



**MUNICIPAL STANDARDS
FOR THE
CITY OF GAYLORD
OTSEGO COUNTY, MICHIGAN**

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INTRODUCTION

The design and construction standards for subdivision and land development contained in this publication are intended as guidelines to be used by the Developer in the preparation and final plats, development plans, and final construction documents. These standards should be utilized in conjunction with local zoning and subdivision ordinances, the State of Michigan Subdivision Control Act, and other applicable State and local regulations to produce residential and commercial developments which conform to the City's requirements.

DEFINITIONS

- (1) OWNER OR DEVELOPER - A natural person, firm, corporation, association, partnership, or other entity who proposes subdivision or other land development and/or municipal improvements and who either has an ownership interest therein or is authorized to act as an agent with respect thereto for an entity having such ownership interest.
- (2) MUNICIPALITY - The City of Gaylord.
- (3) ENGINEER OR CITY ENGINEER - The person, firm, or corporation empowered by the City of Gaylord to provide the required engineering review and inspection services.
- (4) DESIGN ENGINEER - The engineer engaged by the developer to prepare platting documents and plans and specifications for subdivisions or plans and specifications in unplatted land developments.
- (5) CONTRACTOR - The person, firm, or corporation engaged by the developer for construction services in conjunction with the proposed land development.
- (6) MUNICIPAL STANDARDS - The minimum standards for design and construction for all work related to subdivisions and land development.
- (7) MDOT - Michigan Department of Transportation
- (8) MDEQ - Michigan Department of Environmental Quality

REGULATORY CONSTRAINTS

Land Division Act – Public Act 591 of 1996

Land divisions within the City of Gaylord shall comply with this Act.

Soil Erosion and Sedimentation Control Act of 1972

The Soil Erosion and Sedimentation Control Act (Act 347) was enacted to control soil erosion and sedimentation which could enter the State's watercourses through public or private construction operations. Any construction involving an "earth change" as defined in the Act, must obtain a construction permit from the County enforcing agency. The agent for Act 347 is the Otsego County Building and Zoning Department. Developers are directed to contact the Building Department for permit applications and additional information. Also refer to Section 01560 "Special Controls" of the "Standards of Construction - Specifications" section of these standards.

State and Local Building Codes

The City of Gaylord has adopted the State of Michigan code for basic building. The state code will be enforced by Otsego County for mechanical, plumbing and electrical work.

State Construction Permits

Upon receipt of approved plans and specifications from the Developer, the City will make applications for permits to the Michigan Department of Environmental Quality for water main and sanitary sewer construction. The Design Engineer will provide a completed permit application form and 3 sets of plans and specification sealed by a Professional Engineer licensed in the State of Michigan.

All other required permits shall also be secured by the Developer prior to construction.

Subdivision Regulation Ordinance

In addition to these Municipal Standards, the City of Gaylord has a comprehensive subdivision ordinance in effect which outlines the subdivision procedure, design layout standards, improvements, review fees, and penalties for violation of the ordinance. Developers are encouraged to review the requirements of the subdivision ordinance at the outset of their planning and design work.

ADMINISTRATIVE PROCEDURES AND FEES

General

All correspondence, verbal requests, submission of plans, and related information exchanges shall be directed to the City Manager or City Clerk of the City of Gaylord during normal business hours or by mail. Appropriate distribution of information, plans, etc., shall be made by the City. This applies to information received from developers for the Engineer and information from the Engineer for the developer. The intent of this section is to maintain, in the City offices, a copy of all correspondence and related information for City use.

Fees

The Owner is directed to reference Article VIII "Review Fees" of Section 8108 "Jurisdiction and Procedure" of Ordinance 17.00 "Subdivision Ordinance of the City of Gaylord" of the City of Gaylord Compiled Ordinances for information regarding plat review fees.

All fees for plan review fees for compliance with the Municipal Standards shall be paid by the Developer.

The Engineer shall provide an estimate of field inspection charges at the time of street and utility plan approval. The estimated amount shall be deposited with the City by the Developer prior to construction. The City shall disburse the funds to the Engineer.

STANDARDS OF DESIGN - STREETS AND ROADWAYS

Scope

These standards establish the minimum requirements for the design of streets and roadways in the Municipality.

Plans and Specifications

1. The plans and specifications shall be prepared by a professional engineer registered in the State of Michigan.
2. Plans shall consist of a cover sheet showing a location map and site plan of the proposed project, plan and profile sheets covering all the proposed street and roadway construction, and a standard detail sheet. Plan sheet size shall be 24" x 36" or 22" x 34". Plan scale shall be either 1" = 40' or 1" = 20' horizontally and 1" = 4' vertically.
3. Elevations shall be based upon U.S.G.S. datum. Elevations based upon assumed datum will not be approved.
4. Plan profiles shall indicate existing and proposed ground levels, U.S.G.S. elevations, and stationing.
5. Two sets of plans and specifications shall be submitted by the Developer to the Municipality for preliminary approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design. Modifications required to meet the municipal standards, if any, will be noted on two sets, with one such set returned to the Developer for final corrections within 90 days of receipt.
6. Four sets of final plans and specifications shall be submitted by the Developer to the Municipality for approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design.
7. The Developer will be responsible for securing all State and local construction permits required for street and roadway construction.
8. One (1) set of reproducible "as-built" tracings, on mylar or polyester film, shall be submitted to the Municipality upon completion of the construction.

Subsurface Soil Conditions

The Developer shall provide sufficient soil borings and other information to accurately describe the prevailing soil conditions under the proposed streets and roadways. The minimum soil boring depth shall be ten feet below the plan road grade, unless unstable soil conditions are encountered. If such conditions are found, the boring depth shall be extended until stable soil is encountered.

Curb and Gutter

All streets and roadways shall include concrete curb and gutter of the cross-section indicated on the standard detail. HMA curb will not be allowed. On local streets the minimum street width shall be 34' back to back of curb. Concrete curb and gutter width on major streets shall conform to the "uniform Criteria for Major Streets" as adopted by the Michigan Department of Transportation and the Municipality's Master Plan. At all intersections, the minimum curb radius shall be 25', unless otherwise approved.

Sidewalk

Concrete sidewalks (where required) shall be five feet wide and shall generally be located one foot inside right-of-way line. At all intersections of sidewalks and curb and gutter, appropriate ADA compliant pedestrian ramps shall be constructed. Unless otherwise approved, the ramps shall be Type 1 as designated by MDOT. The maximum allowable sidewalk grade shall be seven percent and the minimum allowable grade shall be 0.50 percent. Sidewalk shall have a cross slope of 1/4 inch per foot away from the property line. Sidewalks shall project one inch above finished grade. In cut sections, the maximum sidewalk elevation shall be one foot above the street centerline elevation. In fill sections, the sidewalk elevation shall be no lower than 0.5 feet below the street centerline elevation. Sidewalks shall be 4 inches thick except across residential driveways, which shall be 6 inches thick, and across commercial driveways, which shall be 10 inches thick.

Grade, Horizontal and Vertical Alignment

The minimum vertical grade on any street or roadway shall be 0.50 feet per 100 feet and the maximum grade on any street or roadway shall be 5 feet per 100 feet of length. In general, the minimum length of a vertical curve shall be 100 feet, unless otherwise dictated by site topography. In general, all intersections of streets or roadways shall be made perpendicular to each other. However, intersections ranging from 75° to 90° from perpendicular may be approved. Additional information concerning street geometrics right-of-way widths, block length requirements and other relevant requirements are available from the Municipality.

Driveway Approaches

All driveway approaches between the curb and gutter and sidewalk shall be paved with concrete. Concrete driveway approaches for residential sections shall be 6 inches thick and 10 inches for commercial approaches. The maximum grade on driveway approaches shall be 10 percent. The width of the driveway shall conform to the standard detail.

Right-of-way Width

Right-of-way width shall be a minimum of 66 feet for all public streets.

Private Utility Easement

A 10 foot wide private utility easement shall be provided on each side of the street right-of-way. Gas, power, telephone and other private utilities shall be installed in this easement and not in the public right-of-way.

Utility Location Within the Street Right-of-way

The utilities listed below shall be constructed in the designated location within all street right-of-ways as follows:

- | | | |
|-----------------|---|--|
| Sanitary Sewers | - | on the centerline of the street. |
| Storm Sewers | - | south or east side, 8 feet from the centerline of the right-of-way. |
| Water Main | - | north or west side, 23 feet from the centerline of the right-of-way. |
| Other Utilities | - | as approved by the City Manager. |

Street Surface Materials and Pavement Thickness

The following pavement design are minimum requirements for local streets with restricted wheel loads. Pavement design for major streets shall reflect the increased traffic volume and higher axle loads and shall be subject to approval by the Municipality. The base for local streets shall consist of 6 inches of compacted MDOT 22A gravel constructed on an approved subbase. The pavement thickness shall be 3 ½ inches (385 lb/SYD) of MDOT HMA Mixture No. 13A constructed in two lifts.

STANDARD OF DESIGN - DRIVEWAYS

Scope

These standards establish the minimum requirements for the design of driveways in the Municipality.

Driveway Permits

Application for driveway permit shall be required for all driveway construction and shall be filed with the City of Gaylord. The driveway application shall be filed on a form provided by the City. The driveway application shall contain information as required by the Michigan Department of Transportation Driveway Permit Rules R.247.221 through R.247.224 unless otherwise waived by the City.

Design Standards

All driveways shall meet the Michigan Department of Transportation (MDOT) Standards for Driveway Construction contained in Rules R 247.231 through R 247.267. All references to the "Department" shall be changed to the "City of Gaylord". The City of Gaylord shall make the final determination on allowable driveway widths. In general maximum allowable driveway widths are as follows:

- Residential - 24 feet
- Commercial - 30 feet

STANDARDS OF DESIGN - SANITARY SEWERS

Scope

These standards establish the minimum requirements for the design of sanitary sewers in the Municipality.

Plans and Specifications

1. The plans and specifications shall be prepared by a professional engineer registered in the State of Michigan.
2. Plans shall consist of a cover sheet showing a location map and site plan of the proposed project, plan and profile sheets covering all the proposed street and roadway construction, and a standard detail sheet. Plan sheet size shall be 24" x 36" or 22" x 34". Plan scale shall be either 1" = 40' or 1" = 20' horizontally and 1" = 4' vertically.
3. Elevations shall be based upon U.S.G.S. datum. Elevations based upon assumed datum will not be approved.
4. Plan profiles shall indicate existing and proposed ground levels, U.S.G.S. elevations, and stationing.
5. Two sets of plans and specifications shall be submitted by the Developer to the Municipality for preliminary approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design. Modifications required to meet the municipal standards, if any, will be noted on two sets, with one such set returned to the Developer for final corrections within 90 days of receipt.
6. Four sets of final plans and specifications shall be submitted by the Developer to the Municipality for approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design.
7. The Developer will complete the MDEQ Part 41 permit application form. The City will sign the permit and submit it to the MDEQ after City review and approval. The Developer will be responsible for securing all other permits required for the sanitary sewer construction.
8. One (1) set of reproducible "as-built" tracings, on mylar or polyester film, shall be submitted to the Municipality upon completion of the utility construction. The location of all tees, manholes, and the intersection of the service lateral and the respective property line shall be witnessed from at least two permanent topographic features.

Location

The location of the sanitary sewer within the street right-of-way shall be on the centerline of the street.

Minimum Grades and Velocities

Sanitary sewers shall be designed to maintain a minimum velocity of two feet per second; maximum velocity shall not exceed ten feet per second. Suggested minimum grades for various size sanitary sewers are listed below:

6" (lateral)	1.00%
8"	0.40%
10"	0.30%
12"	0.22%
15"	0.15%
18"	0.12%
24"	0.10%

The minimum depth of cover for sanitary sewers located under a roadway or driveway shall not be less than 6 feet. Sanitary sewers located under other areas shall have a minimum of 5 feet of cover.

Minimum Diameter

The Developer shall install the appropriately sized sanitary sewer system to serve the proposed development and shall submit supporting documentation and calculations to the City to demonstrate adequacy.

The minimum diameter of collection sewers shall be 8 inches and the minimum diameter of the service lateral shall be 6 inches. The municipality may desire to increase the size of certain sewers for their own purposes, in which case the municipality shall pay for the difference in sewer pipe and manhole construction material costs over and above the Developer's proposed diameter sanitary sewer and manhole structures.

Sewer Pipe

Sanitary sewer pipe shall be PVC conforming to ASTM D3033 or ASTM D3034. Minimum wall thickness shall be SDR-35. Joints shall be of the elastomeric gasket push-on type conforming to ASTM D3212.

Manholes

Manholes shall be constructed at all changes in grade, size and alignment of the sanitary sewer. The maximum run between manholes shall be 400 feet. All manholes shall be precast concrete with rubber "O" ring at joints; block or brick sanitary manholes will not be approved. All pipe openings shall be cast in the precast section or cored in the finished wall. Manhole pipe connections shall be furnished with an integrally cast seal system, equal to "Press Wedge II", "Kor-N-Seal", "Lock Joint Flexible Manhole Sleeve", or equal. Sanitary manholes shall have integral concrete manhole bottom. A drop pipe shall be constructed for all sewers entering a manhole at a height of 24 inches or greater above the proposed manhole invert. The minimum inside diameter of a sanitary sewer manhole for sewers through 21 inches in diameter shall be 48 inches. For sanitary sewer 24 to 36 inches in diameter, the minimum inside diameter of the sanitary manhole shall be 60 inches. A minimum of three rows and a maximum of six rows of concrete adjusting bricks or rings shall be constructed on top of the precast cone section. The interior and exterior of the adjusting bricks or rings shall receive a 2 inch thick coat of plaster. All manholes shall be provided with approved manhole steps.

Service Laterals

Connection of the service laterals to the collection sewer shall be by means of a sewer pipe wye or tee fitting. The service lateral shall be constructed to the property line of all lots and marked in accordance with the sanitary sewer standard of construction included herein. In addition, the Developer shall be required to furnish to the Municipality a map indicating the precise location of all sanitary sewer laterals at the property line intersection. The location should be witnessed from two recoverable reference points. All service laterals shall have a minimum 4" diameter cleanout pipe connected to the lateral with a wye fitting. The cleanout pipe shall be extended to the surface and equipped with a threaded cap set flush with the ground surface. The cleanout cap shall be located six inches (6") inside the right-of-way line. For service laterals of extended length, cleanouts shall be constructed at 100 foot intervals. Where sanitary sewers are deeper than 15 feet, 6 inch diameter risers shall be constructed such that the service lateral is 11 feet below finish grade at the property line. All changes in direction, materials, or pipe size shall be done with proper fittings.

Subsurface Soil Conditions

The Developer shall provide sufficient soil borings along the sanitary sewer route to accurately describe the prevailing soil conditions. The borings shall be constructed to a depth of four feet below the proposed invert elevation of the sanitary sewer.

Manhole Casting

Refer to the table of standard castings and valves for the municipalities standard manhole castings.

Lift Stations

Unless otherwise approved lift stations shall be of fiberglass enclosed suction lift type station, Gorman Rupp 7' x10' or approved equal. Each station shall be equipped with an adequately sized wet-well, duplex pumps, suction and discharge plug valves, discharge check valves, high and low water level alarms, ventilation and heaters. Stations shall have provisions for accepting portable emergency generator service compatible with the City's generator and in addition shall have a bypass pump connection. Pump stations shall be similar to the City's existing stations and shall be subject to the approval of the Municipality. Lift station design shall conform to the guidelines contained in the Recommended Standards for Sewage Works, Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (Ten-States Standards) unless otherwise noted or approved. Lift station design shall be subject to the approval of the municipality.

Inverted Siphons

Generally, the use of inverted siphons will not be approved unless specific conditions warrant their use.

Illegal Connections

The connections of footings drains, roof drains, sump pump discharge, or yard drains to the sanitary sewer are strictly prohibited.

Connection Elevations

Plans submitted for approval shall note the elevation of the sanitary sewer service lead at the building foundation line as well as the invert elevation of the service lead at the collection sewer in the street. Minimum cover over the service lateral shall be four feet.

Trench Loading Design

All sanitary sewers shall be designed so as to resist all trench backfill and construction load or anticipated superimposed loadings utilizing a factor of safety of 2.0 of the pipe's resistance to failure.

STANDARDS OF DESIGN - STORM SEWERS

Scope

These standards establish the minimum requirements for the design of storm sewers in the Municipality.

Plans and Specifications

1. The plans and specifications shall be prepared by a professional engineer registered in the State of Michigan.
2. Plans shall consist of a cover sheet showing a location map and site plan of the proposed project, plan and profile sheets covering all the proposed street and roadway construction, and a standard detail sheet. Plan sheet size shall be 24" x 36" or 22" x 34". Plan scale shall be either 1" = 40' or 1" = 20' horizontally and 1" = 4' vertically.
3. Elevations shall be based upon U.S.G.S. datum. Elevations based upon assumed datum will not be approved.
4. Plan profiles shall indicate existing and proposed ground levels, U.S.G.S. elevations, and stationing.
5. Two sets of plans and specifications shall be submitted by the Developer to the Municipality for preliminary approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design. Modifications required to meet the municipal standards, if any, will be noted on two sets, with one such set returned to the Developer for final corrections within 90 days of receipt.
6. Four sets of final plans and specifications shall be submitted by the Developer to the Municipality for approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design.
7. The Developer will be responsible for securing all State and local construction permits required for storm sewer construction.
8. One (1) set of reproducible "as-built" tracings, on mylar or polyester film, shall be submitted to the Municipality upon completion of the utility construction. The location of all tees, manholes and catch basins shall be witnessed from at least two permanent topographic features.

Location

Location shall be within the street right-of-way 8 feet south and 8 feet east of the centerline of the right-of-way.

Minimum and Maximum Velocity

All storm sewers shall be designed to provide a minimum velocity of three feet per second and a maximum velocity of ten feet per second when the pipe is flowing full.

Minimum Diameter

The Developer shall install the appropriately sized storm sewer system to serve the proposed development and shall submit supporting documentation and calculations to the City to demonstrate adequacy.

The minimum diameter for all storm sewer, including catch basin leads, shall be 12 inches. The Municipality may desire to increase the size of certain sewers for their own purposes, in which case the Municipality shall pay for the difference in sewer pipe and manhole structure material costs over and above the Developer's proposed diameter storm sewer and manhole structures.

Manhole

Storm sewer manholes shall be constructed at all changes in grade, size and alignment of the storm sewer. The maximum run between storm sewer manholes shall be 500 feet. Manholes may be either precast concrete or concrete block construction. The minimum inside manhole diameter for storm sewers through 21 inches in diameter shall be 48 inches. For storm sewers from 24 to 36 inches in diameter, the minimum storm manhole diameter shall be 60 inches. For storm sewers 42 inches and larger, "tee" manhole riser sections shall be used. Should a change in grade, size or alignment of the pipe occur in a manhole where one or more of the sewers are 42 inches in diameter or large, the manhole section shall have a minimum inside diameter of the largest pipe diameter plus two feet. All manholes shall be provided with approved manhole steps.

Storm Sewer Design

Storm sewer design shall be consistent with engineering practice and shall utilize a minimum storm flow generated from a 10 year, 24 hour storm event.

Catch Basins

Storm sewer catch basins shall have a minimum inside diameter of 48 inches and shall provide a minimum sump depth of 36 inches below the lowest pipe invert elevation. Catch basins shall be constructed at all low points in the curb and gutter and shall be located so as to limit storm water travel in the gutter section to a maximum distance of 250 feet.

Standard Castings

Refer to the Table of Standard Castings and Valves for the municipalities standard castings.

Trench Loading Design

All storm sewers shall be designed so as to resist all trench backfill and construction load or anticipated superimposed loadings utilizing a factor of safety of 2.0 of the pipe's resistance to failure.

Pipe Materials

Storm sewers shall be constructed with reinforced concrete pipe (RCP) or high density polyethylene corrugated pipe with an integrally formed smooth interior. Corrugated metal pipe (CMP) may be approved for service leads off the public R.O.W. and culverts.

STANDARDS OF DESIGN - WATER DISTRIBUTION SYSTEMS

Scope

These standards establish the minimum requirements for the design of storm sewers in the Municipality.

Plans and Specifications

1. The plans and specifications shall be prepared by a professional engineer registered in the State of Michigan.
2. Plans shall consist of a cover sheet showing a location map and site plan of the proposed project, plan and profile sheets covering all the proposed street and roadway construction, and a standard detail sheet. Plan sheet size shall be 24" x 36" or 22" x 34". Plan scale shall be either 1" = 40' or 1" = 20' horizontally and 1" = 5' vertically.
3. Elevations shall be based upon U.S.G.S. datum. Elevations based upon assumed datum will not be approved.
4. Plan profiles shall indicate existing and proposed ground levels, U.S.G.S. elevations, and stationing.
5. Four sets of plans and specifications shall be submitted by the Developer to the Municipality for preliminary approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design. Modifications required to meet the municipal standards, if any, will be noted on two sets, with one such set returned to the Developer for final corrections within 90 days of receipt.
6. Six sets of final plans and specifications shall be submitted by the Developer to the Municipality for approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design.
7. The Municipality will apply for the water main construction permit from the Michigan Department of Environmental Quality. The Developer will be responsible for completing the Act 399 permit application form for signature by the City and shall be responsible for securing all other permits required for the water distribution system construction.
8. One (1) set of reproducible "as-built" tracings, on mylar or polyester film, shall be submitted to the Municipality upon completion of the utility construction. The location of all valves and curb shutoffs shall be witnessed from at least two permanent topographic features.

Location

Location of the water main within the street right-of-way shall be 23 feet north and 23 feet west of the centerline of the right-of-way. In no case shall a water main be constructed within ten feet (measured horizontally) from a sanitary sewer.

Minimum Size

The Developer shall install the appropriately sized water main to serve the proposed development and shall submit supporting documentation and calculations to the City to demonstrate adequacy.

The minimum size of water main shall be six inches in diameter. The municipality may desire to increase the size of certain mains for their own purposes, in which case the municipality shall pay for the difference

in water main and valve material costs over and above the Developer's proposed diameter water main and valves.

Valves

AWWA approved gate valves shall be placed throughout the distribution system in accordance with the following regulations:

- a. On straight runs, valves shall be spaced at maximum intervals of 800 feet.
- b. At tees, a minimum of two valves are required.
- c. At crosses, a minimum of three valves are required.
- d. At the end of dead end mains, valves shall be constructed to facilitate future connections. Fire hydrants or blow off hydrants shall be placed on dead ends to facilitate flushing.
- e. A valve shall be installed at the intersection of water mains and easement lines. The municipality intends to maintain water main within legal easements.

Valve Boxes and Manholes

Valve boxes shall be used for valves up to 12 inches diameter. Other valves shall be placed in valve manholes as directed by the municipality. Generally valve manholes will be required in any location where re-excavation may be difficult. Valves not placed in valve manholes shall be provided with adjustable screw type valve boxes.

Valve Extension Stems

Where valves are used with valve boxes, the depth to the top of the valve operating nut shall not be greater than 52 feet. Where the water main is buried at a depth where the normal valve operating nut will be at a depth greater than 52 feet, a valve extension stem with operating nut shall be provided and mechanically attached to the valve to provide an operating nut at the 52 foot depth.

Water Mains

Water mains shall be constructed of ductile iron or PVC with a minimum cover of 6 feet. The use of cement-asbestos water main will not be approved. In general, water mains shall be designed in a network with sufficient looping to eliminate "dead end" runs. Any other pipe material shall be subject to the approval of the municipality.

Hydrants

The minimum size for fire hydrants shall be 5 inch diameter and the hydrant shall have connections and special construction as noted on the Table of Standard Castings and Valves. Hydrants shall be spaced along the water main network such that all residential and commercial establishments are within 400 feet of a hydrant (measured along the street right-of-way). Threads on the connections shall be National Standard Threads (NST). The hydrants shall have plugged drains. The pumper connection shall face the street. Hydrants shall be constructed at all dead end mains. Hydrants shall be constructed from the main by use of a standard tee and gate valve. A concrete thrust block of sufficient area shall be constructed to resist the thrust.

Service Connections

Connection to the existing main shall be made with a corporation stop with a minimum diameter of one (1) inch. Service lead shall be type K annealed seamless copper water tubing with flared type fittings. Service lead shall be constructed to within six inches of the property line and shall be terminated with a curb valve. The open end shall be capped and protected during backfill operations. An adjustable curb box shall be provided for each curb box. The size of water service connection shall be approved by the Engineer. Each service connection shall be provided with a minimum of 6 feet of cover. Refer to the Table of Standard Castings and Valves for acceptable makes and model numbers.

Water Meters

Water meters together with the necessary setting equipment are to be furnished by the City upon payment of the necessary fee as established by the City. (This fee is subject to change by the City Council). The meter and appurtenances shall remain the property of the City and shall be maintained by the City in accordance with the City Water Ordinance.

STANDARDS OF DESIGN - SITE GRADING

Scope

These standards establish the minimum requirements for the design of storm sewers in the Municipality.

Plans and Specifications

1. The plans and specifications shall be prepared by a professional engineer registered in the State of Michigan.
2. Plans shall consist of a cover sheet showing a location map and site plan of the proposed project, plan and profile sheets covering all the proposed street and roadway construction, and a standard detail sheet. Plan sheet size shall be 24" x 36" or 22" x 34". Plan scale shall be either 1" = 40' or 1" = 20' horizontally and 1" = 4' vertically.
3. Elevations shall be based upon U.S.G.S. datum. Elevations based upon assumed datum will not be approved.
4. The site plan for street and lot layout shall indicate both existing and proposed contours at a two foot contour interval. Individual lot drainage patterns shall be indicated on the plan.
5. Two sets of plans and specifications shall be submitted by the Developer to the Municipality for preliminary approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design. Modifications required to meet the municipal standards, if any, will be noted on two sets, with one such set returned to the Developer for final corrections.
6. Four sets of final plans and specifications shall be submitted by the Developer to the Municipality for approval. All plans and specifications submitted for approval shall be sealed by the registered engineer in charge of design.
7. The Developer will be responsible for securing all State and local construction permits.

Grading

Site grading shall be designed to allow for drainage of storm water away from residential or commercial buildings. Grades shall be such as to minimize earth settlement problems, avoid concentrating run-off onto adjacent properties, prevent creation of water pockets or pools of standing water and to minimize erosion. The grading design shall incorporate natural drainage courses where possible. In areas where natural drainage is not present, surface (ditches) or subsurface (storm sewers) drainage shall be provided for collection and disposal of storm run-off. It is the intent of these regulations that the grading design minimize the need for banks, retaining walls or terracing. Minimum grade away from structures shall be two percent. On slopes of 3.5 horizontal to 1 vertical or greater, Class A sodding with pegs must be provided to minimize erosion. The maximum allowable slope shall be 3.5 horizontal to 1 vertical. Site grading shall conform to the applicable sections of the Soil Erosion and Sedimentation Control Act. Where mulch is required, a mulch adhesive shall be used.

TABLE OF STANDARD CASTINGS AND VALVES

SEWER SYSTEM

SANITARY MANHOLE CASTINGS	EJIW 1040 A
STORM MANHOLE CASTINGS	EJIW 1040 B
CATCH BASIN CASTINGS	
CURB TYPE (F-4)	EJIW 7045 M1
CURB TYPE (F-4 with no curb back)	EJIW 7000 M3
DITCH TYPE (BEEHIVE)	EJIW 1040 TYPE O2 GRATE
INVERTED CROWN, ROAD EDGE	
PARKING LOTS (CONCAVE INLET)	EJIW 5105 M2

WATER DISTRIBUTION SYSTEM

FIRE HYDRANTS	EAST JORDAN IRON WORKS MODEL 5BR250 WITH 2-2½ HOSE CONNECTIONS AND 1 STANDARD PUMPER CONNECTION. NATIONAL STANDARD THREADS.
GATE VALVES	RESILIENT WEDGE TYPE WATEROUS SERIES 500, KENNEDY KEN-SEAL.
GATE VALVE BOXES	EJIW 6860 SERIES MARKED "WATER"
CORPORATION STOPS	¾" AND 1" – MUELLER 300 BALL CORP MODEL B-25000 OR B-25008 1 ½" AND 2" – MUELLER ORI-CORP MODEL H-15013
CURB STOP	MUELLER ORISEAL 15024I OR APPROVED EQUAL.
CURB STOP BOX	MUELLER 1035 FOR 1" AND MUELLER 1036 FOR 1 ½" AND 2", OR APPROVED EQUAL WITH ARCH PATTERN BASE, STATIONARY ROD AND LID WITH PENTAGONAL BRASS PLUG.
SERVICE LEAD	TYPE K ANNEALED SEAMLESS COPPER.
VALVE MANHOLE CASTINGS	EJIW 1040 A

STANDARDS OF CONSTRUCTION - UTILITY CONSTRUCTION WITHIN MUNICIPAL STREET RIGHT-OF-WAY

General

This specification covers the requirements of all gas, telephone, cable television or other public utilities, and private persons or corporations in conjunction with construction operations within Municipal Street rights-of-way.

All new utility installations including electrical service, telephone and cable t.v. shall be installed underground.

All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum. No street may be closed without prior permission from the authority having jurisdiction. The utility shall be responsible for providing, installing, and maintaining traffic control signs, lights and barricades as required by the MDOT Manual of Uniform Traffic Control Devices.

Whenever reference is made to specifications other than those contained herein, said specifications shall apply and be binding as if fully repeated herein. Unless otherwise specified, all work shall conform with applicable divisions of the "Standard Specifications for Highway Construction", latest revision of the Michigan Department of Transportation (MDOT).

The utility company, private person or corporation shall notify the Municipality 72 hours prior to commencing construction operations, unless the situation warrants immediate action.

Where applicable, construction plans shall be submitted to the City for approval 30 days in advance of the proposed initiation of construction operations.

Construction Operations

In general, construction operations shall be in accordance with the applicable sections of the MUNICIPAL STANDARDS.

1. Pavement Crossings - Unless otherwise specified, where a utility line crosses the entire width of a permanent pavement, the utility, private persons or corporations will be required to bore, bore and jack, or tunnel in accordance with Section 02222, Excavation for Utility Systems. If open cutting of a permanent pavement is allowed, the pavement shall be saw cut prior to excavation and backfilled and compacted in accordance with Section 01410, Soils Compaction and Testing.
2. Pavement Replacement - Where weather conditions allow, pavement shall be replaced upon completion of construction operations. Pavement replacement materials shall be of the same material as the existing pavement. During freezing weather, cold patch shall be used until permanent pavement can be replaced. The utility, private persons or corporations shall be responsible for maintaining the cold patch until the permanent pavement can be replaced.

