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SANITARY SEWER SYSTEMS
(OAKDALE 2621)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Gravity sanitary sewer pipe.
   2. Service connections.
   3. Service pipe.
   4. Riser pipe.

B. Related Sections:
   1. Section 2451 – Trench Excavation and Backfill
   2. MnDOT 2506 – Manholes and Catch Basins

C. Method of Measurement:
   1. Sewer pipe:
      a. Measure by distance in linear feet.
      b. Measure from manhole centers with no deduction for fittings.
      c. Measure along longitudinal axis from manhole centers with no deduction for fittings.
      d. Measure each pipe size, class, and depth zone separately.
      e. Includes removal and disposal of existing pipe, maintenance of existing sewer service during construction and televising completed Work.
   2. Spot Repairs (wye replacement):
      a. Measure by distance in linear feet for pipe acceptably removed and replaced.
      b. Minimum length measurement will be 5 feet.
      c. Includes excavation, backfill, removal of existing pipe, connections to existing pipe, connections, wyes, adapters, televising completed Work, and all other necessary equipment, labor and materials.
      d. Existing pipe damaged by Contractor will not be measured and will be replaced by Contractor.
   3. Manhole connections:
      a. Measure connections to an existing manhole as a unit.
      b. Units include core drilling of manhole wall and base, and construction of a new invert.
   4. Cut-In Wye:
      a. Measure each service wye connection made to the main as a unit.
      b. Includes all labor, equipment, and materials.
   5. Service connections: Measure fittings of each size and type as a unit.
   6. Connect to Existing Service:
      a. Measure as a unit.
      b. Includes all labor, equipment and materials.
   7. Service pipe:
      a. Measure by distance in linear feet of each size.

b. Measure horizontally from end of riser fitting to end of pipe.
8. Riser pipe:
   a. Measure by distance in linear feet for each size.
   b. Measure vertically from end of service wye connection fitting to end of riser fitting.
9. Construct bend on inside service drop:
   a. Measure as a unit.
   b. Includes furnishing & installing a bend to the end of existing sanitary service drop inside manhole.

D. Basis of Payment:
1. Payment for acceptable quantities of sanitary sewer items shall be at the Contract Unit Price as listed on the Bid Form.
2. All associated Work items shall be considered incidental.
3. Maintaining sanitary sewer service during construction shall be considered incidental.

1.02 REFERENCES

A. ASTM:
1. D2321 – Recommended Practice for Installation of Flexible Thermo-plastic Sewer Pipe
2. D3034 – Specification for PVC Sewer Pipe and Fittings
3. F477 – Elastomeric Seals for Joining Plastic Pipe

1.03 SUBMITTALS

A. Quality Assurance/ Control Submittals:
1. Submit Certificates of Compliance from manufacturers certifying that materials meet reference specifications listed in Article 1.02.
2. Submit record of service connections weekly to Engineer.

1.04 HANDLING & DELIVERY OF MATERIALS

A. Inspect pipe and materials during unloading process and notify Engineer of cracked, flawed or otherwise defective material.

B. Remove all materials found to be unsatisfactory by Engineer from the site.

1.05 STAKING

A. Engineer shall provide necessary staking for all Work under this section.

1.06 MAINTAINING SEWER SYSTEM

A. Maintain flow in sanitary sewers on continuous basis while construction is underway.

B. Plug sewers with inflatable plug. Provide pumps, portable generators, hoses, and related items appurtenant to the Work.

C. Sewer service lines to individual users may be disconnected for a period not to exceed 4 hours. Notify users prior to service disconnects.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Provide the following:

Material	Class	Joint
PVC	SDR 26 (Services) & SDR 35 (Main) ASTM D3034 ASTM F477	Elastomeric Gasket

B. Provide pipe fittings of each material type from same manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Line and Grade: Provide means for accurately transferring line and grade from ground surface stakes to working point in trench. Conform to lines, elevations and grades shown on Drawings.

B. Existing Pipe:
   1. Remove and dispose of existing pipe.

C. Water Stops: Provide in manholes as required to prevent infiltration into system.

3.02 CONSTRUCTION REQUIREMENTS

A. Pipe Installation:
   1. Comply with ASTM D2321 for PVC installation.
   2. Inspect pipe for defects and cracks while suspended before lowering into trench.
   3. Place pipe bell at upstream end of pipe length.
   4. Install pipe from lower to higher invert elevation.
   5. Place plug in end of incomplete piping at end of day and when Work stops.
   6. Provide watertight plugs at future connection plugs.
   7. When water is present in trench, seals are to remain in-place while trench is pumped completely dry.
   8. See Section 2451 for pipe foundation and backfill.
   9. Televise and provide a color DVD of completed Work to Owner.

