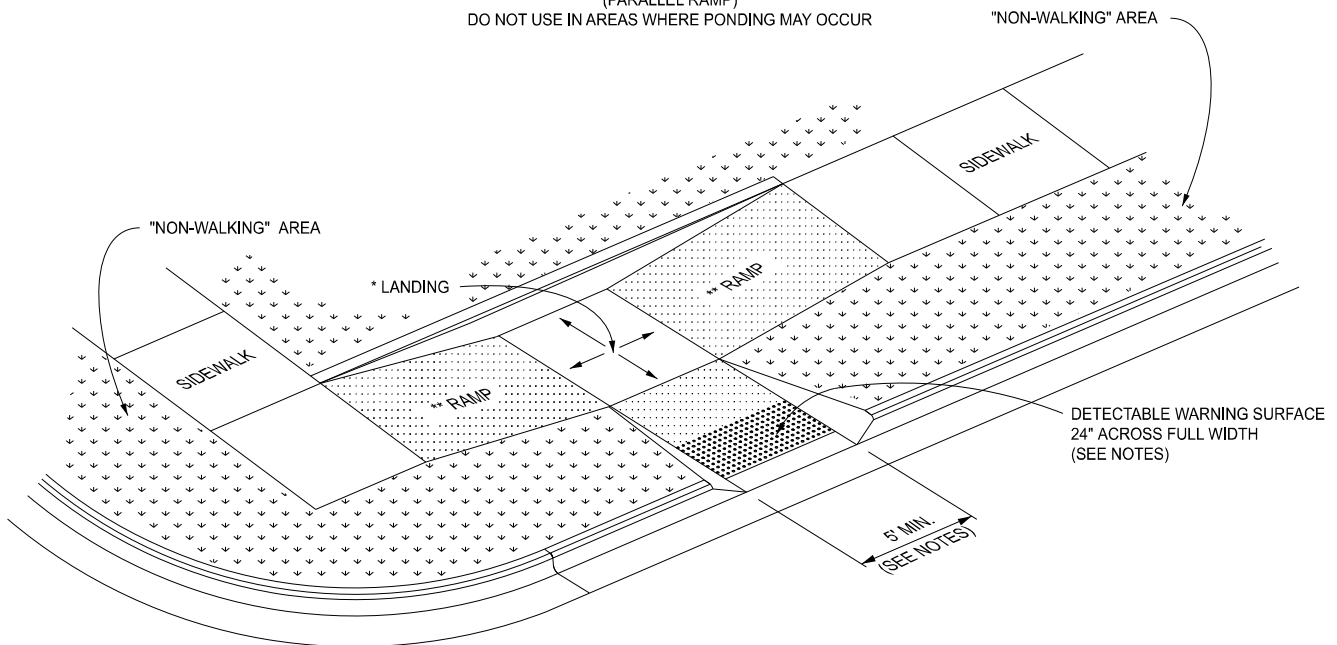
** MAXIMUM RAMP CROSS SLOPE IS 2.1%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



CURB RAMP TYPE P

(PARALLEL RAMP)

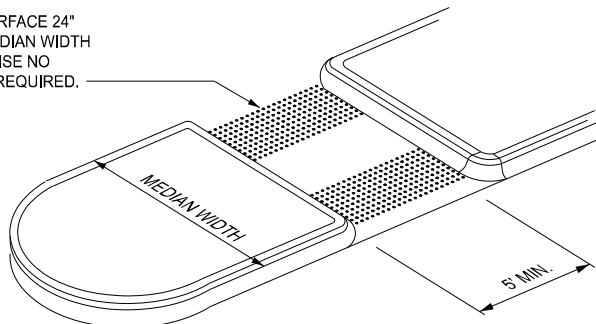
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



CURB RAMP TYPE C

(COMBINATION RAMP)

DETECTABLE WARNING SURFACE 24" ACROSS FULL WIDTH IF MEDIAN WIDTH IS AT LEAST 6'-0". OTHERWISE NO DETECTABLE WARNING IS REQUIRED.



CURB RAMP TYPE M

(MEDIAN ISLAND)



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

STANDARD PLAN FOR CURB RAMP AND DETECTABLE WARNING DETAILS

(SPECIAL DETAIL)
FHWA APPROVAL

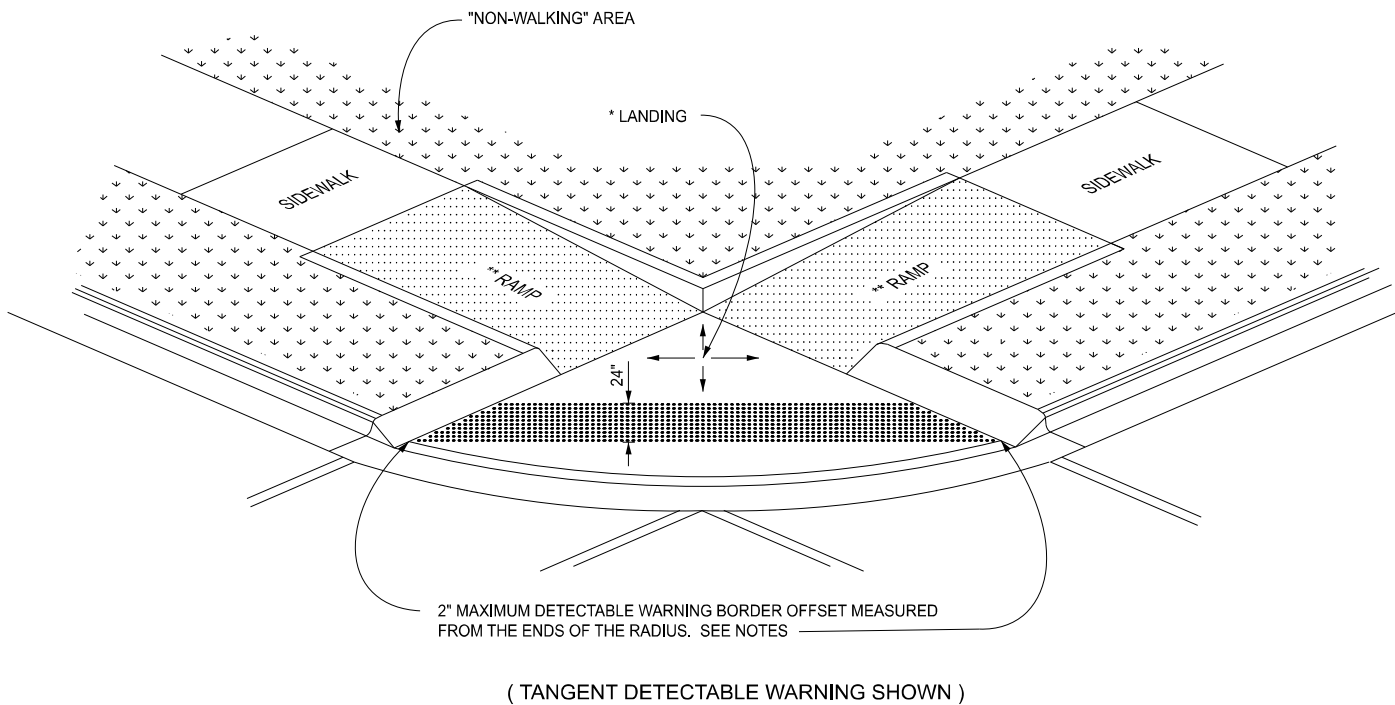
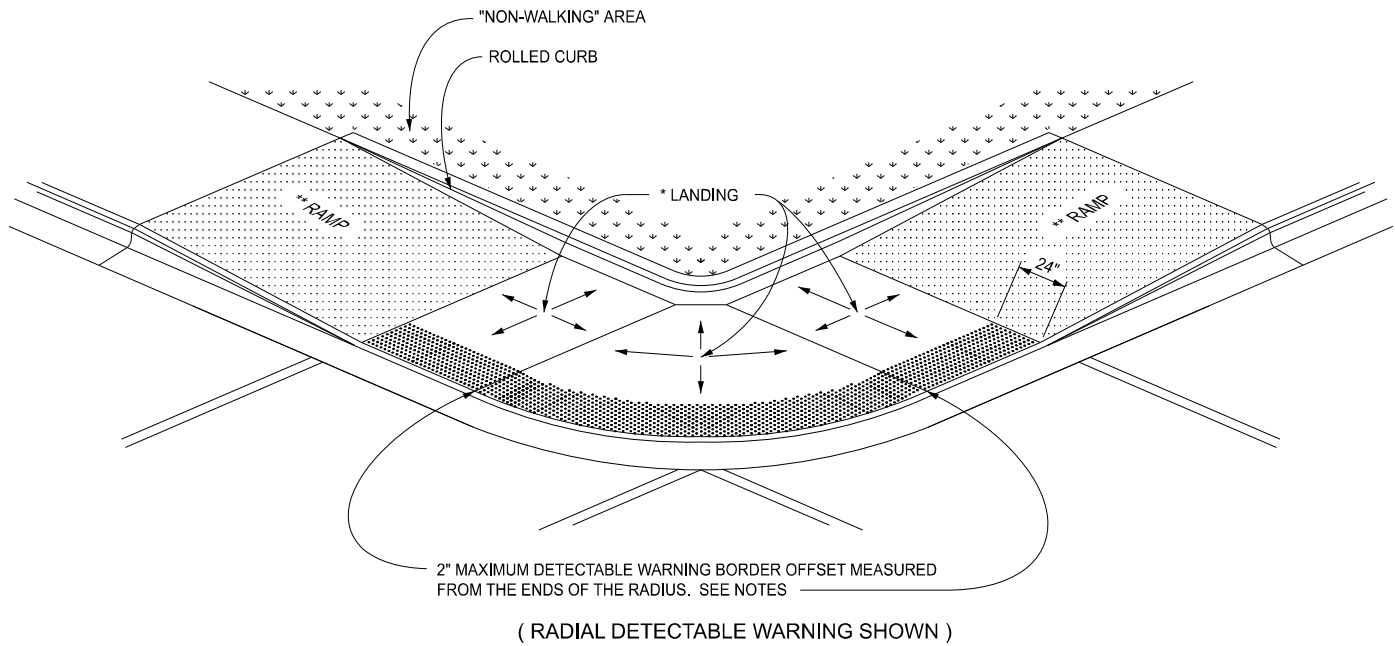
11/08/2023
PLAN DATE

R-28-K

SHEET
3 OF 7

* MAXIMUM LANDING SLOPE IS 2.1% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.1%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



CURB RAMP TYPE D (DEPRESSED CORNER)

USE ONLY WHEN INDEPENDENT DIRECTIONAL RAMPS CAN NOT BE CONSTRUCTED FOR EACH CROSSING DIRECTION



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

STANDARD PLAN FOR CURB RAMP AND DETECTABLE WARNING DETAILS

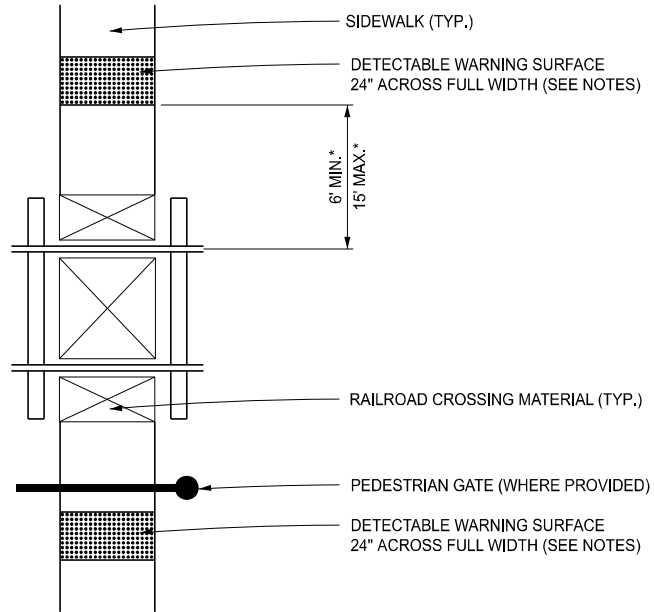
(SPECIAL DETAIL)
FHWA APPROVAL

11/08/2023
PLAN DATE

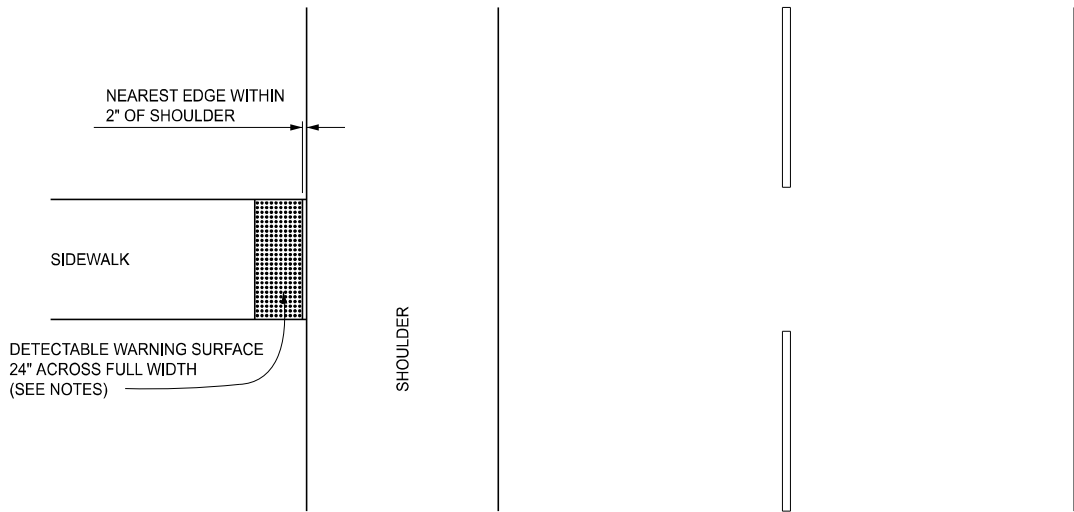
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SHEET
4 OF 7

* THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE RAIL CROSSING IS 6' MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. DO NOT PLACE DETECTABLE WARNING ON RAILROAD CROSSING MATERIAL.



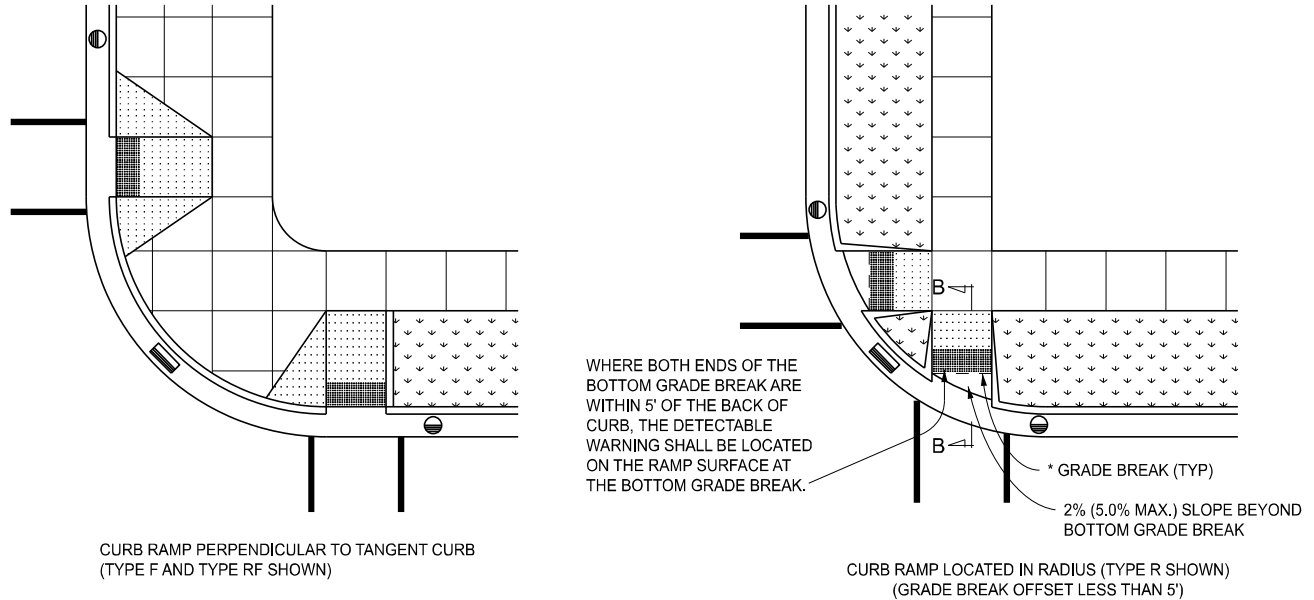
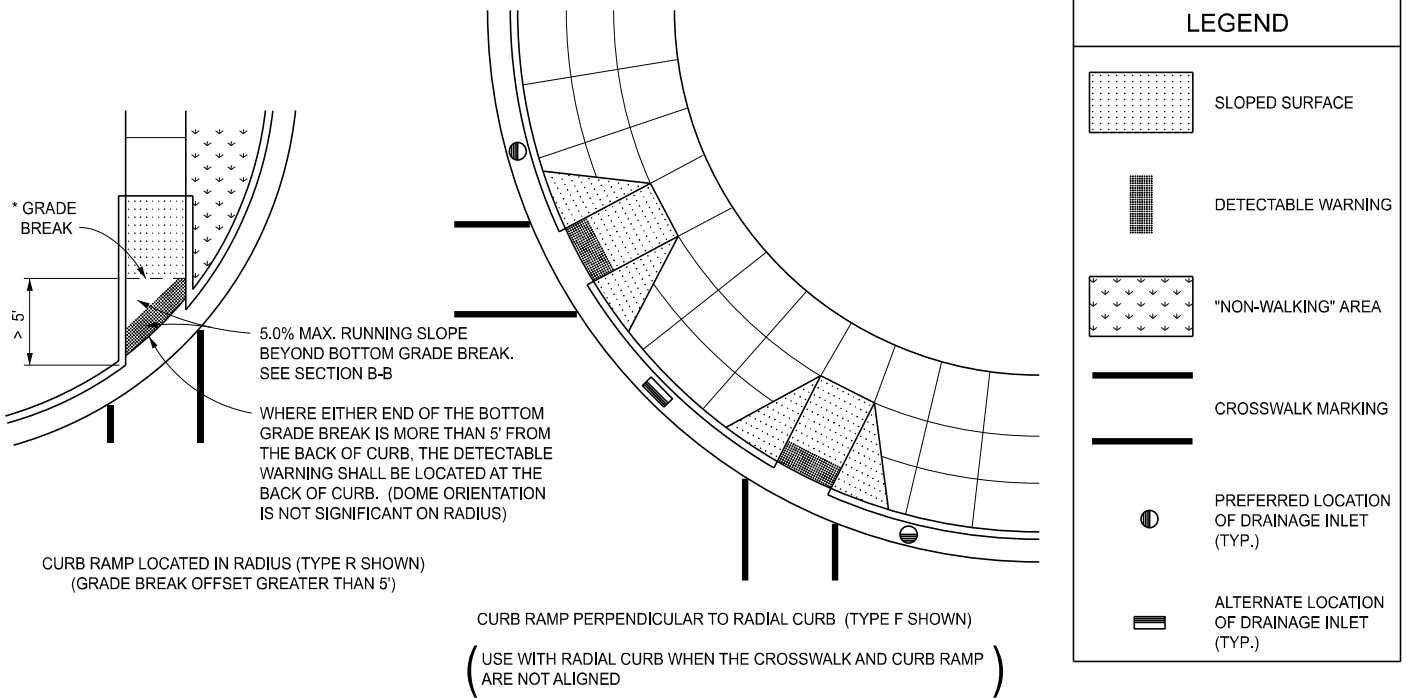
DETECTABLE WARNING AT RAILROAD CROSSING



DETECTABLE WARNING AT FLUSH SHOULDER OR ROADWAY

 Michigan Department of Transportation DEPARTMENT DIRECTOR BRADLEY C. WIEFERICH, PE	STANDARD PLAN FOR CURB RAMP AND DETECTABLE WARNING DETAILS		
	(SPECIAL DETAIL) FHWA APPROVAL	11/08/2023 PLAN DATE	SHEET 5 OF 7

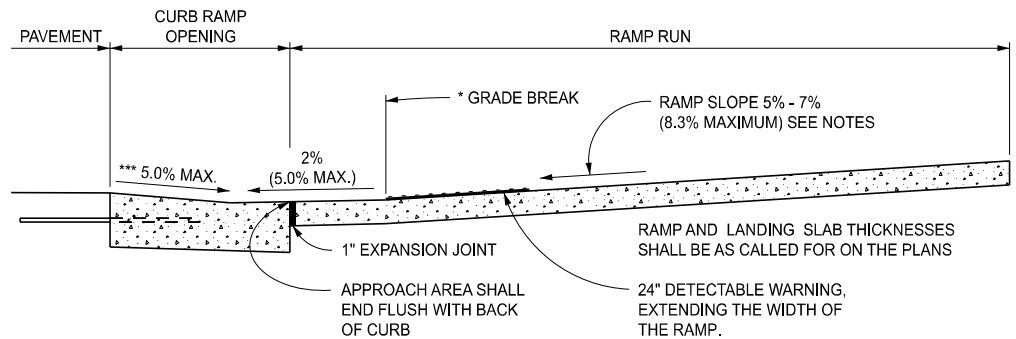
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* GRADE BREAKS AT THE TOP AND BOTTOM OF CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL.

*** TRANSITION ADJACENT GUTTER PAN CROSS SECTION TO PROVIDE 5.0% MAXIMUM COUNTER SLOPE ACROSS THE RAMP OPENING.

SEE SHEET 2 FOR CURB RAMP OPENING DETAILS.



SECTION B-B

CURB RAMP ORIENTATION



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

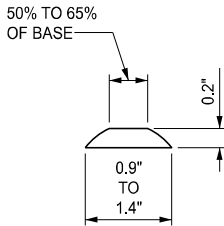
STANDARD PLAN FOR CURB RAMP AND DETECTABLE WARNING DETAILS

(SPECIAL DETAIL)
FHWA APPROVAL

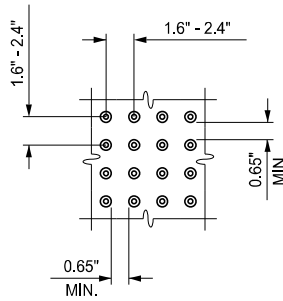
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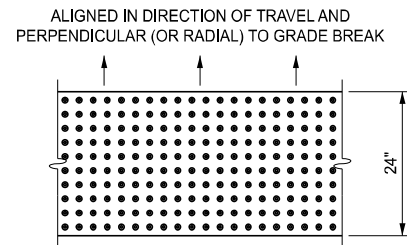
SHEET
6 OF 7



DOME SECTION



DOME SPACING



DOME ALIGNMENT

DETECTABLE WARNING DETAILS

NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS IN THE PUBLIC RIGHT OF WAY.

CURB RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT MARKED AND/OR SIGNALIZED MID-BLOCK CROSSINGS.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE RUNNING SLOPE.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

WHEN 5' MINIMUM WIDTHS ARE NOT FEASIBLE, RAMP WIDTH MAY BE REDUCED TO NOT LESS THAN 4' AND LANDINGS TO NOT LESS THAN 4' x 4'.

CURB RAMPS WITH A RUNNING SLOPE $\leq 5\%$ DO NOT REQUIRE A TOP LANDING. HOWEVER, ANY CONTINUOUS SIDEWALK OR PEDESTRIAN ROUTE CROSSING THROUGH OR INTERSECTING THE CURB RAMP MUST INDEPENDENTLY MAINTAIN A CROSS SLOPE NOT GREATER THAN 2.1% PERPENDICULAR TO ITS OWN DIRECTION(S) OF TRAVEL.

DETECTABLE WARNING SURFACE COVERAGE IS 24" MINIMUM IN THE DIRECTION OF RAMP/PATH TRAVEL AND THE FULL WIDTH OF THE RAMP/PATH OPENING EXCLUDING CURBED OR FLARED CURB TRANSITION AREAS. A BORDER OFFSET NOT GREATER THAN 2" MEASURED ALONG THE EDGES OF THE DETECTABLE WARNING IS ALLOWABLE. FOR RADIAL CURB THE OFFSET IS MEASURED FROM THE ENDS OF THE RADIUS.

FOR NEW ROADWAY CONSTRUCTION, THE RAMP CROSS SLOPE MAY NOT EXCEED 2.1%. FOR ALTERATIONS TO EXISTING ROADWAYS, THE CROSS SLOPE MAY BE TRANSITIONED TO MEET AN EXISTING ROADWAY GRADE. THE CROSS SLOPE TRANSITION SHALL BE APPLIED UNIFORMLY OVER THE FULL LENGTH OF THE RAMP.

THE MAXIMUM RUNNING SLOPE OF 8.3% IS RELATIVE TO A FLAT (0%) REFERENCE. HOWEVER, IT SHALL NOT REQUIRE ANY RAMP OR SERIES OF RAMPS TO EXCEED 15 FEET IN LENGTH NOT INCLUDING LANDINGS OR TRANSITIONS.

DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. THE LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER THE LOCATION OF THE DRAINAGE STRUCTURE. WHERE EXISTING DRAINAGE STRUCTURES ARE LOCATED IN THE RAMP PATH OF TRAVEL, USE A MANUFACTURER'S ADA COMPLIANT GRATE. OPENINGS SHALL NOT BE GREATER THAN $\frac{1}{2}$ ". ELONGATED OPENINGS SHALL BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR TO THE DOMINANT DIRECTION OF TRAVEL.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE ROADSIDE CURB LINE, SHALL BE PROVIDED WHERE AN UNOBSTRUCTED CIRCULATION PATH LATERALLY CROSSES THE CURB RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE RAMP IS BORDERED BY LANDSCAPING, UNPAVED SURFACE OR PERMANENT FIXED OBJECTS. WHERE THEY ARE NOT REQUIRED, FLARED SIDES CAN BE CONSIDERED IN ORDER TO AVOID SHARP CURB RETURNS AT RAMP OPENINGS.

DETECTABLE WARNING PLATES MUST BE INSTALLED USING FABRICATED OR FIELD CUT UNITS CAST AND/OR ANCHORED IN THE PAVEMENT TO RESIST SHIFTING OR HEAVING.



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

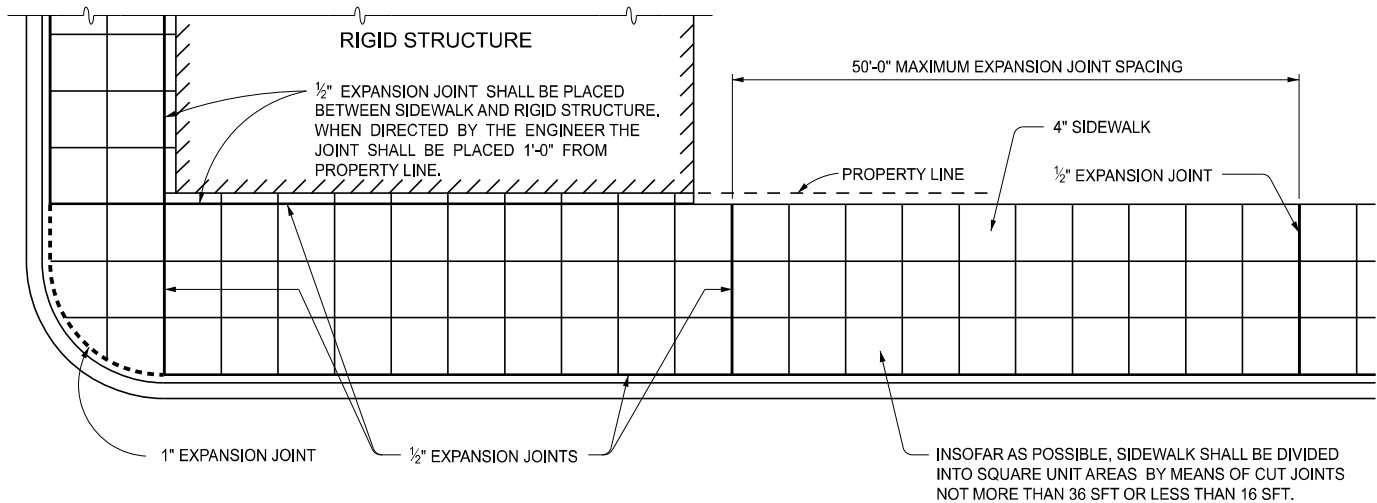
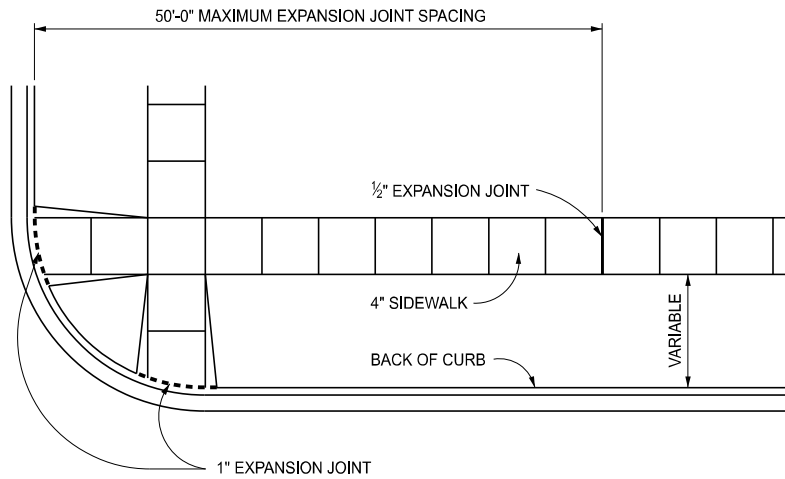
STANDARD PLAN FOR
CURB RAMP AND
DETECTABLE WARNING DETAILS

(SPECIAL DETAIL)
FHWA APPROVAL

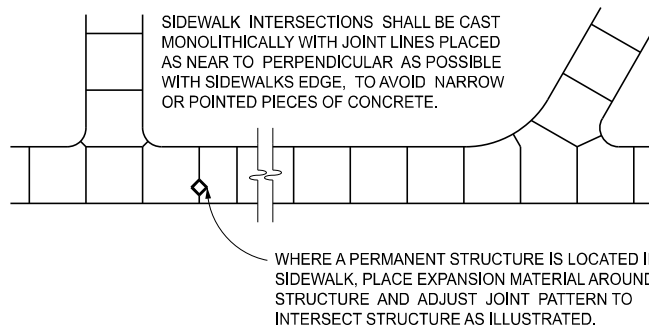
11/08/2023
PLAN DATE

R-28-K

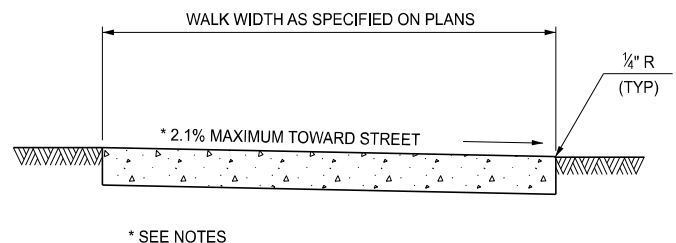
SHEET
7 OF 7



LOCATION OF JOINTS IN CONCRETE SIDEWALK



TYPICAL SIDEWALK JOINT LAYOUTS



4" CONCRETE SIDEWALK

APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

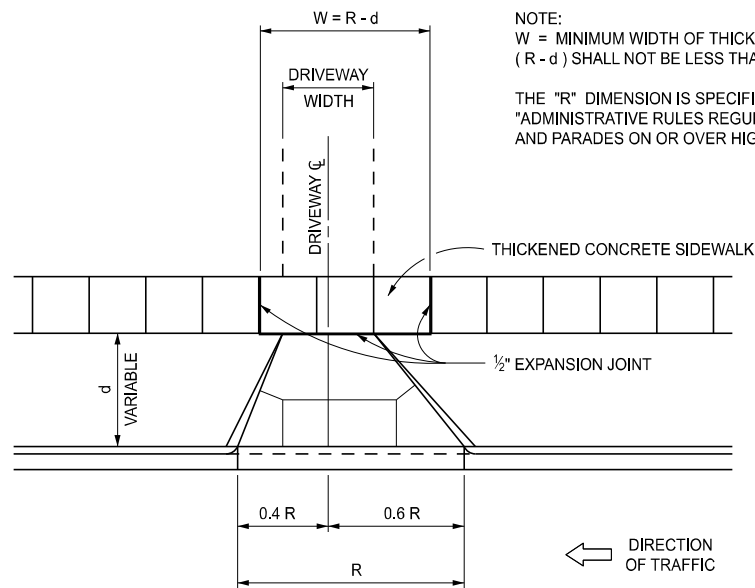
STANDARD PLAN FOR DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

(SPECIAL DETAIL)
FHWA APPROVAL

11/08/2023
PLAN DATE

R-29-J

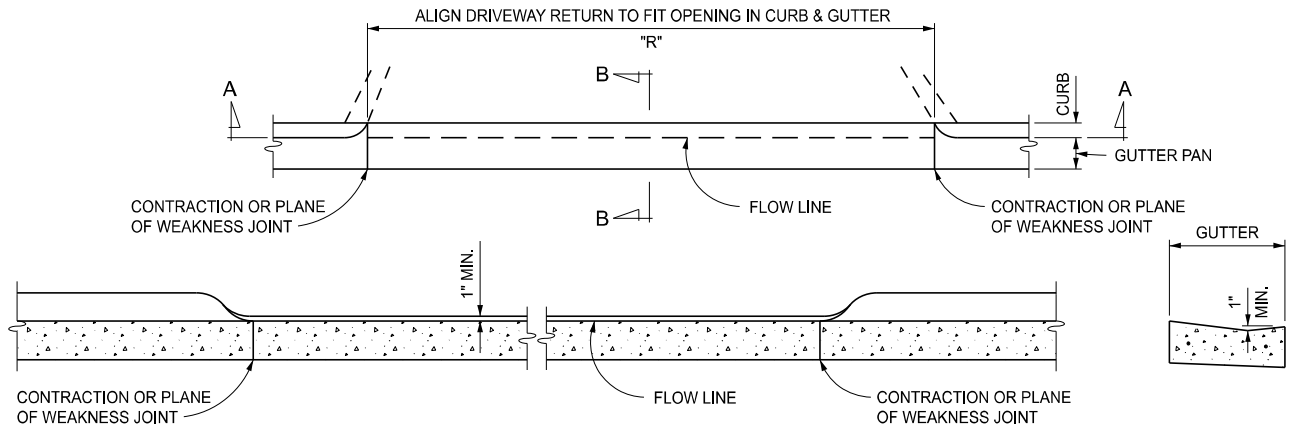
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1 OF 4



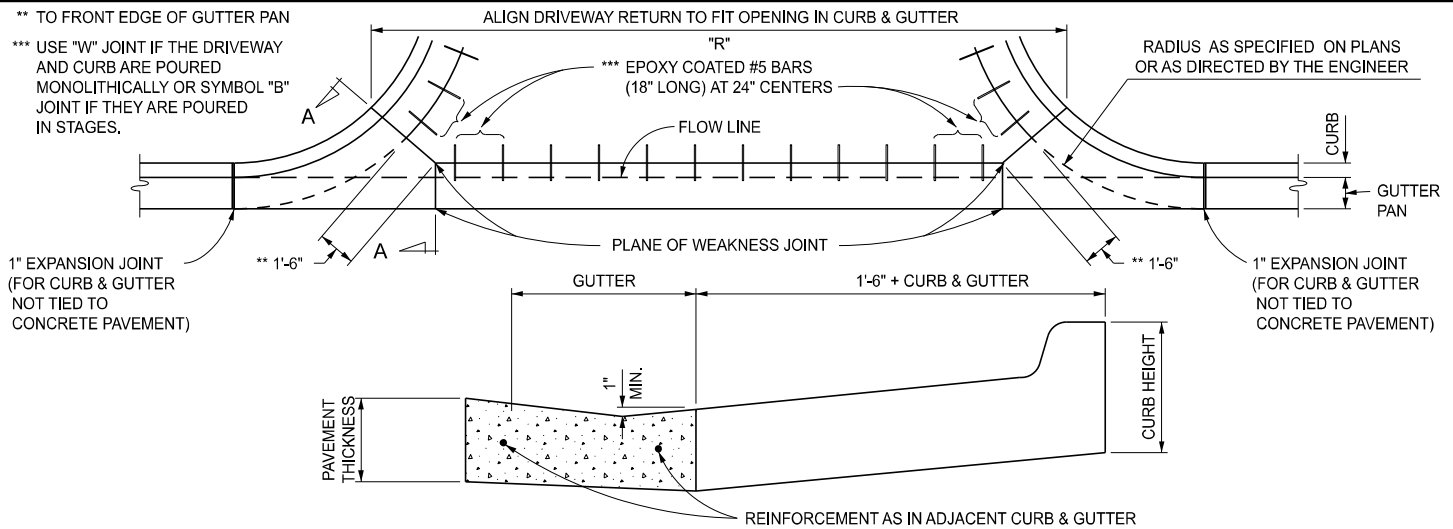
NOTE:
 W = MINIMUM WIDTH OF THICKENED CONCRETE SIDEWALK.
 $(R - d)$ SHALL NOT BE LESS THAN DRIVEWAY WIDTH.

THE "R" DIMENSION IS SPECIFIED IN THE PUBLICATION
 "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS
 AND PARADES ON OR OVER HIGHWAYS".

CONCRETE DRIVEWAY OPENING LAYOUT



SECTION A - A
 CONCRETE DRIVEWAY OPENING, DETAIL L



SECTION A - A
 CONCRETE DRIVEWAY OPENING, DETAIL M

NOTE:
 FOR ROADWAYS WITH CONCRETE PAVEMENTS,
 LONGITUDINAL LANE TIES WILL BE CONTINUOUS
 THROUGH THE DRIVEWAY OPENING AND THE
 SPACING OF THE #5 BARS IN CONCRETE DRIVEWAYS
 SHALL BE ADJUSTED TO AVOID CONFLICT WITH THE
 LONGITUDINAL LANE TIES.



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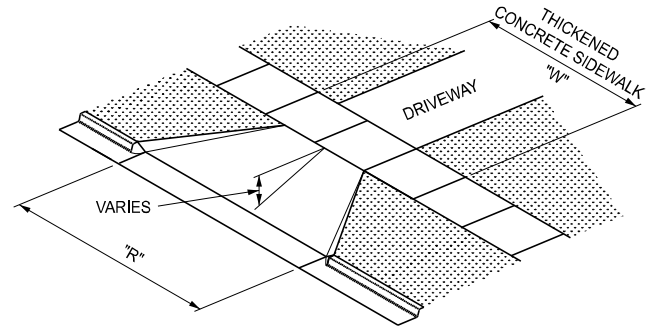
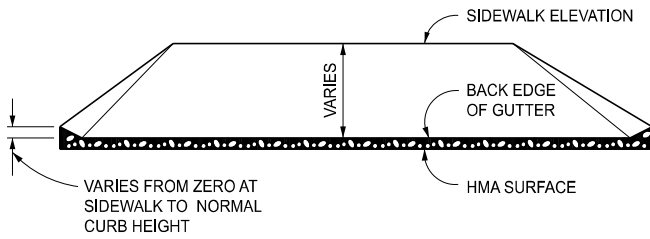
STANDARD PLAN FOR
 DRIVEWAY OPENINGS & APPROACHES,
 AND CONCRETE SIDEWALK

(SPECIAL DETAIL)
 FHWA APPROVAL

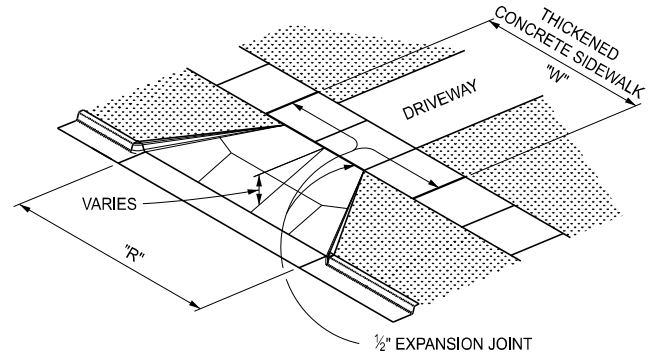
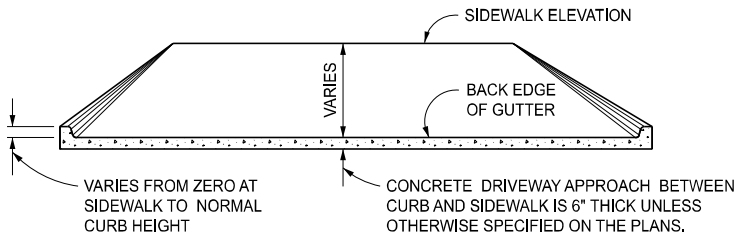
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 PLAN DATE

R-29-J

SHEET
 2 OF 4



HMA DRIVEWAY APPROACH
(TO BE USED WITH DETAIL L)

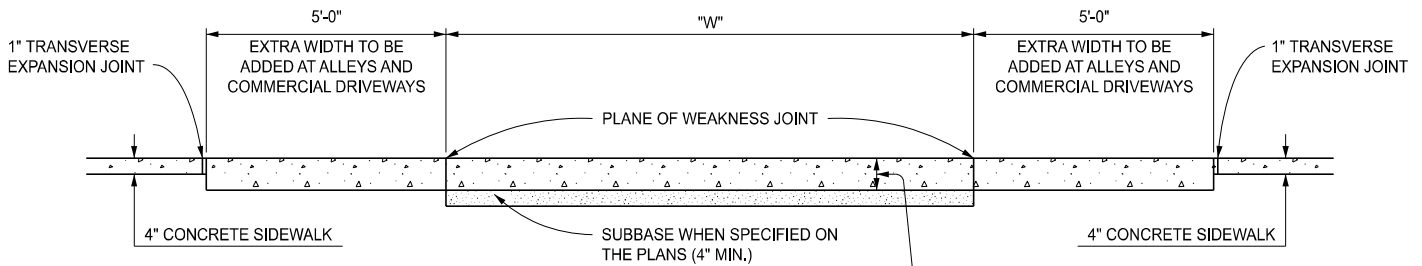


NOTES:

MONOLITHIC CURB IS INCLUDED IN THE CONCRETE DRIVEWAY APPROACH QUANTITY.

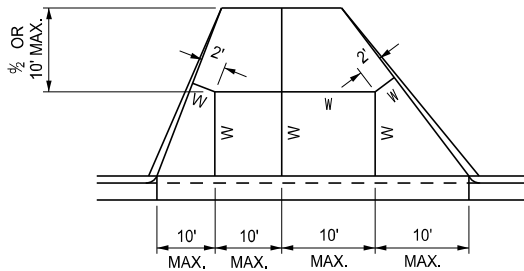
REINFORCEMENT IS NOT REQUIRED UNLESS SPECIFIED ON THE PLANS. WHEN REINFORCEMENT IS SPECIFIED, SEE CHART ON THIS SHEET.

CONCRETE DRIVEWAY APPROACH
(TO BE USED WITH DETAIL L OR M)



WHEN CONCRETE DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS EQUAL TO THE THICKNESS OF THE CONCRETE DRIVEWAY APPROACH. WHEN HMA DRIVEWAY APPROACH IS SPECIFIED, THE THICKENED CONCRETE SIDEWALK THICKNESS IS 6\"/>

THICKENED CONCRETE SIDEWALK



ADJUST DRIVEWAY JOINTS AS NEEDED TO ALIGN WITH ANY COINCIDING TRANSVERSE PAVEMENT JOINTS.

JOINT LAYOUT IS AS INDICATED OR AS DIRECTED BY THE ENGINEER.

INTERMEDIATE DRIVEWAY JOINT DETAILS

REINFORCEMENT FOR CONCRETE DRIVEWAYS

CONCRETE DRIVEWAY THICKNESS	WIRE SIZE (6" x 6" MESH)	AVERAGE WEIGHT (LBS/100 SFT)
LESS THAN 8"	W1.4	21
	W2.9	42
8" OR GREATER	USE WIRE FABRIC REINFORCEMENT SPECIFIED ON STANDARD PLAN R-37-SERIES	



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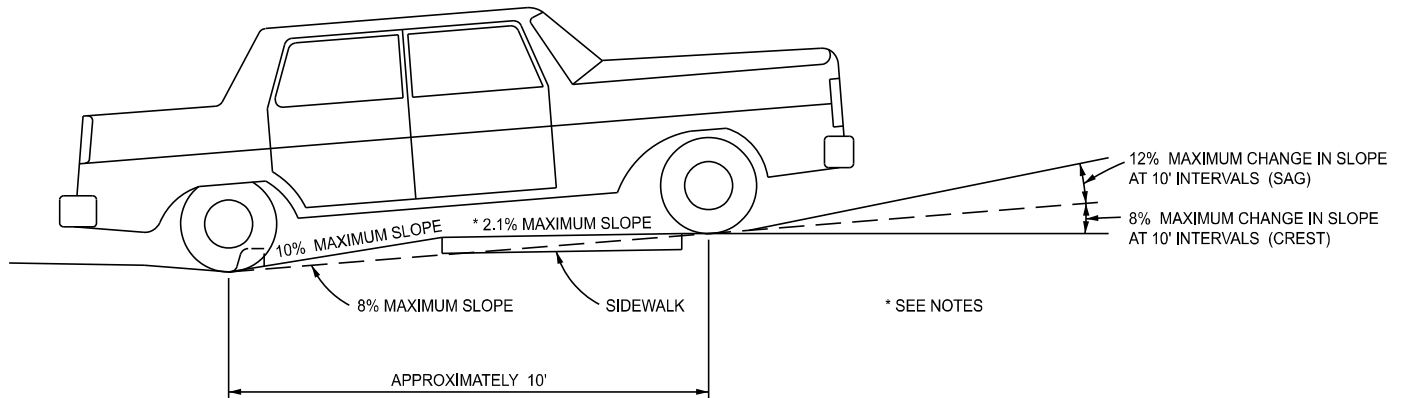
**STANDARD PLAN FOR
DRIVEWAY OPENINGS & APPROACHES,
AND CONCRETE SIDEWALK**

(SPECIAL DETAIL)
FHWA APPROVAL

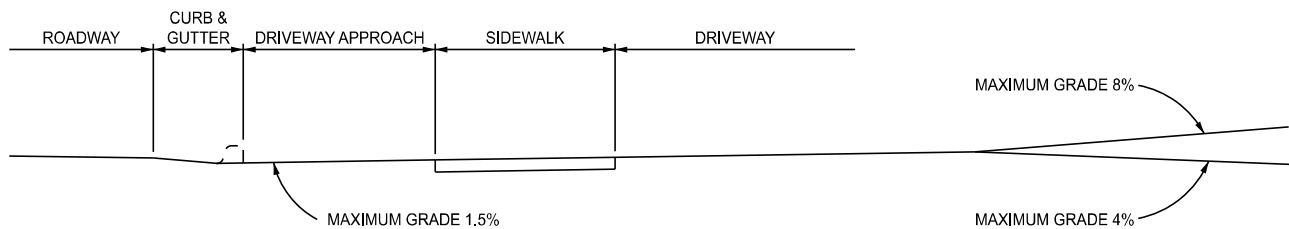
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PLAN DATE

R-29-J

SHEET
3 OF 4



LOW VOLUME COMMERCIAL OR RESIDENTIAL DRIVEWAY SLOPES



COMMERCIAL DRIVEWAY PROFILE FOR MAJOR TRAFFIC GENERATORS

NOTES:

FOR DRIVEWAY DESIGN REFER ALSO TO "ADMINISTRATIVE RULES REGULATING DRIVEWAYS, BANNERS, AND PARADES ON OR OVER HIGHWAYS" AND GEOMETRIC DESIGN G-680-SERIES, COMMERCIAL DRIVEWAYS.

FOR CURB AND GUTTER DETAILS, SEE STANDARD PLAN R-30-SERIES.

TRANSVERSE SIDEWALK SLOPES ARE 2.1% MAXIMUM. IN ORDER TO MEET SITE CONDITIONS, IF THE TRANSVERSE SLOPE IS REQUIRED TO BE LESS THAN 1.5%, LONGITUDINAL DRAINAGE MUST BE PROVIDED.

WHEN SETTING GRADES FOR COMMERCIAL DRIVES, THE TYPES OF VEHICLES USING THE DRIVE SHOULD BE CONSIDERED.



DEPARTMENT DIRECTOR
BRADLEY C. WIEFERICH, PE

STANDARD PLAN FOR DRIVEWAY OPENINGS & APPROACHES, AND CONCRETE SIDEWALK

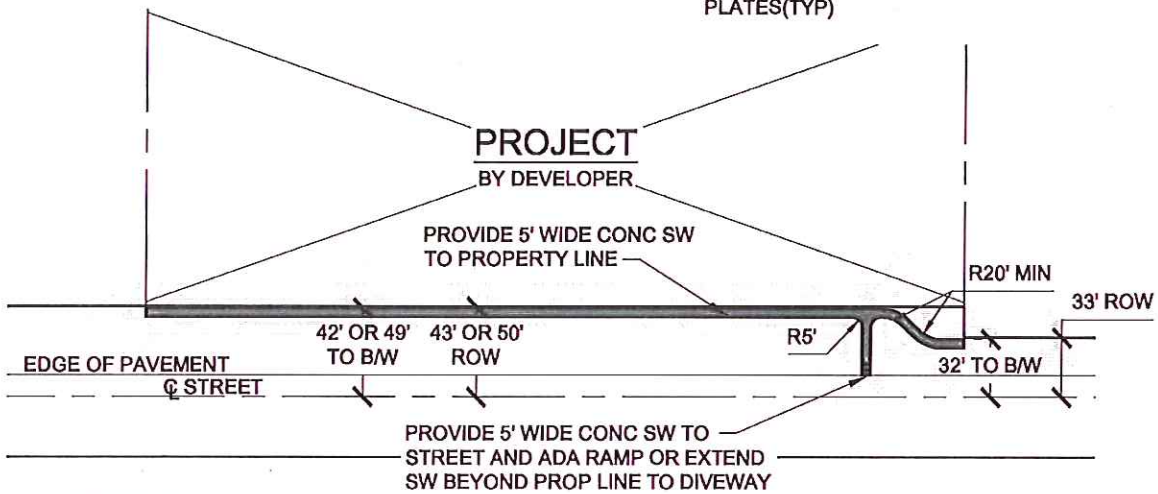
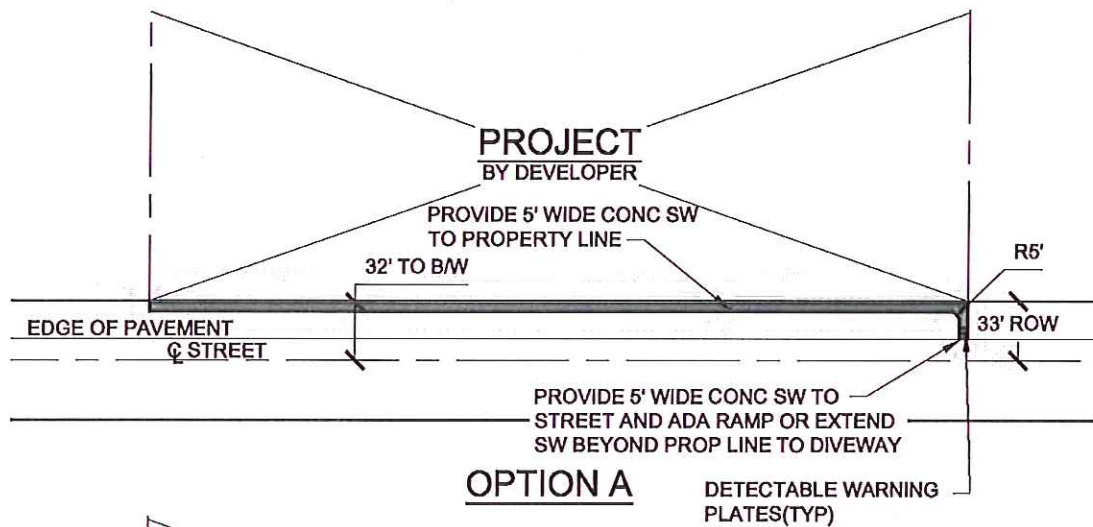
(SPECIAL DETAIL)
FHWA APPROVAL

11/08/2023
PLAN DATE

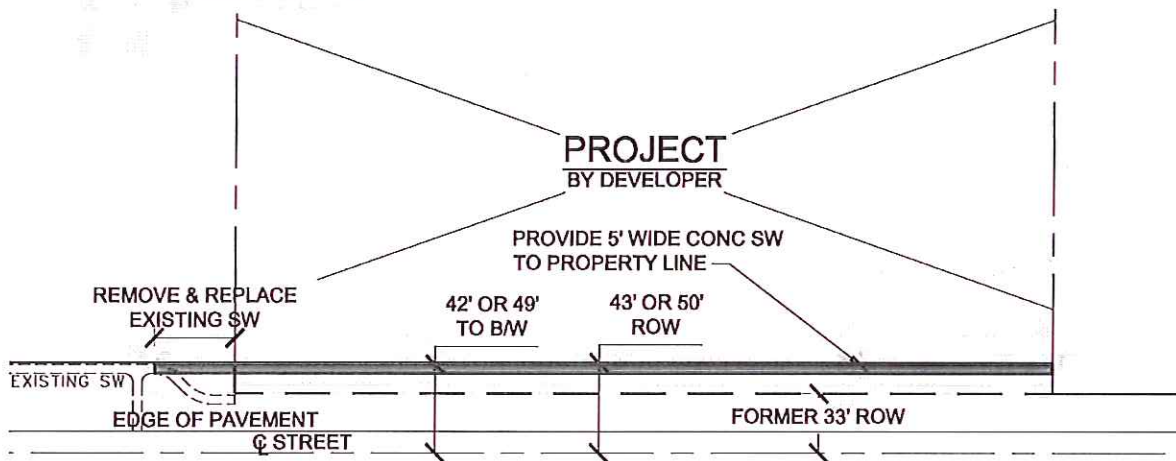
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SHEET
4 OF 4

1071FIG8_SIDEWALK/ SAD040808/ 1:1

**LEGEND**

BY DEVELOPER

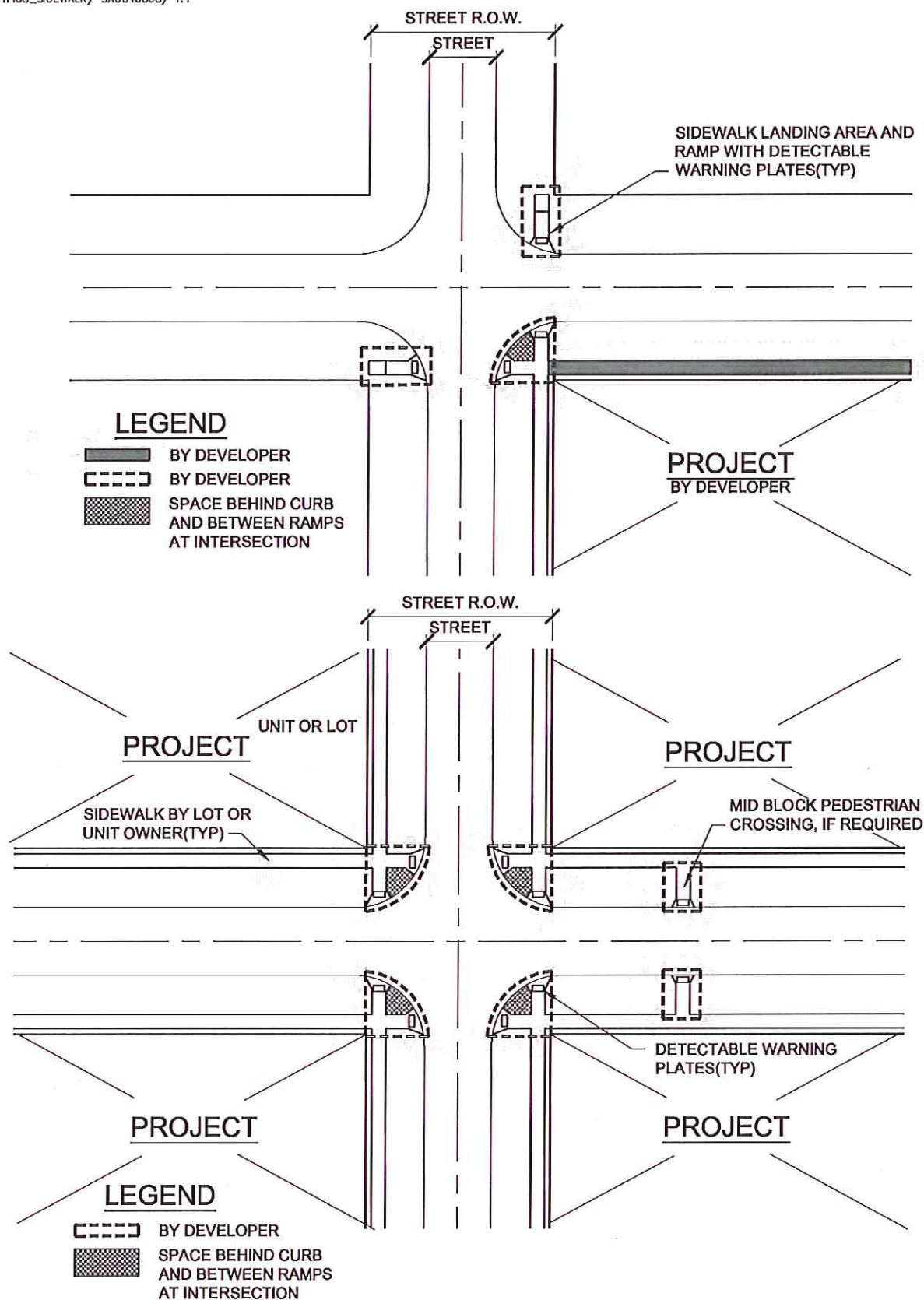
**TYPICAL SIDEWALK REQUIREMENTS**

NTS

PAGE 1 OF 2

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1071FIG8_SIDEWALK/ SADD040808/ 1:1



TYPICAL SIDEWALK REQUIREMENTS

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PAGE 2 OF 2

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SECTION 32 13 14.5

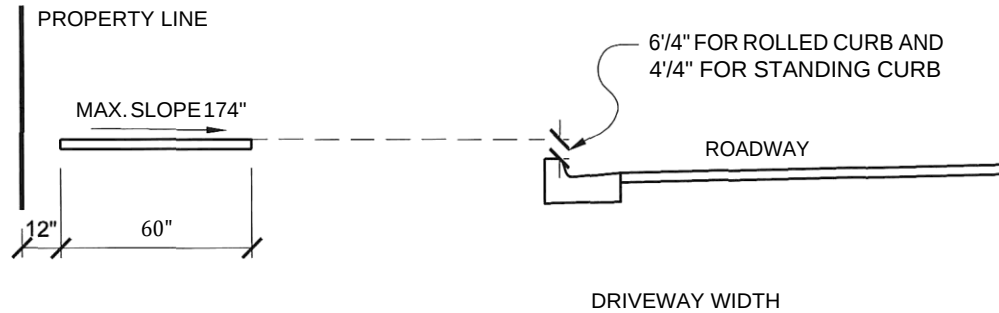
RESIDENTIAL SIDEWALK SPECIFICATIONS

PART 1 - GENERAL

1.01 REQUIREMENTS:

- A. All properties are required to have a concrete sidewalk, 5 feet in width, 1-foot in from the property line to any adjacent street.
- B. All sidewalks shall be a minimum of 4-inches thick except through driveways where they shall be a minimum of 6 inches thick. The driveway approach shall also be a minimum of 6-inches thick.
- C. Sidewalk grade height shall be set try the road curb height along the properties front line. The top of the back of the sidewalk, that side of the properties front line, shall be 8-inches higher than the top of the back of the curb on rolled curb roadway or 6 inches higher than the top of the back of the curb on standing curb roadways.
- D. The sidewalk max slope is $\frac{1}{4}$ -inch per foot toward the street unless otherwise directed. The sidewalk must pass through the driveway as shown in the graphic on the first page. Control jointer shall be placed at 5-foot intervals.
 - 1. Joints shall be constructed to true line with their faces perpendicular to the surface of the sidewalk and shall not vary more than 1.4-inch for their designated position.
 - 2. All edges and joints must be rounded to $\frac{1}{2}$ -inch.
- E. Expansion joints:
 - 1. Expansion joint filler shall extend the full depth of the joint with the top slightly below the finished sidewalk surface.
 - 2. $\frac{1}{2}$ -inch expansion joint must be used on both sides of walk through driveway.
 - 3. $\frac{1}{2}$ -inch expansion joint at all transitions between 4 inch and 6-inch sidewalk.
 - 4. $\frac{1}{2}$ -inch transverse expansion joints shall be placed at property lines and at intervals not exceeding 50 feet.
 - 5. Expansion joints must be placed when connecting to existing concrete.
- F. Concrete mixture:
 - 1. Limestone aggregate
 - 2. Slump: 3 inches maximum
 - 3. Entrained air: 4 percent to 7 percent
 - 4. Strength: 3500 psi, at 28 days
- G. The subbase must be compacted to 95% maximum density.
- H. All edges and joints must be rounded to $\frac{1}{2}$ -inch radius.
- I. The surface shall be slightly broomed transversely.
- J. Pouring of concrete shall not take place in temperatures of less than 40-degree Fahrenheit.

SIDEWALK SPECS



1' ALL SIDEWALKS ARE TO BE A MINIMUM OF 4" THICK

EXPANSION JOINT

5'

TOOLED JOINT
EVERY 60"

EXPANSION JOINT

Tel K/ SS
MINI MU

EXPANSION
JOINT
WHERE
THICKNESS
CHANGES FROM
4" TO 6"

P SI J NT

EXPANSION JOINT
AT PROPERTY LINES
AND 50' INTERVALS

ALL EDGES ARE TO BE TOOLED WITH A 1/8" RADIUS



I am the building permit holder for _____

I have read the above sidewalk installation requirements and understand them and agree to install the sidewalk in accordance with them.

If I have any questions, prior to pouring the sidewalk, I understand I can call Mr. Larry Havemen, the Township's Maintenance Supervisor, at 616-895-6295 ext. 8 and get assistance.

Signed: _____ Date: _____

SECTION 32 13 14.01**SHARED USE PATHS****PART 1 - GENERAL****1.01 SUMMARY:**

- A. This Section includes the work required for construction of a concrete or Hot Mix Asphalt (HMA) shared use path.
- B. Provide Shared Use Path is areas indicated on Township Master Plan.
- C. Definitions:
 - 1. Pavement Structure: All combinations of subbase, base course, and HMA or concrete surface course, including shoulders, placed on a subgrade. Pavement includes HMA or concrete surface.
 - 2. Subgrade: The portion of the earth grade upon which the pavement structure is placed.
 - 3. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.
 - 4. Base Course: The layer or layers of specified material of designed thickness placed on a subbase or subgrade to support a surface course.
 - 5. Leveling Course: The layer of specified material of designed thickness placed on the base course in preparation for the surface course.
 - 6. Surface Course: The top layer of a pavement structure.
 - 7. Bond Coat: Asphalt emulsion used to enhance the adhesion between HMA courses.

1.02 REFERENCES:

- A. MDOT - Michigan Department of Transportation, *"Standard Specifications for Construction", 2020 Edition.*
- B. MDOT – Road Design Manual.
- C. AASHTO – 2012 Guide for the Development of Bicycle facilities
- D. ASTM - American Society of Testing Materials, latest edition.
- E. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
- F. MTM – Michigan Test Methods, latest edition.

1.03 SUBMITTALS:

- A. Certification of quality by producer for the following:
 - 1. Cement
 - 2. Aggregates
 - 3. Asphalt cement
 - 4. Bond coat
- B. Test Specimens and samples: Deliver to the place of inspection and testing.

- C. Mix Design: Provide job-mix formula prepared by independent lab or approved by MDOT one week prior to placement.
- D. Submittal of as-built plans to the Township upon completion of project.

1.04 JOB CONDITIONS:

- A. Weather and Seasonal Limitations:
 - 1. Concrete shall not be placed between November 1 and April 1, unless authorized by the Township. Concrete shall not be placed when the air temperature in the shade is less than 40 degrees Fahrenheit and falling. Concrete shall not be placed if portions of the base, subbase, or subgrade are frozen, or if the grade exhibits poor stability from excessive moisture levels. Chemicals shall not be added to reduce the freezing point. Any deviation from the above, when authorized, will require protection from freezing until the concrete has attained a compressive strength of at least 1,000 psi (1,000 psi strength will typically be attained after 2 days of curing). Concrete damaged by frost action shall be removed and replaced.
 - 2. HMA: Comply with MDOT 501.
- B. Clean-up promptly following pavement installation.
- C. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent pavement installation is completed.
- D. Driveway Closing: 24-hour maximum, plus an additional 96 hours (4 days) for curing of concrete, if applicable. Provide proper notice to property Owner. Maintain access to property with aggregate or bituminous millings as necessary until the driveway is restored.
- E. Protect areas under construction with lighted barricades and reflectorized fencing in accordance with applicable MDOT, MIOSHA, and ASHA regulations.
- F. Number of Crosswalks: two-way intersections are required to have 2 crosswalks, three-way intersections to have 3 crosswalks, and four-way intersections to have 4 crosswalks.
- G. Provide hot mix asphalt verification of mix proportions, aggregate gradation, and temperatures upon request.
- H. Provide easement to Township from public road right-of-way to minimum 2 feet from back edge of path.

PART 2 – PRODUCTS

2.01 MATERIALS:

- A. Subbase: Granular material MDOT Class II, MDOT 902.
- B. Aggregate Base: Aggregate 22A, MDOT 302 and 902.
- C. Hot Mix Asphalt (HMA): Mix LVSP, MDOT 501.
- D. Bond Coat: SS-1h, MDOT 501.

- E. Concrete: Limestone aggregate, 5½ sack minimum, 4% to 7% entrained air, five (5) gallons per sack maximum water/cement ratio, 3-inch slump maximum, 3,500 psi minimum compressive strength at 28 days.
- F. Concrete Curing Material: MDOT 903.
- G. Concrete Joint Filler: MDOT 914.03.
- H. Forms: Rigid in accordance with MDOT 803.03B, except at curved sections which shall utilize a bendable material to provide a uniform radius, supported at adequate intervals.
- I. Detectable Warning Surfaces:
 - 1. Cast ductile iron plate with anchor lugs.
 - 2. Slip resistant textured surface.
 - 3. Color and finish: Black asphalt dip.
 - 4. Provide width to match path width.
 - 5. Meet ADAAG.
 - 6. Manufacturer: East Jordan Iron Works or Neenah Foundry Company.

PART 3 - EXECUTION

3.01 EQUIPMENT:

- A. Provide equipment in accordance with MDOT spec 806.03.A.