SECTION 01410 - SOILS COMPACTION AND TESTING

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment and materials in connection with SOILS COMPACTION AND TESTING.

1.02 RELATED WORK: The Contractor shall compact all bedding, backfill, fills, and embankments to the percentage of maximum unit weight specified herein. All compaction operations shall be performed utilizing suitable methods and equipment specifically designed for earth compaction. Rollers shall be of a standard design and in general shall be vibratory, rubber tire or smooth steel drum for granular materials and kneading type (sheep's foot) for non-granular materials. All operations shall be performed such that they do not damage or displace any pipes, utilities or structures. Compaction by flooding or jetting shall not be allowed. Attention is directed to SECTION 01560 - SPECIAL CONTROLS.

1.03 DEFINITIONS

- A. GRANULAR MATERIALS: Soils having a loss by washing of 15 percent or less.
- B. NON-GRANULAR MATERIALS: Soils having a loss by washing of more than 15 percent.
- C. LOSS BY WASHING: Materials finer than a No. 200 sieve as determined by ASTM C117.
- D. MAXIMUM UNIT WEIGHT: Maximum dry pounds per cubic foot at the optimum moisture content as determined by the following standard tests:
 - 1. Modified Proctor: AASHTO 180, Method C, shall be used for granular and non-granular materials at structures as noted in Part D of the appended table.
 - 2. Standard Proctor: AASHTO T-99 as modified by MDOT shall be used for soils having a loss by wash greater than 15%.
 - 3. Michigan Cone: The MDOT "Method of Test for the Compaction and Density of Soils (Granular)" shall be used for granular materials.
- E. OPTIMUM MOISTURE CONTENT: Shall be the percent moisture of the soil at which the maximum unit weight is obtained by the above tests.
- F. LIFT: Shall be the vertical measure of a soil layer when measured loose.

PART 2 PRODUCTS

2.01 MATERIALS: Shall be as specified herein, and as noted on the plans. The Contractor shall notify the Engineer of the source of materials at least three days prior to their use to allow for testing of samples.

PART 3 EXECUTION

3.01 COMPACTION AND TESTING

A. MOISTURE CONTENT: All material shall be at or near the optimum moisture content when compacted. Unless modified by the Engineer, the allowable moisture range shall be as follows:

1. Granular soils: -3% to +2% above the optimum
2. Non-granular soils: -1% to +3% above the optimum

In the event the moisture content of the material exceed these limits, the material shall be allowed to dry or be dried by discing or harrowing. In the event that the moisture content is too low to obtain the required densities when compacted, water shall be added to increase the moisture content to the optimum.

B. TESTING: Moisture and in-place density tests will be made on the compacted fill in locations and at times as selected by the Engineer. The costs of tests which meet the specifications will be paid by the Owner. The costs of failing tests will be paid by the Contractor and said costs will be deducted from sums due the Contractor. The Contractor may elect to perform additional testing at his own expense for his own purposes, however, the Engineer's decision of the suitability of materials and compliance with specifications shall be final.

C. TABLE OF COMPACTION OPERATIONS AND REQUIREMENTS: The appended table lists requirements for minimum in-place densities and maximum lifts for various compaction operations, material classifications, and locations. The lift thickness, moisture content, type of equipment, number of passes, and weight and speed of equipment shall be adjusted to product the required compaction density with consistent results.

D. SUBSIDENCE AND SETTLEMENT: The Contractor shall be responsible to conduct all compaction operations in such a manner to avoid objectionable soil settlement. Irrespective of compaction tests results, excessive soil settlement any resulting structure or pavement damage shall be repaired by the Contractor.



TABLE OF COMPACTION OPERATIONS AND REQUIREMENTS

COMPACTION OPERATION	MATERIAL CLASSIFICATION (1)	MAX. LIFT LOOSE MEASURE	MIN IN-PLACE DENSITY % MAX UNIT WEIGHT
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A. EMBANKMENTS:

1. General	(3)	9"-12" (4)(6)	95%
2. Under utility structures	Granular	12" (6)	97%

BITUMINOUS SURFACE:

1. Subgrade	Existing Material	9"-18" (5)	95%
2. Aggregate Base Course	As Specified	3"-6"	98%

NOTES:

- (1) Specific material requirements shall be as specified herein or shown on the drawings.
- (2) For pipes of 8 inch O.D. and less, maximum lift shall be one-half of the pipe O.D.
- (3) Material as designated on the drawings or as approved by the Engineer, with exception that frost heave material, as defined in MDOT Specification 2.08.10d may not be used in top 3 feet of embankment below subgrade.
- (4) 9" for non-granular, 12" for granular materials.
- (5) Depth of lift indicated is below excavation at which compaction is required provided a base course is required. If a base course is not required, compacted depth shall be 18".
- (6) The maximum depth of lift for hydraulic compactors which may be allowed by the Engineer will vary depending upon the compaction equipment utilized by the Contractor. The maximum depth of lift shall not exceed 50% (percent) of the maximum compaction lift stated in the compaction equipment manufacturers data sheet, provided the Contractor can demonstrate that the required density has been achieved throughout the depth of the lift.

END OF SECTION



SECTION 01560 - SPECIAL CONTROLS

PART 1 GENERAL

- 1.01 WORK INCLUDED: The work covered by this section of the specifications pertains to SPECIAL CONTROLS.
- 1.02 SPECIFICATIONS BY REFERENCE: Where reference is made in the specifications to standards of any technical society, association, governmental agency, etc., said specifications or standards shall apply and be binding as though fully repeated therein and are to be considered as a part of these specifications.
- 1.03 RELATED WORK: The Contractor shall conduct his work in a manner to prevent air, water, and noise pollution by establishing adequate controls during the construction operations. All controls shall be in accordance with the applicable laws of the State of Michigan.
- A. AIR POLLUTION: The open burning of combustible wastes from clearing and grubbing operations and of waste construction materials will be permitted only with prior approval by the City. The Contractor shall dispose of all such wastes at sanitary landfill(s) licensed by the Michigan Department of Environmental Quality.
1. Dust Control: The Contractor shall maintain all traveled areas in a safe, dust-free conditions at all times. To accomplish this, the Contractor shall remove any tracked materials such as much, dirt, etc. from construction and haul roads, furnish and apply chloride treatment to temporary roads, furnish and install temporary road patches or surface, or any other approved methods or systems.
- B. WATER POLLUTION: The Contractor will be required to perform all construction operations in a manner that will conform to the requirements of Act 347, Soil Erosion and Sedimentation Control Act. The Contractor shall also be required to perform all work in conformance with the requirements of Act 346, Inland Lakes and Streams. The permits for construction will be obtained by the Owner.
- C. NOISE POLLUTION: The Contractor shall exercise judgment in the conduct of operations which by nature result in excessive noise. All such operations shall take place during reasonable daylight periods, which are defined at 7:00 a.m. through 6:00 p.m. unless otherwise stated in the governing municipal ordinance, or authorized by the Owner.
- D. CONSTRUCTION DEBRIS: All construction debris shall be removed from the construction site(s) at regular intervals and disposed of at solid waste landfill(s) licensed by the Michigan Department of Environmental Quality.
- E. HOUSEKEEPING: The project work areas shall be maintained in a neat and clean conditions.

- 1.04 VEHICULAR AND PEDESTRIAN TRAFFIC CONTROL: The Contractor shall be responsible for providing, installing, and maintaining vehicular and pedestrian traffic control signs, lights, and barricades in conjunction with construction operations. Vehicular traffic control measures shall be in accordance with the Michigan Manual of Uniform Traffic Control Devices.
- A. STREET CLOSING: No street or roadway may be closed to traffic without prior written permission of the City of Gaylord.
- B. EXISTING TRAFFIC CONTROL SIGNS: Existing traffic control signs which conflict with construction operations may be temporarily removed. The Contractor shall provide traffic control for the duration of the sign displacement and signs shall be replaced in the proper location immediately after construction operations adjacent to the sign locations are completed.

END OF SECTION

SECTION 02110 - SITE PREPARATION

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment and materials in connection with SITE PREPARATION.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS

PART 2 PRODUCTS - This section not used.

PART 3 EXECUTION

3.01 CLEARING: Shall consist of cutting, removing from the ground, and disposing of trees, stumps, brush, shrubs, and other vegetation occurring within the project site which interfere with excavation, embankment or clear vision, or are otherwise noted on the construction drawings to be removed and includes the preservation from injury or defacement of all vegetation and objects designated to remain. Any trees or shrubs that are designated to be saved but are damaged by the Contractor's operations shall be repaired or replaced by the Contractor, as directed by the Engineer, at not additional cost to the Owner.

3.02 TREE AND STUMP REMOVAL: Shall consist of removing trees or stumps where called for on the plans or directed by the Engineer, or of removing stumps which are shown on the plans as trees occurring within the project site and shall include cutting such trees, removing their stumps and roots from the ground or chipping the stumps and properly disposing of the material. Where removal of a stump may result in damage to existing utilities, the stump shall be removed by chipping to a depth of at least one foot below the finished ground surface. Other stumps may be removed by chipping when approved by the Engineer. The Contractor shall comply with requirements of the Michigan Act 72 of the Public Acts of 1945 and requirements of the Michigan Act 72 and regulations of the Michigan Department of Agriculture in regard to Dutch Elm diseased trees.

3.03 REMOVING MISCELLANEOUS STRUCTURES: Shall consist of removing pavement surface and base course, curb and gutter, sidewalk, manholes and catch basins, salvaging or disposing of the resulting materials, and backfilling the resulting excavations.

- A. PAVEMENT, CURB AND GUTTER, SIDEWALK REMOVAL: Shall be to existing joints or a sawed joint. The sawed joint shall be cut with a concrete saw to a depth sufficient to cut the steel or, if the concrete is unreinforced, at least 3 inches. If the concrete has been covered with bituminous material, the depth of cut shall be sufficient to cut the steel or penetrate at least 3 inches into unreinforced concrete. The use of a crane and ball type pavement breaker will not be permitted within 50 feet of the pavement or other concrete structure that is to remain in place. Sufficient removal shall be made to provide for proper grades and connections in the new work.
 - B. MANHOLE, CATCH BASIN AND INLET REMOVAL: In removing manholes, catch basins and inlets, any live sewer connected to them shall be rebuilt and properly reconnected through the removal areas, and service shall be maintained, as directed by the Engineer, during such construction operations. Unless otherwise noted, removal of the structures shall include the cost of removing the connecting pipes or sewers. Where the existing sewer or pipes are to be abandoned in place, the existing sewer or pipe shall be bulkheaded at the trench or structure wall. The cost of the bulkhead(s) shall be included in the cost of the structure removal or abandonment.
- 3.04 ADJUSTING UTILITY CASTINGS AND COVERS: Shall include all manholes, catch basins, valve vaults, valve boxes, etc., publicly or privately owned, which are located in the project site. All work shall be done in accordance with the structure Owner's requirements.
- A. MANHOLE OR CATCH BASIN CASTING: Adjusting the casting shall apply where the elevation of the casting is lowered by the height of the available adjusting brick or rings or raised to a maximum of 15 inches of brick and block adjustment. This adjustment shall be done by one of the following methods:
 - 1. Masonry Adjustment: Existing castings shall be adjusted to the proper elevation by removing the castings, and setting them to the required elevation by supporting them on a concrete collar or on masonry, so constructed as to hold them firmly in place. The adjacent pavement, curb, or curb and gutter shall be replaced to the original elevation, conditions and kind of construction, unless otherwise provided.
 - 2. Adjusting Rings: Existing covers may be adjusted to the proper elevation by inserting an Engineer approved, variable adjustable casting into the existing frame. The adjustable casting shall be capable of diameter adjustment as well as height adjustment.
 - B. WATER VALVE BOXES: Shall be adjusted by chipping sufficient adjacent pavement or other material, adjusting the casting, and replacing pavement or other material. Water valve boxes which cannot be adjusted properly shall be replaced with a new screw type adjustable valve box to be furnished by the Owner and installed by the Contractor.
 - C. MONUMENT BOXES: Shall be adjusted to the proper elevation by placing an approved cast iron ring to support the cover at the correct elevation, or by removing or chipping sufficient adjacent pavement or other material to remove the casting, raising it to the proper elevation, and supporting it on Class B concrete.
- 3.05 REMOVE AND REPLACE MANHOLE OR CATCH BASIN CASTINGS: Shall be where called for on the plans or in the specifications. The Contractor shall remove existing castings, install new castings

of the style noted on the plans or in the specifications, and adjust the new castings to the proper elevation. The old castings remain the property of the Owner and shall be delivered by the Contractor to a location designated by the Owner.

- 3.06 RECONSTRUCTING MANHOLES OR CATCH BASINS: Reconstruction of manholes or catch basins shall apply to where castings cannot be adjusted to the proper elevation due to the absence or present of sufficient adjusting brick or rings on the manhole structure. The manhole or catch basin structure shall be constructed by one of the following methods:
- A. Precast Structure: If the manhole is constructed of precast concrete sections, the top section(s) shall be removed and replaced with a precast concrete section(s) of such height as to allow for the proposed casting adjustment.
 - B. Manhole Block or Brick: If the manhole is constructed of manhole block or brick, remove sufficient rows of block or brick in order to construct the manhole to the proper grade for casting adjustment.
- 3.07 BITUMINOUS SURFACE REMOVAL: Shall consist of removing a bituminous surface from a rigid base or removing a bituminous surface from an aggregate base without the removal of the aggregate base. The method of removing the bituminous surface shall be approved by the Engineer. The removal of a bituminous surface and the aggregate base will be classed as Earth Excavation, except when the bituminous surface is more than 5 inches in thickness. The removal of bituminous surface will be paid for as Removing Pavement.
- 3.08 DISPOSAL OF MATERIALS: Materials salvaged during the construction of the project shall become the property of the Contractor unless otherwise shown on the plans or in the proposal. Materials reserved for use by the Owner shall be removed without damage to the material and stored outside the limits of construction at the location and in the manner approved by the Owner. Materials that become the property of the Contractor shall be removed from the project before acceptance of the project. Broken concrete which is matted together by steel reinforcement and all other waste material shall be disposed in conformance with SECTION 01560 - SPECIAL CONTROLS.
- 3.09 RESTORATION OF DISTURBED STRUCTURES: Existing structures, including pavement, curb and gutter, sidewalk and other miscellaneous structures, disturbed or damaged as a result of site preparation operations shall be restored or replaced to their original condition by the Contractor at no additional cost to the Owner.
- 3.10 BACKFILLING: All trenches, holes and pits resulting from the breaking down or removal of foundations and miscellaneous structures within the project site shall be backfilled in conformance with SECTION 02223 Paragraph 2.02 - BACKFILL MATERIAL and compacted in conformance with SECTION 01410 - SOILS COMPACTION AND TESTING.

END OF SECTION

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SECTION 02210 - MACHINE GRADING MODIFIED

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with MACHINE GRADING MODIFIED.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.
- B. COORDINATION WITH OTHER CONTRACTORS: Certain portions of the work may require completion of construction under other sections prior to commencing work under this section. The Contractor shall coordinate his work and schedule with other contractors to result in successful completion by the contract completion date.
- C. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01560 - SPECIAL CONTROLS

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 GENERAL: Machine grading modified shall consist of all work required to construct the earth grade in accordance with the specifications and in conformance with the line and grade as indicated on the cross sections shown on the plans or established by the Engineer.

3.02 CONSTRUCTION OPERATIONS: The work of Machine Grading Modified shall consist of sawing full depth at driveways and the limits of construction; removal of bituminous drives, bituminous pavement and bituminous approaches; furnishing, hauling and placing of all required embankment for roadway and sidewalk construction; excavation for roadway and sidewalk construction, excavation for drive approaches, excavation for curb and gutter; tree, stump and brush removal; tree or brush relocation; topsoil stripping; grading for placement of topsoil; and disposal of all excess material. The Contractor shall move the excavated material longitudinally and transversely where necessary and remove all excess material from the construction area.

3.03 ADDITIONAL ITEMS OF WORK: Additional items, specifically noted on the plans as "included with/in Machine Grading Modified" shall be included with this work item.

END OF SECTION

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SECTION 02211 - SITE EARTHWORK

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with SITE EARTHWORK.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.
- B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01410 - SOILS COMPACTION AND TESTING
 - 2. SECTION 01560 - SPECIAL CONTROLS
- C. COORDINATION WITH OTHER CONTRACTORS: Certain portions of the work may require completion of construction under other contracts prior to commencing work under this section. The Contractor shall coordinate his work and schedule with other contractors to result in complying with the contract completion date.

PART 2 PRODUCTS

- 2.01 SUBBASE AND SUBGRADE UNDERCUTTING: Shall conform to MDOT Granular Material Class II.
- 2.02 EMBANKMENT MATERIAL: Materials utilized for embankment construction shall be approved by the Engineer. In general, any natural material which can be compacted to the required density, contains no organic material, and has a maximum unit weight of at least 95 pounds per cubic foot may be used. Materials containing more than 50 percent silt or any frozen material will not be allowed. Silt is defined as material having a particle size of 0.074 to 0.0005 mm.

PART 3 EXECUTION

- 3.01 SITE EARTHWORK: Work performed under this section shall consist of constructing earth grades by excavating soil or rock and by placing embankments or fills. This work shall include the salvaging and stockpiling of selected material, disposing of surplus or unsuitable material, trimming the earth grade, and maintaining the work in a finished condition until acceptance.
 - A. SITE PREPARATION: Undesirable material shall be removed from the grading limits and salvaged or disposed of as specified herein or as shown on the plans.
 - 1. Removing Topsoil: Before removing topsoil, all vegetation of a height greater than one foot shall be reduced to a height of approximately 6 inches and all such vegetation and all brush,

- stones, rocks, and any other objectionable litter or foreign materials shall be removed from the site and disposed of in conformance with SECTION 01560 - SPECIAL CONTROLS. Equipment and methods of operations shall be such as to avoid the lifting of subsoil. If soil or weather conditions are unsuitable, the Contractor shall cease and resume removing topsoil upon orders from the Engineer.
- a. Embankment Areas: Where the embankment is to be 5 feet or less in height to the pavement surface, the topsoil shall be stripped from the area within limits of 1 on 1 slopes spreading outward from the finished shoulders. For embankments upon which a structure is to be built, the topsoil shall be stripped from an area within limits of 1 on 1 slopes spreading outward in all directions from the bottom of structure footing. The depth of the topsoil to be removed shall be as shown on the plans or as directed by the Engineer.
 - b. Cut Areas: Topsoil shall be removed within the grading limits.
2. Salvaging Topsoil: The topsoil may be stockpiled outside the limits of construction or used as shown on the plans or as directed by the Engineer. Topsoil stockpiles shall be located and shaped so as to avoid placing around trunks and over root areas of trees to be preserved or in drainage courses. The topsoil shall be kept separate from other excavated material.
 3. Salvaging Other Materials: If provided on the plans or in the proposal, or if directed by the Engineer, old road surfacing of gravel, crushed stone, or selected excavated materials, shall be removed from the designated areas for use in such items as earth shoulders, salvaged approaches, temporary roadway surfacing or other items requiring the use of such materials. Reasonable care shall be exercised in removing and handling the designated materials to prevent incorporation of foreign or undesirable material. When the salvaged material cannot be placed directly in the contemplated construction, the material shall be stored in stockpiles.
- B. SUBGRADE UNDERCUTTING: Including backfilling, shall be performed to replace material susceptible to frost heaving or differential frost action and unstable soil conditions, as determined by the Engineer. Removing topsoil will not be part of subgrade undercutting. Excavation below subgrade in cut sections, at the transition from cut to fill sections, and any excavation other than peat excavation that may be required below the topsoil in fill sections will be classified as Subgrade Undercutting.
1. Limits of Subgrade Undercutting: After the subgrade has been constructed to the approximate grade, the Engineer will promptly inspect the grade to determine if any subgrade undercutting is required and determine the limits of such undercutting. Where shallow fills are to be placed, the Engineer will inspect the fill area before any embankment is placed and determine the limits of the subgrade undercutting if any, before placing any embankment. All deposits of frost heave material within lines 2 feet outside the proposed surface, shall be removed to a depth as directed by the Engineer. Subgrade undercutting shall be performed within the limits established by the Engineer, and the excavated material shall become the property of the Contractor.

2. Backfilling of Subgrade Undercut Sections: Undercut sections shall be backfilled to the subgrade elevation with MDOT Granular Material Class II. The degree of compaction shall be in conformance with SECTION 01410 - SOILS COMPACTION AND TESTING.
- C. WASTE MATERIAL AND DEBRIS: Of whatever nature shall be removed from the site at the Contractor's expense.
1. Excess Material: From excavation operations which is not required for fill or backfill may be spread at the site in spoil areas as shown on the plans.
 2. Hazardous Waste: Should such waste material as defined by MDNR be encountered during construction, the Contractor shall immediately notify the Engineer. Removal and disposal of such materials from the site shall be considered a changed condition.
- D. CONSTRUCTING EMBANKMENTS: Shall be done with approved materials as specified in paragraph 2.02. In addition, embankments shall be constructed with the maximum allowable lift and degree of compaction conforming to SECTION 01410 - SOILS COMPACTION AND TESTING. In general, embankment construction at outside air temperatures below 35°F. will not be allowed. If embankment construction is allowed under such conditions, the Contractor shall exclude frozen material from any portion of the embankment. Any frozen material on a partially completed fill shall be removed and disposed of prior to placing additional fill on the embankment.
- E. BORROW: Material secured from locations outside the project site will be considered borrow excavation. The Contractor shall perform all work and provide all materials and equipment necessary to excavate, haul and place the borrow material. The Contractor will be held liable for all damages caused by his hauling operations and will be required to pay for such damages.
- F. PREPARATION OF SUBGRADE SURFACE: Where the natural soils form the subbase, the subgrade shall be scarified and blended to a minimum depth of 6 inches to obtain uniformity across all lines of change in soil types. The subgrade shall be compacted in conformance with SECTION 01410 - SOILS COMPACTION AND TESTING.

END OF SECTION

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SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials and performing all operations in connection with EXCAVATION FOR UTILITY SYSTEMS.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02161 - SHEETING AND BRACING
4. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS
5. SECTION 02227 - BORING, JACKING AND TUNNELING FOR UTILITY SYSTEMS
6. SECTION 02901 - RESTORATION AND CLEAN-UP

C. DEVIATIONS: Wherever obstructions not shown on the plans are encountered during the progress of the work and interference to such an extent that an alteration in the plan is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstructions. If the change in plans results in a change in the amount of work by the Contractor, such altered work shall be done on the basis of payment to the Contractor for extra work or credit.

1. Contractor Downtime: In the event that the above mentioned interference causes the Contractor to cease operations temporarily, he shall immediately inform the Engineer through the representative on the job or the Engineer's office. The Engineer will, within one normal working day, defined as 8 hours between the hours of 7:00 A.M. and 6:00 P.M., inform the Contractor how to proceed or to move his operations to another portion of the work without any additional cost to the Owner for Contractor downtime or for relocation to another portion of the work.

D. SUBSURFACE EXPLORATIONS: Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of the existing underground structures, the Contractor shall make explorations and excavations for such purposes at no cost to the Owner. All apparent underground conflicts shall be excavated in advance for utility systems to determine any actual interference.

PART 2 PRODUCTS

- 2.01 BACKFILL FOR UNDERCUTTING: Shall conform to MDOT Granular Material Class II Granular Material or other material approved by the Engineer.
- 2.02 FLEXIBLE PIPE REQUIREMENTS: When undercutting exceeds 12" for flexible pipe (PVC or corrugated pipe) backfill for undercutting shall conform to MDOT requirements for 31A aggregate.

PART 3 EXECUTION

3.01 EXCAVATION AND PREPARATION OF TRENCH

- A. CAUTION IN EXCAVATION: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined. The Contractor shall be held responsible for the repair of such structures if broken or otherwise damaged as a result of excavation at no additional cost to the Owner.
- B. EXCAVATION TO GRADE: The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe per details shown in Section 02223, Bedding and backfilling for Utility Systems.
- C. EXCAVATION BELOW GRADE
1. Contractor's Fault: If the Contractor undercuts the trench bottom below plan grade, the trench shall be restored to plan grade with compacted granular material or stone (at the option of the Engineer) at no additional cost to the Owner.
 2. Unstable Ground Conditions: If unstable ground conditions are encountered at the plan grade, the Engineer will direct the Contractor to excavate the unstable material to a stable base. The Contractor shall then place and compact crushed stone, granular materials or other suitable material, approved by the Engineer, to establish the plan grade.
 3. Compaction of Granular Material: Shall conform to Section 01410, Soils Compaction and Testing.
- D. WIDTH OF TRENCH: The width of the trench shall be ample to permit the pipe to be laid and joined properly. In general, the Engineer has designed for the worst condition assuming a wide trench at the top of the pipe so that the so called "transition width" determines the load on the pipe.
1. Bedding Requirements: When sand bedding is used, the trench widths shall be as required to allow specified compaction of the bedding. If stone bedding is used, a minimum of 6 inches clearance shall be provided on each side of the pipe.

2. Safety: The trench width shall be such that safety is provided at all times. In this regard, it shall be the responsibility of the Contractor to provide a safe trench for working at all times. Trench width and excavation shall meet all requirements of the State of Michigan Safety Inspector, the Department of Labor and MI-OSHA. Sheeting and bracing shall conform to Section 02161, Sheeting and Bracing.
- E. REMOVAL AND DISPOSAL OF WATER: The Contractor shall provide adequate pumping, bailing, or other drainage facilities for removal and disposal of water from the excavation. These facilities shall consist of sumping, dewatering wells, well points or any other system designed and operated to remove groundwater to provide a dry and stable trench.
- F. BORING, JACKING AND TUNNELING: At certain permanent pavement and railroad crossings, the Contractor shall bore and jack, or tunnel utilities in conformance with Section 02227, Boring, Jacking and Tunneling for Utility Systems.
- G. OPEN CUTTING OF PERMANENT PAVEMENT
1. General: Where utilities are to be constructed within the rights-of-way of county, State or Federal highways or railroads, an application will be applied for by the Owner with the respective agency/agencies and shall be executed by the Owner upon fulfillment of requirements by the Contractor. The Contractor shall provide any bonds or assurances required by the agency/agencies. Whenever the specifications and plans conflict with the requirements of the permit, the requirements of the permit shall govern.
 2. Pavement Removal: Prior to excavation through all hard surface pavement, including sidewalks, the pavement shall be sawcut at such places to allow approximately 12 inches of undisturbed earth between the cut and the top edge of the trench. In lieu of sawcuts the pavement may be removed to a clean line at construction joints or contraction joints as approved by the Engineer.
- H. OPEN CUTTING AND TUNNELING OF TREES
1. Open Cutting: Where noted on the drawings, trees up to two inches (2") in diameter, may be balled, removed, and reinstalled after backfilling operations, or replaced in conformance with Section 02901, Restoration and Clean-up. Trees between two inches (2") and eight inches (8") may be removed and replaced by approved tree space if acceptable to the Engineer. Trees eight inches (8") in diameter and smaller shall not be open cut closer than four feet (4') and shall be tied back to a deadman. Trunks or limbs shall be protected from damage. Trees eight inches (8") in diameter and larger shall not be open cut closer than the radius in inches multiplied by one foot; i.e., a twelve inch tree shall not be open cut closer than six feet (6') and shall be tunneled within that radius.
 2. Tunneling: Tunneling operations adjacent to or under trees shall begin at end points which fall outside a radius designated above.

END OF SECTION

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SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials and performing all operations in connection with BEDDING AND BACKFILLING FOR UTILITY SYSTEMS.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum. Special attention shall be made to the interrelationship between types of bedding and class of piped material.
- B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01410 - SOILS COMPACTION AND TESTING
 - 2. SECTION 01560 - SPECIAL CONTROLS
 - 3. SECTION 02161 - SHEETING AND BRACING
 - 4. SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS
 - 5. SECTION 02240 - DEWATERING
 - 6. SECTION 02901 - RESTORATION AND CLEAN-UP

PART 2 PRODUCTS

2.01 PIPE BEDDING MATERIAL: Includes all specified bedding material from 4 inches below the pipe to 24 inches above the top of the pipe.

- A. GRANULAR BEDDING: Shall be well graded granular materials conforming to MDOT Class IIIA material only.
- B. STONE BEDDING
 - 1. Rigid Pipes: Shall be stone conforming to MDOT Specification 8.02 for 6A coarse aggregate.
 - 2. Flexible Pipes (PVC or Corrugated Pipe): Shall conform to ASTM D2321 with a material gradation of 100% passing of the 1½" sieve.
- C. CONCRETE: Shall be Class B wet mix concrete conforming to SECTION 03001 CONCRETE.
- D. FLEXIBLE PIPE BEDDING (PVC OR CORRUGATED PIPE): Shall be approved by the Engineer and graded to provide adequate sidewall support, compactibility, and to prevent loss of support through migration of trench wall material into the bedding or migration of bedding material into the trench

wall or bottom. Where in place trench materials are clay, silt, fine sand or a mixture thereof, the bedding material shall contain sufficient fines and be graded such that there are essentially no voids when compacted.

- 2.02 **BACKFILL MATERIAL:** Includes all trench material above the pipe bedding material to the topsoil, aggregate base course, or grade.
- A. **BACKFILL MATERIAL FOR AREAS OUTSIDE PERMANENT PAVEMENT AREAS:** When the type of backfill material is not indicated on the plans or in the specifications, the Contractor may backfill with excavated material, provided that the excavated material consists of loam, clay, sand, gravel or other materials approved by the Engineer. All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, or other material which in the opinion of the Engineer is unsuitable. However, from one foot above the top of the pipe to grade, suitable material containing stones up to 6 inches in their greatest dimension may be used. Backfill shall be placed to the level required for final restoration in conformance with Section 02901, Restoration and Clean-up.
- B. **BACKFILL MATERIAL UNDER PERMANENT PAVEMENTS OR SIDEWALKS:** Shall be sand, gravel or other granular material conforming to SECTION 01410 SOILS COMPACTION AND TESTING, paragraph 1.03A, Granular Materials, approved by the Engineer. Use of excavated trench material will be allowed only if it conforms to SECTION 01410 SOILS COMPACTION AND TESTING, paragraph 1.03A, Granular Materials. Backfill shall be placed to the level required for final restoration in conformance with SECTION 02901, RESTORATION AND CLEANUP.

