Section 403. DRAINAGE STRUCTURES

403.01. Description. This work consists of adjusting, constructing, or temporarily lowering drainage structures and cleaning existing drainage structures and leads as directed by the Engineer.

Drainage structures include manholes, catch basins, leaching basins, inlets, and drop inlets.

Drainage Structure. Includes concrete footing or precast sump. Used for access to new or existing sewers with a diameter no greater than 48 inches.

Precast Manhole Tee and Manhole Riser. Used for access to new sewers with diameters of at least 42 inches.

Manhole Base, Type 1 or Type 2, and Manhole Riser. Used for access to new or existing sewers with a diameter of at least 48 inches. Manhole Base Type 1 may be substituted for Precast Manhole Tees.

403.02. Materials.Provide materials in accordance with the following:

Concrete, Grade S3...............................................................................701
Mortar Type R-2................................................................................702
Granular Material Class II, III.............................................................902
Steel Reinforcement...........................................................................905
Miscellaneous Metal Products.........................................................908
Castings..............................................................................................908
Culvert, Sewer Pipe, and Box Sections..............................................909
Geosynthetics.....................................................................................910
Masonry Units....................................................................................913

Provide cast-in-place or precast concrete construction for sanitary sewer manholes.

Provide structural steel plate, at least \( \frac{1}{2} \) inch thick, for temporary lowering of drainage structures that span 72 inch, or less. Ensure plates cover the entire drainage structure with a bearing surface of at least 12 inches. Submit to the Engineer, structural calculations prepared by a professional engineer, licensed in the state of Michigan, for plates that span greater than 72 inches.

Provide leveling course hot mix asphalt (HMA) for patching during the temporary lowering operations, or other HMA mixture as approved by the Engineer.
403.03. Construction.

A. **Constructing, Adjusting, and Temporary Lowering of Drainage Structures, Precast Manhole Tees, Manhole Bases, and Manhole Risers.**

1. **Excavation.** Excavate for constructing, adjusting, and temporarily lowering drainage structures, precast manhole tees, manhole bases and manhole risers in accordance with subsection 206.03.A.

2. **Concrete Construction.** Construct concrete portions of drainage structures in accordance with subsection 706.03. Do not cast drainage structures if the concrete temperature is above 90 °F.

3. **Placing Brick and Block Masonry.** Do not place masonry with mortar when the ambient air temperature is 36 °F or less unless approved by the Engineer. Remove and replace work damaged by frost. Apply a ¼-inch thick plaster coat of mortar to the outer surface of structures, and to the inner surface below the outlet flow line on catch basins with traps or sumps. Place the first set of bricks or blocks on a full bed of mortar. Lay brick or block in courses with uniform mortar joints ½ inch thick, ±¼ inch. Stagger joints by half the length of the brick or block on adjoining courses. Place courses level unless otherwise required. Strike and point joints so the exposed surface is smooth. Rake joints and wet brick or block before placing the plaster coat. Allow the brick or block surface to dry to provide for proper bonding of the plaster coat.

   Wet the brick. Allow the brick surface to dry to allow the brick and mortar to bond. Do not use broken or chipped brick on the faces of the structure. Provide a course made of headers, at least every seventh course. Make closures with brick lengths no less than the width of a whole brick.

4. **Precast Reinforced Concrete Units.** Use poured-in-place concrete, in accordance with subsection 403.03.A.2, or precast concrete footings. Construct precast reinforced concrete units in accordance with the contract. Seal the joints with mortar in accordance with subsection 403.03.A.3 or use butyl rubber sealant that conforms to ASTM C 990. Support precast concrete footings on a 6-inch subbase of compacted granular material Class II.

5. **Steel Reinforcement.** Install steel reinforcement in accordance with subsection 706.03.

6. **Inlet and Outlet Pipes.** Place and compact backfill around the manhole base or sump to provide bedding for inlet and outlet pipes.
Extend inlet and outlet pipes through the outside wall surface of the manhole a sufficient length to allow for pipe connections. Carefully construct masonry around pipes and seal with mortar to prevent leakage.

7. **Backfilling.** Backfill in accordance with subsection 401.03.D.
   
The Contractor may stage backfilling to follow the construction progress of the structure.

8. **Temporary Lowering of Drainage Structures.** Lower drainage structures before milling the pavement.
   
   Record the location of the structure so each cover can be reinstalled at its original location. Remove the existing frames and covers and match mark them for later identification and placement. Salvage and safely store frames and covers. Repair the existing structure to allow uniform contact of the steel plate to the top of the structure. Place and compact the HMA for patching in accordance with section 501.

9. **Protection During Construction.** Install appropriate inlet protection device in accordance with section 208, when working around drainage structure.

B. **Drainage Structure Covers.** Provide and install new covers, including frames and grates, on new or existing structures as required. Place castings on a full mortar bed.