3.02 PREPARATION:

- A. Removal: Remove or saw cut at the existing joint or line marked by Owner's Engineer in area of removal.
- B. Disposal of all removed material shall be performed by the Contractor. Keep all removed material off private property at all times.
- C. For concrete path crossing asphalt drives: Saw cut and remove existing asphalt at specified path location and width, and use the saw cut pavement edges as forms, unless a clean straight edge of adequate thickness is not feasible. If the existing drive is concrete within 3 feet of the path edge, remove existing asphalt and replace with concrete.
- D. Cut and protect tree roots as directed by the Owner's Engineer and Township.
- E. Excavation: Form subgrade by trenching, excavating, or filling to the required elevation. Prepare base in accordance with MDOT 806.
- F. Notify Owner's Engineer and Township if unsuitable material exists below subgrade. Remove unsuitable material as directed by Owner's Engineer and Township and replace with subbase to elevation required for bottom of aggregate base course or concrete. If depth of unsuitable material is greater than 2 feet, consult with Owner's Engineer and Township to obtain instructions on how to proceed.
- G. Compact subbase to 95% maximum density.
- H. Scheduling: Maximum time between removal and replacement, or between excavation and placement, shall be 7 days.

3.03 PERFORMANCE (HMA PATH): MDOT 806 and these specifications.

A. Shared Use Path and Ramp Requirements:

1. All shared use paths shall be 10 feet minimum width, with the cross slope of $\frac{1}{4}$ inch per foot from the back of path towards the street, unless otherwise directed.
 - a. Provide minimum 2-foot wide graded shoulders.
 - b. Provide minimum 2-foot horizontal and 8-foot vertical clearance of obstructions.
2. The elevation at the back of path shall be 6-inches above the road centerline, unless otherwise approved.
3. All HMA shared use paths shall be a minimum of 250 lbs/syd HMA over 6 inches of aggregate base over 10 inches of subbase.
4. Ramps shall have a uniform grade except as necessary for short grade changes and shall be in conformance with ADAAG and these specifications. Detectable warning surfaces shall be provided.
5. Ramps shall be 8-inch thick concrete with WW mesh reinforcement.
6. The space behind the curb and between ramps at intersection corners shall be concrete (8-inch thick with WW mesh reinforcement), brick pavers (concrete brick over sand bedding over 6-inch thick concrete with WW reinforcement) or pre-approved landscaping.
7. Detectable warning surfaces:
 - a. Provide for tactile and visual warning that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light.
 - b. Provide cast ductile iron detectable warning plates embedded into newly cast concrete. Provide same width as path, minimum. Install in accordance with manufacturer's recommendations, ADAAG and these specifications. Surface applied products will not be allowed. Do not construct detectable warnings by forming or stamping in newly cast concrete.
 - c. Provide detectable warning plates on all ramps for path crossings of public roads, private roads that are stop sign controlled, and commercial driveways that are stop sign controlled or experience high traffic volumes that would warrant a safe path crossing of the drive. Ottawa County Road Commission requirements for providing detectable warning surfaces on ramps on public roads and at commercial drives shall be met.

B. Subbase:

1. Thickness: Conform to design cross section.
2. Construction method:
 - a. Place in equal layers not exceeding 15-inches loose measure.
 - b. Spread evenly and compact to not less than ninety-five percent (95%) maximum density according to Michigan Sand Cone Test.
3. Tolerance: Construct subbase to plan grade within a tolerance of ± 0.5 inch.

C. Aggregate Base:

1. Thickness: Conform to design cross section.
2. Construction Method: MDOT 302.03.
3. Tolerance: Shape the aggregate base course plan grade and cross section within a tolerance of 0.25 inch.

D. Bond Coat:

1. Construction Method: MDOT 501.03.D.
2. Application Rate: Provide 0.15 gallon per square yard.

- I. Hot Mix Asphalt Leveling and Surface:
 - 1. Cutting: Saw vertically in straight lines parallel or perpendicular to pavement centerline.
 - 2. Thickness: Do not place hot mixed asphalt surface course mixture in lifts exceeding 2 inches unless otherwise approved. Provide design thickness.
 - 3. Construction Methods:
 - a. Paving: Conform method of paving to MDOT 501.03.
 - b. Prior to placement of hot mixed asphalt surface, verify crowns and grades of path for positive drainage. Any deficiencies in grade or crown shall be corrected prior to placement of surface course.
 - J. Hot Mix Asphalt (HMA) Patching:
 - 1. Preparation: Saw cut vertically in straight lines parallel or perpendicular to pavement centerlines. Minimum dimension of area to be patched shall be 2 feet for placement and compaction of materials.
 - 2. Aggregate Base: Provide a minimum of 6 inches of Aggregate 22A compacted in place.
 - 3. HMA Mixture: MDOT Mix LVSP.
 - a. Thickness: Match existing pavement thickness (minimum 2 inches).
- 3.04 PERFORMANCE (CONCRETE PATH): MDOT 806 (except for joint spacing) and these specifications.
- A. Shared Use Path and Ramp Requirements:
 - 1. All shared use paths shall be 10 feet minimum width, with the cross slope of $\frac{1}{4}$ inch per foot from the back of path towards the street, unless otherwise directed.
 - a. Provide minimum 2-foot wide graded shoulders.
 - b. Provide minimum 2 foot horizontal and 8-foot vertical clearance of obstructions.
 - c. Slope beyond the edge of path shoulder shall not exceed a 1:4 slope (1 vertical foot, 4 horizontal feet).
 - 2. The elevation at the back of path shall be 6 inches above the road centerline, unless otherwise approved.
 - 3. All concrete shared use paths shall be a minimum of 5-inch thick over 10 inches of subbase. The concrete path thickness shall be 6 inches across all residential drives and 8 inches across all commercial/industrial drives.
 - 4. Ramps shall have a uniform grade except as necessary for short grade changes and shall be in conformance with ADAAG and these specifications. Detectable warning surfaces shall be provided.
 - 5. Ramps shall be 8-inch thick concrete with WW mesh reinforcement.
 - 6. The space behind the curb and between ramps at intersection corners shall be concrete (8-inch thick with WW mesh reinforcement), brick pavers (concrete brick over sand bedding over 6-inch thick concrete with WW reinforcement) or pre-approved landscaping.
 - 7. Detectable warning surfaces:
 - a. Provide for tactile and visual warning that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light.
 - b. Provide cast ductile iron detectable warning plates embedded into newly cast concrete. Provide same width as path, minimum. Install in accordance with manufacturer's recommendations, ADAAG and these specifications. Surface applied products will not be allowed. Do not construct detectable warnings by forming or stamping in newly cast concrete.
 - c. Provide detectable warning plates on all ramps for path crossings of public roads, private roads that are stop sign controlled, and commercial driveways that are stop sign controlled or experience high traffic volumes that would warrant a safe

path crossing of the drive. Ottawa County Road Commission requirements for providing detectable warning surfaces on ramps on public roads and at commercial drives shall be met.

- B. Concrete Mixing and Delivery: Transit mix concrete conforming to MDOT 601.03E.
- C. Placing and Finishing Concrete:
 - 1. Place concrete on a moist base in one (1) lift to the specified thickness. The concrete shall be thoroughly spaded along the faces of the forms before finishing operations are started. The concrete shall be struck off to the required grade and cross section.
 - 2. The surface shall be slightly broomed transversely to roughen the surface after the concrete has received a float finish. Ramps shall be textured with a coarse broom transversely to the ramp slope.
 - 3. All edges and joints shall be rounded to ½-inch radius.
- D. Curing and Protection:
 - 1. Concrete shall be cured and protected as specified under MDOT 602.03M and 602.03T except that pedestrian traffic may be allowed after 48 hours.
- E. Joints:
 - 1. Joints shall be constructed to true line with their face's perpendicular to the surface of the path and shall not vary more than ¼ inch from their designated position. Transverse joints shall be constructed at right angles to centerline of the path and longitudinal joints shall be constructed parallel to the centerline unless otherwise required.
 - 2. The concrete at the faces of all joints shall be thoroughly spaded or vibrated and compacted to fill all voids and the surface shall be finished smooth and substantially true to grade.
 - 3. One-half (½) inch transverse expansion joints shall be placed in line with all expansion joints in abutting curb, gutter or combination curb and gutter. When the path is not adjacent to such pavement, ½ inch transverse expansion joints shall be placed at intervals not exceeding 100 feet and at all transitions between 4-inch and 6-inch thick path. Expansion joint filler shall extend the full depth of the joint with the top slightly below the finished path surface. The filler shall be supported temporarily until concrete is poured against it.
 - 4. One-half (½) inch longitudinal expansion joints shall be placed between the path and the back of abutting parallel curb or gutter, between the path and buildings, or other rigid structures.
 - 5. Contraction joints shall be placed at 10-foot intervals. They shall divide sidewalk into areas not more than 100 square feet nor less than 30 square feet. Contraction joints will be produced by slab division forms extending to the full depth of concrete or by cutting joints in the concrete after floating to a depth of not less than ¼ the thickness of the concrete. The cut joints shall not be less than 1/8-inch or more than ¼ inch in width and shall be finished smooth and substantially true to line.
- F. Backfilling:
 - 1. After concrete has gained sufficient strength (70% of design), all rails, forms, stakes and supports shall be removed in a manner as not to injure finished concrete and all exposed edges of the concrete shall be backfilled, compacted, and leveled immediately.

- G. HMA Patching: See Paragraph 3.03 above.
 - H. Concrete curb and gutter: Township's, Ottawa County Road Commission's or MDOT's Standard.
 - 1. Match existing curb and gutter.
 - 2. Construction methods: MDOT 802.03.
- 3.05 TESTING AND INSPECTION (HMA PATH): MDOT 501 and these specifications.
- A. Observation: By Township, Township's Engineer, or designated representative.
 - B. Aggregates:
 - 1. Sampling and Analysis: Michigan Testing Methods, Series 100.
 - 2. Exception: Provide certification of approved stockpiled material.
 - C. Hot Mix Asphalt Pavement Density:
 - 1. Density acceptance of HMA mixtures will be measured with a nuclear density gauge using the Gmm from the approved Job-Mix Formula for the density control target.
 - 2. The Contractor is responsible for determining Quality Control Density and establishing a rolling pattern that will achieve the required in place density.
 - D. Hot Mix Asphalt Mix Composition:
 - 1. Sampling:
 - a. Acceptance sampling shall include a minimum of two samples per mix type for each day of production with no less than three samples for each mix type per project.
 - b. Method of sampling shall be determined by the Engineer.
 - 2. Extraction: ASTM D2172
 - 3. Sieve Analysis: ASTM C117 and ASTM C136
- 3.06 TESTING AND INSPECTION (CONCRETE PATH):
- A. Observation: By Township, Township's Engineer, or designated representative.
 - 1. Inspection of forms is required prior to pouring concrete.
 - B. Acceptance Testing:
 - 1. Cement: Certification of quality by producer.
 - 2. Concrete:
 - a. Sample: ASTM C172
 - b. Frequency: Once for each 50 cubic yards of each class of concrete placed.
 - c. Perform following from sample:
 - (1) Mold three 6-inch cylinder compressive strength specimens: ASTM: C31
 - (2) Slump test: ASTM C143
 - (3) Air test: ASTM C231
 - (4) Yield test: ASTM C138
 - (5) Strength test: ASTM C139
 - 3. If initial testing indicates failure or nonconformance to specifications, additional testing shall be paid for by the Contractor. Replace nonconforming material.
 - C. Aggregates: Provide certification of approved stockpiled material.
 - D. Concrete:
 - 1. Limestone aggregate.
 - 2. Slump: 3-inches maximum.

- 3. Entrained Air: 4 percent to 7 percent.
- 4. Strength: 3500 psi, at 28 days.

3.07 TREE ROOT CUTTING:

- A. The following information shall be used as a guide when trimming tree roots:
 - 1. Excavate as shallow as possible in the area adjacent to the tree root.
 - 2. Make clean cuts with a saw or sharp chisel. Do not bury jagged or torn roots.
 - 3. Do not allow the exposed root ends to dry out. If exposed for more than a day, they can dry out. Cover all exposed roots with soil at the end of the day.
 - 4. Avoid cutting roots larger than 3.5 inches.

3.08 TREE ROOT BARRIER:

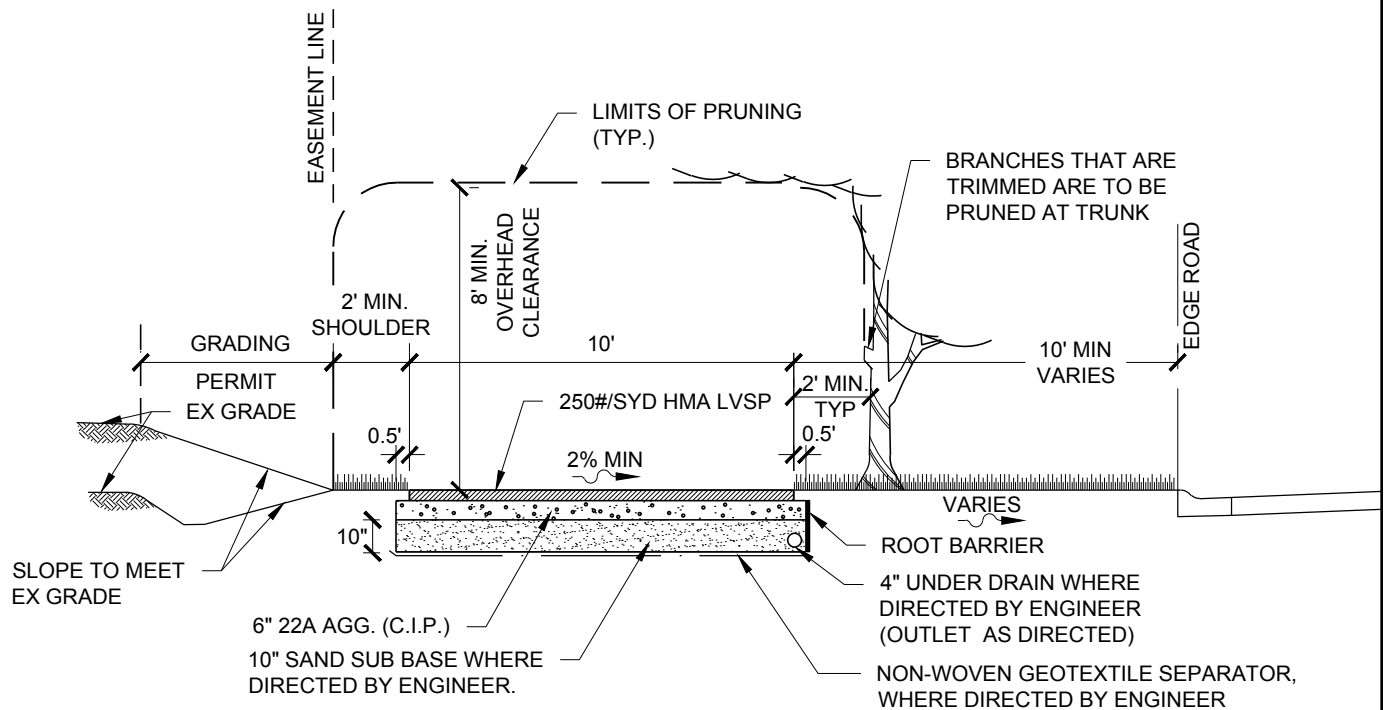
- A. Install tree root barrier along the path adjacent to trees to reduce future damage by tree roots in areas determined by the Township or Township Engineer Installation shall be in accordance with manufacturer's recommendations.
- B. Install in 4-inch wide trench (with roots removed) adjacent to the path between the path and tree to a minimum depth of 30 inches. Secure with pins. Backfill carefully to avoid dislodging the barrier, and compact firmly.
- C. Manufacturer: Typar Biobarrier or approved equal.

3.09 SCHEDULES:

- A. MDOT Standard Plan R-28-J SIDEWALK RAMP AND DETECTABLE WARNING DETAILS (7 sheets).
- B. Typical Cross-Section for HMA Shared Use Path.
- C. Typical Cross-Section for Concrete Shared Use Path.

END OF SECTION

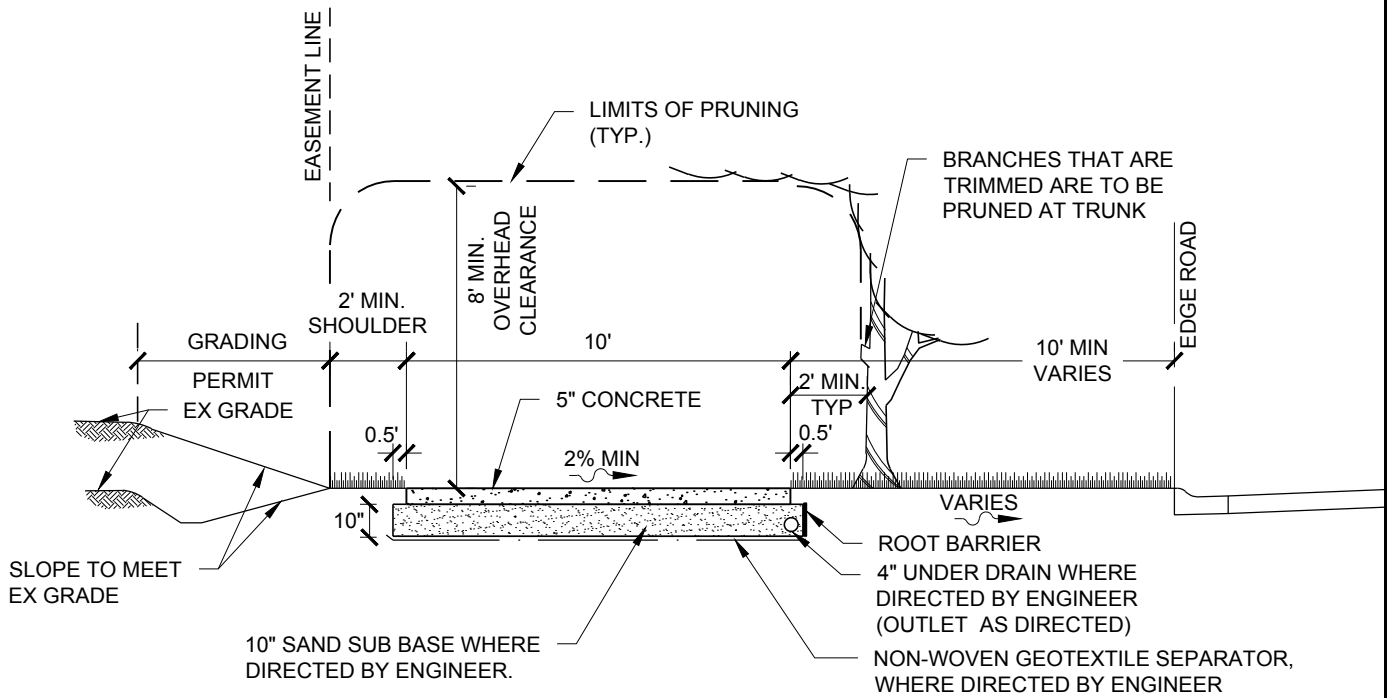
1071FIG_SHARED PATH/karim 010715



TYPICAL CROSS-SECTION HMA SHARED USE PATH

SCALE: NOT TO SCALE

1071FIG_SHARED PATH/karim 010715



TYPICAL CROSS-SECTION CONCRETE SHARED USE PATH

SCALE: NOT TO SCALE

SECTION 32 29 00

SURFACE PROTECTION AND RESTORATION

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for protection and restoration of surface features such as site improvements and all trees, shrubs, lawns, and other landscape features.
- B. Definition of Site Improvements: Fences, retaining walls, parking appurtenances, playing fields and equipment, sheds, mailboxes, lawn sprinkling systems, landscaping, yard lights, and yard accessories.

1.02 REFERENCES:

- A. OCRC – Ottawa County Road Commission
- B. MDOT – Michigan Department of Transportation, *“Standard Specifications for Construction,” Current Edition.*

1.03 JOB REQUIREMENTS:

- A. Lawn Areas Disturbed by Construction Operation shall be as follows:
 - 1. Restoration: Fine grade to 4 inches below finish elevations. Remove all stones and debris greater than 1-inch diameter. Place 4 inches of new topsoil, and heavy duty hydroseed and mulch.
 - 2. Install mulch blanket as directed.
- B. Scheduling:
 - 1. Restoration of lawns and other surface features: Promptly following curb and gutter, site improvements and paving.
 - 2. Restoration of site improvements: Promptly following utility installation.
 - 3. Clean up: Promptly following restoration.
- C. Seasonal Limitations: See MDOT standard specifications 816.03.
- D. See OCRC for county requirements.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Trees, shrubs, and plants: MDOT 917.
- B. Topsoil: MDOT 917.
- C. Chemical Fertilizer: MDOT 917. Phosphorus not allowed.
- D. Grass Seed: MDOT 917.12.
 - 1. Lawns: Mixture THM.
 - 2. Other areas: Mixture THV.

- E. Sod: MDOT 917.13.
- F. Mulch Blanket: Excelsior or straw mulch blanket, MDOT 917.15, anchored in place only with wood stakes.
- G. Site Improvements: Provide materials equal to or better than those that existed prior to start of construction whether shown or not shown on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Inspection: Approval required.

3.02 TREES AND SHRUBS:

- A. Protection: All items not indicated for removal.
- B. Damaged branches: Trim and seal within fifteen (15) days.
- C. Replacement: MDOT 815. Place mulching around tree with diameter one foot greater than ball diameter.
- D. Maintain a clear space of ten feet (10') around all existing and proposed fire hydrants.

3.03 TOPSOIL:

- A. Place new topsoil in preparation of seeding or sodding. Remove all stones and debris larger than 1-inch diameter.
- B. Construction methods: MDOT 816.03.

3.04 SEEDING:

- A. Construction methods: MDOT 816.03 except with the following rates:
 1. Topsoil: 4 inches of new topsoil.
 2. Heavy duty hydroseed.
 3. Heavy duty hydromulch.

3.05 SODDING:

- A. Construction Methods: MDOT 816.03 with 4-inch topsoil.

3.06 SITE IMPROVEMENTS:

- A. Protection: All items not indicated for removal.
- B. Restoration: Approval required.

3.07 SURFACE RESTORATION:

- A. Seed: Backfill with site soil, place new topsoil, fine grade, remove stones larger than 1 inch, clay lumps, wood, debris and other extraneous materials, provide hydraulic seeding.

- B. Sod: Grade backfill to smooth subgrade, place and fine grade new topsoil, place Class A sod, fertilizer, water and roll into new topsoil.

END OF SECTION

SECTION 32 34 13.02**PEDESTRIAN BRIDGE****PART 1 - GENERAL****1.01 DESCRIPTION:****A. Work Included:**

1. This Section includes the design, furnishing, erection, testing and placing in service of a pedestrian bridge intended to carry pedestrian and bicycle traffic.

1.02 REFERENCES:**A. General:**

1. Bridge shall be designed, fabricated and constructed in accordance with the AASHTO Guide Specifications for Pedestrian Bridges and the AASHTO Guide Specifications for Highway Bridges where applicable.

B. The work of this Section shall comply with the following references:

1. AASHTO HB-17– Standard Specification for Highway Bridges, Latest Edition
2. AASHTO GSDPB – LRFD Guide Specifications for Design of Pedestrian Bridges, Latest Edition
3. AASHTO GSDFPB – Guide Specifications for Design of FRP Pedestrian Bridges, Latest Edition
4. Michigan Building Code, Latest Edition
5. AWS D1.1 – Structural Welding Code, Latest Edition
6. AWS D1.5 – Bridge Welding Code, Latest Edition
7. ACI 318 – Building Code and Commentary, Latest Edition
8. AISC – Manual of Steel Construction, Latest Edition
9. AITC TCM–Timber Construction Manual, Latest Edition
10. NDS – National Design Standard for Wood Construction, Latest Edition
11. ASCE 7 – Minimum Design Loads for Buildings and other Structures, Latest Edition
12. PCI - Pre-stressed Concrete Institute:
 - a. MNL-116 - Manual for Quality Control for Plants and Production of Precast Pre-stressed Concrete Products.
 - b. MNL-127 - Recommended Practice for Erection of Precast Concrete.
13. ASTM Standard Specifications:
 - a. A 185 - Steel Welded Wire Fabric. Plain, for Concrete Reinforcement.
 - b. A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - c. C 33 - Concrete Aggregates.
 - d. C 150 - Portland Cement.
 - e. A123 - Standard Specifications for Zinc (hot dip galvanizing) coatings on iron and steel products.

1.03 SUBMITTALS:**A. Signed and sealed design calculations, specifications, plans, and detail drawings.**

1. Prepared by a Professional Engineer registered in Michigan.
2. Submit for:
 - a. Foundation
 - b. Bridge Structure
 - c. Bridge Railings

3. Obtain Engineer's review prior to proceeding with fabrication and construction.

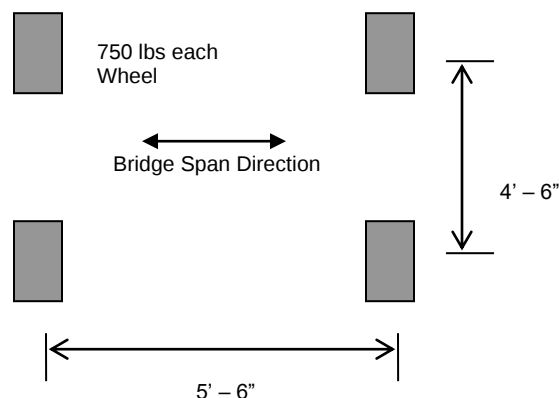
- B. Welder's qualifications and certification.
- C. Structural steel certified steel mill test reports and certification.
- D. Concrete reinforcing steel certified mill steel test report.
- E. Concrete mix design.
- F. Concrete reinforcing steel schedule and layout drawing.
- G. Precast Concrete test reports
- H. Prestressing strand certifications.
- I. Soils report for foundation design.

1.04 GUARANTEE:

- A. Bridge Contractor shall guarantee the structure against any defects in materials or workmanship for a period of one year from the date of completion. If any defect is discovered and reported to the Contractor during the guarantee period, the Contractor shall make the necessary repairs without charge to the Owner.

1.06 DESIGN REQUIREMENTS:

- A. Design Loads:
 1. Dead load: Structure load including decking
 2. Live load: 85 pounds per square foot uniformly distributed. Reductions in live load will be allowed for contributory area exceeding 400 square feet in accordance with the AASHTO Specification. In no case shall the live load be less than 65 pounds per square foot.
 3. Snow load: Calculated per ASCE 7 acting in combination with the live load
 4. Wind load: Calculated per AASHTO Specification
 5. Concentrated load: The bridge structure shall be designed for each of the following point load conditions:
 6. A concentrated load of 1000 pounds placed on any area 2 feet x 2 feet square.
 7. A 3000 pound 4-wheel vehicle as shown in the following diagram placed on the structure to provide the most critical loading.



8. Construction loads: All other associated loads experienced during construction such as equipment, workers, steel rigging and erecting methods.

B. Hydraulic Capacity:

1. For bridges over water the clear opening of the structure shall be designed to pass the 100 yr storm with a minimum of one foot of freeboard to the low beam elevation.
2. The span of the structure shall be set to clear the channel and to minimize scour of the abutments and footings. Where scour counter measures are required, such as sheet piling or rip rap shall be utilized.

C. Abutments:

1. The bridge abutments shall be constructed using cast in place steel reinforced concrete.

D. Foundation:

1. Design the foundation based on the results of a soil investigation report and foundation recommendations provided by Geotechnical Engineer registered in the State of Michigan.

E. Railings:

1. Railings shall be designed to resist a 50 lb/ft linear load applied to any member in from any direction and a nonconcurrent 200 lb point load applied in any direction to the top of the rail.
2. Railing posts shall be spaced at a maximum of 5'-0" on center.

F. Structure Dimensions:

1. The Minimum clear width for the structure as measured from face of curb to face of curb shall be 8 feet.
2. The bridge shall be cambered for dead load of the bridge and 1% of the span length. The camber shall not exceed the maximum grades specified for ADA compliance.

G. Deflection:

1. The vertical deflection of the main span due to the pedestrian load shall not exceed 1/500 of the span length.
2. The horizontal deflection of the main span shall not exceed 1/500 of the span under an 85-mph wind load.

1.07 PERMITS:

- A. The Contractor shall obtain all permits required for the structure including but not limited to the MDEQ Inland Lakes and Streams Army Corps of Engineers Joint Permit, SESC permit and applicable County Road Commission and Drain Commission permits.

PART 2 - PRODUCTS

2.01 BRIDGE:

A. Foundation:

1. Foundation shall consist of reinforced concrete spread footings or piles as recommended in the soil's investigation report.
2. Foundation concrete shall have a minimum 3500 psi compressive strength.

B. Abutments:

1. Abutments shall be constructed of reinforced cast in place concrete with minimum 3500 psi compressive strength.

C. Bearings:

1. The proposed bridge shall include bearing devices designed for the rotational movements of the bridge due to dead and live loads as well as the anticipated thermal expansion and contraction movements of the structure.
2. Anchor rods shall be provided at the bearing points of the bridge to resist the design reactions at the bearing points.

2.02 ATTACHMENTS:

A. Safety Railings:

1. Vertical safety rails or pickets shall be placed on the structure to a minimum height above the deck surface of 54 inches. The pickets shall be placed as to prevent a 4-inch diameter sphere from passing through the railing.
2. Railings shall extend off of the structure where required for approach slopes in excess of 1 on 3 or where required for fall protection from vertical drops.

B. Handrail:

1. The bridge shall have a handrail on each side of the structure meeting ADA requirements.

C. Rubrail:

1. The bridge design shall include a 6-inch-high rubrail located along each side of the structure at deck level. The rubrail shall be designed and located to protect the structure and handrails during snowplowing operations.
2. The design of the rubrail and placement shall not impede stormwater runoff from the structure.

D. Paint:

1. Steel structures shall be constructed with unpainted weathering steel with a minimum corrosion index of 6.0, determined in accordance with ASTM G101.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Coordinate Site access and staging area with Engineer prior to mobilization.

3.02 ERECTION:

- A. Erect in accordance with bridge manufacturer's Shop Drawings and these Specifications.
- B. Remove all lifting lugs and other devices used for the purpose of bridge erection.

END OF SECTION

SECTION 33 01 30.16**CLEANING AND TELEVSING OF SANITARY SEWER****PART 1 – GENERAL****1.01 SUMMARY:**

- A. This Section includes work required for the cleaning and televising (video inspection) of sanitary sewers.
- B. At a minimum, flow channels and benches must be built, and castings must be set to the established gravel grade.
- C. Notification: The Township Inspector or Township Engineer shall be provided notice and allowed three (3) workdays to complete major inspections.

1.02 RELATED SECTIONS:

- A. SP 33 31 00 – Sanitary Sewers.

1.03 SUBMITTALS:

- A. Submit the following to Allendale Charter Township Department of Public Utilities after completion of the sewer cleaning and televising:
 - 1. One report of the video inspection on a flash drive including the following information:
 - a. Specific details as to the internal condition of the sewer and manholes televised noting location and condition of any broken or crushed pipe, obstructions, defective joints, misalignment in line and grade, infiltration, service laterals, manhole flow channels, etc. per the latest version of N.A.S.S.C.O. requirements for MACP/PACP grading.
 - b. Length of sewer section, size, pipe material, manhole identification numbers, street name, etc.
 - 2. Original of the inspection video to Allendale DPU on a USB drive in protective case and labeled. A MDB and export file must be included to be integrated into Township GIS and Asset Management System.
 - 3. A read-only program shall be provided for Allendale DPU use.

1.04 JOB CONDITIONS:

- A. Maintain existing sanitary sewer system operational, if applicable.

PART 2 – PRODUCTS**2.01 EQUIPMENT:**

- A. Sewer Cleaning Equipment:
 - 1. Shall be capable of removing all dirt, grease, rocks, and other deleterious materials without causing damage to the sewer pipe.
 - 2. Must be high velocity water-jetting, and vacuum.
 - 3. Necessary pulleys and supports shall be installed in manholes so as not to restrict the cleaning operation or damage existing manholes.

4. Shall be capable of cleaning sewer lengths of up to 800 feet with vehicular access to one manhole only.
- B. Video Camera:
1. Camera operator to be PACP certified with the latest version.
 2. Shall be specifically designed and constructed for the required video inspection and shall be capable of operating under 100% humidity conditions. Shall be self-powered, no camera pulling is allowed.
 3. Shall have "pan / tilt and rotate" capabilities for viewing into lateral connections and manholes.
 4. Shall be capable of producing quality color picture.
 5. Shall record video continuously for each sewer section from manhole to manhole. The recording speed and electronics shall be equal to that which can be played back on standardized equipment in the electronics industry.

PART 3 – EXECUTION

3.01 PREPARATION:

- A. Sewer and Manhole Cleaning:
1. Clean sewer mains, laterals, and manholes until they are completely free of debris prior to televising (video inspection).
 2. High velocity water-jetting of all debris to downstream manholes.
 3. Remove all sludge, dirt, sand, rocks, grease and other solid or semisolid material resulting from the cleaning operation at downstream manholes. Passing material from manhole section to manhole section will not be permitted.
 4. Properly dispose of removed material.
 5. If sewer televising indicates that the sewers, laterals, and manholes have not been **completely** cleaned free of debris, the sewers, laterals, and manholes shall be re-cleaned and re-televised at no additional cost to the Township.

3.02 PERFORMANCE:

- A. Televising (video inspection):
1. Flush sewer with flow of water from upstream end immediately prior to televising. Minimum five (5) gallons of water to be used for 8" and 10" diameter and 10 gallons for 12" and 15". Volume of water will be determined for anything larger than 15".
 2. Move camera through sewer in either direction at a moderate and uniform rate (30 to 40 feet per minute) per N.A.S.S.C.O specifications for P.A.C.P inspection, stopping when necessary to allow examination and documentation of the sewer's condition and all points of infiltration, cracked or crushed pipe, defective joints, misalignment of line and grade, service laterals, and other points of interest noted during the inspection.
 3. Use the "pan / tilt / rotate" features to inspect all service laterals, defective joints, and manholes.
 4. If the camera encounters a vertical dip in the sewer line, the amount of vertical dip shall be estimated (percent of pipe volume). Any amount of 10% or greater shall be noted.
 5. Note distances from a manhole to the various points of interest. The accuracy of the distance measurements shall be verified and certified to within 0.1 feet.

3.03 ACCEPTANCE:

- A. Deliver completed product as outlined in paragraph 1.03 SUBMITTALS for review by the Township and Township Engineer.

- B. If repairs are necessary to correct deficiencies found during the video inspection, the section repaired shall be re-televised for acceptance.
- C. Repairs causing disturbance to pipe bedding or backfill will require an additional mandatory 30-day waiting period prior to televising. As such, the Contractor will be required to test and inspect the repaired sewer in accordance with SP 33 31 00 SANITARY SEWERS - 3.03 TESTING AND INSPECTION.

END OF SECTION

SECTION 33 05 24

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required to install a carrier or casing pipe under an obstacle using the method commonly known as directional drilling to the grades and alignments shown on the Drawings, where approved by the Township and Township Engineer.

1.02 REFERENCES:

- A. ASTM - American Society of Testing Materials, *Latest Edition*.
- B. PPI - Plastics Pipe Institute
- C. AWWA - American Water Works Association
- D. ANSI - American National Standards Institute
- E. OCRC – Ottawa County Road Commission

1.03 JOB CONDITIONS:

- A. MDOT Right-of-Way: Comply with MDOT "Provisions for Jack Construction (1998)" for permitting, installing and inspecting jacked-in-place and directional-drilled pipe within MDOT right-of-way.
- B. Other Jurisdictions: Comply with all permit requirements.
- C. Critical Crossings: Critical crossings, such as surface water crossings, require valve chambers on each side of the crossing so that the section of piping may be isolated. The valve chambers shall include corporation stops on each side of the valve for purposes of future chlorination, sampling, and leak testing.

1.04 GENERAL REQUIREMENTS:

- A. The Contractor shall be responsible for the method of construction, the stability and accuracy of the drilled and reamed hole and pits constructed, and all costs for damages resulting from any failure thereof. The Contractor shall be solely responsible for the safety of the pits and related structures and personnel engaged in underground construction throughout the duration of the work.
- B. The Contractor's methods and schedule shall consider the overall project requirements and anticipated subsurface soils and groundwater conditions. The Contractor's selection of inadequate, inappropriate, or inefficient equipment and methods will not be cause for adjustments to the contract price or contract time.
- C. The general dimensions, arrangement and details for the drilled hole and pits to be constructed shall be as needed to complete the required work.

- D. Methods of excavation, equipment and procedures for the directional drilling operation and pits shall be selected by the Contractor to provide adequate working space and clearances for the work to be performed.
- E. Pit excavation methods, groundwater control and pit support techniques shall be selected by the Contractor.

1.05 CONTRACTOR QUALIFICATIONS:

- A. The Contractor who will complete the work contained in this Section must be experienced in the type of work specified in this Section and must have successfully completed similar projects within the last three years.
- B. Personnel that will perform the work must be trained and experienced in the fabrication and installation of the materials and equipment, as well as being knowledgeable of the design and the reviewed shop drawings.
- C. At the Engineer's request, the Contractor responsible for the completion of the work contained in this Section shall submit a list of jobs successfully completed within the last three years. Information on each job must include the following:
 - 1. Date of Project
 - 2. Location
 - 3. Length of Directional Drill
 - 4. Size and Material of Pipe
 - 5. General Contractor's name, contact and phone number.
 - 6. Owner's name, contact and phone number.
 - 7. Other information relevant to the successful completion of the project.

1.06 SAFETY:

- A. The Contractor shall become familiar with, and shall at all times conform to, all applicable codes, ordinances, and laws in relation to the work required.
- B. Directional drilling equipment machine safety requirements shall include a common grounding system to prevent electrical shock in the event of a high voltage underground cable strike. The grounding system shall connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats and any other interconnected equipment to a common ground. The drill shall be equipped with an "electrical strike" audible and visual warning system that shall notify the system operators of an electrical strike.
- C. Operators of the drill shall wear electrical shock protection equipment and operate from common grounding mats as required.

1.07 SUBMITTALS:

- A. Proposed drill profile data including the minimum information listed below:
 - 1. Entrance angle
 - 2. Exit angle
 - 3. Minimum radius of curvature
 - 4. Depth of pipe every 50 feet
 - 5. Pilot hole diameter
 - 6. Back ream hole diameter
 - 7. Wet or dry pullback

8. Estimated maximum pullback force

B. HDPE to DI connection:

1. Manufacturer
2. Product data sheet
3. Dimension drawing
4. Installation instructions

C. Drilling Fluid:

1. Bentonite (or alternate):
 - a. Product manufacturer
 - b. Product data sheet
 - c. Mixing instructions
2. Polymer:
 - a. Product manufacturer
 - b. Product data sheet
 - c. Mixing instructions
 - d. Material safety data sheet (MSDS)

D. Drill Path Documentation upon completion: See Article 3.07.

E. Contractor corrective action plan as noted in Section 33 05 24.1, Paragraph 5. See Section 33 05 24.1 for inadvertent loss of drilling fluid.

1. Corrective action plan shall include breach mitigation plan with following phone numbers:
 - a. Pollution Emergency Reporting System (PEAS)
 - b. EGLE, Inland Lakes and Streams

1.08 DELIVERY, STORAGE AND HANDLING:

A. Handle and store materials in a manner that will prevent:

1. Deterioration or damage
2. Contamination with foreign matter
3. Damage by weather or elements

B. After the pipe is fused together and before it is pulled through the drilled hole, the Contractor shall be responsible to provide vehicular and emergency access to all properties affected by the fused pipeline. The Contractor shall be responsible to repair all damage to existing surface and site improvements damaged by the fused pipeline.

1.09 UTILITY PROTECTION:

A. All underground utilities shown on the drawings are shown according to the best available information. It is the Contractor's responsibility to verify the location of all existing utilities prior to working in the area.

B. All utilities are to remain in service and shall be protected by the Contractor from any damage as a result of his operations.

C. Where utilities are encountered and not shown on the drawings, the Contractor shall report them to the Owner before proceeding with the work.

D. All utilities damaged by the Contractor's activities shall be repaired or replaced by the Contractor without preventable delay. All costs to repair the utility including, but not limited

to, materials, labor, inspection, testing and temporary service shall be borne by the Contractor with no cost to the Owner.

- E. All utilities in close proximity to the drill pilot bore, back ream or product pipe installation must be exposed in accordance with all codes, ordinances and regulations to ensure, by visual inspection, that the Contractor's work has not caused any damage to the utility or to the Contractor's work and adequate clearance between the utility and the Contractor's work is maintained.

1.10 APPLICABLE REGULATIONS:

- A. All work covered by this Section shall be performed in accordance with all applicable federal, state, and local laws, regulations, codes, and ordinances which pertain to such work, as well as the supplemental regulations contained in these specifications. If a conflict exists between any laws, regulations, codes, or ordinances, the most stringent shall govern.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Pipe
 1. See Section 33 11 00 WATER MAIN for water main pipe specifications.
 2. See Section 33 34 00 SANITARY FORCE MAINS for sanitary forcemain pipe specifications.
 3. See Section 33 31 00 SANITARY SEWERS for sanitary sewer pipe specifications.
 4. The Contractor is responsible for calculating loads placed on the pipe during its installation based on the Contractor's chosen means and methods of construction. It is the Contractor's responsibility to ensure the pipe will withstand all loadings placed on it during installation. If the pipe with dimensions stated in the specifications will not withstand the installation loads, it is the Contractor's responsibility to size the pipe to withstand the installation loads.
 5. The pipe shall conform to DIPS (Ductile Iron Pipe Size) size and be appropriately striped as water main (blue).
- B. Drilling Fluids:
 1. The Contractor must use a high-quality Bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil-based drilling fluids or fluids containing additives that can contaminate the soil or ground water will not be considered acceptable substitutes. Composition of the drilling fluid must comply with all federal, state, and local environmental regulations.
 2. Polymer used as lubrication in the drilling fluid is acceptable, if desired.
 3. Drilling fluids must be mixed with water that is free from significant solids and contamination. Potable water is acceptable. River water is acceptable provided no organic matter or soil particulates are mixed into the drilling fluid. It is the Contractor's responsibility to apply for and obtain any necessary permits for the procurement of drilling fluid water. It is also the Contractor's responsibility to pay permit application fees, metering charges or any other costs associated with drilling fluid mixing water.
- C. HDPE to Ductile Iron Connection:
 1. See Section 33 11 00 WATER MAIN for water main pipe specifications.
 2. See Section 33 34 00 SANITARY FORCE MAINS for sanitary forcemain pipe specifications.

D. Tracer Wire:

1. Follow trace wire specifications in Section 33 11 00 WATER MAIN and Section 33 34 00 SANITARY FORCE MAINS. Provide minimum copper 6 gauge.

PART 3 - EXECUTION

3.01 ALIGNMENT AND PROFILE OPTIONS:

- A. Alignment and profile shown on the drawings.
- B. An alternate alignment and profile developed by the Contractor with the following requirements:
 1. Alignment must be within easement(s) and right-of-way. See OCRC guidelines and details for alignment locations.
 2. Clearance between utilities is maintained.
 3. 15-foot minimum vertical distance between the drill path and the bottom of a river to prevent drilling fluid breakout.
 4. Changes from the approved plans shall be applied by the Township Public Works Department or Township Engineer.
 5. Follow alignment guidelines in Section 33 34 00 SANITARY FORCE MAINS and Section 33 11 00 WATER MAINS.

3.02 PIPE FUSION:

- A. All pipe shall be joined with the "butt fusion" method in accordance with the pipe manufacturers recommendations. Socket fusion, extrusion welding, hot gas welding and mechanical connections are not acceptable.
- B. Butt fusion joining shall produce a joint of equal or greater tensile strength than the strength of the pipe.
- C. A data logger shall be used to record equipment temperature, time, and pressure conditions during jointing.

3.03 DRILL ENTRANCE AND EXIT PITS:

- A. The Contractor is responsible for the design and construction of the drill entrance and exit pits. Supports may be required to maintain safe working conditions. Ensure stability of the pit, minimize loosening, and minimize soil deterioration and disturbance of the surrounding ground.
- B. Entrance and exit pits must be contained in a temporary construction easement(s) and/or right-of way.
- C. Drill entrance and exit pits must be maintained at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing system or for removal from the site.
- D. Drilling fluid will not be allowed to freely flow on the site, in water, or around the entrance or exit pits. Fluid spilled must be removed as soon as possible and the ground restored to original condition.

- E. Pits must be shored to MIOSHA standard if workers are required to enter the pits for any reason.

3.04 DRILL ENTRANCE AND EXIT ANGLES:

- A. Entrance and exit angles of the drill can be whatever the Contractor desires such that the elevation profile maintains adequate ground cover to ensure no drilling fluid breakout occurs and that ground exit occurs within the designated easement(s) or right-of-way. The Contractor is responsible for ensuring that entrance and exit angles ensure pullback forces do not exceed 5% strain on the polyethylene pipe.

3.05 GUIDANCE SYSTEM:

- A. The guidance system must have the capability of measuring inclination, roll and azimuth. The guidance system must have an independent means to ensure the accuracy of the installation. The Contractor will demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance system will be capable of generating a plot of the borehole survey for the purpose of an as-built drawing.

The guidance system must meet the following specifications:

Inclination:	Range	-90° to +90°
	Accuracy	0.2°
Azimuth:	Range	0° to 360°
	Accuracy	0.5°
Roll:	Range	0° to 360°
	Accuracy	0.2°

3.06 PILOT HOLE TOLERANCES:

- A. The pilot hole shall be drilled along the agreed-to alignment and profile with the following tolerances:
 1. Vertical
 - a. Plus 4 feet (deeper or additional ground cover).
 - b. Minus 1 foot (shallower or reduced ground cover).
 2. Horizontal:
 - a. Plus, or minus 2.5 feet
 3. Curve radius:
 - a. Curve radius shall not exceed the pipe manufacturer's recommendations.

3.07 DRILL PATH DOCUMENTATION:

- A. The Contractor is responsible for maintaining drilling logs that provide drill path data every 25 feet along the drill path. Information logged every 25 feet will, at a minimum, include the following:
 1. Pilot hole:
 - a. Distance out or station
 - b. Depth below a known ground surface elevation
 - c. Plus, or minus (left or right) of alignment
 - d. Torque
 - e. Drill fluid flow rate

- f. Time
- 2. Back ream:
 - a. Distance out or station
 - b. Pull back force
 - c. Torque
 - d. Drill fluid flow rate
 - e. Time

3.08 PIPE GOUGING:

- A. The Contractor shall take every precaution to prevent gouging of the pipe prior to and during pipeline installation.

It is expected some pipe gouging will occur during pullback. However, the constructed pipeline shall not have any gouges that are deeper than 10% of the pipe wall thickness. Pipe that has gouges greater than 10% of the pipe wall thickness will not be accepted.

3.09 INSTALLING PRODUCT PIPE:

- A. After the pilot hole is completed, install a swivel to the reamer and commence pullback operations. Pre-reaming of the tunnel may be necessary and is at the option of the Contractor.
- B. Reaming diameter will not exceed 1.4 times the diameter of the product pipe being installed.
- C. Allow sufficient length of product pipe to extend past the termination point to allow connections to adjacent pipe sections or gate valves. Pulled pipes will be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe will be at the Contractor's discretion.
- D. Install an AWWA C153-11 Mechanical Joint Adaptor, per the manufacturer's requirements, when connecting the pipe to a valve or hydrant.

3.10 YIELD STRESS:

- A. The yield stress shall be calculated from the HDPE material submitted and the cross-sectional area of the pipe. The result will be the force at which the HDPE pipe will yield.
- B. The pullback force will be monitored throughout the pullback. At no time shall the equipment be operated to produce a pullback force that exceeds 75% of the yield force.

3.11 CLEANUP:

- A. All excavated soil, soil cuttings and drilling fluid shall be the property of the Contractor. All material shall be disposed of in accordance with all laws, regulations, codes, ordinance, and these specifications.
- B. Immediately upon completion of the work in this section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean, and acceptable condition.

- C. If a drilling fluid breakout should occur, the area shall be cleaned immediately, and the surface washed and returned to original condition by Contractor.
- D. Every precaution shall be implemented to prevent a drilling fluid breakout in the river. It is the Contractor's responsibility to conduct construction activities to prevent this occurrence. However, if a drilling fluid breakout occurs in the river, it is the Contractor's responsibility to clean up any resultant contamination. See Section 33 05 24.1 HORIZONTAL DIRECTIONAL DRILLING PLAN for information regarding the loss of fluid. The Contractor is also responsible for any damage to property or the environment due to such a breakout.

3.12 HYDROSTATIC TESTING:

- A. The pipe shall be hydrostatically tested before being connected to other piping systems. The pipe shall be tested independently of other hydrostatic tests.
- B. Testing procedure shall conform to ASTM F2164 and applicable guidance in AWWA M55.
- C. Pressure Gauge:
 - 1. A liquid filled, 4" diameter pressure gauge.
 - 2. 0 to 160 psi range
 - 3. Scale minor gradations: 2 psi Max
- D. Pipeline shall be tested after directionally drilled installation and completely backfilled. Testing pipeline prior to its installation is not acceptable.
- E. Maximum length of pipe to be tested shall be 2,000 feet.
- F. Hydrostatic testing procedure:
 - 1. Fill the constructed pipeline with water taking care to bleed off trapped air.
 - 2. Pressurize the pipe to 150 psi
 - 3. Maintain pressure in the pipe for a period of 4 hours to give the pipe time to expand.
 - 4. During this initial 4 hours, make-up water shall be added as needed to maintain the pressure within 5 psi of the specified pressure.
 - 5. At the end of the 4-hour period, the pipe shall be pressurized to 150 psi whereupon the test phase shall begin
 - 6. Test Phase:
 - a. Pressure shall be reduced by 10psi to 140 psi by slowly bleeding off water to reduce pressure.
 - b. Monitor pressure in the pipeline for a period of 1-hour. Do not increase pressure or add water during this time.
 - c. Passing Criteria after the 1-hour test period:
 - 1. Pressure shall not drop below 133 psi (pressure drop of 5% of 140 psi), and
 - 2. No visible leakage is observed.
 - 7. A failing test may be immediately repeated. However, under no circumstances shall the total time under the specified test pressure exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., the test shall be terminated, and the pipeline shall be de-pressurized and permitted to "relax" for a minimum of 8 hours prior to the next testing sequence.
- G. If the hydrostatic test fails, the Contractor shall be responsible for repairing or replacing the pipeline until the hydrostatic test is passed.

3.14 ELECTRICAL CONTINUITY:

- A. Test tracer wire for continuity and repair breaks. Continuity test must be passed prior to acceptance of the project.
- B. Provide Engineer with written test results indicating that each section of the wire has been tested and continuous its entire length. Provide general description of location, date of test, and amperage applied

3.15 SCHEDULES:

- A. Horizontal Directional Drilling Plan for Preventing and Controlling the Loss of Drilling Mud (3 sheets).

END OF SECTION

SECTION 33 05 27.1

HORIZONTAL DIRECTIONAL DRILL PLAN FOR PREVENTING LOSS OF DRILLING MUD

1.0 INTRODUCTION

- A. This directional drill contingency plan provides specific procedures and steps to prevent and/or to contain inadvertent releases of drilling mud (also referred to as frac-outs) for waterbodies that are crossed using horizontal directional drilling (HDD) techniques.

2.0 HORIZONTAL DIRECTIONAL DRILLING PROCESS

- A. Installation of a pipeline by HDD is generally accomplished in three stages. The first stage consists of directionally drilling a small-diameter pilot hole along a pre-determined path. The second stage enlarges this pilot hole to a diameter that will accommodate the pipeline. Numerous "reaming" passes will be necessary with each pass enlarging the diameter of the pilot hole incrementally. The third stage involves pulling the pipeline through the enlarged hole.

During the drilling of the pilot hole, directional control is achieved by using a non-rotating drill string with an asymmetrical leading edge. The asymmetry of the leading edge creates a steering bias, which allows the operator to control the direction of the drill bit. The actual path of the pilot hole is monitored during drilling by taking periodic readings of the inclination and azimuth. These readings are used to calculate the horizontal and vertical coordinates along the pilot holes relative to the initial entry point on the surface.

Once the pilot hole is complete, it is enlarged using reaming tools that are often custom-made for a particular diameter of pipe or type of soil. The reamers are typically attached to the drill string at the exit point and are rotated and drawn to the drilling rig, thus enlarging the pilot hole with each pass. Pipe installation is accomplished by attaching a prefabricated pull section behind a reaming assembly at the exit point and pulling the entire assembly back to the drilling rig.

- B. Ideally, horizontal directional drilling involves no disturbance to the bed or banks of a stream or wetland. However, it is possible that geologic irregularities could be encountered during drilling, and drilling could fail. This plan describes the potential for failure of horizontal directional drilling, the contingency methods that would be implemented in the event of inadvertent release of drilling fluids to water or land, and drill hole abandonment procedures.

The feasibility of the horizontal directional drill method primarily depends on the local geologic setting, as well as site topography and other surface features. For example, horizontal directional drilling may not be feasible in areas of glacial till or outwash interspersed with boulders and cobbles, highly fractured bedrock, or non-cohesive coarse sands and gravels. These formations increase the likelihood that drilling could fail due to refusal of the drill bit, continuous loss of drilling fluid through fractures or weak areas in the ground, or collapse of the bore hole in non-cohesive, unstable substrate.

Fortunately, surface characteristics at the proposed Project drill sites are generally favorable for HDD.

Also, subsurface geotechnical investigations indicate that conditions are favorable for horizontal directional drilling.

3.0 MONITORING PROCEDURES

- A. The Project Engineer and construction personnel will continuously monitor operations during drilling activities.
 - 1. Visual inspection along the drill path, including monitoring the water body for evidence of a release.
 - 2. Continuous examination of drilling fluid pressures and returns flows.

4.0 NOTIFICATION PROCEDURES

- A. If an inadvertent release is discovered, steps will be taken by construction personnel to contain the release as described in Section 5.0, Corrective Action and Cleanup. The Township inspector shall be notified immediately.
- B. If monitoring indicates an in-stream release, the Project Engineer will immediately notify the appropriate Federal and State agencies as soon as possible by telephone and/or email of an in-stream release event, detailing the nature of the release and corrective actions being taken. The notified agencies will determine whether additional measures need to be implemented.
- C. If a release occurs that may migrate downstream and affect water quality, downstream water users will be contacted.

5.0 CORRECTIVE ACTION AND CLEANUP

- A. By monitoring drilling operations continuously, it is intended to correct problems before they occur. In addition, containment equipment including earth-moving equipment, portable pumps, hand tools, sand, hay bales, silt fence, lumber, and a suction dredge will be readily available at the drill site. If a release does occur, the following measures will be implemented to stop or minimize the release and to clean it up.
 - 1. The drilling contractor will decide what modifications to make to the drilling technique or composition of drilling fluid (e.g., thickening of fluid by increasing bentonite content) to reduce or stop minor losses of drilling fluid.
 - 2. If a minor bore path void is encountered during drilling, making a slight change in the direction of the bore path may avoid loss of circulation.
 - 3. If the bore head becomes lodged resulting in loss of drilling pressure, the borehole may be sized by moving the bore head back and forth to dislodge the stuck materials.
 - 4. If necessary, drilling operations will be reduced to assess the extent of the release and to implement other possible corrective actions.
 - 5. If public health and safety are threatened, drilling fluid circulation pumps will be turned off. This measure will be taken as a last resort because it increases the potential for drill hole collapse resulting from loss of down-hole pressure.
 - 6. If a land release is detected, the drilling crew will take immediate corrective action to contain the release and to prevent migration off site.
 - 7. The contractor will construct pits and berms around the borehole entry point to contain inadvertent releases onto the ground.
 - 8. Any drilling mud released into the pits will be pumped by contractor personnel into a mud-processing unit for recycling of drilling fluid and separation of cuttings.
 - 9. Additional berms will be constructed around the bore pit as directed by the Project Engineer to prevent release materials from flowing into the water body.

10. If the amount of an on-land release does not allow practical collection, the affected area will be diluted with fresh water and allowed to dry. Steps will be taken (such as berm, silt fence, and/or hay bale installation) to prevent silt-laden water from flowing into the water body.
11. If hand tools cannot contain a small on-land release, small collection sumps (less than 5 cubic yards) may be constructed to pump the released material into the mud processing system.
12. Contractor HDD crews will immediately implement non-mechanized measures to contain the spread of drilling fluids, including the installation of hay bales or silt fence.
13. Sump pumps or vacuum trucks will be used to remove and dispose of any drilling fluids.

6.0 ABANDONMENT

- A. If corrective actions do not prevent or control releases from occurring into the water body, the HDD Contractor may opt to re-drill the hole along a different alignment or suspend the Project altogether. In either case, the following procedures will be implemented to abandon the drill hole.
 1. The method for sealing the abandoned drill hole is to pump thickened drilling fluid into the hole as the drill assembly is extracted, and using cement grout to make a cap.
 2. Closer to the surface of the hole(s) (within approximately 10 feet of the surface), a soil cap will be installed by filling with soil extracted during construction of the pit and berms.
 3. The bore hole entry location will be graded by the contractor to its original grade and condition after the drill hole has been abandoned.

SECTION 33 05 24.02

HDPE INSTALLATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY:

- A. This section includes a guide for how to install HDPE pipe via butt fusion and HDPE fittings via electrofusion.

1.02 SITE & MATERIAL REQUIREMENTS:

- A. **Safety:** Make sure you fully understand and follow all job site safety requirements. Electrofusion fittings and equipment are not designed or rated as explosion-proof. If they are used in a hazardous or volatile environment, additional ignition risks may exist that are not covered here. When moisture at the fusion site could create a risk of electrical shock, attach the leads to the fitting before energizing the control unit. Always take appropriate precautions to minimize exposure to electrical shock hazards.
- B. **Control Flow:** All heat fusion joining methods require the pipe to be free of any flowing or standing water that could come into contact with the fusion surfaces. Site dewatering may be necessary to prevent groundwater from reaching the fusion area and contaminating the surfaces being joined. In moderately wet conditions, dewatering can be performed using portable submersible pumps. Water must not come into contact with the fusion surfaces during assembly or the fusion cycle, as it can contaminate the joint, interfere with the fusion process, and create voids or pockets when the moisture turns to expanding steam during fusion. Dry ice placed in the pipe upstream of the fusion location may be used to temporarily freeze small amounts of flowing water until the fusion process is complete.
- C. **Ambient Temperature:** Follow the fitting manufacturer's recommended minimum and maximum ambient installation temperatures for electrofusion fittings.
 - 1. Install electrofusion fittings only within the ambient temperature range specified by the manufacturer. The typical allowable range is 14°F to 113°F in accordance with ISO 12176-2. Some manufacturers may allow lower or higher temperature limits and will identify their approved range in the technical specifications; verify this directly with the fitting manufacturer.
 - 2. The control box uses sensor-based ambient temperature readings, so the sensors must not be influenced by outside heat sources such as heat-producing generators or direct sunlight, as these conditions may affect the processor's temperature reading.
 - 3. Protect the fusion work area during adverse weather conditions, including rain or snow. A temperature-controlled welding tent, or a similar enclosure, may be required.
- D. **Electrofusion fittings** are supplied in sealed plastic bags to prevent the buildup of dust, dirt, and other contaminants. The bag should remain on the fitting during normal handling and should not be removed until installation. Fittings are also commonly packaged in boxes to protect them from other forms of deterioration, including oxidation caused by prolonged UV exposure during storage. Store all fittings indoors in their original packaging until they are ready to be installed.

1.03 EQUIPMENT:

- A. **Markers:** Markers shall be permanent, non-petroleum-based, and clearly visible on the pipe color being used. Use markers to indicate insertion depth and to help verify the effectiveness of pipe scraping. Markers shall also be used to identify the required fusion cooling time.
- B. **Cutting Tools:** Use an appropriate saw without lubricants, including oil- or graphite-based products, along with a guide or guide marks. For larger pipe sizes, commonly used cutting tools include reciprocating saws, circular saws with coarse-tooth blades, hot saws, chop saws, and chain saws, provided proper safety precautions and personal protective equipment are used.
- C. **Scraping Tools:** Approved scraping tools for electrofusion joining are those that remove material evenly while preventing contamination from the surrounding area, thereby exposing a clean virgin surface. MAB recommends using "Peeler" type tools that remove a continuous, measurable ribbon from the pipe surface with a minimum thickness of 0.007 inch. The advantages of these tools include:
 - 1. The ribbon thickness can be measured by the operator to confirm that the tool is operating as intended.
 - 2. A continuous ribbon confirms that the full circumference of the pipe has been scraped.
 - 3. Any missed or skipped areas between peeler passes can be easily detected using only lengthwise scribed witness marks.
- D. **Alignment/Restraining Clamps:** Electrofusion fittings develop substantial pressure from thermal expansion during the melt phase of the fusion process. This pressure is a necessary part of the process and is built into the fitting design and fusion parameters. Because polyethylene is a thermoplastic material that softens when heated, the fusion assembly must remain stationary throughout both the melt and cooling phases. As the material cools and re-crystallizes back into a solid state, the joint must not be disturbed. Alignment and restraining clamps help prevent movement of the pipe and joint during both the melt and cooling cycles. Full-encirclement alignment clamps may also help re-round pipe ends, whereas chain- or strap-type clamps do not provide this benefit. The main purpose of clamping is to keep the pipe and fitting assembly properly aligned, stable, free from external stress, and immobile until the required cooling time has elapsed. Alignment and restraining clamps shall always be used when installing electrofusion couplings. If commercially manufactured alignment or restraining clamps are not available, other methods of stabilizing the joint may be used, such as blocking, rigid timber, and ratchet straps to prevent movement of the assembly.
- E. **Coupling Puller:** Because electrofusion couplings require a tight diameter tolerance fit with the pipe, mechanical pulling tools are available from several manufacturers to aid in positioning the coupling.
- F. **Re-rounding Tool:** These tools shall always be used before and during installation to restore the pipe to a round shape. Various tools are available for both internal and external re-rounding applications.
- G. **Electrofusion Control Box (Processor):** A portable device used to supply electrical current to an electrofusion coupler.
- H. **Butt Fusion Welding Machine:** A portable device used for providing pressure, a cutting head, and a heating plate during the butt fusion process.

1.04 PRE-INSTALLATION:

- A. The butt fusion method utilizes a separate procedure for cleaning and squaring the pipe ends from what is called out below.
- B. Pipe Diameter: Verify that the pipe diameter complies with the allowable tolerances of the applicable pipe standard, such as ASTM F714 or AWWA C906, at the specified temperature. Standard tolerances are based on 73°F. Measure the pipe diameter using a Pi tape at 2 inches and 6 inches from the pipe end. Check for pipe toe-in, or end-of-pipe diameter reduction, to confirm that the diameter remains within tolerance at 2 inches from the end. If severe toe-in is present, meaning the pipe diameter is less than the minimum allowable diameter, it may be necessary to cut off up to one full pipe diameter from the pipe end.

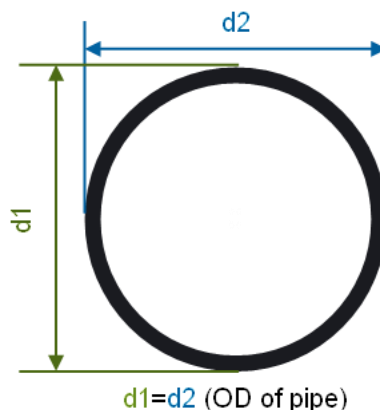
STANDARD PE 4710 IPS AND DIPS PIPE DIMENSIONS (AWWA C906/ASTM F714)
 DIMENSIONS APPLY TO PIPE AT 69.8-77.0 DEGREES F

PE 4710 OUTSIDE DIAMETERS (OD) AND TOLERANCES FOR IPS SIZES		
PIPE SIZE	AVERAGE	TOLERANCE
14" IPS	14.000"	+0.063
16" IPS	16.000"	+0.072
18" IPS	18.000"	+0.081
20" IPS	20.000"	+0.090
22"IPS	22.000"	+0.099
24"IPS	24.000"	+0.108
26"IPS	26.000"	+0.117
28"IPS	28.000"	+0.126
30"IPS	30.000"	+0.135

PE 4710 OUTSIDE DIAMETERS (OD) AND TOLERANCES FOR DIPS SIZES		
PIPE SIZE	AVERAGE	TOLERANCE
14" DIPS	15.300"	+0.069
16" DIPS	17.400"	+0.078
18" DIPS	19.500"	+0.088
20"DIPS	21.600"	+0.097
24"DIPS	25.800"	+0.116
30"DIPS	32.000"	+0.144

(NOTE: For sizes 12 inch and smaller, See MAB-1-2015)

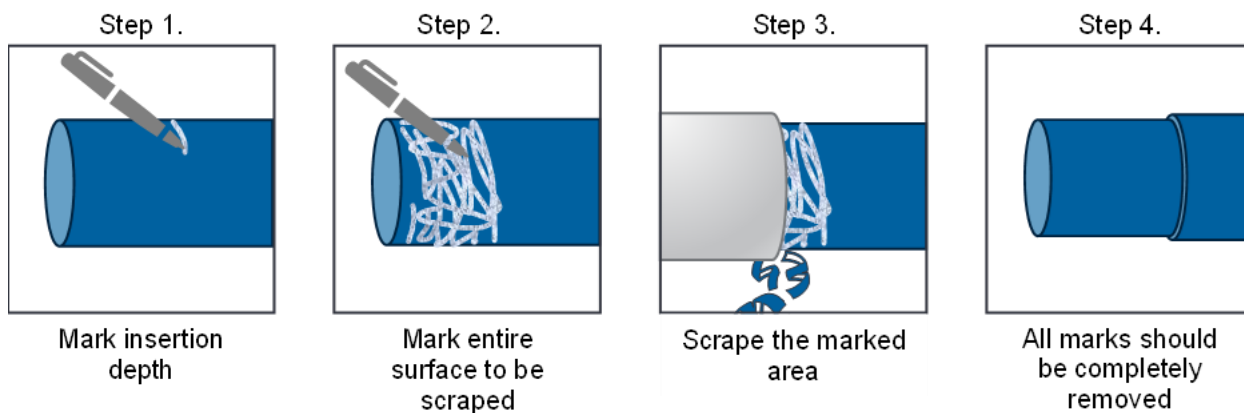
- C. Pipe Out-of-Roundness (OOR): Verify whether out-of-roundness remains after the re-rounding tools have been used.
- Any OOR $\frac{1}{4}$ " or greater must be corrected by re-rounding tools.
 - For pipe sizes 4-inch IPS/DIPS or larger, re-rounding tools are always required for electrofusion.



- D. Pipe End: Cut pipe ends squarely to 90 degrees or within $\frac{1}{2}$ " maximum tolerance from square. Use a carpenter's square for a check.
- E. Pipe alignment: Pipe alignment and clamping are required to achieve a proper fusion. Inspect the assembly alignment to confirm that no stresses are present that could cause movement during the fusion process.