PART 3 EXECUTION

- 3.01 **GENERAL:** Excavation, undercutting, trench widths and dewatering shall conform to SECTION 02222 EXCAVATION FOR UTILITY SYSTEMS. Installation of pipes and structures shall be in accordance with the applicable sections of this specification.
- 3.02 **OPEN TRENCH:** The length of trench allowed to be left open before backfilling shall be a maximum of 100 feet, or as directed by the Engineer. The trench, if bedded to one foot above the top of the pipe, shall still be considered as an open trench.
- 3.03 **PIPE SUPPORT IN UNSTABLE SOIL:** Where the bottom of the trench at subgrade is found to consist of material which is unstable to such a degree that it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct supports as directed by the Engineer. Cost of such supports shall be negotiated at the time of construction.
- 3.04 **CONSTRUCTION IN FILL SECTIONS:** Where it is necessary to lay pipe in a fill area, all unstable or unsuitable material shall be removed and slopes steeper than 1 to 2 shall be stepped before fill material is placed. The embankment shall be of suitable material on 1 to 2 fill slopes and shall be not less than five diameters plus four feet wide at the invert of the pipe and shall be continued up to



provide not less than one foot of cover over the pipe. Compaction shall conform to SECTION 01410 SOILS COMPACTION AND TESTING.

- 3.05 PIPE BEDDING: All trenches shall be bedded by hand, from the bottom of the trench to one foot above the pipe with approved material and compacted by plate compactor or tamping. Bedding material shall be deposited in the trench for its full width on each side of the pipe, fittings and appurtenances. Special care shall be taken to assure that there are no voids under the pipe haunches and that the pipe line and grade is not disturbed. Bedding dimensions and details shall conform to the appended tables.
- A.. FLEXIBLE PIPE BEDDING: Due to sidewall support requirements, flexible pipe bedding shall be placed with extreme care. Wherever trench undercut with porous stone with a high void ratio is used for dewatering, special methods and materials for bedding shall be used as detailed on the appended sheets.
- 3.06 BACKFILL: Backfill shall be carefully placed and compacted in lifts. From the top of the pipe bedding material to four feet above the pipe, compaction shall be with small vibrating plate compactors and heavy wheel driven compactors shall not be used.
- A. BACKFILLING UNDER PERMANENT PAVEMENTS: Permanent pavements include gravel, bituminous concrete, and concrete surfaces streets, curbs, sidewalks, driveways, or similar structures. Where the excavation for utilities cuts through permanent pavements, the entire backfill to subgrade shall consist of granular material approved by the Engineer. Granular backfill shall be placed to the outside edges of shoulders or two feet outside the back of curb.
1. Maintenance of Street Cuts: If replacement of permanent pavement will not be completed within 5 days of excavation, the Contractor shall maintain the road in a serviceable condition, as determined by the City.
 2. Maintenance of Sidewalk Cuts: In sidewalks, sand backfill shall be constructed to the existing sidewalk grade, and maintained until the sidewalk can be poured. If replacement of the sidewalk will not be completed within 5 days of excavation, the Contractor shall construct and maintain a 4 inch bituminous base patch on all sidewalk cuts until the original type of surfacing is replaced.
- B. BACKFILLING AT STRUCTURES: All backfill placed within three (3) feet of manholes or other underground structures shall be approved sand compacted in conformance with SECTION 01410 SOILS COMPACTION AND TESTING.
- C. BACKFILL AT EXISTING UTILITIES: Existing utilities shall be protected during backfilling operations and backfilled in accordance with the requirements and standards of the company or municipality having jurisdiction over the utility. When backfill requirements under utilities are not set forth by the company or municipality, the Contractor shall backfill in conformance with paragraph 3.04. Existing

utility lines damaged during, or as a result of backfilling operations, shall be repaired by the Contractor at his expense.

3.07 **BEDDING AND BACKFILLING IN FREEZING WEATHER:** Bedding and backfilling shall not be constructed in freezing weather, except by permission of the Engineer. Bedding and backfill shall not consist of frozen material and no fill shall be made where the material already in the trench is frozen.

3.08 **COMPACTION:** Compaction lifts and required densities for bedding and backfilling shall conform to SECTION 01410 SOILS COMPACTION AND TESTING.

3.09 **RESTORATION AND CLEAN-UP:** Shall conform to SECTION 02901, RESTORATION AND CLEANUP.

END OF SECTION

SECTION 02231 - AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with AGGREGATE BASE COURSE.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.
- B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01412 - SOILS COMPACTION AND TESTING
 - 2. SECTION 01561 - SPECIAL CONTROLS

PART 2 PRODUCTS

2.01 AGGREGATE: Aggregate base materials shall conform to MDOT Specification 22A Series aggregate.

- A. SINGLE SOURCE: It is the intent of these specifications to secure materials from a single source and to avoid repetitive testing of various sources of aggregate for the convenience of the Contractor.
- B. AGGREGATE PRODUCTION: Prior to any request to the Engineer for approval of aggregate base material, the Contractor or his supplier shall create a stockpile of an appropriate amount for the size project.
- C. TESTING OF SOURCE: Prior to approval and placement of the aggregate base course material, an independent testing laboratory, selected by the Engineer, shall take representative samples of aggregate base course materials from the stockpile and test said samples for compliance with the specified aggregate gradation. Tests required for second sources or failed tests shall be paid by the Contractor.

2.02 CHEMICAL ADDITIVES: Chemical additives may be calcium chloride or calcium-magnesium chloride solution.

PART 3 EXECUTION

3.01 PREPARATION OF SUBGRADE: The subgrade shall be smoothed and trimmed to the required line, grade and cross-section within a tolerance of - : to : of an inch to receive the base course and shall be compacted in conformance with Section 01410, Soils Compaction and Testing. The subgrade

thus formed shall be maintained in a smooth and compacted condition until the base course has been placed. No base course shall be placed on the subgrade until it has been approved by the Engineer.

3.02 CHEMICAL ADDITIVE: A chemical additive may be added to the aggregate base course material in conformance with MDOT specification 3.01.05 upon approval by the Engineer.

3.03 AGGREGATE BASE COURSE PLACEMENT

- A. EQUIPMENT: The use of motor graders and other approved equipment will be allowed during spreading, depositing and compacting operations.
- B. PLACEMENT: Where the required thickness of the aggregate base course is 6 inches or less, the material may be spread and compacted in a similar manner. The aggregate base shall have a moisture content sufficient to obtain optimum moisture content. Aggregate base shall not be placed during freezing or other unfavorable weather conditions.
- C. COMPACTION: The spreading work shall be followed by vibrating compactors or pneumatic tired rollers until required density has been attained. Special care shall be exercised to secure proper compaction adjacent to curb lines. Compaction shall conform to Section 01410, Soils Compaction and Testing.
- D. GRADING TOLERANCE: The finished surface shall be shaped to the specified crown and established grade to within a tolerance of $-\frac{3}{4}$ to $\frac{3}{4}$ of an inch. Twenty-four (24) hours prior to placing of any surface course on the prepared base, the Contractor shall notify the Engineer, who will check the grade and crown at proper intervals to verify compliance with the grading and shaping tolerance. Any section not meeting tolerance shall be reshaped before the Engineer grants approval to place surface material.
- E. MAINTENANCE: The Contractor shall, without additional cost to the Owner, be required to regrade and reshape the finished surface if the surface becomes damaged during any interval between completion of base course and placing of bituminous surface material.

3.04 TESTING: After placement of the aggregate base course, the finished base course shall be tested for compliance with the compaction requirements of Section 01412, Soils Compaction and Testing.

END OF SECTION



SECTION 02513 - BITUMINOUS LEVELING/SURFACE COURSE

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in conjunction with the construction of BITUMINOUS LEVELING/SURFACE COURSE in accordance with the Michigan Department of Transportation 2012 Standard Specifications for Construction and applicable MDOT Special Provisions as they relate to Hot Mix Asphalt.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.
- B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01410 - SOILS COMPACTION AND TESTING
 - 2. SECTION 01560 - SPECIAL CONTROLS
 - 3. SECTION 02231 - AGGREGATE BASE COURSE

PART 2 PRODUCTS

2.01 MATERIALS: The composition of the bituminous leveling/surface course mixes shall conform to the requirements of Section 501 of the Michigan Department of Transportation 2012 Standard Specifications for Construction and applicable MDOT Special Provisions.

- A. LEVELING COURSE: Shall be the MDOT Hot Mix Asphalt mix as indicated on the plans.
- B. SURFACE (TOP) COURSE: Shall be the MDOT Hot Mix Asphalt mix as indicated on the plans.
- C. BITUMINOUS BOND COAT: Shall be as per the Michigan Department of Transportation 2012 Standard Specifications for Construction.

2.02 PROPORTIONS: The Contractor shall submit to the Engineer, for review, a laboratory Marshall mix design representative of the mixture to be placed by the Contractor. The HMA mixture shall conform to the MDOT 2012 Standard Specifications for Construction and applicable MDOT Special Provisions.

2.03 LABORATORY TESTING: Representative samples of the bituminous material will be taken at the plant and/or job site and submitted to an independent testing laboratory, selected by the Engineer, for determination of aggregate gradation and asphalt content.

PART 3 EXECUTION

3.01 ADJUSTING UTILITY CASTING AND COVERS: Shall conform to Section 02110, Site Preparation.

3.02 PLACEMENT OF BITUMINOUS MIXTURE(S) ON AN AGGREGATE BASE COURSE

- A. CONDITIONING AGGREGATE SURFACE: Prior to placement of the bituminous mixture(s), the aggregate surface shall be shaped to the required grade and cross-section in conformance with Section 02231, Aggregate Base Course. Where the aggregate surface is irregular, the use of a scarifier may be required. Additional aggregate shall be placed as directed by the Engineer when it is required to shape and consolidate the surface. Unless otherwise noted, the shaped surface shall be rolled to provide thorough compaction. Wetting may be required to facilitate shaping the surface and to assist in compaction of the subbase in conformance with Section 01410, Soil Compaction and Testing. The surface thus formed shall be maintained in a smooth and compacted condition until it is paved. Immediately before paving, all excess loose material remaining on the surface shall be removed to the shoulder. The length of existing road which is prepared and conditions for paving shall be determined by the Engineer.
- B. PLACEMENT: Placement of the Hot Mix Asphalt shall conform to Section 6 of the MDOT 2012 Standard Specifications for Construction and applicable MDOT Special Provisions.

3.03 PLACEMENT OF BITUMINOUS MIXTURE(S) ON EXISTING BITUMINOUS OR CONCRETE SURFACE

A. PREPARING EXISTING PAVEMENT

- 1. Removing Bituminous Patching: Existing bituminous patches of $\frac{3}{4}$ -inch thickness or more, and bituminous patches of less than $\frac{1}{2}$ -inch thickness with a high bitumen content which may cause bleeding or instability, shall be removed and patched in accordance with the following paragraph, Wedging and Patching.
 - 2. Wedging and Patching: All holes and depressions in the pavement section and all spaces caused by removing old surface material shall be wedged with a Bituminous Mixture as determined by the Engineer, placed and thoroughly compacted by tamping or rolling in layers of not more than $2\frac{1}{2}$ -inches in thickness before constructing the full width of bituminous pavement.
 - 3. Pavement Joints: The existing joint fillers shall be removed to an elevation $\frac{3}{4}$ -inch below the surface of the pavement by mechanical or hand methods. Where existing transverse and longitudinal pavement joints and cracks are repaired, the existing bituminous surface and any loose or spalled concrete around the joint shall be filled with a Bituminous Mixture as determined by the Engineer and compacted with a machine vibrator or approved roller. The prepared pavement shall be approved by the Engineer and the Contractor before placing any bituminous concrete mixture.
- B. BOND COAT: Prior to application of the bond coat, all existing surfaces shall be swept clean. The bond coat shall be applied at a rate of 0.10 gallons per square yard. The material shall be applied immediately ahead of paving operations for distances of 1,000 feet to 1,500 feet, depending upon traffic conditions.

- C. PLACEMENT: Placement of the Hot Mix Asphalt shall conform Section 501 of the MDOT 2012 Standard Specifications for Construction and applicable MDOT Special Provisions.
- 3.04 THICKNESS: The required bituminous material and thickness shall be shown on the plans or in the specifications.
- 3.05 SMOOTHNESS REQUIREMENTS: Shall conform to Section 501.03H of the MDOT 2012 Standard Specifications for Construction.
- 3.06 DENSITY REQUIREMENTS: Pavement density will be measured by the Engineer with a Nuclear Density Gauge using the Gmm from the Job Mix Formula (JMF) 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. The Contractor is responsible for establishing a rolling pattern that will achieve the required in place density.

END OF SECTION

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SECTION 02525- CONCRETE CURB AND GUTTER

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the construction of CONCRETE CURB AND GUTTER.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01560 - SPECIAL CONTROLS
2. SECTION 03001 - CONCRETE
3. SECTION 03600 - GROUT

PART 2 PRODUCTS

2.01 CONCRETE: Shall be Class A with a 28 day compressive strength of 3,500 psi. Materials, mixing, placing and curing shall conform to Section 03001, Concrete.

2.02 REINFORCING STEEL: Shall conform to ASTM A615 Grade 40. The size and location shall be as noted on the plans.

2.03 PREFORMED BITUMINOUS JOINT FILLERS: Shall consist of a bituminous mastic composition formed and encased between layers of felt, conforming to ASTM D2475.

PART 3 EXECUTION

3.01 BASE PREPARATION: The Contractor shall excavate or fill, as required, to within six inches of the proposed curb and gutter base. The Contractor shall place and compact a bed of sand, bank run gravel or other material equal to MDOT Granular Material Class II to bring the base to the desired grade. All tree roots 2 inches or more in diameter which are cut in conjunction with the base preparation shall be painted with Bartlett's Tree Paint, Tanglefoot Tree Paint, or equal.

3.02 LINE AND GRADE: All curbs are to slope uniformly to the catch basins so that no standing water forms in the finished gutter. Grades are shown on the plans.

3.03 FORMS: Shall be of such design of steel or wood as to insure the accurate maintenance of lines and grades and shall extend for the full depth of the required concrete. Flexible strips may be used where necessary on curves.

- 3.04 JOINTS: Expansion joints shall be 1-inch thick and placed at 400 foot intervals along the curb, at all street returns, within 20 feet each side of structures, and at the end of each day's pour. Contraction joints shall be placed at 40 foot maximum intervals. For both expansion and contraction joints, the reinforcing steel shall be broken each side of the joint at a distance of 6-inches minimum to 18-inches maximum. Joint filler shall extend to the full depth of the joint, and the top shall be recessed $\frac{1}{4}$ - to $\frac{1}{2}$ -inch from the finished surface of the structure. Plain or weakness joints shall be placed every 10 feet.
- 3.05 PLACING CONCRETE: No concrete shall be placed until the subgrade and forms have been reviewed by the Engineer. The subgrade shall be wetted and the concrete deposited to the proper depth and spaded or vibrated sufficiently to insure satisfactory consolidation prior to finishing.
- A. FINISHING: The curb and gutter shall be rounded with an approved finishing tool having a radius of $\frac{1}{4}$ inch to the dimensions shown on the standard details. Patching, when necessary shall be with concrete from the mixture used in the curb. The finished surface shall not vary more than $\frac{1}{8}$ -inch in 10 feet from the established grade when check with a 10 foot straightedge. Voids in the curb back shall be patched with a grout mixture conforming to Section 03600, Grout.
- B. CURING: Sufficient tarps or plastic sheets shall be stored on the job to prevent rain damage to the newly placed curb. Immediately after the free water has left the concrete surface, the curb shall be coated with a uniform coat of white membrane curing compound at the rate of one gallon per 200 square feet. No vehicle or foot travel shall be allowed on the new curb for 96 hours.

END OF SECTION



SECTION 02528 - CONCRETE SIDEWALKS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the construction of CONCRETE SIDEWALKS.

1.02 RELATED WORK

- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.
- B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01560 - SPECIAL CONTROLS
 - 2. SECTION 03001 - CONCRETE

PART 2 PRODUCTS

2.01 CONCRETE: Shall be Class A with a 28 day compressive strength of 3,500 psi. Materials, mixing, placing and curing shall conform to Section 03001, Concrete.

2.02 PREFORMED BITUMINOUS JOINT FILLERS: Shall consist of a bituminous mastic composition formed and encased between layers of felt, conforming to ASTM D2475.

PART 3 EXECUTION

3.01 BASE PREPARATION: The sidewalk base shall consist of a minimum of four inches of compacted sand or other materials equal to MDOT Granular Material Class III. In areas of existing granular subbase, the natural base may be used. In areas of existing unstable base material, the Contractor shall excavate the unstable material, as directed by the Engineer and place and compact sand or other material equal to MDOT Granular Material Class II. All tree roots 2-inches or more in diameter which are cut in conjunction with the base preparation shall be painted with Bartlett's Tree Paint, Tanglefoot Tree Paint, or equal.

3.02 FORMS: Shall be clean and straight, composed of wood or metal. The forms shall be staked to line and grade in a manner that will prevent deflection or settlement. Forms shall be clean and oiled before placing concrete. Removal shall not take place in less than 12 hours after placement of concrete.

3.03 JOINTS: 0.50-inch transverse expansion joint shall be placed every 50 feet the full depth of the sidewalk, at driveways, and where the new walk abuts existing concrete structures. Contraction joints shall be formed every 5 feet or as requested by the Owner. All joints shall be constructed at right angles to the centerline of the sidewalk.

3.04 PLACING CONCRETE: The subgrade shall be thoroughly wetted and the concrete deposited thereon to the proper depth. Concrete shall be spaded along the forms, compressed and struck off flush with the

top of the forms. The surface shall be floated with a steel float, edges and joints properly tooled, and then finished with a wood float or brush as required to provide a non-slip surface.

- 3.05 CURING: Sufficient tarps or plastic sheets shall be stored on the job to prevent rain damage to the newly placed sidewalk. Immediately after the free water has left the concrete surface, the sidewalk shall be coated with a uniform coat of white membrane curing compound at the rate of one gallon per 200 square feet. No vehicular or foot traffic shall be allowed on the new sidewalk for 96 hours after pouring.

END OF SECTION

SECTION 02529 - CONCRETE DRIVES AND APPROACHES

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the construction of CONCRETE DRIVES AND APPROACHES.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01560 - SPECIAL CONTROLS
2. SECTION 03001 - CONCRETE

PART 2 PRODUCTS

2.01 CONCRETE: Shall be Class A with a 28 day compressive strength of 3,500 psi. Materials, mixing, placing and curing shall conform to Section 03001, Concrete.

2.02 STEEL REINFORCING: Welded wire fabric conforming to ASTM A185 or A497 shall be used where noted on the plans.

2.03 PREFORMED BITUMINOUS JOINT FILLERS: Shall consist of a bituminous mastic composition formed and encased between layers of felt, conforming to ASTM D2475.

PART 3 EXECUTION

3.01 BASE PREPARATION: The drive and/or approach shall consist of a minimum of four inches of compacted sand or as shown on the plans. In areas of existing granular subbase, the natural base may be used. In areas of existing unstable base material, the Contractor shall excavate the unstable material, as directed by the Engineer and place and compact sand or other material equal to MDOT Granular Material Class II. All tree roots 2-inches or more in diameter which are cut in conjunction with the base preparation shall be painted with Bartlett's Tree Paint, Tanglefoot Tree Paint, or equal.

3.02 FORMS: Shall be clean and straight, composed of wood or metal. The forms shall be staked to line and grade in a manner that will prevent deflection or settlement. Forms shall be clean and oiled before placing concrete. Removal shall not take place in less than 12 hours after placement of concrete.

- 3.03 JOINTS: 0.50-inch transverse expansion joint shall be placed full depth every 50 feet, at the sidewalk, at driveways, and at the back of curb. Contraction joints shall be formed at the drive or approach centerline or as requested by the Owner. All joints shall be constructed at right angles to the centerline of the drive or approach.
- 3.04 PLACING CONCRETE: The subgrade shall be thoroughly wetted and the concrete deposited thereon to the proper depth. Concrete shall be spaded along the forms, compressed and struck off flush with the top of the forms. The surface shall be floated with a steel float, edges and joints properly tooled, and then finished with a wood float or brush as required to provide a non-slip surface.
- 3.05 CURING: Sufficient tarps or plastic sheets shall be stored on the job to prevent rain damage to the newly placed approach or drive. Immediately after the free water has left the concrete surface, the sidewalk shall be coated with a uniform coat of white membrane curing compound at the rate of one gallon per 200 square feet. No vehicular or foot traffic shall be allowed on the new drive or approach for 96 hours after pouring.

END OF SECTION



SECTION 02665 - WATER MAINS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in conjunction with the installation of WATER MAINS.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS
4. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS
5. SECTION 02901 - RESTORATION AND CLEAN-UP
6. SECTION 02715 - CONCRETE UTILITY MANHOLES AND CATCH BASINS
7. SECTION 03001 - CONCRETE

1.03 SUBMITTALS: Detailed material lists, specifications, and written certification, for all materials furnished under this section of the specification shall be submitted to the Engineer for review.

PART 2 PRODUCTS

2.01 MATERIALS: Shall be new and of the type as specified herein or the standard of the governing agency, as noted on the plans.

A. WATER MAIN PIPE

1. General Requirements:

- a. Material Selection: Unless specifically shown on the plans or listed in the form of proposal to be a specific material, the Contractor may elect to utilize any of the following materials subject to specifications and size limitations outlined below.
- b. Single Material Requirement: Unless otherwise approved by the Engineer, a single material shall be used for all water main in the contract. If multiple pipe materials are permitted, the change in materials shall be accomplished at normal junctions such as valves or fittings.
- c. Pipe Markings: All pipe delivered to the job site shall bear the marks required by the ANSI/AWWA specification.

2. Ductile Iron (D.I.): Shall conform to ANSI/AWWA C151/A121.51 and the following:
 - a. Class and Size: Unless otherwise noted on the plans, pipe wall thickness shall be a minimum of Class 52. Ductile iron may be used for six inch (6") and larger diameter pipe.
 - b. Exterior Coating: Bituminous, 1 mil thick.
 - c. Lining: Standard thickness cement-mortar conforming to ANSI/AWWA C104/A21.4.
 - d. Polyethylene Encasement: ANSI/AWWA C105/A21.5.
 - e. Flanged Joints: ASA Class 125.
 - f. Mechanical Joints and Push-on Joints: ANSI/AWWA C111/A21.11 OR ANSI/AWWA C153/A21.53, bolts and nuts shall be high strength corrosion resistant alloy with hex head nuts.
 - g. Fittings: Ductile iron or cast iron, cement-mortar lined, conforming to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
 - h. Electrical Continuity: Bronze wedges or continuity straps.
3. Polyvinyl Chloride (PVC): Shall conform to ANSI/AWWA C900.
 - a. Class and Size: SDR 18 wall thickness, six (6) inch through twelve (12) inch diameter.
 - b. Joints: Integral wall-thickened bell and spigot with elastomeric-gasket conforming to ASTM D3139.
 - c. Fittings: Shall conform to paragraph 2.01.A.2.g. above.

B. VALVES

1. General Requirements:
 - a. Working Pressure: 150 psi minimum.
 - b. Joints: Unless otherwise indicated on the plans or valve schedule, mechanical joint conforming to ANSI/AWWA C111/A21.11. End flanges, if specified, shall be ANSI B16.1 Class 125.
 - c. Direction of Opening: Agency standard.

2. Resilient Seated Gate Valves: Shall conform to ANSI/AWWA C509 or ANSI/AWWA C515 and the following:
 - a. Body Construction: ASTM A126 Class B, cast iron.
 - b. Operator: Hex nut, unless otherwise indicated on the plans or the valve schedule.
 - c. Manufacturer: East Jordan Iron Works, Clow, Waterous or equal.
- C. VALVE BOXES: Cast iron, screw type, three (3) piece; cover shall be furnished marked "Water." EJIW series 6860 or agency standard.
- D. VALVE EXTENSION STEMS: Where valves are used with valve boxes, the depth to the top of the valve operating nut shall not be greater than 52 inches. Where the water main is buried at a depth where the normal valve operating nut will be at a depth greater than 52 inches, a valve extension stem with operating nut shall be provided and mechanically attached to the valve to provide an operating nut at the 52 inches depth.
- E. HYDRANTS: Shall conform to ANSI/AWWA C503 and the following:
 1. Type and Size: Breakaway traffic flange; 53-inch main valve seat.
 2. Connections: Two (2), 22-inch hose nozzles and 1 pumper connection; agency standard threads.
 3. Direction of Opening: Agency standard.
 4. Manufacturer: EJIW Model 5-BR or Model 5BR-250.
- F. SERVICE LEAD, CORPORATION STOP, CURB VALVE AND CURB BOX
 1. Service Lead Pipe: ASTM B88 type k annealed seamless copper water tube of the size indicated on the plans. Fittings shall be flared type.
 2. Corporation Stop: :3/4" and 1" - Mueller 300 Ball Corp Model B-25000 or B-25008; 1-1/2" and 2" - Mueller Ori-Corp Model H-15013.
 3. Curb Valves: Mueller H-15204, Oriseal, or approved equal.
 4. Curb Box: Mueller #10385 for 1" curb valves and Mueller #10386 for 1 ½ " and 2" curb valves, or approved equal. Curb boxes shall have a minimum of 1 ¼ " riser diameter, and shall be equipped with a stationary rod.
 5. Compression fittings for corporation stops and curb stops shall be equipped with stainless steel interior bands, plastic bands shall not be permitted.

2.02 BEDDING MATERIAL: Shall conform to section 02223, Bedding and Backfilling for Utility Systems.

2.03 MANHOLES: Shall be precast concrete conforming to Section 02715, Concrete Utility Manholes and Catch Basins.

PART 3 EXECUTION

3.01 WATER MAIN INSTALLATION

- A. GENERAL: Installation shall be in accordance with ANSI/AWWA C600 for ductile iron pipe, ASTM D2774 and AWWA Standard C605-05 for PVC pipe and the following:
- B. LAYING PIPE: Pipe shall be laid with the bell ends facing the direction of laying, unless otherwise directed or allowed by the Engineer.
- C. LOCATION: As indicated on the plans. Maintain at least a ten feet separation from any sewer, unless specifically indicated on the plans.
- D. GRADE AND ALIGNMENT: Provide cover of 6 feet, unless otherwise indicated on the plans.
- E. WET TRENCH LAYING: When the trench contains water, open ends of the pipe shall be closed by a watertight plug. This provision shall apply during the noon hour as well as overnight.
- F. PIPE BEDDING: Shall conform to Section 02223, Bedding and Backfilling for Utility Systems.
- G. PIPE ENCASEMENT: Ductile iron pipe, bedded in an area of aggressive soil such as peat, shall be encased in a polyethylene encasement.
- H. ELECTRICAL CONTINUITY: Unless otherwise noted on the plans, electrical continuity shall be provided for ductile iron pipe.
- I. LOCATING PROVISIONS: A suitable means for magnetically locating PVC water main shall be provided and approved by the Engineer in writing prior to construction.
- J. THRUST BLOCKS: Shall be made of Class B, poured-in-place concrete, placed at all bends, dead ends, tees, reducers, hydrants and valves, as required.
 - 1. Thrust Table: Shall be used for sized noted. For larger sized, the details will be shown on the plans. Area in square feet of concrete thrusting against undisturbed earth shall be computed by dividing the total thrust by the safe bearing load of the soil.



<u>Thrust Main Size</u>	<u>Tee or Plug</u>	<u>90° Bend</u>	<u>45° Bend</u>	<u>222° Bend</u>	<u>113° Bend</u>
4"	2,840	4,000	2,100	1,100	600
6"	5,800	8,200	4,300	2,300	1,100
8"	8,900	14,000	7,400	3,900	2,000
10"	14,800	21,000	11,000	5,800	2,900
12"	20,900	30,000	15,500	8,200	4,100
14"	28,000	40,000	21,000	11,000	5,500
16"	36,200	51,000	27,000	14,200	7,100
18"	45,400	64,000	34,000	17,800	8,900
20"	55,800	79,000	37,500	21,800	11,000

2. Safe Bearing Loads for Soils (Horizontal Thrust):

<u>Soil</u>	<u>Safe Bearing Load Lbs. per Sq. Ft.</u>
Muck, Peat, etc.	0
Soft Clay	1,000
Sand	2,000
Sand	3,000
Sand and Gravel cemented w/clay	4,000
Hard compacted clay	5,000

3. Thrust Blocks in Unstable Soil Conditions: Thrust shall be resisted by piling driven to solid foundations or by removal of unstable soil material and replacement with ballast of sufficient stability to resist thrust. Thrust block size and method of thrust resistance shall be approved by the Engineer before construction.
4. Special Thrust Containment: Use of joint ties and containing thrust within the pipe will be considered by the Engineer upon a definite proposal of methods submitted by the Contractor. Only methods retaining the freedom of joint to bend will be considered.
5. Pipe Cleaning - All new water main shall be cleaned by "pigging" prior to disinfection.

3.02 VALVE AND HYDRANT INSTALLATION

- A. VALVE VAULTS: Precast concrete valve vaults shall be provided for valves over twelve (12) inches in diameter, unless otherwise indicated on the plans of the valve schedule.
- B. HYDRANT BASE: Hydrants shall be placed upon a poured-in-place or precast concrete base (Class B, 4 inches thick) of at least 2 square feet, on a 4-inch crushed stone base, or as indicated on the plans. Suitable solid stone or salvage slab may be used for the concrete base as approved by the Engineer. A pocket of crushed stone shall be placed around the bottom eighteen (18) inches of the hydrant barrel depth.

- C. DEPTH OF BURY: Hydrant leads shall have a 6 foot minimum cover, including crossings through ditch sections.
- D. HYDRANT DRAIN PORTS: Shall remain plugged unless otherwise indicated on the plans.
- E. HYDRANT THRUST RESTRAINT: Shall conform to paragraph 3.02.G of this specification.

