

TECHNICAL SPECIFICATIONS

DIVISION G – GENERAL REQUIREMENTS

SECTION 01390

CONSTRUCTION SURVEY STAKING BY ENGINEER

PART 1 - GENERAL

1.01 SCOPE:

- A. The work covered by this Section of the Project Manual shall include furnishing all horizontal alignment and vertical elevations by the Engineer necessary to complete the installation of manholes, sanitary sewer, storm sewer, water main and street paving.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Storm Sewer: Section 02571.
- B. Plastic Pipe: Section 15064.
- C. Plastic Pipe: Section 15065.
- D. Precast Concrete Manholes: Section 03440.

PART 2 - PRODUCTS - None

PART 3 - EXECUTION

3.01 STAKING:

- A. The Contractor shall notify the Engineer of all staking needs a minimum of one (1) week prior to the start of construction.
- B. For street paving, a centerline stake at 100 foot intervals will be set for rough grading when the finish grade differs more than 2 feet from existing ground. Offset line and grade stakes will be set at 25 foot intervals on each side of the specified street paving or back of curb width.
- C. For the storm sewers, the Engineer will set line and grade stakes on an offset line for the laser beam method of construction consisting of two (2) line stakes and one (1) grade stake at each structure. The Contractor shall make his own arrangements with the Engineer for any additional staking.

- D. For sanitary sewer, the Engineer will set line and grade stakes for the laser beam method of construction consisting of two (2) line stakes and two (2) grade stakes at each manhole. The Contractor shall make his own arrangements with the Engineer for any additional staking.
- E. For water main, the location for fire hydrants and bends will be staked. The depth will only be staked when vertical clearance with other utilities is critical and the finished street surface elevation has not been staked.
- F. The Contractor shall protect the stakes from unnecessary disturbance until permission is given to remove same. Replacement of stakes which have been negligently damaged or removed by the Contractor shall be made by the Engineer and the cost of said replacement paid for by the Contractor.
- G. It shall be the Contractor's responsibility to periodically check the stakes for accuracy of alignment and grade as construction proceeds.
- H. The cost of initial construction staking as described in this section will be paid for by the Owner. Additional staking or replacement of stakes negligently damaged or removed by the Contractor will be the Contractor's responsibility.
- I. Additional staking not described above shall be the Contractor's responsibility and expense.

* * * END OF SECTION * * *

SECTION 01500

COORDINATION OF SPECIFICATIONS, PLANS,
AND SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE:

- A. In case of discrepancy between various items included in the Contract Documents, the items shall prevail, or govern, in the following order:
1. Change Orders
 2. Addenda
 3. Proposal and Contract form
 4. Plans, including all plan notes
 5. Technical Specifications/Special Provisions
 6. Supplementary Conditions
 7. General Conditions
 8. LTAP Local Road Specifications for the State of Minnesota
 9. Minnesota Department of Transportation Standard Specifications for Construction.

* * * END OF SECTION * * *

DIVISION M - MECHANICAL

(Water Main and Sanitary Sewer)

SUMMARY OF PRODUCTS

PART 1 - GENERAL

1.01 CONDITIONS OF THE CONTRACT:

- A. The water main shall be constructed in accordance with the Standard Utilities Specifications for Water Main and Service Line Installation and Sanitary Sewer and Storm Sewer Installation by the City Engineers Association of Minnesota.
- B. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS are hereby made part of this Section.
- C. This Section provides a brief overview of the products specified in DIVISION M - MECHANICAL. Refer to the individual Sections for complete product and installation specifications.

PART 2 - PRODUCTS

2.01 WATER MAIN & SERVICE PRODUCTS COVERED BY THIS SECTION:

- A. Water Main: PVC Pipe AWWA C900 DR-Pressure Class PVC pipe shall be DR 18 (Class 235) with elastomeric gasket joints. Ductile Iron Pipe (DIP) shall be class 52 as per AWWA C151.
- B. Fittings: Ductile Iron Mechanical Joint, AWWA C110/ANSI 21.10, Class 250, Mechanical Joint; or AWWA C153/ANSI A21.53, Class 350. All mechanical joints shall be epoxy coated, restrained and thrust blocked. All mechanical joints shall use Core Blue "T" Bolts and Mega Lug (or equal) restrainers. **All ductile iron fittings shall be epoxy coated and have 6 oz. Zinc Anode Caps on all bolts for corrosion protection.**
- C. Tracer Wire: No. 12 copper clad steel, fully annealed, high carbon 1055 grade steel, HS-CCS, conductivity of 21%, with 30 mil HDPE insulation, rated for direct bury use at 30 volts and break load of 452 lbs. Tracer wire access box by Copperhead.
- D. Joint Restraints: DIP - Megalug, Series 1100 as manufactured by EBAA Iron Sales, Inc., Grip Ring as manufactured by Romac Industries, or approved equal. PVC - Megulug, Series 2000 as manufactured by EBAA Iron Sales, Inc., Grip Ring as manufactured by Romac Industries, or approved equal.
- E. Gate Valves: Valves may be Mueller Resilient Seat Gate Valves as manufactured by Mueller Co., Decatur, Illinois or American AVK, Series 65 Resilient Seated Gate Valve as manufactured by American AVK Co., Fresno, CA or Clow

Resilient Wedge Valves as manufactured by Clow Corporation, Oskaloosa, Iowa or approved equal. Valves shall comply with all applicable parts of AWWA C509 or AWWA C515, constructed of ductile iron materials. Stem shall be stainless steel.