C. **Adjusting Drainage Structure Covers.** Adjusting drainage structure covers applies when the new elevation of the cover requires a vertical change of no greater than 6 inches. Immediately before placing the HMA top course or overlay, make final adjustments to drainage structure covers within the HMA pavement section, if only applying one course. Adjust the cover to the required elevation by supporting it on one of the following:

   1. A metal ring adjustor,
   2. A concrete collar,
   3. Masonry in a full mortar bed, or
   4. An alternate adjustor selected from the Qualified Products List.

   Hold adjusted covers in place. Remove and replace the adjacent pavement, curb, or curb and gutter to match the existing grades or the required new elevations.

D. **Additional Depth of Adjusting Drainage Structures.** Additional depth of adjusting drainage structure covers applies when a drainage structure cover is adjusted more than 6 inches from the existing cover.
elevation due to a change in elevation of the roadway or when alterations to the drainage structure exceed 6 inches regardless of the change in cover elevation. Remove damaged or unsound portions of the structure, as directed by the Engineer, and adjust as required.

E. Drainage Structure Taps. Make connections to existing drainage structures, owned by counties, municipalities, or drain commissions, in accordance with the owner’s regulations and the contract. If a conflict exists between the owner’s regulations and these specifications, the owner’s requirements take precedence.

If tapping an existing drainage structure, cut an opening into the receiving structure at least equal to the outside diameter of the inlet pipe plus 6 inches and insert the pipe. Pack a layer of mortar at least 3 inches thick around the inlet pipe and strike smooth with the inner wall of the receiving structure. Repair or replace existing drainage structure damaged by Contractor operations during tapping at no additional cost to the Department.

Tap directly to a sewer or culvert in accordance with subsection 402.03.D.

F. Cleanout. Maintain catch basins, manholes, leaching basins, and inlets installed on the project. Ensure installed catch basins, manholes, leaching basins, and inlets are free of silt, debris, and other deleterious material at the time of final acceptance.

G. Cleaning Existing Drainage Structures and Leads. Before starting work, the Engineer will determine the condition and will identify the areas on the project that require cleaning of existing drainage structures and leads.

First, clean the downstream drainage structure nearest the trunk sewer and place a temporary bulkhead so the trunk sewer remains clear. Clean upstream drainage structures and leads only after cleaning and bulkheading the downstream drainage structure.

Clean the drainage structures, leads, or both, of sand, silt, and debris and prevent further contamination of the leads.

Dispose of the waste generated from the drainage structure or drainage structure lead cleanout operation using either Disposal Alternate A, or Disposal Alternate B, in accordance with subsection 403.03.G.1 and subsection 403.03.G.2.

If the Contractor suspects the waste generated is contaminated but non-hazardous or is hazardous, the Contractor must notify the Engineer.
Immediately notify the Engineer if testing shows the material is a hazardous waste as defined in 1994 PA 451, Part 111, Hazardous Waste Management.

1. **Disposal Alternate A.**
   a. **Solid Waste Phase.** Solid waste disposal rules require that the waste have no releasable liquids. Dispose of the solid waste at a Type II landfill. The landfill may require testing before accepting the waste. Provide disposal documentation from the Type II landfill to the Engineer.
   b. **Liquid Waste Phase.** Dispose of the liquid waste using one of the following options:
      
      Option 1 – Evaporate the liquid waste by use of drying beds, decanting stations, or similar systems that contain the solids during evaporation.
      
      Option 2 – Place liquid waste in a sanitary sewer system with the sanitary sewer owner’s approval. Provide a copy of the owner’s approval to the Engineer.
      
      Option 3 – Pump the majority of clear liquid from the drainage structure and leads without disturbing the solids. Discharge this clear liquid to:
      
      i. A sanitary sewer system with the sanitary sewer owner’s approval;
      
      ii. The curb and gutter such that it re-enters and is completely contained within the storm sewer system and does not enter the waters of the state; or
      
      iii. An area of undisturbed, well-vegetated ground at a rate that does not result in excessive ponding, runoff, or soil erosion.
      
      Dispose of the remaining solid and liquid phase as waste using Disposal Alternate A, either Option 1 or Option 2, or Disposal Alternate B.

2. **Disposal Alternate B.** Use a Licensed Liquid Industrial Waste Hauler to transport the waste generated and dispose of it in accordance with 1994 PA 451, Part 121, Liquid Industrial Waste. Provide the Engineer a copy of the transport manifest.

**403.04. Measurement and Payment.**

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Structure, __ inch dia</td>
<td>Each</td>
</tr>
<tr>
<td>Dr Structure, Add Depth of __ inch dia, 8 foot to 15 foot</td>
<td>Foot</td>
</tr>
</tbody>
</table>
Dr Structure, Add Depth of __ inch dia, more than 15 foot ........ Foot.
Drop Inlet, Type ................................................................. Each
Mh, Precast Tee, Cl __, __ inch .............................................. Each
Mh Base, __ inch, Type ......................................................... Each
Mh Riser ................................................................................. Foot
Dr Structure Cover, Type ....................................................... Each
Dr Structure Cover, Adj, Case ................................................ Each
Dr Structure, Adj, Add Depth ................................................ Foot
Dr Structure, Tap, __ inch ....................................................... Each
Dr Structure, Temp Lowering .................................................. Each
Dr Structure, Cleaning .......................................................... Each
Dr Structure Lead, Cleaning, __ inch ........................................ Foot

A. Drainage Structures Excluding Drop Inlets. The Engineer will measure the depth of drainage structures, with the exception of drop inlets, from the top of the masonry to the top of the concrete footing.