1.05 INSTALLATION:

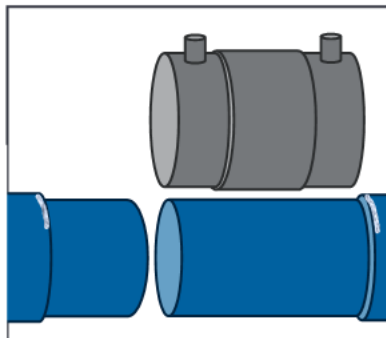
- A. Cleaning: Clean the inside and outside of both pipe ends by removing dirt, mud and other debris.
 1. Use clean water for the initial cleaning of pipe surfaces prior to scraping.
 2. Clean connection area with 96% disposable isopropyl wipes.
 3. Pipe installed by directional boring, where drilling lubricants such as bentonite have been used, requires special attention during cleaning both before and after scraping. Even when dried, drilling lubricants can be difficult to detect and can easily be spread by wiping. Use extra care to wipe only areas that have already been cleaned with isopropyl alcohol so contaminants are not transferred onto prepared surfaces.
- B. (ELECTROFUSION) Marking:
 1. Mark the stab depth on each pipe.
 2. Mark the entire circumference.
 3. Mark should also provide the limits of the required scraping area.



- C. (ELECTROFUSION) Scrapping: Pipe surfaces develop oxidation as a result of the extrusion process, transportation, and exposure to outdoor conditions. This oxidation is a normal chemical reaction that causes a physical change in the molecular structure of the polymer chains at the pipe surface. Because oxidation creates a physical barrier, those surfaces cannot be effectively heat-fused. Merely roughening the pipe surface is not enough. This oxidized layer must be removed to achieve a proper fusion. Even new pipe must be scraped to ensure a successful fusion.
 1. The minimum amount of material to be removed is seven thousandths of an inch (0.007"), which is approximately the thickness of two sheets of standard paper. The maximum amount of material removed shall not exceed forty thousandths of an inch (0.040"). Care shall be taken during scraping to avoid reducing the pipe wall below its minimum required thickness.

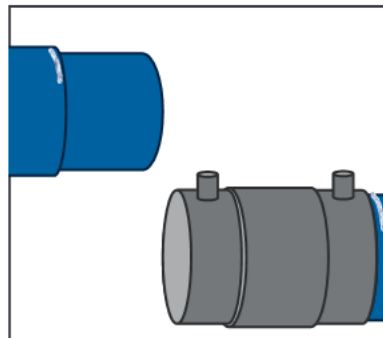
2. Before scraping, place witness marks on the pipe surface with a permanent marker. Any marks still visible after scraping indicate that portions of the surface were missed and additional scraping is required.
3. Hand scrapers should be avoided because they do not provide consistent results and require a high level of operator experience to achieve accuracy.
4. Any gouges deeper than 10% of the pipe wall thickness shall be removed by cutting out that section of pipe and replacing it.
5. Wood rasps and metal files are not acceptable scraping tools.

Step 1.



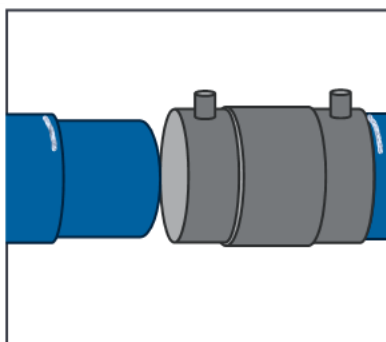
Scrape one pipe for the full length of the coupling; scrape the other for half the length of the coupling.

Step 2.



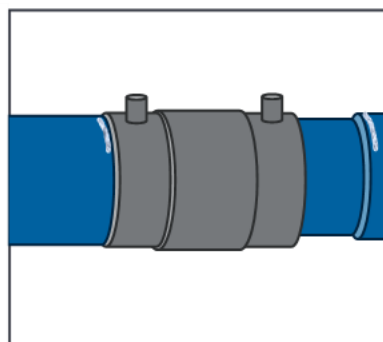
Move the half-length scraped pipe to the side and slide the coupling over the full-length scraped pipe.

Step 3.



Move the half-length scraped pipe back into place.

Step 4.

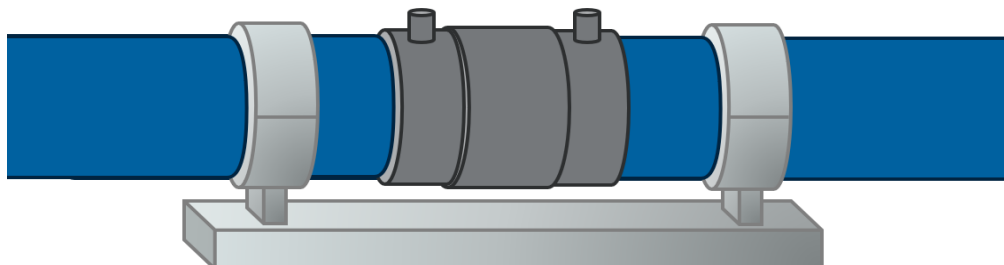


Slide coupling from the full-length scraped pipe onto the half-length scraped pipe.

D. (ELECTROFUSION) Alignment & Fitting Clamp:

1. Electrofusion fittings develop significant pressure from thermal expansion during the melt phase of the fusion process. This melt pressure is a necessary part of the process and is built into the fitting design and fusion parameters. Because polyethylene is a thermoplastic material that softens when heated, all electrofusion fittings shall be installed using alignment and restraining clamps.

2. Verify pipe end alignment to ensure that no binding or stress is placed on the coupling during the fusion process or before the required cooling time has been completed.



E. (ELECTROFUSION) Control Box:

1. Electrofusion control boxes, sometimes referred to as processors, perform vital functions during the fusion process. The control box provides carefully regulated voltage for the required fusion cycle time, resulting in the designed energy required for fusion. During the fusion process, the control box also monitors the power being supplied to the fitting and can detect certain assembly or fitting errors, such as shorted heating coils or short-stabbed pipe ends.
2. When using the fitting barcode, the control box confirms the dimensions of the fitting to be installed and automatically adjusts the fusion parameters for that particular fitting based on the manufacturer's requirements and field ambient temperature.
3. Modifying the fusion time to account for higher or lower ambient temperatures is known as temperature compensation. Not all fittings require temperature compensation; however, all barcodes include two characters indicating whether this feature applies.
4. Allow the control box to acclimate to jobsite weather conditions for at least 15 minutes before starting the fusion process so it can accurately measure ambient temperature.
5. The control box will stop the fusion process if any required protocol falls outside the acceptable range and will display an error message. Error code definitions are typically attached to the unit or provided in the operator's manual for reference if an error occurs. Each fusion record, including the result of the fusion cycle, is stored and can be downloaded using USB, Bluetooth, or another wireless connection. Because displayed error codes vary by manufacturer, refer to the manufacturer's user manual for interpretation. System operators shall retain these downloaded fusion records and link them to the installed fittings in the project documentation.
6. Minimum Requirements for Control Box:
 - a. Use a 24-digit barcode compatible control box conforming to ISO 12176-2 to deliver the required energy to the coupling.
 - b. The control box shall be capable of delivering 80 amperes average (up to 105 amp peak) at 8 to 48 volts output.
 - c. The control box shall be capable of reading the coupling barcode and applying the correct fusion parameters, including automatic temperature compensation, to the fitting without operator intervention.
 - d. The control box must be capable of reading ambient temperatures at the fusion site.
7. Fusion parameters:
 - a. Fitting manufacturer, fitting size, fusion time, voltage, and cooling time.
 - b. DIPS sizes will display as the metric (mm) equivalent or as a non-standard IPS size.

F. Butt Fusion Welding Machine:

1. Butt fusion varies from the above description. This process includes providing a clean-cut edge on the two ends being joined.
2. A heating plate is then placed between the two ends, at a specified temperature. The pipe is held in a pressurized state on the hot plate for a determined duration. This is called heat soak.
3. Once the time requirement is met, the plate is removed, and the two ends are subsequently held in a pressurized state against each other; this is the cool-down period.
4. Fusion parameters vary per manufacturer; however, standards are as follows:
 - a. Interfacial Pressure: 60-90 psi (standard range for butt fusion)
 - b. Heater Temp: 425°F - 450°F (218°C - 232°C)
 - c. Bead Size: 3/8" - 7/16" (Initial heater bead)
 - d. Heat Time: 125 - 150 seconds (based on pipe thickness)
 - e. Cool Time: 25 - 30 minutes (under pressure)

END OF SECTION

Electrofusion Inspection Report

Project Information					
Project Name:					
Date:		Time:			
Location / Joint ID:					
Contractor:					
Installer / Technician:					
Operator Qualification (OQ) Card Checked?			Yes		No

1. Pipe & Fitting Specifications					
Pipe Diameter (OD):		mm	SDR:		
Pipe Material (PE4710):					
Fitting Manufacturer:					
Fitting Size / Type:					
Fitting Barcode Number:					

2. Pre-Fusion Inspection & Preparation					
(Coupler) Pipe End Cut Square (90°, Tolerance 1/2")?		Yes		No	N/A
Swarf (Debris) Removed?		Yes		No	
Cleaning Solvent (Isopropanol >96%) Used?		Yes		No	
Surface Clean & Dry?		Yes		No	
Insertion / Stab Depth Marked?		Yes		No	
(Coupler) Re-rounding Clamps Used (≥1/4")?		Yes		No	N/A
Pipe Surface Scraped (Oxidation removed)?		Yes		No	

3. Fusion Process Information					
Processor Machine (Make & Model):					
Ambient Temperature:		°C / F			
Fusion Time Required:		seconds			
Fusion Time Actual:		seconds			
Cooling Time Required:		minutes			
Cooling Time Actual:		minutes			
Voltage Required:		Volts			
Voltage Actually Applied:		Volts			
Fusion Cycle Successful (No Errors)?		Yes		No	

4. Post-Fusion Visual Inspection					
Fusion Indicators (Pop-ups) Risen?		Yes		No	N/A
Excess Melt Leaking from Ends?		Yes		No	
Wire Coils Protruding?		Yes		No	
Misalignment/Pipe Deflection within limits?		Yes		No	
Clamps Removed After Cooling?		Yes		No	

5. Sign-Off					
Inspector:		Signature:		Date:	
Final Acceptance:		Approved		Rejected	

Butt Fusion Inspection Report

Project Information					
Project Name:					
Date:		Time:			
Location:					
Pipe Length	Location:		feet		
Contractor:					
Installer / Technician:					
Operator Qualification (OQ) Card Checked?			Yes		No

1. Pipe & Fitting Specifications					
Pipe Diameter (OD):		mm	SDR:		
Pipe Material (PE4710):					
Fitting Manufacturer (if applicable):					
Fitting Size / Type (if applicable):					
Fitting Barcode Number (if applicable):					

2. Pre-Fusion Inspection & Preparation					
Pipe End Cut Square (90°)?		Yes		No	
Swarf (Debris) Removed?		Yes		No	

3. Fusion Process Information					
Ambient Temperature:		°C / F			
Fusion Time Required:		seconds			
Fusion Time Actual:		seconds			
Cooling Time Required:		minutes			
Cooling Time Actual:		minutes			
Heater Temperature Required:		°C / F			

4. Post-Fusion Visual Inspection					
Heater Temperature Remained in Spec?		Yes		No	
Heat Soak Time Remained in Spec?		Yes		No	
Cooling Time Required:		minutes			
Cooling Time Actual:		minutes			

5. Sign-Off					
Inspector:		Signature:		Date:	
Final Acceptance:		Approved		Rejected	

SECTION 33 05 25
BORING AND JACKING

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required to place a specified size and type of casing pipe under a structure, roadway, or railroad by boring and jacking, without disturbing their condition or use, including placement of the utility pipe (carrier pipe) inside the casing pipe, filling the annular space and related work.

1.02 SUBMITTALS:

- A. Submit the following for review by Township and Township Engineer:
 - 1. Design data.
 - 2. Jacking and receiving pit bracing.
 - 3. Both casing and carrier pipe, fitting, including carrier pipe supports.
 - 4. Annular space filling materials
- B. Permits:
 - 1. Supply written verification that all the boring and jacking equipment and materials are in compliance to applicable permit requirements.
 - 2. Submit this verification for the Township and Township Engineer's review prior to beginning the work.
 - 3. Obtain any required permits for the boring and jacking operation.

1.03 JOB CONDITIONS:

- A. Comply with MDOT form 3702 for application requirements for trenchless installation.
- B. Other Jurisdictions: Comply with all permit requirements.

1.04 SCHEDULING:

- A. Provide all equipment, materials, and personnel necessary for non-stop completion of the boring and jacking operation, including all equipment and materials required for safety and protection of the public.
- B. Special Conditions: Where special use or conditions of overlying structure exist, schedule the work such as not to alter, interfere or endanger the structure.
- C. Permit Scheduling: Conduct the work in such a manner as to comply with any permit scheduling requirements. Notify the permitting agency with adequate notice.
- D. Clean-up promptly after completion of the backfill operation.

1.05 START-UP:

- A. Provide scheduling notification to the Township and Township Engineer, prior to start-up.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Carrier Pipe shall be as shown on the drawings and in conformance to the specification Sections.
- B. Casing Pipe:
 - 1. Welded steel pipe ASTM A-139, Grade B with a minimum of 35,000 PSI yield strength and welded leak-proof joint construction.
 - 2. Size Requirements: Larger size will be permitted, if desired.
 - a. Pressure main: Inside diameter of casing pipe shall be at least 6 inches greater than the outside diameter of the pressure pipe bells.
 - b. Gravity sewer: Inside diameter of casing pipe shall be at least 8 inches greater than the outside diameter of the gravity pipe bells.
 - 3. Nominal outside diameter and wall thickness shall be as required by permit agency and as indicated on the drawings.
- C. Casing Filler Material shall be one of the following:
 - 1. Pea Gravel: Commercial grade meeting the following gradation:

Sieve Size:	<u>5/8"</u>	<u>3/8"</u>	<u>No. 4</u>	<u>loss by wash</u>
% Passing:	100	0-85	0-8	0-3
 - 2. Sand: MDOT 902.08, Grade 2MS.
 - 3. Cementious Grout: MDOT 1005.02, Type H-1.
- D. Auger or Boring Device:
 - 1. Provide mechanical means or arrangement to prevent the auger and cutting head from leading the casing pipe, to prevent any unsupported excavation ahead of the casing pipe.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Permits: Obtain all permits required prior to initiation of construction. Notify permitting agency in advance of starting the boring and jacking operation.
- B. Clearing: Clear all areas as necessary for access pits.

3.02 ACCESS PITS:

- A. Location:
 - 1. Streets and rural roads: Minimum 15 feet from edge of pavement to the face of pit.
 - 2. Railroads: Minimum 25 feet from outside rail to the face of pit.
 - 3. Limited Access Highways: Minimum 30 feet from edge of pavement to the face of pit.
- B. Protection:
 - 1. Protect all open access pits with suitable fencing.
 - 2. Protect open pits in right-of-way with MDOT type III lighted barricades.
- C. Dewatering:
 - 1. Dewater pits without removing adjacent soil and undermining the access pit structure.

D. Size: Provide adequate space for jacking equipment and blocking.

3.03 SHEETING AND BRACING:

- A. Provide steel sheet piling at the front face of all access pits, as a minimum.
- B. Provide steel sheet piling on all faces of the access pit when located within right-of-way, or within 1 on 1 slope from edge of pavement to bottom of access pit.
- C. Provide steel sheet piling in accordance with MDOT 704.02 and 704.03. Provide a minimum sheet piling section modulus of 5.4 cubic inches for access pits up to 15 feet deep.

3.04 INSTALLATION:

- A. Alignment and Grade:
 - 1. Provide two or more guide rails to support the casing pipe at the established line and grade.
 - 2. Keep rails lubricated during jacking operation.
- B. Depth:
 - 1. Provide a minimum of 5 feet of cover between bottom of structure or pavement, and top of casing pipe. Provide minimum 7 feet of cover between bottom of railroad tracks and top of casing pipe.
- C. Jacking:
 - 1. Provide jacks and backstops of sufficient capacity to withstand the jacking thrust.
 - 2. Provide bearing blocks to transfer the pressure uniformly from the jacks to the casing pipe perimeter so as not to exceed the design compressive strength of the pipe.
 - 3. Lubricate the outside of the casing pipe with bentonite or other suitable lubricant.
 - 4. Jacking forces shall be distributed in a manner that average compressive stresses developed will not exceed design compressive strength of the pipe used.
- D. Boring:
 - 1. Provide sufficient auger lengths to complete entire bore.
 - 2. Upon initial placement, jack the casing pipe a minimum of ½ diameter to initiating boring.
 - 3. Do not allow auger to extend beyond the leading edge of the casing pipe at anytime during installation.
- E. Carrier pipe Installation:
 - 1. Install carrier pipe on suitable skids or blocking to maintain line and grade as shown on the drawings.
 - 2. Join each carrier pipe section prior to inserting into casing pipe.
 - 3. After carrier pipe installation, check line and grade and test for leakage in accordance with testing requirements.
 - 4. After acceptance, fill the annular space between the casing and carrier pipes with casing filler material to within 2 inches of the top of the casing pipe.
 - 5. Upon completion of filling operation, seal the ends of the casing pipe with a 1 foot thick concrete bulkhead.

- F. Log: Contractor shall keep a log of any additions or alterations of auger or casing pipe.
- G. All voids around the outside of the jacked pipe shall be filled by means of pressure grouting with approved material as specified in the standard MDOT Specifications. Grouting shall be completed within 48 hours of completing the bore or as directed by the Engineer. Should soil squeezing occur causing failure or damage to the earth supports, immediate steps shall be taken to stop the flow of earth and to strengthen the bracing. If loss of heading occurs, the problem area shall be stabilized as soon as possible and all voids filled by such methods and materials as approved by the Township Engineer.

END OF SECTION

SECTION 33 05 29

CURED-IN-PLACE PIPE (CIPP)

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work necessary to restore existing sanitary sewers by the installation of a cured-in-place pipe (CIPP) abandonment of laterals and sealing of infiltration using point repairs and lateral liners. The CIPP shall be formed by inverting a resin impregnated flexible tube into the existing sewer line using air or steam pressure and curing with air, steam, or UV to produce a hard, impregnable pipe, which is tightly formed to the original pipe. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping of sewage flows, cleaning, television inspection of the sewers to be lined, installation of the liner, curing records, reconnection of sewer service connections, and final television inspection.

1.02 REFERENCES:

- A. This specification references standards from the American Society for Testing and Materials which are made a part hereof by **such reference and shall be the latest edition and revision thereof**. In case of conflicting requirements between this specification and these referenced documents, this specification will govern:
 1. ASTM F2019 (Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP))
 2. ASTM F1216 (Standard Practice Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube)
 3. ASTM F1743 (Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP))
 4. ASTM D5813 (Cured-in-Place Thermosetting Resin Sewer Pipe)
 5. ASTM D790 (Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials)

1.03 PRODUCT, MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS:

- A. Products and Installers must meet the following criteria to be deemed Acceptable:
 1. For a Product to be considered, a minimum of 50 successful wastewater collection system projects of a similar size and scope of work shall be performed in the U.S. and documented to the satisfaction of the Owner to assure viability.
 2. For an Installer to be considered, the Installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least 15 years active experience in the installation. In addition, the Installer must have successfully installed at least 100,000 feet of a cured-in-place product in wastewater collection systems. Acceptable documentation of these minimum installations must be submitted to the Owner. Installer's project managers must have a minimum of two years of CIPP installation experience and must be on-site during the installation of the CIPP products.
 3. Sewer rehabilitation products submitted for approval must provide third party test results supporting the structural performance (short-term and long-term) of the product and such data shall be satisfactory to the Owner. No product will be approved without independent third-party testing verification.

4. Both the rehabilitation manufacturing and installation processes shall operate under a quality management system which is third-party certified to ISO 9000 or other recognized organization standards. Proof of certification shall be required for approval.

1.04 SUBMITTALS:

A. Pre-Construction:

1. Design Calculations:
 - a. Calculations of minimum wall thickness completed by an engineer proficient in the design of CIPP systems.
2. Resin and Liner Product Data:
 - a. Material product data
 - b. Installation instructions.
3. Certified Wet-Out Report to be submitted by the Contractor for each liner length to be installed for the project.

B. Post Construction:

1. CCTV footage of the finished product for final inspection.
2. Summary of CIPP lining.
3. Video televising logs/reports/USBs.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Tube - The sewn Tube shall consist of one or more layers of absorbent non-woven fabric and meet the requirements of ASTM F1216, Section 5.1 or ASTM F1743, Section 5.2.1 or ASTM D 5813, Sections 5 and 6, or ASTM F2019. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.
 1. The wet-out Tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.
 2. The Tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation.
 3. The outside layer of the Tube shall be coated with an impermeable, flexible membrane that will contain the resin and allow the resin impregnation (wet out) procedure to be monitored.
 4. The Tube shall contain no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
 5. The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.
 6. Seams in the Tube shall be stronger than the non-seamed felt material.
 7. The Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.
 8. Contractor may use UV GRP Cured-In-Place-Pipe (CIPP) per ASTM specifications.
- B. Resin - The resin system shall be a corrosion resistant polyester or vinyl ester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813 and ASTM F1743, the

physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

2.02 STRUCTURAL REQUIREMENTS:

- A. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall.
- B. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his Company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing as defined within the relevant ASTM standard. A percentage of the instantaneous flexural modulus value (as measured by ASTM D790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Retention values exceeding 50% of the short-term test results shall not be applied unless substantiated by qualified third-party test data to the Owner's satisfaction. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in the CIPP design.
- C. The Enhancement Factor 'K' to be used in 'Partially Deteriorated' Design conditions shall be assigned a value of 7.
- D. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If the layers separate during field sample testing, new samples will be required to be obtained from the installed pipe. Any reoccurrence may cause rejection of the work.
- E. The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

MINIMUM CIPP PHYSICAL PROPERTIES

<u>Property</u>	<u>Test Method</u>	<u>Fiber Reinforced CIPP</u>	
		Min. per ASTM F1216	Enhanced Resin
Modulus of Elasticity	ASTM D790	250,000 psi	400,000 psi
Flexural Stress	ASTM D790	4,500 psi	4,500 psi

- F. The required structural CIPP wall thickness shall be based, as a minimum, on the physical properties in Paragraph 5.E above or greater values if substantiated by independent lab testing and in accordance with the design equations in the Appendix X1, Design Considerations of ASTM F1216, and the following design parameters:

Design Safety Factor (typically used value)	=	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design (<i>As determined by long-term tests described in Paragraph 2.02B and approved by the Owner</i>)	=	50%
Ovality* (calculated from (X1.1 of ASTM F1216)	=	2%
Enhancement Factor, K	=	See Paragraph 2.02.C
Soil Density**	=	120 pcf
Live Load**	=	AASHTO H-20
Design Condition (partially or fully deteriorated)***	=	***

* Denotes information, which can be provided here or in inspection videotapes or project construction plans. Multiple lines segments may require a table of values.

** Denotes information required only for fully deteriorated design conditions.

***Based on review of video logs, conditions of pipeline can be fully or partially deteriorated. (See ASTM F1216 Appendix) The Owner will be sole judge as to pipe conditions and parameters utilized in design.

- G. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.
- H. Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical-testing requirements.
- I. Hydraulic Capacity - Overall, the hydraulic cross-section shall be maintained as large as possible. The CIPP shall have as a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.
- J. CIPP Field Samples - When requested by the Owner, the Contractor shall submit test samples to the Allendale Department of Public Utilities (APU) from field installations of the same resin system and tube materials as proposed for the actual installation. The test samples will be handled and delivered by APU to a third-party testing facility. These test results must verify that the CIPP physical properties specified in Paragraph 2.02.E have been achieved in previous field applications. Samples for this project shall be made and tested as described in Paragraph 3.04A.

PART 3 - EXECUTION

3.01 INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS:

- A. The Contractor shall submit plan and proof if seals will be required to stop infiltration. If a leak occurs after the completion of the project and within the warranty period, the Contractor shall repair the seal at no cost to the Township.
- B. It shall be the responsibility of the Owner to locate and designate all manhole access points open and accessible for the work and provide rights-of-access to these locations. If a street must be closed to traffic because of the orientation of the sewer, the Contractor shall institute the actions necessary to provide access during this for the mutually agreed time

period. The Owner shall provide free access to water hydrants for cleaning, installation and other process related work items requiring water.

- C. Cleaning of Sewer Lines - The Contractor shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Contractor shall dispose of all debris removed from the sewers during the cleaning operation in an approved manner. Any hazardous waste material encountered during this project will be considered as a changed condition.
- D. Bypassing Sewage - The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for lining. Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make the bypass. The pump(s) and bypass line(s) shall be of adequate capacity to accommodate the sewage flow. The Owner and/or Engineer may require a detail of the bypass plan to be submitted for approval.
- E. Inspection of Pipelines - Inspection of pipelines shall be performed by NASSCO certified and equipment personnel trained in locating breaks, obstacles and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP. These shall be noted and corrected. A thumb drive and suitable written log for each line section shall be produced in MDE file format for later reference by the Owner and/or Engineer.
- F. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaning equipment, the Contractor shall notify the Owner and/or Engineer. If an excavation and point repair is necessary, the Contractor shall make the repair, schedule, and coordinate his work accordingly at no additional cost to the Owner.
- G. Acceptance Video Televising: Section 33 01 30 – Video Televising of Sewers. In accordance with Allendale Charter Township Construction Standards. Pipe Logix to be used unless otherwise approved by the Township.
- H. Public Notification - The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:
 - 1. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.
 - 2. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.
 - 3. A note that homeowners should cover floor drains to prevent odors during construction.
- I. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing the CIPP.

3.02 INSTALLATION:

- A. CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications:
 - 1. Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the potential loss of resin during installation through cracks and irregularities in the original pipe wall, as applicable.
 - 2. Delivery and storage of the CIPP shall be to the construction site. Temperature logs shall be kept and reported to the Township Inspector.
 - 3. Tube Insertion – The wet-out tube shall be positioned in the pipeline using either inversion or a pull-in method as defined within relevant ASTM standards previously stipulated. If pulled into place, a power winch or its equivalent should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
 - 4. Temperature gauges shall be placed between the tube and the host pipe's invert position to monitor the temperatures during the cure cycle.
 - 5. Curing shall be accomplished by utilizing UV or steam pressure in accordance with the manufacturer's recommended cure schedule. A cool-down process shall be conducted that complies with the resin manufacturer's specification.
- B. During and after the curing process, the Contractor shall ventilate/expel all noxious odors or fumes. Contractor shall conform to OSHA requirements and keep the process in place until all noxious odors have reached an acceptable level and there is no potential health hazard left to the construction workers or the general public.

3.03 REINSTATEMENT OF BRANCH CONNECTIONS:

- A. Branch connections to buildings shall be re-opened without excavation, utilizing a remotely controlled cutting device, monitored by a CCTV. The Contractor shall certify a minimum of two complete functional cutters plus key spare components are on the job site before each installation or are in the immediate area of the jobsite and can be quickly obtained. Unless otherwise directed by the Owner or his authorized representative, all laterals will be reinstated. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation, providing temporary service and restoration work.

3.04 INSPECTION:

- A. CIPP samples shall be prepared for each installation designated by the Engineer or approximately 20% of the project's installations. Pipe physical properties will be tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either sampling method proposed. The flexural properties must meet or exceed the values listed in this specification, Table 1 of ASTM F1216 or the values submitted to the Engineer by the Contractor for this project's CIPP wall design, whichever is greater.
 - a. The samples shall be planned prior to construction. Township will inspect the collection of the samples deliver the samples to a testing facility.
- B. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87.5 % of the

submitted minimum design wall thickness as calculated in Paragraph 2.02F of this specification.

- C. Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.

3.05 CLEAN-UP:

- A. Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

END OF SECTION

SECTION 33 11 00

WATER MAINS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for water mains, structures, and appurtenant work.
- B. Operation:
 - 1. The Township shall operate all valves in the water system. No such valves shall be operated by the Contractor unless authorized by the Township.
 - 2. Valves improperly operated by Contractor resulting in resident notifications, additional flushing or chlorination, shall have costs back charged to Contractor.

1.02 REFERENCES:

- A. AWWA - American Waterworks Association, latest edition.
- B. ANSI - American National Standards Institute, latest edition.
- C. ASTM - American Society Testing Materials, latest edition.
- D. Recommended Standards for Water Works – Ten State Standards, latest edition.
- E. EGLE – Department of Environment, Great Lakes, and Energy

1.03 SUBMITTALS:

- A. Submit the following for review by Township or Township's Engineer:
 - 1. Product Data on all appurtenances including but not limited to, pipe, restraints, Valves, Hydrant and service fittings, gaskets, and fasteners and structures.
 - 2. Details for each connection to existing water main.
 - 3. Proposed equipment and method for flushing, pressure testing, leakage testing and chlorination.
 - 4. Each supplier shall only submit the items they are supplying for the specific project. Indicate specific size, model, or version on their submittal.
 - 5. Submittals must be approved by ACT Department of Public Utilities prior to the Pre-Construction Meeting.
- B. Drawings:
 - 1. Provide a one line drawing of all mains stubs and hydrant connections (in an accent color) with lengths. Allendale Public Utilities must be allowed access during construction to GPS locate all fittings and top of pipe or inverts at grade changes. Also, provide length and size of services and tap locations if not straight across from curb stop. Call out any areas of pipe having more or less than 5' of cover.
 - 2. Provide certifications on pipe and fittings indicating conformance to specifications prior to installation.
 - 3. Submittal of drawings of record plans to: Allendale Township Field Inspector.
 - 4. Provide the Township 1 printed set and a PDF file, and the Township Engineer 1 electronic file in AutoCAD format of record drawings (as-builts) with as-constructed dimensions and witnesses. (in State Plane).

- a. All measurements to be English Standard.

1.04 JOB CONDITIONS:

- A. Interrupting Water Service:
 - 1. Scheduling: Obtain Township's approval prior to interruption of service.
 - 2. Provide notice of twenty-four (24) hours to affected occupants and twenty-four (24) hours to Fire Department of time and duration.
 - 3. Provide stand-by service as required; outage not to exceed four (4) hours.
 - 4. Existing valve operation shall be by Township employees or Township representative only. Valves operated by Contractor or contractors representative are subject to penalty up to and including the cost of residential notifications, additional flushing or chlorination, and testing.
 - 5. Prevent contamination of existing water mains.
- B. Install service lines after pressure and bacteriological testing is accepted.
- C. Clean up promptly following pipe installation within maximum of 100 feet behind pipe laying operation. Clean up shall include backfill and rough grading.
- D. Installation not allowed when air temperature is 25 degrees F or colder, or when determined to cold by Allendale Township field inspector.
- E. Salvage all existing valve boxes, curb boxes and hydrants removed and deliver to the Township's yard. Hydrants shall be removed carefully without causing damage to the hydrant and fittings.
- F. If valve boxes or CSB are in pavement, they shall be wrapped with concrete joint foam or other approved means so as to keep concrete from contacting the body. Any cavity shall be filled with sand.
- G. The Field Inspector shall be provided notice and allowed three (3) workdays to perform major inspections for water mains. Major inspections include the following:
 - 1. Substantial Completion
 - 2. Completion
 - 3. Fire Protection System Inspection
 - 4. Pressurizing systems
 - 5. Flushing
 - 6. Pressure testing
 - 7. Live taps and tie ins
- H. Miss Dig requirements for contractors are as follows:
 - 1. Miss Digs will be passed onto the Contractor until ownership has been turned over to the Township.
- I. See General Requirements section 1.04.B for staking requirements.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Cement Lining: ANSI A21.4 standard thickness for ductile iron pipe and fittings.

2.02 PIPE:

- A. Ductile Iron: ANSI A21.50 and ANSI A21.51; Class 52.
- B. High density polyethylene (HDPE) pipe: HDPE pipe shall be made from a high density, extra high molecular weight material designated as PE3408 with an SDR of 11 or less with working pressure of at least 160 psi. ASTM D3350-83 cell class PEPE445574C. The pipe shall meet current AWWA C906 (4-63 inches). Materials must be listed and approved for use with potable water under ANSI/NSF Standards. Use of HDPE pipe is not permitted unless specified by the Township.
 - 1. All HDPE pipe and fittings shall conform to ASTM D3350 with cell classifications meeting PE445574C, reference AWWA C905-15 (4" through 65") AWWA C901-08 (1/2" through 3"). They shall be listed as SDR11, PE4710, or 3408 as a minimum.
- C. Service Tubing:
 - 1. Copper: ASTM B88, Type K annealed and soft temper.
 - 2. Water services shall be 1-inch diameter for residential uses (i.e. single-family dwellings) and 1 ½ inch diameter or larger for commercial, industrial, or multi-family uses. All runs under 100-feet shall be free of couplings.
 - 3. Long service lines (1" over 100', 1.5" over 60' and 2" over 40') may use HDPE listed as SDR11 (PE 4710 or 3408).

2.03 JOINTS:

- A. Ductile Iron Pipe and Fittings:
 - 1. Mechanical: ANSI A21.11. (i.e. – Iron Megalugs)
 - 2. Push-on ANSI A21.11.
 - 3. Glands: ANSI A21.11 – (i.e. – Iron Megalugs)
 - 4. Rubber-Gasket: ANSI 21.11
 - 5. Electrical Continuity: Provide bronze wedges (3 per joint through 12", then 4 or thermite welded sockets and cables.
- B. Mechanical Joint Restraint:
 - 1. Megalug Joint Restraints by EBAA Iron Sales, Inc
 - 2. Fast-Grip gaskets by American Pipe
 - 3. Field Lok 350 by US Pipe
- C. HDPE
 - 1. All HDPE pipe and fittings shall conform to ASTM D3350 with cell classifications meeting PE445574C, reference AWWA C905-15 (4" through 65") AWWA C901-08 (1/2" through 3"). They shall be listed as SDR11, PE4710, or 3408 as a minimum.
 - 2. Sections of polyethylene pipe shall be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment and an interfacial fusion pressure of 75 psi.
 - 3. No Sidewall fusion connections are permitted.
 - 4. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical jointing will be accomplished by either using a HDPE flange adapter with Ductile Iron back-up ring or HDPE Mechanical Joint adapter with Ductile Iron back-up ring.

5. Socket fusion, hot gas fusion threading, solvents and epoxies shall not be used to join HDPE pipe.
6. The butt fusion jointing will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with graphic representation of the fusion cycle. This log shall be part of the Quality Control records.
7. Water services meeting this specification Part 2, 2.02C for 1" and 1.5" can be coupled using mechanical fittings, installed per the manufacturer's specifications and meeting Michigan Plumbing Code 605.22.1.
 - a. 2" and larger must follow the butt fusion requirements.

D. HDPE to Ductile Iron Connection:

1. The connection from the HDPE pipe to DI shall be manufactured by the pipe manufacturer. It shall be made of HDPE and connect to the DI pipe with a standard rubber gasket and a mechanical joint gland.
2. The mechanical joint adapter shall be of the same SDR rating as the pipe. Additional restraint shall be provided on the ductile iron pipe side of the connection point by restraining pipe joints for a distance of at least 150 feet.
3. Additional restraint shall be provided on each side of the connection point in the form of an HDPE anchor ring encased in concrete or other methods as approved by Township Engineer. All proposed connection and restraint details shall be included on the plans.
4. Connections shall not be made for a period of 24 hours after the pipe has been installed to allow the pipe to approach an equilibrium temperature with it's surrounding environment.
5. Follow manufacturer's recommendation for number of electrofusion flex restraints needed at each connection.
6. The HDPE pipe shall be properly aligned at all connections.

E. Service Tubing and Fittings:

1. Copper: Match Township's standard. Provide electrically conductive fittings.
2. Provide compression joints.

2.04 FITTINGS:

- A. Ductile Iron: ANSI A21.10, or ANSI A21.53, Class 54, 250 psi working pressure through 12 inches and 150 psi above. Mechanical joint solid sleeves, Clow Corporation #F1012 or equal.
- B. HDPE
 1. Butt Fusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing stand of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers, Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits and per AWWA C906.
 2. Electrofusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits per AWWA C906.

3. Flanged and Mechanical Joint Adapters – Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
4. Water services 2.02C of this specification for 1" and 1.5" can be coupled using mechanical fittings, installed per the manufacturers specifications and meeting Michigan Plumbing Code 605.22.1.
 - a. 2" and larger must follow the butt fusion requirements.

2.05 VALVES (OPEN RIGHT):

- A. Gate: AWWA C515 Resilient seated, epoxy coated surfaces, rubber encapsulated gate, bronze non-rising stem with double o-ring seal. Provide full diameter unobstructed flow. End connections shall match pipe.
 1. Manufacturer(s): East Jordan, American Flow Control, US Pipe Metroseal 250 or American Darling.
- B. Butterfly:
 1. Butterfly valves shall only be permitted in booster/pump stations.
 2. AWWA C504, Class 150-B, cast iron short body, cast iron disc, mechanical joint, worm gear traveling nut operator for direct burial.
- C. Boxes: Three (3) section cast iron with lid marked WATER: All sections must have threaded ends for screw on connection.
 1. Upper section: Screw on adjoining center section and full diameter throughout. Place geotextile fabric around threaded joint of risers, if used. No screw in extensions allowed.
 2. Center section: Screw on, and Minimum 5 inch inside diameter.
 3. Base section: Fit over valve bonnet and shaped round for valves through 10 inch and oval for 12-inch and over. Place geotextile fabric around valve bonnet.

2.06 HYDRANTS (OPEN RIGHT):

- A. Provide City of Grand Rapids standard to match Township's existing hydrants.
 1. Compression Type Fire Hydrants - Compression type fire hydrants shall be in strict conformity with the ANSI/AWWA C502 and the following specifications:
 - a. Compression type fire hydrants shall be 5BR-250 by East Jordan.
 - b. The hydrant shall be painted with a zinc chromate primer and finish coat of Rust Oleum #944 chrome yellow above grade after installation and after turning / height adjustment and with two coats of asphalt varnish below grade. Painting shall be in strict accordance with ANSI / AWWA C502.
 - c. Barrel and stem extensions shall be made at or above the ground line and without digging.
 - d. The hydrant shall be supplied with a tapped drain. The drain shall be plugged, if below water table.
 - e. When the drain is to be utilized, the drain shall be backfilled with drain field stone and wrapped with soil separating fabric.
- B. Only EJ 5BR 250 hydrants in good working order may be salvaged for re use.
- C. Barrel length shall be properly sized, so the centerline of the pumper nozzle is 21" to 27" above grade at a minimum 5' depth of cover over the pipe.

- D. Provide Hydrant Flag: 3/8-inch Ultimate Hydrant Marker, 48", ej#99840085
 - 1. Contractor to provide finish grade mark at hydrant on offset stake
- E. Hydrant Extension: 36-inch maximum, limited to 1 per hydrant.
 - 1. Install breakaway coupling in new extension.
- F. A clear space of not less than ten feet (10') shall be provided in front of and around all fire hydrants. A clear space is required to be free of all obstructions such as parked cars, landscaping, utilities, service vehicles, construction work, snow and all other blockages.
- G. Hydrant Leads: Ductile iron pipe with mechanical joints.
 - 1. Hydrant leads longer than 10 feet or tapped hydrant leads shall be minimum 8-inch diameter.
- H. Fall Time Hydrant Maintenance:
 - 1. If hydrants are not turned over to the Township prior to winter weather, hydrants shall be verified free of water.
- I. Hydrants to be bagged out of service where there are existing homes.

2.07 SERVICE FITTINGS:

- A. Corporation Stops:
 - 1. Copper tubing: Inlet AWWA CC thread; outlet electrical conductivity fitting, F1000-G series or A.Y. McDonald 74701-22 Series.
- B. Curb Stops: Inlet electrical conductivity fitting, Ford B44-XXX-NL series or A.Y. McDonald 76100-22 Series.
- C. Curb Stop Boxes: M&E Manufacturing, or approved equal, adjustable 50 inches to 66 inches with stationary rod to within 1 foot of surface grade. Provide 1 1/4-inch top, and arch and pattern base. Embed stationary rod into the cotter pin saddle. **NOTE – The stationary rod must be East Jordan special rod for Allendale.**

2.08 WATER METER:

- A. General: Water service line must have twelve (12) inches of clearance above finished floor and twelve (12) inches away from any adjacent wall, partition, or foundation. If not provided, Contractor is responsible to rectify.
- B. Water services shall be perpendicular to their penetrated surface. They shall be sleeved through concrete, with the sleeve being no more than 6" beyond the concrete surface (wall or floor).
- C. Service and meter must be in a heated and secured location that is readily available.
- D. If any of these are not provided, the contractor is responsible to rectify.
- E. Residential:
 - 1. Water service line must have twelve (12) inches of clearance above finished floor and twelve (12) inches away from any adjacent wall, partition, foundation, or obstruction. If not provided, Contractor is responsible to rectify.
 - 2. Meters shall not be located in crawl spaces or under stair ways unless there is a 4.5' clearance.

F. Commercial:

1. The service line material shall be a minimum of 12" through the penetrated surface. Minimum clearance of 12" is required (multiplied by 2 per size of meter over 2". ie 3" requires 24" below and both sides. 4" requires 36" below and on both sides). A minimum of 5' must be provided above with clear access to maintain the meter.

G. Fire suppression line

1. Fire suppression line only (no other connections):
2. Any service main over 2" in diameter and/or 20' in length, that is designed to serve only as a fire suppression system feed, will require a pressure testing/ chlorination port. If a hydrant is within 10' of the tap, it can be used as such. Otherwise, a 1" corp must be installed for this purpose. All pipe and fittings placed before the port or is within the size and length criteria stated above, must be swabbed with no less than 50ppm chlorinated water. After testing is completed and approved, the corp will be removed and plug installed. Another option is a standpipe between the valve and fire suppression main. This will require a sleeve to be installed.
3. The pressure test will be in accordance with the public main testing procedure. The fire main will be filled via the testing set up with chlorinated water of not less than 50ppm liquid chlorine. This will be measured at the downstream end. Then pressure tested with the same water. This chlorinated water will then be flushed out after the testing time but no less than 3 hours from reaching the 50ppm minimum at the downstream end. Domestic Service Connections will not be allowed off from fire suppression lines.

2.09 BACKFLOW PREVENTION:

- A. All irrigation systems and commercial and industrial water accounts shall have a backflow prevention device.
- B. Backflow preventors must be ASSE 1013 approved reduced pressure zones devices.

2.10 TRACER WIRE:

A. General:

1. Open Trench - Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
2. Directional Drilling/Boring - Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
3. Trace wire – Pipe Bursting/Slip Lining - Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

B. Connectors:

1. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
2. Direct bury wire connectors – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner so as to prevent any uninsulated wire exposure.

3. Non locking friction fit, twist on or taped connectors are prohibited.

C. Termination/Access

1. All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
2. All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
3. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
4. All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
5. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.
6. Service Laterals on public property - Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
7. Service Laterals on private property - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.
8. Hydrants – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)
9. Long-runs, in excess of 500 linear feet without service laterals or hydrants - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

D. Grounding

1. Trace wire must be properly grounded at all dead ends/stubs
2. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
3. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
4. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
5. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

2.11 MISCELLANEOUS:

- A. Service Clamps:
 - 1. Painted ductile iron saddle with dual stainless-steel bands and hardware
 - 2. Threads shall be AWWA C800.
 - 3. Four corner fasteners.
- B. Plastic Seamless Encasement Tubing: Required in areas of corrosive soils.
 - 1. Material: ASTM D-1248 Polyethylene, Type I, Class C, 8 mils thick. AWWA C105.
 - 2. Closing Tape: 2-inch wide Poly Ken #900 Or Scotchwrap #50.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Alignment and Grade:
 - 1. Deviations: Notify the Township and Owner's Engineer and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on plans.
 - a. Verify location and depth of existing utilities in advance of construction and provide adjustments in alignment and grade of water main.
 - 2. Depth of pipe: Minimum cover over pipe below finished grade shall be 5 feet.
 - 3. When the minimum clearance (18-inches) and cover (5-feet) can be obtained, the watermain is to be located above the sanitary sewer. Otherwise, any sanitary sewer joints within 10-feet of watermain shall be encased in concrete (Ref Section 31 23 33 EXCAVATION BACKFILLING AND COMPACTING, Paragraph 2.01.A.3)
- B. Bedding:
 - 1. Method: See Methods of Bedding Detail.
 - 2. Provide bedding area backfill in accordance with MDOT Standard Plan R-83.
 - 3. Provide continuous bearing supporting entire length of pipe barrel evenly.
- C. Cleaning Pipe and Fittings:
 - 1. General: Provide interior free of foreign material and joint surfaces free of lumps and blisters.

3.02 INSTALLATION:

- A. General: Meet requirements of AWWA C600 and these specifications.
- B. Laying Pipe:
 - 1. Prevent entrance of foreign material and plug watertight when left unattended.
 - 2. Provide pipe length and bedding as a unit in a frost free, dry trench.
 - 3. Special supports and saddles: See Article 3.06 SCHEDULES.
 - 4. Provide minimum vertical and horizontal separation between parallel water main and sanitary sewer or force main of 18 inches and 10 feet, respectively, unless otherwise approved.
 - 5. Township's approval required for pipe lengths less than 6 feet.
 - 6. Joint deflection shall not exceed the following values or as recommended by pipe manufacturer.

Maximum Joint Deflection

Nominal Pipe Size (inches)	Push-On Joint		Mechanical Joint	
	Deflection Angle (Deg-Min)	Maximum Offset (inches)*	Deflection Angle (Deg-Min)	Maximum Offset (inches)*
8	3° - 30'	14	4° - 00'	15
12	3° - 30'	14	4° - 00'	15
16	2° - 15'	8 ¼	2° - 40'	10
24	2° - 15'	8 ¼	1° - 45'	7

*Offsets are based upon 18-foot lengths of pipe

C. Cutting Pipe:

1. Ductile iron: Power saw.

D. Jointing:

1. Mechanical:
 - a. Lubricate as recommended by manufacturer.
 - b. Tighten bolts evenly per manufacturing recommendations.
2. Push-on:
 - a. Lubricate as recommended by manufacturer.

E. Setting Valves, Fittings and Fire Hydrants:

1. General: See Article 3.06 SCHEDULES.
2. Valves: Set plumb.
3. Valve boxes:
 - a. Base section: Center and plumb over operating nut and 2 inches above bonnet.
 - b. Upper section: Set cover ¼-inch below finished grade.
 - c. Witnesses: Provide access for GPS locating.
 - d. If in concrete or asphalt, wrap with concrete joint foam to prevent finish material contacting the body.
4. Hydrants:
 - a. Connection: With ductile iron pipe and auxiliary valve.
 - b. Positioning: Plumb with pumper nozzle facing curb or street and nozzle centerline 21 to 27 inches above finished grade. Finished grade shall be as dictated by street construction or as directed by Township.
 - c. Provide necessary length of 6-inch pipe for hydrant leads.
 - d. Locate at 8 feet from right-of-way line within road right-of-way per OCRC, unless otherwise directed by Township or Township Engineer. **Private roads, hydrants shall be 1' off sidewalk.**
 - e. Provide access to all hydrants by providing Hydrant Berm, if needed.
 - f. Bolt-Thru Mechanical Joint Restraint is allowed to minimize 2' min clearance from tee.
5. Provide joint restraint using Megalug retainer glands (Paragraph 2.03.A.3) in accordance with the pipe restraint table referenced in Paragraph 3.02.H.1 and Schedule 3.06. A.4. Locking rubber gaskets will not be allowed on hydrant leads.

F. Connections:

1. Existing water mains:
 - a. Provide temporary support during cut-in.
 - b. Disinfect by swabbing pipe, valves, and fittings with four percent (4%) chlorine solution.
 - c. Pressure off: Install mechanical joint solid sleeve.
 - d. Pressure on: Install tapping sleeve, valve, and box.

2. Service lines:

- a. Watermain must be situated along the lot's road frontage for service to be provided. All service lines must be located in 10' utility easement (if available) or within road right of way. Easements will not be allowed to obtain service to a residence.
- b. Service lines shall have twelve (12) inch vertical clearance from storm and sanitary sewers.
- c. Align at right angles to street or easement line. Maintain minimum 5 feet separation from sewer laterals. Locate 10 feet from left property line (facing lot) unless otherwise directed by Township or Township Engineer.
- d. Minimum depth shall be same as pipe. Minimum size shall be 1-inch in diameter for residential uses and 1 ½-inch or larger for all other usage (multi-family and commercial) based on REU's.
- e. Install after acceptable pressure test, chlorination of water main and acceptable bacteriological testing. 24 hour notice shall be given to the Public Utilities Inspector when installation of water services will occur for Drip Testing.
- f. Curb stop boxes: Set plumb and at grade.
 - (1) Locate at easement line within easement or at road right-of-way line within road right-of-way, unless otherwise directed by Township.
 - (2) Cover with 4' long section of 4-1/2" I.D. PVC pipe buried 1'.
 - (3) Set cover flush.
- g. Tapping shall be at 45° above center and shall provide horizontal loop (no more than 6" above top of main) at corporation stop.
- h. Maximum tap sizes shall be as follows:

<u>Type of Pipe</u>	<u>Pipe Size</u>								
	6"	8"	10"	12"	14"	16"	18"	20"	24"
	<u>Maximum Direct Tap Size</u>								
Ductile:	1"	1½"	2"	2"	2"	2"	2"	2"	2"

G. Dead-end water main stubs longer than 20 feet:

1. Install standpipe with shutoff at dead-ends to aid in chlorinating, testing and flushing. Remove standpipe upon approval of water main.

H. Pipe Joint Restraint:

1. Provide mechanical joint restraint or locking rubber for the minimum lengths shown in joint restraint detail (i.e. Schedule 3.06.A.4).
The length of restrained pipe required shown in joint restraint detail is based on trench backfill being compacted to 95% of the maximum density according to the ASTM D6938 (Nuclear Method).
2. The joint restraint detail does not consider polyethylene wrapped pipe. If the pipe is wrapped with polyethylene, a greater length of restrained pipe will be required. Unless otherwise specified, a multiplier of 1.5 shall be used to determine the required length when the pipe is wrapped with polyethylene.
3. If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.
 - a. Tees: Pipe restraint length shown in the joint restraint detail shall be provided in the branch direction. Also, the minimum length of pipe restraint in the straight through (run) direction shall be 10 feet on both sides of the tee.

- b. Bends: Pipe restraint length shown in the joint restraint detail shall be provided on both sides of the bend.
 - c. Dead End: Pipe restraint length shown in the joint restraint detail shall be provided back from the dead-end plug.
 - d. All joints shall be restrained for pipe within casings.
 - e. All joints between bends on water main offsets shall be restrained.
 - f. See Joint Restraint Requirements detail for restrained joint pipe details.
 - 1) If the pipe is wrapped with polyethylene, a greater length of restrained pipe will be required. Unless otherwise specified, a multiplier of 1.5 shall be used to determine the required length when the pipe is wrapped with polyethylene.
- I. Reaction Backing (Only allowed when approved by the Township Engineer):
- J. Polyethylene Encasement:
 - 1. In corrosive soils: install over ductile iron pipe and tape seams in accordance with AWWA C105.
- K. Tracer Wire:
 - 1. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
 - 2. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
 - 3. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
 - 4. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.
 - 5. Trace wire must be properly grounded as specified.
 - 6. Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)
 - 7. At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)
 - 8. Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead- end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
 - 9. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.
 - 10. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.
 - 11. Water System:
 - a. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
 - b. Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.

- c. Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.
- d. Above-ground tracer wire access boxes will be installed on all fire hydrants.
- e. All conductive and non-conductive service lines shall include tracer wire.

3.03 FIELD QUALITY CONTROL:

A. Testing and Inspection:

1. General:

- a. Observation: By Township or Township's Engineer – measurements by contractor.
- b. Notification: The Township Inspector or Township Engineer shall be provided notice and allowed three (3) workdays to perform major inspections for water main.
- c. Equipment and assistance: Contractor is responsible for providing equipment and conducting tests. 2 pressure gauges are required.
- d. Required water: By Township where available from municipal system.
(1) Provide backflow prevention device on connection to existing water system.
- e. Opening of valve to existing water main by Township personnel: After passing pressure / leakage, chlorination, and bacteriological testing.
- f. Meet requirements of AWWA C600 and these specifications. Meet requirements of AWWA C600 for ductile iron pipe, AWWA M55 for HDPE installation, ASTM F2620 for HDPE construction, and AWWA C901 for HDPE pipe, and these specifications.
1) See Article 1.21 INSPECTORS AND INSPECTIONS in Division 01 GENERAL REQUIREMENTS for compaction testing requirements.

2. Electrical continuity: Test ductile iron pipe for continuity and repair breaks.

3. Pressure/Leakage Test:

- a. Observation: By Township Public Utilities Department or Township's Engineer – Contractor is responsible for conducting the test and providing Township with documentation of the test..
- b. Notification: The Township Inspector or Township Engineer shall be provided notice and allowed three (3) work days to perform major inspections for water main.
- c. Equipment and assistance: Contractor is responsible for providing equipment and conducting tests.
- d. Conditions: Air or air-water methods of applying pressure prohibited.
- e. Sequence: After flushing, prior to Chlorination.
- f. Procedure: Fill system slowly, expel air through corporation stop at high points and apply pressure.
- g. Pressure: Test will begin when less than 10 psi loss is achieved. Maintain water pressure of 150 psi.
- h. Duration: Two (2) hours. If 0 psi loss is noted after 1 hr, the test may conclude.
- i. Make-up water: From measurable source.
- j. Leakage: Quantity of water supplied to maintain test pressure.
- k. Allowable: Less than:

$$L = \frac{SD \times \text{square root of } P}{148,000}$$

where,

L = leakage (gallons per hour).

S = length of pipe (feet).

D = nominal pipe diameter (inches).

P = average test pressure (pounds per square inch gauge) at start of the test.

- l. Correction: Repair defects and repeat test until acceptable.

- m. Maximum length of pipe to be tested shall be 2000 feet.
 - n. Testing is in accordance with AWWA C901/C906 for HDPE. AWWA C900 for DI
4. Hydrostatic Testing
 - a. See Section 33 05 24 HORIZONTAL DIRECTIONAL DRILLING for details on hydrostatic testing.
 5. Dead-end water main stubs longer than 20 feet:
 - a. Install standpipe with shutoff at dead-ends to aid in chlorinating, testing and flushing. Remove standpipe upon approval of water main.
 6. Testing valves only: Maintain pressure on main and check all valves as follows:
 - a. Need to maintain an air pressure of 120 psi for 5 minutes on tapping valve.
 - b. Need to maintain a water pressure of 150 psi.
 - c. Correction: Repair defects and repeat test until acceptable.

3.04 FLUSHING:

- A. Flushing: Shall be performed in accordance with ANSI/AWWA C651-14
 1. Observation: By Township or Township's Engineer.
 2. Sequence: Prior to pressure testing and chlorination.
 3. Maximum intervals: 2,000 linear feet at one time.
 4. Required water: By Township where and when available from municipal system. Maintain 40 psi residual pressure in existing water system. Discharged water shall be directed into the nearest storm drain system.
 5. Minimum velocity: 3.0 feet per second at pipe wall. See table below for size and number of Taps required to achieve minimum velocity:

Required flow and openings to flush pipelines (with 40 psi residual pressure in water main)

Pipe Diameter <i>inches</i>	Flow Required to Produce 3.0 ft/s Velocity in Main <i>gpm</i>	Number of 2 ½-in. Hydrant Outlets	Number of 4 ½" Hydrant Outlets	Stand Pipe Diameter <i>inches</i>
4	120	1	1	2
6	260	1	1	2
8	470	1	1	2
10	730	1	1	4
12	1060	2	1	4
16	1880	2	1	4

**Pipes greater than 16" diameter require engineer calculation for stand pipe diameter*

6. Additional Information: The water velocity flowing through an eight-inch pipe will yield 470 gallons per minute. No restrictions shall be used on the flushing outlet, i.e. discharge hosing.

3.05 DISINFECTION:

- A. Chlorination:
 1. Meet the requirements of ANSI/AWWA C651-92 (AWWA Standard for Disinfecting Water mains), continuous-feed method.
 2. Observation: By TOWNSHIP or TOWNSHIP's ENGINEER.
 3. Required water: By TOWNSHIP where available from municipal system.
 4. Equipment and Assistance: Contractor is responsible for providing equipment and conducting disinfection.

5. Chlorine gas: Not permitted on job-site.
6. Sequence: Following pressure tests and flushing and prior to connection to existing water main.
7. Retention time: Twenty-four (24) hours.
8. Procedure: Inject chlorine solution between 50 and 100 mg/l at the beginning, at a
9. constant rate to produce residual-free chlorine concentration of not less than 25 mg/l or more than 100 mg/l in all portions of the main at the end of the 24-hour retention period. Operate valves and clear line of residual chlorine after the retention period. If after the 24-hour retention period, a minimum of 10 mg/l is maintained in the system, flush the remaining chlorine out and leave the pipe set without flow for 16 hours.
10. Sampling: By TOWNSHIP, a minimum of two (2) samples shall be taken fifteen (15) minutes apart.
 - (a) All sample ports are to remain running until all samples have been taken.
 - (b) Samples shall be dropped off at the Allendale WRRF no later than 1pm.
10. Correction: Re-chlorinate sections not meeting EGLE bacteriological requirements.
 - a. Retesting shall be paid by CONTRACTOR.
11. Disposing of heavily chlorinated water directly to open drains: Discharge water through de-chlorinated tablets in mesh sack.

3.06 SCHEDULES:

- A. Standard Details:
 1. Special supports for underground utilities / pipe saddles
 2. Methods of bedding pipe
 3. Water main offset / relocation detail
 4. Joint restraint requirements
 5. Hydrant Detail
 6. Hydrant berm
 7. Standard Straight Fire Hydrant Installation
 8. Standard 90 Degree Fire Hydrant Installation
 9. Copper service lead connection / sample point.
 10. Joint adapter detail
 11. Underground utilities detail
 12. H.D.P.E. to D.I.P. connection
 13. Commercial Water Service Detail
 14. Tracer Wire Details
- B. Water / Sewer Leakage & Pressure Testing Report Form.

END OF SECTION

SECTION 33 11 00.01

REMOVAL/ABANDONMENT OF WATER SERVICES

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes the work required for the abandonment of one or more water service(s) from the water main to the curb stop valve and box and appurtenant work.

1.02 REFERENCES:

- A. AWWA - American Waterworks Association, latest edition.
- B. ANSI - American National Standards Institute, latest edition.
- C. ASTM - American Society Testing Materials, latest edition.
- D. Recommended Standards for Water Works – Ten State Standards, latest edition

1.03 SUBMITTALS:

- A. Submit the following for review by Township Public Utility Department
 - 1. Product Data on material used to plug/seal at the corporation stop at the Water Main and/or at the Curb Stop Valve and Box.
 - 2. Proposed equipment and method for flushing, pressure testing, leakage testing, and chlorination as needed to ascertain Water Main meets Township Standards for potability.
 - 3. Submittals must be approved prior to construction.
- B. Report witness measurements on valves, fittings and curb boxes that are exposed and left in place (in-situ) during removal/abandonment.
 - 1. Provide measurements from two permanent fixtures such as building corners, power poles and trees 8-inch diameter and larger.
 - 2. Provide length and depth measurements.
 - a. Provide access for APU to GPS locate
- C. Provide certifications on material used to plug/seal Water Main, Corp Stop and/or Curb Stop indicating conformance to specifications prior to installation.
- D. Submittal of drawings of record plans to:
 - 1. Submittal of drawings of record plans to: Allendale Township Field Inspector.
 - 2. Provide the Township 1 printed set and a PDF file, and the Township Engineer 1 electronic file in AutoCAD format of record drawings (as-builts) with as-constructed dimensions and witnesses. (in State Plane).
 - a. All measurements to be English Standard.

1.04 JOB CONDITIONS:

- A. Interrupting Water Service(s):
 - 1. See SECTION 33 11 00 – WATER MAINS paragraph 1.04 for additional information.

2. Where removal of the water service to the water main is required, the existing water main shall be sealed in such a manner as to prohibit dirt and foreign material from entering. Materials used shall be approved by the Township. The plug/seal shall be provided and installed by the Contractor, as directed by the Township.
 3. Prevent contamination of existing water mains.
- B. Clean up promptly upon completion or safely secure site if work not completed in one (1) work day. Clean up shall include backfill, rough grading and restoration of grounds. REF SECTION 31 23 00 – EXCAVATING, BACKFILLING AND COMPACTING.
 - C. Contractor is solely responsible for confirming actual soil conditions and depth of water table.
 - D. Pavement, sidewalk, curbs or gutters removed or destroyed in connection with performance of the work shall be saw cut as directed by the Township and shall be replaced with pavement, sidewalks, curbs, gutters of the same kind, or better by the Contractor in accordance with Township Standards.
 - E. Granular Subbase and Aggregate Base shall be placed beneath the restored pavement to Township Standards.
 1. See GENERAL REQUIREMENTS for information on compaction testing.
 - F. All materials furnished by Contractor, shall meet Township Standards.
 1. Salvaged parts are to be delivered to the Township.
 - G. Areas of work shall be restored to conditions prior to water service removal or better.
 - H. No water services are to be abandoned in place unless directed by the Township or Township Engineer.
 - I. Removal/Abandonment not allowed when air temperature is 25 degrees F or colder or when determined too cold by Township.
 - J. Salvage all existing water meter, transponder, if applicable, and meter valves {inlet & outlet} (either side of water meter) and curb boxes removed and deliver to the Township's yard.
 - K. Demolition Permit
 1. Contractor to have at least \$500,000 personal injury and property damage insurance on file with Township staff prior to Notice to Proceed.
 - L. Ownership of debris
 1. Township has first right to surplus materials.
 2. The Contractor is directly and solely responsible for disposal of surplus and unsuitable material.
 - M. The unit price includes the cost of structure repairs to remove water service, sawing, removal, and disposal; providing, placing, and compacting backfill and providing and placing replacement soil or base material(s) as determined by the Township.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Refer to SECTION 33 11 00 – WATER MAINS

- B. Refer to SECTION 31 23 00 – EXCAVATING, BACKFILLING AND COMPACTING
- C. All materials must conform to Township, Ottawa County Health Department and the Environment, Great Lakes, and Energy (EGLE).

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Contractor shall make proper provisions for the maintenance and continuation of utility services to surrounding properties as directed by the Township or Township Engineer, unless otherwise specified.
- B. Properties may have more than one water service. Determine their locations prior to excavation.
- C. Alignment:
 - 1. Notify Township Public Utility Department or Township's Engineer and to obtain instructions to proceed where there is a discrepancy, or an obstruction not shown on plans.
 - 2. Verify location and depth of existing utilities in advance of removal/abandonment. Provide the Township with GPS coordinates to all abandoned corporation stops.
- D. Bedding:
 - 1. Method: See Paragraph 3.06 SCHEDULES.
 - 2. Provide bedding area backfill in accordance with MDOT Standard Plan.
 - 3. Provide continuous bearing supporting entire length of exposed water main evenly, when exposed.
- E. Cleaning Pipe and Fittings:
 - 1. Provide interior free of foreign material and joint surfaces free of lumps and blisters.

3.02 REMOVAL/ABANDONMENT:

- A. General: Meet requirements of AWWA C600 and these specifications.
- B. Determine status of property:
 - 1. Occupied – contact Township to report status and receive instructions on how to proceed.
 - 2. Unoccupied – proceed with removal/abandonment.
- C. Refer to SECTION 33 11 00– WATER MAINS
- D. Provide and place traffic and pedestrian traffic barriers, as necessary.
- E. For water service removal from water main to curb stop box:
 - 1. Remove existing water service and leave corporation stop in place.
 - 2. Use a Ford or equivalent Tube Nut, Copper Gasket and Brass Corp Stop Plug. Prior to backfilling the abandoned corporation, the Township must inspect and give approval. Should the corp leak, the corp must be removed and the water main should be plugged using a plug/seal approved by the Township.
 - 3. If the corp is located within a saddle on the water main and requires removal, a Smith-Blair (or equivalent) repair clamp must be furnished by the contractor and installed.

4. If shutting down the water main is necessary to complete the disconnect, the Township and residents must be notified at least 24 hours in advance.
5. Excavate and remove water service and Curb Valve Stop and Box to five (5) feet outside of the ROW.
6. Witness location of plugged service tap. Allendale Public Utility Department to GPS locate.
7. Backfill in accordance with MDOT Standard Plan 12-83c prior to starting water service removal/abandonment on private property.
8. Salvage water meter, transponder, if applicable, and meter valves {inlet & outlet} (either side of water meter). Return to Township.
9. Backfill and grade in accordance with MDOT Standard Plan 12-83c and \ 31 23 00 – EXCAVATING, BACKFILLING AND COMPACTING

F. Remove and dispose of abandoned pipe, valves and boxes, or other appurtenances, as necessary for the removal/abandonment of the water service at no cost to the Township.

3.03 FIELD QUALITY CONTROL:

- A. Refer to SECTION 33 11 00 – WATER MAINS 3.03
- B. Contractor performing the work shall give the Township 48 hours' notice of water service abandonment/removal for inspection.