3.03 SERVICE LEAD INSTALLATION

- A. GENERAL: Open cutting of existing hard surfaced pavement will not be allowed. Service leads may be bored, drilled or jacked; jetting of water or air will not be allowed. Under normal conditions, casings will not be required except where probable damage to the roadbed or the service lead exists. Service leads shall be installed to provide a depth of cover of 6 feet.
- B. INSTALLATION WITHOUT CASING: In stable soils, the diameter of the auger head shall not exceed the diameter of the service lead by more than one inch. Service lead pipe shall be pushed or pulled through after the hole has been augered. Pipe ends shall be examined after installation for damage. If damaged, the service pipe shall be replaced.
- C. INSTALLATION WITH CASING: In unstable soils, as determined by the Project Manager, the combination of boring and jacking simultaneously shall be utilized providing the cutting edge of the auger does not advance ahead of the casing. Casing diameter shall not exceed the diameter of the service lead by more than one inch. Casing pipe may be removed at the Contractor's option.
- D. BORING INSTALLATION: Shall conform to the requirement of the local agency/utility.
- E. CONNECTION TO EXISTING SERVICES: Connections to existing water services with like material shall be made with standard couplings; connections of dissimilar materials shall be made with appropriate couplings with Nylon dielectric bushings.

3.04 HYDROSTATIC TESTING

- A. GENERAL: Upon completion of installation of the water main, corporations, services, curb stops and appurtenances, the Contractor shall furnish all apparatus, materials, labor and water required to perform the pressure tests of the watermain and services in accordance with AWWA C605, Section 7.3 Hydrostatic Testing, ANSI/AWWA C600 or AWWA C605-05 for PVC pipe and the following:
- B. PRE-TEST PROCEDURES: The Contractor shall open all valves, including hydrant auxiliary valves, and then completely fill the line with water with a special emphasis upon removing all air from the pipe, valves or hydrants. If necessary, the Contractor shall install additional corporation stops at high points to allow the air to be expelled.
- C. PRELIMINARY TEST: A preliminary pressure test by the Contractor shall be accomplished. Any leaks encountered shall be corrected and the test shall be rerun until results are

satisfactory.

- D. FINAL PRESSURE AND LEAKAGE TEST: Shall conform to ANSI/AWWA C600 or AWWA C605-05 for PVC pipe, Hydrostatic Section 7.3.6, in the presence of the Engineer, who shall receive 24 hours notice prior to testing. If it is necessary for the Engineer to observe more than one test on any section of mainline, the Contractor shall be liable for the additional cost involved for observation of subsequent tests. All pressure testing shall be conducted at a minimum pressure of 150 psi, unless otherwise permitted by the Engineer.
- E. LEAK REPAIR: The Contractor shall provide all labor and materials, etc., as required to repair any leaks, or otherwise required to meet these tests; all leaks shall be repaired, regardless of the amount of leakage. Water damage resulting from flushing or testing procedures shall be the responsibility of the Contractor.

3.05 DISINFECTION

- A. GENERAL: Procedures shall conform to ANSI/AWWA C651-14 Disinfecting Water Mains, Effective Date February 1, 2015, and the following:
- B. PRELIMINARY FLUSHING: After the pressure test and before disinfection, the Contractor shall flush out the new pipe lines until the water runs clear. Each valved section of the newly laid pipe shall be flushed separately with potable water from the public supply.
- C. DISINFECTION: The Contractor shall disinfect the new mains in increments designated by the Engineer. Samples shall be taken from corporation stops only. If mains dead end at hydrants, with no adjacent valve, the Contractor shall install an additional corporation stop for sampling.
- D. BACTERIOLOGICAL WATER SAMPLES: Shall be collected by the Contractor, or his duly authorized representative, in the presence of the Engineer, in conformance with ANSI/AWWA C651. Two successive safe tests taken 24 hours apart are required; analysis shall be made by a State approved laboratory.
- E. FAILING TESTS: In the event of an unsafe test, the test shall be repeated as described above. The Contractor shall be responsible for the tests and shall be liable for any costs when more than one treatment or set of tests is necessary.

END OF SECTION

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SECTION 02715 - CONCRETE UTILITY MANHOLES AND CATCH BASINS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with CONCRETE UTILITY MANHOLES AND CATCH BASINS.

1.02 RELATED WORK

A. REQUIREMENTS: All concrete utility manholes, including catch basins and valve vaults, shall be installed in accordance with the details indicated on the drawings and these specifications.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS
4. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS
5. SECTION 02665 - WATER MAINS
6. SECTION 02722 - STORM SEWERS
7. SECTION 02732 - SANITARY SEWER
8. SECTION 02901 - RESTORATION AND CLEAN-UP
9. SECTION 03001 - CONCRETE
10. SECTION 03600 - GROUT

1.03 SUBMITTALS: Detailed material lists and specifications for all materials furnished under this section of the specification shall be submitted to the Engineer for approval. Submittals shall be in accordance with Section 2.12 of the GENERAL CONDITIONS.

PART 2 PRODUCTS

2.01 PRECAST SECTIONS: Precast sections shall conform to ASTM C478. Sewer pipe opening connections to precast concrete manholes shall conform to the following specifications:

A. SANITARY SEWERS: Manhole pipe connections shall be furnished with an integrally cast seal system, equal to "A-Lok", "Kor-N-Seal", "Lock Joint Flexible Manhole Sleeves", or equal. Sanitary manholes shall have integral concrete manhole bases. Manhole section joints shall be of the O-ring rubber joint type or preformed type of butyl sealant material. All pipe openings shall be case in the precast section or cored in the finished wall. Broken and patched connections will not be accepted.

B. STORM SEWER :Manhole pipe connections shall be with a non-shrink grout. Manhole section joints shall be of the mastic joint type or butyl rubber sealant type unless otherwise shown on the drawings.

- C. VALVE MANHOLES AND OTHER STRUCTURES: Details and joints shall conform to the drawings.
- 2.02 MANHOLE ADJUSTING BRICK: Shall be concrete units conforming to ASTM C55.
- 2.03 MANHOLE ADJUSTING RING: Shall be standard precast reinforced concrete rings with a minimum of two inch height and a maximum of 6 inch height.
- 2.04 MANHOLE STEPS: Shall be furnished in all manholes unless otherwise noted on the plans, and shall be Co-Polymer Polypropylene Plastic manhole steps reinforced with 3/8" deformed reinforced bar. Manhole steps shall be of the press-fit type with serrated type treat and lugs. Steps shall not be cast in wall. Steps shall be spaced at sixteen inches on center in a true vertical alignment unless shown otherwise on the drawings.
- 2.05 FRAMES AND COVERS: The cast iron frames and covers shall conform to the castings noted on the plans or in the specifications. Cover lettering shall be included when specified. It is the intention of this specification to provide frames and covers considered standard in the Owner's system.
- 2.06 GROUT: Shall conform to Section 03600, Grout.
- 2.07 CONCRETE: Shall conform to Section 03001, Concrete.

PART 3 EXECUTION

- 3.01 INSTALLATION: Utility manholes shall be constructed of precast concrete sections including risers, adjusting rings and precast tops of eccentric cone or flat slab type, as indicated on the drawings.
- A. UTILITY MANHOLE AND CATCH BASINS
1. Precast Concrete: Precast bottoms or bases shall be set on uniform bedding of 8 inches of compacted sand or existing granular material as approved by the Engineer. When water is encountered in the trench, bases shall be set on a minimum of 12 inches of stone fill conforming to MDOT 6A.
 2. Integral Base: The Contractor, at his option, may use integral cast base and riser sections conforming to ASTM C478, except that integral bases shall be used on all sanitary sewer manholes.
- B. PRECAST CONCRETE RISERS: Shall be set plumb and manhole steps shall be aligned to form a continuous ladder. Joints between manhole sections shall utilize rubber O-rings or preformed butyl rubber sealant material for sanitary sewer manholes and shall utilize mastic or preformed butyl rubber sealant for storm manholes, catch basins and valve vaults unless otherwise shown on the drawings.

C. CASTINGS: Shall be installed as specified below:

1. Sanitary Sewer Manholes and Valve Vaults: Castings shall be set on precast concrete adjusting rings with a minimum adjustment of 4 inches and a maximum of 12 inches. Casting and rings shall be set in grout unless otherwise called for on the drawings.
2. Storm Sewer Manholes and Catch Basins: Castings shall be set on precast concrete adjusting rings with a minimum adjustment of 4 inches and a maximum of 12 inches or, if allowed on the drawings, adjusting brick may be used.
3. Casting Elevations: Where castings are to be flush with permanent pavements, the Contractor shall adjust the frame to the proper grade. Where castings are on flat slab tops in non-paved areas, they shall extend approximately one inch (1") above finish earth grade unless shown otherwise.
4. Finish: The interior and exterior surface of adjustment rings or bricks shall be tooled to give a smooth finish coat of grout.

E. DROP PIPES: Shall be constructed at sanitary manholes wherever the difference in elevation between any inlet and outlet sewer is more than two vertical feet or as noted in the plans. All drop pipes shall be encased in concrete and shall conform to the drawing details. All drop pipes shall be exterior unless otherwise noted on the plans.

F. FLOW CHANNELS: Shall be constructed in manhole bottoms with mechanically mixed concrete. Flow channel depth shall be the full pipe diameter and concrete thickness shall be a minimum of 4 inches measured from the top of the base to the bottom of the flow channel. Where the grade of sewer is continuous through the manhole, the Contractor may lay the pipe through the manhole, fill around the pipe with concrete and carefully break out or cut out the top of the sewer pipe.

3.02 TESTING: All sanitary sewer manholes shall be tested in conformance with Section 02732, Sanitary Sewers. The Contractor shall repair any leaks, flaws or irregularities in any manholes or catch basins.

END OF SECTION

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SECTION 02722 - STORM SEWERS

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the installation of STORM SEWERS.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS
4. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS
5. SECTION 02715 - CONCRETE UTILITY MANHOLES AND CATCH BASINS
6. SECTION 02901 - RESTORATION AND CLEAN-UP
7. SECTION 03001 - CONCRETE
8. SECTION 03600 - GROUT

1.03 SUBMITTALS: Detailed material lists and specifications for all materials furnished under this section of the specification shall be submitted to the Engineer for review. Submittals shall be in accordance with Section 2.12 of the GENERAL CONDITIONS.

1.04 CERTIFICATION OF MATERIALS: When requested, the Contractor shall furnish certification that all materials meet the requirements set forth in the plans and specifications. Source of the certification shall be determined by the Engineer.

PART 2 PRODUCTS

2.01 SEWER PIPES AND JOINTS: Shall be new unless noted on the plans and shall be stored and handled as recommended by the manufacturer. The size, type, and class shall be as shown on the plans or noted in the specifications. All pipe shall be marked with the class and date of manufacture by the manufacturer.

A. NON-REINFORCED CONCRETE PIPE (CSP): Shall conform to ASTM C14, Class 3 unless otherwise noted on the plans with acceptance on the basis of plant load bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections.

B. REINFORCED CONCRETE PIPE (RCP): Shall conform to ASTM C76 with acceptance on the basis of plant load bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections unless otherwise specified pipe shall be minimum Class III.

- C. CORRUGATED PIPE: Shall be polyethylene as specified herein.
1. Corrugated Polyethylene Pipe: Shall be smooth wall interior, corrugated exterior polyethylene conforming to AASHTO M-294, ADS N-12 or approved equal.
 2. Joints: Shall be integral bell & spigot push on rubber gasketed joints, 3 psi minimum, "Soil Tight" as manufactured by ADS.
 3. Deflection Testing: The completed installation of polyethylene sewers shall at no point have out of round pipe deflections greater than 5%. Deflectometer or mandrel gauging tests shall be performed prior to acceptance of sewers. The test shall be conducted after the final backfill has been in place at least 15 days.
- D. END SECTIONS: Shall be suitable design for the pipe and adjoining grades to provide a smooth transition from the pipe to the rectangular stream cross-section. The section shall be of material at least as heavy as the pipe, shall be reinforced on all edges, and have a toe plate. End sections shall be manufactured and furnished by the pipe supplier.
- E. JOINTS: Shall conform to one of the following specifications:
1. Rubber "O" Ring: Shall be "Tylox", "Ring-Tite", or equal.
 2. Bituminous Mastic Joints: Shall be made when the joint surfaces are clean and dry, using DeWitt #10, "Sewertite" by Philip Carey Company, or equal. Cold weather joint compound may be used only with approval of the Engineer. All excess material shall be removed from the inside of the pipe.
 3. Butyl Rubber Sealant: May be used in lieu of rubber "O" ring or bituminous mastic joints. Butyl rubber sealant shall be "RUB 'R-NEC LTM" by K.T. Snyder Company, or equal.
 4. Band Couplings: Bolted corrugated metal couplings shall be used at all connections of corrugated metal pipe.
- F. LUBRICANTS: For the making of pipe joints shall strictly conform to the recommendations of the pipe manufacturer.
- G. GROUT FOR POINTING PIPE JOINTS: Shall conform to Section 03600, Grout.
- H. UNDERDRAINS: Shall be perforated high density polyethylene corrugated tubing wrapped in filter conforming to AASHTO M-252 requirements. The filter wrap shall conform to MDOT requirements for geotextiles.
- 2.02 MANHOLES AND CATCH BASINS: Shall be precast concrete conforming to Section 02715, Concrete Utility Manholes and Catch Basins.
- 2.03 BEDDING AND BACKFILL MATERIALS: Shall conform to Section 02223, Bedding and Backfilling for Utility Systems.

- A. CONCRETE PIPE BEDDING: Shall be Type 1.
- B. CORRUGATED PIPE BEDDING: Shall conform to flexible pipe bedding.

PART 3 EXECUTION

- 3.01 GENERAL: Handling, storage, installation, and the making of joints shall strictly follow the manufacturers' recommendations. Rubber materials affected by ultraviolet rays shall be protected from direct sunlight.
- 3.02 GRADE AND ALIGNMENT: All sewer shall be laid utilizing an "in-line" laser for vertical and horizontal control. Vertical and horizontal alignment of the invert shall, at any point, be within ± 0.04 feet (2-inch) of plan elevation and line.
- 3.03 LAYING OF SEWER: Each pipe shall be inspected for possible defects before being placed in the trench. Joint surfaces shall be free of earth or frozen matter. All pipe shall be laid from the low end of the sewer upgrade with bell ends upgrade to line and grade as called for on the plans and each pipe as laid shall be checked by the Contractor. The use of brick, lumps of clay, wood, etc., to bring the pipe to grade will not be permitted.
 - A. JOINTS: Shall be made in strict accordance with the manufacturers' recommendations utilizing the recommended lubricant. Wood blocks or other approved materials shall be used to protect the pipe ends from pry bars, chains, etc. Pipe shall be pushed closed to the "home" position and if joints do not remain tightly closed the pipes shall be replaced.
 - B. FINAL LINE AND GRADE: After the pipe is laid, care in backfilling and other operations shall be taken so as not to disturb its line, grade, or joint. Misalignment shall be cause for rejection of the sewer.
- 3.04 PIPE BEDDING AND BACKFILL: Shall conform to Section 02223, Bedding and Backfill for Utility Systems.
- 3.05 POINTING: Concrete pipe joints on sewers 30 inches in diameter and larger shall be pointed up with grout on the inside after backfilling is complete.
- 3.06 CONNECTIONS TO LIVE SEWERS: When connections are made with sewers carrying storm water, special care must be taken that no part of the work is built underwater; a flume or dam must be installed and pumping maintained if necessary and the new work kept dry until completed and any concrete or grout has set up.
- 3.07 REMOVAL OF UNSUITABLE MATERIAL: Whenever any pipe section, fitting or appurtenance is found to be unsuitable for installation due to specification non-conformance, poor workmanship, damage, or any other reason, it shall be removed from the construction site during the working day by the Contractor. Any material not so removed shall be painted or otherwise marked by the Engineer to prevent its subsequent use.
- 3.08 RESTORATION AND CLEAN-UP: Shall conform to Section 02901, Restoration and Clean-up.

3.09 TV INSPECTION: The Owner or his representative shall have the option of performing a TV inspection of any section of sewer for signs of structural damage, misalignment or improper joints. The costs of the inspection shall be paid by the Owner unless the inspection reveals faulty construction or materials wherein the costs shall be paid by the Contractor.

3.10 CORRECTION OF DEFECTIVE WORK: Whenever any inspection indicates defective material or installation, the Contractor shall repair the section to the satisfaction of the Engineer at no cost to the Owner. Any pipe or fitting having structural damage shall require the removal and replacement of the damaged section.

END OF SECTION



SECTION 02732 - SANITARY SEWER

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the installation of SANITARY SEWERS.

1.02 RELATED WORK

A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner and interference with flow of traffic shall be kept to a minimum.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01410 - SOILS COMPACTION AND TESTING
2. SECTION 01560 - SPECIAL CONTROLS
3. SECTION 02222 - EXCAVATION FOR UTILITY SYSTEMS
4. SECTION 02223 - BEDDING AND BACKFILLING FOR UTILITY SYSTEMS
5. SECTION 02715 - CONCRETE UTILITY MANHOLES AND CATCH BASINS
6. SECTION 02901 - RESTORATION AND CLEAN-UP
7. SECTION 03100 - CONCRETE
8. SECTION 03600 - GROUT

1.03 SUBMITTALS: Detailed material lists and specifications for all materials furnished under this section of the specification shall be submitted to the Engineer for review. Submittals shall be in accordance with Section 2.12 of the GENERAL CONDITIONS.

1.04 CERTIFICATION OF MATERIALS: When requested, the Contractor shall furnish certification that all materials meet the requirements set forth in the plans and specifications. Source of the certification shall be determined by the Engineer.

PART 2 PRODUCTS

2.01 PIPES AND JOINTS: All materials shall be new. Manufacturers' recommendations for storage, handling, and installation shall be strictly adhered to. Materials shall be of the type as listed herein meeting the specifications noted. Unless specifically shown on the plans and/or listed in the form of proposal to be a specific materials, the Contractor may elect to utilize any of the following materials subject to specifications and size limitations herein except that sewer pipe materials may be changed only at manholes.

A. PIPE

1. Ductile Iron (D.I.): Shall be per ANSI/AWWA C151/A21.51. Pipe wall thickness will vary with depth of cover and shall conform to Section 02223, Bedding and Backfilling for Utility

- Systems. Pipe shall be standard thickness cement-mortar lined per ANSI/AWWA C104/A21.4. Pipe joints shall be mechanical joints or push-on joints conforming to ANSI/AWWA C111/A21.11. Ductile iron may be used for six inch (6") and larger diameter pipe.
2. Reinforced Concrete Pipe (RCP): Shall conform to ASTM C76. Pipe class will vary with depth of cover and type of bedding and shall conform to Section 02223, Bedding and Backfilling for Utility Systems. Pipe joints shall conform to ASTM C443 for rubber gasket joints. RCP may be used for eighteen inch (18") or larger diameter pipe.
 3. Polyvinyl Chloride (PVC): Shall conform to ASTM D3034. Minimum pipe wall thickness shall be SDR-35. All pipe shall have a "home" mark. Joints shall be of the elastomeric gasket push-on type conforming to ASTM D3212. PVC may be used for six inch (6") through fifteen inch (15") diameter pipe. Installation shall conform to ASTM D2321 standards, at minimum, for PVC pipe.
- B. FITTINGS: All piping connections and pipe size and/or direction changes shall be made with standard manufactured fittings conforming to the following:
1. Ductile Iron Fittings: Shall be standard manufactured fittings of ductile iron or cast iron conforming to ANSI/AWWA C110/A21.10 for mechanical joints and push-on joints. Fittings shall be cement-mortar lined per ANSI/AWWA C104/A21.4 and shall have the standard exterior bituminous coating. Service lateral fittings shall be tees. Plugs shall be iron or plastic suitable for air testing.
 2. Reinforced Concrete Pipe Fittings: Service lateral connections shall be made using standard manufactured components. Holes in the pipe barrel shall be cored. The connection shall be made utilizing a system of 300 series stainless steel bands and an elastomeric molded boot conforming to ASTM C443. Epoxy coated aluminum bands may be used in lieu of stainless steel upon written approval of the Engineer.
 3. Polyvinyl Chloride Fittings: Shall be full fittings conforming to ASTM D3033 or ASTM D3034 for pipe wall thickness of SDR-35. Joints shall conform to ASTM D3212. Service lateral connections shall be made with standard wye fittings. Tees, tee-wyes, or saddles shall not be used.
- C. CONNECTIONS OF DISSIMILAR PIPE MATERIALS: Shall not be made using Donuts, oversize gaskets, etc. Connections shall be made utilizing one of the following methods:
1. Standard Adapters: Shall be a manufacturer's standard adapter with joints conforming to the above specifications.
 2. Couplings: Shall be an elastomeric coupling complete with 300 series stainless steel tension bands conforming to ASTM C425. Couplings shall be Clow Band-Seal Couplings, Fernco Flexible Couplings, or equal.
- D. CHANGES IN PIPE SIZES: Shall be made using standard smooth flow increasers or reducers.



- E. LUBRICANTS: All lubricants for the making of pipe joints shall strictly conform to the recommendations of the pipe manufacturer.
 - F. GROUT FOR POINTING PIPE JOINTS: Shall conform to Section 03600, Grout.
 - G. POLYETHYLENE ENCASEMENT: For ductile iron pipe shall conform to ANSI/AWWA C105/A21.5.
- 2.02 SANITARY SEWER MANHOLES: Shall be precast concrete conforming to Section 02715, Concrete Utility Manholes and Catch Basins. Joints between the pipe and the manhole shall be as specified therein.
- 2.03 CHEMICAL GROUT: For sealing minor joint leaks shall be an EPA approved type.
- 2.04 MARKING: All pipe, fittings and appurtenant items furnished to the job site shall be marked in accordance with the applicable specification. Any unmarked materials are subject to rejection by the Engineer.
- 2.05 BEDDING AND BACKFILL MATERIALS: Shall conform to Section 02223, Bedding and Backfilling for Utility Systems as applicable to sanitary sewers where in pipe class and bedding requirements are given for various depths of cover.

PART 3 EXECUTION

- 3.01 GENERAL: Handling, storage, installation, and the making of joints shall strictly follow the manufacturers' recommendations. Plastic and rubber materials affected by ultraviolet rays including all PVC products shall be protected from direct sunlight. Material handling during cold weather shall take into account increased brittleness for plastic materials. Pipe which is warped or bowed due to temperature variations such that the deviation from straightness is greater than one inch shall not be installed.
- 3.02 GRADE AND ALIGNMENT: All sewer shall be laid utilizing an "in-line" laser for vertical and horizontal control. Vertical and horizontal alignment of the invert shall, at any point, be within ± 0.04 feet (1/2-inch) of plan elevation and line. The grade variation allowance should not result in less than minimum standard slopes on any particular sections of sewer.
- 3.03 CUTTING OF PIPE: Full lengths of pipe shall be used whenever feasible. Cutting of pipe where required shall be done only using methods as recommended by the manufacturer, utilizing tools and equipment as required to provide a neat, perpendicular cut without damage to the pipe or coatings. All burrs shall be removed. Spigot ends of cut pipe shall be beveled similar to factory beveling. If field cutting or coring of pipes exposes any bare metal surface, the surface shall be covered with an epoxy coating.

- 3.04 LAYING OF SEWER: Each pipe shall be inspected for possible defects before being placed in the trench. Joint surfaces shall be free of earth or frozen matter. All pipe shall be laid with the bell ends upgrade to line and grade as called for on the plans and each pipe as laid shall be checked by the Contractor. Pipe shall be laid from the low end of the sewer upgrade. The use of brick, lumps of clay, wood, etc., to bring the pipe to grade will not be permitted.
- A. JOINTS: Shall be made in strict accordance with the manufacturers' recommendations utilizing the recommended lubricant. Wood blocks or other approved materials shall be used to protect the pipe and fitting ends from pry bars, chains, etc. Pipe shall be pushed closed to the "home" position and if joints do not remain tightly closed the pipes shall be replaced.
 - B. FINAL LINE AND GRADE: After the pipe is laid, care in backfilling and other operations shall be taken so as not to disturb its line, grade, or joint. Misalignment shall be cause for rejection of the sewer.
 - C. POINTING: Pipe joints on RCP sewer 30 inches in diameter and larger shall be pointed up with grout on the inside after backfilling is complete.
- 3.05 PIPE BEDDING AND BACKFILL: Shall conform to Section 02223, Bedding and Backfill for Utility Systems.
- 3.06 CONNECTIONS TO LIVE SEWERS: When connections are made with sewers carrying sewage or water, special care must be taken that no part of the work is built underwater; a flume or dam must be installed and pumping maintained if necessary and the new work kept dry until completed and any concrete or grout has set up.
- 3.07 SERVICE LATERALS: Shall be installed to the property line or length as shown on the construction drawings. The location of the service lateral shall be as shown, or when serving an existing building, to the location designated by the building owner. Where an existing service lead is to be connected, the Contractor shall locate the lead.
- A. SERVICE LATERAL END: Shall be capped and blocked sufficiently to withstand all required acceptance test pressures.
 - B. MARKING: The Contractor shall mark the end of each service lateral with a 2 x 4 of sufficient length to extend from the service lateral to 3 inches below grade. The top of each 2 x 4 shall have four 16 penny common nails driven into it for subsequent location with a magnetic locator.
 - C. RECORD OF LOCATIONS: The Contractor shall record and submit to the Owner and the Engineer a location sketch of the service lateral fitting measured upstream from the nearest manhole and shall record the location of the terminus of the service lateral with a minimum of two witness measurements to permanent physical features, building corners, etc. Any services not readily located within one year after date of final payment due to inaccurate as-built measurements shall be field located by the Contractor at no expense to the Owner.

- D. RISERS: Where sanitary sewers are constructed deeper than 15 feet, service risers shall be constructed as shown in the standard detail. VCP tees shall be encased in concrete as shown on the plan details. Risers shall be constructed such that the service lateral is 11 feet deep at the property line. When main sanitary sewers are less than 15 feet deep, no riser is required and the lateral shall be constructed at a slope such that the service lead is 11 feet deep at the property line, if feasible. The six inch service laterals shall be constructed at a minimum slope of 0.60%. Lateral fittings shall be installed with the branch connection tilted up 45 degrees.
- E. SERVICE LATERAL INSPECTION: All service lateral pipes shall be left with at least the top of the pipe exposed until inspected by the Owner or his representative and authorization for backfill given.
- 3.08 REMOVAL OF UNSUITABLE MATERIAL: Whenever any pipe section, fitting or appurtenance is found to be unsuitable for installation due to specification non-conformance, poor workmanship, damage, or any other reason, it shall be removed from the construction site during the working day by the Contractor. Any material not so removed shall be painted or otherwise marked by the Engineer to prevent its subsequent use.
- 3.09 RESTORATION AND CLEAN-UP: Shall conform to Section 02901, Restoration and Clean-up.
- 3.10 SANITARY SEWER TESTING: In general, the sanitary sewers shall be tested by applying an air pressure test described in the following paragraphs. Methods of testing and measurement other than specified herein shall be approved by the Engineer. The Contractor shall be responsible for furnishing all equipment and labor for the air testing at no additional cost to the Owner. The Engineer may, as an alternative to or in addition to the air testing, require an infiltration test of the sanitary sewers in certain instances. All testing shall be performed in the presence of the Engineer. Where the installation of the new sanitary sewer requires removal of the existing sewer and immediate connection of services, the air testing requirement will be waived. Mandrel testing will still be required.
- A. AIR TESTING: Is required to be performed on all sanitary sewers. The following described test procedure shall be used. Testing of reinforced concrete pipe shall be in accordance with ASTM C924. Testing of PVC pipe shall conform to ASTM F1417.
1. Equipment Record: Portable air compressor, standard air hose and connections, minimum of 50 feet of single and triple air hose, one single and one triple connection pneumatic sewer plug, one hand air pump, stopwatch, and one air gauge, range 0-30 psig graduated in tenths from 0 to 10 psig.
 2. Preliminary Requirements: After all sewer, lateral, and manhole construction and backfilling operations have been completed, the sewer shall be cleaned by the Contractor as follows:
 - a. Inflatable Balls: The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line or a rope may be fastened to the ball to enable

the Contractor to know and control its position at all times. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole. In the event cemented or wedged debris, or damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

- b. **Pneumatic Plug Test:** The pneumatic plugs shall pass the following qualifying test in the presence of the Engineer and Contractor prior to the line testing. One length of sewer pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked; air shall be introduced into the pipe until the pipe pressure reaches 15 psig. The pneumatic plugs being checked shall hold against this pressure without bracing being needed, and without movement of the plugs out of the pipe. All pneumatic plugs shall pass the aforementioned qualifications before being used to test the actual installation.
3. **Test Procedures:** Immediately following the pipe cleaning described, low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater pressure, as determined by the Engineer, that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize.
 - a. **Acceptance:** The portion of the line being tested shall be accepted if the portion under the test meets or exceeds the requirements of ASTM C828. This requirement shall be accomplished by performing the test as follows: The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure of any groundwater that may be over the pipe shall not be less than the time shown for the given diameters in the table following this paragraph. If the system does not meet the foregoing requirements, the Contractor will be required to locate and repair the leaks at no extra cost to the Owner and repeat the tests until the allowable leakage is obtained.



AIR TEST TABLE

Note: If the section of line to be tested includes more than one pipe size (i.e., lateral connections), calculate the test time for each size and add the test times to arrive at the total test time for the section.

ASTM C828

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

PIPE SIZE (INCHES)	TIME - PER 100' PIPE SIZE		PIPE SIZE (INCHES)	TIME - PER 100'	
	MIN.	SEC.		MIN.	SEC.
4	0.3	18	21	3.0	180
6	0.7	42	24	3.6	216
8	1.2	72	27	4.2	252
10	1.5	90	30	4.8	288
12	1.8	108	33	5.4	324
15	2.1	126	36	6.0	360
18	2.4	144	39	6.6	396
			42	7.3	438

- B. INFILTRATION TEST: An infiltration test may be conducted on a sanitary sewer only where the groundwater table is at least two feet above the invert of the sewer. The Engineer will measure the amount of infiltration at the sanitary manholes utilizing V-notch weirs or other measurement apparatus. The maximum allowable infiltration or exfiltration rate is 100 gallons per mile per inch diameter of sewer per 24 hours at any time for an individual run between manholes.
- C. MANHOLE EXFILTRATION TEST: An exfiltration test shall be performed by the Contractor of each manhole. All pipes shall be plugged and the manhole filled with water to the bottom of the casting. After a stabilization period, the fall of water will be measured to determine the exfiltration rate. The maximum allowable exfiltration shall not exceed 0.5 gallons per foot of depth per foot of diameter per 24 hour day. All materials, labor, and water shall be furnished by the Contractor and the cost thereof shall be incidental to the cost of construction.
- D. PVC DEFLECTION TESTS: The completed installation of PVC sewers shall at no point have out-of-round pipe deflections greater than 5.0%. Deflection will be measured by rigid ball or mandrel whose diameter is not less than 95% of the inside pipe diameter. Deflectometer or go no-go gauging tests shall be performed prior to acceptance of sewers. The test shall be conducted after the final backfill has been in place at least 30 days.