B. Manhole Installation:
   1. Place precast manhole base on compacted granular subgrade.
   2. Install manhole in accordance with the plan details.
   3. Locate steps within 1 inch of vertical alignment and within 1 inch of required vertical spacing.
   4. Provide monolithic base for drop manholes.

C. Service Connections:
   1. Install at locations as directed.
   2. Place fitting branches at a 15-degree to 45-degree angle above horizontal.
   3. Cut in wyes with approved adapters as directed by Engineer.

D. Connect to Existing Manhole:
   1. Core drill hole for new pipe in existing manhole.
   2. Patch wall to make a watertight connection.
   3. Reconstruct existing invert.

E. Service Pipe:
   1. Extend pipe to right-of-way line as directed on the plans.
   2. Install pipe at minimum 1 percent to maximum 2 percent grade.
   3. Connect to existing service pipe with adapters as approved by Engineer.
   4. Place gasketed plug at end of pipe.
   5. Mark end of service with a 4-inch by 4-inch by 8-foot timber set 4 feet below grade.
   6. Maintain a record of each service connection as follows to be submitted to Engineer at the end of each week:
      a. Type of service connection.
      b. Distance from downstream manhole.
      c. Length of riser.

F. Pipe Spot Repairs:
   1. Locate, excavate and remove existing deteriorated pipe segment by cutting existing pipe.
   2. Bypass existing flow, if necessary.
   3. Replace pipe segment with PVC sewer pipe.
   4. Provide all necessary wyes, connectors and adapters and connect to existing pipe and services.
   5. Backfill excavated area.
   6. Televise and provide a color DVD of completed Work to Owner.

G. Riser Pipe:
   1. Extend riser from service connection at 45-degree angle above horizontal to a point 11 feet below street grade.
   2. Install riser pipe against undisturbed trench wall.
   3. Place concrete collar around service connection as shown on Drawings.

3.03 FIELD QUALITY CONTROL

A. Remove all dirt and foreign material from pipe interior prior to testing.

B. Gravity Sewer Pipe;
   1. Pipe diameter 27 inches and smaller: Air test.
   2. Pipe diameter larger than 27 inches: Infiltration test.

C. Perform the following tests upon completion of sewer construction and prior to any external plumbing connections:
   1. Infiltration test:
      a. Manholes shall be watertight, with no leakage permitted.
      b. Place 90-degree V-notch weirs in locations directed by Engineer to measure leakage in sewer lines.
      c. Allowable leakage rate shall be 100 gallons/day/inch diameter/mile of sewer between any adjacent manholes.
      d. Provide corrective measures for lines exceeding the allowable leakage rate.

2. Air test:
    a. Place inflatable sewer stoppers in manhole at each end of reach to be tested.
    b. Connect 1 end of an air hose to plug used for air inlet.
    c. Connect other end of hose to potable air control equipment
    d. This equipment consists of valves and pressure gages used to control the rate of air flows to the test section and to monitor air pressure inside the pipe.
    e. Connect an air hose between compressor (or other source of compressed air) and control equipment.
    f. Add air to pipe section. Monitor air pressure so pressure inside pipe does not exceed 5.0 psig.
    g. When pressure reaches 4.0 psig, stop air supply so internal pressure is maintained for 2 minutes.
    h. These 2 minutes allow time for air temperature to come to equilibrium with the pipe walls.
    i. During this time check plugs with soap solution to detect any plug leakage. If plugs are found to leak, bleed off air, tighten plugs, and begin again by supplying air.
    j. After temperature has been allowed to stabilize for 2 minutes, disconnect air supply and allow pressure to decrease to 3.5 psig.
    k. At 3.5 psig, start stopwatch to determine time required for pressure to drop to 2.5 psig.
    l. Provide corrective measures for any line not meeting requirements.
    m. Test results are usually better if sewer pipe walls are damp at time of testing.
    n. Time shall be equal or greater that the allowable time shown in table at end of this Section.
3. Deflection Test:
    a. Perform on PVC pipe at least 30 days after trench backfill has been placed.
    b. Perform test by pulling a mandrel through each line between manholes without aid of mechanical pulling devices.
    c. Mandrel diameter: 95 percent of nominal pipe size.
    d. The line will be considered acceptable if mandrel can progress through line without binding.
    e. Provide corrective measures for lines not meeting these requirements.

3.04 RECORDS

A. Maintain a record of each service connection as follows:
    1. Type of service connection.
    2. Distance from downstream manhole.
    3. Length of riser.

B. Furnish the record to Engineer at the end of the Work.

Time Required for a 0.5 PSIG Pressure Drop for Size and Length of Pipe Indicated

1 Pipe Diameter (inches)	2 Minimum Time (minutes: seconds)	3 Length For Minimum Time (feet)	4 Time For Longer Length (seconds)	Specified Minimum for Length (L) Shown (minutes:seconds)							
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	20:14	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	23:07	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09