3.04 FLUSHING:

- A. Refer to SECTION 33 11 00 – WATER MAINS 3.04

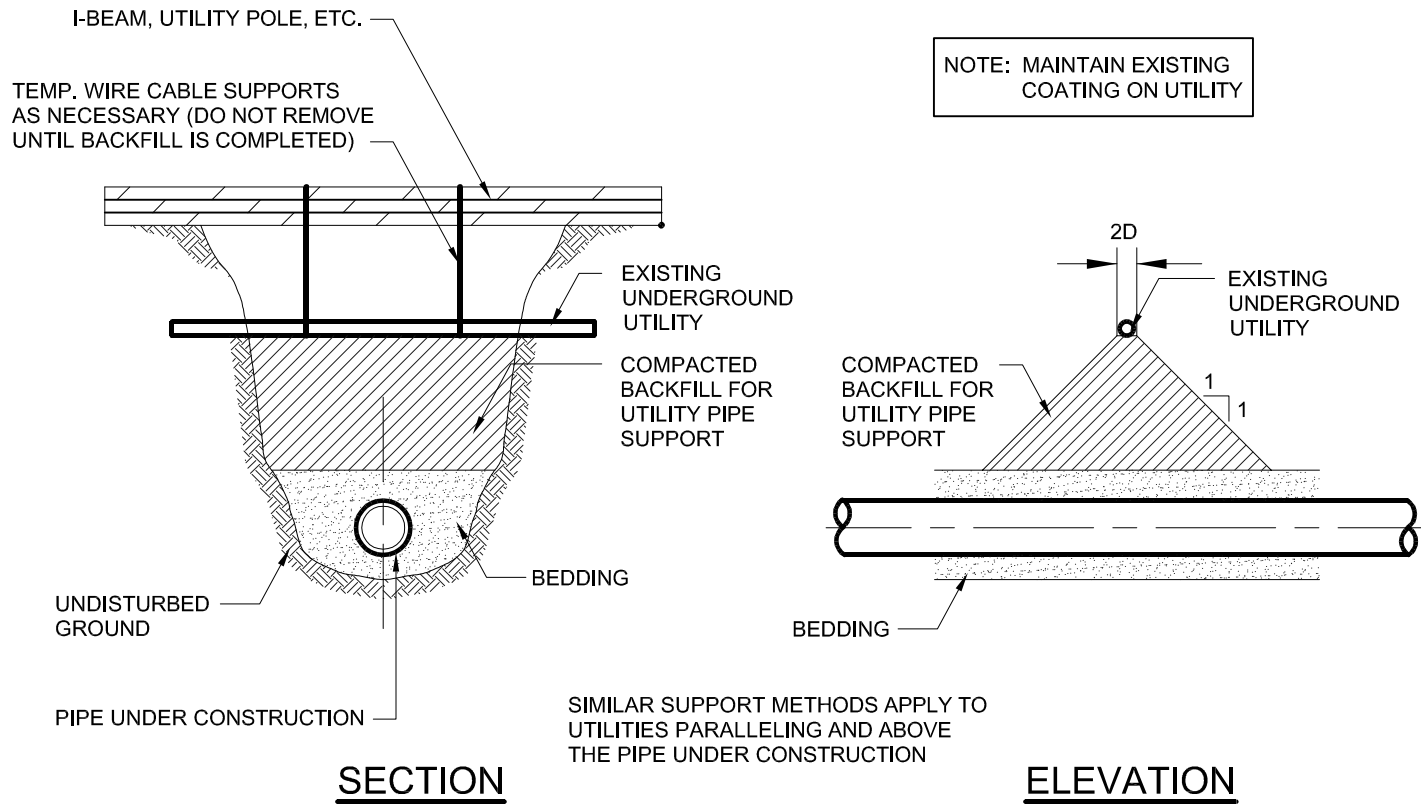
3.05 DISINFECTION:

- A. Refer to SECTION 33 11 00 – WATER MAINS 3.05

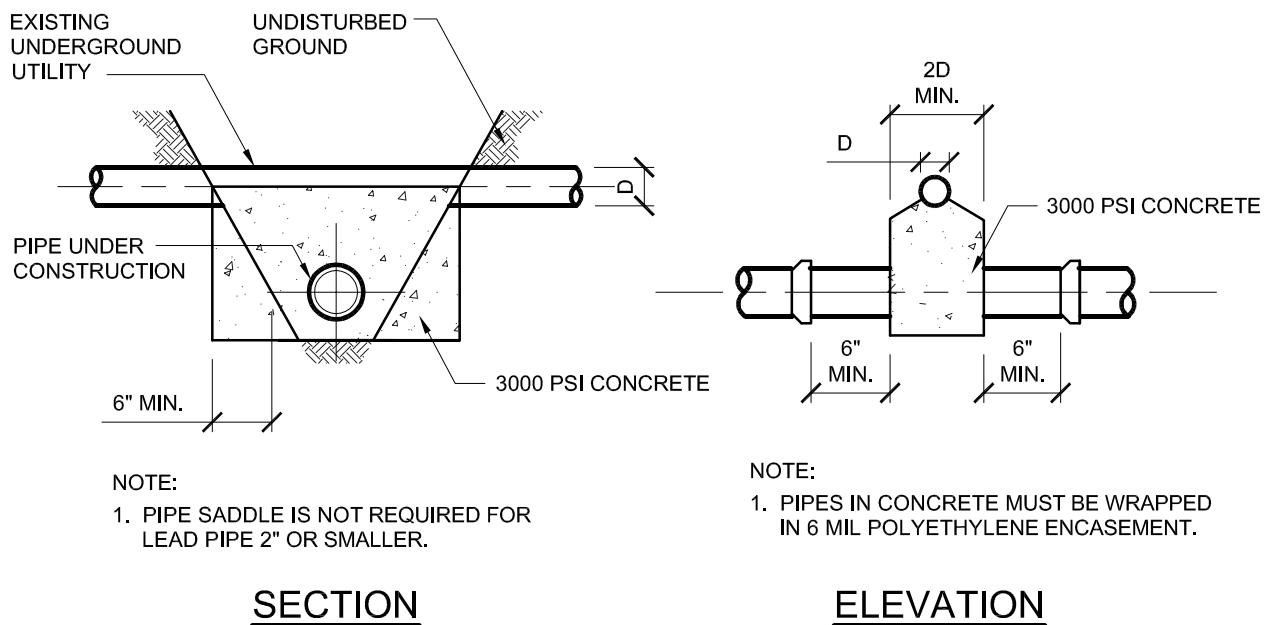
3.06 SCHEDULES:

- A. Refer to SECTION 33 11 00 – WATER MAINS 3.06

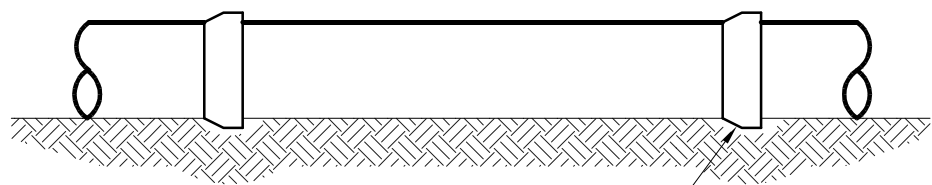
END OF SECTION



SPECIAL SUPPORTS FOR UNDERGROUND UTILITIES

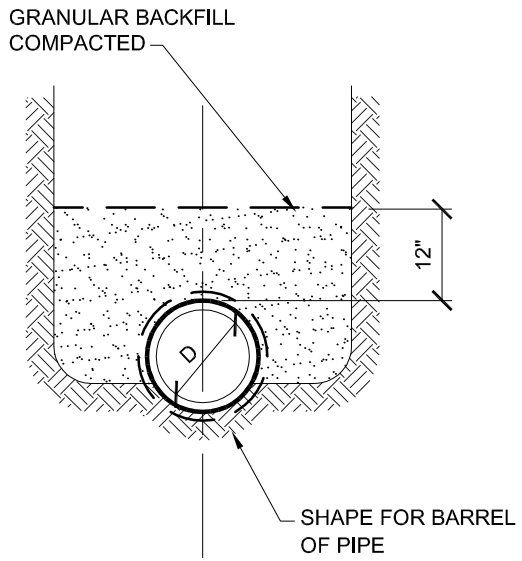


PIPE SADDLES

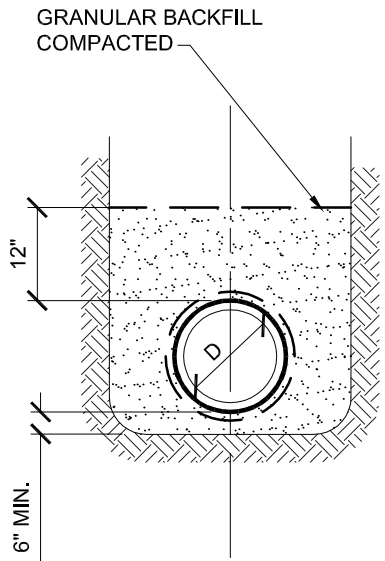


BELL HOLE EXCAVATIONS
REQUIRED FOR METHODS I & II

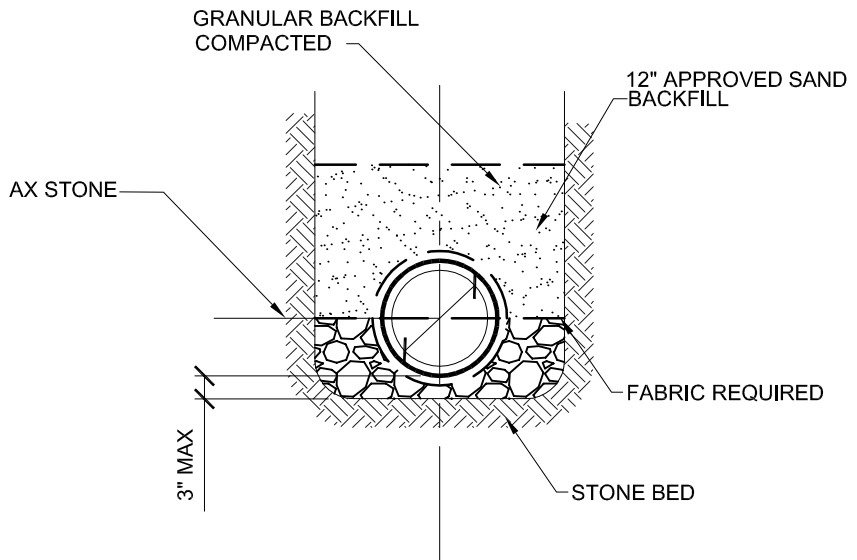
EXCAVATION FOR BELLS



METHOD I



METHOD II

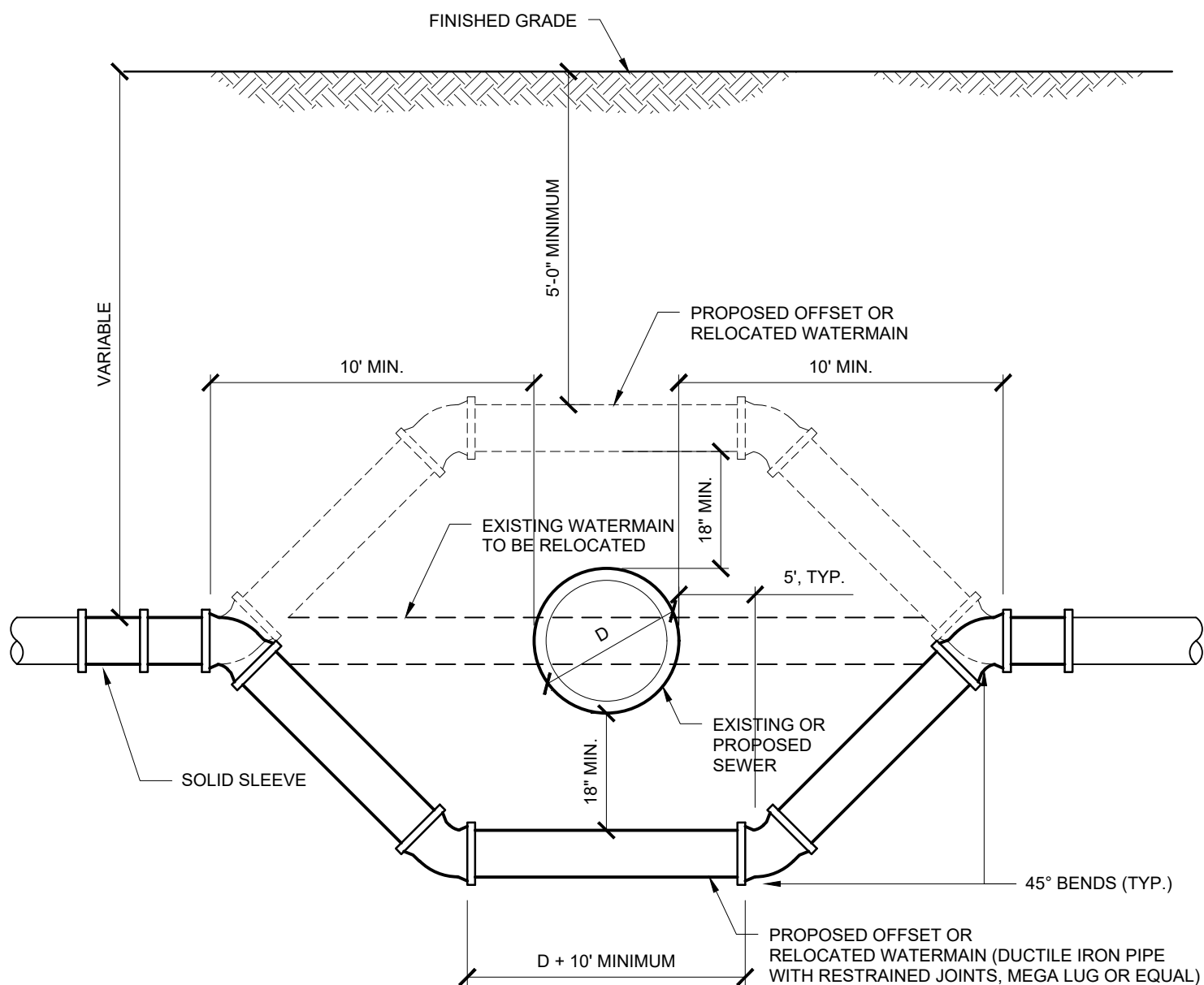


METHOD III W/ STONE

NOTES:

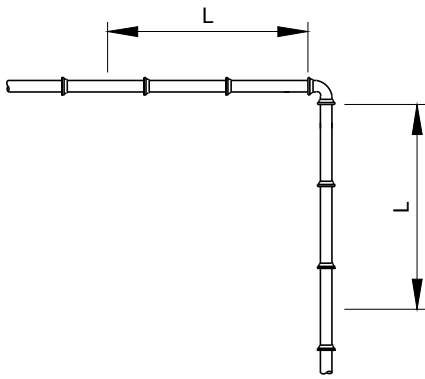
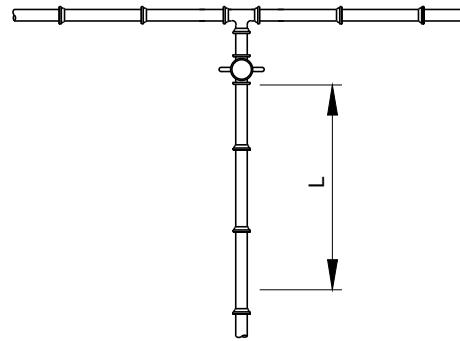
1. METHOD I: IN AREAS OF UNCONSOLIDATED SOILS (SAND, GRAVEL, ETC.)
2. METHOD II: IN AREAS OF CONSOLIDATED SOILS (CLAY, HARDPAN, ROCK, ETC.)
3. METHOD III: IN AREAS OF WET SOILS WITH STONE (CLAY, HARDPAN, ROCK, ETC.)
4. IN AREAS WITH MORE THE 3" MAX OF STONE UNDER THE PIPE, FABRIC IS REQUIRED

METHODS OF BEDDING PIPE

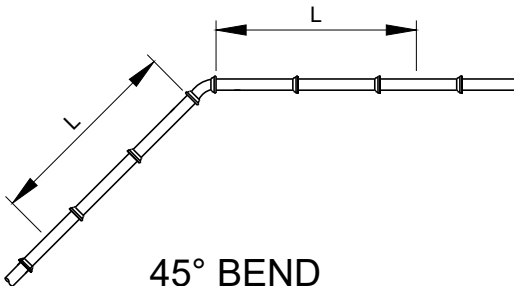
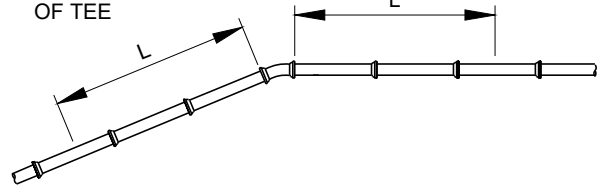
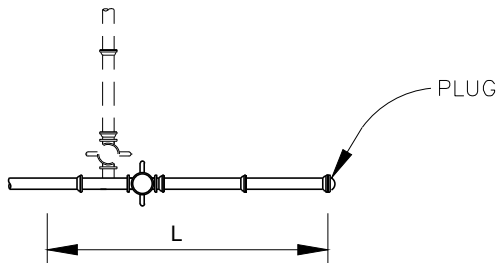
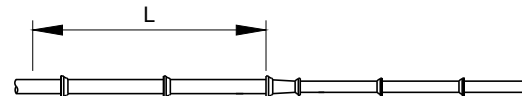


NOTE: WHEN THE MINIMUM CLEARANCE AND COVER CAN BE OBTAINED, THE WATERMAIN IS TO BE RELOCATED ABOVE THE SEWER. OTHERWISE, ANY SANITARY SEWER JOINTS WITHIN 10 FEET OF WATERMAIN SHALL BE ENCASED IN CONCRETE (REF. SECTION 02220, PARAGRAPH 2.01.A.3).

WATERMAIN OFFSET / RELOCATION DETAIL

90° BENDTEE

MINIMUM LENGTH OF MECHANICAL JOINT RESTRAINT
IN THROUGH DIRECTION SHALL BE 10' ON BOTH SIDES
OF TEE

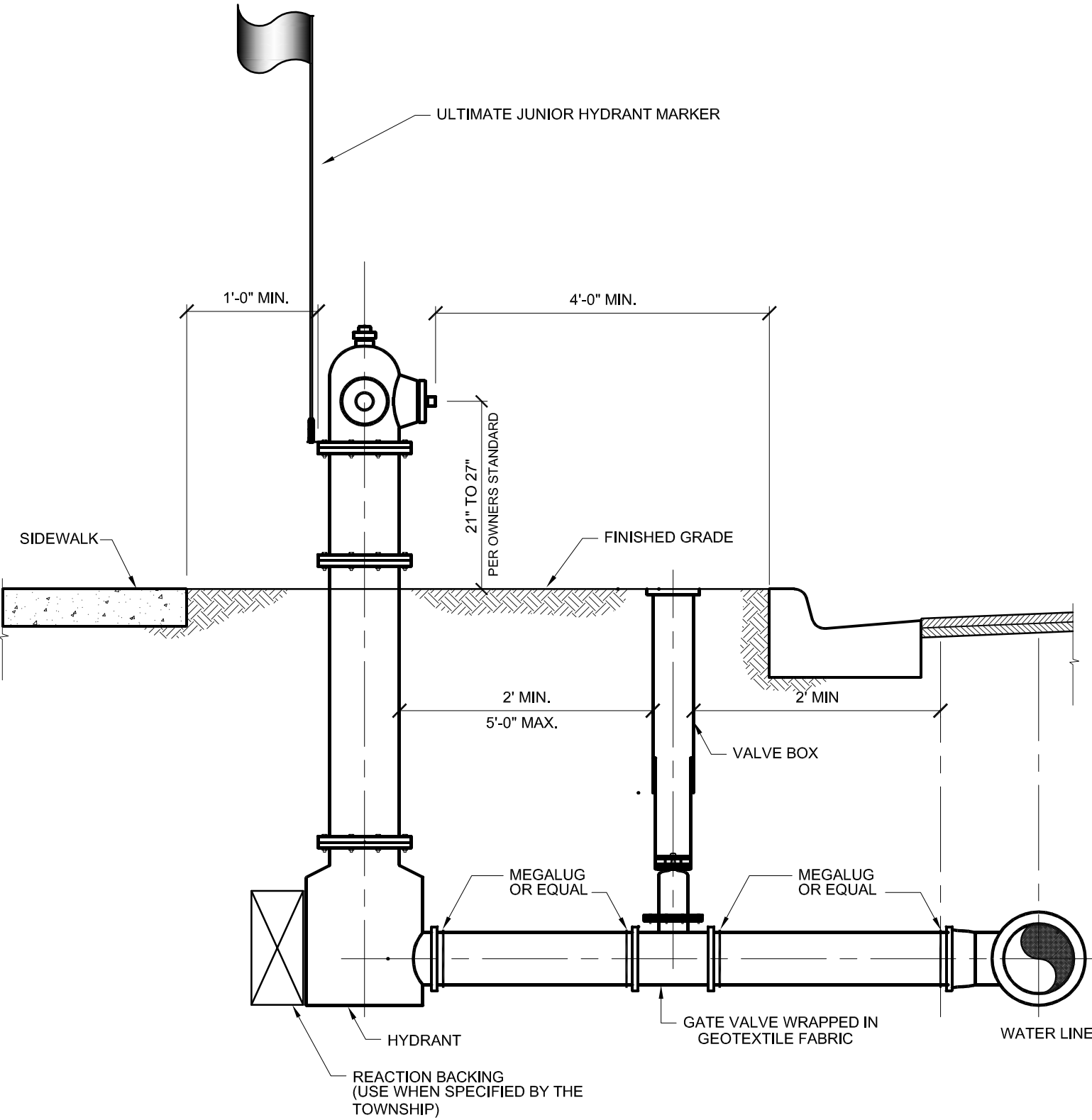
45° BEND22 1/2° BEND OR LESSDEAD ENDREDUCERS

"L" = MINIMUM LENGTH OF MECHANICAL JOINT
RESTRAINT SHOWN IN TABLE
MULTIPLY BY 1.5 IF PIPE IS WRAPPED IN POLYETHYLENE

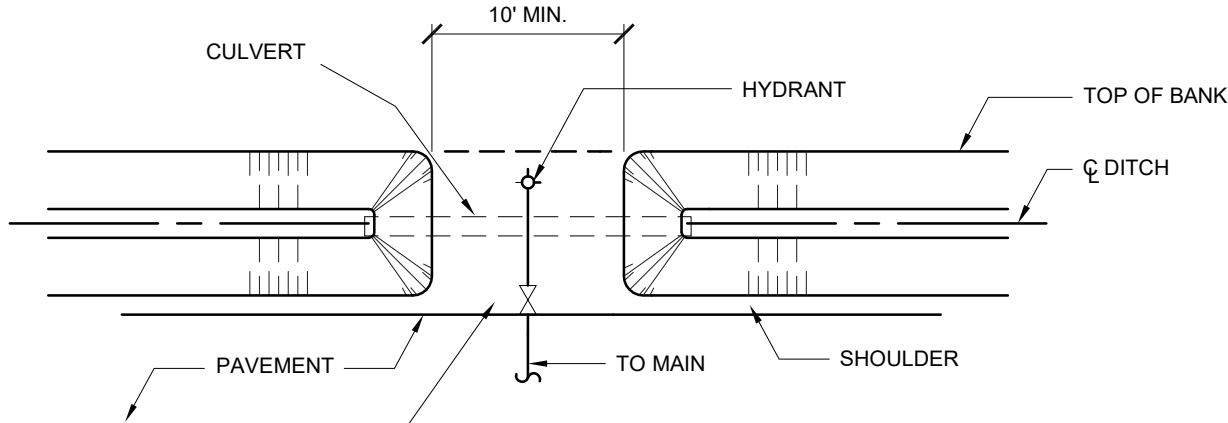
PIPE RESTRAINT LENGTH (L) REQUIRED, FEET*							
Pipe Dia.	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110

* AND ** - SEE PARAGRAPH 3.02H OF SPECIFICATION SECTION 33 11 00
***VERTICAL BENDS REQUIRE 50% OF ADDITIONAL RESTRAINT.

JOINT RESTRAINT REQUIREMENTS

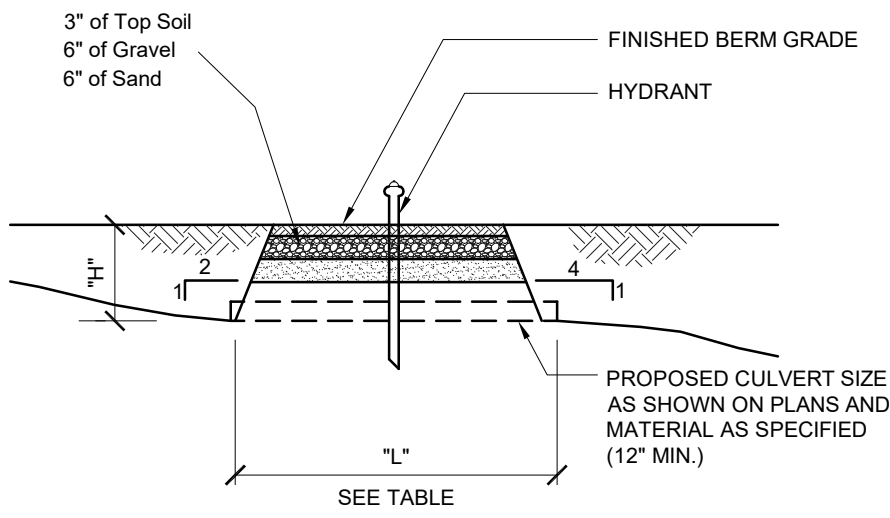


HYDRANT ASSEMBLY



HYDRANT CANNOT BE LOCATED IN SHOULDER

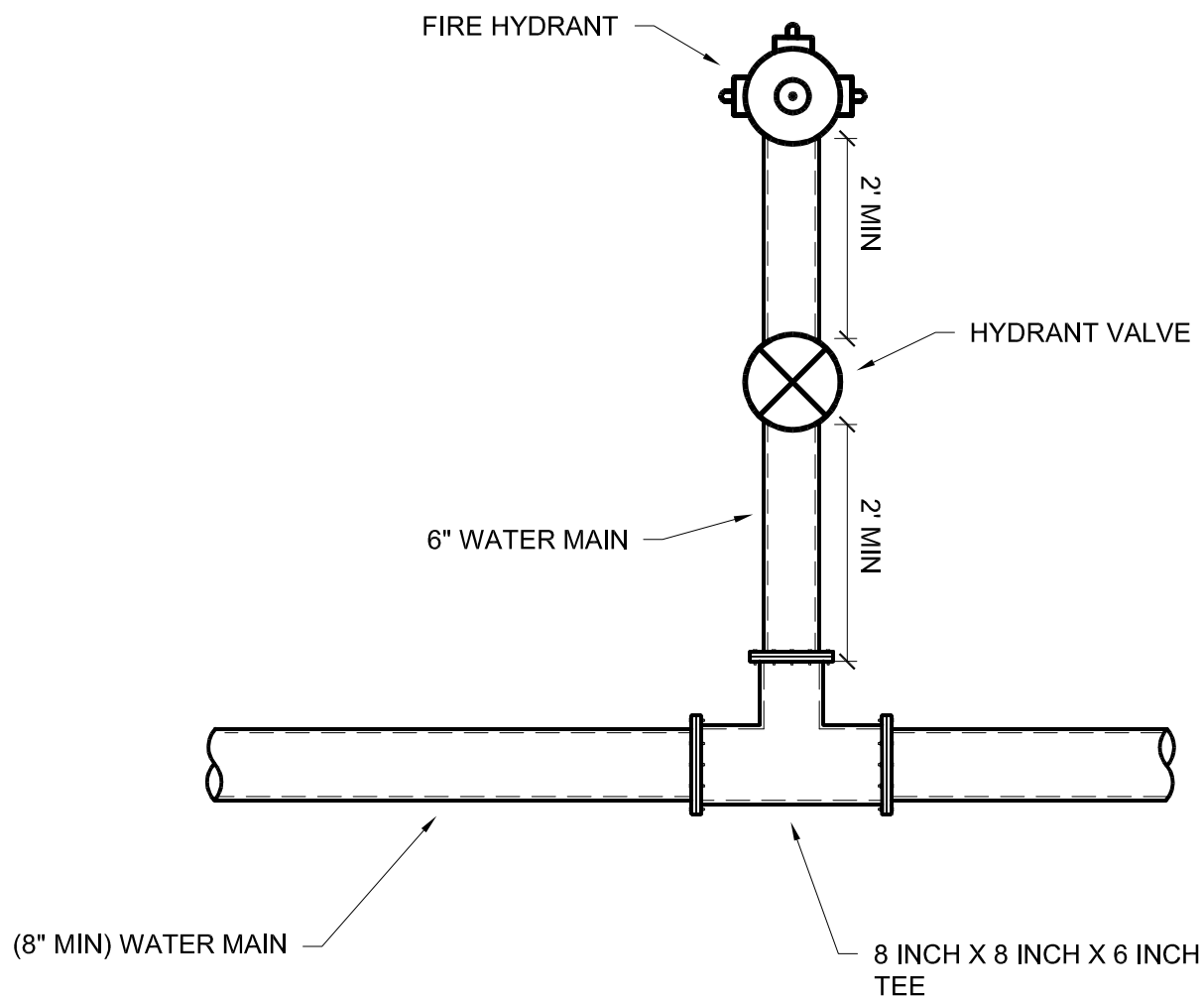
PLAN



ELEVATION

1:2 SIDE SLOPE		1:4 SIDE SLOPE
SODDED		SEEDED
"H"	"L" (MIN.)	"L" (MIN.)
2'	18'	26'
3'	22'	34'
4'	26'	42'
5'	30'	50'
6'	34'	58'

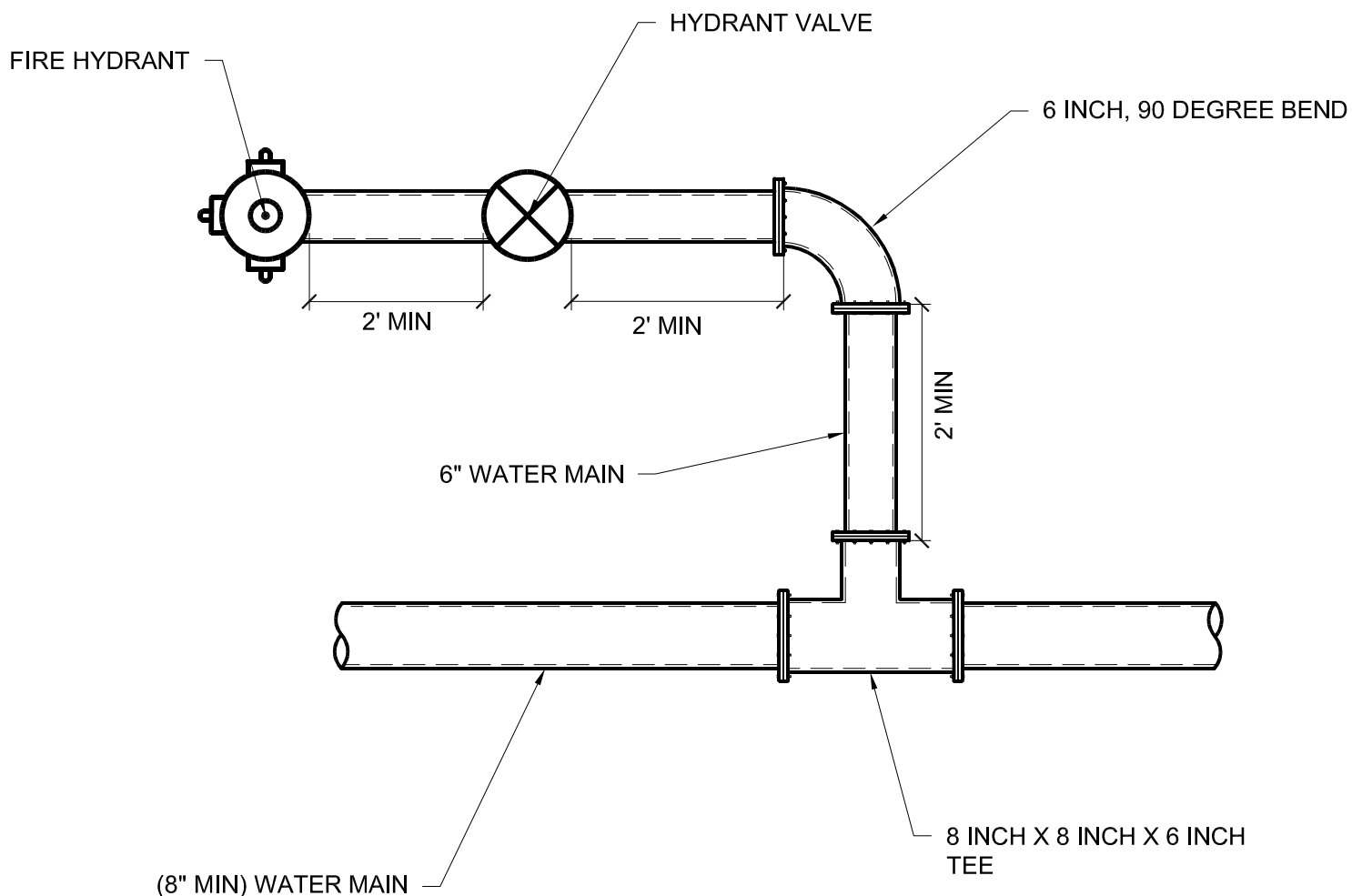
HYDRANT BERM



NOTES

1. HYDRANT LEAD OVER 10 FT IN LENGTH REQUIRE 8-IN MINIMUM DIAMETER WATER MAIN AND MAY UTILIZE A REDUCER A MAXIMUM OF 2 FT AWAY FROM VALVE.

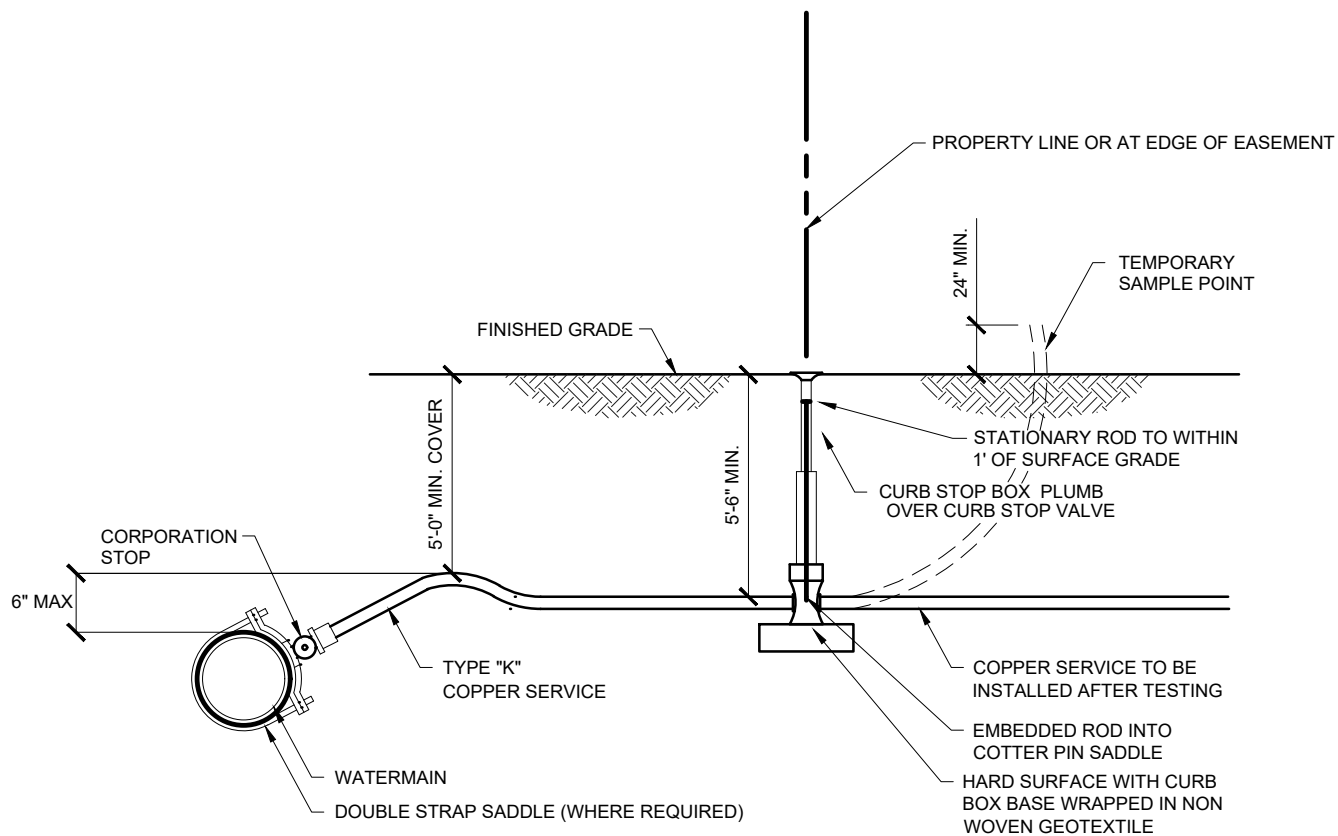
STANDARD STRAIGHT FIRE HYDRANT DETAIL



NOTES

1. THE 2' MIN IS NOT REQUIRED WHEN A A BOLT-THRU MECHANICAL JOINT RESTRAINT IS USED.
2. HYDRANT LEAD OVER 10 FT IN LENGTH REQUIRE 8-IN MINIMUM DIAMETER WATER MAIN AND MAY UTILIZE A REDUCER A MAXIMUM OF 2 FT AWAY FROM VALVE.

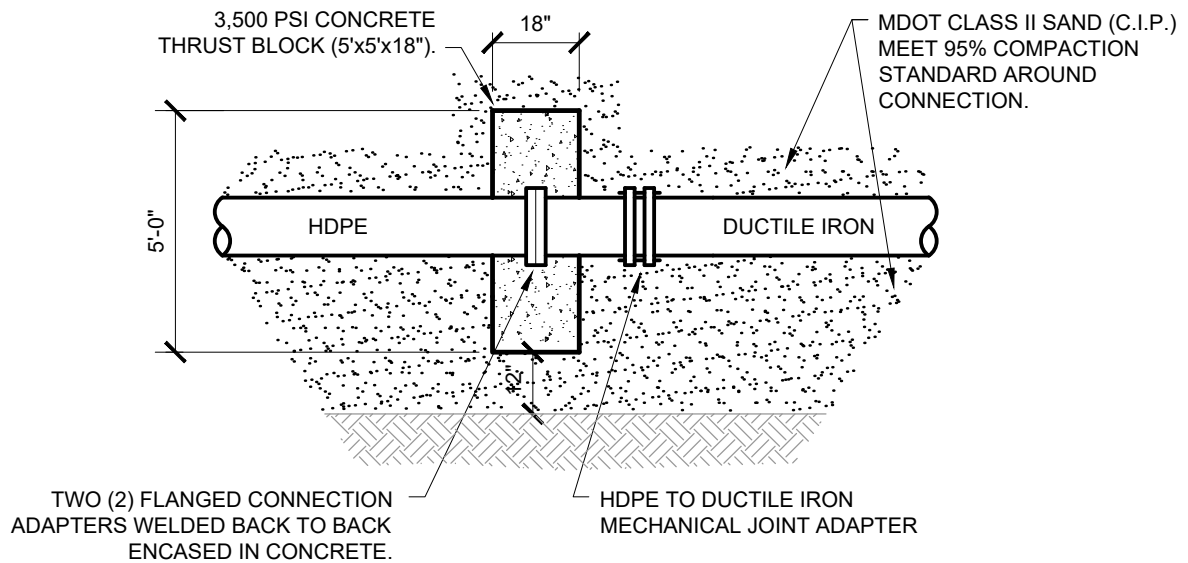
STANDARD 90 DEGREE FIRE HYDRANT DETAIL



NOTES:

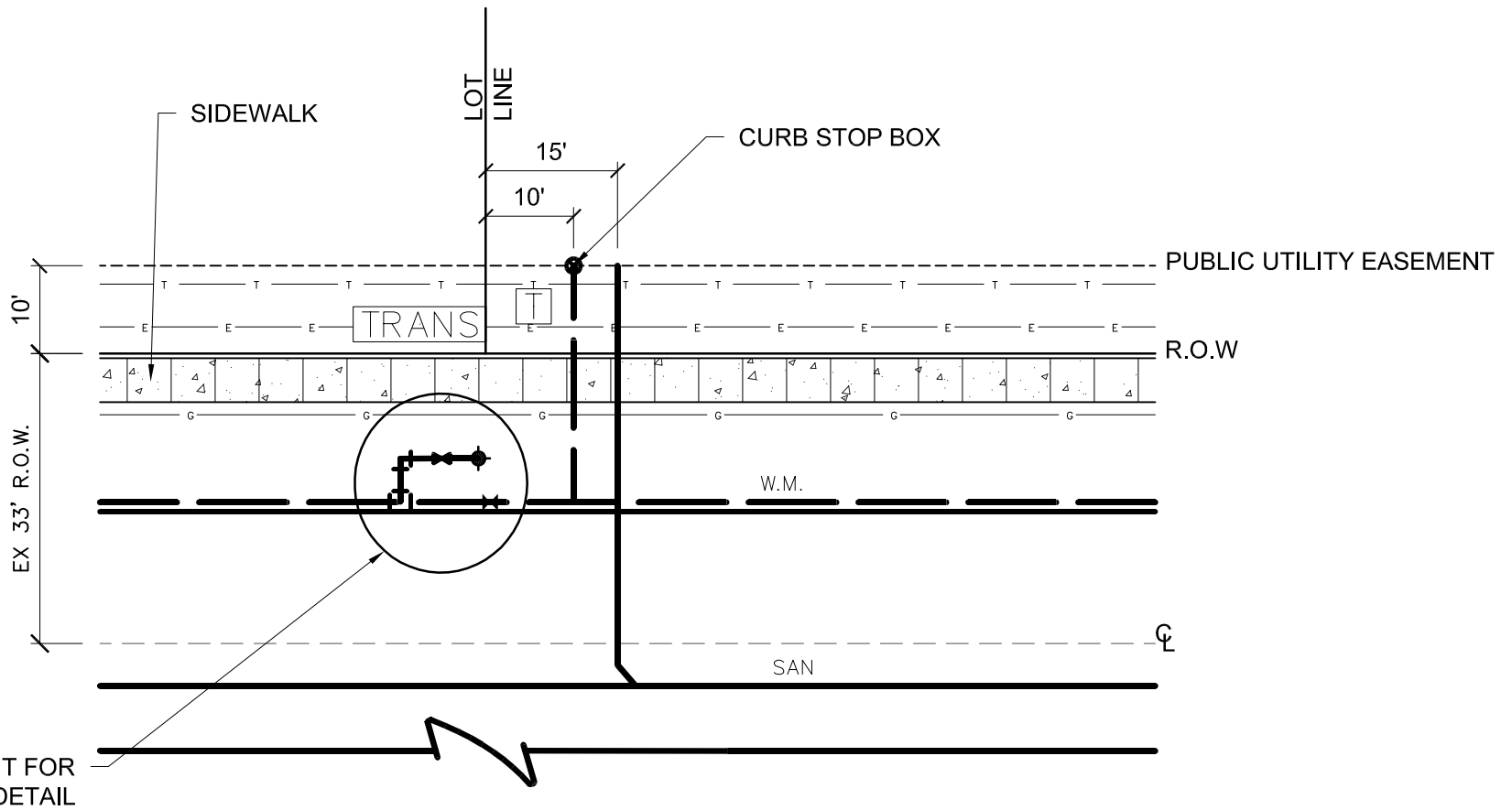
1. SAMPLE POINT TO BE USED FOR FUTURE SERVICE LEAD.
2. NO TAP SHALL BE MADE CLOSER THAN 18" TO ANY COUPLING OR JOINT IN THE PIPE.

COPPER SERVICE LEAD CONNECTION/SAMPLE POINT



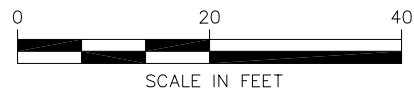
HDPE TO DUCTILE IRON MECHANICAL JOINT ADAPTER DETAIL

NOT TO SCALE



UNDERGROUND UTILITIES

DRAWING TO SCALE

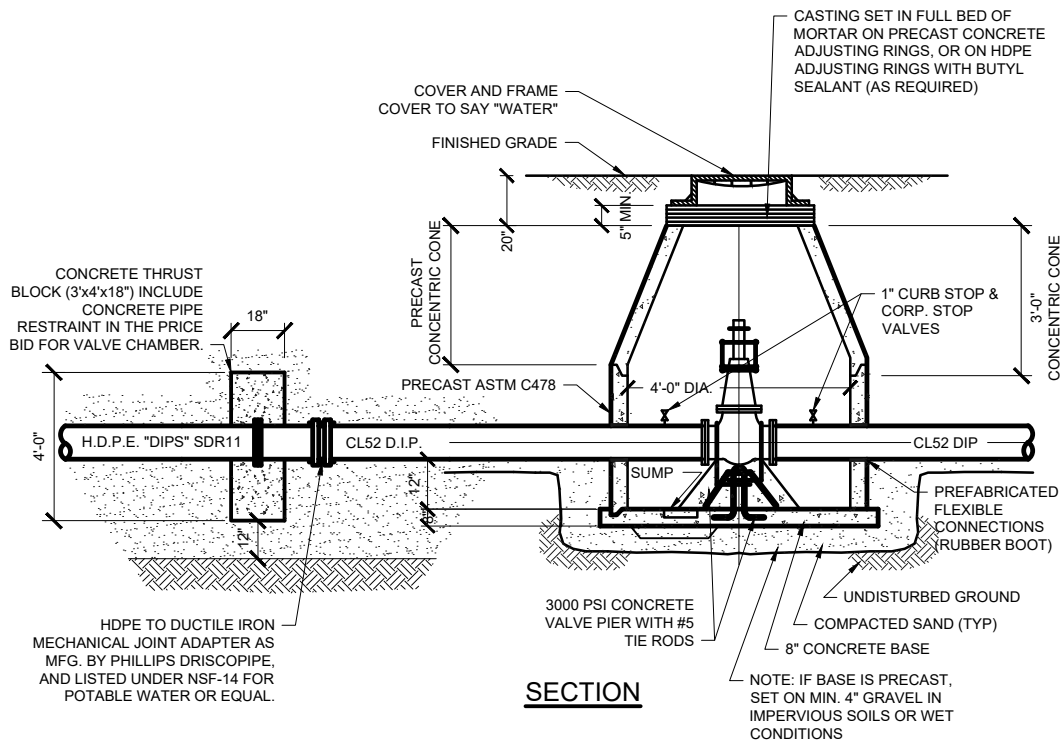
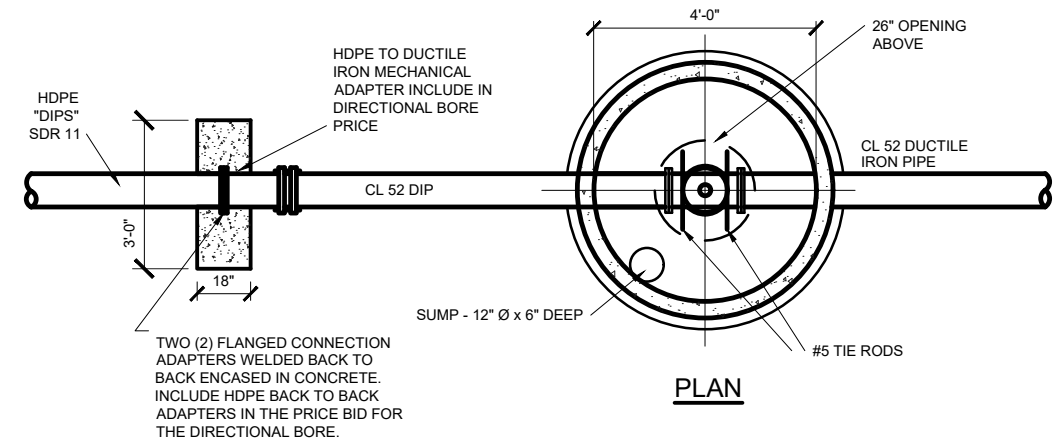


LEGEND

— E — E — Electrical
— T — T — Telephone
— G — G — Gas

T Telephone Pedestal

TRANS Transformer



HDPE TO DIP CONNECTION

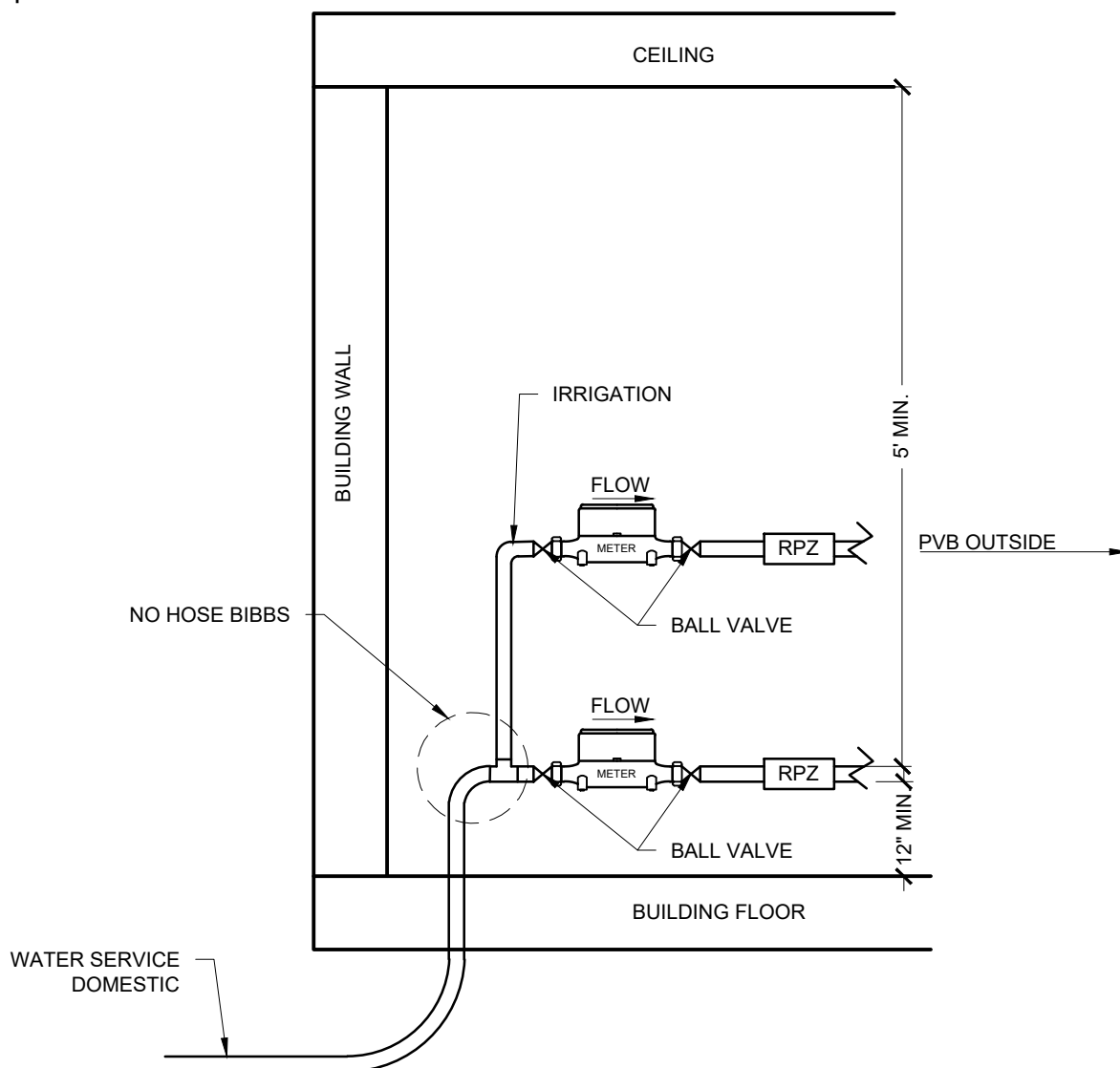
WHERE PERIODIC TESTING IS REQUIRED

Residential:

Water service line must have twelve (12) inches of clearance above finished floor and twelve (12) inches away from any adjacent wall, partition, foundation, or obstruction. If not provided, Contractor is responsible to rectify

Commercial:

The service line material shall be a minimum of 12" through the penetrated surface. Minimum clearance of 12" is required (multiplied by 2 per size of meter over 2". I.e 3" requires 24" below and both sides. 4" requires 36" below and on both sides). A minimum of 5' must be provided above with clear access to maintain the meter.



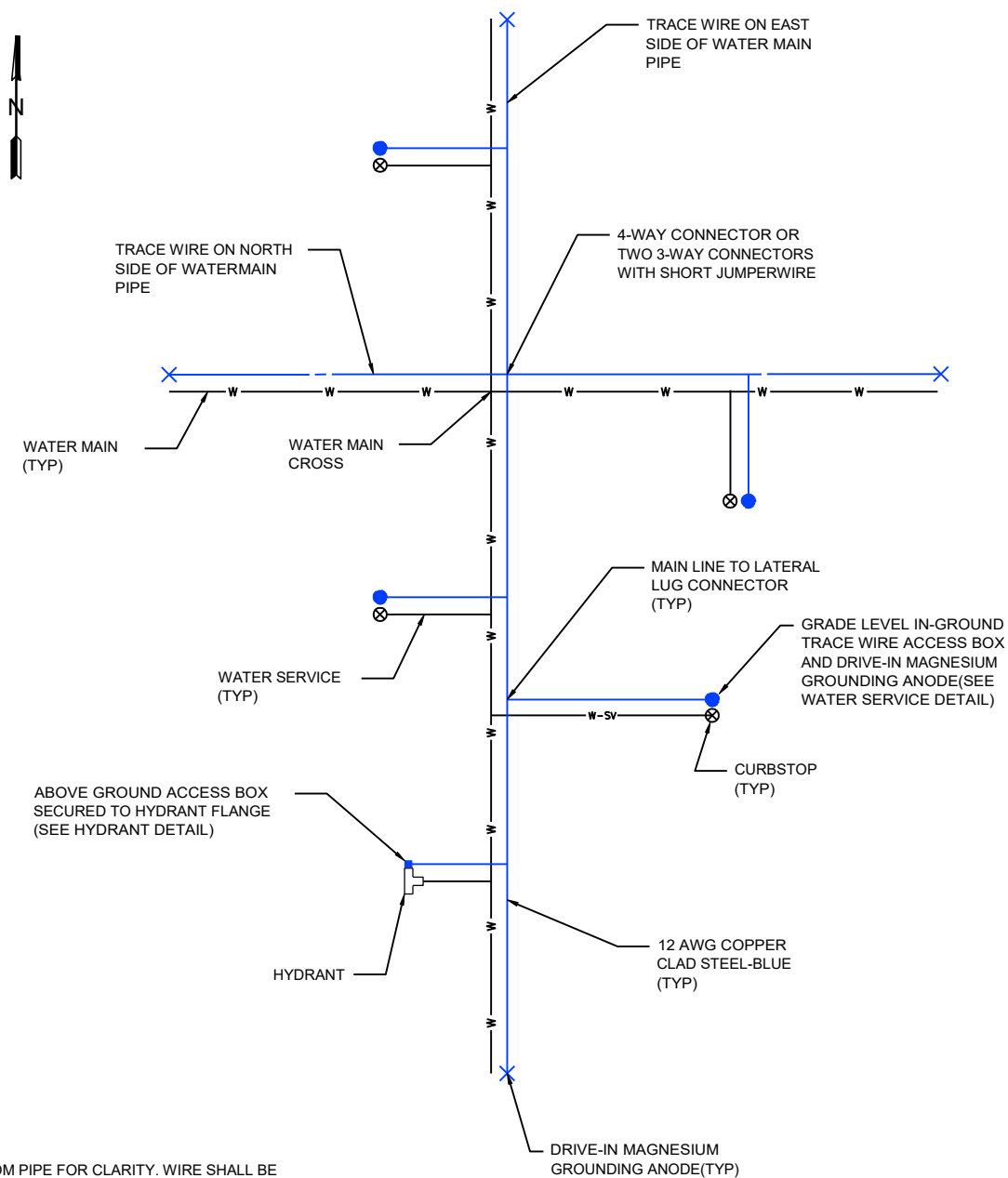
COMMERCIAL WATER SERVICE DETAIL

NOT TO SCALE

ALLENDALE TOWNSHIP
6676 LAKE MICHIGAN DR
DEPARTMENT PUBLIC UTILITIES

F&V PROJECT NO. 001071





NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

TRACE WIRE PLAN (WATER)

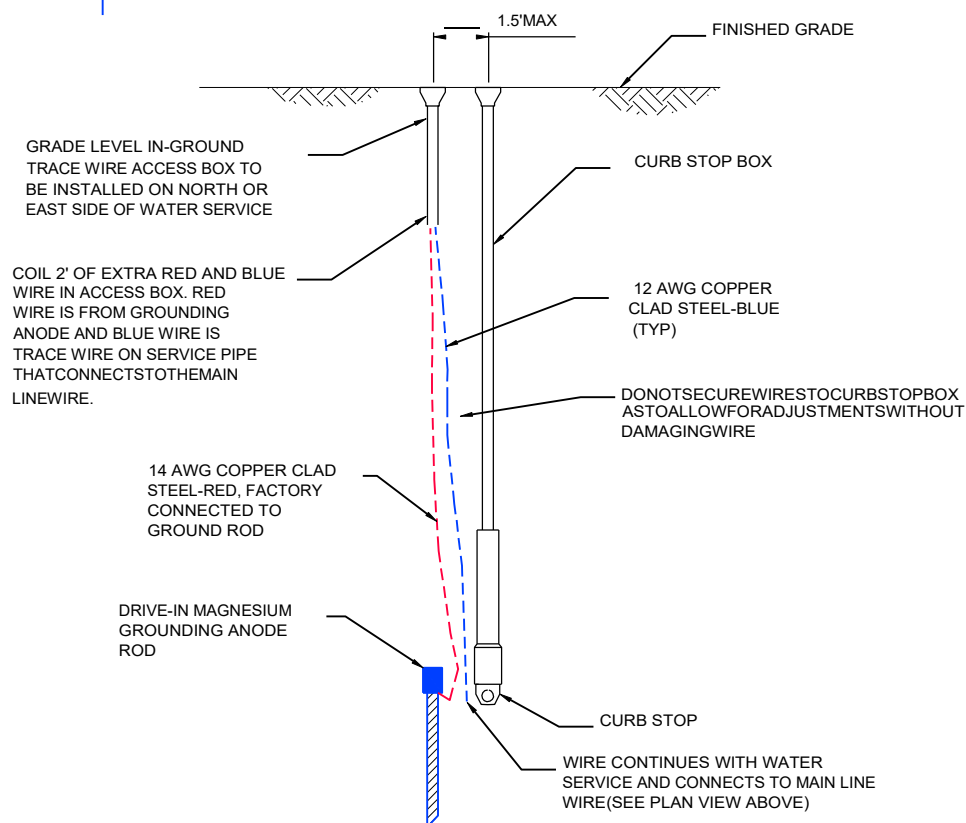
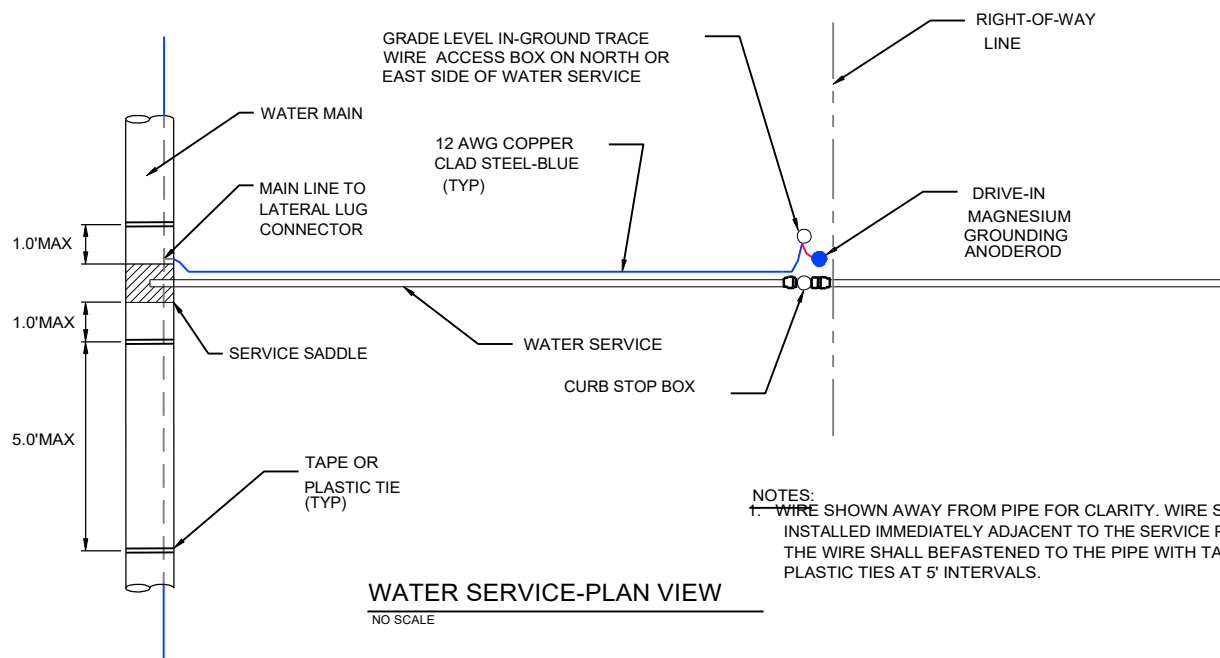
NO SCALE

MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL



TRACE WIRE
SAMPLE WATER PLAN

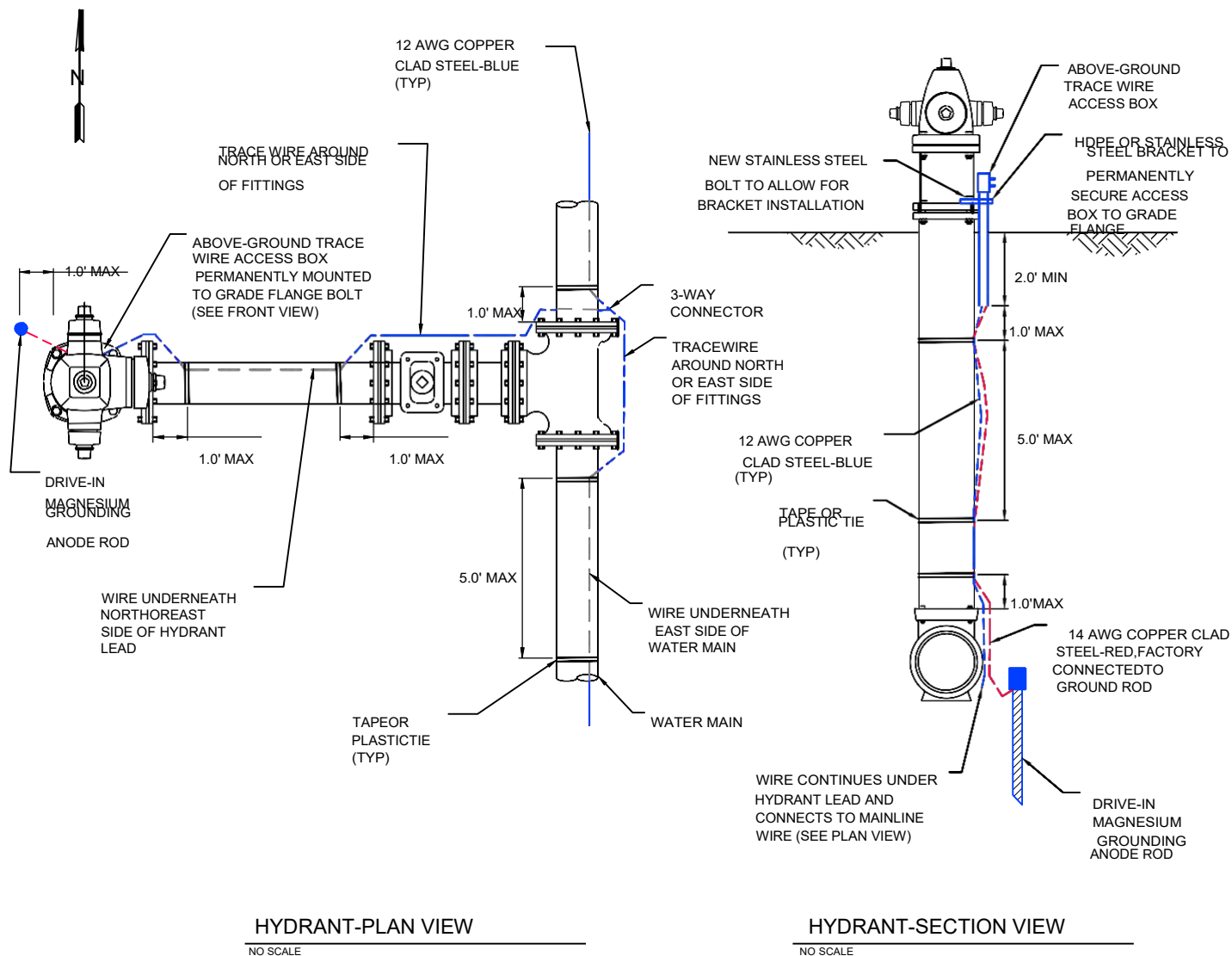
May 28, 2014



MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACE WIRE
WATER SERVICE DETAIL

May 28, 2014



MICHIGAN
RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACE WIRE
HYDRANT DETAIL

WATER/SEWER LEAKAGE & PRESSURE TESTING REPORT

PROJECT: _____
 PROJECT NO.: _____
 LOCATION: _____

DATE: _____
 INSPECTOR: _____
 REPORT NO.: _____

LOCATION	TEST NO.	PIPE SIZE (IN.)	LENGTH OF PIPE (LFT.)	PRESSURE AT START OF TEST (PSI)	PRESSURE AT COMPLETION OF TEST (PSI)	ALLOWABLE LOSS (GAL/HR)	ACTUAL LOSS (GAL/HR)	TIME REQUIRED FOR TEST	ACTUAL TIME OF TEST	APPROVED	REJECTED	REMARKS

WATERMAINS:

1. PRESSURE TEST: DURATION = 1 HR.
140 TO 150 PSI @ LOWEST POINT
2. LEAKAGE TEST: DURATION OF TEST = 2 HRS.
ALLOWABLE LOSS:

$$L = \frac{SD \times \text{square root } (P)}{148,000}$$

148,000

L = LEAKAGE (GALLONS PER HOUR)

S = LENGTH OF PIPE (FEET)

D = NORMAL PIPE DIAMETER (INCHES)

P = AVERAGE TEST PRESSURE (PSI GAUGE)

3. VALVES: ALLOWABLE LEAKAGE = LESS THAN 10 PSI IN 5 MINUTES W/PUMP OFF

(120 psi air, 150 psi water)

LEAKTST.XLS

SEWERS:

1. EXFILTRATION AIR TEST: DURATION = (SEE CHART ON BACK)
3.5 PSI AFTER STABILIZATION OF PRESSURE
PRESSURE LOSS FROM 3.5 TO 2.5 PSI MUST NOT EXCEED TIME LIMITS
TIME FOR 2 OR MORE SIZES IN SAME RUN SHALL BE COMPUTED AND
ADDED TOGETHER

SECTION 33 31 00

SANITARY SEWERS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes work required for sanitary sewer pipe, structures, and appurtenant work.
- B. Operation:
 - 1. The Township shall operate all valves in the sanitary sewer system. No such valves shall be operated by the Contractor unless authorized by the Township.
 - 2. Valves improperly operated by Contractor resulting in resident notifications, additional flushing, shall have costs back charged to Contractor.
 - 3. Where connection to the existing sanitary sewer system is proposed, the existing sanitary sewers or the proposed sanitary sewer shall be plugged to prohibit dirt and foreign material from entering the existing sanitary sewer system. The plugs used shall be approved by the Township and shall not be removed until authorization is received in writing from the Township. The plugs shall be provided, installed, and removed by the Contractor at its sole cost and expense, as directed by the Township.