- E. POST CONSTRUCTION INFILTRATION: Following complete construction and prior to connection of services to the sewer, the Engineer shall have the option of requiring retesting of any section of sewer where excessive infiltration is observed or suspected. Any of the above tests may be utilized per the Engineer's requirements. The costs of the tests shall be paid for by the Owner unless the test fails wherein the costs shall be paid by the Contractor.

- F. TV INSPECTION: The Owner or his representative shall have the option of performing a TV inspection of any section of sewer for signs of structural damage, joint leaks or infiltration. The costs of the inspection shall be paid by the Owner unless the inspection reveals faulty construction or materials wherein the costs shall be paid by the Contractor.

- G. CORRECTION OF DEFECTIVE WORK: Whenever any of the above tests or inspections indicate defective material or installation, the Contractor shall repair and retest the section to the satisfaction of the Engineer at no cost to the Owner. The use of chemical grouts shall be limited to the repair of minor joint leaks and shall not be used without the specific written approval of the Engineer. Any pipe or fitting having structural damage shall be removed and replaced. Any PVC sewer with deflection in excess of the 5.0% limitation shall be re-excavated, inspected for structural damage, and then rebedded and backfilled and retested.

END OF SECTION



SECTION 02901 - RESTORATION AND CLEAN-UP

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with RESTORATION AND CLEAN-UP.

1.02 RELATED WORK

A. REQUIREMENTS: The Contractor shall restore all areas disturbed by his construction operations to a condition equal to or better than the existing prior to construction and shall clean-up and haul away all construction debris and litter caused by his operation.

B. RELATED SECTIONS: Including, but not limited to:

1. SECTION 01560 - SPECIAL CONTROLS
2. SECTION 02231 - AGGREGATE BASE COURSE
3. SECTION 02513 - BITUMINOUS LEVELING/SURFACE COURSES
4. SECTION 02525 - CONCRETE CURB AND GUTTER
5. SECTION 02528 - CONCRETE SIDEWALK
6. SECTION 02936 - TOPSOILING AND SEEDING
7. SECTION 02938 - SODDING
8. SECTION 03001 - CONCRETE

1.03 CLEAN-UP: General rough grading and clean-up shall follow immediately after installation of utilities so that no more than 1,000 lineal feet of cleanup shall remain to be completed at any time during construction. The Contractor shall remove all equipment, debris, and waste material from the construction site and material and equipment storage areas prior to final inspection and after restoration.

PART 2 PRODUCTS - This section not used.

PART 3 EXECUTION

3.01 PERMANENT PAVEMENT: All street surfaces, driveways, curb and gutter and sidewalks removed or disturbed by construction operations shall be restored to their original condition, or better unless otherwise shown on the plans and/or details. Street base course and surfacing shall conform with SECTION 02231 - AGGREGATE BASE COURSE and SECTION 02513 - BITUMINOUS LEVELING/SURFACE COURSE. All concrete for restoration shall be air entrained Class A concrete conforming to SECTION 03001 - CONCRETE or SECTION 03300 - STRUCTURAL CONCRETE. All street, driveway and sidewalk crossings shall be restored immediately after completion of the crossing to accommodate vehicular and pedestrian traffic. Temporary patching of pavements of bituminous base will be required in the event of final restoration is not anticipated within 5 days of the crossing construction.

- 3.02 MISCELLANEOUS STRUCTURES: Mail boxes, fences, culverts, ditches and other existing structures shall be resorted or replaced, as required, to original or better condition in a manner acceptable to the Engineer.
- 3.03 BOUNDARY MARKER REPLACEMENT: The Contractor shall have replaced by a Registered Land Surveyor, at his own expense, all section corners, property corners or boundary markers of any type or material that may be damaged or destroyed by his construction operation.
- 3.04 SEEDING: Lawn areas disturbed by the Contractor's construction operations shall be topsoiled and seeded in conformance with Section 02936, Topsoiling and Seeding. Prior to topsoil or seeding, rocks, sticks, roots larger than 2" in diameter, and other debris shall be removed from areas to be seeded. In general, lawn areas shall be all areas back of the curb unless otherwise designated on the plans or noted in the specifications.
- 3.05 SODDING: Areas designated on the drawings to be sodded shall be sodded in conformance with Section 02938, Sodding. The Contractor at his option may sod areas required or designated to be seeded.
- 3.06 PLANTINGS: Shrubs, other plantings, and trees removed during construction, other than those specifically designated to be removed, shall be replaced with new material equal to that removed. Replacement shall be with approved stock from a State-inspected nursery and shall carry a one year replacement guarantee.

END OF SECTION

SECTION 02936 - TOPSOILING AND SEEDING

PART 1 GENERAL

1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with TOPSOILING AND SEEDING.

1.02 RELATED WORK

- A. REQUIREMENTS: The Contractor shall topsoil, grade, fertilize, seed and mulch lawn and other designated areas disturbed by construction operations. Attention is directed to Section 01560 - SPECIAL CONTROLS.

PART 2 PRODUCTS

2.01 TOPSOIL: Any topsoil necessary to complete the work over and above the topsoil stockpiled during construction operations shall be furnished by the Contractor. Topsoil shall be free from brush, objectionable weeds or other litter. Additional topsoil shall consist of loose, friable loamy topsoil without admixture of subsoil or refuse, and approved by the Engineer prior to spreading.

2.02 SEED: All seed to be used shall be labeled in accordance with the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and shall be in accordance with the State seed rules and regulations. Seed certificates or tags from the seed bags shall be submitted to the Engineer. Seed shall conform to MDOT Section 816 for roadside and Class A mixtures.

2.03 FERTILIZERS: Chemical fertilizer shall be standard commercial grade with packaging clearly marked in accordance with applicable Federal laws. Bulk fertilizer may be used when certified delivery slips are furnished by the Contractor.

2.04 MULCH BLANKET: A straw erosion control blanket shall be used in all seeded areas and shall meet the approval of the Engineer. The mulch blanket shall be Rhino Erosion King straw blanket by Rhino Seed & Landscape Supply, or similar approved equal.

PART 3 EXECUTION

3.01 PREPARATION OF SEED BED

- A. GRADING: Grades on areas to be seeded shall be maintained in a true and even condition. Where the grades are not defined, they shall be established by the Contractor to blend with existing adjacent grades without irregularities and shall provide for proper drainage.
- B. FINISHING: All large clogs, lumps, and rocks over 1" in diameter, brush, roots, stumps, litter, or other foreign matter shall be raked up and removed from the area and disposed of by the Contractor.

- C. PLACING TOPSOIL: The surface of the subgrade immediately prior to being covered with topsoil shall be raked or otherwise loosened to a depth of not less than 3". The topsoil shall be evenly spread over the areas by blade graders, or other approved methods, to a depth of at least 3 inches. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent the formation of low places and pockets where water will stand. Topsoil shall not be placed when the subgrade is in a condition detrimental to seeding or proper grading.
- C. APPLICATION OF FERTILIZER: Fertilizer shall be distributed uniformly over the areas to be seeded at a rate which will provide 240 pounds per acre of chemical fertilizer nutrients, in equal proportions of nitrogen, phosphoric acid and potash and shall be incorporated into the soil to a depth of at least 3 inches by Brillion seeding or other acceptable methods.
- D. CLEAN-UP: After completion of the above operations, the surface shall be cleared of stones, roots, brush, wire, grade stakes and other objects that might be a hindrance to maintenance operations.

3.02 SEEDING

- A. SEEDING REQUIREMENTS: MDOT Class A seed mixture shall be used on all lawn areas. MDOT Roadside seed mixture shall be used for areas disturbed by construction and not defined as lawn area. No seeding shall be done until the Engineer has inspected the seed containers.
- B. SEEDING: Prior to seeding, the topsoil shall be disked, harrowed, or otherwise loosened to a depth of 3 inches minimum. Seed shall be placed by the Brillion seeding method or hydroseeding, unless approved otherwise. Seeding shall be accomplished between the period of April 15 into the fall as long as weather conditions permit seed bed preparation. Seeding rate shall be Class A: 220#/A, Roadside: 200#/A.
- C. COMPACTING: Immediately after seeding, the entire area shall be compacted by means of a cultipacker, roller or approved equipment weighing 60 to 90 pounds per linear foot of roller. The final rolling shall be a right angles to slopes to prevent water erosion.

3.03 MULCHING: Mulch blanket shall be applied over seed and fertilizer using staples, wood pegs, or other acceptable methods per the blanket manufacturer's recommendations.

3.04 ESTABLISHMENT OF SEEDED AREAS: The Contractor shall be responsible for the proper care of the seeded area during the period when the grass is becoming established, and shall be responsible for a total grass cover. The acceptance must be demonstrated by the results.

- A. WATERING: The seed bed for lawn areas shall be given one watering immediately after placement sufficient to wet at least two (2) inches of the seed bed. Additional watering at the same rate shall be accomplished at five (5) day intervals for a period of five (5) weeks, or a total of eight applications of water. In case of rain, the Contractor shall obtain approval of the Engineer to omit an application of water or re-schedule the watering interval. After the five week period, maintenance of the seeded areas will be assumed by the Owner or respective property owners. The Contractor will not be held responsible for any mowing of seeded areas.



- B. REPAIR: If any time prior to the end of the five (5) week period during which the Contractor is responsible for watering of the seeded areas, the ground is displaced due to subsidence, or sliding or gulying on sloped areas, the Contractor shall repair and re-seed the damaged areas at his expense.

- C. WEEDS: After the grass has become established and it appears to have more than 10% weeds, the Contractor shall spray with an approved herbicide.

END OF SECTION

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SECTION 03001 - CONCRETE

PART 1 GENERAL

- 1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with furnishing CONCRETE.
- 1.02 RELATED WORK: The Contractor shall notify the Engineer in writing of the name and address of the ready mix concrete supplier to be used one week prior to placement of any concrete.

PART 2 PRODUCTS

- 2.01 CEMENT: Shall be ASTM C150, Type IA or I. Air content shall be 5.5 percent, with a tolerance of +1.5, -0.5, when required.
- 2.02 AGGREGATE
- A. FINE AGGREGATE: Shall conform to MDOT Specification 2NS fine aggregate.
 - B. COARSE AGGREGATE: Shall be gravel and stone conforming to MDOT Specification 6AA coarse aggregate.
- 2.03 WATER: Shall be clean and free from injurious deleterious substances such as oil, alkali and organic matter. If drinking water quality is not used, the Engineer shall approve the water source before use.
- 2.04 ADMIXTURES
- A. AIR-ENTRAINING AGENT: Shall conform to ASTM C260.
 - B. ACCELERATING ADMIXTURES: Shall conform to ASTM C494, Type C, non-chloride and non-corrosive type.
 - C. GENERAL ADMIXTURES: Shall be used only as herein specified. Written approval of the Engineer shall be required to use any other admixtures.
- 2.05 REINFORCING STEEL BARS: Shall conform to ASTM A615, Grade 60, unless otherwise noted on the plans.
- 2.06 CURING COMPOUND: For exposed concrete surfaces shall be equal to MDOT Specification 8.24.06.a., "White Membrane Curing Compound". (ASTM C309, Type 2).
- 2.07 PROPORTIONS
- A. MIXTURE DESIGN: Cement, fine and coarse aggregates shall be mixed in approximately 1:2:3 parts (dry and loose) by volume to achieve the following minimum strengths and cement content.

<u>Class</u>	<u>Cement Content Sacks per CYD</u>	<u>Minimum 28 Day Compressive Strength (psi)</u>
AA	6.5	4,000
A	6.0	3,500
B	5.5	3,000

- B. WATER CONTENT: Shall be the minimum amount necessary to provide workability. Slump as measured by ASTM C143 shall be from 2 to 4 inches.
- C. MIXING: Transit mixing concrete conforming to ASTM C94 shall be used unless otherwise approved by the Engineer.
- D. ADMIXTURES
 - 1. Air-Entraining Cement or Admixtures: Shall be used for all exposed concrete, but shall not be required for buried concrete.
 - 2. Accelerating Admixtures: Shall be used only for buried concrete to allow the Contractor to proceed sooner with the backfill operations. Use of calcium chloride will not be allowed.

PART 3 EXECUTION

- 3.01 CONCRETE PLACEMENT: Prior to placement of concrete, all forms and placement of reinforcing steel and embedded items shall be approved by the Engineer. Forms shall be cleaned of all debris and reinforcement secured in position. Concrete shall be placed as rapidly and continuously as possible without segregation. Concrete shall not be allowed to free fall more than six (6) feet.
 - A. TEMPERATURE: No concrete shall be placed in temperature lower than 40° F. unless special provisions are made and approved by the Engineer. Admixtures shall not be used to prevent freezing.
 - B. BASE: Concrete shall be placed on undisturbed soil, free from water, mud, frost, and ice.
 - C. COMPACTION: Each layer of concrete shall be compacted with a mechanical vibrator which shall be supplemented by handspading, rodding and tamping, as required to consolidate the fresh concrete. Vibrators shall be applied at uniformly spaced points no further apart than 18 inches or the visible effectiveness of the machine. Vibrators shall not be inserted into layers which have begun to set nor shall vibration be continued to a point where objectionable segregation occurs. Form vibrators will not be permitted.
 - D. REINFORCING STEEL: Shall be accurately placed and firmly held in place as indicated on the plans. All splices shall have a minimum lap of 36 bar diameters. The minimum cover for concrete placed against earth shall be 3 inches and for surfaces exposed to the weather, shall be 2 inches.

E. CURING OF CONCRETE: All concrete shall be maintained in a thoroughly wet condition for not less than seven (7) days after placement by adding moisture, or by preventing loss of original moisture, by one of the following methods:

1. Moist Curing: Unformed surfaces shall be covered with burlap, and shall be kept moist. Forms shall be kept wet at all times and when removed, curing shall be continued by wetting concrete with a fine spray from a hose until curing period is completed. Burlap shall not be used for curing of exposed surfaces in the finished work. Ponding on slabs on earth may be used.
2. Moisture Barrier Curing: Surfaces shall be covered with a moisture barrier lapped six (6) inches at the edges and ends. Moisture barrier covering shall be weighted to prevent displacement and all holes and tears shall be repaired and moisture added as required to maintain an adequate curing environment.
3. Membrane Curing: Shall be utilized on all exterior slabs, pavements, sidewalks, curb and gutters.

3.02 FIELD AND LABORATORY CONTROL TESTS

- A. FIELD TESTING: The Engineer will perform slump tests (ASTM C143) for each truckload of concrete placed and air content tests (ASTM C138) when applicable and as required to maintain the air content within the tolerance specified.
- B. LABORATORY TESTING: Compressive strength tests shall be made for each 50 cubic yards of concrete placed. Three (3) molded concrete cylinders will be made (ASTM C31) and delivered to the designated testing laboratory. The testing laboratory shall perform the compressive strength tests in conformance with ASTM C39. The cost of the testing will be paid by the Owner.

END OF SECTION

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SECTION 03345-CONCRETE FINISHES

PART 1 GENERAL

- 1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with CONCRETE FINISHES.
- 1.02 RELATED WORK
- A. REQUIREMENTS: All concrete surfaces shall be finished as specified herein. Materials shall be compatible with painting and waterproofing requirements of these specifications.
 - B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01560 - SPECIAL CONTROLS
 - 2. SECTION 03300 - STRUCTURAL CONCRETE
- 1.03 SUBMITTALS: Detailed material lists and installation instructions on materials furnished under this section shall be submitted to the Engineer for review. Submittals shall be in accordance with Section 2.12 of the GENERAL CONDITIONS.

PART 2 PRODUCTS

- 2.01 FLOOR HARDENER: Shall be Surfhard as manufactured by Euclid Chemical Company, Lapidolith as manufactured by Sonneborn Building Products, or equal.

PART 3 EXECUTION

- 3.01 FORMED SURFACES: As a minimum, all formed surfaces shall receive a plain finish. Other required finishes shall be as scheduled within this or other sections of these specifications, or as noted on the plans.
- A. PLAIN FINISH: Immediately after removal of forms all fins and loose material shall be removed and all surface air holes shall be filled. All other defective areas such as holes, voids, aggregate pockets, and depressions shall be cut out to solid concrete. These defective areas shall be cleaned and wetted thoroughly and immediately brushed with neat cement and filled with Portland cement grout and finished, flush with the adjacent surfaces. Patch work shall be damp cured for a period of 48 hours and when exposed, it shall be finished to match adjacent surfaces.
 - B. RUBBED FINISH: Shall consist of a plain finish and then removing form marks and other such irregularities by rubbing the surface with a Carborundum stone and water as soon as practical after form removal.
 - C. TEXTURED FINISH: Shall be prepared with a plain finish. The textured finish shall consist of a waterproofing, heavy base, white cementitious coating with a bonding agent added to the mixing water. The cementitious coating shall be applied in two coats with a brush at a coverage

rate of 2 lbs/SYD per coat. Materials shall be applied in strict conformance with the manufacturer's instructions.

- 3.02 UNFORMED SURFACES: Fresh concrete shall be screeded to the desired level, tamped with an approved metal grid tamper to force the coarse aggregate away from the surface and then floated with straight edges to the required finish level. Dusting of fresh concrete will not be permitted. When the concrete has sufficiently set, the concrete shall be wood floated to bring moisture to the surface and then steel troweled to a smooth finish free from trowel marks. This is the minimum finish required for unformed surfaces, such as slabs, floors, tank bottoms, sumps, concrete fillets, etc.
- A. BURNISHED FINISH: All interior concrete floor surfaces shall receive a burnished finish. Upon completion of the initial finish and after the concrete has sufficiently set to ring a steel trowel, a second steel trowling shall be used to produce a burnished finish.
 - B. BROOMED FINISH: Shall be provided for areas such as exterior sidewalks, slabs, steps, and as directed by the Engineer. After receiving the initial finish for unformed surfaces, a broomed finish shall be applied with the fiber-bristle brush in a direction transverse to the line of traffic.
 - C. FLOOR HARDENER: Shall be applied to all floors not specified to receive floor covering or as noted in the finish schedule. The hardener shall be applied in accordance with the manufacturer's instructions after curing, cleaning, and work above the floor is completed. Three (3) coats of hardener shall be applied with one gallon of hardener per 100 to 150 square feet average per coat.
- 3.03 CURING: Concrete shall be cured in conformance to Section 03300, Structural Concrete.

END OF SECTION

SECTION 03450- CONCRETE PAVING UNITS

PART 1 GENERAL

- 1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with furnishing and installation of CONCRETE PAVING UNITS.
- 1.02 RELATED WORK
- A. REQUIREMENTS: All work shall be carried on in a neat and satisfactory manner.
 - B. RELATED SECTIONS: Including, but not limited to:
 - 1. SECTION 01410 - SOILS COMPACTION AND TESTING
 - 2. SECTION 02528 – CONCRETE SIDEWALKS
 - 3. SECTION 02901 - RESTORATION AND CLEAN-UP
- 1.03 SUBMITTALS: Detailed material lists and specifications for all materials furnished under this section of the specifications shall be submitted to the Engineer for review. Submittals shall be in accordance with Section 2.12 of the GENERAL CONDITIONS.
- 1.04 CERTIFICATION OF MATERIALS: When requested, the Contractor shall furnish certification that all materials meet the requirements set forth in the plans and specifications. Source of the certification shall be determined by the Engineer.

PART 2 PRODUCTS

- 2.01 CONCRETE PAVING UNITS shall be rustic blend Omni-stone and rustic blend and charcoal colored Holland stone by Fendt Builder's Supply, Inc. or approved equal. Units shall meet or exceed the minimum values set forth in the American Society for Testing and Materials (ASTM) specification C936, Standard Specification for Solid Interlocking Concrete Paving Units. This standard requires a minimum compressive strength of 8,000 psig, water absorption of less than 5 percent, and resistance to at least 50 cycles of freezing and thawing.
- 2.02 Concrete base shall be per the Concrete Sidewalks specification.
- 2.03 Sand bedding course shall be 2NS as defined by MDOT.

PART 3 EXECUTION

- 3.01 CONCRETE PAVING UNITS shall be laid in patterns and colors as designated on the drawings. Paver installation shall begin from a corner or straight edge. All edges of the interlocking concrete pavers (including the underlying base or leveling course) must be restrained.

- 3.02 CONCRETE BASE shall be placed to the depth indicated on the drawings. Concrete base to receive bull float finish and be drilled with weep holes, ½" diameter minimum, 24" O.C. each way. The concrete base course shall be inspected by the engineer prior to proceeding.
- 3.03 SAND BEDDING course shall be screeded to a loose thickness of 1/2" to 1" conforming to the contour of the subbase surface. The screeded sand shall be fully protected against accidental precompaction and not be disturbed in any way, including compaction by rain.
- 3.04 INSTALLATION:
- A. Alignment: String lines shall be used to ensure the pavers will be set true to line and grade. Care shall be taken to ensure that the pavers properly coincides and aligns with adjacent work lines and elevations.
 - B. Placement: Paving units shall be placed "hand tight" and level on the loose base or leveling course. It is important that the leveling course not be disturbed or that individual pavers be pre-compacted. Joint and edge spacing will be within 1/8" of gap. No portion of a days work shall be left untrimmed, joints and voids unfilled, or uncompacted at days end.
 - C. Cutting: Where two pavers do not fit at the edges of the pavement, the pavers shall be cut to fit neatly against the edges. Spaces exceeding 1/4" around manholes, drainage inlets, tree wells, hydrants, light poles, and other structures shall be filled with pavers. Cutting shall be performed on brick within the patterned field, not the soldier course. Cutting shall be done by a masonry saw so as to leave a clean edge to the traffic surfaces.
 - D. Blending: Color blending will require paving units to be installed from a minimum of three bundles simultaneously drawing the paver vertically, rather than horizontally. Engraved units shall also be blended uniformly with standard units in locations directed by the Owner.
 - E. Compaction: A minimum of three (3) passes of a plate vibrator (minimum compaction force of 2,500 pounds for 2-3/8" pavers and 5,000 pounds for pavers 3-1/8") shall be made to set the concrete pavers in the sand bedding course, prior to filling joints with bedding. Vibrator must not be passed nearer than one (1) yard from an unrestrained edge. Any units which are structurally damaged during compaction shall be immediately removed and replaced.
 - F. Joint Filling: All voids and joints are to be filled by sweeping and vibrating sand equal in gradation to the sand in the base or leveling course or slightly finer (100% passing the No. 16 sieve and 10% passing the No. 200 sieve). Sweeping and vibration will be continued until all joints are full. Pavers shall be swept clean and excess sand removed.

END OF SECTION



SECTION 03600 - GROUT

PART 1 GENERAL

- 1.01 WORK INCLUDED: The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, and materials in connection with the use of GROUT.
- 1.02 RELATED WORK: Grout used in related work specified elsewhere shall conform with the requirements of this specification.

PART 2 PRODUCTS

2.01 GROUT:

- A. PORTLAND CEMENT: Shall be ASTM C150, Type 1 or 1A.
- B. NON-SHRINK GROUT: Shall conform to Corps of Engineers specification CRD-C588. Material shall be as manufactured by W. R. Meadows, Five Star, Embeco, or equal. Non-staining material shall be used for all exposed work.
- C. MORTAR: Shall be ASTM C270, Type M.

2.02 FINE AGGREGATE: Shall conform to MDOT Specification 2MS for masonry sand.

2.03 WATER: Shall be clean and free from injurious deleterious substances such as oil, alkali and organic matter. If drinking water quality is not used, the Engineer shall approve the water source before use.

2.04 ADMIXTURES: Shall not be used without written permission of the Engineer.

2.05 PROPORTIONS: Grout shall be mixed in the following proportions:

- A. GROUT: Shall consist of proportions of Portland Cement or mortar and sand with sufficient water to form a workable mix in accordance with the following requirements:

<u>Use</u>	<u>Parts Cement</u>	<u>Parts Cement</u>
Utility Structures - Precast Section Joints	1	2
Sewer Joints - when specified	1	2

- B. NON-SHRINK GROUT: Shall be mixed in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 GROUT: Shall be placed within 12 hours of the time the mix is completed.

- 3.02 NON-SHRINK GROUT FOR HYDRAULIC STRUCTURES: Used for caulking around pipes through concrete walls, repair of joints, in concrete pipe and other circumstances where the effectiveness and durability of the grout depends upon the reduction or elimination of drying shrinkage shall be placed in accordance with manufacturer's recommendations.
- 3.03 NON-SHRINK GROUT FOR EQUIPMENT OR STRUCTURAL BASES: Shall be used to completely fill the voids between bearing plates and the structural foundations to provide full bearing for the base. All grout shall be placed in accordance with the manufacturer's recommendations.

END OF SECTION



SECTION 03601 - NON-STRUCTURAL FLOWABLE FILL

PART 1 GENERAL

- 1.01 WORK INCLUDED: This work shall consist of furnishing and placing non-structural flowable fill for abandoning pipes and miscellaneous structures; constructing miscellaneous bulkheads for forms; and backfilling. This specification is not intended to address flowable fill used as structural backfill.
- 1.02 RELATED WORK: Non-Structural Flowable Fill used in related work specified elsewhere shall conform with the requirements of this specification.

PART 2 PRODUCTS

2.01 NON-STRUCTURAL FLOWABLE FILL:

Supply flowable fill consisting of a mixture of Portland cement, fly ash, sand and water. Use materials conforming to the Standard Specifications for Construction except as modified by this special provision. All flowable fill is intended to be removable using conventional mechanical excavation methods.

Use either Type I or IA Portland cement conforming to section 901 of the Standard Specifications for Construction and Class F or C fly ash as specified by ASTM C 618 except that there is no limit on loss on ignition. Use 2NS material for fine aggregate.

Produce a mix of cement, fly ash, sand and water in the following proportions.

Portland Cement	50 lb/cyd
Fly Ash	500 lb/cyd
Sand	2850 lb/cyd
Water	approx. 376 lb/cyd (sufficient to produce desired flowability)

PART 3 EXECUTION

- 3.01 NON-STRUCTURAL FLOWABLE FILL: Shall be produced and delivered at a minimum temperature of 50° F. Transport mixture to the point of placement in a revolving drum mixer or agitator.

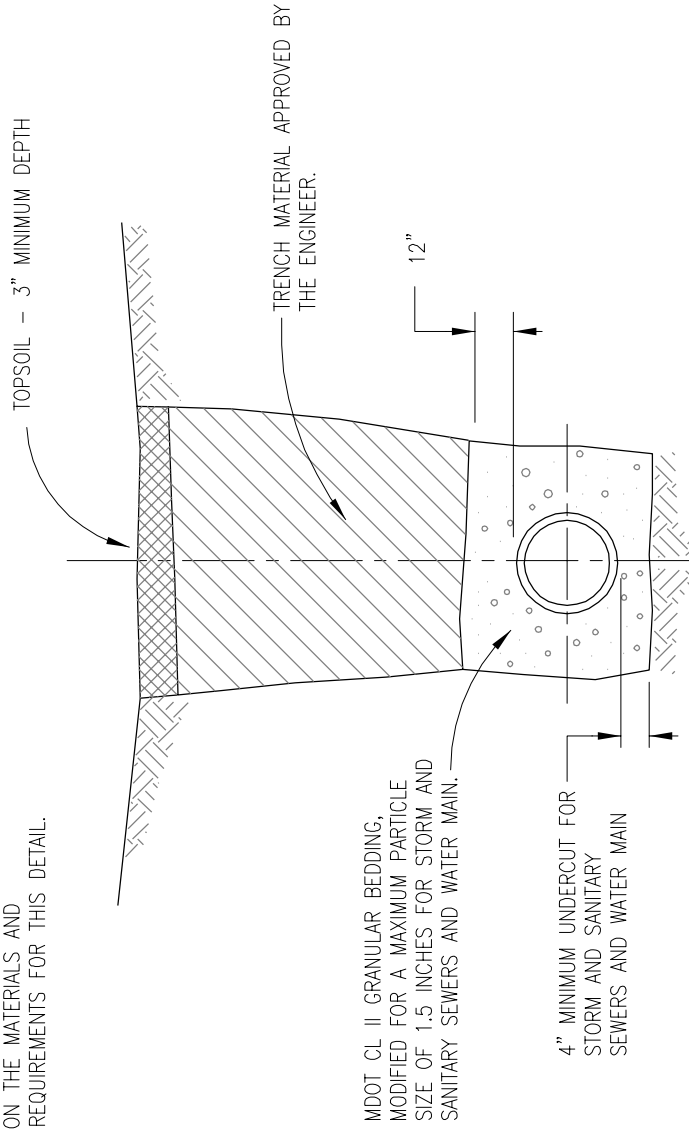
Secure all pipes and conduits within the backfill area to counteract the buoyant effect of flowable fill. Place the material evenly around manholes and in utility trenches to avoid dislocating pipes and conduits.

END OF SECTION

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TRENCH WIDTHS
THE PROPOSED TRENCH WIDTHS FOR ALL
UNDERGROUND PIPE SIZES AND MATERIALS
SHALL BE IN ACCORDANCE WITH ASTM D2321.

NOTE
REFER TO THE APPROPRIATE SPECIFICATIONS
FOR DETAILS ON THE MATERIALS AND
INSTALLATION REQUIREMENTS FOR THIS DETAIL.