The unit price for Dr Structure, of the diameter required includes the cost of concrete footing and no greater than 8 feet of the drainage structure depth. The unit price for Dr Structure includes the cost of temporary or final grade adjustments of the structure.

The unit price for Dr Structure, Add Depth, 8 foot to 15 foot, of the diameter required includes the cost of drainage structure portions, greater than 8 feet deep, but no greater than 15 feet deep.

The unit price for Dr Structure, Add Depth, more than 15 foot, of the diameter required includes the cost of drainage structure portions greater than 15 feet deep.

The unit price for new structures includes the cost of cleaning new drainage structures.

B. Drop Inlets. The Engineer will measure drop inlets as units, of the type required, regardless of depth.

The Department will pay separately for pipe leading from the drop inlet to a sewer or catch basin. The cost of pipe from drop inlets, Type 1 is included in the unit price for related sewer pay items, in accordance with subsection 402.04. The cost of pipe from drop inlets, Type 2, is included in the unit price for the related encased sewer pay item.

The Department will pay for a sewer tap or drainage structure tap, in accordance with subsection 402.04, only if tapping the sewer or encased sewer into an existing drainage system is required.
C. **Manhole Base and Riser.** The Engineer will measure **Mh Riser** vertically from above the collar of the **Mh, Precast Tee**, or above the **Mh Base** to the top of the riser.

The unit price for **Mh Base, Type 1** includes the cost of cutting access holes in the sewer.

If the Contractor uses **Mh Base, Type 1** in place of **Mh, Precast Tee** and the contract does not include the pay item **Mh Base, Type 1**, the unit price for **Mh, Precast Tee** includes the cost of installing a Type 1 manhole base.

D. **Drainage Structure Covers.** When new covers are placed on existing structures, the Engineer will measure and the Department will pay for **Dr Structure Cover, Adj, Case __** in addition to the new cover.

The unit price for **Dr Structure Cover, Adj, Case 1** includes the cost of the following:

1. Sawcutting existing pavement, curb, and curb and gutter;
2. Adjusting the cover up or down, no greater than 6 inches; and
3. Removing and replacing pavement adjacent to the adjusted cover.

The Department will pay separately for removing and replacing curb and gutter adjacent to the adjusted structure.

The Department will only pay for **Dr Structure Cover, Adj, Case 2** for structure adjustments located outside existing pavement, curb, and curb and gutter.

The unit price for **Dr Structure Cover, Adj**, of the case required includes the cost of repairs for uniform contact of temporary steel plate to the top of structures.

The Engineer will measure **Dr Structure, Adj, Add Depth**, of the required diameter and depth, beginning 6 inches from the level of the existing structure, in the direction of adjustment, to the limit of the additional adjustment depth. If the contract includes a pay item for **Dr Structure, Adj, Add Depth**, the contract will also include a pay item for **Dr Structure Cover, Adj**, of the case required. The unit price for **Dr Structure, Adj, Add Depth** includes the cost of drainage structure taps, within the limits of the adjustment.

The Department will pay for drainage structure taps outside the limits of the adjustment as **Dr Structure, Tap**. The Department will pay for taps to existing sewers as **Sewer Tap**, of the size required, in accordance with subsection 402.04.
E. Drainage Structure, Temporary Lowering. The unit price for Drainage Structure, Temp Lowering includes the cost of the following:

1. Match marking;
2. Removing, salvaging, and transporting castings to and from site;
3. Storing the existing structure castings;
4. Plating the structure;
5. HMA patching; and
6. Removing the plate and HMA patching materials for final adjustment.

The Department will pay separately for the final adjustments to drainage structures. The unit price for Drainage Structure Cover, Adjust, Case 1 includes the cost of removing pavement to lower the structure.

The cost of repairs is included in unit price for the related drainage structure adjustment pay item.

F. Cleaning Existing Drainage Structures and Leads. The unit price for Drainage Structure, Cleaning includes the cost of testing for disposal, hauling and disposing of generated waste.

The unit price for Drainage Structure Lead, Cleaning, of the size required includes the cost of testing for disposal, hauling and disposing of generated waste.

The Department will pay separately for placing and removing temporary bulkheads.

The cost for cleaning out existing sewers, plugged by Contractor operations, is included in related pay items.

The Department will pay for disposal of contaminated material, whether non-hazardous or hazardous, in accordance with subsection 109.05.D.