1.02 REFERENCES:

- A. ASTM - American Society Testing Materials, latest edition
- B. NCPI - National Clay Pipe Institute.
- C. MDOT – Michigan Department of Transportation
- D. OCRC – Ottawa County Road Commission
- E. 10 States for Standards Sanitary
- F. Specification 31 23 23 – FLOWABLE FILL

1.03 SUBMITTALS:

- A. Submit the following for review by Township Inspector;
 - 1. Manufacturer's certifications for all pipe fittings, manholes, and castings.
 - 2. Plan of proposed equipment and method for leakage testing.
 - 3. Details of connection to sanitary sewer system.
 - 4. Submittals must be approved by ACT Public Utility Department prior to the Pre-Construction Meeting.
- B. If final paving is not completed and wear course is not installed prior to October 1, submit a plan to the Township Inspector to place castings at base grade.
- C. Report witness measurements and "as-built" elevation on end of service lines.
 - 1. Provide a one line drawing of all mains and stubs (in an accent color) with lengths. Allendale Public Utilities must be allowed access during construction to GPS locate all

fittings and top of pipe or inverts at grade changes. Also, provide length and size of services and tap locations if not perpendicular to the main.

2. Provide invert measurements at all manholes. Invert measurements are to be taken prior to cone installation.

D. Report presence of underground utilities and drains.

E. Line and grade control method other than Laser Beam shall be approved by Township or Township's Engineer.

F. Submittal of drawings of record plans:

1. Elevations and inverts shall be submitted in state plain

G. Provide the Township 1 printed set and a PDF file, and the Township Engineer 1 electronic file in AutoCAD format of record drawings (as-builts) with as-constructed dimensions and witnesses, in State Plane. All measurements to be English Standard

H. Large diameter pipe (over 18"):

1. Calculations of loading shall be presented and approved.

I. A plan must be in place prior to October 1 for final paving to determine if the casting need to be set to base grade in the event that the wear course is not installed prior to asphalt plants shutting down

1.04 JOB CONDITIONS:

A. Existing sanitary sewer system shall remain operational. Contractor is required to provide bypass pumping as needed for construction.

B. Do not bypass wastewater to ground or surface waters.

C. Clean up promptly following pipe installation and within maximum of 400 feet behind pipe laying operation. Cleanup includes backfill and rough grading.

D. The Township Inspector shall be provided notice for observation of the following testing procedures:

1. Leakage Testing
2. Video Televising

E. The Township Inspector shall be provided notice and allowed three (3) workdays to perform major inspections for sanitary sewer. Major inspections include the following:

1. Substantial Completion
2. Final Completion

F. See General Requirements section 1.04.B for staking requirements.

PART 2 - PRODUCTS

2.01 PIPE:

A. Sanitary sewer pipe 8" – 15" shall be plastic truss (PVC), ASTM D2680 or plastic (PVC), ASTM D3034-SDR 35/PS 46 for depths up to 19 feet and SDR 26/PS 115 for depths over 19 feet unless otherwise approved by Township and Township's Engineer.

- B. Pipes larger than 15" shall be plastic (PVC) solid wall, ASTM D3034 SDR 26/PS 115 or Vylon closed profile, ASTM D1784.
- B. Service Pipe: Provide minimum 6-inch, same classification as mainline pipe.
 - 1. ASTM D3034-SDR35 or 26, or ASTM D2680.
- C. Plastic Pipe: Provide seating marks where couplings are used for jointing.
 - 1. Joints: Provide rubber "O" ring.
- D. Joint Repair or Connecting to Existing Sewer Pipe of Different Material:
 - 1. Provide gasketed slip coupling or ROMAC XR-501. Flexible couplings shall not be used.
- E. Provide Joint Materials as Indicated for the following Pipes:
 - 1. Plastic (PVC): ASTM D3212
 - 2. Plastic (PVC) truss pipe: ASTM D2680.
 - 3. Vylon closed profile pipe: ASTM D3212.
 - a. Lateral connections shall be made with InsertaTee at top of pipe sealed by water activated grout on the outside.
- J. Hydraulic cement shall be used for all flow channel work.
 - 1. Minimum 1" thick.
- K. Cut in taps shall be Romac CB saddle with hydraulic cement around joint. Glue on wye shall not be used.

2.02 MANHOLES:

- A. Manholes shall be precast units or cast-in-place concrete – no brick allowed.
- B. Maintain uniform diameter from manhole base to cone section.
- C. Precast Units: ASTM C76 Class III or ASTM C478 with circular reinforcement, modified for "O" ring gaskets. Barrel joints shall be sealed externally with Press Seal EZ wrap or approved equivalent (Cadillac wrap).
 - 1. Pipe Openings: Provide flexible, watertight rubber boot using mechanically compressed flexible joint re-seal, link-seal, Pressure Wedge, Kor-N-Seal or equal. Conform to ASTM C923.
- D. Concrete: 4000 psi 28 day, 4-inch maximum slump.
- E. Concrete Brick: ASTM C55, Grade N-1 (repair of brick manholes ONLY)
- F. Grade Rings: ASTM C478 with mastic rope seal or mortar for adhesion.
- G. Mortar (For grade ring adjustments only): ASTM C270: 1-part Portland cement, 1-part lime and 3 parts sand by volume.
- H. Manhole Steps:
 - 1. Plastic with $\frac{3}{8}$ -inch steel rod reinforcement conforming to ASTM D4101, Type II.
 - 2. Dimensions: 10-inch deep by 10-inch wide, 5-inch tread depth.
 - 3. Comply with applicable Occupational Safety and Health Administration Standards (OSHA).

- I. Standard Manhole Castings: East Jordan 1040 A cover or – two (2) hole cover with the words “ALLENDAL E AREA SANITARY SEWER” & East Jordan 1045 Z1 frame.
 - 1. Non-Standard Manhole Castings (non-pavement areas): East Jordan 1040 APT with words “SANITARY SEWER” & East Jordan 1045 ZPT frame. Pentagon bolts to be required for the bolt down cover.
- J. Bituminous Waterproofing: ASTM D449.
- K. Cement Waterproofing: Masonry filler.
- L. Provide Press Seal EZ Wrap or Township approved equal for all joints.

2.03 FLOWABLE FILL:

- A. Flowable fill shall be low strength, lean mix, flowable mortar meeting the specifications in 31 23 23 – Flowable Fill.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Alignment and Grade:
 - 1. Deviations: Notify Owner's Engineer and Township Inspector to obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on the plans.
 - 2. Laser Beam Control: Provide.
 - 3. Check grade: At set-up point, 25-foot, 50-foot, 100-foot and 200-foot points thereafter to the next set-up point. Pipe invert elevation is to be measured prior to setting manhole cone for as-built drawings.
 - 4. Projector advancement: Reset at each manhole.
- B. Bedding:
 - 1. Method: See Article 3.05 SCHEDULES.
 - 2. Provide bedding area backfill in accordance with MDOT Standard Plan No. R-83C.
 - 3. Provide continuous bearing by supporting entire length of pipe barrel evenly.

3.02 INSTALLATION:

- A. Laying pipe:
 - 1. Direction shall be upstream with spigot or tongue end downstream and bell end upstream.
 - 2. Joints shall be smooth and clean.
 - 3. Place pipe length and bedding as a unit in a frost free, dry trench.
 - 4. Special supports and saddles: See Article 3.05 SCHEDULES.
 - 5. Sewer joints within 10-feet and above watermain offset, shall be encased in concrete (ref 02220-2.01. A.3)
 - 6. Minimum grade for 8-inch pipe: 0.45%.
 - a. Add 0.05% to all slopes that are at a top end run.
 - 7. Minimum pipe length of 4' unless between a WYE.
 - 8. If stone is required to control wet trench, see Bedding Detail for fabric requirements.
 - 9. Invert elevations shall be taken prior to setting the cone.
 - a. Report all invert elevations to the APU inspector at the end of the day.
 - b. Failure to do so will result in the cone being excavated and proper measurements taken.

Pipe Size	Minimum Required Slope	Pipe Size	Minimum Required Slope
8"	0.45%*	21"	0.12%
10"	0.32%	24"	0.10%
12"	0.26%	27"	0.08%
15"	0.20%	30"	0.06%
18"	0.16%		

*Add 0.05% to all slopes that are at a top end run

- B. Jointing:
1. Provide solvents, adhesives and lubricants as furnished by Manufacturer.
 2. Gasket position: Confirm that the gasket is in place and that the joint is properly made.
- C. Manholes:
1. General: See Article 3.05 SCHEDULES:
 2. In the event of unsuitable soils, refer to the Methods of Bedding Pipe detail for use of stone.
 3. See the standard Sanitary Manhole Detail for manhole installation.
 4. Manholes shall be installed and set according to 10-States Standards.
 5. Provide casting grade setting as follows:
 - c. Existing pavement: Finished grade.
 - d. Gravel grade: 6 inches below in road R.O.W (only).
 - e. Unpaved areas: Finished grade.
 6. Provide waterproofing on ASTM C478 units and cast-in-place manholes using one of the following methods:
 - a. Bituminous: Apply 1 gallon per 100 sq.ft. to outside free of holidays and open pin holes
 - b. Cement: Apply masonry filler to outside by brushing on two (2) coats, each minimum of 2 lbs. per sq. yd.
 6. Cored holes:
 - a. Fill voids around boots with hydraulic cement.
 7. Flow channels:
 - a. Construct with concrete per the Sanitary Manhole Detail (attached to this specification) unless otherwise directed by Township and slope towards center of manhole.
 - b. Grout flow channel using hydraulic cement. Provide smooth, constant grade across structure.
 - c. Minimum elevation difference between pipe inverts: 0.1 feet.
 8. Casting adjustment: concrete ring between leveling and top course of bituminous.
 - a. Centered on chimney opening with maximum height of 20" from top of cone to top of casting.
 - b. The entire casting and adjustment ring area shall be smoothed with concrete mix, inside.
 - c. In pavement areas the exterior shall have cast in place concrete from base course pavement to 6" below the top of cone and extend 6" beyond the outside of the cone. Clean pick holes after paving.

- d. In non-pavement areas the exterior shall have cast in place concrete 6" below the top of cone placed a minimum of halfway up the casting and extend 6" beyond the outside of the cone.
 9. Drop connections. shall be required for any drops greater than one (1) foot above the spring line of the down stream invert. The alternative drop connection should be used for drops greater than 0.1 feet and less than 1 foot: See Article 3.05 SCHEDULES.
 10. Provide access to all manholes for sewer maintenance vehicles as directed by Township and Township Engineer.
 - a. Berms will vary dependent on type of road and distance of structure out of ROW.
 - b. Construction of berms shall meet same specs as hydrant berm
 11. Manholes with precast flow channels are required to have a smooth constant grade across the structure.
- D. Abandoning and filling existing sanitary sewer:
1. Plug both ends of the sewer pipe to be abandoned and fill the existing pipe completely with flowable fill.
 2. Refer to Section 31 23 23 FLOWABLE FILL for flowable fill requirements.
- E. Connections:
1. Expose existing sanitary sewer and structures to which the new work is to be connected to confirm condition, location, and elevation.
 2. Connect to existing sanitary manhole by coring an opening adequate to insert pipe and flexible water tight rubber boot and secure circumference of pipe with Hydraulic cement.
 - a. Relay and repoint loose blocks and bricks on existing block and brick structures. Re-channel flow lines and benches with concrete and hydraulic cement.
 3. Construct manhole over existing sanitary sewer by installing precast manhole doghouse over existing pipe onto precast concrete manhole base. Do not cut open the existing pipe until written approval has been obtained from the Township.
 4. Future Sanitary Sewer: Provide the following:
 - a. Plug: Pipe 6-inch through 21-inch with standard disc.
 - b. Bulkhead: Pipe 24-inch and larger with brick and mortar and ½-inch plaster coat outside.
 - (1) 24 inch - 36 inch: 4-inch thick.
 - (2) 42 inch - 60 inch: 8-inch thick.
 5. No inside drop connections shall be permitted.
- F. Service Lines:
1. Sanitary sewer must be situated along lot's road frontage for service to be provided. All laterals must be located in 10' utility easement (if available) or within the road right of way. Easements will not be allowed to obtain service to a residence.
 2. Align at right angles to street or easement line. Locate 15 feet from left property line (facing lot) unless otherwise directed by Township.
 3. Grade: Provide at uniform rate from connection or main riser to the property or easement line, minimum 1/4 inch per foot (2%) for residential and commercial uses.
 4. Provide minimum depth at street right-of-way line, property line or easement line as follows:
 - a. House with basement: 12 feet below first floor elevation or 3 feet below basement elevation, whichever is deeper.
 - b. Commercial and industrial buildings, schools, churches: As determined by Owner's Engineer.
 - c. The above depths govern, except that the minimum depth at the right-of-way line or property line shall be 6 feet below street or easement centerline grade unless otherwise permitted.

- d. The above depths are based on homes located at minimum setback from street right-of-way line and with typical 8-foot high ceiling in basement. Depths required may increase based on setback and ceiling heights.
 - 5. Connection fitting:
 - a. Locate as shown on Plans or as directed by Owner's Engineer in field.
 - b. 45° or 60° Wyes: Provide on all pipe except concrete pipe.
 - c. Tees: Allowed only on reinforced concrete pipe.
 - d. No laterals shall be connected to manholes.
 - 6. Main riser will be allowed where cover exceeds 13 feet at mainline.
 - 7. Plugging: Provide standard caps securely blocked.
 - 8. Markers: Place a wood marker (2" x 2" minimum) at end of lateral with sufficient length to extend from invert of lateral to ground surface. Install a steel re-rod 12-inches in length immediately next to the wood marker with the top of the re-rod 2" below grade. Cover 2' x 2' wood marker and steel re-rod with 4' long 4-1/2" ID minimum pipe buried 1' foot.
 - 9. Witnesses: Report the following to the Owner's Engineer for preparation of record drawings:
 - a. Wyes and Tee: Measurements to nearest downstream manhole.
 - b. APU staff will GPS locate the end of the lateral.
 - c. Laterals: Provide lengths and invert elevations.
 - 10. Property line Riser: Required on all laterals. See Article 3.05 SCHEDULES.
 - 11. Before making a building connection to the sanitary sewer system, the excavation shall be inspected by the Public Utilities Department.
- L. Abandoning existing sanitary lateral: Required on properties with existing sanitary laterals that will not be used. Abandonment of an existing lateral will require a mainline point repair as follows:
- 1. Sanitary sewer main point repair:
 - a. Abandonment of existing sanitary lateral requires a point repair at the sanitary mainline by way of cured-in-place pipe (CIPP) lining.
 - b. Materials: Source One Environmental PipePatch cured-in-place-pipe lining, or approved equivalent, is required for sanitary sewer mainline point repairs. Prior to execution of the point repair, contractor must submit manufacturer specifications and certifications of the materials being used for the Township to review.
 - c. Minimum of 48" lining required for CIPP point repair centered at the wye.
 - d. Preparation: Prior to performing the point repair, the sanitary mainline must be cleaned by way of hydraulically propelled high velocity jet spray.
 - e. Finish: The cured liner must provide a smooth transition from the host pipe to the repair. Following completion of the repair, the pipeline must be televised per Section 33 01 30.16– Cleaning and Televising Sanitary Sewers
 - f. The private end of the sanitary lateral must be cut and capped at the R.O.W or easement.
 - g. Inspections: All sanitary lateral abandonments must be witnessed by the Township. The Township Inspector must have 48-hour notice prior to execution of the sanitary lateral abandonment.
- M. By-pass Pumping: Contractor to provide by-pass pumping of wastewater flow as required during construction or replacement of sanitary sewer.
- 1. Contractor must submit a plan to be approved prior to work commencing.
- I. Pipe insulation: Where noted on plans, place 2-inch thick Styrofoam insulation board 4 feet wide over pipe at top of bedding.

- J. No excavation within 10-feet of sanitary sewer or other manner which could cause undermining of service after back fill which could impact its function as determined by Township Public Utility Department and /or Township Engineer.

3.03 TESTING AND INSPECTION:

A. General:

1. Observation: By Township Inspector
2. Testing: Perform upon completion and before connecting to active system.
3. Leakage tests: Provide after installation including all laterals ,stubs, manhole sections and backfill.
4. Notification: Clean, pretest and arrange for final inspection and test.
5. Notification: The Township Inspector shall be provided three (3) workdays to complete major inspections (See Paragraph 1.04.D).
6. Provide necessary equipment, manpower and assistance.
7. Video televising and Deflection testing:
 - a. Testing shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system
 - b. Castings shall be set at minimum gravel grade
 - c. Provide test results and video prior to wear course paving.
 - d. Contractor to preform deflection testing prior to cleaning and televising.

B. Compaction testing is required as follows:

1. Backfill 95% of Maximum Unit Weight in ROW and 85% after pipe bedding levels when not in ROW.
2. The minimum frequencies of tests for density control are as follows:
3. Trench Backfill – 1 test per 12 inch layer of backfill per run of pipe between structures. Minimum 1 test per lateral.
4. Structure Backfill – 1 test per 12 inch layer of backfill per pipe run at each structure.
 - a) Contractor is allowed to continue installation if waiting for the tester; however, structures shall not be fully backfilled. Each pipe run at the structure shall be compacted to a different lift and tested. Invalid tests shall be handled per location.
5. Results shall be relayed to the field inspector on the day they are taken.
6. Written compaction test results are to be submitted to the Field Inspector within one (1) week of the test date.

C. Line and Grade: Allowable drift between structures from proposed alignment will be as follows:

1. Line:
 - a. Through 36-inch: 0.20 foot.
 - b. Over 36-inch: 0.40 foot.
2. Grade:
 - a. Allowable sag between pipe joints: Less than 10% of pipe diameter with maximum of 1-inch.
3. Sags in excess of tolerance shall be repaired prior to acceptance by Township. Repaired sections shall be re-televised.

D. Plastic pipe deformation:

1. Pipe deflection will be limited to five percent (5%) of diameter per 10 State Standards.
2. Pull GO, NO-GO type gauge through pipe by hand.
3. Contractor shall provide proof ring for GO, NO-GO gauge from the manufacturer.
4. Schedule: Conduct after final backfill has been in place a minimum of thirty (30) days, and after shutdown of dewatering operation.

5. Correction: Repair defects and retest until acceptable.

- E. Video Televising (see Section 33 01 30.16– Cleaning and Televising Sanitary Sewers):
1. Contractor to complete video televising of completed sewers. The sewer main, laterals and manholes shall be cleaned and completely free of debris prior to televising. Flush sewer with flow of water from upstream end immediately prior to televising. Minimum of five (5) gallons (for 8" pipe) of water to be used.
 2. Schedule: Televising after final backfill has been in place a minimum of thirty (30) days, and after shutdown of dewatering operation and after pipe deflection testing.
 3. Contractor to provide 1 original (USB Drive) of video of sewers to the Township.
 4. Repairs causing disturbance to the pipe bedding or backfill will require retesting and an additional mandatory 30-day waiting period for televising.
- F. Leakage Testing:
1. Contractor to perform exfiltration (air) test.
 2. Exfiltration air test will have a holding time not less than that listed in table. Refer to Article 3.05 - Schedules
 3. Correction: Repair defects and repeat test until acceptable.
 - a. Method of repairing defects shall be approved by Township or Township's Engineer.
- G. Exfiltration (air): Perform in accordance with NCPI Publication, *"Low Pressure Air Test for Sanitary sewers"*, and in accordance with ASTM F 1417, *"Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air"*.
1. Condition: Clean, dry pipe
 2. Procedure:
 - a. All pressure readings are above the average groundwater head.

3.04 ADJUST AND CLEAN:

- A. General: Keep pipe and structures clean as work progresses. At a minimum, plug downstream invert where low points of the road may cause infiltration into the structure.

3.05 SCHEDULES:

- A. Exfiltration Air Test Table.
- B. Water / Sewer Leakage & Pressure Testing Report Form.
- C. Standard Details:
1. Special supports for underground utilities / pipe saddles.
 2. Methods of bedding pipe.
 3. Standard sanitary manhole.
 4. Standard Sanitary manhole casting.
 5. Watertight manhole cover.
 6. Plastic pipe manhole junction.
 7. Two-way sanitary sewer cleanout.
 8. Standard riser details.
 9. Underground utilities detail.
- D. Manhole Final Inspection Punch List.

END OF SECTION

EXFILTRATION AIR TEST

TIME REQUIRED FOR LOSS OF PRESSURE FROM 3.5 PSIG TO 3.0 PSIG FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015 (CU. FT./MIN./SQ.FT. OF INTERNAL SURFACE AREA)

Pipe Diameter (in.)	Mini- mum time for (min; sec.)	Length Time (ft.)	Time for Min. Longer length (sec.)	Specification Time for Length (L) Shown (min:sec)										
				100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft	500ft	550ft	600ft
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12	3:34	3:55	4:16
8	3:47	298	.760	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	6:20	6:58	7:36
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	9:54	10:53	11:52
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50	14:15	15:40	17:06
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	22:16	24:29	26:43
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	32:03	35:16	38:28
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	43:37	47:59	52:21
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	56:59	62:41	68:23
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	72:07	79:20	86:33
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	89:02	97:56	106:51
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	107:44	118:31	129:17
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	128:13	141:02	153:51
39	18:25	61	18.054L	30:57	45:09	60:11	75:14	90:16	105:19	120:22	135:24	160:32	165:31	180:34
42	19:50	57	20.939L	34:54	52:21	69:48	87:15	104:42	122:09	139:36	157:03	174:31	191:58	209:25

Note: When 2 sizes of pipe are involved, the time shall be computed by the ratio of lengths involved.

Example: 400 feet of 10-inch pipe and 200 feet of 6-inch pipe

$$\text{Time} = \frac{\text{Length (1)} \times \text{Time (1)} + \text{Length (2)} \times \text{Time (2)}}{\text{Length (1)} + \text{Length (2)}} = \frac{400 \times 7:54 + 200 \times 2:50}{400 + 200}$$

$$= \frac{400 \times 474 + 200 \times 170}{400 + 200} = 373 \text{ seconds} = 6:13 \text{ (min:sec)}$$

WATER/SEWER LEAKAGE & PRESSURE TESTING REPORT

PROJECT: _____
 PROJECT NO.: _____
 LOCATION: _____

DATE: _____
 INSPECTOR: _____
 REPORT NO.: _____

LOCATION	TEST NO.	PIPE SIZE (IN.)	LENGTH OF PIPE (LFT.)	PRESSURE AT START OF TEST (PSI)	PRESSURE AT COMPLETION OF TEST (PSI)	ALLOWABLE LOSS (GAL/HR)	ACTUAL LOSS (GAL/HR)	TIME REQUIRED FOR TEST	ACTUAL TIME OF TEST	APPROVED	REJECTED	REMARKS

WATERMAINS:

1. PRESSURE TEST: DURATION = 1 HR.
140 TO 150 PSI @ LOWEST POINT
2. LEAKAGE TEST: DURATION OF TEST = 2 HRS.
ALLOWABLE LOSS:

$$L = \frac{SD \times \text{square root } (P)}{148,000}$$

148,000

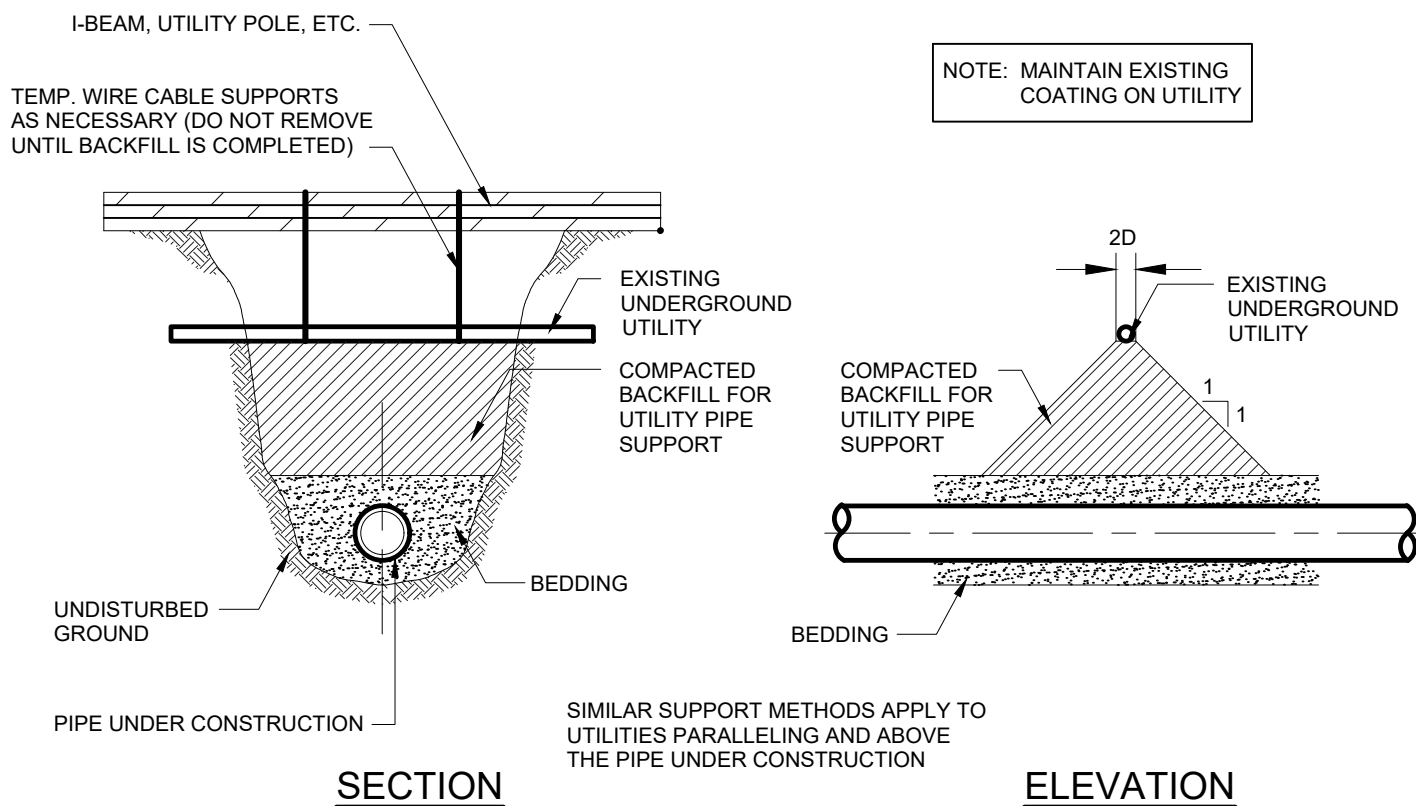
L = LEAKAGE (GALLONS PER HOUR)
 S = LENGTH OF PIPE (FEET)
 D = NORMAL PIPE DIAMETER (INCHES)
 P = AVERAGE TEST PRESSURE (PSI GAUGE)

3. VALVES: ALLOWABLE LEAKAGE = LESS THAN 10 PSI IN 5 MINUTES W/PUMP OFF

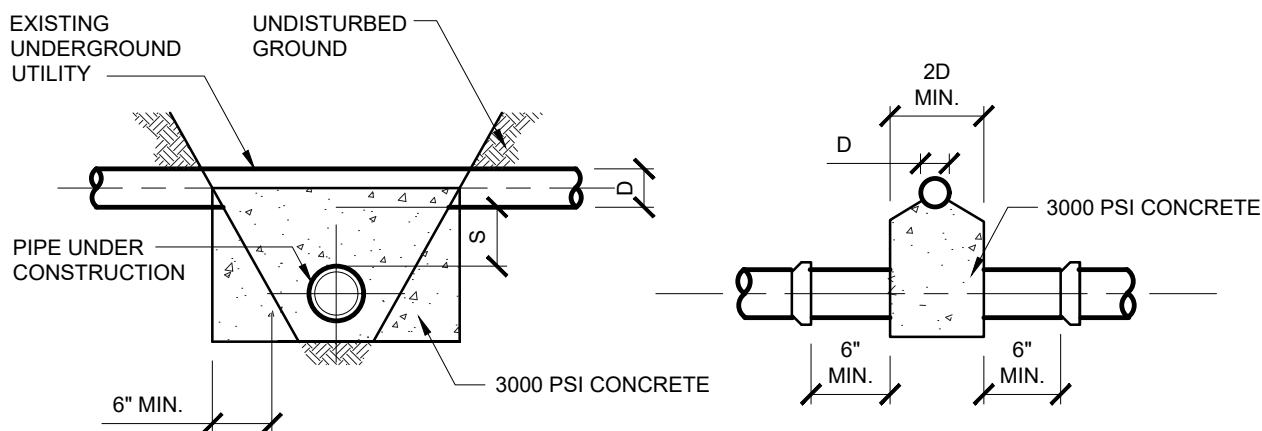
(120 psi air, 150 psi water)
 LEAKTST.XLS

SEWERS:

1. EXFILTRATION AIR TEST: DURATION = (SEE CHART ON BACK)
 3.5 PSI AFTER STABILIZATION OF PRESSURE
 PRESSURE LOSS FROM 3.5 TO 2.5 PSI MUST NOT EXCEED TIME LIMITS
 TIME FOR 2 OR MORE SIZES IN SAME RUN SHALL BE COMPUTED AND
 ADDED TOGETHER



SPECIAL SUPPORTS FOR UNDERGROUND UTILITIES



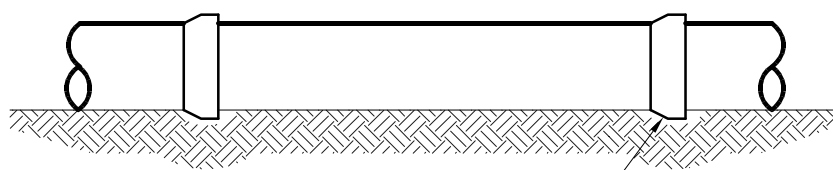
NOTES:

1. PIPE SADDLE REQUIRED WHEN SEPARATION (S) IS 12 INCHES OR LESS UNLESS OTHERWISE DIRECTED OR SHOWN ON PLANS
2. PIPE SADDLE IS NOT REQUIRED FOR PLASTIC, STEEL, LEAD OR COPPER PIPE 2" OR SMALLER.

SECTION

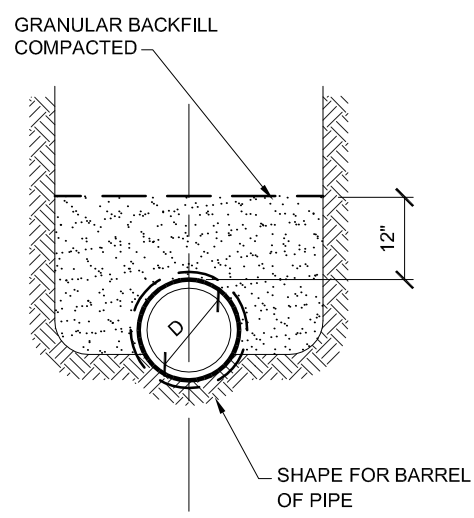
ELEVATION

PIPE SADDLES

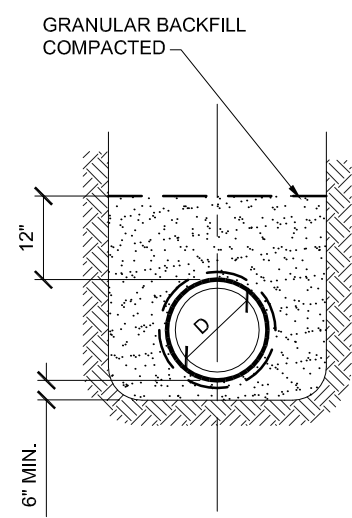


BELL HOLE EXCAVATIONS
REQUIRED FOR METHODS I & II

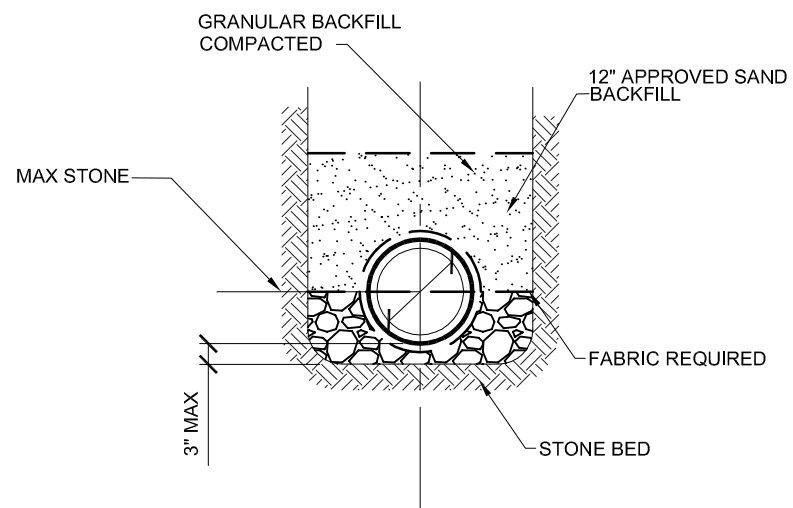
EXCAVATION FOR BELLS



METHOD I



METHOD II

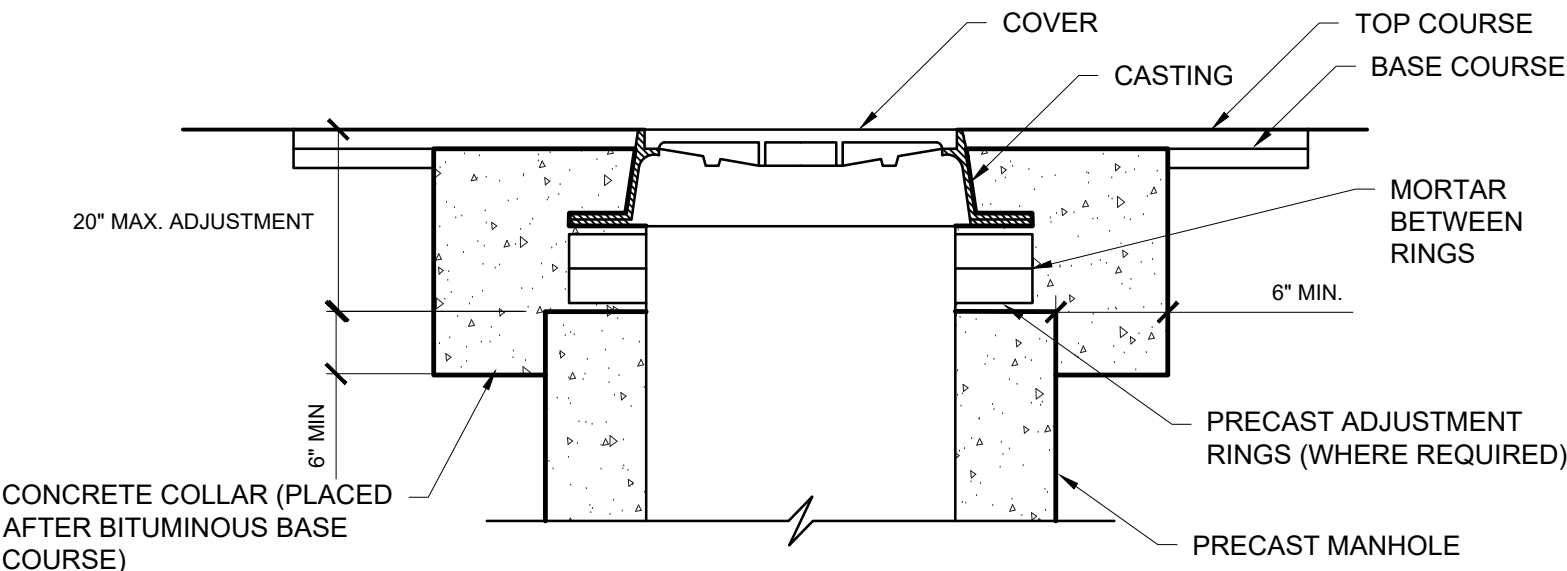


METHOD III W/ STONE

NOTES:

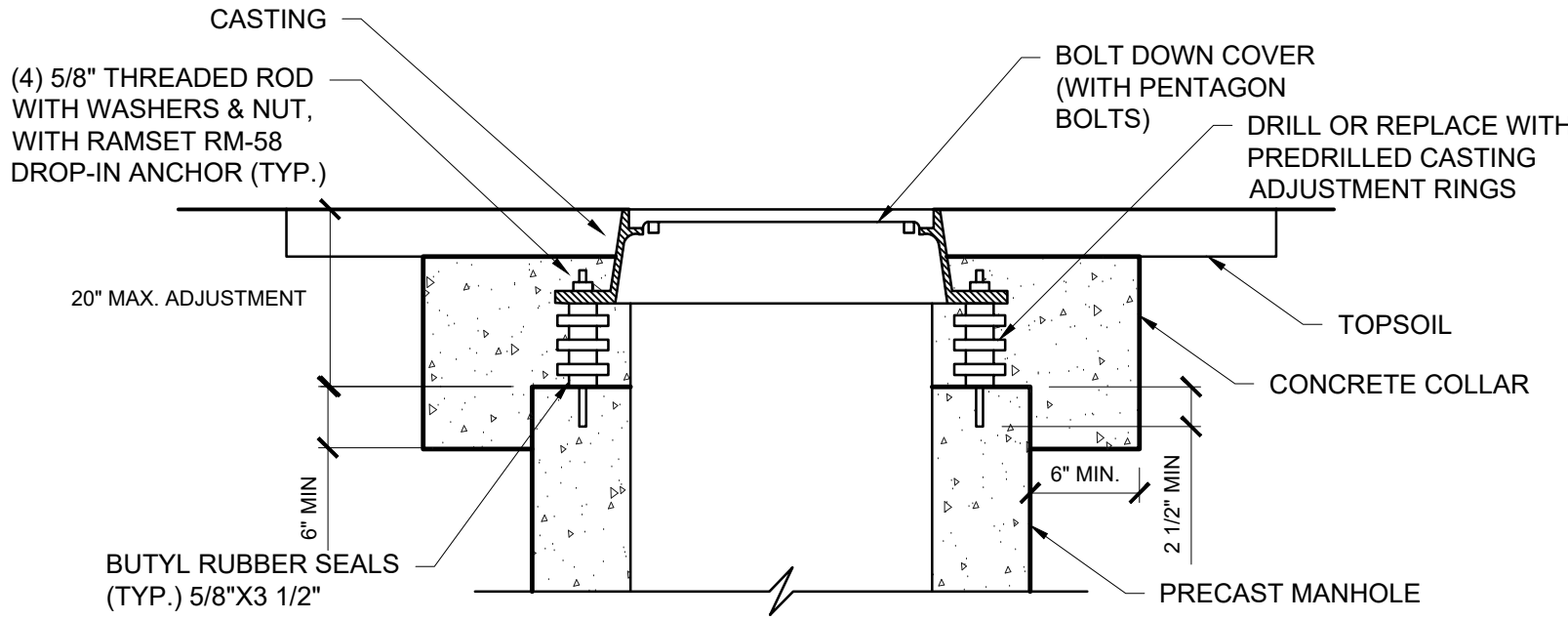
1. METHOD I: IN AREAS OF UNCONSOLIDATED SOILS (SAND, GRAVEL, ETC.)
2. METHOD II: IN AREAS OF CONSOLIDATED SOILS (CLAY, HARDPAN, ROCK, ETC.)
3. METHOD III: IN AREAS OF WET SOILS WITH STONE (CLAY, HARDPAN, ROCK, ETC.)
4. IN AREAS WITH MORE THE 3" MAX OF STONE UNDER THE PIPE, FABRIC IS REQUIRED

METHODS OF BEDDING PIPE



CASE I: MANHOLE IN ROADWAY

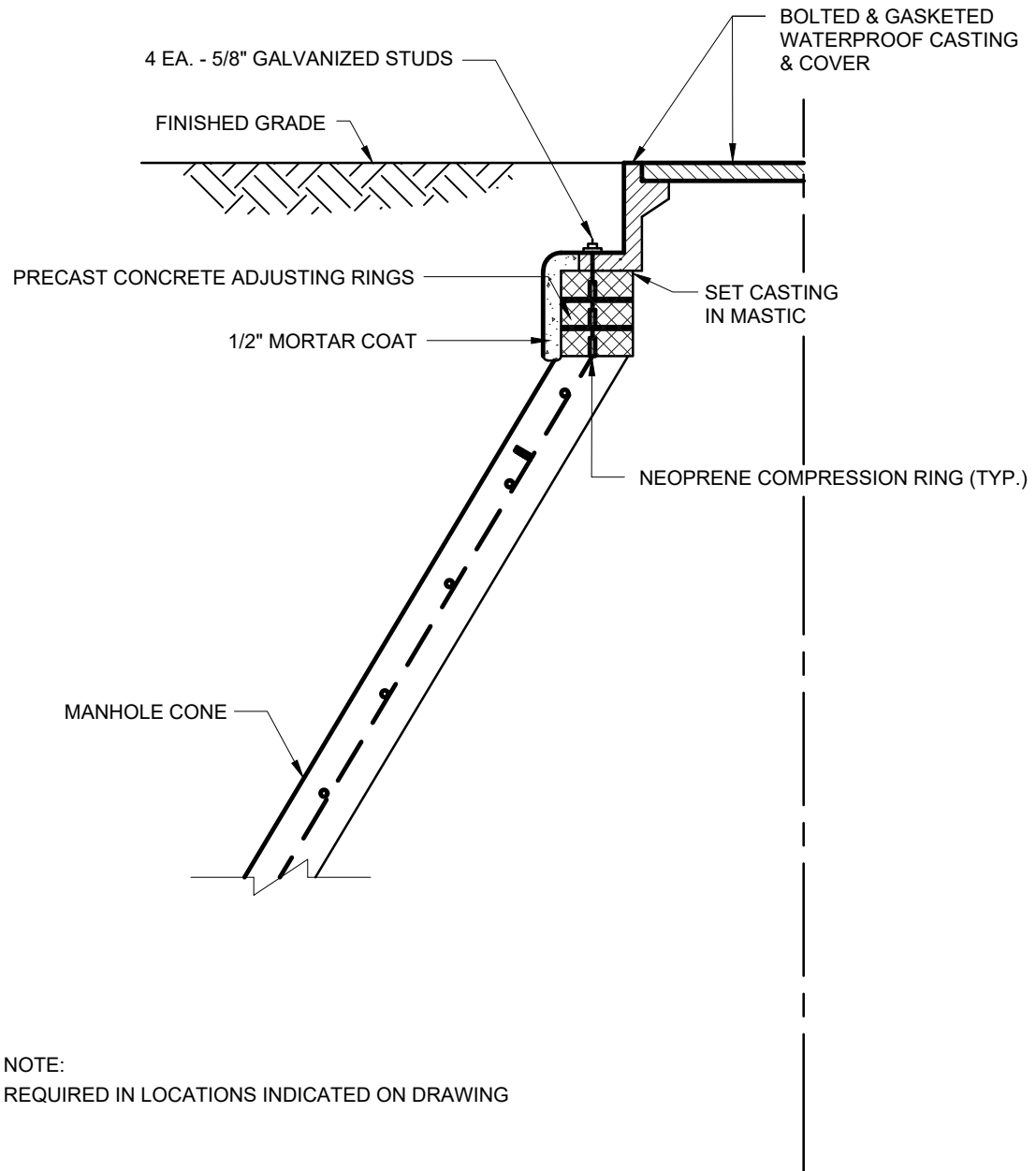
NO SCALE



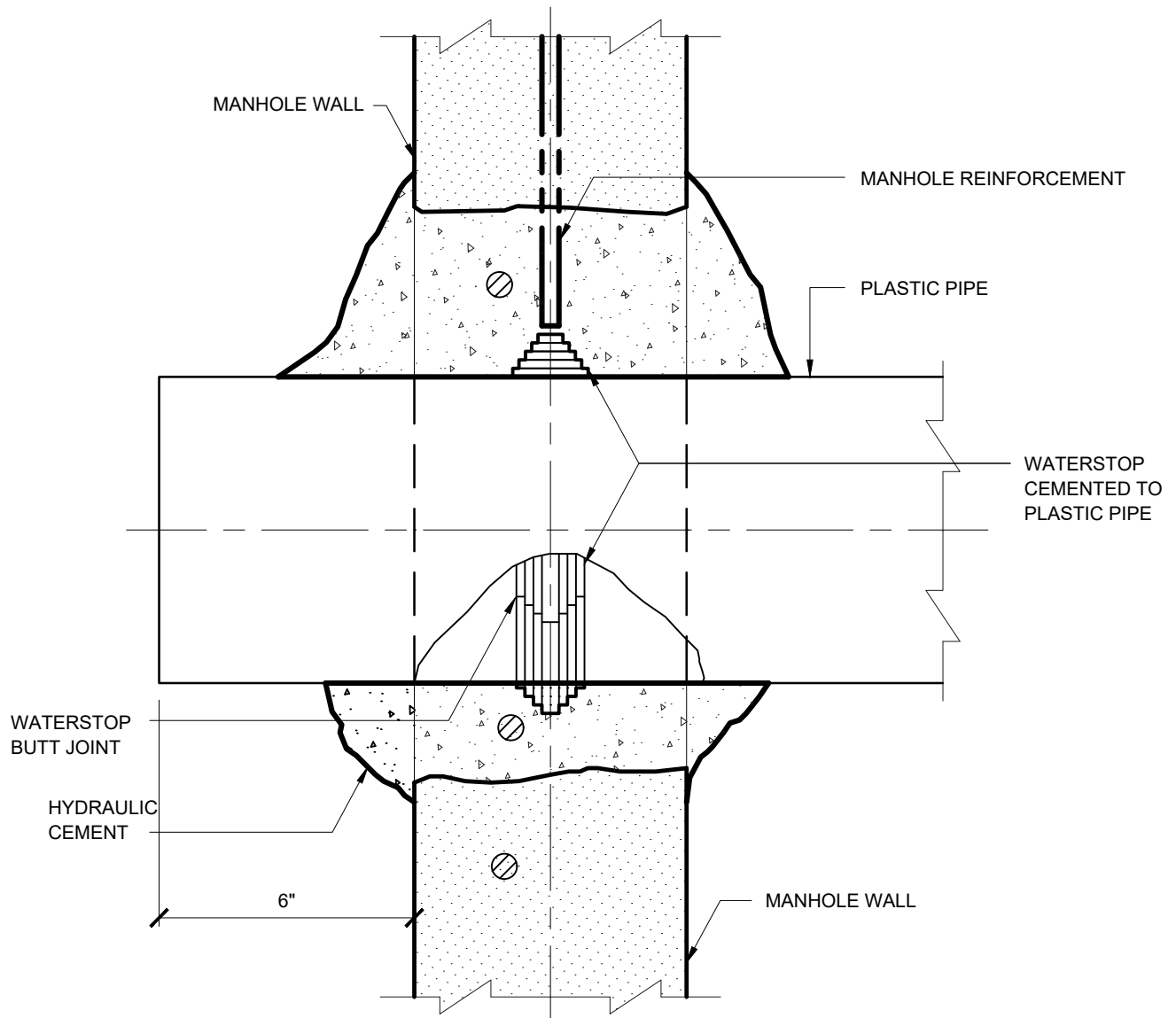
CASE II: MANHOLE IN EASEMENT OUTSIDE OF ROADWAY

NO SCALE

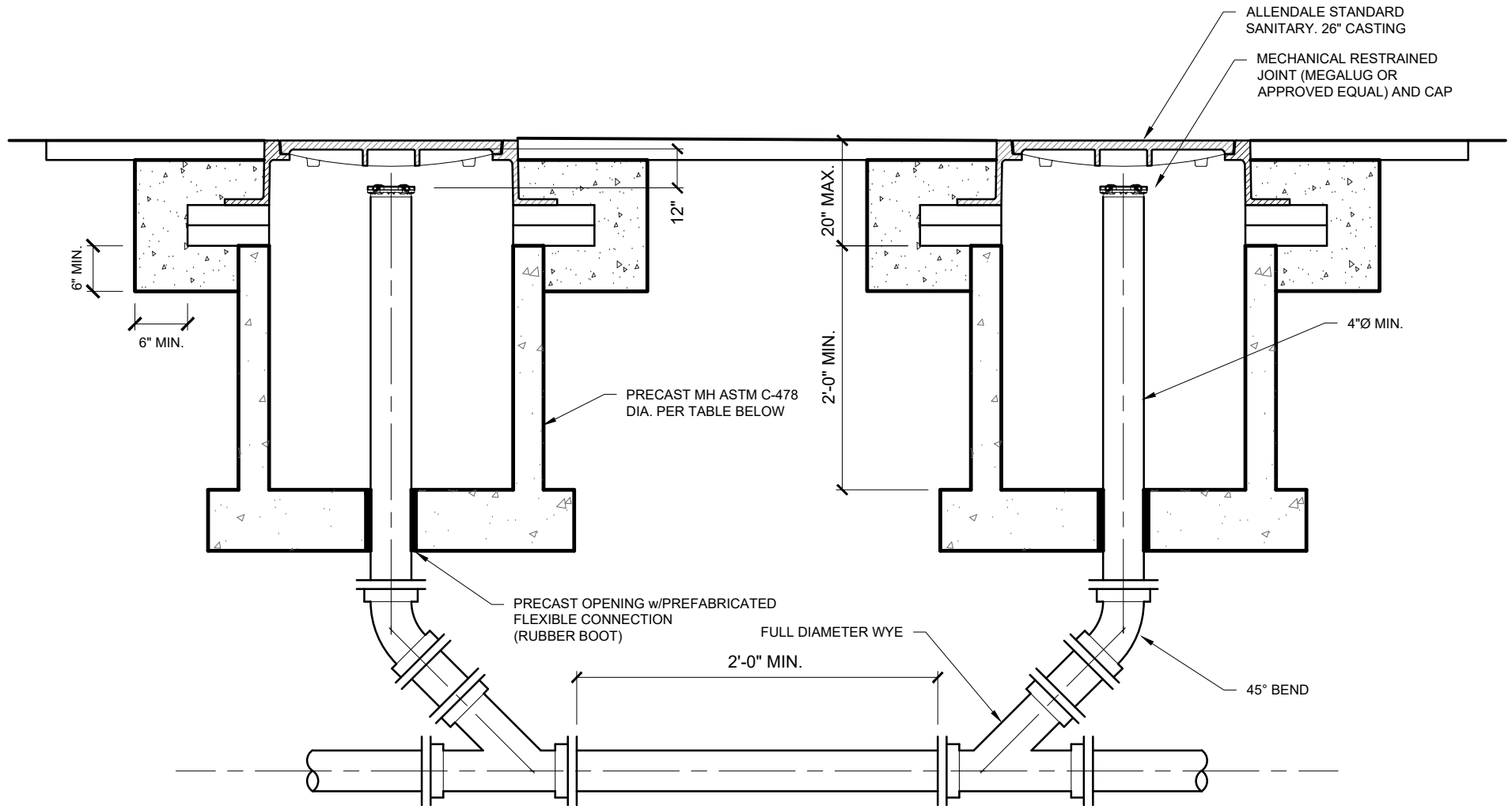
STANDARD SANITARY MANHOLE CASTINGS



WATER TIGHT MANHOLE COVER



PLASTIC PIPE MANHOLE JUNCTION



TWO-WAY FORCEMAIN CLEANOUT

SCALE: NOT TO SCALE

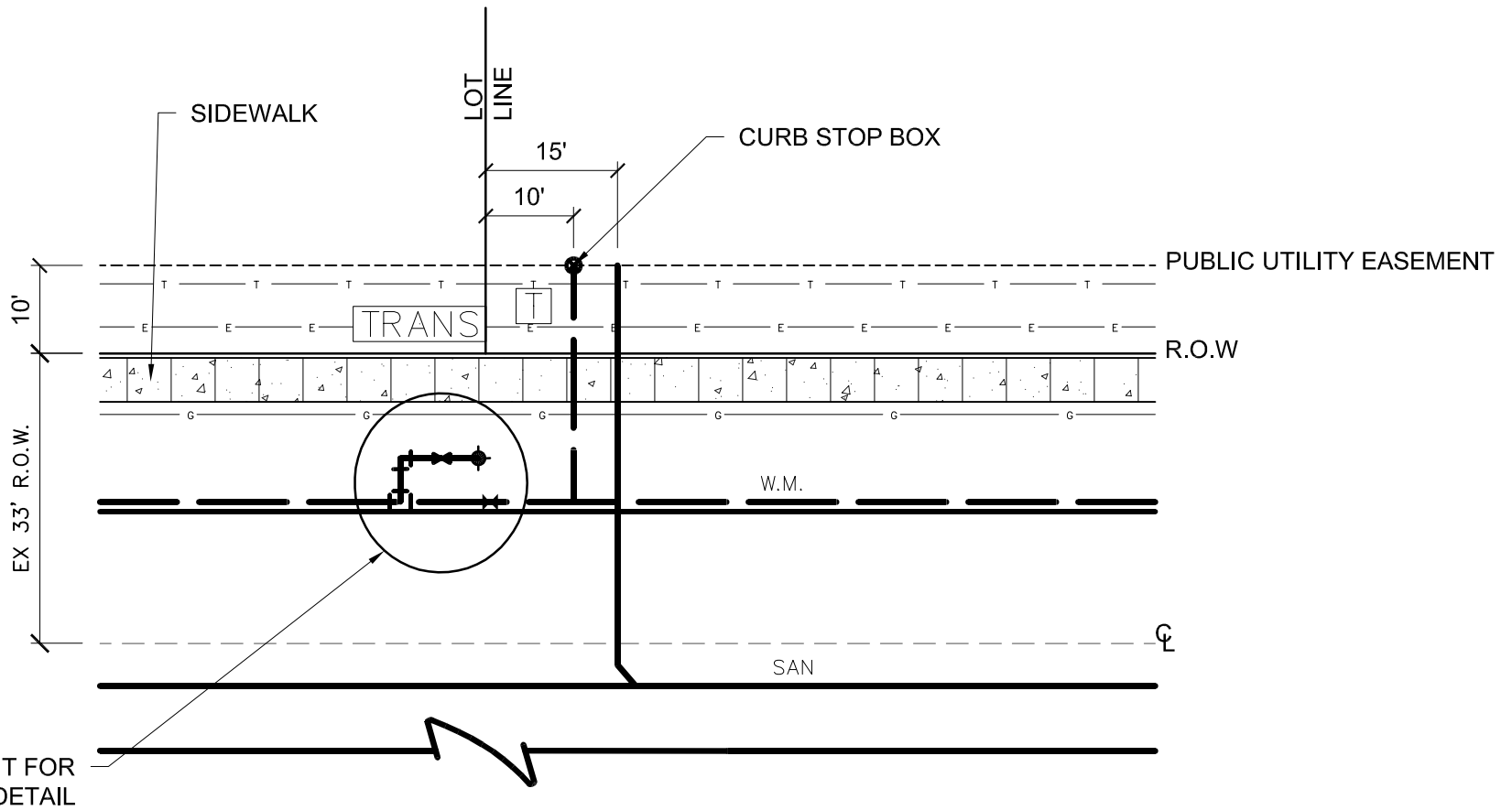
NOTES:

* ADDITIONAL DEPTH MAY BE REQUIRED BY OTTAWA COUNTY ROAD COMMISSION IF LOCATED WITHIN THE ROADWAY

MINIMUM CLEAN OUT DIAMETER BY PIPE SIZE

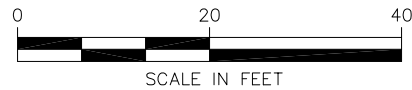
PIPE SIZE	DIA.
LESS THAN 10"	2'-0"
10" OR GREATER	4'-0"

STANDARD RISER DETAILS



UNDERGROUND UTILITIES

DRAWING TO SCALE



LEGEND

— E — E — Electrical
— T — T — Telephone
— G — G — Gas

[T] Telephone Pedestal

[TRANS] Transformer



MANHOLE FINAL INSPECTION PUNCH LIST

- ☐ Verify specification for correct casting.
- ☐ Record depth of all inverts to top of casting.
- ☐ Verify chimney adjustment rings are completely cemented in place and plaster coated.
- ☐ Verify casting is centered in the opening and completely cemented in place with no voids between casting and top of chimney (check maximum dimensions – see manhole detail).
- ☐ Cement lift holes and all penetrations.
- ☐ Verify pipe penetrations are properly sealed.
- ☐ Flow lines are completed and smooth with no high or low spots.
- ☐ Flow line is poured up to spring line or ½ the diameter of pipe.
- ☐ Benches sloped to flow line at 1" per foot minimum.
- ☐ All voids in walls and bottom are cemented.
- ☐ Manhole steps and bottom are clean of concrete, bituminous, dirt, debris, etc.
- ☐ Verify slope is correct from proposed upstream to down-stream inverts. Must have a minimum of 0.1 feet of elevation drop across inverts.
- ☐ Casting has been properly adjusted prior to final top course (check tilt to match pavement cross slope).
- ☐ Final inspection completed before final top course of asphalt is laid.

RECOMMENDED SAFETY CHECK LIST (may not be all-inclusive)

1. Use vehicle to protect yourself from traffic.
2. Use construction cones on street with traffic (4 minimum)
3. Always wear reflectorized safety vest.
4. Follow Confined Space Permitting & Entry Procedures if entering a manhole.

SECTION 33 32 05

SUBMERSIBLE DUPLEX PUMP STATIONS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes all work associated with submersible pump stations and their associated mechanical, electrical, and structural components.
- B. Definitions:
 - 1. Pavement structure: Any combination of subbase, aggregate base, base course, leveling course and surface course, including shoulders, placed on subgrade.
 - 2. Permanent pavement: All improved pavement surfaces above the quality of treated or untreated gravel.
 - 3. Subgrade: That portion of the earth grade upon which the pavement structure is to be placed.
 - 4. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.
 - 5. Base course: The layer of specified or selected material of designed thickness placed on a subbase or a subgrade to support leveling and surface courses.
 - 6. Leveling course: Layer of specified material placed on the base course in preparation for the surface course.
 - 7. Surface course: The top layer of a pavement structure.
 - 8. Bond Coat: Asphalt emulsion used to enhance the adhesion between HMA courses.
 - 9. Maximum Specific Gravity of Asphalt (Gmm): The ratio of the weight in air of a unit volume of an un-compacted asphalt mixture to the weight of an equal volume of gas free distilled water at a given standard temperature.
 - 10. Maximum density (soils): Maximum unit weight of soil material according to Modified Proctor Method ASTM D1557.
 - 11. Density Control Target: Target density of a HMA mixture determined by multiplying the Gmm times the density of water (62.4lb/ft³).
- C. Electrical Service Arrangement:
 - 1. Contractor shall make arrangement with electric utility on the Owner's behalf to provide electric service to the new pump station building. All costs associated with this utility work shall be paid for by the CONTACTOR.
 - 2. Contractor shall be required to provide any necessary temporary power during construction to facilitate construction.
 - 3. Contractor shall obtain a meter base from the utility and install as shown on plans.
- D. Natural Gas Service:
 - 1. The Contractor shall arrange for the installation of natural gas service for the generator set (where applicable) on the Owner's behalf. All costs associated with this natural gas service will be paid for by the Contractor. All process piping, pressure reducing regulators and connections between the natural gas service and the generator shall be provided by the Contractor.
 - 2. Contractor to notify the Township when meter installation occurs.
 - a. Township shall be onsite for meter installation.

E. Operation:

1. All public sanitary sewer pumping stations will be operated by the Township and designs must be submitted to approved by the Township's Engineer prior to construction.
2. For structures incorporating a grinder pump, they must be located within the dwelling and will be the responsibility of the property owner.

1.02 GENERATOR PERFORMANCE CRITERIA:

- A. Generator shall be able to start (X) X HP, 480 volt, three phase, XX HZ, NEMA Code G Motor on stater or VFD as determined by the project with a minimum X KW Auxiliary load and start a second XHP, 480 volt, three phase, XX HZ code G motor on a full voltage starter with first motor running, at 20% instantaneous voltage dip or less.

1.02 REFERENCES:

- A. The work of this Section shall comply with the following:
1. ACI – American Concrete Institute Manual of Concrete Practice:
 - a. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - b. ACI 318 – Building Code Requirements for Reinforced Concrete.
 2. AWS - American Welding Society:
 - a. AWS D1.1 – Structural Welding Code - Steel.
 - b. AWS D1.4 – Structural Welding Code - Reinforcing Steel.
 3. CRSI Manual of Standard practice.
 4. ANSI C80.1, Specification for Rigid Steel Conduit, Zinc.
 5. ANSI C80.4, Specification for Fittings for Rigid Metal Conduit and for Electrical Metal Tubing.
 6. NEC 370, Outlet, Device, Pull and Junction Boxes, Conduit Bodies and Fittings.
 7. NEC 500, Hazardous [XXXXXX] Locations, Classes I, II, and III; Divisions 1 and 2.
 8. NEC 501, Class I Locations.
 9. CAS 282 - Emergency Electrical Power Supply for Buildings.
 10. National Electric Code 1999 – Articles 517, 700, 701, and 702 pertaining to construction and installation of emergency and standby systems.
 11. NFPA110 – Emergency and Standby Power Systems.
 12. NEMA Standard Publication No. 250 – Enclosures for Electrical Equipment (1000 Volts maximum).
 13. IEC8528 Part 4 – Control Systems for Generator Sets.
 14. UL2200 – The generator set shall be listed to UL2200 or submit to an independent third-party certification process to verify compliance as installed.
- B. MDOT – Michigan Department of Transportation, "2022 Standard Specifications for Construction."
- C. ASTM – American Society of Testing Materials, latest edition.
- D. MTM – Michigan Test Methods, latest edition.
- E. National Board of Fire Underwriters (NBFU).
- F. National Electrical Contractors "Standard of Installation" (NECA).
- G. Institute of Electrical & Electronic Engineers (IEEE).
- H. National Electrical Code (NEC).

- I. National Electrical Manufacturers Association (NEMA).
- J. Michigan Occupational Safety and Health Administration (MIOSHA).
- K. National Fire Protection Association (NFPA).
- L. Underwriters' Laboratories, Inc. (UL).
- M. Ottawa County Road Commission.
- N. Allendale Charter Township Standard Construction Requirements.
 - 1. Division 01 – GENERAL REQUIREMENTS
 - 2. 31 23 00 – EXCAVATING, BACKFILLING AND COMPACTING
 - 3. 32 29 00 – SURFACE PROTECTION AND RESTORATION

1.03 PRECAST CONCRETE DESIGN REQUIREMENTS:

- A. Precast concrete manufacturer:
 - 1. Responsible for the structural design of:
 - a. Precast concrete units.
 - b. Hollow core plank headers.
- B. Precast concrete units design calculations:
 - 1. By a Registered Professional Engineer licensed to practice at the location of the Work.
 - 2. In accordance with ACI 318.
 - 3. For design loads as follows:
 - a. Dead loads of precast concrete units.
 - b. Uniform live loads as indicated on the Drawings.
 - c. Concentrated dead and live loads from other structural members, equipment, and lifting devices.
 - d. Wind loads as indicated on the Drawings.
 - e. Topping loads.
 - f. Drifted snow loads.

1.04 PUMP DESIGN AND PERFORMANCE REQUIREMENTS:

- A. General:
 - 1. A minimum of two pumps are required at each pump station. Pumps within an individual pump station shall be identical.
 - 2. Pumps shall be specifically made for raw sewage pumping applications.
 - 3. Each pump shall be equipped with a submersible motor and discharge base elbow.
 - 4. Pumps shall operate between the maximum and minimum system head curves provided within the pump manufacturers recommended limitation of the pump without excessive vibration and any cavitation.
 - 5. Each pump shall be automatically and firmly connected to the discharge connection, guided by no less than two guide rails extending from the top of the station to the discharge connection.
 - 6. The pump connection to the discharge shall be watertight.
 - 7. All equipment and materials placed inside the pump station shall be UL or FM listed for use in NEC Classified Class 1, Division 1, Group D, hazardous locations.
 - 8. All fasteners and miscellaneous metals shall be non-magnetic stainless steel.

B. Non-Clog Pumps:

1. When non-clog pumps are supplied, the design point must be greater than or within 50% of the Best Efficiency Point.

C. Performance criteria:

1. LIFT STATION NAME

- | | |
|-----------------------------|-----------------------|
| a. Pump Type: | Non-Clog |
| b. Design point: | [XXX] gpm @ [XX]' TDH |
| c. Minimum Pump Efficiency: | [XX.X] % |
| d. Motor Size: | [XX] Horsepower |
| e. Nominal Rotative Speed: | 1800 RPM |
| f. Motor Voltage: | 480 V, 3 phase |

1.05 SPECIAL PROVISIONS:

A. Wireless Internet Service Provider (WISP):

1. This Section includes, but is not necessarily limited to, the furnishing and installation of Wireless Internet Service (WIS), Wireless Internet Service Modem and WIS antenna and antenna cable at Lift Station Control Panel.
2. All costs associated with WISP Installation and monthly monitoring fees will be paid for by Owner.
3. Contractor shall coordinate installation of WIS with WISP and Owners Systems Integrator (OSI) on Owner's behalf.
4. WISP shall assign the RTU a static IP address and communications from the RTU to the MTU at the WRRF shall be Ethernet.
5. OSI responsible to work with WISP to establish reliable wireless communications between lift station and existing MTU at WRRF.

1.06 OWNERS SYSTEMS INTEGRATOR:

A. Contractor shall engage in the services of the Owner's Systems Integrator in a separate contract on the Owner's behalf.

1. OSI contact is Windemuller Automation, Wayland Michigan. (616) 877-8770.
2. OSI is responsible for all hardware and programming modifications at existing WRRF MTU and providing all WRRF OIT and Lift Station HIM and PLC programming. This requirement shall include any necessary program updates for existing Owner maintained programming software to accommodate the new lift station control panel.
3. OSI is responsible to work with Contractor to debug system at all lift station start up and to provide a working SCADA system as described in this specification and the drawings.
4. OSI shall provide a cellular network modem, surge arrestor, antenna cable and antenna.
5. If Windemuller Automation is not the lift station control panel supplier, Township approved builder to pay for install and wiring for communications with the OSI.

1.07 LIFT STATION CONTROL DESCRIPTION (PLC AND SCADA PROGRAMMING BY OSI):

A. OSI contact is Windemuller Automation, Wayland Michigan. (616) 877-8770.

B. Level Control:

1. The pumps shall be controlled by a radar level transmitter installed in the wet well and a programmable logic controller (PLC) and a Human Machine Interface (HMI). One float shall serve as a back-up control system and one float for the Wet Well Level High Alarm. All control circuits in wet well shall be intrinsically safe.