NORMAL TRENCH BACKFILL

NO SCALE

FIGURE 1.0
NORMAL TRENCH BACKFILL DETAIL

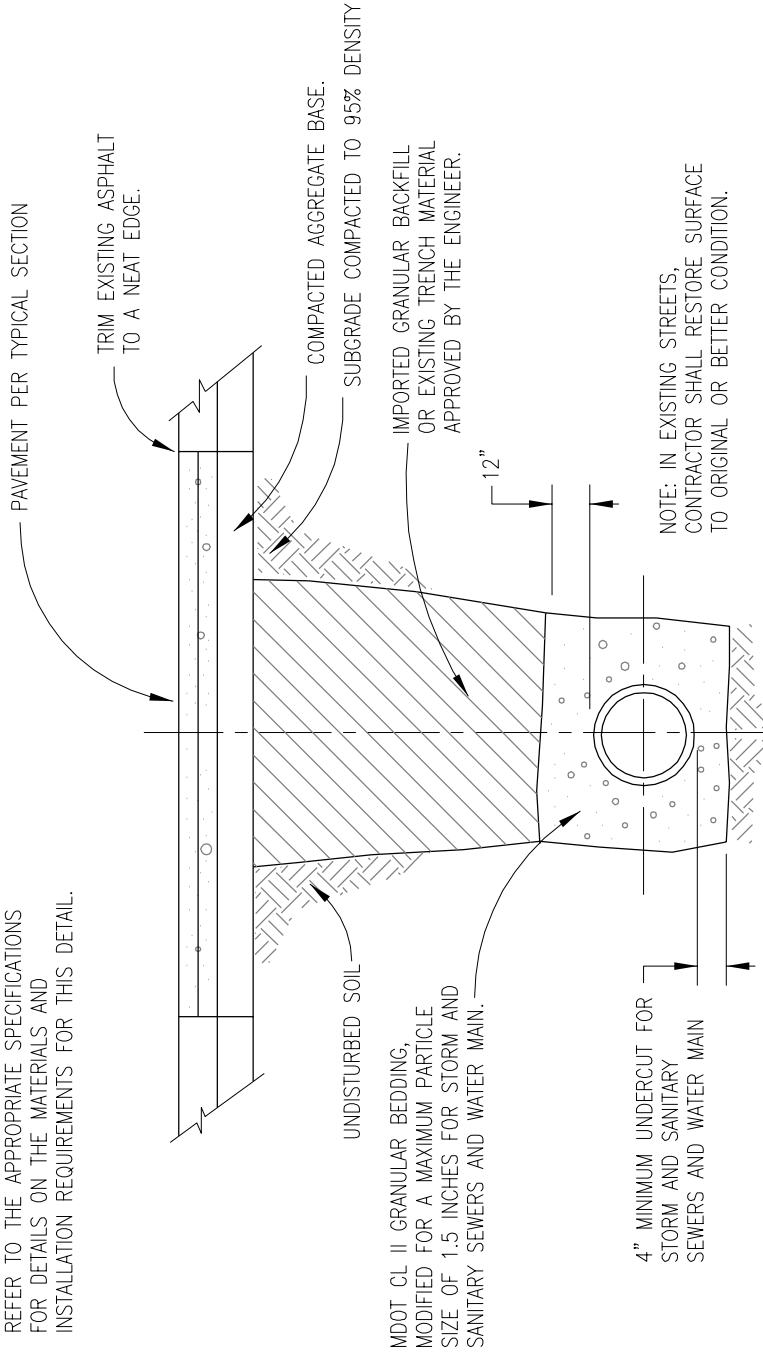
CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN



TRENCH WIDTHS
THE PROPOSED TRENCH WIDTHS FOR ALL
UNDERGROUND PIPE SIZES AND MATERIALS
SHALL BE IN ACCORDANCE WITH ASTM D2321.

NOTE
REFER TO THE APPROPRIATE SPECIFICATIONS
FOR DETAILS ON THE MATERIALS AND
INSTALLATION REQUIREMENTS FOR THIS DETAIL.



TRENCH BACKFILL UNDER ROADWAY

NO SCALE

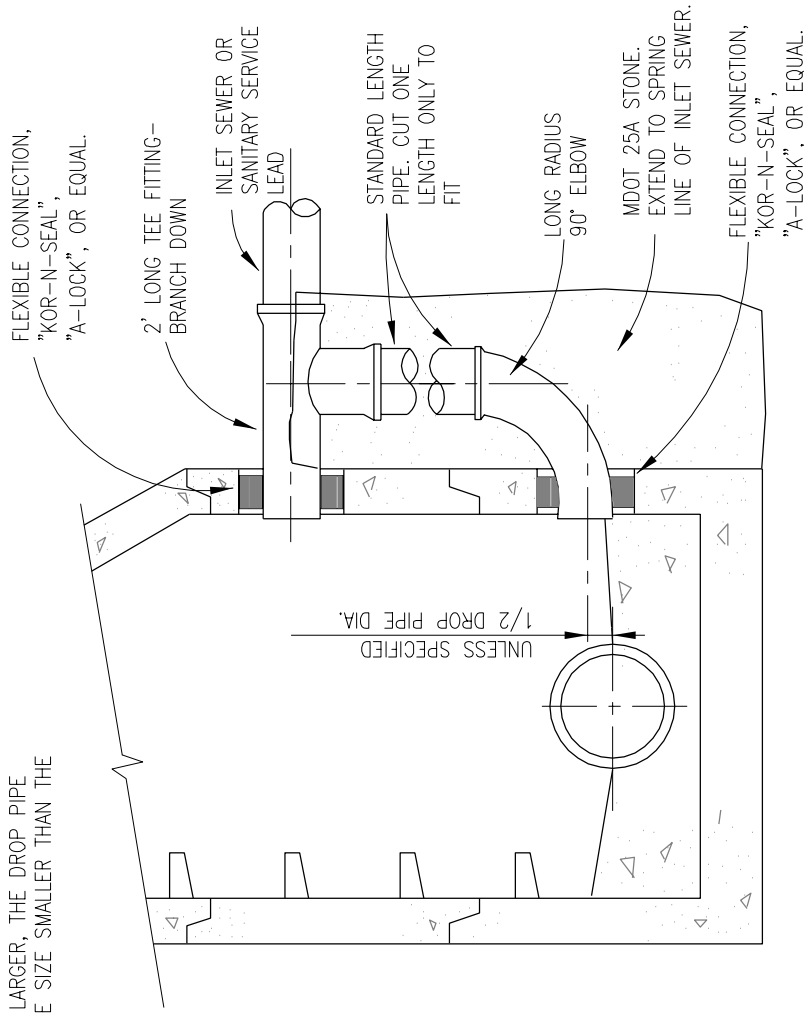
FIGURE 1.1
TRENCH BACKFILL UNDER ROADWAY DETAIL

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN



NOTE:
FOR 8" DIAMETER SEWERS WITH DROP CONNECTION, THE DROP PIPE SHALL BE 8" DIAMETER. FOR 10" DIAMETER SEWERS AND LARGER, THE DROP PIPE SHALL BE ONE SIZE SMALLER THAN THE MAIN LINE.



EXTERNAL DROP PIPE DETAIL

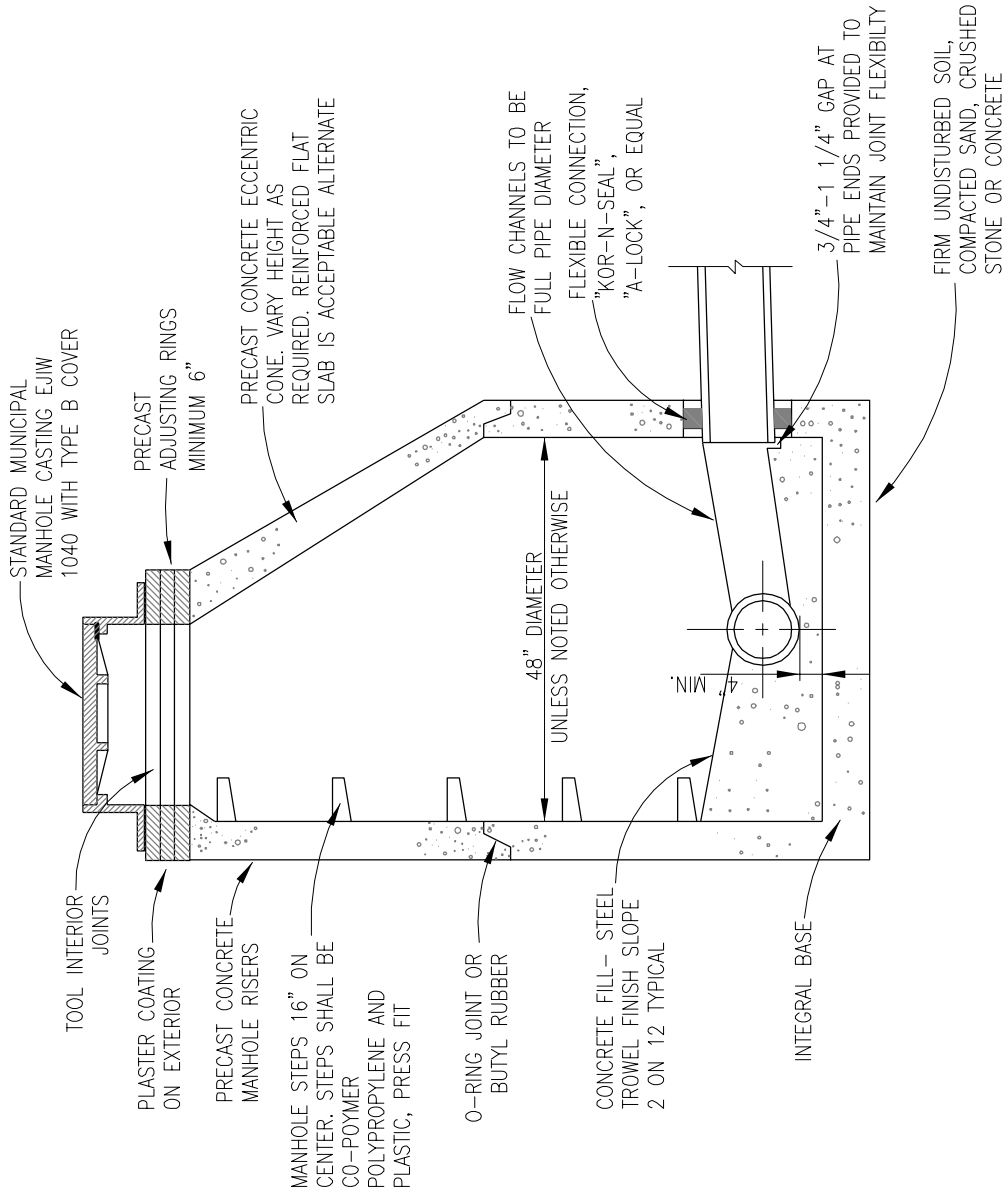
NO SCALE

FIGURE 3.0
STANDARD DROP PIPE MANHOLE

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD SANITARY MANHOLE

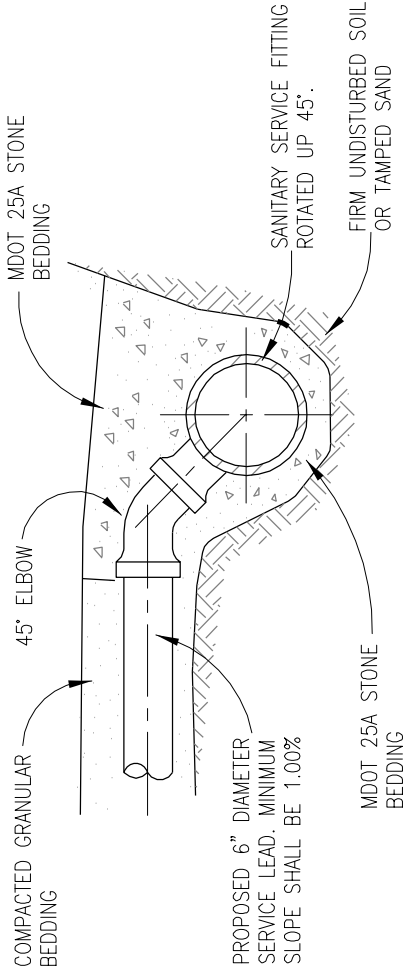
NO SCALE

FIGURE 2.0
 STANDARD SANITARY MANHOLE

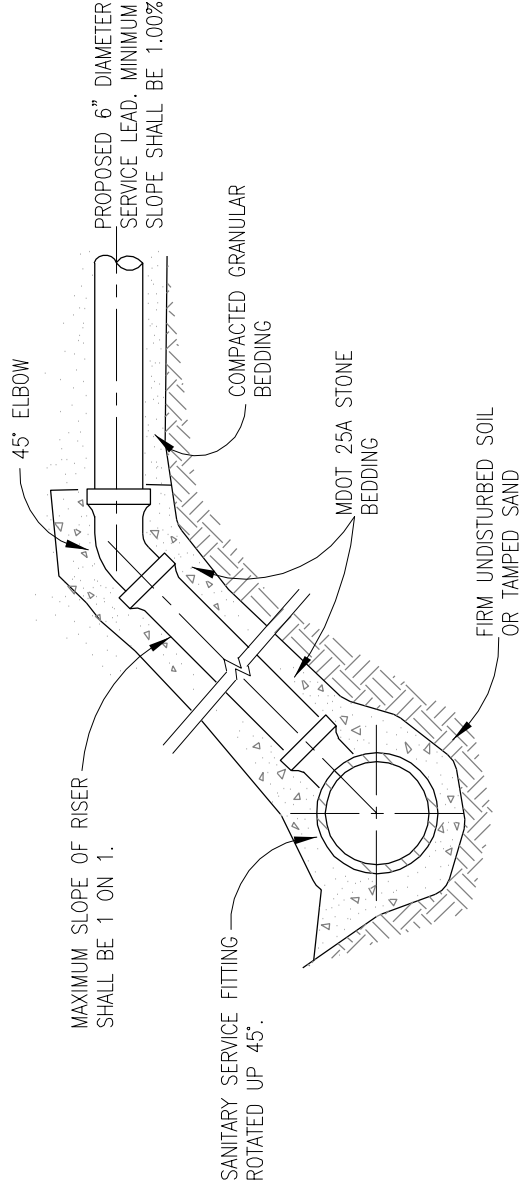
CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





HORIZONTAL CONNECTION



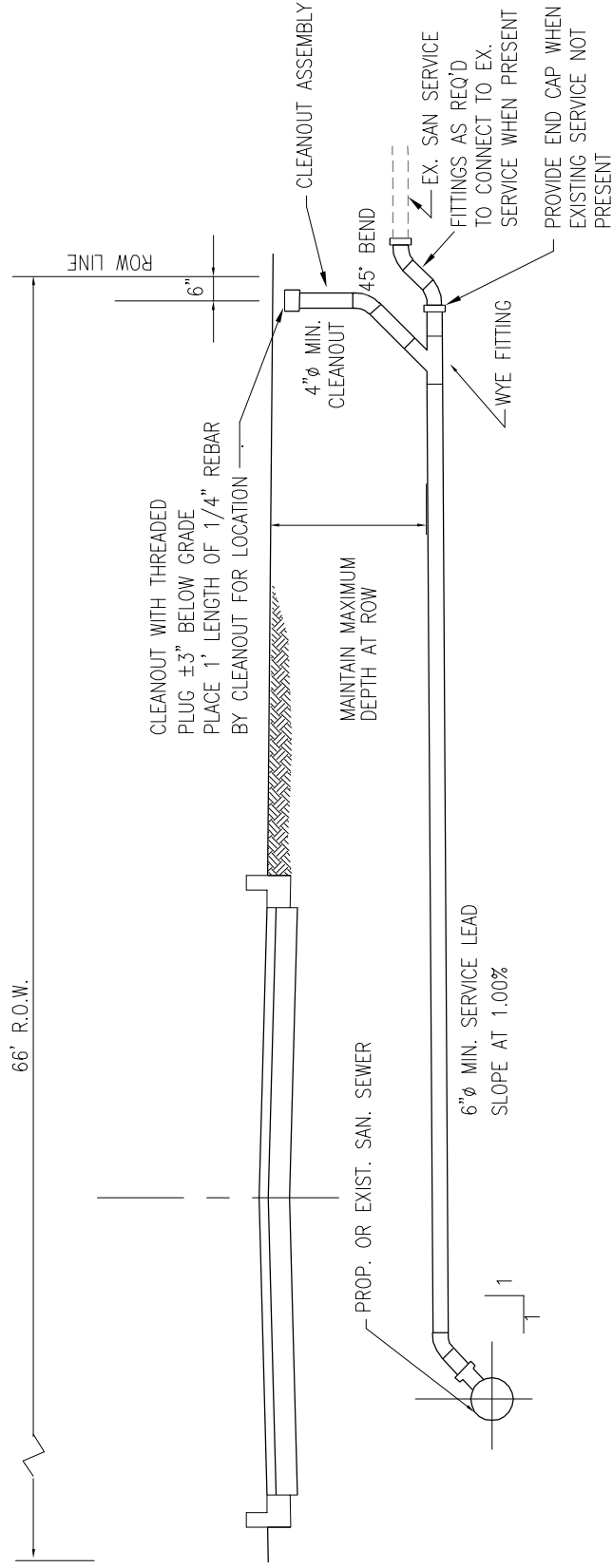
RISER CONNECTION

SANITARY SERVICE CONNECTIONS

(PVC PIPE ONLY)
 NO SCALE

FIGURE 4.0
SANITARY SERVICE CONNECTIONS





SANITARY SERVICE LEAD DETAIL

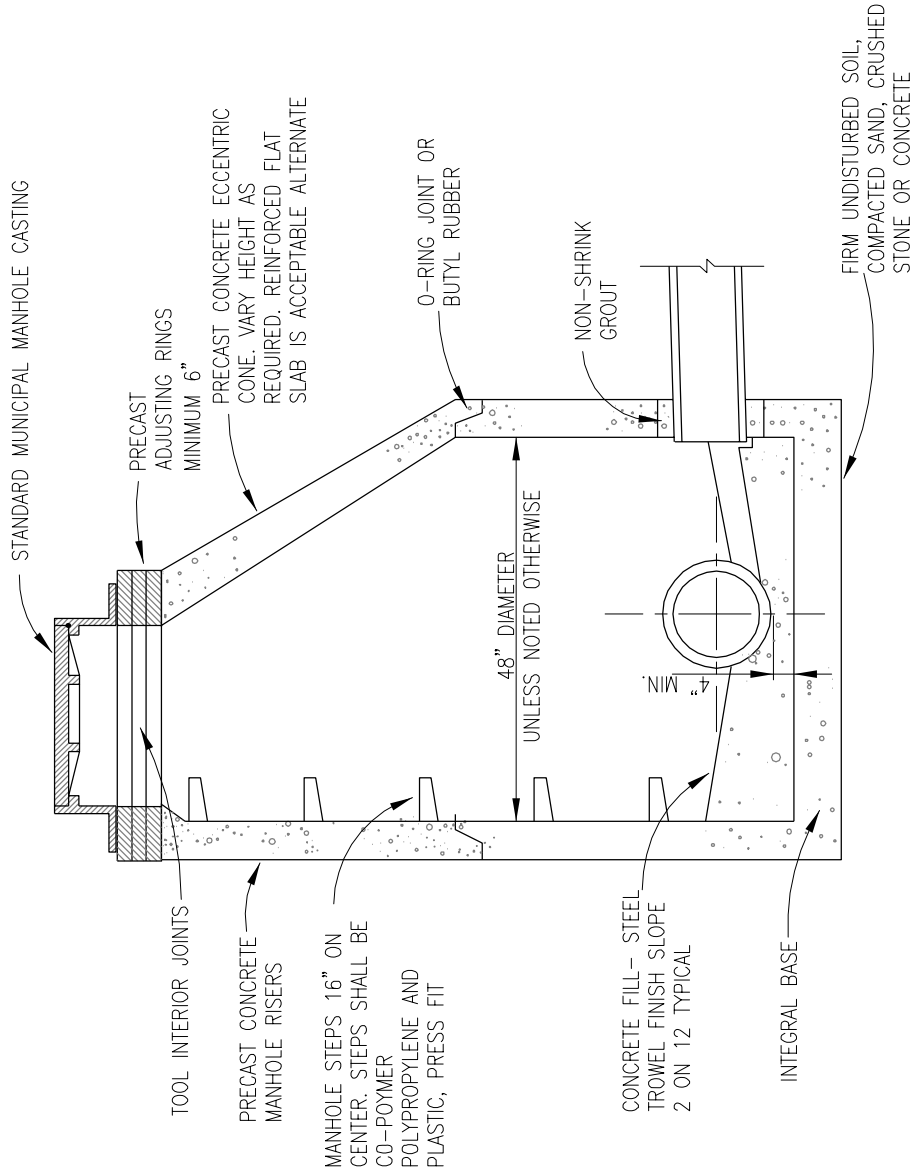
NO SCALE

**FIGURE 5.0
 SANITARY SERVICE LEAD**

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD STORM MANHOLE

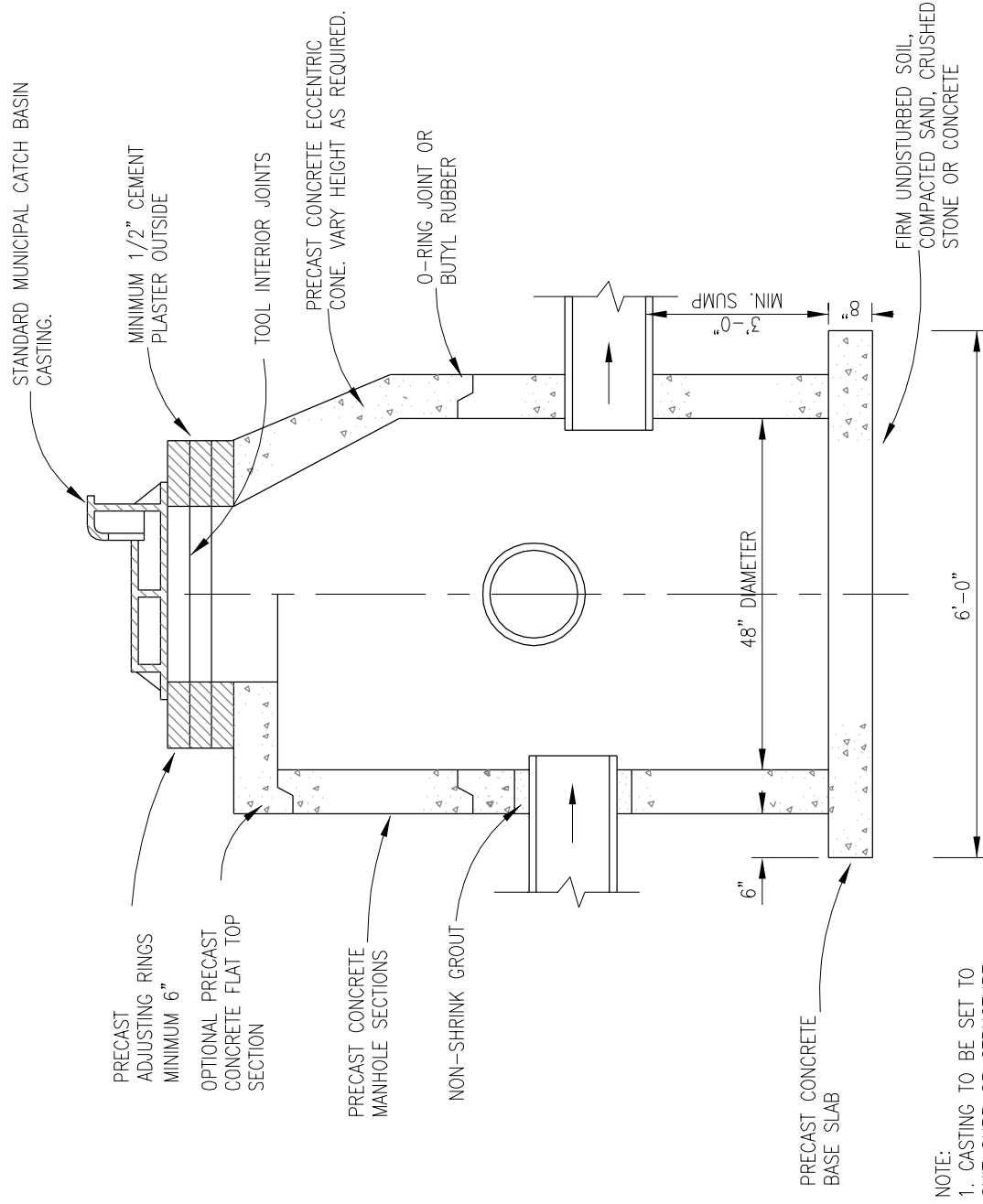
NO SCALE

FIGURE 6.0
 STANDARD STORM MANHOLE

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





NOTE:
 1. CASTING TO BE SET TO SUIT CURB OR STRUCTURE.
 2. INTEGRAL BASE IS AN ACCEPTABLE ALTERNATE.

STANDARD CATCH BASIN

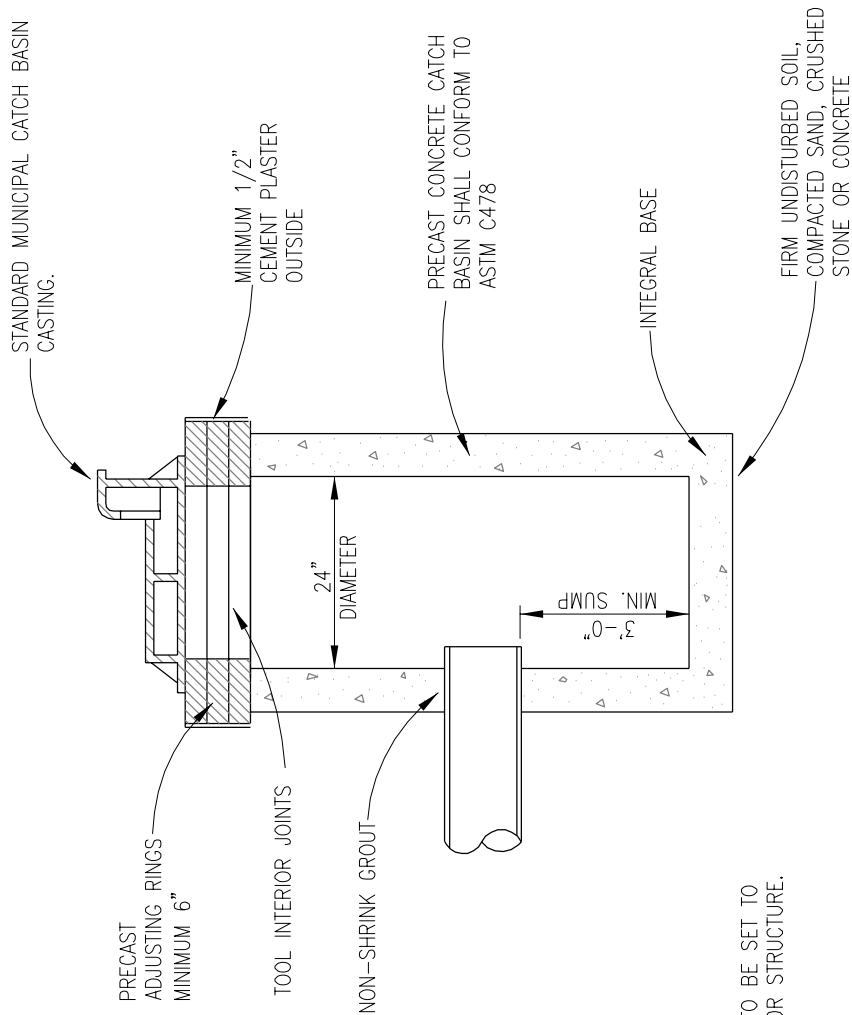
NO SCALE

**FIGURE 7.0
 STANDARD CATCH BASIN**

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





NOTE:
 1. CASTING TO BE SET TO SUIT CURB OR STRUCTURE.

24 INCH DIAMETER CATCH BASIN

NO SCALE

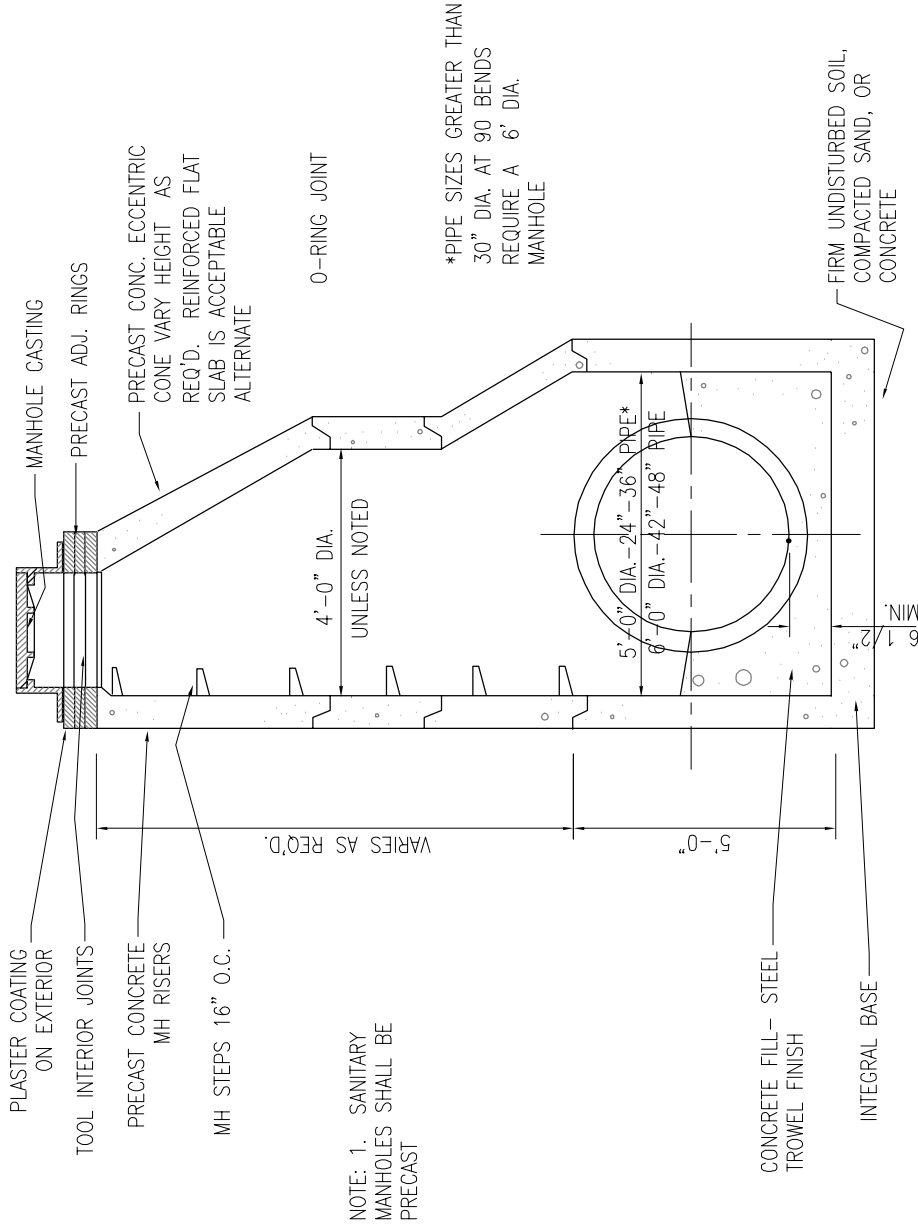
NOTE: TO BE USED ONLY WHEN THERE IS A SINGLE STORM LEAD LESS THAN 50 FEET IN LENGTH.