2. Sequence of Operation:

- a. All elevations and setpoints described in operations sequence below shall be operator adjustable from the HMI on the front of the pump station control panel.
 - 1) Scale the level transducer to "[X.XX-XX.XX] feet." All setpoint adjustments shall be in 0.01' increments.
- b. Operations Sequence:
 - 1) As the water level in the wet well rises to the elevation shown for "Lead Pump On," the first pump shall be activated. The first pump shall stay on until the level is pumped down to first pump off level.
 - 2) If the water level in the wet well rises to the elevation shown for "Lag Pump On," the second pump shall be activated. The second pump shall stay on until the level is pumped down to the second pump off elevation.
 - 3) Program an operator adjustable on and off setpoint level icon in feet for both pumps. The titles of each and shall be:
 - a) Lead Pump "On [X.XX] Feet, Off [X.XX] Feet."
 - b) Lag Pump "On [X.XX] Feet, Off [X.XX] Feet."
 - 4) If the water level in the wet well, indicated by the radar level transmitter, rises to the high-water level, an alarm shall be activated. Program an operator adjustable trip and reset setpoint level in feet for the high-level alarm. The titles shall be:
 - a) High Level Alarm "Trip [X.XX] Feet, "Reset [X.XX] Feet" will be set at the plat SCADA and indicated locally.
 - 5) If the water level in the wet well, indicated by the radar level transmitter, decreases to the level shown as low level, the low-level alarm will be activated. Low level alarm shall provide redundant "Off" for all pumps. Program an operator adjustable trip and reset setpoint level in feet for the low-level alarm. The titles shall be:
 - a) Low Level Alarm "Trip [X.XX] Feet, "Reset [X.XX] Feet" will be set at the plat SCADA and indicated locally.
 - 6) A backup level control selector switch using 1 float will serve as a redundant level control in the event of a PLC failure. Program the Variable Frequency Drives (VFD) digital input to run at 60Hz based on the backup level control switch "enabled" position. The back up level control shall start both pumps in sequence with a short time delay as shown on drawings. The first pump start is activated by the Backup High Level Float. The second pump start is activated by an On-Delay Timer.
 - a) Backup High Level Float FS-1 "Trip [X.XX] Feet."
 - b) Pump(s) off shall be activated by an Off-Delay timer.
- c. Automatic Mode Speed Control:
 - 1) Both pumps are controlled by variable frequency drives (VFD) and the PLC when the HMI HAND-OFF AUTO switch is placed in the AUTO mode of operation. Program the PLC analog output range and existing reused VFD input range to 30 Hz equals minimum speed or 4 mA speed reference input and 60 Hz equals maximum speed or 20 mA speed reference input.
 - 2) Program an operator adjustable minimum and maximum speed setpoint level icon in feet for both pumps. The titles of each shall be:
 - a) Speed One Pump, "Min Speed [X.XX] Feet, Max Speed [X.XX] Feet ."
 - b) Speed Two Pumps, "Min Speed [X.XX] Feet, Max Speed [X.XX] Feet."
 - 3) Regardless of how many pumps are being called to run all pumps will run at the same speed. As the wet well level increases the output speed will increase proportionally between the minimum speed setpoint and maximum speed setpoint. As the liquid level decreases, the speed signal shall be reduced proportionally until the minimum speed setpoint is reached.

- 4) Minimum speed(clamping) shall be set in the PLC so that the VFD analog input signal matches the PLC analog output signal. Owner shall adjust the minimum speed as pump efficiency degrades over time.
 - 5) Program a 24-hour clock in the PLC that at [XX:XX] hours adjustable, will run whichever pump is online at 100 percent until it reaches the off-set point. Then reset the 24-hour clock and begin the cycle again. This will prevent a single pump from running more than one day and not exercising the other pump. This also serves to evacuate the force main of any solids that may have settled during the 24-hour period.
 - d. Hand Mode Speed Control:
 - 1) If either of the pumps are selected to be operated in HAND mode, this shall force the PLC output to 20 mA so the selected pump will run at full speed.
 - e. Pump Alternation:
 - 1) Both pumps shall be automatically alternated in sequence as determined by the automatic alternator in the PLC and the HMI screen. Program a "Next to Run" indicator on the HMI screen. In the Manual Mode the operator will select what the fixed sequence shall be. This permits a pump to be moved to a lesser priority in the sequence while they may be taken out of service. In the manual mode the operator will select between 1-2 or 2-1 sequence on the HMI.
 - 2) The two modes of operation for the alternator shall be "Automatic" and "Manual."
 - 3) Selecting Hand or Off in the HMI HOA shall disable Alternation and put the opposite pump in lead.
- C. Hard Wired Pilot Devices:
1. Provide the following hard wired pilot devices on the control panel door front
 - a. Back Up Level Control Red Indicator Light
 - b. High Level Alarm Float Red Indicator Light
 - c. Loss of Phase Red Indicator Light
 - d. Alarm Test Pushbutton
 - e. Alarm Reset Pushbutton
 - f. Pump Overtemperature Red Indicator Light (each pump)
 - g. Pump Seal Failure Indicator Light (each pump)
 - h. Hand-Off-Remote Switch (each pump).
 - i. Low Level Alarm Float Red Indicator Light
 - j. Any additional lights or selector switches shown on drawings.
- D. HMI Pilot Devices and Indicators:
1. Program the HMI with the following pilot devices and operator adjustable control parameters.
 - a. HAND-OFF-AUTO switch (each pump).
 - b. Run Indicator (each pump).
 - c. Elapsed Time Meter (each pump).
 - d. Lead Lag Selector
 - e. Next To Run Indicator
 - f. Pump On and Off Setpoints
 - g. Speed Control Minimum and Maximum Level Setpoints
 - h. Wet Well Level
 - i. Amps Indicator (each pump).
 - j. 24 Hour Flushing Clock
 - k. Manual Speed Settings (used with HMI HAND Mode).
 - l. HAND-OFF-REMOTE in REMOTE (each pump).
 - m. ATS in Emergency
 - n. ATS in Normal

- o. Generator Running
 - p. All setpoints described in the Control Description.
- E. Alarm System:
1. Local Alarms: Program the HMI with the following conditions.
 - a. High wet well water level.
 - b. Power outage.
 - c. Low wet well water level.
 - d. Pump Fault (each pump).
 - e. Lag Pump Ran (anytime the second pump is called to run).
 - f. Generator Fault
 - g. Seal Fail (both pumps)
 - h. Overtemperature (both pumps).
 2. Station Alarms: The exterior station alarm light shall be energized by the following:
 - a. High wet well level.
 - b. Level Controller Common Alarm.
 - c. Low wet well level.
 3. Remote Monitoring: The following conditions shall be monitored remotely by the SCADA at the WRRF for the pump stations. Program the existing SCADA dialer so the Owner has the ability to select which of the alarms they will receive a call out for.
 - a. High Wet Well Level Alarm
 - b. Phase monitor
 - c. Low Wet Well Level alarm
 - d. Run Indication (each pump)
 - e. Hours (each pump)
 - f. Amps (each pump)
 - g. Pump Hand-Off-Remote in Remote (each pump)
 - h. Back-Up Control On Alarm.
 - i. Lag Pump Ran Alarm
 - j. Wet Well Level
 - k. ATS Status
 - l. Generator Running
 - m. Generator Warning
 - n. Generator Alarm
 - o. Communication Fai
 - p. Radar Fail
 - q. Pump Fail to Run (each pump)
 - r. Pump High Temperature (each pump)
 - s. Pump Seal Fail (each pump)
 - t. VFD Fault (each pump)
 - u. Power Fail to Panel
 - v. UPS in Alarm

1.08 ARC FLASH STUDY AND LABELING

- A. Provide a field arc flash study for Lift Station.
- B. Provide Arc Flash Labels Warning Labels on all meter socket enclosures, disconnect switch or circuit breaker enclosures, automatic transfer switches, switchboards, panelboards, load centers, industrial control panels, motor starters and variable frequency drives in accordance with NEC 110.16 and NFPA 70.
- C. Provide Field Marking Labels on all meter socket enclosures, disconnect switch or circuit breaker enclosures, switchboards, panelboards, load centers, industrial control panels,

motor starters and variable frequency drives in accordance with NEC 110.24 and NFPA 70.

- D. Field marking labels shall include, but not be limited to, the maximum available fault current, the date the fault current calculation was performed, name of contractor performing the available fault current calculation, name of the equipment, arc flash boundary, PPE requirements, shock risk when cover is removed, glove class, limited approach distance, restricted approach distance and calculated incident calories.

1.09 SUBMITTALS:

- A. Submit materials, manufacturer, operation and maintenance data, shop drawings, and record drawings for:
- B. Pre-Construction:
 - 1. Pump & Motor:
 - a. Pump manufacturer, model & materials of construction.
 - b. Motor manufacturer, model, horsepower, materials of construction, insulation, speed, efficiency, voltage, NEMA classification & service factor.
 - c. Pump curve including speed, efficiency, horsepower, net positive suction head needed.
 - d. Dimensional drawing of the two-pump system including the distance between pumps, guiderails, discharge connection size, and minimum access door size.
 - 2. Piping, Fittings and Valves:
 - a. Manufacturer, material & AWWA/ASTM designations.
 - b. Joint construction details
 - 3. Individual Structure Build Sheets:
 - a. Top, bottom, and invert elevations.
 - b. Pipe orientation.
 - c. Individual precast concrete section dimensions.
 - d. Prefabricated rubber boot material & manufacturer.
 - e. Casting manufacturer & model.
 - 4. Access Doors:
 - a. Manufacturer, model, size, materials of construction.
 - b. Clearly identify optional features to be provided.
 - c. Detailed dimensional drawing.
 - 5. Inside Drop:
 - a. Manufacturer, model, materials of construction & dimensional drawing.
 - 6. Pressure Gauges:
 - a. Manufacturer, model, size, and materials of construction
 - 7. Structural Precast Concrete Shed:
 - a. Product Data:
 - 1) Cut sheets and promotional brochures for the product.
 - 2) Certification that all ASTM specifications specified are met.
 - 3) Door and hardware product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions, and finishes.
 - b. Shop Drawings:
 - 1) Submit dimensional drawings of each precast panel indicating reinforcing steel and its location along with concrete dimensions and connection hardware detail.
 - 2) Supporting design calculations shall be sealed and signed by a professional engineer licensed to practice in the state of Michigan.
 - 3) Door hardware schedule. APU will provide entry system for door.

- c. Building Panel Samples:
 - 1) Submit sample of precast panels.
 - 2) Submit sample of door paint color selections.
 - 8. HMA Pavement:
 - a. Asphalt Mix Designs: Provide job-mix formula (JMF) prepared by independent lab or approved by MDOT for hot mixed asphalt, base, leveling and surface courses to Engineer two weeks prior to paving. The job-mix formula shall include, at a minimum, the Gmm, Gmb, Gb, Gse, Gsb, and parameters listed in Tables 1 & 2 of this specification.
 - b. Certification of quality by producer for the following:
 - 1) Aggregates
 - 2) Asphalt cement
 - 3) Pavement marking material
 - 4) Prime coat
 - 5) Bond coat
 - 9. Concrete Shed Pad:
 - a. Provide shop drawings of pad layout.
- C. Electrical Submittals:
 - 1. Variable Frequency Drives
 - a. Provide detailed product data on each type of variable frequency drive controller proposed. Data to be included:
 - 1) Design type with components used.
 - 2) Performance details including allowable electrical input parameters, speed regulation, power factor, harmonic output effect of harmonic to input line, operating temperature, required environment, minimum and maximum speed setting, linear acceleration and deceleration setting, other adjustments.
 - 3) Physical details including dimension and weights.
 - 4) Statement of warranty.
 - 5) Location of nearest in-warranty and out-of-warranty trained service labor and details of cost. Also include details on parts availability.
 - 6) Complete circuit diagrams depicting design control circuit wiring diagrams for the lift station. MFR Standard wiring diagrams will be rejected. At a minimum, include ladder diagrams with rung numbers, conductor and terminal number, coil function description, contact reference and cross reference, timer settings device function, fuse or breaker sizes, and one (1) line diagram.
 - 7) Complete spare parts listing with present current pricing
 - b. Qualifications:
 - 1) Submit resumes and qualifications of the Field Service Engineer(s) performing start up, field testing, training, and certifications as specified below.
 - 2. Electrical Equipment:
 - a. Provide Shop Drawings and Manufacturers Data for:
 - 1) Float switches and Rada.
 - 2) All equipment and electrical enclosures.
 - 3) Control Enclosures.
 - 4) Transformers.
 - 5) Motor starters.
 - 6) Wiring devices.
 - 7) Service power lightning arresters.
 - 8) Surge protection.
 - 9) Electrical service equipment.
 - 3. Lift Station Control Panel:
 - a. Provide Schematics and Wiring Diagrams using quality control manufacturer's standards with ladder diagram type, numbered logic rungs, numbered wires, and

terminations, contact references by type and line, detailed bill of material and equipment layout showing all components for the following:

- 1) Pump control systems.
- 2) Equipment enclosures.
- 3) Lift station control circuitry.
- b. Proposed wiring color code.
- c. Provide Operations and Maintenance Data from the Control Panel.
4. Generator and Automatic Transfer Switch:
 - a. Generator:
 - 1) Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
 - 2) A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
 - 3) Manufacturer's certification of prototype testing.
 - 4) Manufacturer's published warranty documents.
 - 5) Dimensional drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
 - 6) Schematic wiring diagram showing all external connection required with field wiring terminals marked in a consistent point-to-point manner.
 - 7) Manufacturer's installation instructions.
 - 8) Sound level data.
 - 9) Dimensioned drawings for the generator cabinet, automatic transfer switch cabinet and the Outer Control Enclosure
 - b. Certifications:
 - 1) Provide generator set certified test record of the final production testing prior to shipping as follows:
 - a) Single-step load pick-up
 - b) Transient and steady state governing
 - c) Safety shutdown devices testing
 - d) Voltage regulation
 - e) Rated power
 - f) Maximum power
 - c. Operation & Maintenance Manual:
 - 1) Provide four hard copy sets and one in .pdf format.
 - 2) The manuals shall include outline, interconnection, wiring, and control drawings accurately describing the equipment provided and system operation.
 - 3) Provide ladder logic for all programmable logic controllers in the system.
 - 4) Include operators and spare parts manuals for all system equipment.
 - 5) Prior to completion of Contract, provide three (3) hard copies and one (1) pdf of product data specified above plus detailed wiring and connection data.

1.10 QUALITY ASSURANCE:

- A. Factory Testing:
 1. Test each pump before shipment. Furnish factory certified performance curves for each pump based on test results. Required data across the entire pump curve include:
 - a. Flow
 - b. Head
 - c. Rotation speed
 - d. Amp draw
 2. Submit certified performance curves for review in accordance with Submittals.

- B. Precast concrete producer shall demonstrate adherence to the standards set forth in the National Precast Concrete Association Quality Control Manual. Precast concrete producer shall meet requirements written in subparagraph 1 or 2.
 - 1. NPCA Certification – The precast concrete producer shall be certified by the National Precast Concrete Association's Plant Certification Program prior to and during production of the products for this project.
 - 2. Qualifications, Testing, and Inspection
 - a. The Precast concrete producer shall have been in the business of producing precast concrete products similar to those specified for a minimum of 5 years.
 - b. The Precast concrete producer shall show that the following tests are performed in accordance with the ASTM standards indicated. Tests shall be performed for each 150 cu. yd. of concrete placed, but not less frequently than once per week.
 - 1) Slump: C143
 - 2) Compressive Strength: C31, C192, C39
 - 3) Air Content (when air-entrained concrete is being used): C231 or C173
 - 4) Unit Weight: C138
 - c. The Precast concrete producer shall provide documentation demonstrating compliance with this subparagraph.
 - d. The Owner may place an inspector in the plant when the products covered by this specification are being manufactured.
- C. Generator and Automatic Transfer Switch:
 - 1. All equipment shall be new, UL listed, factory tested, and delivered ready for installation.
 - 2. Manufacturer's qualifications: Firm regularly engaged in manufacturing of outdoor natural gas engine-driven generator unit and ancillary equipment of type, rating, and characteristics required, whose products have been in satisfactory use in similar operation for not less than five years.
 - 3. Installer's qualifications: Firm with at least five years of successful installation experience on project with outdoor natural gas engine-driven generator unit similar to that required for this project.
 - 4. Supplier's qualifications: Firm shall be the manufacturer's authorized distributor, who shall furnish all emergency power system equipment, perform initial start-up service, conduct field acceptance testing, provide training, and warranty services. The supplier shall have 24-hour service availability and factory trained service technicians qualified to perform warranty service on all products provided. Suppliers must have a maintenance facility within 120 miles of the jobsite.
 - 5. Provide 100 percent parts, labor and travel expenses, two years warranty, from the start-up date, for all products against defects in materials, workmanship, and intended functions.
 - 6. Engines must be in current production by engine manufacturer (discontinued engines will be rejected).
 - 7. Gear reducing transmissions or devices that run engine at different RPM than alternator will not be accepted.

1.11 JOB CONDITIONS:

- A. Seasonal Limitations:
 - 1. Removal of permanent pavement: Unless otherwise specified, execute during the period from March 15 to October 15.
 - 2. Restoration of permanent pavement: Unless otherwise specified, execute during the period from April 15 to November 15.
- B. Clean up promptly following pavement installation.

- C. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent pavement installation is completed.
- D. Driveway Closing: Twenty-four (24) hour maximum. Provide proper notice to property owner.
- E. Allow access to the hot mixed asphalt plant for verification of mix proportions, aggregate gradations, and temperatures.

1.12 DELIVERY, STORAGE AND HANDLING:

- A. Protect all equipment during delivery and during storage on site. Store equipment on suitable blocking to maintain parts clear of the ground and cover to insure drainage of all rainwater.
- B. Exercise and lubricate equipment during storage in accordance with manufacturer's recommendations.
- C. Handling
 - 1. Products shall be stored, handled, shipped, and unloaded in a manner to minimize damage. Lifting holes or inserts shall be consistent with industry standards. Lifting shall be accomplished with methods or devices intended for this purpose.

1.13 PERMITS, INSPECTIONS, AND UTILITY CONNECTIONS:

- A. Obtain all necessary permits and pay all fees in connection with all permits, inspections, and approval by the proper authorities in local jurisdiction of such work. Final inspection by the Owner will not occur until necessary certificates of satisfactory inspection are received.

PART 2 - PRODUCTS

2.01 WET WELL, VALVE, AIR RELIEF, CLEANOUT, AND METER CHAMBERS:

- A. Construction:
 - 1. Pre-cast reinforced concrete manhole sections shall be in conformance with ASTM C478 with circular reinforcement, modified for "O" ring gaskets.
 - 2. Base slab shall be integrally cast with the barrel of the manhole and reinforced in accordance with the drawings.
 - 3. Caisson bottom section (if applicable) shall be constructed with steel driving shoe.
 - 4. Top slab shall be pre-cast concrete formed to be placed on top of the manhole barrel sections. Top slab shall be designed for H-20 loading. Coordinate placement of access doors.
 - 5. Manhole Steps (Valve, Air Relief, and Meter Chambers only):
 - a. Polypropylene encapsulated steel.
 - b. Dimensions: 10-inches wide, 4-inch minimum clear tread depth, spaced 16 inches apart.
 - c. Steps shall be in accordance with:
 - 1) ASTM C 478
 - 2) ASTM D 4101 (polypropylene)
 - 6. Provide Raven 405 coating system in wet well structure.
 - 7. Wet well minimum diameter is 7'

B. Valve Chamber:

1. Each valve chamber shall consist of a valve vault, one-way force main cleanout manhole, two (2) isolation valves, and bypass connection.
2. Each station shall have a bypass structure located on the influent pipe prior to the wet well.

2.02 WET WELL INSIDE DROP:

A. Construction:

1. Wet well inside drop shall be constructed of marine grade fiberglass with a force line hood attachment.
2. Drop bowl back shall be constructed to conform to the diameter of the wet well.
3. Drop pipe shall be ASTM D3034 PVC SDR 35 pipe. Connection to drop bowl shall be hard piped.
4. Support drop pipe to wet well wall at 5' intervals, two supports minimum, with clamps specifically designed for such situations. Clamps shall be non-magnetic stainless steel.
5. Trim drop pipe per the design drawings and cut v-notch in incoming gravity flow sewer pipe per inside drop manufacturer's recommendations.
6. Inside drop shall be as manufactured by RELINER®/Duran Inc. or approved equal.
7. Wet well shall have one gravity sewer connection.

2.03 PIPING SYSTEMS:

A. Submersible Pump Discharge Piping:

1. Pipe:
 - a. Ductile Iron: ANSI A21.50 and ANSI A21.51; Class 52.
 - b. Cement Lining: ANSI A21.4, AWWA C-104 standard thickness for ductile iron pipe and fittings.
2. Joints:
 - a. Buried: Restrained Mechanical ANSI A21.11.
 - 1) Megalug by EBBA Iron Sales, Inc. or approved equal.
 - b. Exposed: Flanged, Class 125, ANSI B16.1/AWWA C-115.
3. Fittings:
 - a. Ductile Iron AWWA C-110/ANSI A21.10.
 - b. Cement lined as specified for pipe above.
4. Valves:
 - a. Gate:
 - 1) Resilient-wedge gate valves: ANSI/AWWA C509 or C515.
 - a) Non-rising Stem (NRS)
 - b) Wrench nut: 2-inches square with extensions as indicated on the drawings.
 - c) Open Left (counterclockwise)
 - d) Flanged ends
 - e) Stem Seal: O rings
 - b. Check:
 - 1) Valmatic swing-flex check valve with backflow actuator and mechanical indicator
 - c. Air Release: Valmatic Model #801A WW single body combination air valve
 - 1) 2" NPT connection.
 - 2) Epoxy coated
 - d. Coatings:
 - 1) All exposed pipe outside of the wet well shall be painted with Tnemec 33GR Gray.

2.04 PRESSURE GAUGES:

- A. General: Pressure gauges to be mounted on each pump discharge line, as shown on the drawings.
 - 1. Quantity: Two (2) required at each pump station.
 - 2. Gauge accuracy shall be 1% of full scale.
 - 3. Pressure gauge case shall be constructed of stainless steel.
 - 4. Gauge window shall be shatterproof glass and minimum 4" face.
 - 5. Gauge shall be liquid (glycerin) filled.
 - 6. Connection size shall be 1/2" NPT.
 - 7. Gauge shall be stem mounted with a lower connection location and oriented to be read from surface.
 - 8. Bourdon tube/socket material shall be 316 stainless steel / 316 stainless steel.
 - 9. Provide shut-off cocks, diaphragm seal protectors, and other appurtenances at each pressure gauge tap location as detailed on the Drawings.
 - 10. Pressure range dependent on force main discharge pressure at [XX] psi, with 5.0 psi figure intervals and 0.5 psi minor graduations for the Lift Station.
- B. Manufacturer and Model:
 - 1. Pressure gauges shall be Ashcroft® Duragauge® Type 1009 or approved equal.

2.05 PRECAST CONCRETE SHED:

- A. All lift stations shall have a precast concrete shed set on poured foundation that houses all electrical controls.
- B. Manufacturers:
 - 1. Approved Manufacturers. For the purpose of this specification the following manufacturers are considered capable of providing the precast concrete shed as specified:
 - a. Advanced Concrete Products Inc.
 - b. Quality Precast Inc.
 - c. Kerkstra Precast Inc.
 - d. Or Township approved equal.
- C. Design Requirements:
 - 1. Design Loads
 - a. Designed in accordance with latest versions of the Michigan Building Code and ASCE – 7.
 - b. Minimum loads:
 - 1) Wind Load: 130 MPH, Exposure Group "C"
 - 2) Life roof load: 60 PSF
 - 2. Minimum Interior Dimensions: 12'-0" Wide x 10'-0" Deep x 8'-0" Tall
- D. Foundation
 - 1. Precast shed to be installed on a poured foundation with finished floor.
- E. Finishes:
 - 1. Interior Finish: Smooth steel form finish. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be tolerated but no major imperfections, honeycombs or other defects will be permitted.
 - 2. Exterior Finish: Exposed aggregate. 17A limestone exposed by pressure washing.
 - 3. All lifting lug holes shall be grouted smooth after installation.

4. Interior and exterior caulking required at panel joint lines.

F. Accessories:

1. Door and Frame:

- a. Provide 6'-0" x 7'-0" double door and frame precast into wall panel.

- 1) Hollow metal doors:

- a) UL listed.
 - b) 18 Gauge galvanized steel.
 - c) Hardware:
 - (i) Classroom lockset keyed shall be provided by Owner.
 - (ii) Stainless steel hinges.
 - (iii) 4" wide aluminum threshold.
 - (iv) Weatherstrip between door and frame, door and door, door and floor.
 - (v) Provide astragal.
 - (vi) Door Stops.

- d) Frame:

- (i) UL Listed
 - (ii) 16 Gauge galvanized steel
 - (iii) Factory painted to match door
 - (iv) Keypad Supplied by Township

- e) Lift station door to face wet well and building wall behind the door shall be clear of any installation.

- f) Door color shall be Tnemec 32GR Light Gray or Equal.

- b. Passive Vents

- 1) Two passive vents shall be cast into wall panels with manually actuated dampers.
 - 2) Each vent shall be 16" x 4" minimum.
 - 3) Frame and screened shall be cast into the concrete and have a mesh opening sized to exclude insects.
 - 4) Locations:
 - a) Each vent shall be located in the center of the 10' wall section.
 - b) The bottom of the screen shall be located 7'-0" off the floor.

G. Materials:

1. Concrete:

- a. Concrete shall be a uniform mix of quality materials listed in Article 2.4. Mix proportions shall be determined by following the standards in ACI 318 Chapter 5. Recommendations for selecting proportions for concrete are given in detail in Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete (ACI 211.1). Recommendations for lightweight concrete are given in Standard Practice for Selecting proportions for Structural Lightweight Concrete (ACI 211.2).

- b. Water-Cement Ratio: 0.45 or less

- c. Air Content: Shall be within the limits give in Table 1.

Table 1: Total Air Content for Frost-Resistant Concrete		
Nominal Maximum	Severe Exposure	Air Content, %
Aggregate Size (Inches)		Moderate Exposure
3/8	6.0 to 9.0	4.5 to 7.5
1/2	5.5 to 8.5	4.0 to 7.0
3/4	4.5 to 7.5	3.5 to 6.5
1	4.5 to 7.5	3.0 to 6.0
1-1/2	4.5 to 7.0	3.0 to 6.0

*For compressive strengths greater than 5000 psi, air content may be reduced 1%.

- d. Compressive Strength: 5,000 psi minimum.
 - 2. Portland Cement: ASTM C150, Type I, II, III or V.
 - 3. Aggregates: ASTM C33 or C330.
 - 4. Water: Potable or free of deleterious substances in amounts harmful to concrete or embedded metals.
 - 5. Admixtures:
 - a. Air-entraining: ASTM C260
 - b. Water reducing, retarding, accelerating, high range water reducing: ASTM C494
 - c. Pozzolans, fly ash and other mineral admixtures: ASTM C618
 - d. Ground granulated blast furnace slag: ASTM C989
- H. Reinforcement and Connection Materials:
- 1. Provide all reinforcement, accessory and connection materials required. Concrete reinforcement shall be steel bars or welded wire fabric, or combination thereof.
 - 2. Reinforcing Bars
 - a. Deformed Billet-steel: ASTM A615
 - b. Deformed Rail-steel: ASTM A616
 - c. Deformed Axle-steel: ASTM A617
 - d. Deformed Low-alloy steel: ASTM A706
 - 3. Reinforcing Wire
 - a. Plain Wire: ASTM A82
 - b. Deformed Wire: ASTM A496
 - 4. Welded Wire Fabric
 - a. Plain Wire: ASTM A185
 - b. Deformed Wire: ASTM A497
 - 5. Epoxy Coated Reinforcement
 - a. Reinforcing Bars: ASTM A775
 - b. Wires and Fabric: ASTM A884
 - 6. Galvanized Reinforcement
 - a. Reinforcing Bars: ASTM A767
 - 7. Inserts and Embedded Metal – All items embedded in concrete shall be of the type required for the intended task, and meet the following standards:
 - a. Structural steel plates, angles, etc.: ASTM A36
 - b. Proprietary items: In accordance with manufacturers published literature
 - c. Welded studs: AWS D1.1
 - d. Finishes:
 - 1) Hot-dipped galvanized: ASTM A152
 - 8. Joint Sealant:
 - a. Joint sealants shall comply with ASTM C920
 - b. Joints between shed and floor slab shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal.
 - c. Exterior caulk joint to be 3/8" x 3/8" square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.
 - 9. Pipe and Conduit Entry:
 - a. Core drilled hole through precast concrete panels after shed installation, or
 - b. Preformed hole through precast concrete panels cast in place at time of panel manufacture.
 - c. All pipe and conduit entries shall be grouted closed after pipe or conduit is fully installed.
 - 1) Grout: Portland cement non-shrink grout.

I. Fabrication:

1. Roof and wall panels must each be produced as single component monolithic panels. No roof or vertical wall joints will be allowed, except at corners. Wall panels shall be set on top of floor panel.
2. Sloped Roof: Roof panel shall slope $\frac{1}{2}$ " from front to back in 10-foot direction. The roof shall extend a minimum of 2 $\frac{1}{2}$ " beyond the wall panel on each side and have a turndown design which extends $\frac{1}{2}$ " below the top edge of the wall panels to prevent water migration into the shed along top of wall panels. Roof shall also have an integral architectural ribbed edge.
3. The foundation must have $\frac{1}{2}$ " step-down around the entire perimeter to prevent water migration into the shed along the bottom of wall panels.
4. Forms for manufacturing precast concrete products shall be of the type and design consistent with industry standards. They should be capable of consistently providing uniform products and dimensions. Forms shall be constructed so that the forces and vibrations to which the forms will be subjected can cause no product damage.
 - a. Forms shall be cleaned of concrete build-up after each use.
 - b. Form release agents shall not be allowed to build up on the form casting surfaces.
5. Reinforcement
 - a. Cages of reinforcement shall be fabricated either by tying the bars, wires, or welded wire fabric into rigid assemblies or by welding where permissible in accordance with AWS D1.4. Reinforcing shall be positioned as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover shall be one-third of that specified but not more than $\frac{1}{2}$ ". Concrete cover shall not be less than $\frac{1}{2}$ ". Positive means shall be taken to assure that the reinforcement does not move significantly during the casting operations.
6. Embedded Items
 - a. Embedded items shall be positioned at locations specified in the design documents. Inserts, plates, weldments, lifting devices, and other items to be imbedded in precast concrete products shall be held rigidly in place so that they do not move significantly during casting operations.
7. Placing Concrete
 - a. Concrete shall be deposited into forms as near to its final location as practical. The free fall of the concrete shall be kept to a minimum. Concrete shall be consolidated in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Vibrators used to consolidate concrete shall have frequencies and amplitudes sufficient to produce well consolidated concrete.
 - b. Cold Weather Requirements – Recommendations for cold weather concreting are given in detail in Cold Weather Concreting reported by ACI Committee 306.
 - 1) Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather.
 - 2) All concrete materials and all reinforcement, forms, fillers, and ground with which concrete is to come in contact shall be free from frost.
 - 3) Frozen materials or materials containing ice shall not be used.
 - 4) In cold weather the temperature of concrete at the time of placing shall not be below 45° F. Concrete that freezes before its compressive strength reaches 500 psi shall be discarded.
 - c. Hot Weather Requirements – Recommendations for hot weather concreting are given in detail in Hot Weather Concreting reported by ACI Committee 305.
 - 1) During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing shall not exceed 90° F.

8. Curing:
 - a. Curing by Moisture Retention – Moisture shall be prevented from evaporating from exposed surfaces until adequate strength for stripping (Article 2.6, paragraph F) is reached by one of the following methods:
 - 1) Cover with polyethylene sheets a minimum of 6 mils thick.
 - 2) Cover with burlap or other absorptive material and keep continually moist.
 - 3) Use of a membrane – curing compound applied at a rate not to exceed 200 sq. ft. per gallon, or per manufacturers' recommendations.
 - b. Surfaces that will be exposed to weather during service shall be cured as above a minimum of 3 days. Forms shall be considered effective in preventing evaporation from the contact surfaces. If air temperature is below 50°F the curing period shall be extended.
 - c. Curing with Heat and Moisture
 - 1) Concrete shall not be subjected to steam or hot air until after the concrete has attained its initial set. Steam, if used, shall be applied within a suitable enclosure, which permits free circulation of the steam. If hot air is used for curing, precautions shall be taken to prevent moisture loss from the concrete. The temperature of the concrete shall not be permitted to exceed 160° F. These requirements do not apply to products cured with steam under pressure in an autoclave.
9. Stripping Products from Forms
 - a. Products shall not be removed from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.
10. Shipping Products
 - a. Products shall not be shipped until they are at least 5 days old, unless it can be shown that the concrete strength has reached at least 75% of the specified 28-day strength, or that damage will not be caused which will impair the performance of the product.
- J. Source and Quality Control:
 1. Fabricate precast units in accordance with ACI 318 and the National Precast Concrete Association's Quality Control Manual for Precast Plants.

2.06 HMA PAVEMENT:

- A. A HMA drive shall be provided up to and around the lift station from the access road.
- B. Subbase: Granular material Class II, MDOT 902.07, Table 902-3.
- C. Aggregate Base: Aggregate 22A, MDOT 302.02 and 902.05.
- D. Hot Mix Asphalt (HMA) Leveling Course:
 1. MDOT 501.02, HMA 13A.
 2. MDOT 904.03, Asphalt binder PG 58-28.
- E. Hot Mix Asphalt (HMA) Surface Course:
 1. MDOT 501.02, HMA 13A
 2. MDOT 904.03, Asphalt binder PG 58-28.
 3. Aggregate Wear Index (AWI) 220.
- F. Bond Coat: Asphalt material SS-1h. MDOT 501.02 and 904.03C.

G. Pavement Marking: MDOT 920.01.

H. MIXTURES:

1. Furnish hot mixed asphalt mixture designed using Marshall mixture design methods.
2. The mix design shall be developed using a 50 blow Marshall hammer.
3. Reclaimed Asphalt Pavement (RAP) may be substituted for a portion of the new material required to produce the HMA mixture.
4. If greater than 17% RAP binder by weight of the total binder is proposed for the mixture the selected binder grade shall be adjusted to compensate for the stiffness of the asphalt binder in the RAP. The Contractor shall supply blending chart and RAP test data used to determine the binder selection.

Table 1: Mix Design Criteria and Volumetric Properties

	Mixture No.				
	2C	3C	4C	13A	36A
Target Air Void, % (a)	3.00	4.00	4.00	4.00	4.00
VMA (min) (b)	11.00	13.00	14.00	14.00	15.00
VFA	65-78	65-78	65-78	65-78	65-78
Fines to Binder Ratio (max) (c)	1.2	1.2	1.2	1.2	1.2
Flow (0.01 inch)	8-16	8-16	8-16	8-16	8-16
Stability (min), lbs	1200	1200	1200	900	900
a. Lower target air voids by 1.00% if used in a separate shoulder paving operation. Consider reducing air void targets to 3.00% for lower traffic volume roadways when designing 13A and 36A mixtures. b. VMA calculated using Gsb of the combined aggregates. c. Ratio of the weight of aggregate passing the No. 200 sieve to total asphalt binder content by weight; including fines and binder contributed by RAP.					

5. The following Table 2 shall be used to determine the aggregate properties of the specified mixture.

Table 2: Aggregate Properties

	Mixture No.				
	2C	3C	4C	13A	36A
Percent Passing Indicated Sieve or Property Limit					
1 ½ inch	100				
1 inch	91-100	100			
¾ inch	90 max.	91-100	100	100	
½ inch	78 max.	90 max.	91-100	75-95	100
3/8	70 max.	77 max.	90 max.	60-90	92-100
No. 4	52 max.	57 max.	67 max.	45-80	65-90
No. 8	15-40	15-45	15-52	30-65	55-75
No. 16	30 max.	33 max.	37 max.	20-50	
No. 30	22 max.	25 max.	27 max.	15-40	25-45
No. 50	17 max.	19 max.	20 max.	10-25	
No. 100	15 max.	15 max.	15 max.	5-15	
No. 200	3-6	3-6	3-6	3-6	3-10
Crushed (min), % (MTM 117)	90	90	90	25	60
Soft Particle (max), % (a)	12.0	12.0	8.0	8.0	8.0
Angularity Index (min) (b)	4.0	4.0	4.0	2.5	3.0
L.A. Abrasion (max), % loss (c)	40	40	40	40	40
Sand Ratio (max) (d)	-	-	-	50	50

- a. The sum of the shale, siltstone, structurally weak, and clay-ironstone particles must not exceed 8.0 percent for aggregates used in top course. The sum of the shale, siltstone, structurally weak, and clay-ironstone particles must not exceed 12.0 percent for aggregates used in base and leveling courses.
- b. The fine aggregate angularity of blended aggregates, determined by MTM 118, must meet the minimum requirement. In mixtures containing RAP, the required minimum fine aggregate angularity must be met by the virgin material. NAA fine aggregate angularity must be reported for information only and must include the fine material contributed by RAP if present in the mixture.
- c. Los Angeles abrasion maximum loss must be met for the composite mixture, however, each individual aggregate must be less and 50.
- d. Sand ratio for 13A and 36A no more than 50% of the material passing the No. 4 sieve is allowed to pass the No. 30 Sieve.

2.07 CONCRETE PAVEMENT:

- A. The area around the wet well and valve vault shall be paved with concrete.
- B. Materials:
 1. Subbase: Granular material MDOT class II, MDOT 902.
 2. Concrete: Limestone aggregate, 5½ sack minimum, 4% to 7% entrained air, five (5) gallons per sack maximum water/cement ratio, 3-inch slump maximum, 3,500 psi minimum compressive strength at 28 days.
 3. Concrete Joint Filler: Conform to MDOT 914.03.
 4. Forms: Rigid in accordance with MDOT 803.03B, except at curved sections which shall utilize a bendable material to provide a uniform radius, supported at adequate intervals.
 5. Gravel Base: MDOT 902.05, 22A Aggregate.

2.08 WATER SERVICE:

- A. Each lift station shall be equipped with a RPZ Backflow Preventor.
 1. General:
 - a. Reduced pressure principle assembly: AWWA C511.
 - b. ASSE Listed 1013.
 - c. Materials of construction:
 - 1) Bronze body.
 - 2) Cover bolts: Stainless steel.
 - 3) Replaceable polymer check seats for first and second checks.
 - 4) Removable stainless steel relief valve seat.
 - 5) Silicone rubber disc material in the first and second check plus the relief valve.
 - d. Inlet and outlet connections: Bronze union.
 - e. Quarter turn, full port, resilient seated, bronze ball valve shutoffs.
 - f. Manufacturer and model:
 - 1) Watts Regulator Company, Series 009.
 - 2) Wilkins, Model 375.
 - 3) Or equal.

2.09 NON-CLOG PUMP CONSTRUCTION:

- A. General: The submersible non-clog pump shall be manufactured to pump raw wastewater including passing larger solids through the impeller without plugging or dewatering of the solids as an integral part of the pumping action.

- B. Solid size: The submersible pump shall be capable of passing a 3" diameter non-compressible solid without grinding or chopping the solid.
- C. Pump Volute and Motor Casing:
 - 1. ASTM A536 or ASTM A48 Class 30 ductile iron or class 35B cast iron.
 - 2. All water or oil passages shall be smooth and free of imperfections and blowholes for good flow performance.
- D. Impeller:
 - 1. Dynamically balanced open or semi-open.
 - 2. Two vanes minimum capable of trimming while maintaining dynamic balance.
 - 3. Slip fit to a tapered shaft and key driven.
 - 4. ASTM A148 cast iron case hardened.
 - 5. Minimum hardness: Rockwell C 45
- E. Shaft: Stainless steel
- F. Bearings:
 - 1. Upper radial and lower thrust bearings required.
 - 2. Permanently lubricated without the need for lubricating at a prescribed schedule.
 - 3. Minimum L10 bearing life at the design point of the pump:
 - a. Upper bearing: 100,000 hrs.
 - b. Lower bearing: 100,000 hrs.
- G. Seals:
 - 1. Dual mechanical cartridge style seals with an oil chamber between them.
 - a. Upper Seal: Carbon rotating face vs Ceramic stationary face
 - b. Lower Seal: Silicon Carbide vs Silicon Carbide
 - c. All other seal components shall be stainless steel
 - 2. Oil in reservoir must be FDA approved non-toxic.
 - 3. Leak detection probe:
 - a. Mounted in the oil reservoir between the seals.
 - b. Must detect water in the oil and trip the Seal Fail Alarm
 - 4. Leak detection probe relay – Mini Cas:
 - a. As recommended and provided by pump manufacturer.
 - b. Ship loose to control panel manufacturer for installation in factory.
- H. Factory applied paint:
 - 1. The finished assembled pump shall be painted the manufacturers recommended coating for immersion in raw sewage.
- I. Warranty:
 - 1. The pump, motor and power cord unit shall be warranted against defects in material and workmanship for a period of two (2) years after final acceptance of the pumping system after pump station start-up.
 - 2. Defects shall be repaired or replaced at no cost including delivery, labor and materials.
- J. Acceptable Manufacturers. For the purpose of this specification, the following manufacturers are considered capable of providing the pumps as specified:
 - 1. Flygt, Including the "N" impeller
 - 2. ABS

K. Motors

1. Submersible, capable of driving pump over full range of pump characteristic curve without exceeding one hundred percent (100%) of motor horsepower rating based on a 1.15 service factor.
2. Continuous use: Minimum 10 starts and stops per hour.
 - a. 480 volts three phase
 - b. Horsepower: [XX] Hp based on pump design point
 - c. U.L. or F.M. listed for NEC classified Class 1, Division 1, Group D hazardous locations.
 - d. Housing: Air or oil filled watertight casing.
 - e. Insulation: Class H.
 - f. Shaft: Stainless steel.
 - g. Capable of running totally, partial, or non-submerged.
 - h. Provide seal leakage water sensor probe to indicate water in seal chamber.
 - i. Thermal sensors in motor windings shall deactivate starter when temperature exceeds safe level.
 - j. Motor electric service cable shall be extra hard usage and submergence rated with sufficient length to reach control panel without splices. Wiring in the pumping chamber shall permit total submergence without affection operation.
 - k. Motor starting requirements not to exceed NEMA Code G.
 - l. For lift stations utilizing variable frequency drives provide an inverter Duty Rated in accordance with NEMA MG1 Part 31.
 - m. Provide duplicate pump motor nameplate to control panel fabricator with seal fail relays for installation in control panel.

2.10 PUMP GUIDE RAIL SYSTEM:

- A. Entire guide rail system shall be non-sparking 316 stainless steel suitable for NEC classified Class 1, Division 1, Group D hazardous locations.
- B. Rail dimensions shall be per the pump manufacturer and shall be a minimum of 2" diameter, and minimum schedule 40.
- C. Rails shall be securely anchored to the pump discharge elbow and the hatch opening. Intermediate supports shall be provided at 12' spacing (minimum).

2.11 ACCESSORIES:

- A. Discharge connection: Cast iron or Ductile Iron, bolted to the floor.
- B. Lift chain: Stainless steel, with lifting capacity of twice pump weight, minimum.

2.12 MISCELLANEOUS:

- A. Pump Base: fitted with ANSI 125lb flange.
- B. All mating sealed parts shall be machined and have Buna N elastomeric gaskets and shall provide a watertight connection.
- C. Pump Base Anchor Bolts: Non-magnetic 316 stainless steel. Size, length, and embedment per the pump manufacturer's recommendations.
- D. Guide bracket: Non-sparking with corrosion resistant surfaces.

E. Pump discharge: Automatically sealed to discharge connection when pump is lowered into place. Pump flange shall have non-sparking contact surfaces.

F. Miscellaneous Metals: All miscellaneous metals shall be non-magnetic 316 stainless steel.

2.13 ACCESS DOORS:

A. Access doors shall:

1. Be designed to be integrally cast in concrete.
2. Be designed for H-20 loading.
3. Have double leaf door.
4. Be ¼" aluminum diamond plate top.
5. Have an extruded aluminum frame.
6. Have aluminum or stainless-steel hinges with stainless steel pin.
7. Have a spring assist operator.
8. Have a holding arm to lock door in open position at 90 degrees from horizontal.
9. Have a recessed padlock hasp.
10. Have a flush square "key-hole" with removable opening handle and threaded plug for hole for operation of door from outside the structure.
11. Have a spring-loaded latching mechanism with handle for opening of door from interior of the structure.
12. Have is parts that are to be in contact with concrete coated in bituminous paint.
13. Have a secondary safety grate that:
 - a. is integral to door frame.
 - b. is Aluminum.
 - c. is powder coat painted with an orange finish.
 - d. has a 300 psf load rating.
 - e. shall not interfere with withdrawal of equipment.
14. Be manufactured by: East Jordan.

2.14 VENTS AND CARBON FILTERS:

A. Vents shall be 3-inch diameter schedule 40 stainless steel tube piping with flange.

B. Carbon filters shall be flanged to bolt to vent tubing. Acceptable products and manufacturers:

1. Peacemaker Vent Scrubber by Syneco Systems Inc.
2. Vent Pure – G by General Carbon Corp.
3. Or Township approved equal.

2.15 LIFT STATION CONTROL PANELS:

A. All lift station control panels shall be listed (UL698A) for control panels having intrinsically safe extensions to hazardous areas.

B. Instrumentation shall be provided from a supplier that routinely has provided equipment on water and wastewater projects. Representative project experience must include at least 3 projects in the past 5 years.

C. The lift station control panel supplier shall be responsible for the design and layout of the control panel to meet project conditions.

D. Pre-approved lift station control panel supplier is Owner's System Integrator.

2.16 LIFT STATION CONTROLS:

- A. The pumps shall be controlled by a radar level transmitter suspended in the wet well and a programmable logic controller (PLC) and a Human Machine Interface (HMI). Floats shall serve as a back-up control system. All control circuits in wet well shall be intrinsically safe.

2.17 LIFT STATION CONTROL PANEL FINISHES:

- A. Provide baked enamel finishes on exposed surfaces.
- B. Provide galvanized finishes for damp or wet locations.
- C. Touch up or refinish damaged paint.

2.18 LIFT STATION CONTROL PANEL SELECTOR SWITCHES AND PUSHBUTTONS:

- A. All selector switches and push buttons shall be oil tight NEMA Type 13, with contacts, colors, and legend plates as indicated on Drawings. Manufacturer shall be Allen-Bradley.
- B. Pilot lights shall be transformer push-to-test type. Same type and brand as push buttons.

2.19 BACKUP CONTROL FLOAT SWITCHES:

- A. Hermetically sealed mechanical tilt with 100-foot suspension cable rated at a minimum of 13 ampere at 120-volt A.C.
- B. SPST contact.
- C. Corrosion resistant poly-propylene float, leakproof, shockproof, and corrosion resistant to sewage.
- D. Shorter length suspension cords may be furnished provided they have sufficient length to reach junction box without splice.
- E. Design based on Connery Model 2900-B3-S1-C1. Township approved equal features and product by Gems/Warrick.

2.20 LIFT STATION CONTROL PANEL FLOAT SWITCH CONTROL RELAYS:

- A. Intrinsically safe type.
- B. Minimum 2 independent contact.
- C. Maximum switching sensitivity of 10,000 ohms.
- D. Manufacturers: Design based on Warrick, Stahl, Crouse Hinds, Diversified Electronics or Township approved equal.

2.21 LIFT STATION CONTROL PANEL POWER FAILURE RELAY – PHASE MONITOR:

- A. Shall be able to monitor 280 volts, single phase or 480 three phase as determined by project location with usually closed (closed with normal energized power) 120 volt contact the control circuit, DPDT contacts. Monitor for undervoltage, overvoltage, phase sequence, and loss of phase.

- B. Manufacturers: Diversified Electronics model XXXXXXXX.
- C. Mount Power Failure Relay adjacent to main service entrance circuit breaker with fuses inside a NEMA 3R Enclosure.

2.22 LIFT STATION CONTROL PANEL RELAYS:

- A. Time Delay:
 - 1. Electric type.
 - 2. Delay on energize as necessary.
 - a. Minimum contact rating 1 ampere at 120-volt A.C.
 - b. Design based on Square D or Allen Bradley.
- B. Control:
 - 1. Miniature plug-in type.
 - 2. Minimum contact rating 10 ampere at 120-volt A.C. with necessary contacts as shown on drawings.
 - 3. Square D, Potter Brumfield, or Owner's Representative approved equal.

2.23 ACCESSORIES FOR LIFT STATION CONTROL PANEL:

- A. Nameplates: Minimum 1 inch x 3 inch white plastic with engraved black lettering.
- B. Pilot and Alarm Lights: 120 volt transformer type, push to test, 60 Hertz, with plastic lens and color matched rings; furnish special tools for lamp replacement, if required.
- C. Selector Switches and Push Buttons: Rated oil-tight not less than 120 volt, 10 ampere, 60 Hertz with maintained or momentary contacts as required. Provide legend plates "HAND-OFF-REMOTE" or as shown on drawings.

2.24 LIFT STATION LOW VOLTAGE, LIGHTING AND POWER CONDUCTORS:

- A. Exterior lighting to be switch operated and illuminate lift station wet well and valve vault.
- B. Identify each end of each conductor by wire marking tape or sleeve. This includes splice points at all junction boxes. Mark on outer cover giving loop number and/or discrete wire number.
- C. Conductors provided on 120/240 and 480 volt power and control systems to be stranded per ASTM B-8 soft drawn copper.
- D. Insulation system shall be type THHN for field and MTW for lift station control panel, rated 600V as defined and listed in Article 310 of NEC. Output wiring from VFD's shall be XHHW-2.
- E. Minimum size conductor utilized shall be #14 AWG for control circuits and #12 for power and lighting circuits.
- F. Color code conductor insulation as follows:

Line Voltage	-Black
Grounding Conductor	-Green
Neutral	-White
Control	-Red
DC Circuits	-Blue

Voltage from External source -Yellow
 Intrinsically safe -Light Blue

Color shall be integral with the insulation compound applied by cable manufacturer.

2.25 LIFT STATION CONTROL PANEL SEAL FAIL RELAYS AND OVERTEMPERATURE RELAYS:

- A. Provide new mini-cass relays from Flygt representative to match existing pumps.

2.26 LIFT STATION CONTROL PANEL RTU:

- A. Lift Station Level Controller RTU is an integral component of the Lift Station Control Panel.
- B. Lift Station Level Controller RTU shall be programmable logic controller and shall have adequate inputs and outputs to perform the design sequence of operation plus 10% spares.
- C. All HMI and PLC programming and software for Level Controller RTU and WRRF SCADA System by Owner's Systems Integrator.
- D. Lift Station Level Controller RTU and HMI shall perform all functions and control descriptions outlined in the specifications and drawings.
- E. Remote monitoring for Lift Station Level Controller RTU will be through their integral ethernet communications ports in conjunction with the Owner provided wireless communication system and the existing SCADA system at the WRRF. All existing SCADA System programming and hardware requirements the WRRF MTU will be provided by Owner's Systems Integrator.
- F. Lift Station RTU PLC shall be Opto 22 EPIC-PR1 Controller with all necessary I/O modules, power supplies, and accessories to perform functions described and depicted in the contract documents. No equals, plant standard.
- G. Lift Station HMI shall be 15" color touch screen panel monitor 1920 x 1024 resolution connected to Opto 22 EPIC-PR1.

2.27 INTERNET SERVICE PROVIDER (ISP) MODEM AND RF HARDWARE:

- A. Provided by Owner's ISP. Control Panel Manufacturer shall leave 1' H x 1' W x 1' D space on the subpanel for ISP to install modem, antenna cable, surge arrestor, and antenna. Provide a 120VAC receptacle outlet for connect to the modem and a VPN router backed up by an online double conversion UPS. OSI to provide the modem and VPN router. (
- B. Control Panel Manufacturer to provide 1" conduit sleeve from lift station control panel to building exterior for OSI to run antenna cable.
- C. Contractor shall accompany ISP to site to allow them access to the Lift Station Control Panel and to supervise communication equipment installation and to prevent the Lift Station Control Panel warranty breaches due to improper penetrations of Lift Station Control Panel Enclosure or substandard housekeeping practices, IE: Metal Shaving Control, making penetrations in top of cabinet.

2.28 LIFT STATION CONTROL PANEL DC POWER SUPPLY WITH BATTERY BACK-UP:

- A. Furnish 24-volt DC, 4-amp output - 120 VAC input power supply for HMI and modem. Manufacturer shall be Astrodyne Model AD55-B or Engineer approved equal.
- B. Furnish 24-volt DC, 4-amp output - 120 VAC input power for PLC power supply. Astrodyne Model AD55-B or Engineer approved equal
- C. Connect the aforementioned components in accordance with the Control Schematics on the Manufacturer's drawings.
- D. Contractor shall provide on-line double conversion UPS to perform desired function. Design based on Vertiv (Libert) GTX5-500 or 1000LVRT2UXL.

2.29 LEVEL CONTROL RADAR TRANSMITTER/INTRINSICALLY SAFE BARRIER:

- A. Provide Endress and Hauser Radar Level Transmitter model FMR20 to match existing radar level transmitters used in the system. Provide suspension cord with sufficient length to reach the control junction box at the control building without splicing.
- B. Provide Endress and Hauser or entity approved intrinsically safe barrier for radar level transmitter 4-20 mA circuit.
- C. Calibrate to suit the wet well depth.

2.30 LIFT STATION CONTROL PANEL ENCLOSURE CABINET LIGHT:

- A. Furnish 120 vac, 60 watt LED fixture. Provide door interlock switch accessory.
- B. Design based on Hoffman LEDA1S35 fixture with Saginaw accessory switch SCE-LSA or Township approved equal.

2.31 LIFT STATION CONTROL PANEL HVAC AND CONTROLS:

- A. As sized and determine by the Lift Station Control Panel Manufacturer to facilitate controls.
 - a. Lift Station Control Panel cabinet environmental rating. Although the cabinet is identified to be installed indoors the cabinet shall carry a NEMA 3R rating minim and have HVAC designed to keep all the control panel components operating within their listed environmental temperature and humidity ratings since the building is not heated or cooled. Calculations for the control panel cabinet HVAC system shall be based on the cabinet being installed outdoors in Allendale Charter Township Michigan. This requirement shall include but not be limited to cabinet insulation, heaters, and air conditioning or cooling fans. Should the HMI to keep it at it's designed operating temperature and humidity ratings.

2.32 LIFT STATION CONTROL PANEL CONVENIENCE RECEPTACLE:

- A. 120 VAC, 20 amp, GFI specification grade, white.
- B. Leviton or equal.

2.33 LIFT STATION CONTROL PANEL CURRENT TRANSFORMERS:

- A. Furnish general use ammeter current transformer.
- B. Insulation level shall be 600 volts, 10 kV BIL full wave. 4-20 mA output.
- C. Design based on Dwyer CCT40-100 series Current Transformers. Provide on 1 output leg of each starter or VFD.

2.34 WIRE DUCT:

- A. Provide 1" x 3" or 2" x 3", slotted plastic wireway with cover as required for all internal control panel wiring.
- B. Manufacturers: Panduit, Thomas and Betts, or Township approved equal.

2.35 ADJUSTABLE FREQUENCY DRIVE CONTROLS (VFD):

- A. Provide 12 pulse constant torque (heavy duty), solid state AC adjustable frequency controllers to provide stepless variable speed over a 30% to 100% of motor base, 60 hertz, speed range.
- B. Provide custom designed control circuits for each drive assembly.
- C. Speed regulation with 100 percent load change shall be within 3 percent of maximum speed.
- D. Power factor of motor and controller combined shall be a minimum of 0.90 lagging over entire speed and load range.
- E. Service factor of combination motor and controller shall be a minimum of 1.15.
- F. Designed to operate on 480 volts three phase AC (-5 percent, + 10 percent) 3 phase, 60 Hertz (+ 2 percent) input.
- G. Control Signal: 4-20 ma.
- H. Cabinets: NEMA 3R enclosures.
 - 1. All VFD power and control components shall be mounted on a sub-panel mounted on the inside back of the cabinet. This shall include but not be limited to VFD, reactors, disconnect switch, circuit breakers and fuses, transformers relays and contactors. No components may be mounted on the inside sides of the cabinet. These requirements exclude pilot devices, HMI, and disconnect handles that are required to be mounted on the cabinet door. Cabinets shall be welded finished steel with no removable back, top, or side panels.
 - 2. Cabinet environmental rating. Although the cabinet is identified to be installed indoors the cabinet shall carry a NEMA 3R rating minimum and have HVAC designed to keep all the control panel components operating within their listed environmental temperature and humidity ratings since the building is not heated or cooled. Calculations for the control panel cabinet HVAC system shall be based on the cabinet being installed outdoors in Allendale Charter Township Michigan. This requirement shall include but not be limited to cabinet insulation, heaters, and air conditioning or cooling fans. Should the HMI to keep it at its designed operating temperature and humidity ratings.

I. Acceptable Manufacturers:

1. Eaton
2. Allen Bradley
3. ABB

2.36 CONDUIT:

- A. Rigid Galvanized Steel: UL listed and ½" minimum size. ANSI C80.1, threaded, as shown on Drawings.
- B. All conduit inside and outside building shall be Rigid Metal Conduit. All conduit between the control junction box and the wet well shall be PVC coated Rigid Metal Conduit.
- C. All buried conduit not connecting to the wet well may be PVC sch 40 conduit.
- D. All conduit connecting to the wet well shall be PVC Coated Rigid Metal Conduit.
- E. Pull Boxes, Junction Boxes, and Conduit Fittings: UL listed, liquid tight, dustproof, conforming to JIC standards, cast malleable iron gasketed with cast hot dip galvanized blank or nipple covers held in place with stainless steel screws. ANSI C80.4, sized per NEC Article 370.
- F. Sewage wet well is Hazardous Area Class 1, Division 1, Group D.
 1. Install in accordance with NEC Article 501.
 2. All wiring shall be in conduit, except in wet well where cable goes to level controls.

2.37 ENCLOSED CIRCUIT BREAKERS:

- A. Minimum Interrupting Capacity: 22,000 amperes at 240 volts, single phase or 480 three phase as determined by the project location with size as shown on the drawings.
- B. Main shall be U. L listed for service entrance. All others U.L. listed.
- C. Nema 3R Enclosed.
- D. Provide Square D.

2.38 GROUNDING:

- A. Provide grounding resistance of 25 ohms or less and provide a Power Service Surge Arrester.

2.39 LOAD CENTER:

- A. Nema 3R Enclosed, with 2P main circuit breaker sized to transformer secondary.
- B. Provide quantity and size breakers as shown on drawings.
- C. Minimum Interrupting Capacity: 10,000 AIC at 240 VAC.
- D. Provide Square D or Township approved equal.

2.40 TRANSFORMER:

- A. Dry type, Class H, 150 degrees Centigrade (c) rise insulation.
- B. Enclosed for indoor or outdoor operation.
- C. For transformers above 3 KVA provide standard 2 percent taps above and below nominal rated voltage.
- D. Noise level: 45 decibels per ANSI C89.11961 (R1969).

2.41 IDENTIFICATIONS:

- A. Name Plates: Provide on all equipment, switches, breakers, and panels. Name Plates shall be 1" x 3" white plastic with 3/16" black lettering.
- B. Circuits: Provide inside each distribution or branch circuit panel a typewritten schedule under glass or plastic identifying each circuit emanating from panel.

2.42 GENERATOR:

- A. Each lift station shall be equipped with a concrete generator foundation and a natural gas driven generator.
- B. Ratings
 - 1. The generator set shall have a minimum standby duty rating of [XX] KW, at 0.8 power factor, and operate at 1800 RPM.
 - 2. System voltage: 480 volts, single phase or 480 three phase as determined by the project area, three wire, 60 Hertz.
 - 3. Site conditions: Altitude 600 feet. Ambient temperatures up to 104 degrees F.
- C. Construction
 - 1. The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components and shall incorporate vibration isolators of the type and quantity as specified by the manufacturer.
 - 2. Vibration control for generator unit shall include pads, springs, rails, bases, hangers, and connectors as required for vibration control and isolation.
 - 3. Emissions: Conform to federal standards and be EPA certified.
- D. Engine and Engine Equipment
 - 1. The engine shall be stationary, liquid cooled, with a fuel system that is compatible with natural gas. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
- E. AC Generator
 - 1. The AC generator shall be synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.
 - 2. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single

phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

3. The generator shall be capable of delivering rated output KVA at rated frequency and power factor at any voltage not more than 5% above or below rated voltage.

F. Engine Generator Set Control

1. A NEMA 3R enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall be vibration isolated, and prototype tested to verify the durability of all components under the vibration conditions encountered. Control panel shall be sealed to prohibit intrusion of pests and rodents.

G. Outdoor weather protective housing:

1. Generator housing shall be factory assembled to generator set base. Housing shall provide ample airflow for operation at rated load in the ambient condition specified.
2. The housing shall have hinged side access doors and rear control door. All doors shall be lockable.
3. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using two step electrocoating paint process or equal, meeting the performance requirement specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:
 - a. Primer thickness, 0.5-2.0 mils. Topcoat thickness, 0.8-1.2 mils.
 - b. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
 - c. Crosshatch adhesion, per ASTM D2794-93, 120-160 inch-pounds.
 - d. Salt spray, per ASTM B117-90, 1000 plus hours.
 - e. Humidity, per ASTM D2247-92, 1000 plus hours.
 - f. Water soak, per ASTM D2247-92, 1000 plus hours.
4. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable.
5. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.
6. Accessories include engine heaters, battery charger, generator strip heater.
7. The enclosure shall either be insulated by acoustical foam and or include intake shrouds to limit noise.
8. Maximum average sound level shall not exceed 67.8 dba at 25 feet.
9. Protective housing shall be sealed to prohibit intrusion of pests and rodents.

H. Design is based on Onan Cummins natural gas generator with alternator or Township approved equal.

2.43 AUTOMATIC TRANSFER SWITCH:

- A. Ratings: [XXX] Amps, 480 volts three phase, 3 Pole, 3 Phase, 3 wire, NEMA 3R Enclosed, 22,000 AIC minimum.
 1. Main contacts shall be rated for the operation voltage as installed.
 2. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of 40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
 3. Transfer switch equipment shall have with stand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

B. Construction:

1. Transfer switch shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions.
2. Transfer switches shall be 3-pole and shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
3. Enclosures shall be UL listed and NEMA 3R rated. The enclosure shall provide NEC wire bend space when both sources and the load are all connected from either the top or bottom of the transfer switch. The cabinet door shall be key-locking.

C. Connections:

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

D. Control:

1. Solid-state under voltage sensors shall simultaneously monitor both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. The voltage sensors shall monitor and respond to a failure of three phases or of any phases.
2. Provide open transition delayed transition automatic transfer switch. The control system shall include field adjustable provisions to control the speed of transfer of the transfer switch.
 - a. The control shall include an adjustable time delay between live sources from 0-60 seconds. This delay isolates the load from either live source during transfer or retransfer to allow for decay of any voltage/frequency generated by the load during transfer/retransfer operation.
 - b. Switches that incorporate an in-phase monitor system and cannot change the speed of the contacts transfer operation shall not be acceptable.
 - c. This control scheme shall operate the same under a power outage condition and under routine exercise operation.
3. Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 6 seconds to 30 minutes, factory set at 5 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

E. Enclosure:

1. Enclosures shall be UL listed. The cabinet door shall be key locking.
2. Transfer switch equipment shall be provided in a NEMA rated Enclosure.
3. Enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key operated switches) shall be accessible to authorized personnel only by opening the key locking cabinet door. Transfer switches with manual operating handles and/or non-key operated control switches located on outside of cabinet do not meet this specification and are not acceptable.
4. Enclosure shall have the same temperature requirements as the VFD.

2.44 MANUAL TRANSFER SWITCH:

- A. Manual Transfer Switch. Provide [XXX] amp, 480 volts three phase, three pole double throw, NEMA 3R Enclosed. Manufacturer: Square D, Eaton, GE, or Cutlar Hammer.
- B. Provide a terminal block for an auxiliary generator and power testing.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Subgrade:
 - 1. Obtain approval prior to placing the subbase or aggregate base course.
 - 2. Construct to the required line, grade, and cross section. MDOT 205.03.N.
 - a. If subbase is required: Trim within 1 inch of design grade.
 - b. Tolerance if subbase is not required: Trim within $\pm \frac{3}{4}$ inch of design grade.
 - 3. Compaction:
 - a. Compact to not less than ninety percent (90%) of the maximum density according to the Modified Proctor Method ASTM D1557.
 - b. Compact to not less than ninety-five percent (95%) of the maximum density using the Michigan Cone Test.
- B. Excavation: Conform to MDOT 205.03.G.
- C. Embankment: Conform to MDOT 205.03.H and 205.03.I.
- D. Inspection: Obtain approval of Township subgrade and each layer of pavement structure prior to placing successive layer.

3.02 INSTALLATION:

- A. Install electrical products and controls in accordance with Township ordinances, National Electrical Code, and manufacturers' recommendations, shop drawings, and contract drawings to be prepared by the township engineer.
- B. Precast Concrete:
 - 1. Precast concrete products shall be installed to the lines and grades shown in the contract documents or otherwise specified.
 - 2. Products shall be lifted by suitable lifting devices at points provided by the precast concrete producer.
 - 3. Products shall be installed per the precast concrete producer's recommendation.
- C. Variable Frequency Drive:
 - 1. Install all equipment in accordance with Specifications, manufacturer's recommendations, and applicable codes and regulations.
- D. General Electrical:
 - 1. Obtain power meter sockets from power company and install as shown.
 - 2. Run ground conductor into service enclosures and ground according to National Electrical Code.
- E. Generator:
 - 1. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction.

2. Install equipment in accordance with manufacturer's instructions and instructions included in the listings or labeling of UL listed products.
3. Installation of equipment shall include furnishings and installing all interconnecting wiring between all major equipment provided for the on-site power system.
4. The Contractor shall also perform interconnecting wiring between equipment sections, under the supervision of the equipment supplier.
5. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions.
6. Equipment shall be initially started and operated by representatives of the manufacturer in coordination with the electrical Contractor.
7. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.03 PERFORMANCE:

A. Subbase:

1. Thickness: Conform to design cross section.
2. Construction method:
 - a. Place in equal layers not exceeding 15 inches loose measure.
 - b. Spread evenly and compact to not less than ninety-five percent (95%) maximum density according to Michigan Sand Cone Test.
3. Tolerance: Construct sub-base to plan grade within a tolerance of + 0.5 inch.

B. Aggregate Base:

1. Thickness: Conform to design cross section.
2. Construction Method: MDOT 302.03.
3. Tolerances:
 - a. Curbed streets: Shape the aggregate base course to the design grade and cross section within a tolerance of + 1/4 inch.
 - b. Other: Shape within a tolerance of + 1/2 inch of the design grade and cross section.
 - c. Check and correct grades and cross section prior to HMA placement if traffic use is allowed.

C. Hot Mixed Asphalt Base:

1. Construction Methods: Conform placement of the hot mixed asphalt base mixture not exceeding lifts of 3 inches in accordance with MDOT 501.03.
2. Tolerances:
 - a. Curbed streets: Shape the hot mixed asphalt base course to the design grade and cross section, within a tolerance of + 3/8 inch.
 - b. Other: Unless otherwise specified, shape within + 3/4 inch of the design grade and cross section.

D. Bond Coat:

1. Construction Method: MDOT 501.03.D.
2. Application Rate: Provide 0.15 gallon per square yard.

E. Hot Mixed Asphalt Leveling and Surface:

1. Cutting: Saw vertically in straight lines parallel or perpendicular to pavement centerline.
 - a. Thickness: Per authority having jurisdiction.
 - 1) Do not place hot mixed asphalt surface course mixture in lifts exceeding 2 inches unless otherwise approved. Provide design thickness.
2. Construction Methods:

- a. Paving: Conform method of paving to MDOT 501.03.
- b. Prior to placement of hot mixed asphalt surface, verify crowns and grades of roadway for positive drainage. Any deficiencies in grade or crown shall be corrected prior to placement of surface course.
- 3. Tolerances: Hot mixed asphalt surface on streets with new curbs shall have a finish elevation of $\frac{1}{4}$ inch above curb.
- 4. Asphalt Yield: The design asphalt yield has been based on 110 lbs/syd per inch of thickness. Construction asphalt yield in excess of 15% of the plan yield shall not be paid unless otherwise approved by the Engineer.

3.04 STRUCTURE COVER ADJUSTMENT:

- A. Construction Method: MDOT 403.03.C.
 - 1. Adjust structure castings to finish grade or to a maximum of $\frac{1}{4}$ inch below finish grade of all manholes, catch basins, and valve boxes.
 - a. Set grades of castings and valve boxes from street grades with castings tilted where necessary to meet proposed street grades and crown.
 - b. All castings, when adjusted to finish grade shall be placed in a bed of concrete grade S2 placed in the entire area disturbed for casting adjustment.
 - 2. Adjust castings to finish grade after the leveling course is complete.
 - a. Castings shall be kept below grade or flush with the proposed sand subgrade so as not to conflict with grading operations or conflict with placement of leveling course.
 - b. HMA removed from the area for casting adjustment shall be saw cut square or round around the casting.
 - 3. Adjustment of new structures will not be a pay item.
 - 4. Wrap valve box and CSB per specification.

3.05 TESTING AND INSPECTION:

- A. Observation: By the Engineer or his designated authorized representative.
- B. Aggregates:
 - 1. Sampling and Analysis: Michigan Testing Methods, Series 100.
 - 2. Exception: Provide certification of approved stockpiled material.
- C. Hot Mixed Asphalt Pavement Density:
 - 1. Density acceptance of HMA mixtures will be measured with a nuclear density gauge using the Gmm from the approved Job-Mix Formula for the density control target. The required in place density of the HMA mixture shall be 92.0-96.0% of the density control target.
 - 2. The Contractor is responsible for determining Quality Control Density and establishing a rolling pattern that will achieve the required in place density.
- D. Hot Mixed Asphalt Mix Composition:
 - 1. Sampling:
 - a. Acceptance sampling shall include a minimum of two samples per mix type for each day of production with no less than three samples for each mix type per project.
 - b. Method of sampling shall be determined by the Engineer.
 - 2. Extraction: ASTM D2172
 - 3. Sieve Analysis: ASTM C117 and ASTM C136
 - 4. Tolerance: Acceptable tolerances for HMA parameters are detailed in the following Table.

Table 3: Uniformity Tolerance Limits for HMA Mixtures		
PARAMETER	Surface & Leveling Course	Base Course
	Range	Range
Binder Content	+ 0.50	+ 0.50
% Passing #8 and Larger Sieves	+ 8.0	+ 9.0
% Passing #30 Sieve	+ 6.0	+ 9.0
% Passing #200 Sieve	+ 2.0	+ 3.0
1. The mixture shall be proportioned to test as closely as possible to the Job-Mix-Formula. 2. The crushed particle content of the aggregate shall not be more than 10 percentage points above or below the crush particle content listed in the approved JMF.		

5. Acceptance: If for any one mixture, two consecutive aggregate gradations on one sieve, or binder contents exceed the uniformity tolerance or do not meet the minimum requirements for crushed particle content the mixture will be rejected.

3.06 GENERATOR ON SITE ACCEPTANCE TEST:

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Representatives of the manufacturer shall conduct testing. Electrical Contractor shall be present at the time of testing. The Owner or Owner's representative shall be notified in advance and shall have the option to witness the tests.
- B. Test alarm and shutdown circuits by simulating conditions.
- C. Check all trouble and alarm indicators, including those at remote annunciator.

3.07 FIELD QUALITY CONTROL:

- A. Wet Well, Valve Chamber, and Meter Chamber Interior Evaluation:
 1. Contractor shall provide the opportunity for Owner or Owner's representative to view the interior of all structures in accordance with current confined space entry requirements.
 2. Equipment and all personnel for confined space entry provided by Contractor.
 3. Contractor shall provide all other personnel appropriately trained for confined space entry.
 4. Evaluation and any corrections must be completed prior to Start-up.
- B. Pressure Testing:
 1. Air or air-water methods of applying pressure prohibited.
 2. All visually noted leaks or pipe movements must be repaired.

3.08 PUMP STATION START-UP AND TESTING:

- A. Contractor to coordinate and schedule the start-up:
 1. The Contractor shall arrange and pay for all required personnel to attend the start-up. Costs for the Engineer and Owner to attend the start-up shall be borne by the Owner for the first Start-up attempt. Costs for subsequent start-up attempts shall be the responsibility of the Contractor. Required personnel at start-up:
 - a. General Contractor
 - b. Mechanical Contractor
 - c. Electrical Contractor
 - d. Systems Integrator
 - e. Pump Manufacturer's Representative

- f. Generator Manufacturer's Representative
 - g. Engineer
 - h. Owner
 - 2. The Contractor shall provide and pay for clean water for station testing as well as be responsible for disposal of the water at the discharge of the force main.
 - 3. Contractor must fill the discharge force main full of water prior to scheduling start-up.
 - 4. The Contractor shall operate the pump station to allow the following tests to be completed. Measurements and witnesses of the measurements shall be coordinated by the Contractor. Tests may be repeated at the discretion of the Owner or Owner's representative.
 - a. Visual verification the force main is full of water by running a pump while looking at the force main discharge.
 - b. Flow and head of each pump running alone.
 - 1) Must achieve two (2) tests w/ the same result.
 - c. Flow and head of pumps running together.
 - 1) Must achieve two (2) tests w/ the same result.
 - d. Amp draw on each leg on meter and SCADA.
 - e. Flow Meter reading
 - f. Draw down via live tape to verify controls flow data.
 - 1) Must achieve two (2) tests w/ the same result.
 - g. Test each alarm condition and ensure the alarm reaches the Owner's operator.
 - h. Simulate utility power outage and ensure that:
 - 1) the permanent generator automatically starts and automatically transfers power to the station, or
 - 2) the portable generator and manual transfer switch transfer power to the station.
 - 3) Other tests as equipment manufacturers or Owner or Owner's representative deem necessary.
 - 5. If the station fails to pass the start-up tests and it is necessary to reassemble the start-up team at a later date, the costs for the subsequent testing shall be borne by the Contractor and shall include, but not be limited to, the time and materials for Owner or Owner's representative and equipment manufacturers.
- B. Owner's Operator Training:
- 1. A training session shall be held to train the operators how the system is operated.
 - 2. The operator training shall be separated from the start-up and shall be on a separate day than the start-up.
 - 3. The Contractor shall coordinate and pay for appropriate training personnel to train the operators in the use and programming of the system and shall, at a minimum, include the following personnel:
 - a. Systems integrator
 - b. Pump manufacturer's representative
 - c. Generator Manufacturers representative
 - 4. Minimum on-site time of each training representative: 8 hours

3.09 VFD START-UP AND OPERATOR TRAINING:

- A. Provide the services of an experienced competent service engineer for a minimum of (1) 8-hour day per drive not including travel time for start-up assistance. Service engineer must be a direct employee of the Drive Manufacturer, not an employee of the Drive Manufacturers Distributor. Service engineer shall be responsible for:
 - 1. Checking the installation including wiring and connections.
 - 2. Setting the adjustments on the drive control.

- 3. Executing a complete drive start up demonstrating the operation of the equipment to the Owner.
 - 4. Making field adjustments to drive programming parameters as directed by Township Engineer.
- B. It is the responsibility of the Contractor to be certain that the service engineering specified time is adequate since start-ups of each VFD will be at different times. The cost for additional time if required shall be responsibility of the Contractor.
- C. Provide a service technician for (1) 8-hour day (not including any system debugging or travel time) to check out the system installation at system start-up and to train the owners operators. During this time the Contractor will be asked to assist in fine tuning all controls for optimum operation. This will include but not be limited to making minor wiring changes and time delay adjustments and assisting Owner's Systems Integrator with, PLC's, HMI's, and SCADA Start up.

3.10 GENERATOR STARTUP AND TRAINING:

- A. Manufacturer's representative shall preform a hour load bank test in accordance with NFPA 110.
- B. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The startup and training program shall be 4 hours minimum in duration not including any travel time or load bank test time. Training date shall be coordinated with the Owner or Owner's Representative, and the Facility Owner.

3.11 GENERATOR SPARE PARTS, TOOLS, AND SIGNS:

- A. Contractor shall include two engine services including oil, coolant samples and reports within the first year.
- B. Set Required of Each:
 - 1. Operating, maintenance, repair, and adjustment data.
 - 2. Parts lists.
- C. One Set Required of Each:
 - 1. Any special tools, gauges, etc., required for operation, owner maintenance, and adjustment.
 - 2. All special tools needed to perform routine maintenance and replacement of fuel injectors.
- D. Two Sets Required of Each:
 - 1. Air cleaner cartridges.
 - 2. Oil filter cartridges.
 - 3. Fuel filter cartridges

3.12 CLEARANCES:

- A. Maintain clearances from electric panels and other electrical installations as required by NEC.
- B. Maintain working clearances around electrical equipment as required for proper maintenance and operation.

3.13 CLEANING:

- A. Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment, and related areas.
- B. Clean equipment and components of dirt and construction debris upon completion of installation.
- C. Touch-up scratched or marred enclosure surfaces to match finishes.
- D. Protect installed equipment and components from damage during remainder of construction period.

END OF SECTION

REVISION:

ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN
MASTER LIFT STATION

MASTER LIFT STATION DRAWINGS

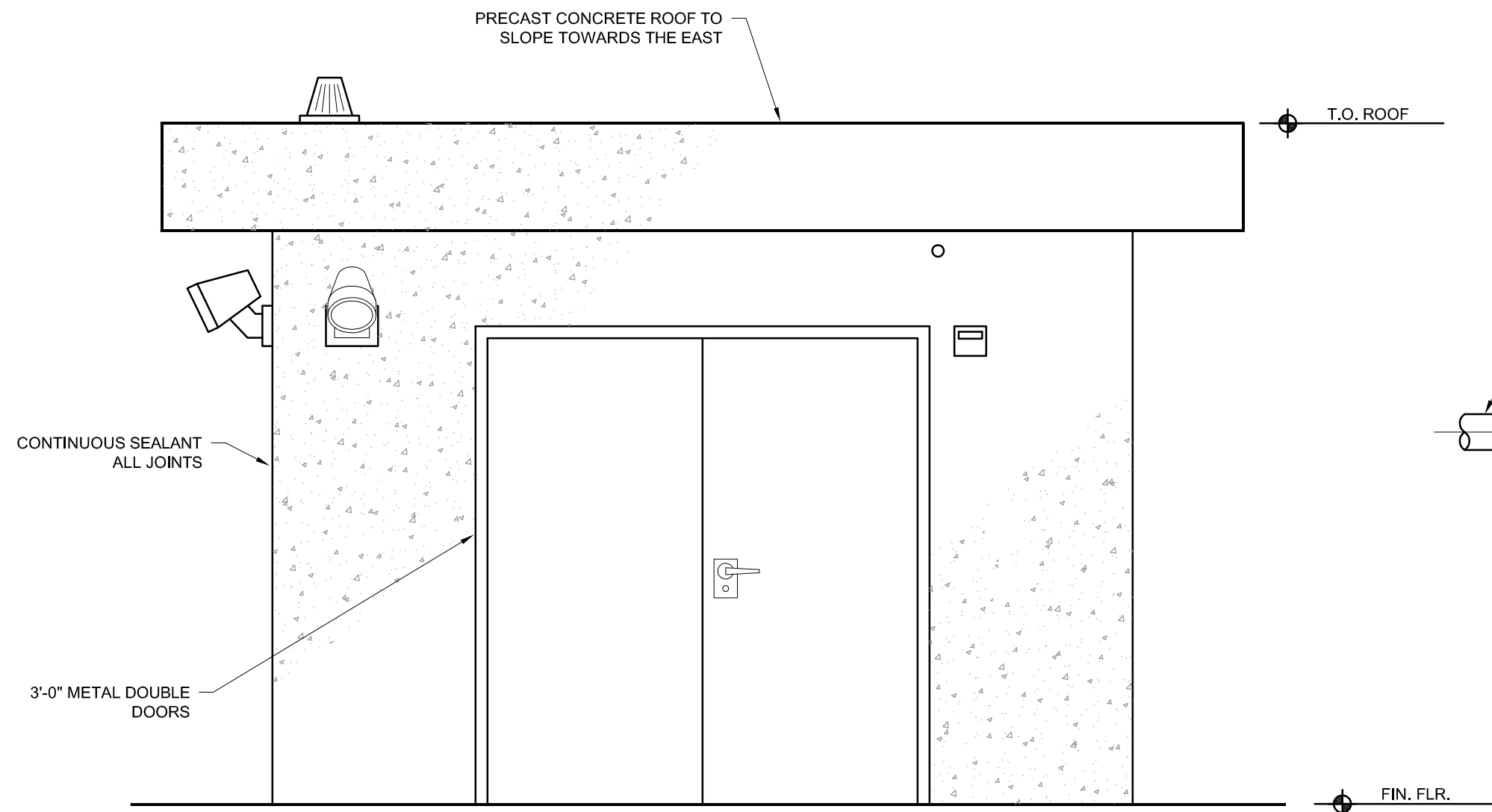
DESIGN TEAM: PROJ MGR: SRP
DESIGNED BY: SRP
DRAWN BY: RWD
CHECK BY:

DRAWING INFORMATION:
Master Lift Station
032028 enma.graham

JUNE 2024

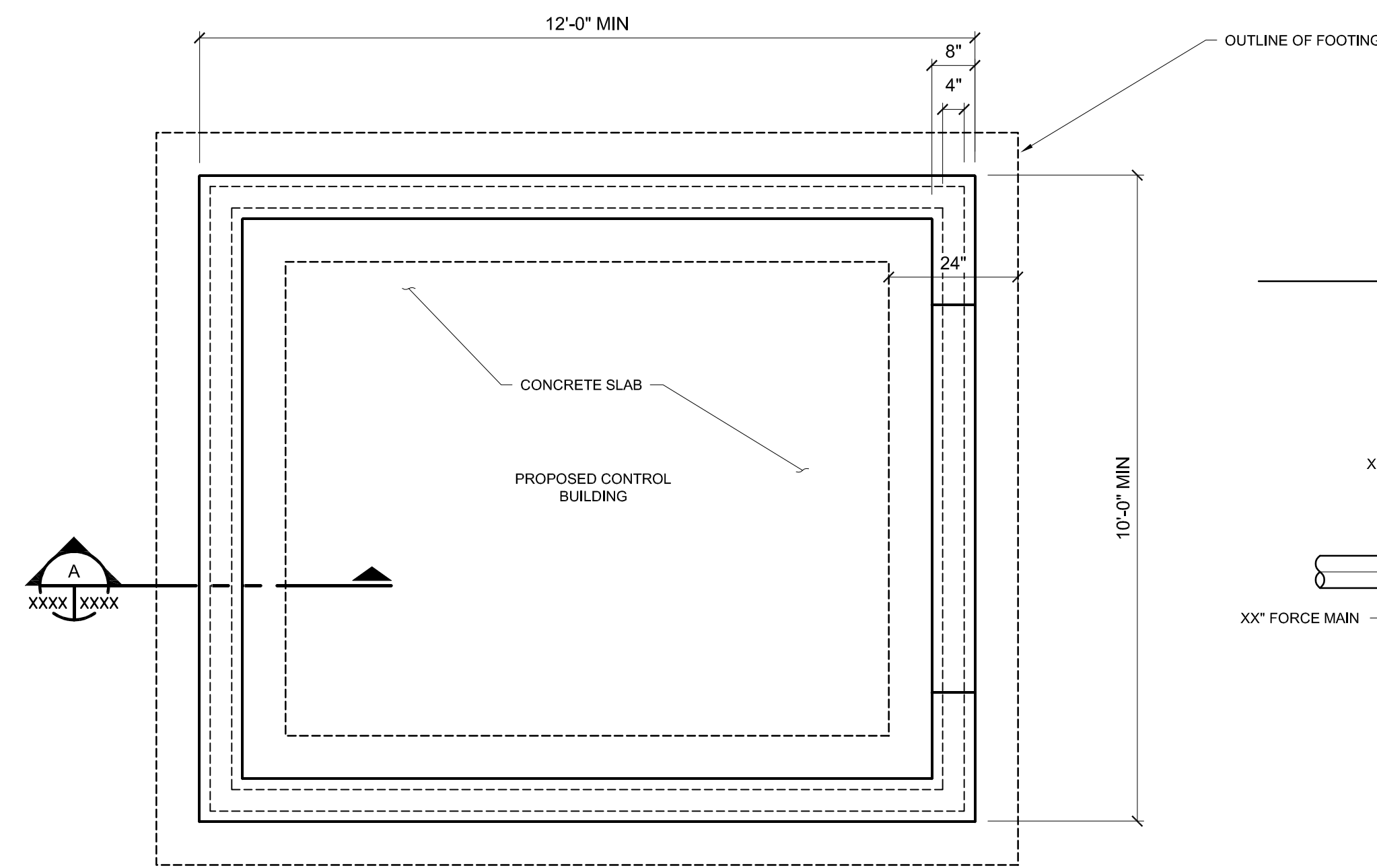
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CONTROL BUILDING EAST ELEVATION

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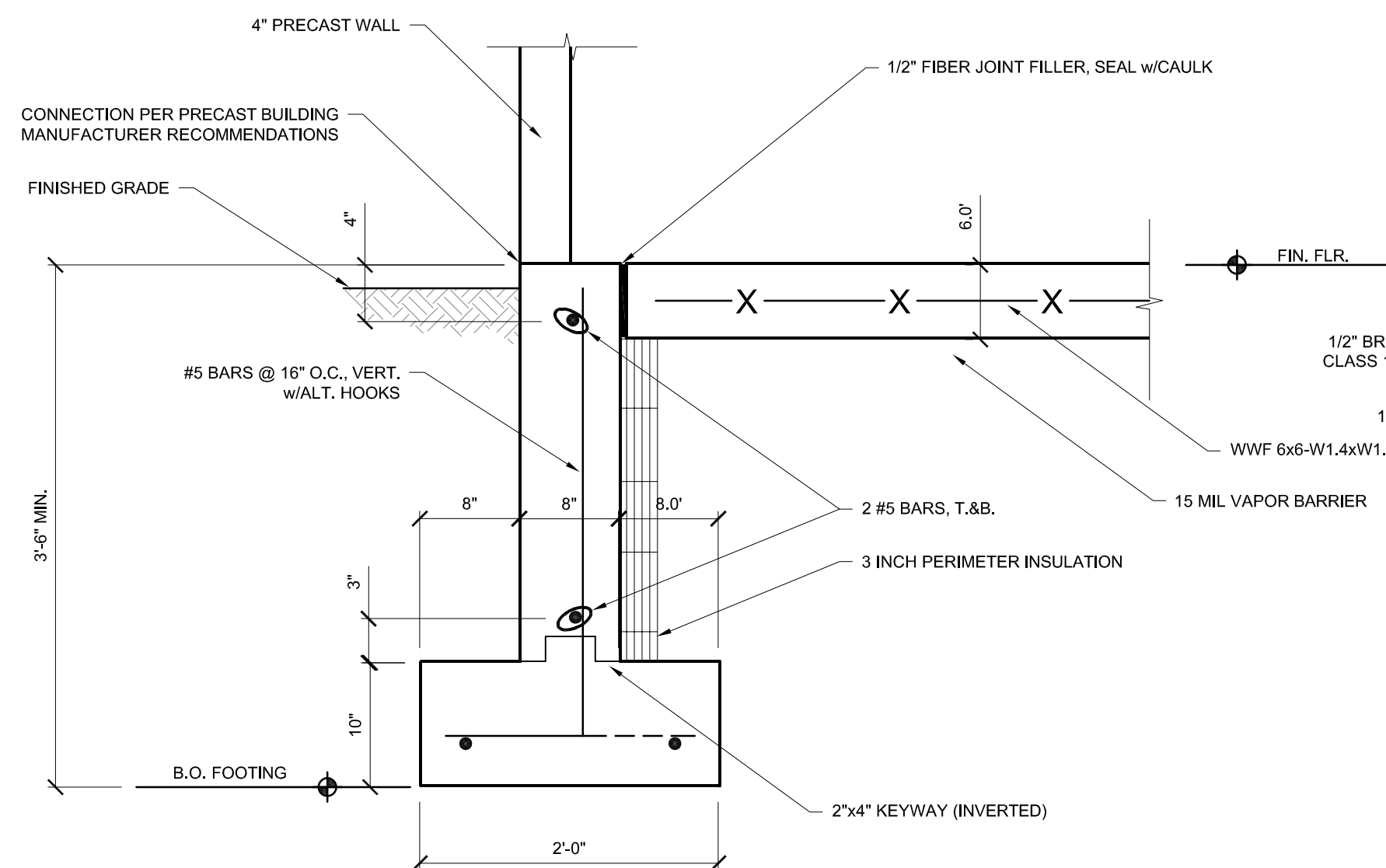


CONTROL BUILDING FOUNDATION PLAN

NOT TO SCALE

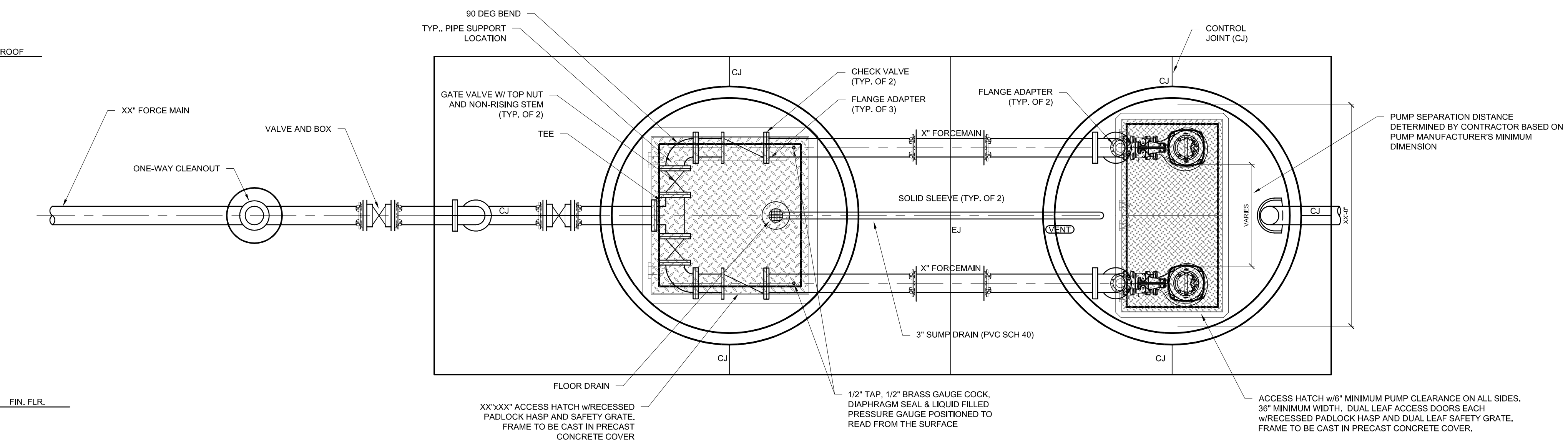
GENERAL NOTES:

- CONCRETE CONTRACTOR TO CONFIRM BUILDING FOUNDATION DIMENSIONS w/PRECAST CONCRETE BUILDING SUPPLIER.
- BUILDING DOORS SHALL FACE WET WELL AND VALVE CHAMBER



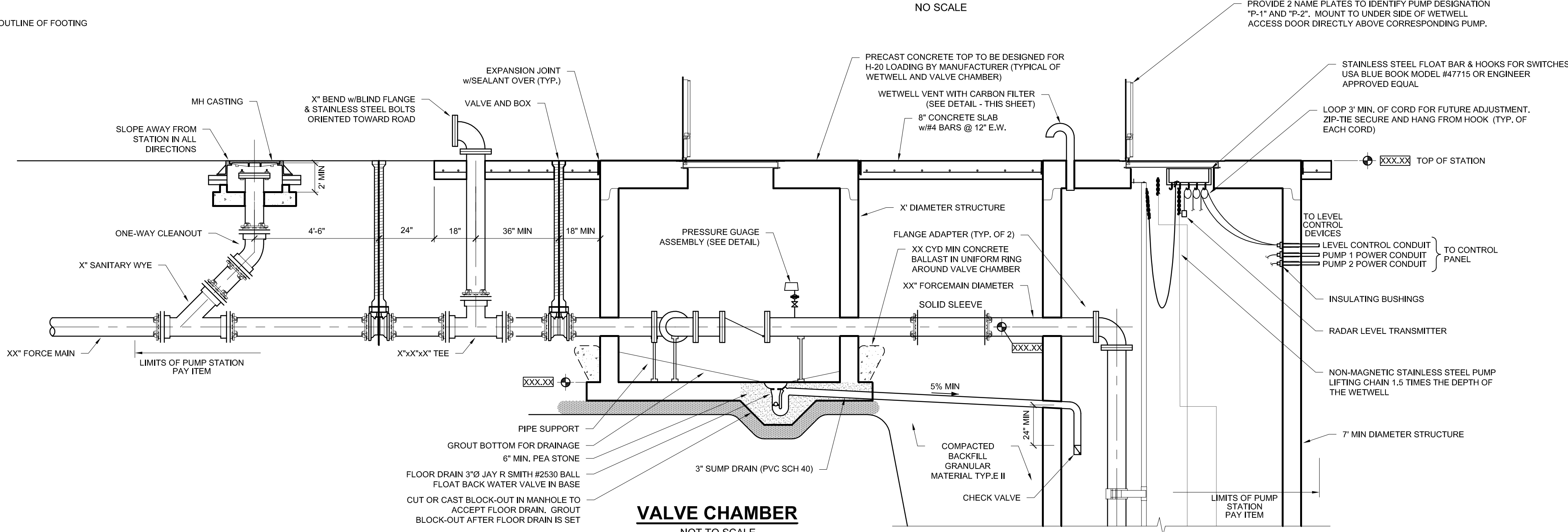
DETAIL

FOUNDATION SECTION
SCALE: 1"=1'-0"



PLAN VIEW

NO SCALE

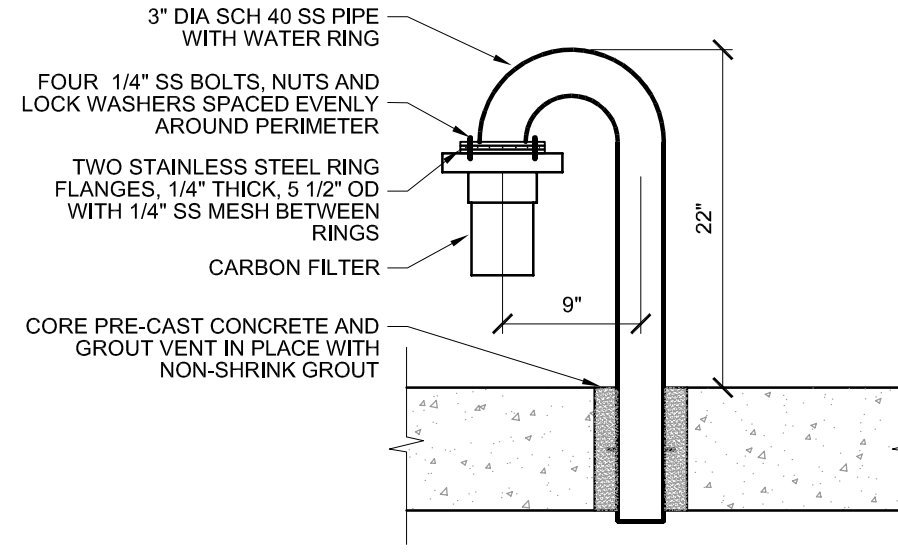


VALVE CHAMBER

NOT TO SCALE

GENERAL DRAWING NOTES:

- ALL BURIED FORCEMAIN PIPE CONNECTIONS SHOWN ON THIS DRAWING SHALL BE RESTRAINED MECHANICAL JOINT. ALL JOINTS INSIDE STRUCTURES SHALL BE FLANGED.
- ALL INTERIOR FASTENERS AND HARDWARE TO THE WETWELL VALVE CHAMBER AND METER CHAMBER SHALL BE NON-SPARKING STAINLESS STEEL INCLUDING FLANGE BOLTS
- SEAL ALL PIPE PENETRATIONS WITH A WATERTIGHT RUBBER BOOT
- ALL STRUCTURES SHALL BE ASTM C-478 PRECAST CONCRETE WITH A DOUBLE COAT OF BITUMINOUS WATERPROOFING ON THE EXTERIOR. BASES SHALL BE INTEGRALLY CAST WITH BOTTOM SECTIONS
- PROVIDE RAVEN 405 COATING SYSTEM IN WET WELL.

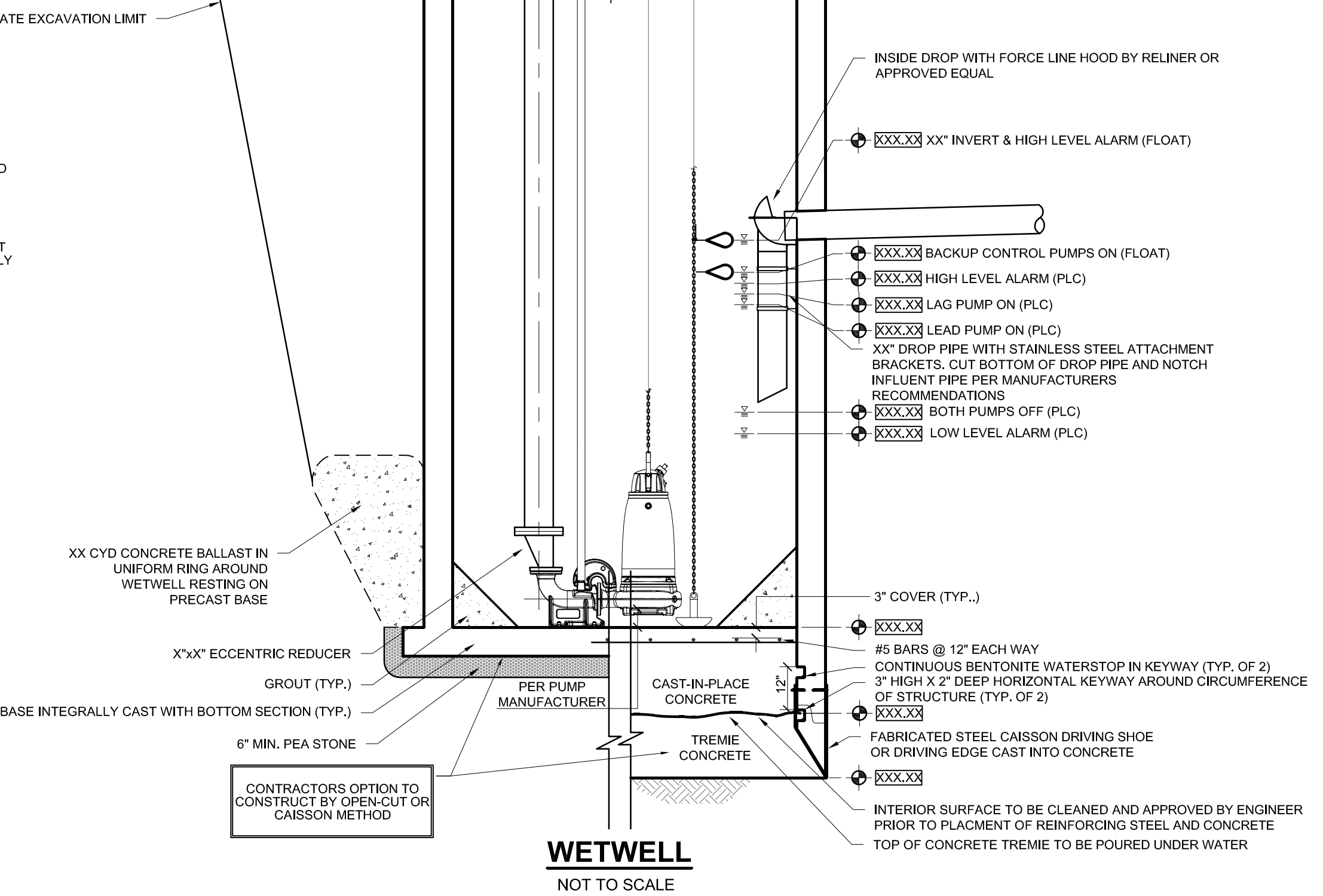


WETWELL VENT

NOT TO SCALE

PRESSURE GAUGE ASSEMBLY

NOT TO SCALE



WETWELL

NOT TO SCALE

SECTION 33 34 00
SANITARY FORCE MAINS

PART 1 - GENERAL

1.01 SUMMARY:

- A. This Section includes work required for sanitary force mains, structures, and appurtenant work.

1.02 REFERENCES:

- A. ASTM - American Society Testing Materials, latest edition.
- B. ANSI - American National Standards Institute, latest edition.
- C. PPI - Plastic Pipe Institute

1.03 SUBMITTALS:

- A. Submit the following for review by Township or Township's Engineer:
 - 1. Product data on Isolation Valves, Air Release Valves, pipe, fittings, restraints, and associated structures.
 - 2. Proposed equipment and method for Pressure and Leakage testing
 - 3. Details for connection to sanitary sewer system.
 - 4. Submittals must be approved by ACT Public Utility Department prior to the Pre-Construction Meeting.
 - 5. Submit copy of Quality Control records after construction completion.
- B. Report witness measurements on fittings.
 - 1. Provide a one-line drawing of all mains and stubs (in an accent color) with lengths. Allendale Public Utilities must be allowed access during construction to GPS locate all fittings and top of pipe or inverts at grade changes.
- C. Provide certification on pipe and fittings indicating conformance to specifications prior to installation.
- D. Submittal of drawings of record plans to:
 - 1. Provide the Township 1 printed set and a PDF file, and the Township Engineer 1 electronic file in AutoCAD format of record drawings (as-builts) with as-constructed dimensions and witnesses (in State Plane). All measurements to be English Standard.

1.04 JOB CONDITIONS:

- A. Clean up promptly following pipe installation and within maximum of 600 feet behind pipe laying operation. Cleanup includes backfill and rough grading.
- B. Installation not allowed when air temperature is 25 degrees or colder (F), or when determined too cold by Township field inspector.
- C. See General Requirements section 1.04.B for staking requirements.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Cement Lining: ANSI A21.4 Standard thickness for ductile iron pipe and fittings.

2.02 PIPE:

- A. Ductile Iron: ANSI A21.50 and ANSI A21.51; Class 52.
- B. HDPE – ASTM D3350 (standard specifications for polyethylene plastic pipe and fitting materials), SDR 11, PE4710.
- C. HDPE
 1. All HDPE pipe and fittings shall conform to ASTM D3350 with cell classifications meeting PE445574C, reference AWWA C905-15 (4" through 65") AWWA C901-08 (1/2" through 3"). They shall be listed as SDR11, PE4710, or 3408 as a minimum.
 2. Sections of polyethylene pipe shall be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi.
 3. No Sidewall fusion connections are permitted.
 4. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical jointing will be accomplished by either using a HDPE flange adapter with Ductile Iron back-up ring or HDPE Mechanical Joint adapter with Ductile Iron back-up ring.
 5. Socket fusion, hot gas fusion threading, solvents and epoxies shall not be used to join HDPE pipe.
 6. The butt fusion jointing will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with graphic representation of the fusion cycle. This log shall be part of the Quality Control records.
 7. Water services 2.02C of this specification for 1" and 1.5" can be coupled using mechanical fittings, installed per the manufacturer's specifications and meeting Michigan Plumbing Code 605.22.1.
 - a. 2" and larger must follow the butt fusion requirements.

2.03 JOINTS:

- A. Ductile Iron Pipe and Fittings:
 1. Mechanical: ANSI A21.11.
 2. Push-on: ANSI A21.11.
 3. Electrical Continuity: Provide bronze wedges (3 per joint), or thermite welded sockets and cables.
- B. HDPE to Ductile Iron Connection:
 1. The connection from the HDPE pipe to DI shall be manufactured by the pipe manufacturer. It shall be made of HDPE and connect to the DI pipe with a standard rubber gasket and a mechanical joint gland.

2. The mechanical joint adapter shall be of the same SDR rating as the pipe. Additional restraint shall be provided on the ductile iron pipe side of the connection point by restraining pipe joints for a distance of at least 150 feet.
3. Additional restraint shall be provided on each side of the connection point in the form of an HDPE anchor ring encased in concrete or other methods as approved by Township Engineer. All proposed connection and restraint details shall be included on the plans.
4. Connections shall not be made for a period of 24 hours after the pipe has been installed to allow the pipe to approach an equilibrium temperature with its surrounding environment.
5. Follow manufacturer's recommendation for number of electrofusion flex restraints needed at each connection.
6. The HDPE pipe shall be properly aligned at all connections.

2.04 FITTINGS:

- A. Ductile Iron: ANSI A21.10, ANSI 21.53, Class 54, 250 psi working pressure through 12-inch and 150 psi greater than 12-inch.
- B. HDPE
 1. Butt Fusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers, Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits and per AWWA C906.
 2. Electrofusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits per AWWA C906.
 3. Flanged and Mechanical Joint Adapters – Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

2.05 VALVES (Open Left):

- A. Gate:
 1. AWWA C515, double disc, non-rising stem, fully bronze mounted and roller and gear operator over 16 inches.
 2. Resilient-wedge gate valves: ANSI/AWWA C509 or C515.
 - a. Non-rising Stem (NRS)
 - b. Wrench nut: 2-inches square with extensions as indicated on the drawings.
 - c. Open Left (counterclockwise)
 - d. Flanged ends
 - e. Stem Seal: O rings
- B. Resilient Wedge for anything under 16 inches (add spec)
- C. Plug: ANSI B16.1, Clow Corporation F-5410, or equal.

- D. Air release: APCO 400 or Val-Matic 48 BWA.
- E. Boxes: Three (3) section cast iron with lid marked SEWER.
 - 1. Upper section: Screw on adjoining center section and full diameter throughout. Place geotextile fabric around threaded joint of risers, if used.
 - 2. Center section: Minimum 5-inch inside diameter.
 - 3. Base section: Fit over valve bonnet and shaped round for valves through 10-inch and oval for 12-inch and over. Place geotextile fabric around valve bonnet.

2.06 AIR RELEASE VALVE AND CLEANOUT CHAMBERS:

- A. Chambers shall be precast or cast-in-place concrete.
- B. Precast Units: ASTM C478 and ASTM C76, Class III.
 - 1. Joints: Cement mortar, preformed bituminous rope or "O"-ring gaskets.
 - 2. Pipe Opening: Pipe diameter plus 6-inch, maximum.
- C. Concrete: 4000 psi 28 day, 4-inch maximum slump.
- D. Concrete Brick: ASTM C55, Grade N-1 (For repair of existing brick structures only).
- E. Grade Rings: ASTM C478.
- F. Mortar: ASTM C270, 1-part Portland cement, 1-part lime and 3-parts sand by volume.
- G. Chamber Steps:
 - 1. Plastic with $\frac{3}{8}$ -inch steel reinforcement.
 - 2. Dimensions: 10-inch deep by 10-inch wide, 5-inch tread depth.
- H. Chamber Casting: East Jordan 1040 A cover – two (2) hole cover with the words "ALLENDAL AREA SANITARY SEWER" and East Jordan 1045 Z1 frame.
- I. Piping: Coal tar epoxy coating required.

2.07 TRACER WIRE:

- A. General:
 - 1. Open Trench – Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
 - 2. Directional Drilling/Boring – Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
 - 3. Trace wire – Pipe Bursting/Slip Lining – Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.
- B. Connectors:
 - 1. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
 - 2. Direct bury wire connectors – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire

installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.

3. Non locking friction fit, twist on or taped connectors are prohibited.

C. Termination/Access

1. All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
2. All grade level/in-ground access boxes shall be appropriately identified with "sewer" or "water" cast into the cap and be color coded.
3. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
4. All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
5. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.
6. Service Laterals on public property - Trace wire must terminate at an approved grade level/in- ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
7. Service Laterals on private property - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.
8. Hydrants – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)
9. Long-runs, in excess of 500 linear feet without service laterals or hydrants - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

D. Grounding

1. Trace wire must be properly grounded at all dead ends/stubs
2. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose and buried at the same elevation as the utility.
3. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
4. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
5. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

2.08 MISCELLANEOUS:

- A. Tie Rods and Clamps: Clow Corporation or Traverse City Iron Works.
- B. Polyethylene Encasement:
 - 1. Material: ASTM D1248 Polyethylene, Type I, Class C, 8 mils thick.
 - 2. Closing tape: 2-inch wide Poly Ken #900 or Scotchwrap #50.
- C. Mechanical Joint Restraint: Megalug by EBBA Iron Sales, Inc.

PART 3 - EXECUTION

3.07 PREPARATION:

- A. Alignment and Grade:
 - 1. Deviations: Notify Owner's Engineer and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on the plans.
 - a. Verify location and depth of existing utilities in advance of construction and provide adjustments in alignment and grade of force main.
 - b. Depth of pipe: Minimum cover over pipe below finished grade shall be 5 feet.
 - 2. High points in pipe line: Locate at air release valves.
 - 3. Install pipe to elevations and grades when indicated on drawings.
 - 4. Measure pipe inverts prior to setting cones, for as-built drawings.
- B. Bedding:
 - 1. Method: See Article 3.04 SCHEDULES.
 - 2. Provide bedding area backfill in accordance with MDOT Standard Plan No. R-83C
 - 3. Provide continuous bearing by supporting entire length of pipe barrel evenly.
- C. Cleaning Pipe and Fittings:
 - 1. General: Provide interior free of foreign material and joint surfaces free of lumps and blisters.
- D. Termination:
 - 1. Force mains shall terminate at the bottom of a manhole 0.1 foot above outlet invert.
 - 2. The alignment of forcemain discharge must be within 30 degrees of straight through (i.e. 12 o'clock to 6 o'clock position).
 - 3. Manhole flow channels shall be constructed to crown of downstream outlet for forcemain receiving structures.

3.08 INSTALLATION:

- A. Laying pipe:
 - 1. Place pipe length and bedding as a unit in a frost free, dry trench.
 - 2. Special supports and saddles: See Article 3.04 SCHEDULES.
 - 3. Joint deflection shall be as recommended by pipe manufacturer.
 - 4. HDPE pipe installation shall comply with AWWA manual M55 and construction shall meet ASTM F2620.
- B. Cutting Pipe:
 - 1. Ductile iron: Power saw.

- C. Jointing:
 - 1. Mechanical:
 - a. Lubricate with manufacturer specified material.
 - b. Tighten bolts evenly to manufacturer specifications.
 - 2. Push-on:
 - a. Lubricate as recommended by manufacturer.
 - b. Shape beveling as recommended by manufacturer.
- D. Setting Valves and Fittings:
 - 1. General: See Article 3.04 SCHEDULES.
 - 2. Valves: Plumb.
 - 3. Valve boxes:
 - a. Base section: Center and plumb over operating nut and 2 inches above bonnet joint.
 - b. Upper section: Set cover flush with finished grade.
 - c. Witnesses: Provide two (2) measurements to permanent surface features.
- E. Cleanout and Air Release Valve Chambers:
 - 1. General: See Article 3.04 SCHEDULES:
 - 2. Base Bedding: Provide 3-inch bed of stone with full and even bearing in impervious soils or wet conditions. Otherwise provide on undisturbed, frost-free, dry subgrade. Anything over 3 inches of stone, fabric will be required on top.
 - 3. Precast: Fill joint space completely and trowel.
 - 4. Provide casting setting as follows:
 - a. Existing pavement: Finished grade.
 - b. Gravel road: 6 inches below.
 - c. Unpaved areas: Finished grade.
- F. Pipe Joint Restraint:
 - 1. Provide mechanical joint restraint for the minimum lengths shown in joint restraint detail (i.e. Schedule 3.06.A.4)
 - * The length of restrained pipe required shown in the joint restraint detail is based on trench backfill being compacted to 95% of the maximum density according to the Modified Proctor Method. The joint restraint detail does not consider polyethylene wrapped pipe. If the pipe is wrapped with polyethylene, a greater length of restrained pipe will be required. Unless otherwise specified, a multiplier of 1.5 shall be used to determine the required length when the pipe is wrapped with polyethylene.
 - ** If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.
 - a. Tees: Pipe restraint length shown in the joint restraint detail shall be provided in the branch direction. Also, the minimum length of pipe restraint in the straight through (run) direction shall be 10 feet on both sides of the tee.
 - b. Bends: Pipe restraint length shown in the joint restraint detail shall be provided on both sides of the bend.
 - c. Dead End: Pipe restraint length shown in the joint restraint detail shall be provided back from the dead-end plug.
 - d. See 3.06 SCHEDULES for a detail illustrating the joint restraint requirements.
 - e. All joints shall be restrained for pipe within casings.
 - f. All joints between bends on water main offsets shall be restrained.

G. Reaction Backing (allowed only where restrained joints cannot be used and when approved by Engineer):

1. Placement:
 - a. Place concrete manhole block next to pipe and concrete reaction backing behind. Megalugs and fitting bolts shall not be covered with concrete.
2. Bearing area: Provide the following square feet of concrete against trench wall in sand:

Pipe	Tees	Hydrants	Wyes	22½°	11¼°
Size	Plugs	90° Els	45° Els	Els	Els
4"	2	1	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
12"	9	11	6	3	2
16"	13	20	10	6	3

3. Other Soil Conditions:
 - a. Cement sand or hardpan - Multiply above by 0.5
 - b. Gravel - Multiply above by 0.7
 - c. Hard dry clay - Multiply above by 0.7
 - d. Soft clay - Multiply above by 2.0
 - e. Muck - secure all fittings with Megalug retainer glands or tie rod clamps and concrete reaction backing the same as listed for sand conditions. Install as required by SECTION 02220 – EXCAVATING, BACKFILLING AND COMPACTING.

H. Polyethylene Encasement:

1. In corrosive soils: Install over ductile iron pipe and tape seams in accordance with AWWA C-105.

I. Tracer Wire:

1. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
2. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
3. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
4. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.
5. Trace wire must be properly grounded as specified.
6. Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)
7. At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)
8. Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead- end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

9. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.
10. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.
11. Sanitary Sewer:
 - a. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
 - b. Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.
 - c. Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right of way.

3.09 TESTING AND INSPECTION:

- A. General:
 1. Observation: By Township Field inspector.
 2. Completion: Before connection to lift station.
 3. Notification: Pretest and arrange for inspection and test.
 4. Equipment and assistance: Provide.
 5. Required water: By Township where available from municipal system.
 6. HDPE testing shall be in accordance with AWWA C901.
- B. Electrical Continuity: Test ductile iron pipe for continuity and repair breaks.
- C. Pressure:
 1. Conditions: Air or air-water methods of applying pressure prohibited.
 2. Range: 100 to 110 psi at lowest elevation.
 3. Duration: 1 hour and until completion of inspection.
 4. Procedure: Fill system slowly, expel air through air release valve connection at high points and apply pressure. Install air release valve after test.
 5. Inspection: Examine line and appurtenances for leaks and movement.
 6. Corrections: Repair defects, visible leaks and repeat test until acceptable.
- D. Leakage:
 1. Condition: Following pressure test.
 2. Average pressure: Within pressure test range.
 3. Duration: two (2) hours.
 4. Filling: As in pressure test.
 5. Supplying make-up water: Measurable source.
 6. Leakage: Quantity of water supplied to maintain test pressure.
 7. Allowable: Less than:

$$L = \frac{ND \times \text{Square root of } P}{3700}, \text{ where}$$

L = leakage (gallons per hour)
 N = number of joints
 D = nominal pipe diameter (inches)
 P = average test pressure (pounds per square inch gauge)

Note: Formula equals 0.8 gallon per hour per mile per inch diameter at 100 psi for 18-foot lengths.

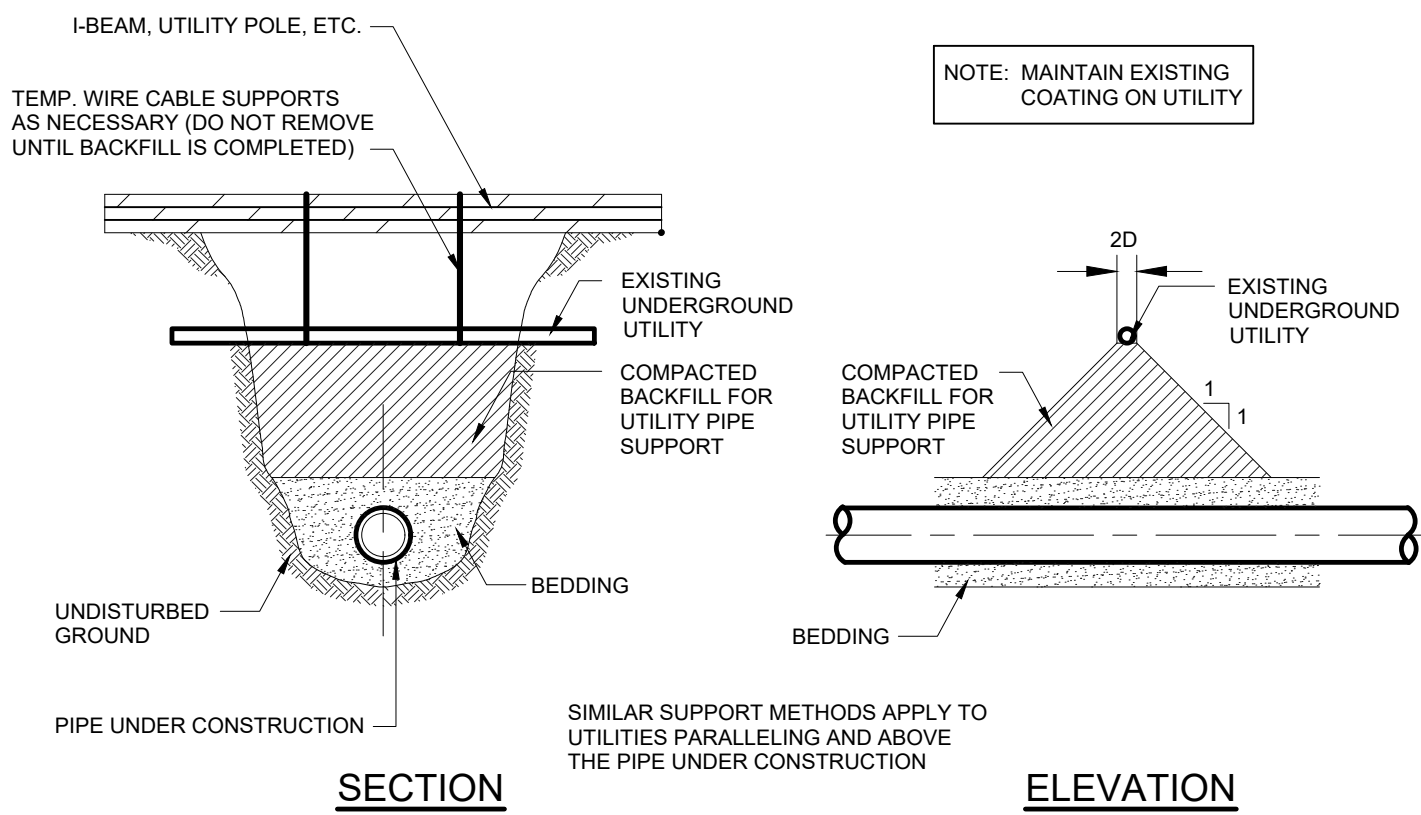
8. Correction: Repair defects and repeat test until acceptable.

3.10 SCHEDULES:

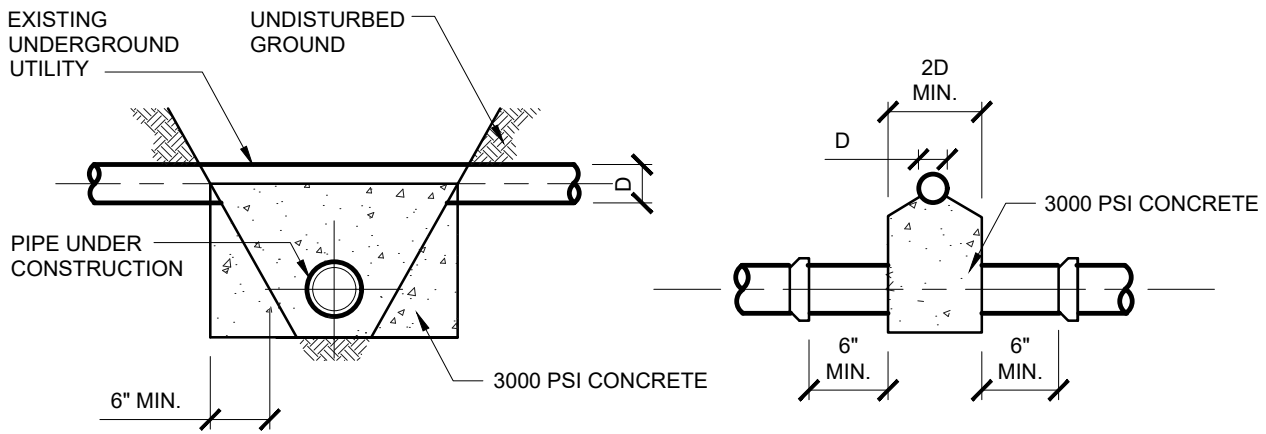
A. Standard Details:

1. Special supports for underground utilities / pipe saddles
2. Methods of bedding pipe
3. Standard air release valve chamber
4. Joint Restraint Requirements
5. Drop connection detail
6. Force main discharge detail
7. Clean out detail
8. HDPE details
9. Tracer Wire Specifications

END OF SECTION



SPECIAL SUPPORTS FOR UNDERGROUND UTILITIES

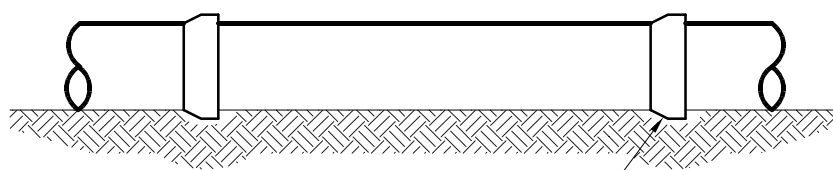


NOTE:
1. PIPE SADDLE IS NOT REQUIRED FOR PLASTIC, STEEL, LEAD OR COPPER PIPE 2" OR SMALLER.

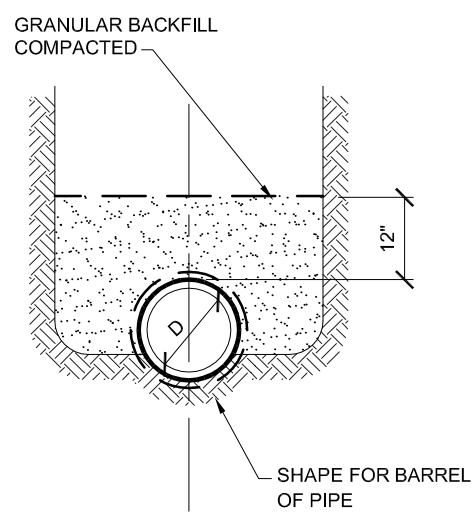
SECTION

ELEVATION

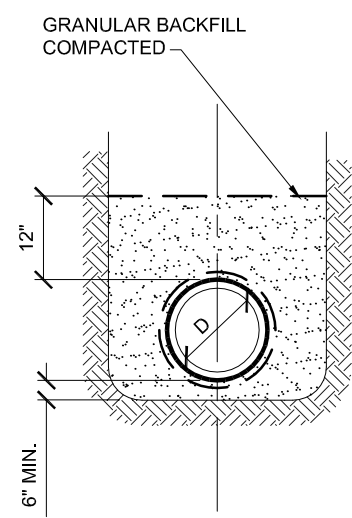
PIPE SADDLES



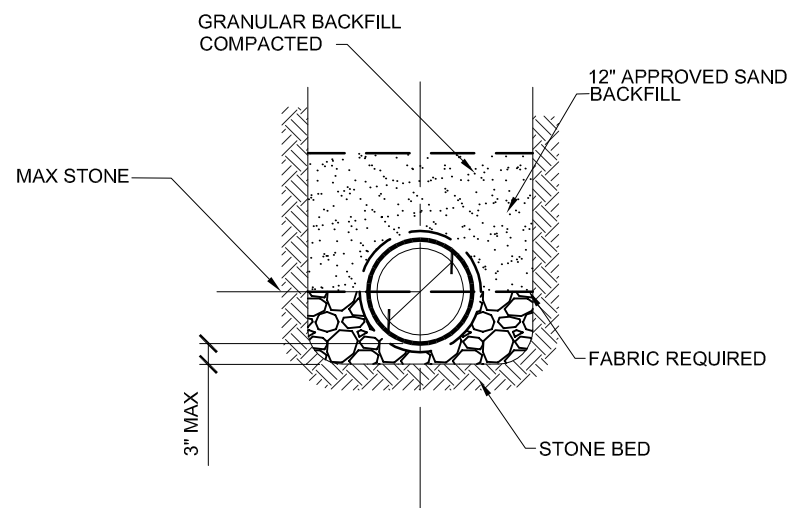
EXCAVATION FOR BELLS



METHOD I



METHOD II

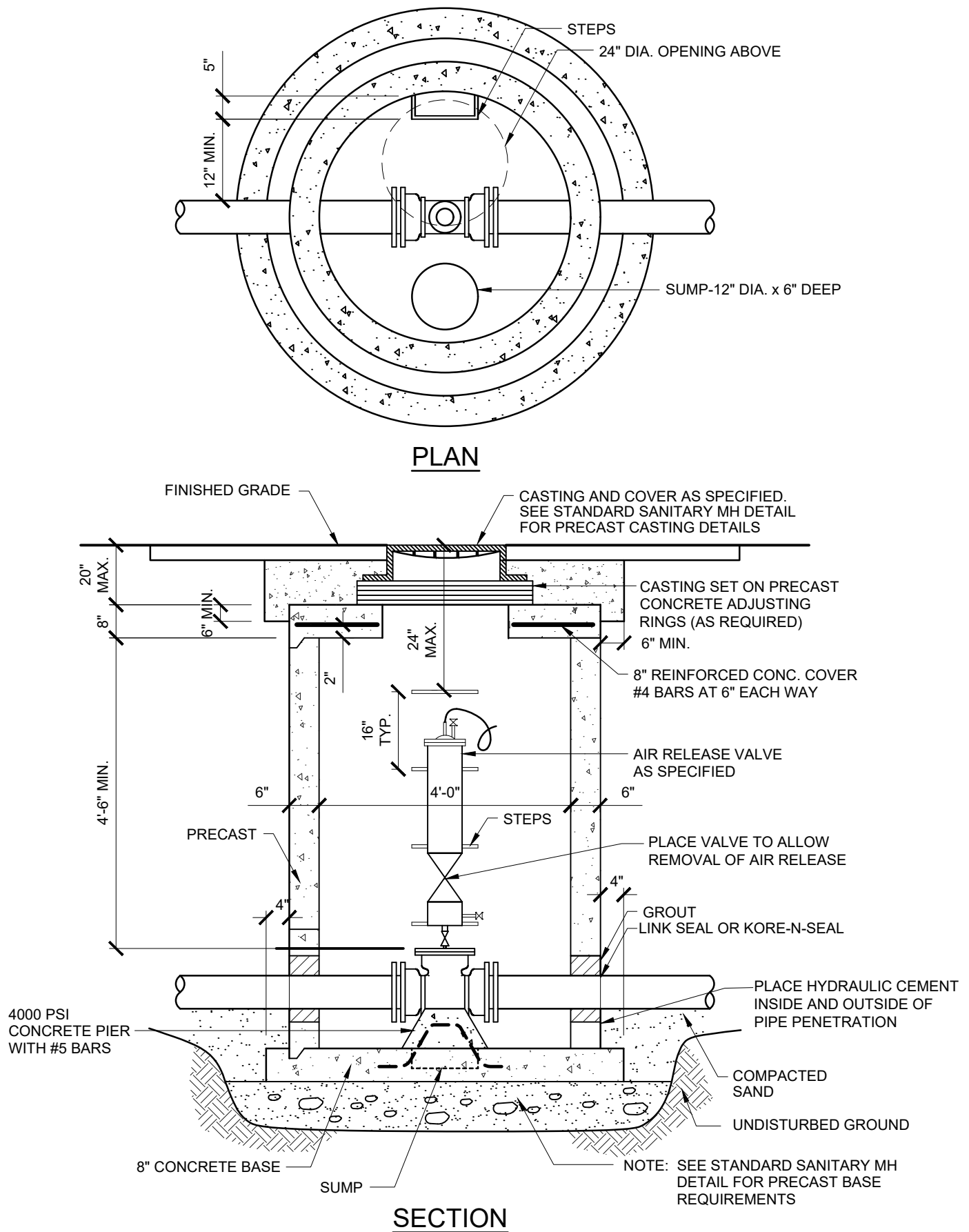


METHOD III W/ STONE

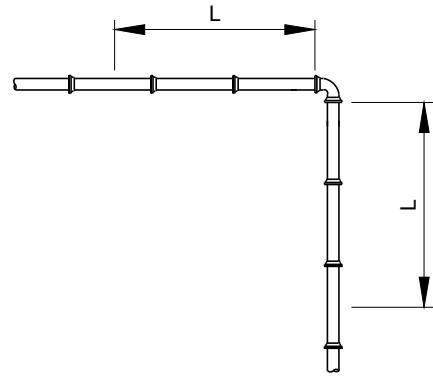
NOTES:

1. METHOD I. IN AREAS OF UNCONSOLIDATED SOILS (SAND, GRAVEL, ETC.)
2. METHOD II: IN AREAS OF CONSOLIDATED SOILS (CLAY, HARDPAN, ROCK, ETC.)
3. METHOD III: IN AREAS OF WET SOILS WITH STONE (CLAY, HARDPAN, ROCK, ETC.)
4. IN AREAS WITH MORE THE 3" MAX OF STONE UNDER THE PIPE, FABRIC IS REQUIRED

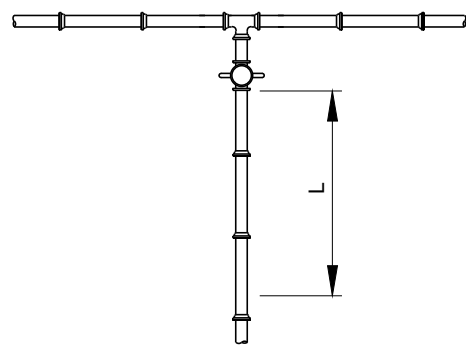
METHODS OF BEDDING PIPE



STANDARD AIR RELEASE VALVE CHAMBER

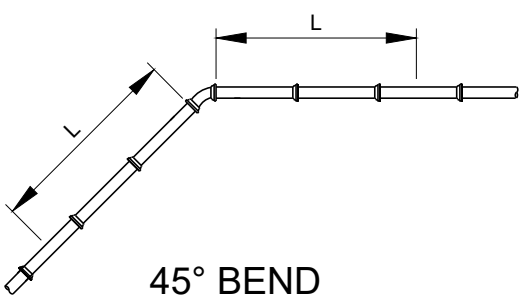


90° BEND

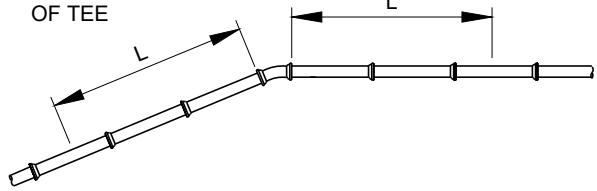


TEE

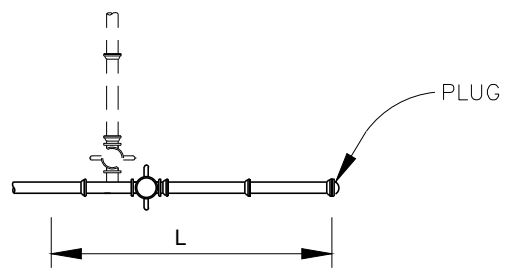
MINIMUM LENGTH OF MECHANICAL JOINT RESTRAINT IN THROUGH DIRECTION SHALL BE 10' ON BOTH SIDES OF TEE



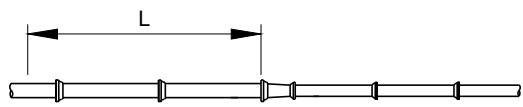
45° BEND



22 1/2° BEND OR LESS



DEAD END



REDUCERS

"L" = MINIMUM LENGTH OF MECHANICAL JOINT RESTRAINT SHOWN IN TABLE
MULTIPLY BY 1.5 IF PIPE IS WRAPPED IN POLYETHYLENE

PIPE RESTRAINT LENGTH (L) REQUIRED, FEET*							
Pipe Dia.	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110

* AND ** - SEE PARAGRAPH 3.02H OF SPECIFICATION SECTION 33 11 00
***VERTICAL BENDS REQUIRE 50% OF ADDITIONAL RESTRAINT.