FIGURE 7.1
24 INCH DIAMETER CATCH BASIN

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD MANHOLE
24" TO 48" PIPE

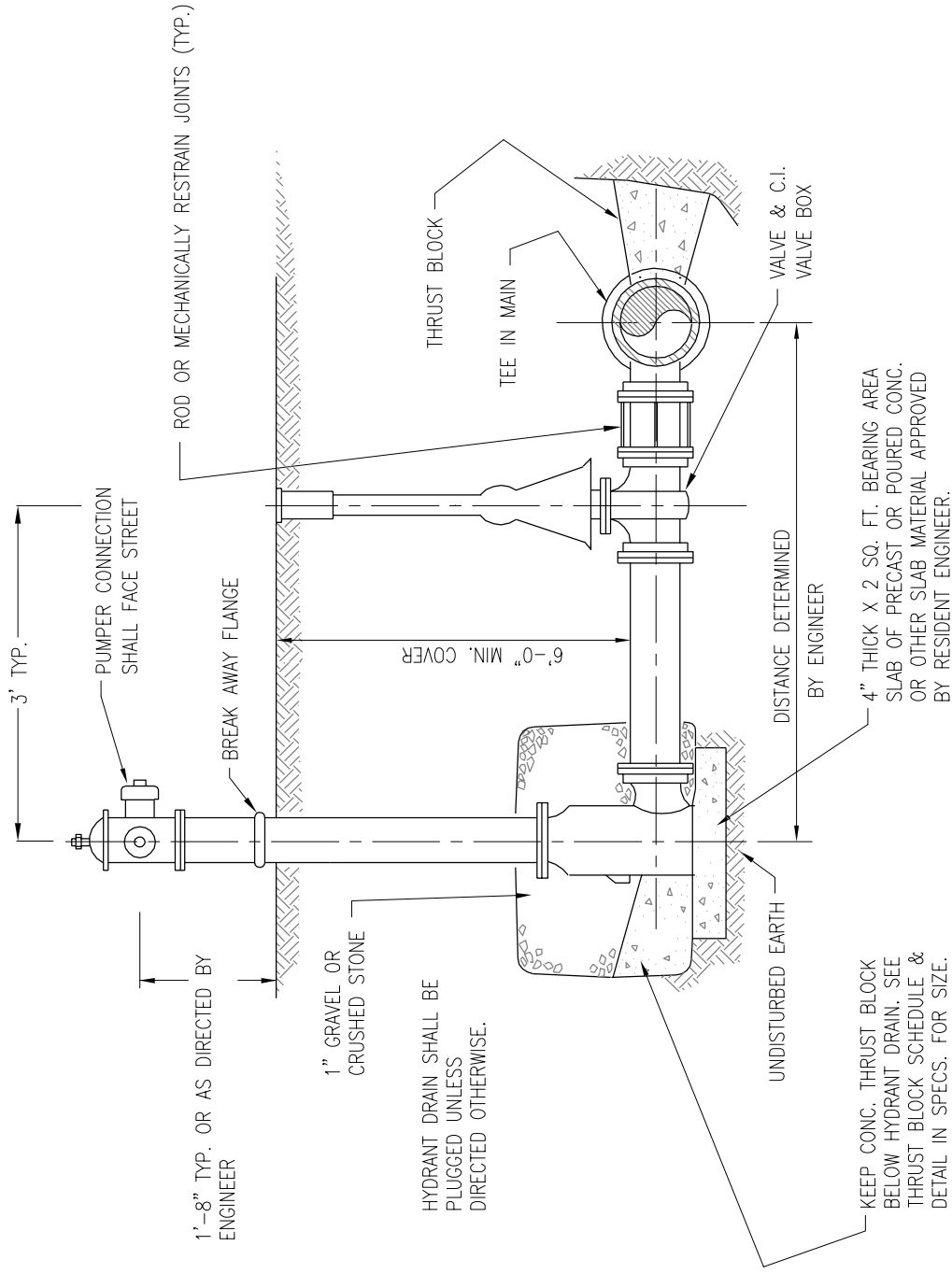
NO SCALE

FIGURE 8.0
STANDARD MANHOLE 24" TO 48" PIPE

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD HYDRANT ASSEMBLY DETAIL

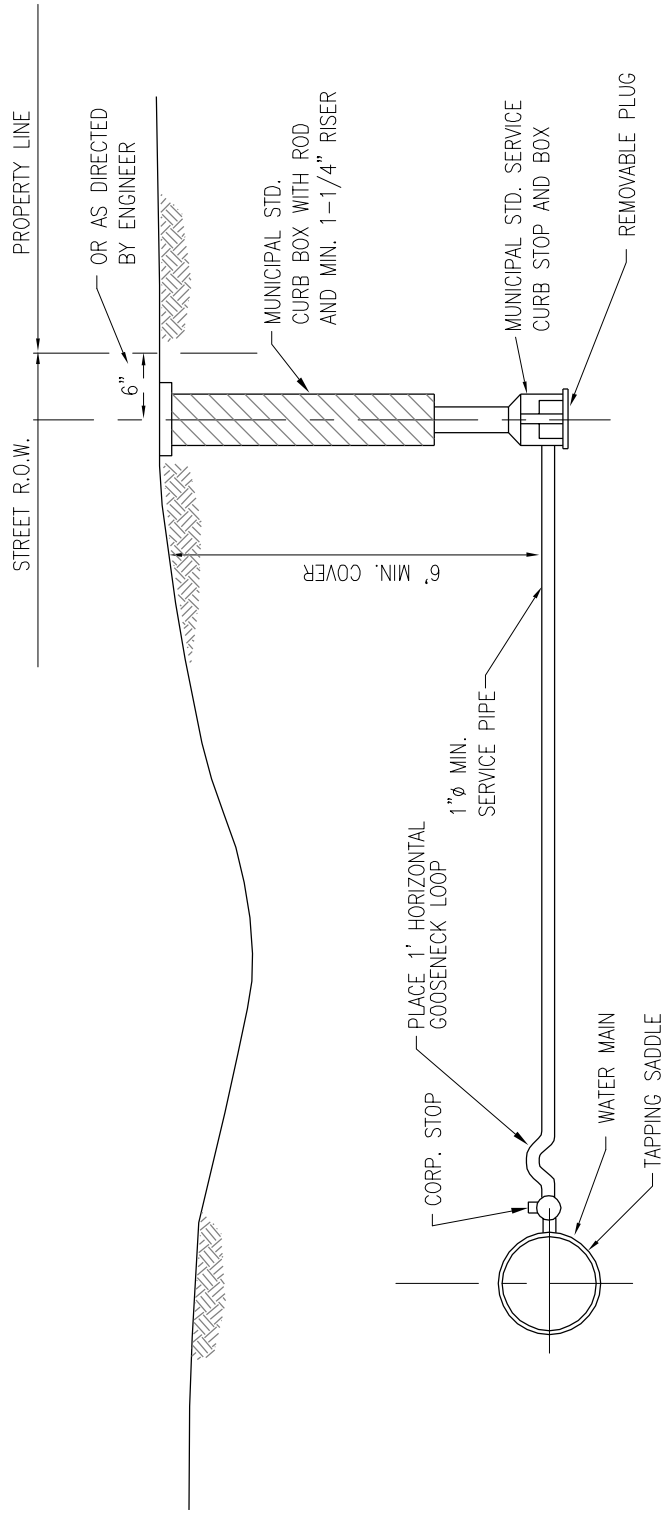
NO SCALE

FIGURE 9.0
 STANDARD HYDRANT ASSEMBLY DETAIL

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





WATER SERVICE CONNECTION DETAIL

NO SCALE

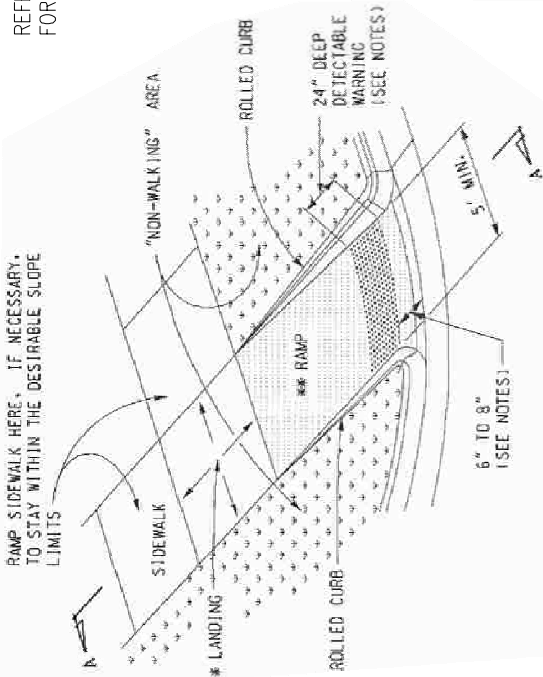
FIGURE 10.0
 WATER SERVICE CONNECTION DETAIL

CITY OF GAYLORD MUNICIPAL STANDARDS

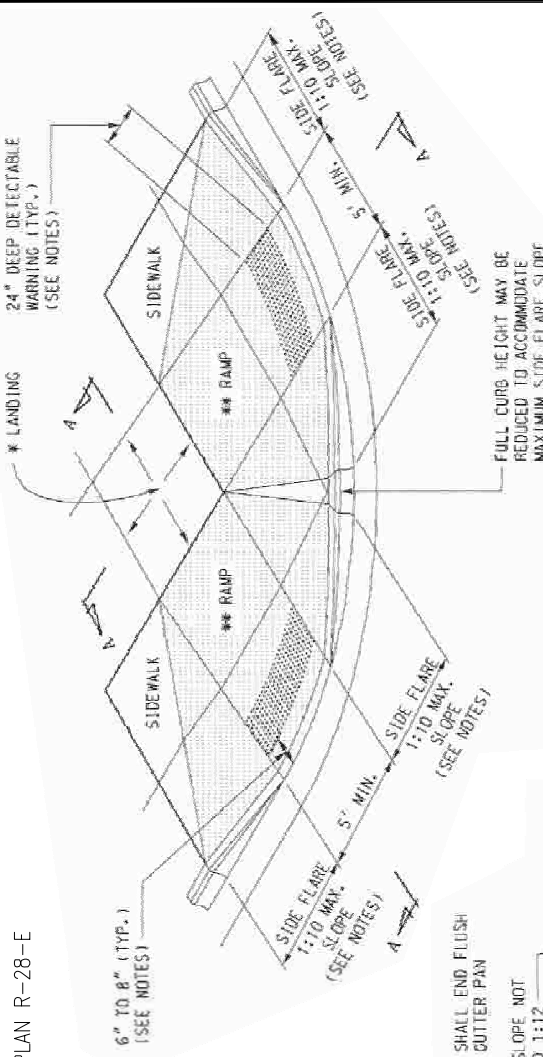
OTSEGO COUNTY, MICHIGAN



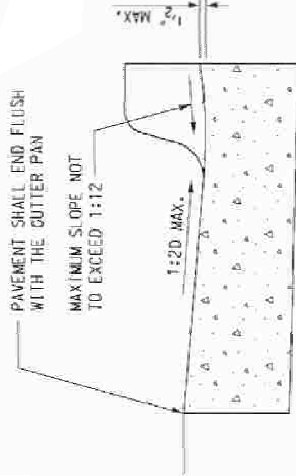
REFER TO MDOT STANDARD PLAN R-28-E FOR MORE INFORMATION.



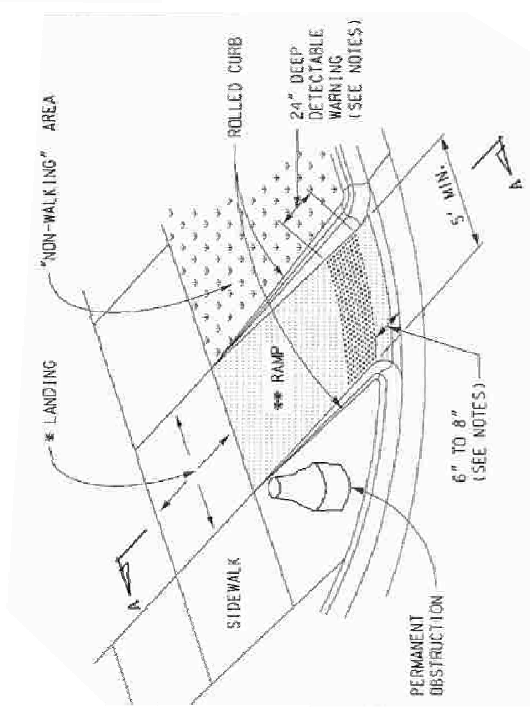
**TYPE 1
 IN-LINE SIDEWALK RAMP**



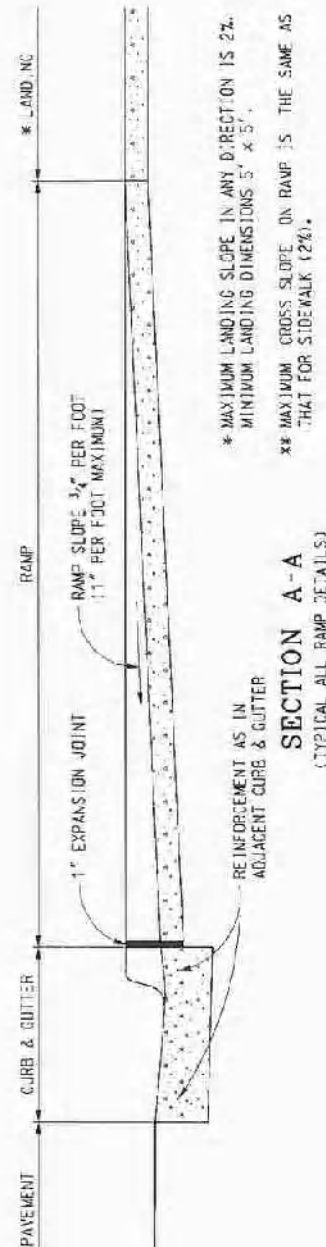
**TYPE 4
 FLARED SIDEWALK RAMP
 (TWO RAMPS ARE SHOWN)**



**SECTION THROUGH CURB CUT
 (TYPICAL ALL RAMP TYPES)**



**TYPE 2
 OFFSET SIDEWALK RAMP**



* MAXIMUM LANDING SLOPE IN ANY DIRECTION IS 2%.
 MINIMUM LANDING DIMENSIONS 5' x 5'.
 ** MAXIMUM GROSS SLOPE ON RAMP IS THE SAME AS THAT FOR SIDEWALK (2%).

**SECTION A-A
 (TYPICAL ALL RAMP DETAILS)**

PEDESTRIAN RAMP DETAIL

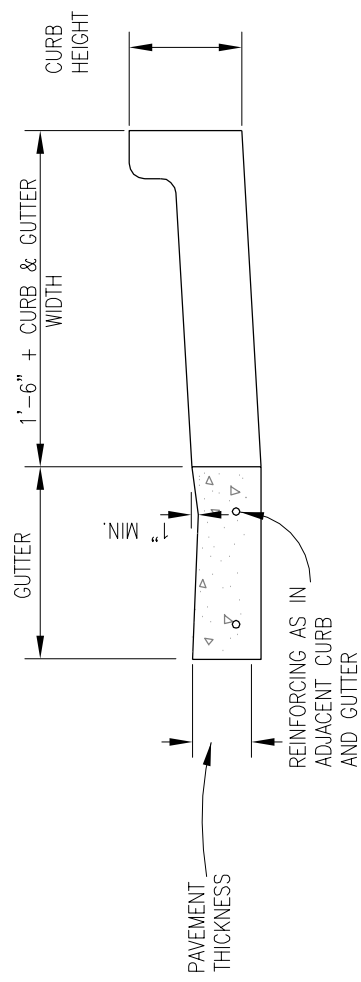
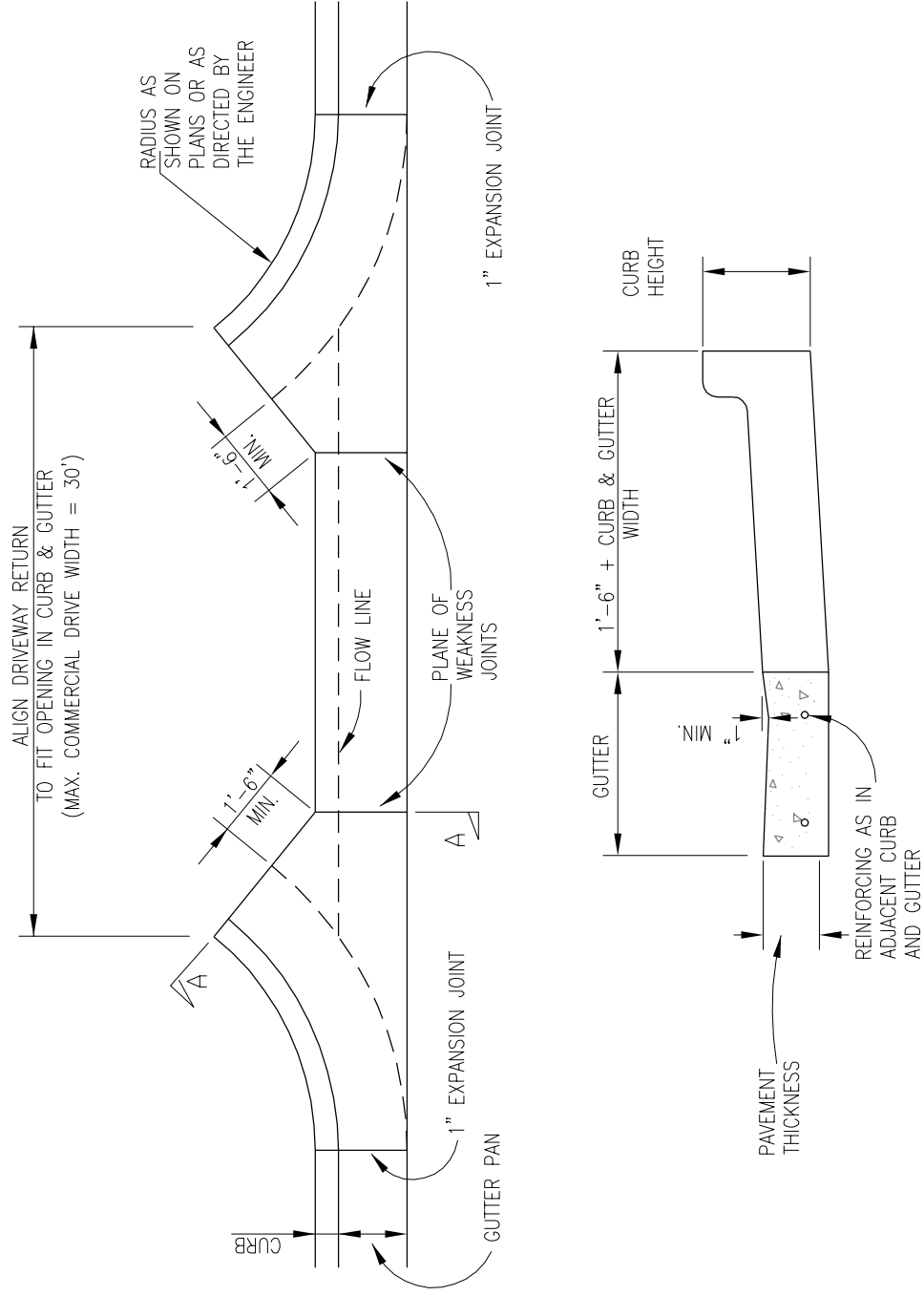
NO SCALE

**FIGURE 11.0
 PEDESTRIAN RAMP DETAIL**

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





SECTION A-A

TYPE M DRIVEWAY OPENING

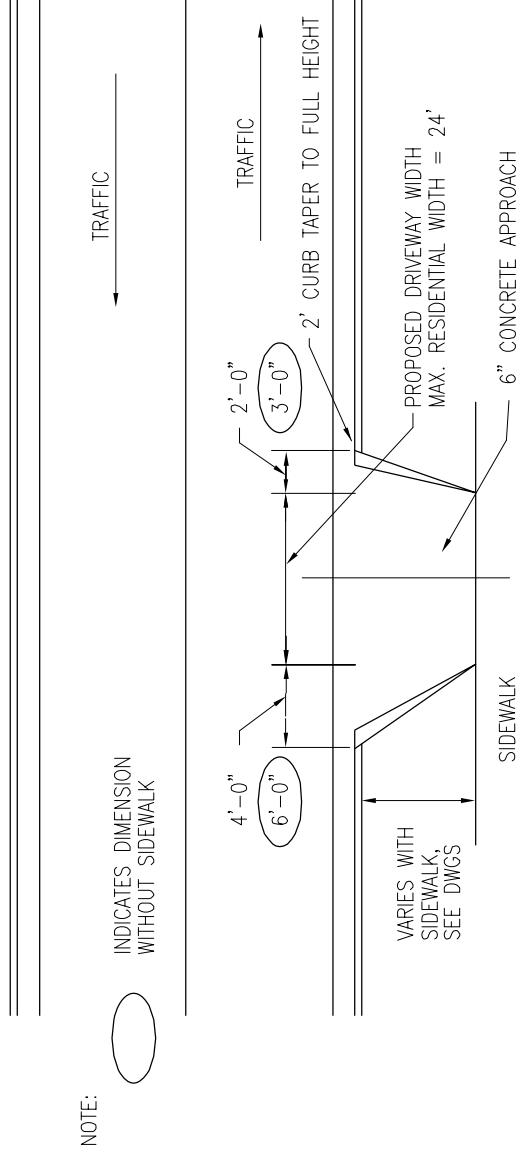
NO SCALE

**FIGURE 12.0
 TYPE M DRIVEWAY OPENING**

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





TYPICAL CURB BREAKS DETAIL L

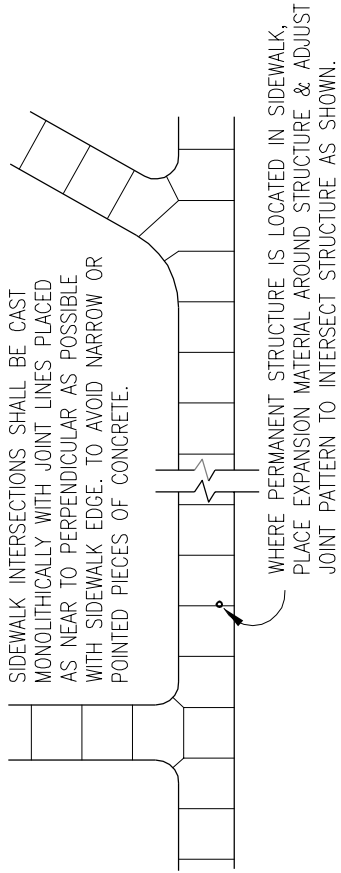
NO SCALE

FIGURE 12.1
TYPICAL DRIVEWAY CURB BREAKS DETAIL L

CITY OF GAYLORD MUNICIPAL STANDARDS

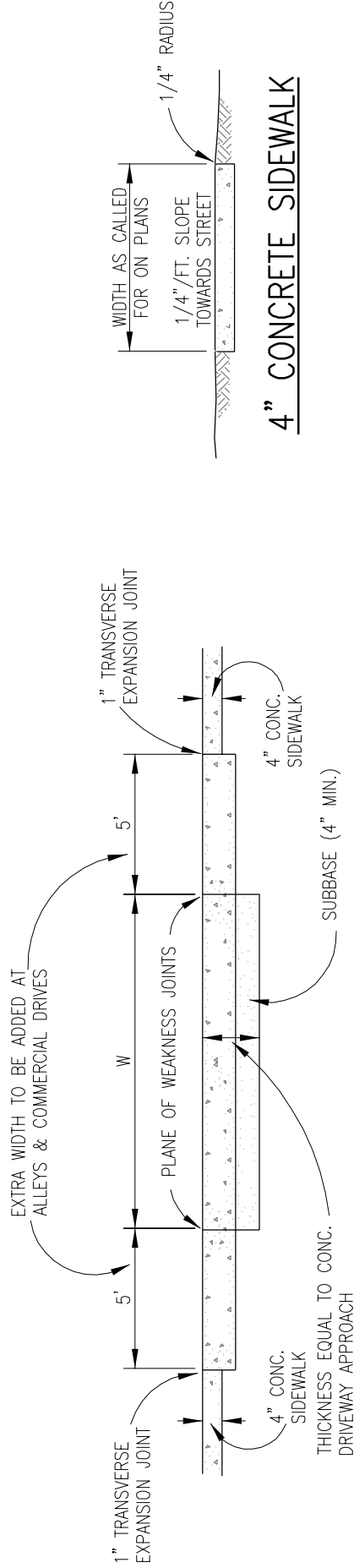
OTSEGO COUNTY, MICHIGAN





NOTES: SIDEWALK TRANSVERSE SLOPE MAY VARY FROM ZERO TO 1/4" PER FT. TO MEET SITE CONDITIONS. WHEN TRANSVERSE SLOPE IS LESS THAN 1/4" PER FT. LONGITUDINAL DRAINAGE MUST BE PROVIDED. IN SETTING GRADES FOR COMMERCIAL DRIVES THE TYPES OF THE USING VEHICLES SHOULD BE CONSIDERED