JOINT RESTRAINT REQUIREMENTS

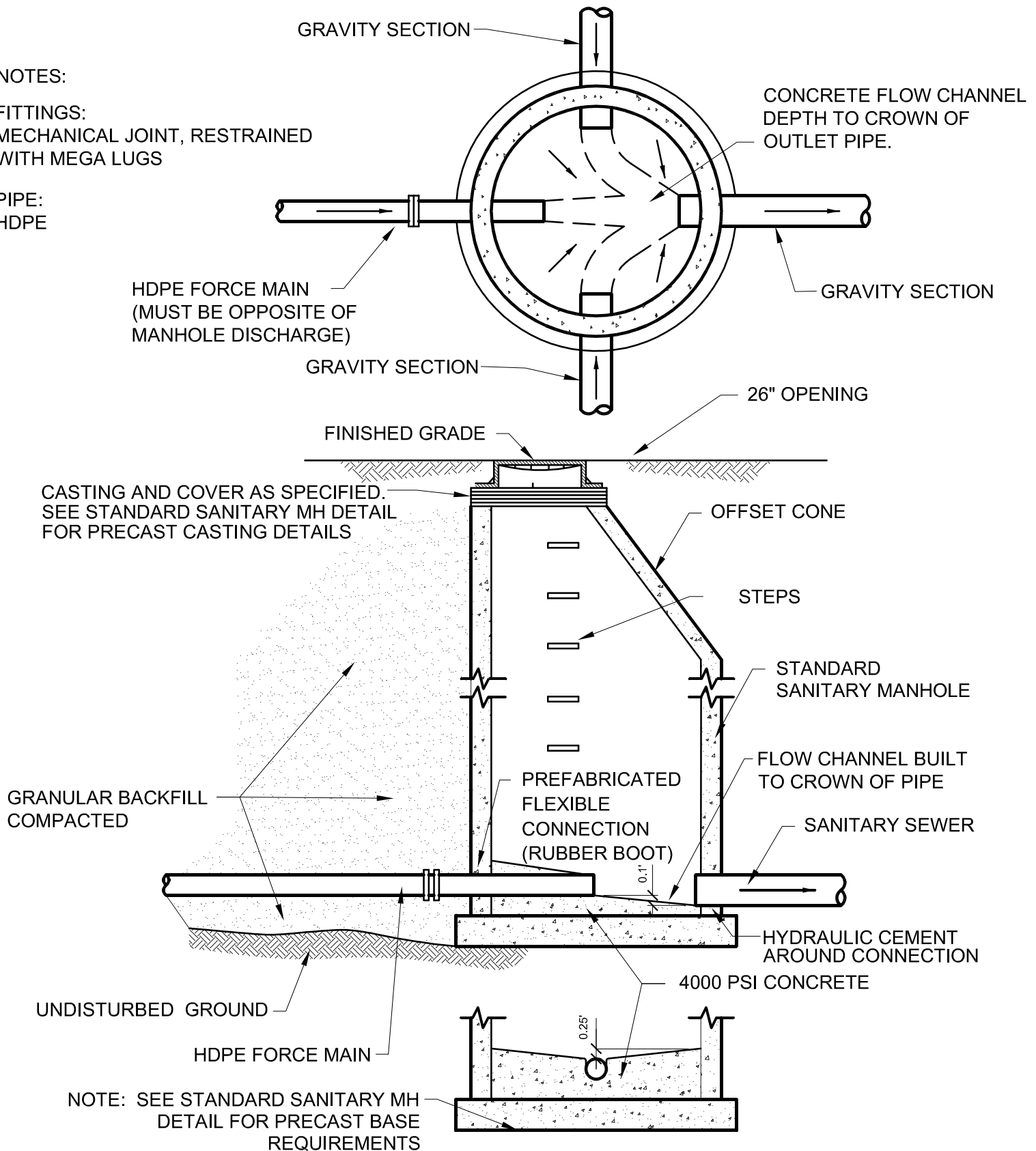
NOTE: SEE STANDARD SANITARY MH
DETAIL FOR PRECAST BASE
REQUIREMENTS

FM DROP CONNECTION DETAIL

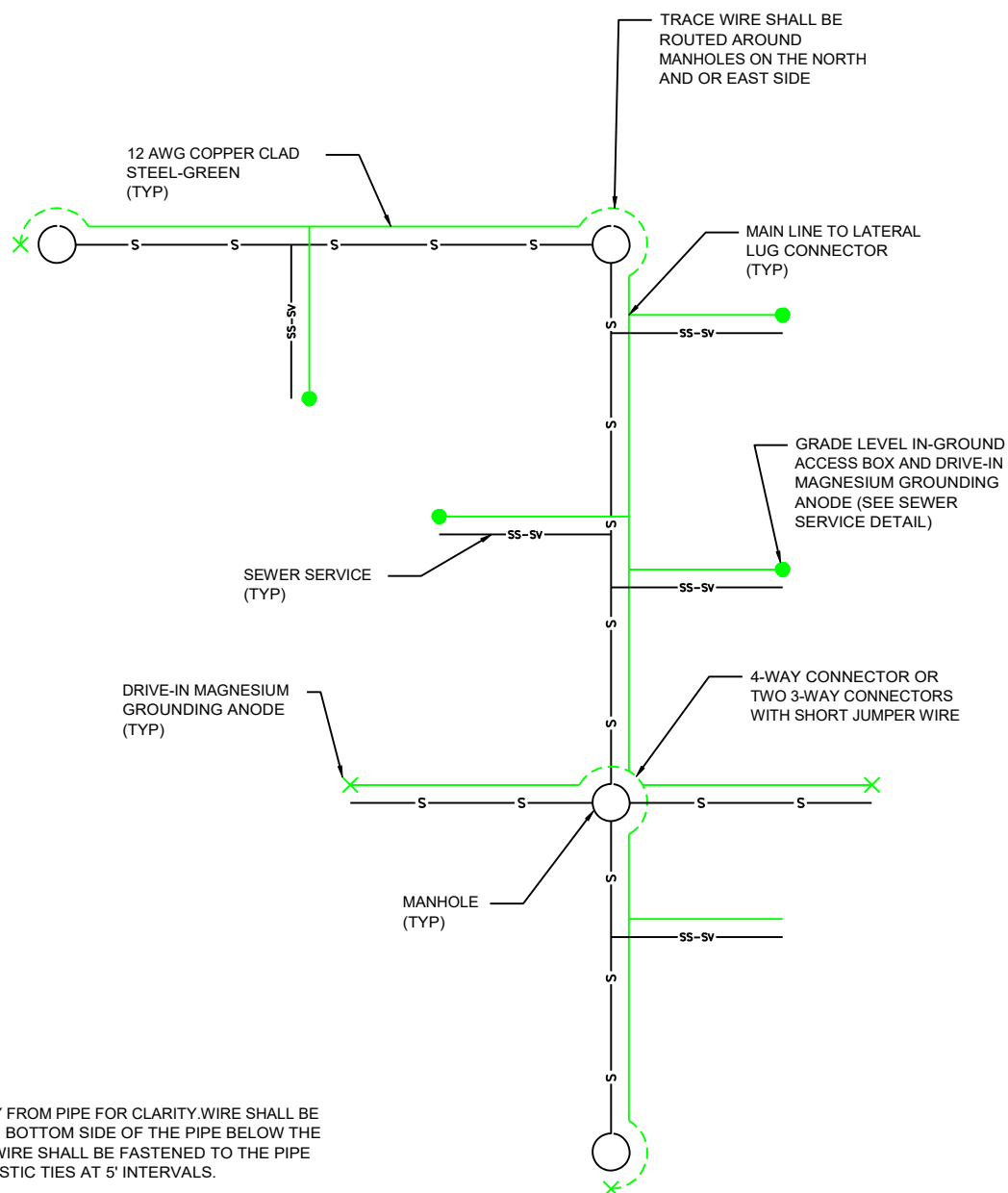
NOTES:

FITTINGS:
MECHANICAL JOINT, RESTRAINED
WITH MEGA LUGS

PIPE:
HDPE



FORCE MAIN DISCHARGE DETAIL



NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

TRACE WIRE PLAN(SEWER)

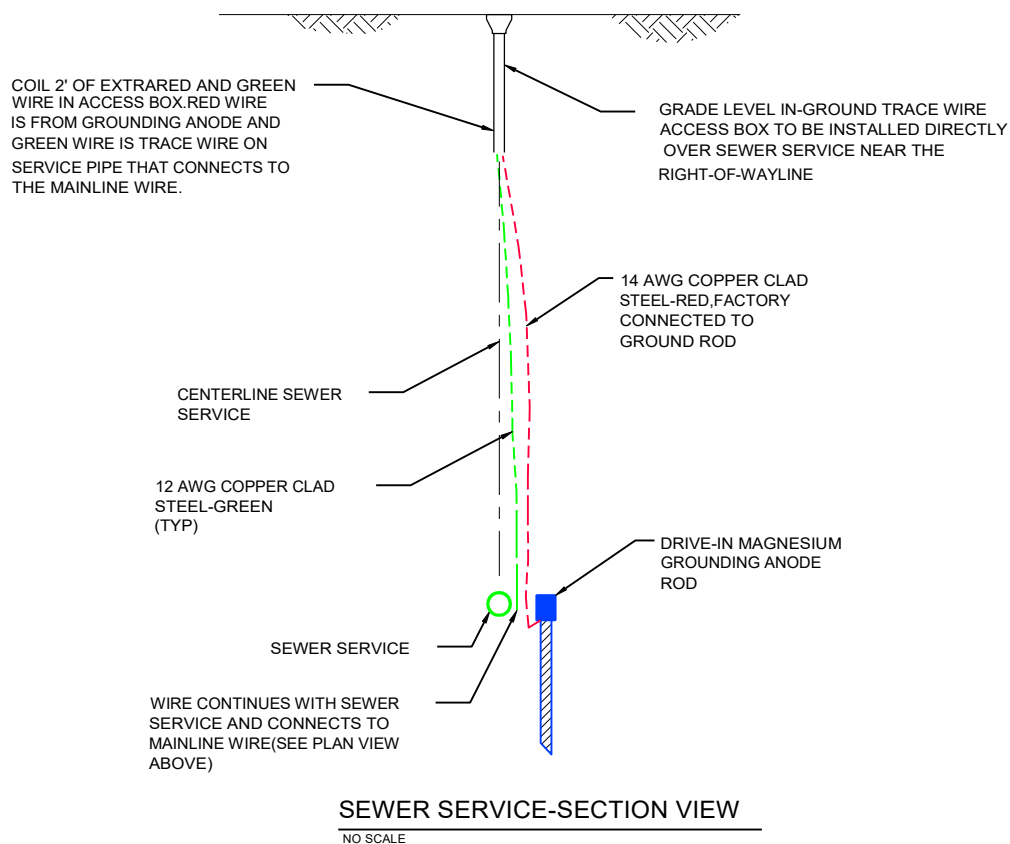
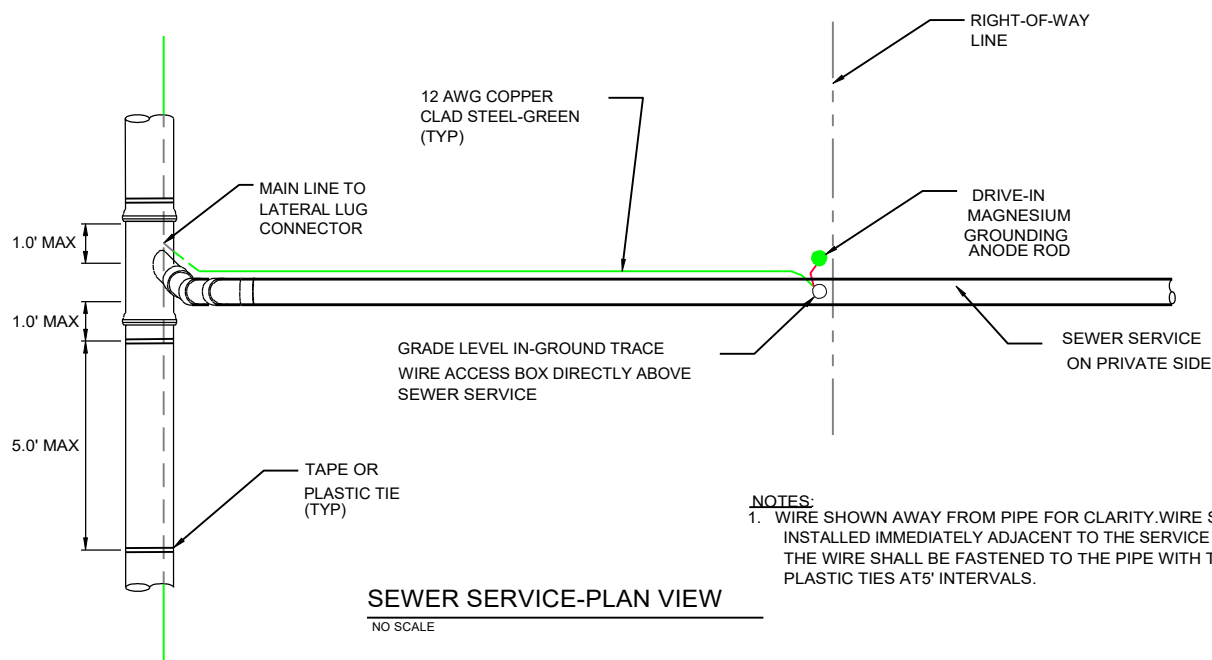
NO SCALE



MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACE WIRE
SAMPLE SEWER PLAN

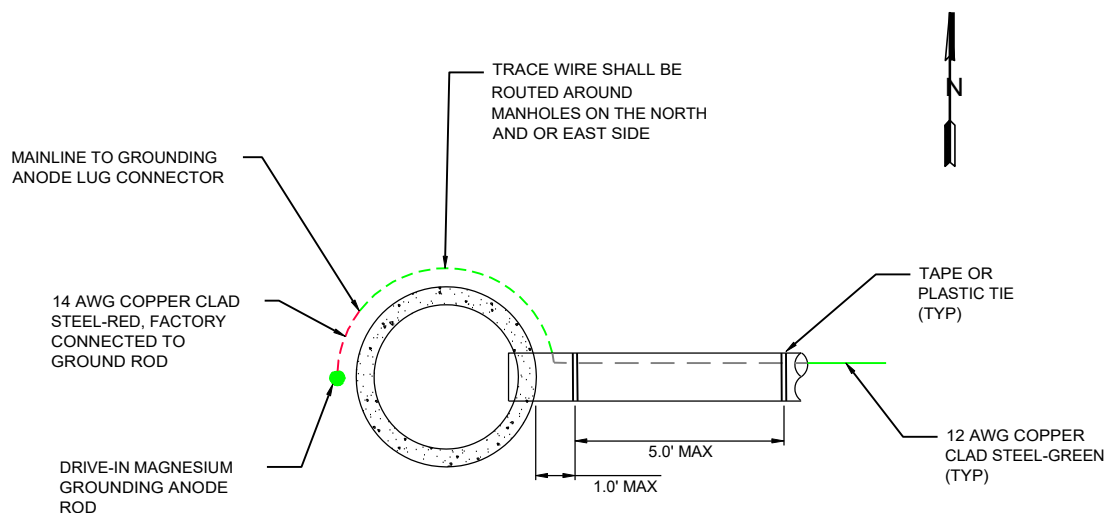
May 28, 2014



MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

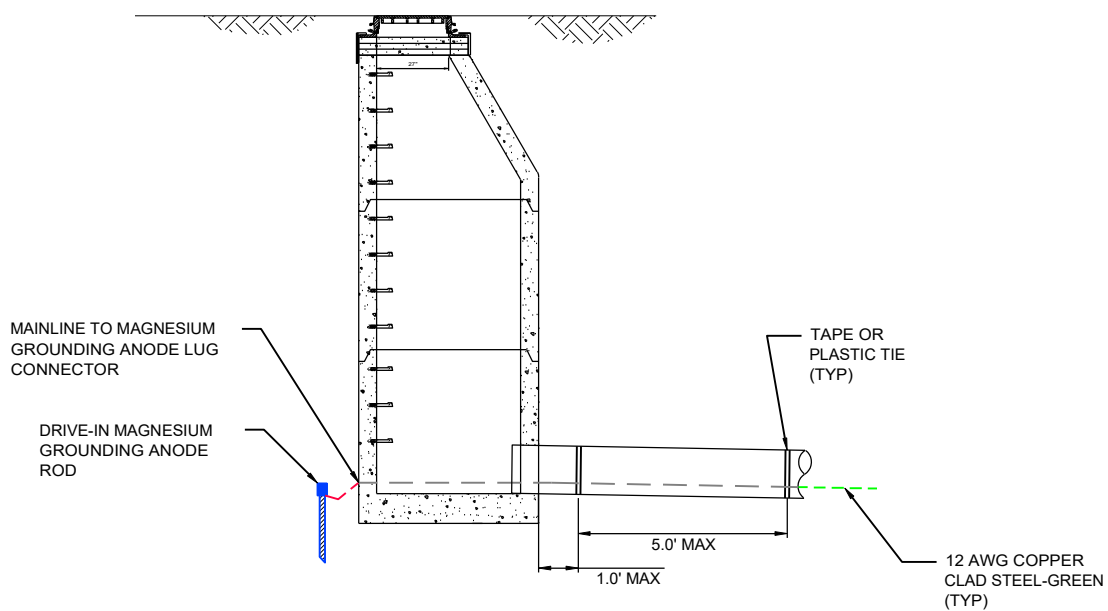
TRACE WIRE
SEWER SERVICE DETAIL

May 28, 2014



SEWER MANHOLE-PLAN VIEW

NO SCALE



SEWER MANHOLE-SECTION VIEW

NO SCALE

MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAILTRACE WIRE
SEWER MANHOLE DETAIL

May 28, 2014

APPENDIX A

APPENDIX “A”

WATER MAIN AND SANITARY SEWER PLANS AND SPECIFICATIONS OVERVIEW

1. The Plans and Specifications shall be submitted with a cover letter which shall contain a brief description of the proposed extension or connection, including the name, location and the lengths and sizes of the water mains and sewer lines per street to be constructed. The plans must indicate the project name, location of the project and location sketch. Refer to Section 01000, Paragraph 1.03 for complete description of the plan review process.
2. The plans must be sealed by a State of Michigan licensed professional engineer.
3. The proposed Plans must be reviewed and approved by the Township and Township Engineer.
4. Easements for water and/or sewer lines must be detailed on the Plans. Platted easements must be so noted and one (1) executed easement document must be submitted for each easement.
5. A general note must be included on the Plans stating the construction shall be done in accordance with the “Allendale Charter Township Standard Construction Requirements”.
6. The Plans must define all areas of construction adjacent to lakes, streams, water courses, or other erosion sensitive locations and reference acceptable control techniques, which must be used to control soil erosion and sedimentation.
7. If the project is within 500 feet of a lake or stream, or if the construction activity is within a 100 year floodplain and /or wetlands (Wetlands as defined by 30301(d) of Part 303 of Act 451 of Michigan, PA 1994) copies of all necessary permits or evidence of submittal, or a request for determination from the Michigan Department of Environmental Quality – Land and Water Management Division regarding those activities must be submitted.
8. For water mains constructed within public easement, the curb stops, or shut-off valve must be located on the easement line or right-of-way.
9. For water main and sanitary sewer projects, the permit applications for water systems as required by Act 399 and wastewater systems as required by Authority of Part 41, Act 451 of Michigan, PA 1994 as amended shall be completed and submitted.

APPENDIX B

APPENDIX “B”

DEVELOPMENT FEE

This fee is intended to cover the cost of plan review, construction observation/inspection and administration by the Township and Township Engineer on development projects in the Township.

The fee amount will be considered an estimated amount and is estimated for each development project by application of the following rates:

<u>Item</u>	<u>Rate</u>
Water main	See Township Rate Schedule
Sanitary Sewer	See Township Rate Schedule
Force main	See Township Rate Schedule
Sidewalk, Shared Use Path, Pedestrian Bridge	See Township Rate Schedule
Pump Station(s)	See Township Rate Schedule

The entire estimated Development Fee shall be paid by the Developer to the Township prior to submittal of plans to MDEQ for permits.

The above noted fees are intended to cover all Township expenses related to site plan reviews, construction plan reviews, meeting, construction observation/inspection, and Township administration. Any plans submitted multiple times for review will have an additional charge for each plan review after the second review. Beginning with the third submittal, a review fee of \$400.00 will be added on to the development fee.

The Development Fee amount paid by the Developer to the Township will be placed into an Escrow Account. Draws from the Escrow Account will be made by the Township for the actual costs incurred in plan review, design engineering, construction observation/inspection and administration by the Township and Township Engineer.

Should expected costs exceed fees placed in the escrow account, the Township may request additional funds be deposited into the account in an amount necessary to cover current and/or projected future costs.

Monies remaining in the Escrow Account upon completion of the project and acceptance by the Township will be returned to the Developer within 30 days after final acceptance of the project by the Township.

APPENDIX "B"**COMMERCIAL REVIEW FEE**

This fee is intended to cover the cost of plan review, construction observation/inspection and administration by the Township and Township Engineer on commercial projects in the Township.

The fee amount will be considered an estimated amount and is applied for each commercial project. This fee will be \$1,500.

The above noted fees are intended to cover all Township expenses related to construction plan reviews, meetings, construction observation/inspection, and Township administration.

The Commercial Review Fee will be paid by the Owner to the Township and will be placed into an Escrow Account. Draws from the Escrow Account will be made by the Township for the actual costs incurred in plan review, construction observation/inspection and administration by the Township and Township Engineer.

Should expected costs exceed fees placed in the escrow account, the Township will require additional funds be deposited into the account in an amount necessary to cover current and/or projected future costs.

Monies remaining in the Escrow Account upon completion of the project and acceptance by the Township will be returned to the Developer within 30 days after final acceptance of the project by the Township.

APPENDIX C

UTILITY LINE EASEMENT

Contract No. _____
 Plan Sheet _____
 Tax Description No. _____
 Tax Map _____

THIS INDENTURE, made and entered into this _____ day of _____, 20__, by and between _____, whose address is _____, hereinafter referred to as "Grantor," and **ALLENDALE CHARTER TOWNSHIP, a body corporate, as authorized by the Constitution of the State of Michigan, acting by and through its TOWNSHIP BOARD**, whose address is 6676 Lake Michigan Dr., P.O. Box 539 Allendale, Michigan 49401, hereinafter referred to as "Township";

WITNESSETH:

For and in consideration of the sum of _____ (\$_____) Dollar(s), paid to Grantor, the receipt of which is hereby acknowledged, Grantor does hereby grant unto Township, its successors and assigns, a non-exclusive perpetual and permanent easement and right of way, under, through and across a certain piece or parcel of land situated in the _____ **OF** _____, **in the COUNTY OF OTTAWA and STATE OF MICHIGAN**, the piece or parcel of land being owned by Grantor in fee simple and described as follows:

FEE DESCRIPTION:

EASEMENT DESCRIPTION:

This Easement is exempt from ad valorem transfer tax by reason of MCL 207.526, Section 6(a) and MCL 207.505, Section 5(a).

The easement and right of way granted herein shall be for the purpose of the construction and installation of utility lines, including sewer line or lines, water line or lines, storm sewer lines, drains and drain tiles, and their appurtenant valves, hydrants and accessories, under, through and across the above-described Easement Description for the purpose of constructing, operation, maintaining, repairing, replacing, reinstalling, inspecting and keeping in working order the utility lines, sewer lines, water lines and storm sewer lines, and their appurtenant valves, hydrants and accessories, which are running under, through and across the above-described Easement Description, all hereinafter collectively referred to as "Utility Lines."

The easement and right of way granted herein shall include the right to enter upon sufficient land of Grantor adjacent to the Easement Description ("Adjacent Land") as is required for the construction, installation, maintenance, repair, replacement, reinstallation, operation and inspection of said Utility Lines, together with the right to install intersecting Utility Lines therein. In exercising its rights to enter Adjacent Land, Township shall conduct its activities in a manner that will minimize its presence on land outside of the easement and right of way. Each time it enters the Adjacent Land, Township shall, at its sole expense, restore it to the condition it was in immediately prior to entry.

TERM: Said easement and right of way under, through and across the above-described Easement Description, for the use and benefit of Township, its successors and assigns, shall be perpetual.

AUTHORITY: Grantor warrants that they have the right and authority to grant this easement as above-described and own the lands covered by the Easement Description.

RESTORATION: The easement and right of way shall include, but not be limited to, Township's right to enter upon the Easement Description at such times as may be reasonably necessary to construct, maintain, repair, replace, reinstall and inspect its Utility Lines across, through and under the above-described Easement Description, together with the right to excavate a trench or ditch for the location of said Utility Lines. Township shall have the further right to remove trees, brush, undergrowth and other obstructions situated upon the above-described Easement Description interfering with the location, construction, maintenance or repair of said Utility Lines. As a consideration for the Township to have the right to construct and install said Utility Lines, Township shall be obligated, at its sole expense (i) to fill and grade to ground level the trench or ditch occupied by said Utility Lines and (ii) to restore the drives, parking areas, shrubs or grass to their former condition, insofar as is reasonably possible. Township does further covenant and agree that in the event it shall become necessary, at any time, to enter upon the above-described Easement Description for the purpose of maintenance, repair, replacement, construction or reinstallation of said Utility Lines, Township shall, at its sole expense, return said piece or parcel of land to a similar condition as before such maintenance or repair upon the completion of the same, insofar as is reasonably possible.

The removal or demolition of any existing buildings, structures or fences which shall be required for the reasonable exercise of the foregoing powers, shall be removed or demolished at the expense of the Township.

INDEMNIFICATION: Township agrees to fully defend, indemnify, save and keep harmless the Grantor from any and all claims for damage to real and personal property and injuries and death suffered by persons in any manner caused by or growing out of or in any way connected with the construction, installation, repair, maintenance or presence of said Utility Lines, under and across the piece or parcel of land of Grantor or the presence of Township or its employees, guests, invitees, contractors and agents upon the Easement Description or Adjacent Land. Grantor agrees that they will not construct a building, structure or other permanent improvement on said Easement Description without first obtaining the written consent of the Township, which consent will not be unreasonably withheld, delayed or conditioned; and this conveyance includes a release of any and all claims to damage arising from or incidental to the exercise of any of the foregoing powers, except as above provided.

The pronouns and relative words herein are written in the masculine and singular only. If more than one joins in, or be either of the feminine sex or a business entity, such words shall be read as if written in plural, feminine or neuter, respectively.

The Grantor has caused these presents to be signed the day and year first above written.

Sign here: _____
Type here: _____

Sign here: _____
Type here: _____

Address: _____

UTILITY LINE EASEMENT

CONSENT AND ACKNOWLEDGMENT OF EASEMENT

Parcel _____ (_____)

KNOW ALL MEN BY THESE PRESENTS, that _____,
_____, of _____, as the
Mortgagee under a certain Mortgage dated _____, 20__, and recorded
on _____, 20__, in Liber _____ of Ottawa County records on Page
_____, hereby consents to the grant of easement made by
_____, Mortgagor in the Mortgage herein described,
to _____,
dated _____, 20__, and recorded on _____, 20__, in
Liber _____ of Ottawa County records on Page _____, and acknowledges that such Mortgage
will be subject to this Easement.

Dated this _____ day of _____, 20__.

Signed in the Presence of:

Sign here: _____
Type here: _____

By: _____
Sign here: _____
Type here: _____
Its: _____

Sign here: _____
Type here: _____

By: _____
Sign here: _____
Type here: _____
Its: _____

STATE OF _____)
) ss.
 COUNTY OF _____)

On this _____ day of _____, 20____, before me, a Notary Public, in and for
 said _____ County, appeared _____ and
 _____, to me personally known, who,
 being by me duly sworn, did say that they are respectively the _____
 _____ and the _____ of
 _____, the banking corporation
 named in and which executed the within instrument, and that instrument was signed on behalf of
 said banking corporation by authority of its Board of Directors, and said
 _____ and _____
 acknowledged said instrument to be the free act and deed of said banking corporation.

Prepared by:

Sign here: _____
 Type here: _____

Notary Public
 _____ County, _____

My Commission Expires: _____

STATEMENT OF JUST COMPENSATION

TO: _____

THIS STATEMENT OF JUST COMPENSATION is based on the fair market value of the interest in real property, hereinafter described, obtained by the

_____, for the _____
 _____ **Project.** This Statement is not less than the appraised value of the interest in said property acquired, and this Statement disregards any decrease or increase of the fair market value of the property caused by the Project. It has been determined that there is no damage to any remaining real property. There are no buildings, structures or other improvements, including fixtures, removable building equipment and trade fixtures which are considered to be part of the real property interest for which the offer of just compensation is made, as follows:

REAL PROPERTY:

INTEREST OBTAINED:

DESCRIPTION OF PROPERTY:

INTERESTED PERSONS:

APPORTIONMENT OF JUST COMPENSATION:

APPRAISED FAIR MARKET VALUE:

By: _____

Its: _____

THE UNDERSIGNED acknowledges receipt of the foregoing Statement of Just Compensation and understands their rights and hereby waives their rights under Public Law 91-646, and agrees to grant the interest requested on the terms proposed, even if a donation of such interest.

This waiver includes a waiver of any appraisal of our property, including accompanying an appraiser inspecting our property. This waiver and the execution of the Easement and/or instruments of conveyance of our interest in such property is made without undue influence or coercive action of any nature by anyone involved in this Project. We understand that we could request an appraisal of our property and have the right to receive Just Compensation for the conveyance of the interest being requested by the party receiving the Easement or conveyance.

Dated this ____ day of _____, 200_.

BICYCLE PATH AND WALKWAY EASEMENT

Parcel No. _____
 _____ Project

THIS INDENTURE made and entered into this ____ day of _____, 200_, by and between _____, of _____, hereinafter "Grantor," and the _____, of _____, hereinafter "Township;"

WITNESSETH:

For the sum of One and no/100 (\$1.00) Dollar and other valuable consideration paid to the Grantor by the Township, the receipt of which is hereby acknowledged by Grantor, the Grantor does hereby grant, bargain, convey and assign unto the Township, its successors and assigns, a non-exclusive, perpetual and permanent easement and right-of-way over and across that certain piece or parcel of land situated in the _____ **OF** _____, **COUNTY OF** _____ **and STATE OF MICHIGAN**, the piece or parcel of land being owned by the Grantor in fee simple and described as follows:

FEE DESCRIPTION:

IN A PUBLIC BICYCLE PATH AND WALKWAY EASEMENT SPECIFICALLY DESCRIBED AS FOLLOWS:

EASEMENT DESCRIPTION:

This Easement is exempt from transfer tax by reason of MCL 207.526, Section 6(a); and MCL 207.505, Section 5(a).

The easement granted herein shall be for the purpose of installing, constructing, operating, maintaining, repairing, replacing, reinstalling, inspecting and keeping in working order the Bicycle Path and Walkway (including sidewalks at the election of the Township) which may run over and across the above-described easement and right-of-way, all hereinafter collectively referred to as the "Bicycle Path and Walkway Easement."

The easement granted herein shall include the right to enter upon sufficient land owned by the Grantor which is adjacent to the Bicycle Path and Walkway as is required for the construction, installation, maintenance, repair, replacement, reinstallation, operation and

inspection of said Bicycle Path and Walkway, together with the right to install signs on the adjacent land as to the use by the public.

TO HAVE AND TO HOLD said Bicycle Path and Walkway Easement and right-of-way over and across the above-described piece or parcel of land unto the Township, its successors and assigns, for the use and benefit of the Township, its successors and assigns, **FOREVER**.

The Grantor warrants that they have the right and authority to grant this easement as above-described and own the lands covered by the easement and right- of-way.

The easement and right-of-way shall include, but not be limited to, the right to enter upon the easement at any reasonable time for the purpose of such construction, maintenance, repair, replacement, reinstallation and inspection of its Bicycle Path and Walkway, together with the right to excavate a foundation for the location of such Bicycle Path and Walkway. The easement and right-of-way shall further include right to remove trees, brush, undergrowth and other obstructions situated upon the above-described piece or parcel of land which may interfere with the location, construction, maintenance or repair of such Bicycle Path or Walkway. The Township, as a consideration for our granting the right to construct and install such Bicycle Path and Walkway, shall be obligated to fill and grade to ground level the areas adjoining the Bicycle Path and Walkway and shall also be obligated to restore to their former condition, insofar as is reasonably possible, the drives, parking areas, shrubs and/or grass along side such Bicycle Path and Walkway. The Township further covenants and agrees that it will restore such piece or parcel of land to a similar condition, insofar as is reasonably possible, in the event it shall at any time become necessary to enter upon the easement for the purpose of maintenance, repair, replacement, construction or reinstallation of such Bicycle Path and Walkway.

The removal or demolition of any existing buildings, structures or fences required for the reasonable exercise of the foregoing powers shall be removed or demolished at the Township's expense.

The Township agrees to fully indemnify, save and keep harmless the Grantor from any and all claims for damage to real and personal property and injuries or death suffered by persons in any manner caused by or growing out of the construction, installation, repair, maintenance or presence of said Bicycle Path and Walkway over and across the piece or parcel of land of Grantor, except for the negligence of the Grantor, their heirs, representatives, successors or assigns. The Grantor further agrees that they will not construct a building, structure or improvement on such easement and right-of-way without first obtaining the written consent of the Township, and this conveyance includes a release of any and all claims to damage arising from or incidental to the exercise of any of the foregoing powers, except as above provided.

The pronouns and relative words herein are written in the masculine and singular only. If more than one joins in, or be of the feminine sex or a business entity, such words shall be read as if written in plural, feminine or neuter, respectively.

APPENDIX D

APPENDIX "D"**DEVELOPMENT, WATERMAIN EXTENSION or SEWER MAIN EXTENSION AGREEMENT****CONTRACT FACE PAGES****I. PARTIES****A. DEVELOPER (the "Developer"):**

Name

Address

Type of legal entity, i.e. Corporation, Partnership, Limited Liability Company, Individual, etc.

B. ALLENDALE CHARTER TOWNSHIP (the "Township")
6676 Lake Michigan Drive, PO Box 539, Allendale, MI 49401**II. DESCRIPTION OF THE IMPROVEMENTS (the "Project").****A. Public Utilities:**

1. Watermain: _____(LF) along _____Streets
2. Sewer Main _____(LF) along _____Streets

B. Public Improvements:

1. Developer Sidewalk _____(LF)
2. Street Lights along _____Streets

III. PROJECT COMPLETION DATE (the "Completion Date"):

IV. IRREVOCABLE LETTER OF CREDIT**A. *Required at substantial completion for connections. The letter will contain funds for all uncompleted items.***

The amount of the Letter of Credit shall be based on the cost estimate for the construction prepared by the Owner's Engineer and approved by the Township Engineer.

V. AGREEMENT OF THE PARTIES:

In consideration of the mutual covenants and agreements contained in the attached Terms and Conditions, the parties mutually agree that the Developer will acquire and construct the Project at Developer's sole expense, that after completion and acceptance of the Project by the Township, ownership of the following items shall be transferred by the Developer to the Township for \$1.00 pursuant to the Township's standard form Bill of Sale:

☐	Public Water Main and all Appurtenances
☐	Public Sanitary Sewer Main and Public Sanitary Sewer Manholes
☐	Sidewalk along Public Roads

All aspects of the acquisition, construction, completion, and transfer of the Project to the Township shall be governed by all applicable ordinances and construction standards, as well as the attached Terms and Conditions.

IN WITNESS WHEREOF, the parties have executed this Agreement.

Witnesses:

DEVELOPER:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: _____

Dated: _____, 20__

ALLENDALE CHARTER TOWNSHIP:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Supervisor

Dated: _____, 20__

(2) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Clerk

Dated: _____, 20__

* Printed Name
(LS) Legal Signature

DEVELOPMENT AGREEMENT

TERMS AND CONDITIONS

Section 1. **PRECONSTRUCTION MATTERS.** Before commencing construction of the Project, Developer shall accomplish all of the following:

- (a) Obtain all necessary permits for the installation and construction of the Project from all agencies having jurisdiction;
- (b) Submit to the Township for approval detailed plans and specifications for the Project prepared by a professional engineer licensed in Michigan. Construction of the Project shall not commence unless and until the Township approves these plans and specifications in writing. ***Developer shall pay in cash to the Township the Township Development Fee then in effect.***

The Development Fee amount paid by the Developer to the Township will be placed into an Escrow Account. Draws from the Escrow Account will be made by the Township for the actual costs incurred in plan review, design engineering, construction observation / inspection and administration by the Township and Township Engineer.

The Township may require additional funds to be placed in the Escrow Account should the account become depleted throughout the project. Monies remaining in the Escrow Account upon completion of the project and acceptance by the Township will be returned to the Developer within 30 calendar days after final acceptance of the project by the Township.

If the Township requests changes in the plans and specifications for the Project, Developer agrees to make such changes as shall be requested by the Township provided, however, the Township shall not withhold its approval of the plans and specifications unreasonably and, further, that if Township requirements with respect to the plans and specifications are in conflict with those of any agency having jurisdiction, the requirements of the agency shall control. The fact the Township may require higher quality materials or better construction practices than an agency shall not be deemed a conflict and the Township requirements shall control. The plans and specifications shall provide for complete restoration to original or better condition of all paved street surfaces and bicycle paths as well as replacement of all driveways and landscaping disturbed or damaged in the course of the construction of the Project;

(c) ***Submit to the Township the names of the proposed general contractor and all subcontractors who will be constructing and completing the Project on behalf of Developer. Construction of the Project shall not commence unless and until the Township has approved in writing Developer's general contractor and all subcontractors, such approval not to be withheld unreasonably. On request, Developer shall submit to the Township such information concerning Developer's proposed contractors as the Township shall reasonably request;***

(d) All easements shall be executed prior to the pre-construction meeting. All easements shall be in such form and substance as shall be required by the Township. All easements shall be perpetual and shall be at least as wide as required by the Township but no less than twenty (20) feet in width in any event. Developer shall provide to the Township such proof of title and other title documentation as the Township shall reasonably require in order to verify that the Township is receiving good title to all easements being transferred to the Township by the conclusion of the project.

(e) Schedule and convene a preconstruction meeting per the terms described in Section 01000, General Requirements Part 1.06.

Section 2. **PROJECT CONSTRUCTION.** Developer shall cause the Project to be constructed in accordance with the approved plans and specifications in a good and workmanlike manner and so as to meet all quality standards and tests which would apply and be conducted if the Township itself constructed and acquired the Project. During construction of the Project, the Township shall be free itself or with third party contractors or consultants to undertake such inspection of the Project as the Township shall deem appropriate. No change order shall be issued with respect to the approved plans and specifications without prior written approval of the Township, such approval not to be withheld unreasonably.

Section 3. **DEWATERING.** If the Project requires dewatering, Developer agrees that Developer alone, at Developer's sole cost and expense, is responsible for any negative impact including, but without limitation, quantity, quality and taste, caused to the well water supply of any lands affected by Project dewatering. No Project shall be transferred to the Township, and the Township will not approve any Project or accept ownership thereof, unless and until the Township is satisfied that all negative impact to well water supplies caused by the Project have been fully and satisfactorily corrected. The Township may require written documentation from the owner of lands whose well water supply has been affected by Project dewatering that such land owner is satisfied with his/her/their well water supply if the lands have not been connected to the public water system. In the event of a disagreement between the Township and the Developer as to whether a particular well has been adversely affected by the Project, the Township Engineer shall make a written determination and this determination shall be final and binding on the Township and the Developer.

Section 4. **COMPLETION OF THE PROJECT.** The Project shall be completed and made available to the Township for final inspection and approval no later than the completion date. Upon completion of the Project and after final inspection and written approval by the Township, such approval not to be withheld unreasonably, the public utilities shall be transferred by the Developer to the Township pursuant to the Township's standard form Bill of Sale.

The Township shall not be obligated to approve the Project or accept unless and until it is satisfied the Project has been constructed in accordance with approved plans and specifications and in a good workmanlike manner and, further, that the Project meets all quality standards and tests which would apply and be conducted if the Township itself acquired and constructed the Project. In addition, the Township shall not be obligated to approve the Project and accept unless and until all of the restoration has been fully completed.

Prior to the Township's approval of the Project and an acceptance the Township shall receive from the Developer such waivers of lien, affidavits and other documentation as the Township shall reasonably deem necessary to be assured that all contractor(s) and all pipe and other equipment suppliers in connection with the project have been paid in full and that there are no liens or other unpaid obligations outstanding with respect to the Project.

Prior to approval and acceptance, the Township requires a written opinion from the Developer's consulting engineer that the Project has been constructed and completed in accordance with the approved plans and specifications.

If the Contract face pages require that the Developer provide an irrevocable letter of credit prior to commencement of construction in order to guarantee completion of the Project by the Completion Date, this irrevocable letter of credit shall be issued by a bank in favor of the Township in the amount shown on the Contract face pages. The letter of credit to be provided shall be in such form and with such provisions as the Township shall reasonably require. A standard format for the Letter of Credit is included in Appendix D of the Standard Construction Requirements. In lieu of a Letter of Credit, the Developer may deposit a check with the Township for the full amount of the completion guarantee.

Said check will be deposited and held by the Township in an escrow account. The escrow account shall be used for the same purpose as a Letter of Credit with draws being made in a similar manner.

The Project shall not be connected to the Township sewer and/or water systems unless and until the Township has completed its final inspection and approved the Project in writing. ***If the Developer desires to connect the Project to the water and/or sewer systems after substantial completion but in advance of this final inspection and written approval, Developer shall provide to the Township an irrevocable letter of credit issued by a bank in favor of the Township in such amount and duration as the Township shall reasonably determine is necessary to pay all costs and expenses related to completing the Project. The letter of credit to be provided shall be in such form and with such provisions as the Township shall reasonably require.***

The amount on the Letter of Credit will not be reduced during the general course of construction on the Project, but may only be reduced as agreed upon by the Township at the time of substantial completion of the Work, provided that the amount of the Letter of Credit after the proposed reduction is still deemed by the Township to be sufficient to complete the project as determined by the Township or their authorized representatives.

If the Project is not completed by the Completion Date, the Township shall have the right to complete the Project at Developer's expense and to pay the full cost of such completion by making a draw or draws against Developer's letter of credit. Developer shall reimburse the Township for all costs incurred in completing the Project including, but without limitation, engineering, third party contractors and the charges of the Township personnel necessary to supervise the completion of the Project. To the extent the Township costs to complete the Project are not fully paid by a draw or draws on a letter of credit, Developer shall pay such amounts to the Township on demand. Amounts not paid on demand shall bear interest at a rate of 1% per month or fraction of a month that the amount remains unpaid.

Section 5. **GUARANTEE.** The Developer shall guarantee the completed Work for one year after final completion and shall promptly repair, replace, restore, or rebuild, as the Township may determine, any finished work in which defects of materials or workmanship may appear or to which damage may occur (or has occurred) because of such defects during the one-year period, except where other periods or maintenance and guarantee are provided. The one-year period shall begin when the Certificate of Final Completion is signed by the Township and issued to the Developer (see Guarantee Period Agreement form at the end of Section 01000 – General Requirements). The one-year guarantee period shall be extended for an additional year from the time that any of the finished Work is repaired, replaced, restored or rebuilt pursuant to the guarantee agreement as determined by the Township. (See Guarantee Period Agreement Form at the end of Section 0100 – General Requirements.)

Section 6. **INSURANCE.** Beginning as and when construction of the Project is commenced, and continuing at all times while the Project or any part thereof is under construction, Developer and/or its contractor(s) shall continuously carry and maintain the same insurance coverage which is routinely required by the Township with respect to the construction of its own water and sewer projects. The Township and its Township Board members, officers, agents and employees, the Township Engineer and its directors, officers, agents and employees, and the Ottawa County Road Commission and its board members, officers, agents and employees, shall all be named as additional insureds under such insurance, and such insurance shall also provide that it is the primary source of coverage for all such parties named as additional insureds with respect to the Project and the acts of omission of Developer and its contractor(s) related thereto.

Certificates evidencing the acquisition of all insurance required by this section and that such insurance is in full force and effect shall be deposited with the Township before construction of the Projects is commenced. Developer shall furnish, or cause to be furnished, upon request of the Township, certified copies of all policies required pursuant to this section as well as all amendments and

renewals. All insurance policies required pursuant to this section shall contain a provision that they are non-cancelable and not subject to material modification by the insurer except upon 30 days' prior written notice to the Township. At least 30 days prior to the expiration or cancellation of any such insurance policy, there shall be furnished to the Township evidence satisfactory to it that the policy has been renewed or replaced by another policy. Construction of the Project shall not commence unless and until the Township has approved the insurance required to be provided by Developer and its contractor(s) pursuant to this section in writing, such approval not be withheld unreasonably.

With respect to the Project, Developer agrees to indemnify the Township and its Township Board members, officers, agents and employees, as well as all of the other additional insureds named in the first paragraph of this section, from and against any and all claims, costs, actions, causes of action, losses, or expenses (including reasonable attorney's fees and other expense of defense) resulting from or caused by the acts or omissions of Developer or its contractor(s) in acquiring, constructing and completing the Project.

Section 7. CONNECTION CHARGES/RATES. *Developer shall pay all applicable connection and other charges imposed by the Township pursuant to the local rate ordinance or rate resolution with respect to the Project. The Township shall be entitled to establish such water rates and/or sewer usage rates as the Township deems appropriate. The fact the Developer has installed the Project at its expense shall not excuse Developer or any party owning or utilizing lands and premises within the development served by the Project or any part thereof from being obligated to pay water rates and sewer rates or any other charges levied by the Township generally against water and/or sanitary sewer customers.*

Section 8. TOWNSHIP UTILIZATION OF THE PROJECT. As and when the public utilities have been transferred to the Township pursuant to the Bill of Sale referred to above, the Project shall become part of the Township water and/or sewer system, as the case may be, and may be utilized by the Township in such manner as the Township utilized other portions of its water and sewer systems. Without limiting the generality of the preceding sentence, the Township may connect other water and/or sewer customers to the Project itself and may also connect water and/or sewer extensions to the Project and connect additional customers to those extensions, all without any obligation to make any payment or reimbursement to the Developer on account of the Developer having constructed the Project at Developer's expense, unless there is a written agreement to the contrary.

Section 9. ENFORCEMENT. In the event the Township has to take legal action to enforce the terms of this Agreement, the Developer agrees and shall be responsible to pay all of the Township's expenses, including reasonable attorney fees and engineering fees, associated with the legal action.

Section 10. MISCELLANEOUS. Neither this Contract nor any rights under it may be assigned nor may any duty be delegated without prior written consent of the non-assigning nor non-delegating party. Any attempt to assign or delegate rights or duties without prior written consent shall be void. This Contract shall inure to the benefit of and be binding upon the parties hereto and their respective successors and permitted assigns.

All notices and other documents to be served and transmitted hereunder shall be in writing and addressed to the respective parties hereto at the addresses stated on the Contract face pages or such other address or addresses as shall be specified by the parties hereto from time to time and may be served or transmitted in person or by ordinary or certified mail properly addressed with sufficient postage. This is an integrated contract. It contains the full understanding of the parties and supersedes all other understandings, agreements or conditions, written or oral, regarding the subject matter of this Contract. This Contract has been executed in the State of Michigan and shall be governed by Michigan law, except as to matters pertaining to choice of law. The waiver by any party hereto of a breach or

violation of any provision of the Contract shall not be a waiver of any subsequent breach of the same or any other provision of this Contract. If any section or provision of this Contract is unenforceable for any reason, the unenforceability thereof shall not impair the remainder of this Contract, which shall remain in full force and effect. It is contemplated that this Contract will be executed in multiple counterparts, all of which together shall be deemed to be one contract. The captions in this Contract are for convenience only and shall not be considered as part of this Contract or in any way to amplify or modify the terms and provisions hereof. This Contract shall be enforceable only by the parties hereto and their successors in interest by virtue of any assignment which is not prohibited under the terms of this Contract and no other person shall have the right to enforce any of the provisions contained herein. No amendment, modification or waiver shall be effective unless in writing and signed by both parties. All rights and remedies set forth in this Contract are cumulative and are in addition to any other legal or equitable rights and remedies.

[END OF CONTRACT TERMS]

LETTER OF CREDIT FORM**Bank:**

[Name and address]

Irrevocable Standby Letter of Credit

Bank Reference No. _____

Issued: _____

Beneficiary:

Allendale Charter Township

6676 Lake Michigan Drive

PO Box 539

Allendale, MI 49401-0539

Applicant:

[Developer Name and address]

Project:

[Description of Public Improvements]

Date: _____

Expiration Date: _____ [3 months after **Project** completion date]

Amount: USD _____

Bank Reference No.: _____

Gentlemen:

We hereby establish our Irrevocable Standby Letter of Credit No. _____ in your favor for the account of **Applicant** up to an aggregate amount of USD _____ available by your draft(s) at sight drawn on **Bank**.

Drafts to be accompanied by the following document(s):

1. Beneficiary's statement signed by the Supervisor of Allendale Charter Township, stating: "**Applicant** has failed to satisfactorily install the **Project**."
2. Copy of Letter of Credit and any amendments.

Partial drawings are permitted.

Draft(s) must be marked "Drawn under **Bank** Irrevocable Standby Letter of Credit No. _____ dated _____."

We hereby agree with you that drafts drawn under and in strict compliance with the terms of this credit will be duly honored by us upon presentation at this office on or before our close of business on **Expiration Date**.

Except as otherwise expressly stated herein, this Letter of Credit is issued subject to the International Standby Practices of the International Chamber of Commerce ("ISP98"). This Letter of Credit shall be

deemed to be a contract made under the laws of the State of Michigan and shall, as to matters not governed by ISP98, be governed by and construed in accordance with the laws of the State of Michigan, other than its conflict of laws rules, which would result in the application of the law of any jurisdiction other than the laws of the State of Michigan.

Sincerely,

Bank

Authorized Signature

Printed Name and title

APPENDIX E

Reserved for future use.

APPENDIX F

APPENDIX “F”

TOWNSHIP POLICY ON PARTICIPATION TOWARDS OVERSIZING

WATER MAIN

- Developer required to meet Water System Master Plan.
- If Master Plan is not clear, the following minimum pipe sizes will be required:

Residential Area	-	8"
Commercial/Industrial Area	-	12"
Section Line Roads	-	12"
- Looping of water main may be required.
- Township to participate in oversizing where deemed appropriate (construction cost only).
- Participation for oversizing shall be based on actual bid prices not-to-exceed dollars per inch diameter of oversizing per linear foot of water main. Please See Water Rate Schedule for value

SANITARY SEWER AND FORCE MAIN

- Developer required to meet Sanitary Sewer System Master Plan.
- Township to participate in oversizing where deemed appropriate (construction cost only).
- Participation for oversizing shall be based on actual bid prices not-to-exceed dollars per inch diameter of oversizing per linear foot of sanitary sewer and/or force main. Please see Sewer Rate Schedule for value
- No participation for extra depth.

PUMP STATION

- Township to participate in construction cost of pump station if the ultimate service area (as defined in the master sewer map/plan; i.e. sub-district area) is at least 50% greater than the Development area.
- .
- Upgrade of existing pump stations may be required.

WATER MAIN AND SEWER OVERSIZING AGREEMENT FORMS See Attached

WATERMAIN OVERSIZING AGREEMENT

THIS AGREEMENT, entered into this _____ day of _____, 20____, between ALLENDALE CHARTER TOWNSHIP, 6676 Lake Michigan Drive, P.O. Box 539, Allendale, MI 49401, hereinafter referred to as the "Township" and GSM Properties, LLC. 4694 Cleveland Steet E. Coopersville, MI 49404 hereinafter referred to as the "Developer".

WITNESSETH:

WHEREAS, the Developer, at his own expense, is installing ____ lineal feet of _____ inch diameter water main along _____ from _____ to the edge of the property as a part of a project known as: _____

And,

WHEREAS, said water main has, at the request of the Township, been oversized from a normal 8 inch diameter water main to a _____ inch diameter water main for purposes of providing transmission capability,

NOW, THEREFORE, it is agreed as follows:

1. The Developer will construct said water main in accordance with the Township's Standard Construction Requirements.

2. The Township will, within thirty days of acceptance of said water main by the Township, pay to the Developer the sum of _____ which sum represents the difference in material cost of normal 8 inch diameter water main and said _____ inch diameter oversized water main.

3. All rights, title and interest in the aforesaid oversized water main shall remain in the Township. Should it be determined in any court of law that the Developer owns in whole or in part any legal or equitable interest in said oversized water main it is agreed between the Township and Developer that such interest may be purchased by the Township for the sum of One Dollar (\$1.00).

4. All notices and other documents to be served and transmitted under this agreement shall be in writing and addressed to the respective parties at the addresses stated on the Contract face pages or such other address or addresses as shall be specified by the parties from time to time and may be served or transmitted in person or by ordinary or certified mail properly addressed with sufficient postage. This is an integrated contract. It contains the full understanding of the parties and supersedes all other understandings, agreements or conditions, written or oral, regarding the subject

Michigan and shall be governed by Michigan law, except as to matters pertaining to choice of law. The waiver by any party of a breach or violation of any provision of this Contract shall not be a waiver of any subsequent breach of the same or any other provision of this Contract. If any section or provision of this Contract is unenforceable for any reason, the unenforceability thereof shall not impair the remainder of this Contract, which shall remain in full force and effect. It is contemplated that this Contract will be executed in multiple counterparts, all of which together shall be deemed to be one contract. No amendment, modification or waiver shall be effective unless it is made in writing and signed by both parties. All rights and remedies set forth in this Contract are cumulative and are in addition to any other legal or equitable rights and remedies.

5. This Agreement shall be binding on the parties hereto, their successors and assigns.

IN WITNESS THEREOF, the parties have set their hands and seals on the day and year first above written.

Witnesses:

DEVELOPER:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: _____

Dated: _____, 20__

ALLENDALE CHARTER TOWNSHIP:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Supervisor

Dated: _____, 20__

(2) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Clerk

Dated: _____, 20__

* Printed Name
(LS) Legal Signature

SEWER OVERSIZING AGREEMENT

THIS AGREEMENT, entered into this _____, day of _____, 20 _____, between ALLENDALE CHARTER TOWNSHIP, 6676 Lake Michigan Drive, P.O. Box 539, Allendale, MI 49401, hereinafter referred to as the "Township" and GSM Properties, LLC. 4694 Cleveland Steet E. Coopersville, MI 49404 hereinafter referred to as the "Developer hereinafter referred to as the "Developer".

WITNESSETH:

WHEREAS, the Developer, at his own expense, is installing _____ lineal feet of _____ inch diameter sewer _____ from _____ the edge of the property as part of a project known as: _____

and,

WHEREAS, said sewer has, at the request of the Township, been oversized from a normal 8 inch diameter sewer to a ____ inch diameter sewer for purposes of providing transmission capability,

NOW, THEREFORE, it is agreed as follows:

1. The Developer will construct said sewer in accordance with the Township's Standard Construction Requirements.
2. The Township will, within thirty days of acceptance of said sewer by the Township, pay to the Developer the sum of _____ which sum represents the difference in material cost of a normal 8 inch diameter sewer and said ____ inch diameter oversized sewer.
3. All rights, title and interest in the aforesaid oversized sewer shall remain in the Township. Should it be determined in any court of law that the Developer owns in whole or in part any legal or equitable interest in said oversized sewer it is agreed between the Township and the Developer that such an interest may be purchased by the Township for the sum of One Dollar (\$1.00).
4. All notices and other documents to be served and transmitted under this agreement shall be in writing and addressed to the respective parties at the addresses stated on the Contract face pages or such other address or addresses as shall be specified by the parties from time to time and may be served or transmitted in person or by ordinary or certified mail properly addressed with sufficient postage. This is an integrated contract. It contains the full understanding of the parties and supersedes all other understandings, agreements or conditions, written or oral, regarding the subject

matter of this Contract. This Contract has been executed in the State of Michigan and shall be governed by Michigan law, except as to matters pertaining to choice of law. The waiver by any party of a breach or violation of any provision of this Contract shall not be a waiver of any subsequent breach of the same or any other provision of this Contract. If any section or provision of this Contract is unenforceable for any reason, the unenforceability thereof shall not impair the remainder of this Contract, which shall remain in full force and effect. It is contemplated that this Contract will be executed in multiple counterparts, all of which together shall be deemed to be one contract. No amendment, modification or waiver shall be effective unless it is made in writing and signed by both parties. All rights and remedies set forth in this Contract are cumulative and are in addition to any other legal or equitable rights and remedies.

5. This Agreement shall be binding on the parties hereto, their successors and assigns.

IN WITNESS THEREOF, the parties have set their hands and seals on the day and year first above written.

Witnesses:

DEVELOPER:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: _____

Dated: _____, 20__

ALLENDALE CHARTER TOWNSHIP:

(1) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Supervisor

Dated: _____, 20__

(2) _____ (LS)
* _____

By: _____ (LS)
* _____

Dated: _____, 20__

Its: Clerk

Dated: _____, 20__

* Printed Name
(LS) Legal Signature

APPENDIX G

Address Application Form

Allendale Charter Township

6676 Lake Michigan Dr.

P.O. Box 539

Allendale, MI 49401

Phone: (616) 892-3121

Fax: (616) 895-6330

Chief Mike Keefe – Allendale Fire Department

mikekeefe@allendale-twp.org

General Info (please print or type)

Name	
Address	
City	
State	
ZIP Code	
Telephone (Home)	
Telephone (Cell)	
Telephone (business)	
Fax	
E-Mail	

New Business or Building Info (please print or type)

Name				
City				
State				
ZIP Code				
Parcel#				
Approved Split	YES	☐	NO	☐

Date	
Signature(s)	

- No Address numbers will be assigned without submitting a current legal survey of the property, and approved by the Chief Building and Zoning Administrator
- All numbers will be assigned by the Allendale Charter Township Fire Chief according to the approved numbering sequence
- All numbers should be displayed in accordance with the "Numbering Guide" of the Allendale Fire Department
- The Township's adopted building code requires house numbers to be displayed prior to occupancy
- Address signs are available through the fire department for \$15.00 each

Your New Address is	
Date	
Fire Chief Signature	

HOUSE (LOT) NUMBERING GUIDE
NUMBERS TO BE AFFIXED BY OWNERS; SIZE AND LOCATION OF NUMBERS PER FIRE
DEPARTMENT GUIDELINES

So that emergency service workers, such as firefighters, emergency medical technicians, and police, can quickly locate a particular location in an emergency, the owner, occupant, or agent of each building should affix or inscribe the proper address number according to the plan set forth in the following guide:

- A. Every building located less than two hundred (200) feet from the edge of a public or approved private road right of way, hereafter called roadway, should display Arabic numbers not less than seven (7) inches high on the side of the building facing the street to which the address is assigned. The numbers shall be clearly visible and readable to the occupants of an emergency service vehicle while traveling in either direction on the roadway.
- B. Every building located more than two hundred (200) feet from the edge of a roadway, and/or any building for which the numbers are not clearly visible and readable to the occupants of an emergency service vehicle on the roadway, should have in addition to the numbers specified in paragraph (A), Arabic numbers not less than four (4) inches in height displayed on a post, or on a regulation United States Postal Service mailbox, or on a sign, which post, mailbox, or sign shall be located directly in front of the building on the same side of the roadway. If a sign is used, it must conform to the township "Sign Ordinance." The numbers shall be clearly visible and readable to the occupants of an emergency service vehicle, while traveling in any direction on the roadway. All signs designating a business must incorporate their address as part of the sign. All number and/or letters to comply with this section.
- C. Every two (2) family or multi-family residential apartment or complex, should have its assigned number displayed in accordance with paragraph (A) & (B) above, and/or paragraph; (D), (h), & (I) below. Further, each individual apartment should have Arabic letters not less than four (4) inches high displayed on or near the front or main entrance to each apartment.
- D. Any building housing more than one (1) residence, or apartment, shall be numbered according to © above, and shall be separately numbered as Apartment No 1, 2, 3, etc. the manner to be determined by the enforcing official, or his agent. Where the building has one address and multiple store fronts the additional spaces will be suites, numbered in the following manner Suite 100, 200, 300, 400
- E. All commercial buildings should display Arabic numbers not less than seven (7) inches high and conforms to section (B) & (C) above, as applicable.
- F. Every building, while under construction, must have temporary numbers displayed. The numbers shall be clearly visible and readable to the occupant of an emergency service vehicle, while traveling in either direction on the roadway.
- G. The color of the Arabic numbers and/or letters shall be in contrast to the immediate background to which they are affixed or inscribed. The numbers shall be displayed so as to be readily visible and readable during normal daylight hours.
- H. The above sections shall be construed to mean that, if the Arabic numbers and/or letters as specified herein are hidden by an awning, overhang, or other obstruction, or if the numbers are not clearly visible and readable to the occupants of an emergency service vehicle on the roadway, then the owner, occupants of an emergency service building shall place supplementary Arabic numbers and/or letter in the manner determined by the enforcing official, or his agent, to best meet the intent of this guide.

- I. All approved private roadways shall have the roadway "Named", and an authorized street sign installed in the location determined by the enforcing official, or his agent. All buildings will be numbered of the roadway per the accepted standard.
- J. Building numbers may be spelled out for decorative purposes; however, Arabic numbers meeting the intent of this guide shall also be displayed.
- K. All applicants for building permits are requested to apply for a "Request for Building Number Form," Each applicant is requested to comply with these requirements as a condition of receiving the building permit. A building should be numbered in accordance with the provisions of this guide before occupancy.
- L. Mobile Home Parks and Condominium Projects may use four (4) inch numbers with approval of the enforcing official.
- M. The Fire Chief is designated the enforcing official of the guide.
- N. For the purpose of the "Guide", an "Owner" shall be defined as: any person, agent, operator, form, or corporation having legal or equitable interest in the property; or recorded in the official records of the State, County, Township, or Municipality as holding title to the property; otherwise having control of the property, including the guardian of the state of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court. For the purpose of the Article, the owner shall be presumed to be the designated person or entity listed on the tax rolls maintained by the township for the structure or building, unless the enforcing officer is otherwise notified in writing.

**Recommended location for number is above the garage door. Most new homes already use this location, although this location will not work on all homes.*

APPENDIX H

APPENDIX H**PRE-CONSTRUCTION MEETING
AGENDA / MINUTES**

Meeting Date: _____ Time: _____

Project Title / Public Improvements: _____

PARTIES

Owner (Developer): _____ Phone Number: _____
As Noted in Definitions

Owner's Engineer: _____ Phone Number: _____
As Noted in Definitions _____ Phone Number: _____

Contractor: Section 0100, Part 1.12 _____
As Noted in Definitions

Manager: _____ Phone Number: _____
Site Superintendent: _____ Phone Number: _____
Sect.1.12.05
Safety Representative: _____ Phone Number: _____
Sect. 1.12.03

Township: _____
Supervisor: Adam Elenbaas Phone Number: 616.895.6295
Public Utility Chad Doornbos Phone Number: 616.892-3117
Superintendent:
Public Utility Inspector: Jon Currier Phone Number: 616.895.5142
Fire Department: Tony Dolce Phone Number: 616.895.6295
Maintenance Dept.: Larry Haveman Phone Number: _____
Sidewalks and lighting.

Township Engineer: Fleis & VandenBrink Phone Number: 616.977.1000
Engineer: Brant Mercer Phone Number: 616.965.8768
Inspector:

PERMITS

Agencies:	☐	Ottawa County Road Commission (work within ROW)	Date of Contact
Section	☐	Ottawa County Water Resources Commissioner	_____
1.04	☐	(SESC, County Drain / Storm Water Management)	_____
	☐	MDOT (work within ROW)	_____
	☐	EGLE (Wetland, Inland Lakes and Streams, Notice of Coverage, Water Main, Sanitary Sewer)	_____
	☐	Other: _____	_____

FROM PROJECT CHECKLIST

Confirm receipt of the following:

- ☐ Certificate of Insurance
- ☐ Copy of EGLE Permits
- ☐ Copies of Ottawa County Road Commission Permits
- ☐ Copies of Ottawa County Water Resources Commissioner Permits
- ☐ Copies of Michigan Department of Transportation Permits
- ☐ Submittals

SCHEDULE

Anticipated Start Date: _____

Detailed Schedule: _____

Completion Date(s): _____

UTILITIES

Identify potential conflicts / scheduling concerns

Electric: Consumers Energy

Great Lakes Energy

Gas: DTE Energy / Michcon

SEMCO

Telephone: AcenTek

AT&T, SBC / Ameritech

Cable Vision: Charter Communications

AcenTek

Water Transmission:

City of Grand Rapids (M-45 & Fillmore)

City of Coopersville (60th Avenue north of M-45)

MISCELLANEOUS

Subcontractors / Material
Suppliers:

Staking: Sect. 1.18

By (firm name):

Notice: 2 working days

Contact Person:

Phone Number:

Materials Testing:
Sect. 1.18 & 1.36

By (firm name):

Notice:

Contact Person:

Phone Number:

Compaction:

Bituminous:

Concrete:

Other:

Public Safety /
Convenience:

Dust Control, Tracking and Access
Barricades & Signing
Protection of Work Areas

Anticipated Road Closures / Detours:

Notice to Police, Fire Department, Schools:

SPECIAL REQUIREMENTS

OCRC	IDR's Inspection / Testing Detours	_____

OCWRC	SESC	_____

MDOT	Notification Inspection	_____

ALLENDALE TOWNSHIP

Date of Approved Plans: _____

Record Drawings: Sketches, Dimensions, Witnesses:
Sect. 1.12.07

By Contractor (with assistance of Township Inspector)

Preparation of Record Drawings:
By Owner's Engineer

"As-Built" measurements are the contractor's responsibility, not TOWNSHIP site inspector

Notice:

24 Hour notice needed for Visual Inspections

3 working days notice needed for Major inspections.

A weekly email with the next week's schedule shall be sent to all interested parties by noon on the last working day of each week

All deviations and revisions from approved plans must be reviewed and approved by Township Inspector and Owners Engineer

Allendale Fire Department: Sections 1410 – Access for Fire Fighting and Section 1412 – Water Supply for Fire protection of the most recent edition International Fire Code will be enforced (see Section 1.49 of the general Requirements of the Township Standard Construction Requirements)

Stationary rods for curb stops shall be obtained from East Jordan.

Sanitary Sewer:

Testing: Exfiltration Air Test
 Video Televising (30 days
 after last backfill)

Water Main:

DOUBLE CHECK ELEVATIONS (existing hydrants may have been raised)

Testing: Pressure / Leakage Test
 Flushing
 Chlorination: Samples / testing of bacteriological requirements by Township

Sidewalk / Shared Use Path: Inspection / approval of forms required prior to pouring concrete

Obtain and understand Township Standard Construction Requirements with 2024
 updates_____

Water and sewer fact sheet containing required connection fees_____

Curb Stop Box Rods only spec from EJ

“As-Built” measurements are the contractor’s responsibility, not TOWNSHIP site inspector

Construction Progress Checklist

Job Name:				
Contractor & Supervisor:				
Name:				
Address:				
Email:				
Phone:		Office		Cell
Owner:				
Name:				
Address:				
Email:				
Phone:		Office		Cell
Construction Manager:				
Name:				
Address:				
Email:				
Phone		Office		Cell
Engineer:				
Name:				
Address:				
Email:				
Phone		Office		Cell

Sanitary	
Install Completed	
Pressure Test After Backfill	
Televising (30 Days after pressure test)	
Manhole Inspection	
(after casting set to grade – can vary with each project	
All Laterals Marked Properly	
Final After Top Coat of BIT and/or Green Area Grading	
Water Main:	
Install Complete	
Pressure Test	
Chlorinate	
Bac T Test	
Services Complete	
F.D. H&V Inspection	
Hydrant & Valve Inspection	
Services Marked Properly	
Final After Top Coat of BIT and/or Green Area Grading	
Substantial Completion (water & sewer)	
Punch List:	
Final Punch List to Contractor	
Final Punch List Completed	
Asbuilt Filed	
(Send to Steve and Bruce for final billing and paperwork.)	

NOTE: Water and Sewer hook ups only allowed after Substantial Completion.

PAPER WORK CHECK LIST

Copy of recorded easements –

Complaints resolved –

Guarantee period agreement in writing –

Storm water operation and maintenance agreement recorded –

Engineer's certificate signed –

Warranty bill of sale signed –



2960 Lucerne Drive SE
Grand Rapids, MI 49546
P: 616.977.1000
F: 616.977.1005
www.fveng.com