TYPICAL SIDEWALK JOINT LAYOUT



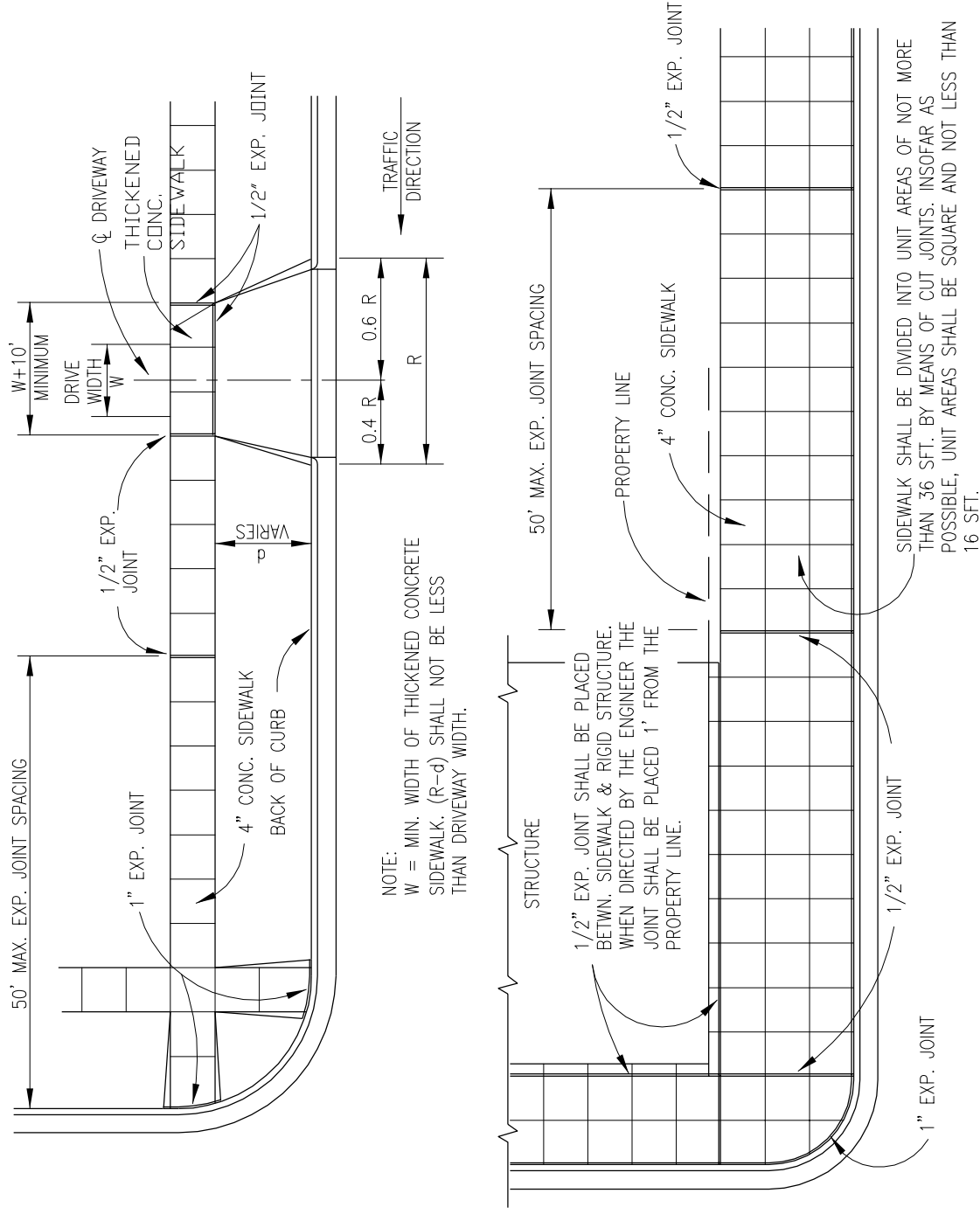
THICKENED CONCRETE SIDEWALK

FIGURE 13.0
 SIDEWALK DETAILS

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





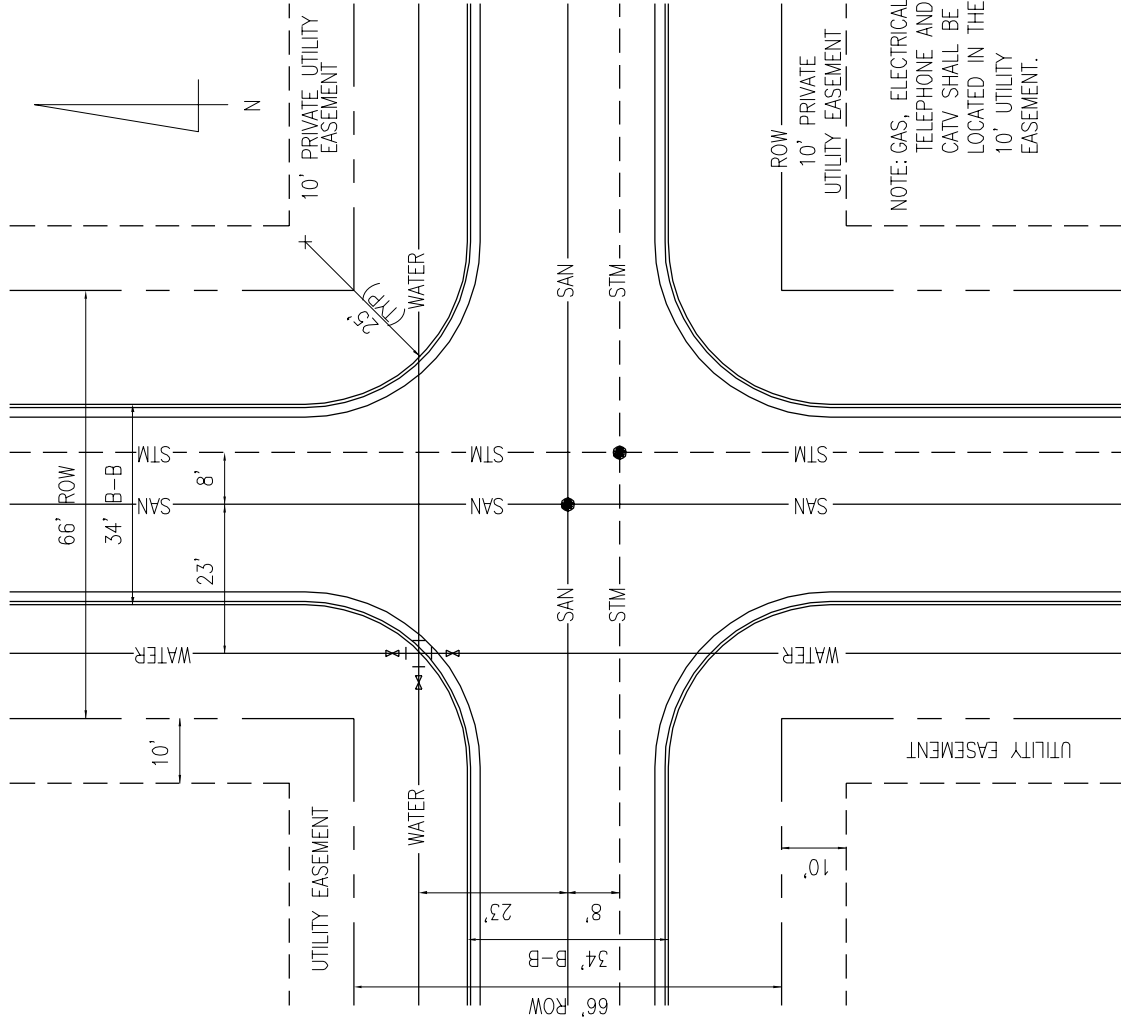
LOCATION OF JOINTS IN CONCRETE SIDEWALK

FIGURE 13.1
 SIDEWALK DETAILS

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD STREET & UTILITY LAYOUT

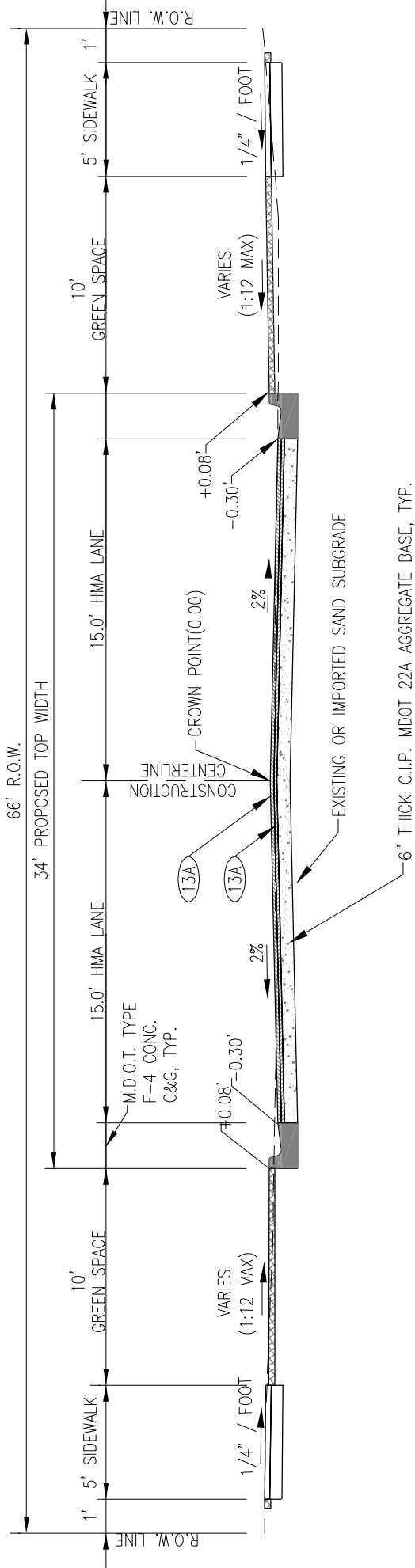
NO SCALE

FIGURE 14.0
 STANDARD STREET & UTILITY LAYOUT

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





HMA APPLICATION ESTIMATE

IDENT NO.	ITEM	RATE: LBS/SYD	PERFORMANCE GRADE	REMARKS
13A	HMA, 13A	220	58-28	LEVELING COURSE (2")
13A	HMA, 36A	165	58-28	WEARING COURSE (1 1/2")
BC	HMA BOND COAT	0-0.10 GAL.	NA	FOR INFORMATION ONLY

34' TYPICAL ROADWAY CROSS SECTION

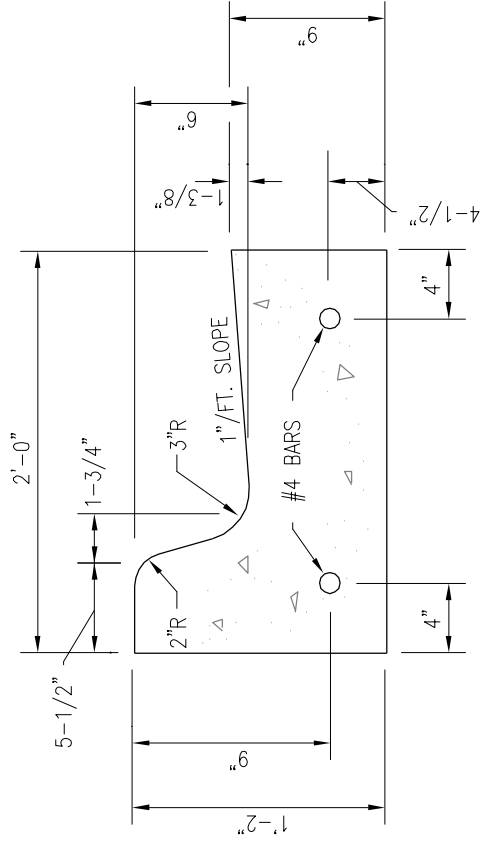
NO SCALE

FIGURE 15.0
 34' TYPICAL ROADWAY CROSS SECTION

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN





STANDARD MDOT F-4 CURB & GUTTER DETAIL

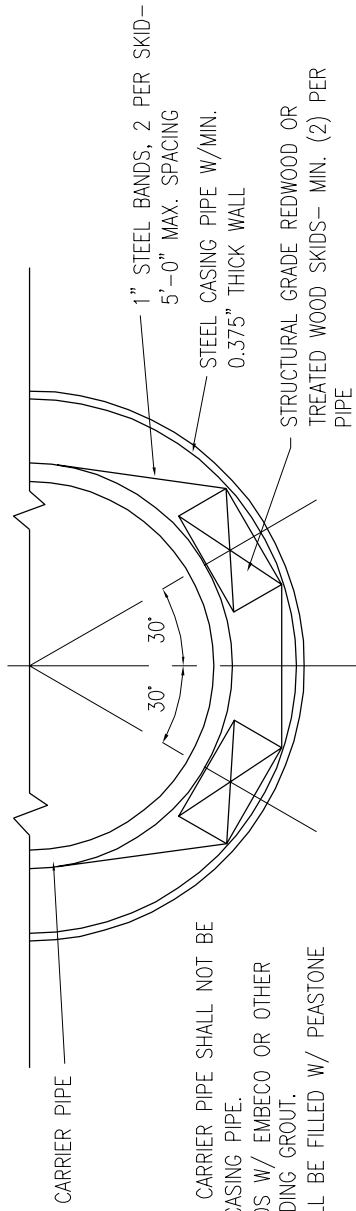
NO SCALE

FIGURE 16.0
 STANDARD MDOT F-4 CURB & GUTTER DETAIL

CITY OF GAYLORD MUNICIPAL STANDARDS

OTSEGO COUNTY, MICHIGAN

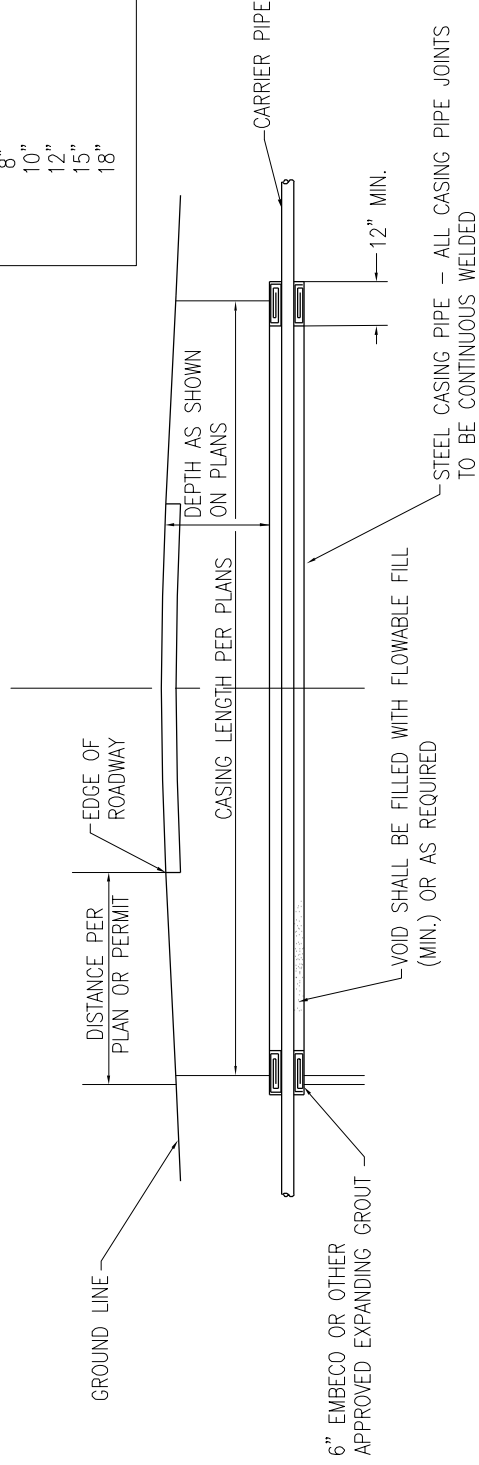




- NOTES:
1. BELL ENDS OF CARRIER PIPE SHALL NOT BE IN CONTACT W/ CASING PIPE.
 2. BULKHEAD ENDS W/ EMBECO OR OTHER APPROVED EXPANDING GROUT.
 3. THE VOID SHALL BE FILLED W/ PEASTONE AGGREGATE.

SKID DETAIL
 NO SCALE

MINIMUM CASING SIZES		
CARRIER PIPE SIZE	CASING SIZE SEWER	CASING SIZE WATER
6"	12"	14"
8"	16"	18"
10"	18"	20"
12"	20"	24"
15"	24"	
18"	30"	



TYPICAL CASING PIPE SECTION
 NO SCALE

BORE & JACK DETAILS

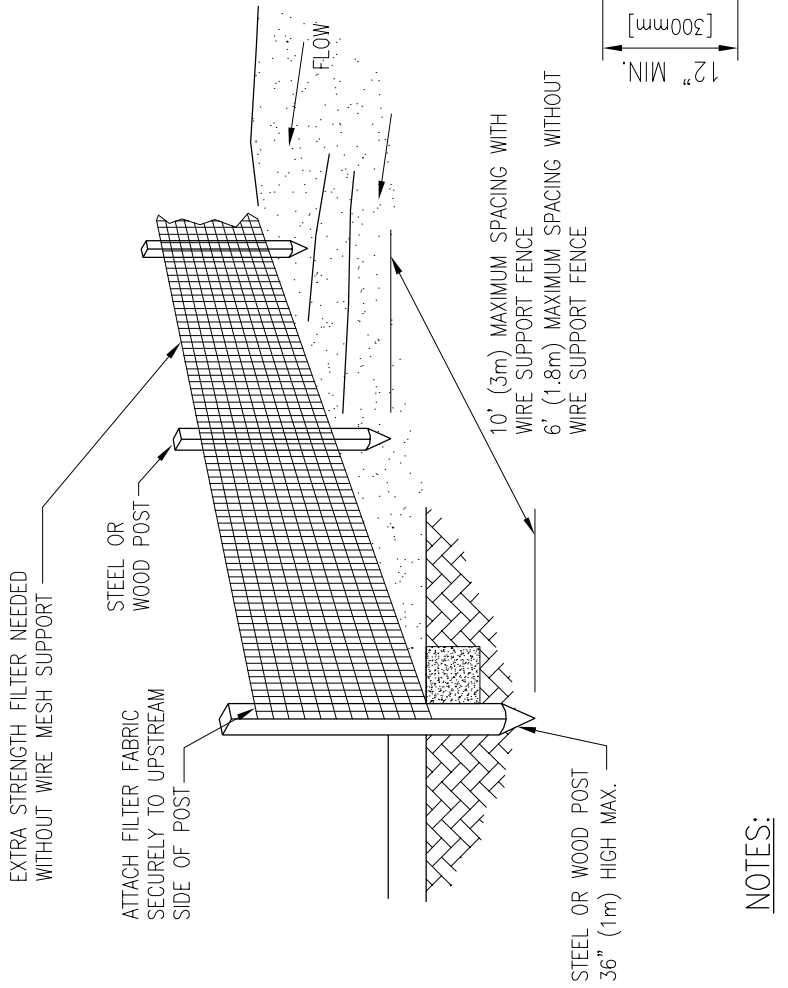
NO SCALE

**FIGURE 17.0
 BORE & JACK DETAILS**

CITY OF GAYLORD MUNICIPAL STANDARDS

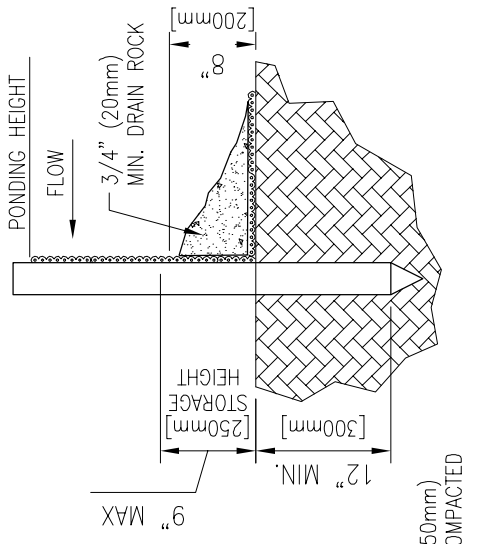
OTSEGO COUNTY, MICHIGAN





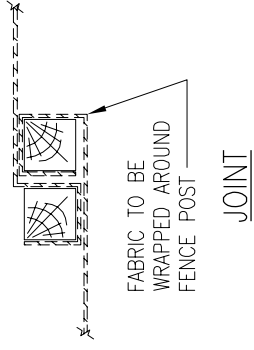
NOTES:

1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.



TRENCH DETAIL

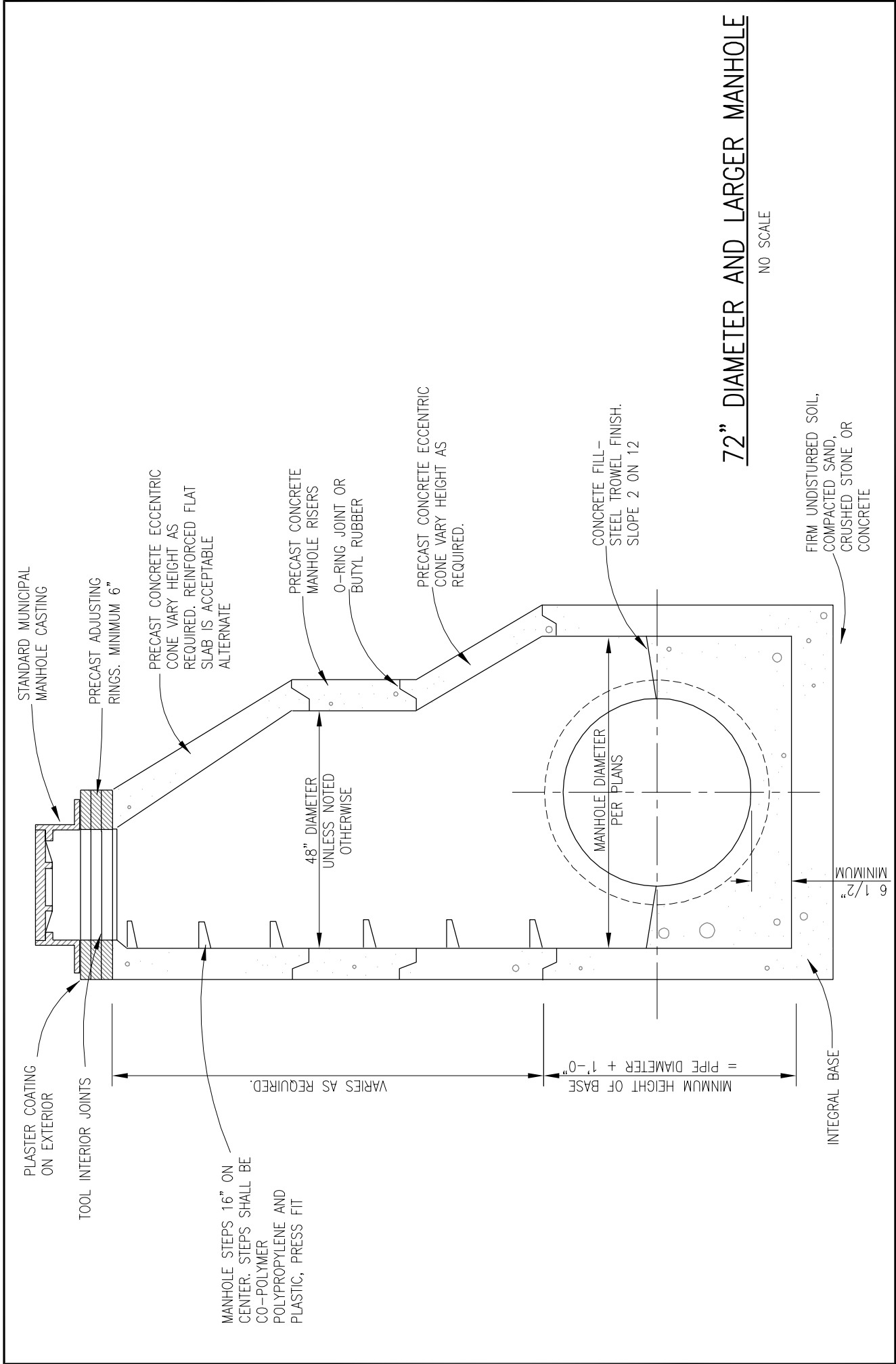
INSTALLATION WITHOUT TRENCHING



SILT FENCE DETAIL

NO SCALE

FIGURE 18.0
SILT FENCE DETAIL



72" DIAMETER AND LARGER MANHOLE

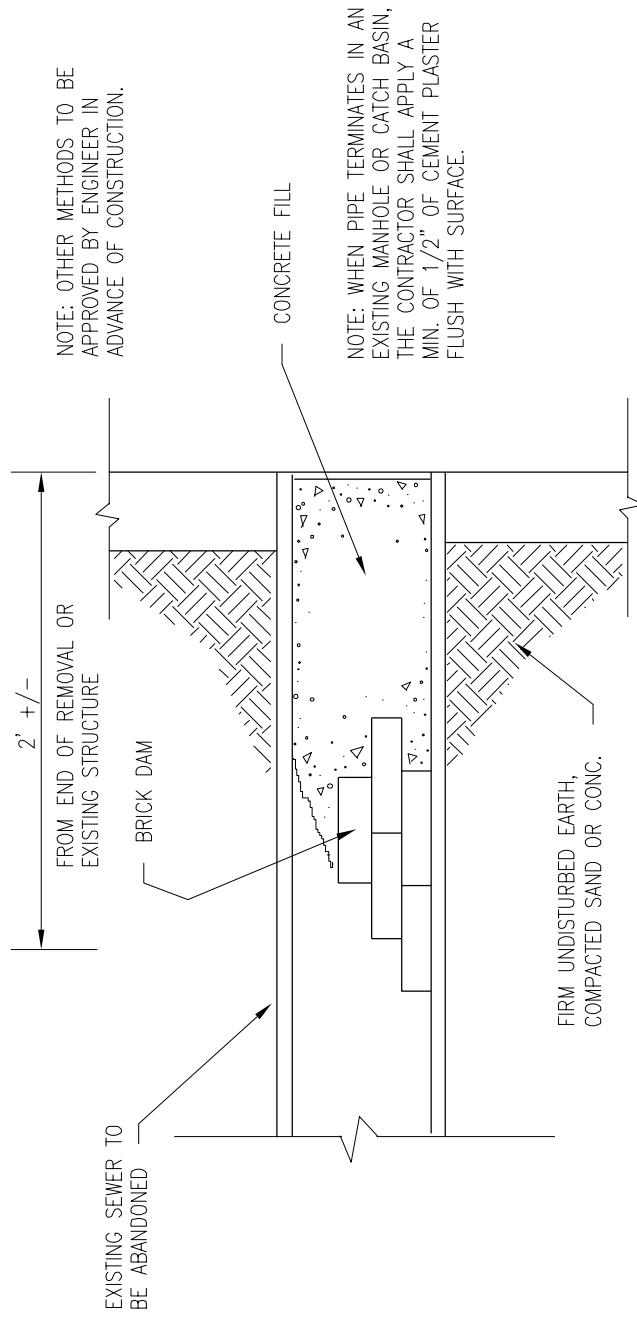
NO SCALE



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OTSEGO COUNTY, MICHIGAN

FIGURE 19.0
LARGE DIAMETER STORM MANHOLE DETAIL



BULKHEAD DETAIL FOR ABANDONED SEWERS & WATER MAIN

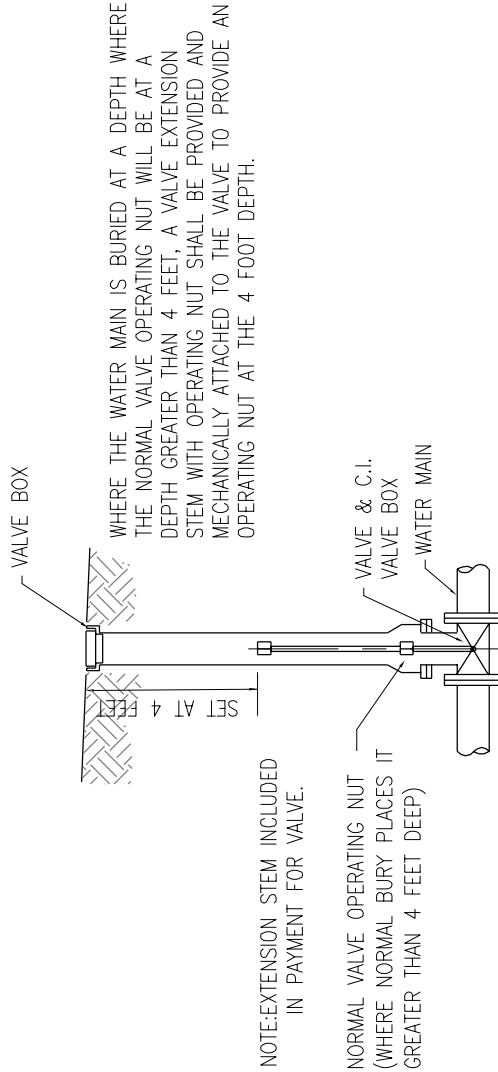
NO SCALE

**FIGURE 20.0
 BULKHEAD DETAIL**

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WATER MAIN VALVE EXTENSION STEM DETAIL

NO SCALE

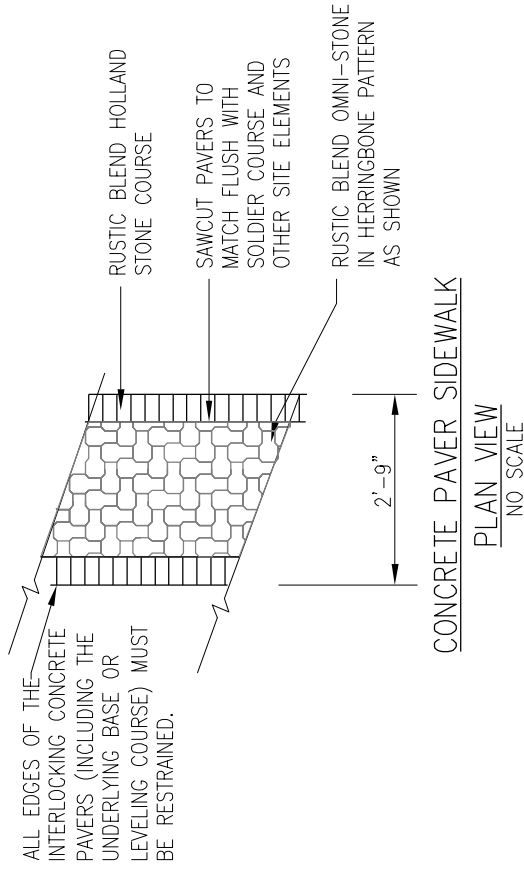
FIGURE 21.0
 WATER MAIN VALVE EXTENSION STEM DETAIL

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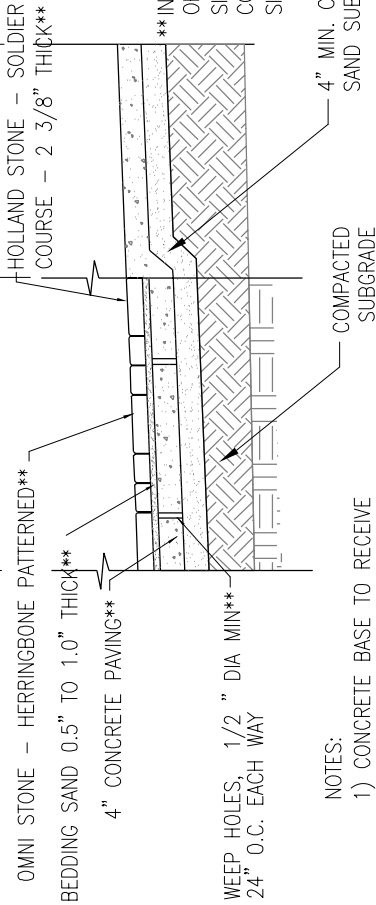
OTSEGO COUNTY, MICHIGAN



NOTE: WHERE REPLACING PAVER SIDEWALK IN EXISTING PAVER AREAS, USE 6" CIP 21AA AGGREGATE BASE TO MATCH THE SURROUNDING AREA IN LIEU OF THE CONCRETE BASE.



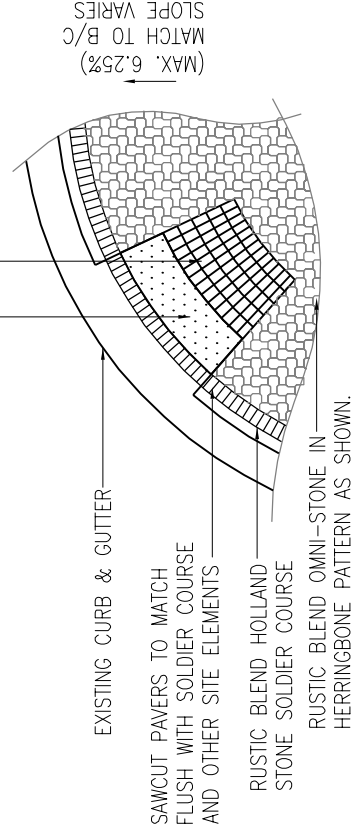
SET PAVER FINISH GRADE 1/4" MAX ABOVE CONCRETE EDGE TO ALLOW FOR SETTLEMENT. COMPACT PAVERS WITH VIBRATORY COMPACTOR.



NOTES:
 1) CONCRETE BASE TO RECEIVE BULL FLOAT FINISH.

PEDESTRIAN RAMP WITH COLOR CONTRAST AT MAX. 1:12 SLOPE TO MATCH EXISTING CURB CUTS OR AS SHOWN, CHARCOAL HOLLAND STONE OR EQUAL. FAN HOLLAND STONE PERPENDICULAR TO BACK OF CURB AND SAWCUT TO MATCH OMNI-STONE AND SOLDIER COURSE (TYP). REFER TO FIGURE 11.0 PEDESTRIAN RAMP DETAIL FOR RAMP DESIGN REQUIREMENTS.

DETECTABLE WARNING SURFACE, PER MDOT DETAIL R-28-E MUST USE EAST JORDAN IRON WORKS TRUNCATED DOME DETECTABLE WARNING PLATES (BRICK PAVER RAMPS ONLY)



INTERSECTION CONCRETE PAVER DETAIL

NO SCALE

TYPICAL CONCRETE PAVER CROSS SECTION

NO SCALE

FIGURE 22.0
 CONCRETE PAVER SIDEWALK DETAILS

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