- F. Valve Box: Tyler 666-S, Mueller Cat. No. H-10360, Buffalo type or equal, 5-1/4 inch shaft, two piece, screw type (incidental to Valve), with self-centering valve box adapter (Adapter II). No Valve Stem Extensions shall be provided.
- G. Fire Hydrant: American Darling B-84-B-5, 8' Bury depth.
- H. Pipe Coupling: Center Sleeve shall be steel pipe or tubing conforming to ASTM A53, A512 or formed carbon steel with a minimum yield of 30,000 psi. End Ring shall be ductile iron conforming to ASTM A536 or steel meeting or exceeding ASTM A576, grade 1010-1020. Gaskets shall be new rubber compounded for water service and resistant to permanent set. Bolts and nuts shall be high strength, low alloy corrosion resistant steel.
- I. Curb Stop and Box: Ford B44-444M or McDonald 76104Q, 1" (inside diameter), Minneapolis pattern. McDonald 5614 Minneapolis pattern base, length 7', size 1 1/4". Compression fittings only.
- J. Stationary Rod: None
- K. Corp Stop: FB1000-4 or McDonald 74701B-22 (1" inside diameters). **Compression fittings only.**
- L. Service Line: 1" (inside diameter) SDR-9 Municipex pipe (no splices) with stiffeners at corp. & curb stop connections. No 12 HS-CCS **30 mil** Tracer wire for all service pipe.
- M. Saddles: Ford FC202 or McDonald 3825 #2 x 1" for C900 pipe.
- N. Stainless Steel Stiffeners (for service lines): McDonald 6136.
- O. Pipe Bedding: Class B(b) of ASCE Manual No. 37, 1969, and bedding materials equal to Class II of ASTM D2321. Class II bedding materials – coarse sands and gravels with maximum particle size of 1-1/2 inches (Incidental to Pipe).
- P. Transition Coupling: long sleeve restrained coupling with an epoxy coated ductile iron body with stainless steel nuts and bolts.
- Q. Service Splice Kit: Lateral Splice Kit: Copperhead 3WB-01. Splice Kit: Copperhead LSC1230C.

- R. Sanitary Tracer Wire Terminal Box: Copperhead Snake Pit Lite Duty Adjustable LD14G2T-ADJ-SW or Copperhead Snake Pit Concrete/Driveway Access Point CD14G2T-SW with SnakePit Two-terminal Switchable Lid SP-SWLID-G2. Contractor shall determine appropriate box for the field situation in each case.
- S. Water Tracer Wire Terminal Box: Copperhead Snake Pit Lite Duty Adjustable LD14B2T-ADJ-SW or Copperhead Snake Pit Concrete/Driveway Access Point CD14B2T-SW with SnakePit Two-terminal Switchable Lid SP-SWLID-B2. Contractor shall determine appropriate box for the field situation in each case.

2.02 SANITARY SEWER PRODUCTS COVERED BY THIS SECTION

- A. Sanitary Sewer Main and Service Line: PVC pipe and fittings shall meet requirement of ASTM D3034, minimum pipe nominal diameter ratio to wall thickness (SDR) of 26.
- B. Service Wyes: Heavy Wall, conform to ASTM F1336.
- C. Sanitary Manhole Base: **Crushed Stone** with the following gradation (Incidental to Manhole):

<u>Sieve</u>	<u>Percent Passing</u>
1-1/2"	100%
1"	95 to 100%
1/2"	25 to 60%.
No. 4	0 to 10%
No. 8	0 to 5%

- D. Sanitary Sewer & Water Manhole Castings: Neenah R-1668 or R-1733 machined, non-vented, non-rocking cover, or approved equal. Water manhole shall have the word "WATER" on the lid. Sanitary Sewer manhole shall have the word "SEWER" on the lid. **All castings (new or existing) within the project area shall have an external chimney seal installed as supplied by Cretex or an approved equal.**
- E. Tracer Wire: No. 12 solid single strand **45 mil** with HMWPE jacket.

* * * END OF SECTION * * *

SECTION 02221

TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 GENERAL:

- A. Work included in this Section involves the trenching (open trench), laying of pipe, backfilling, compacting, disposition of excess excavated material, sedimentation and siltation control, and clean-up.

1.02 QUALITY ASSURANCE:

- A. When requested by the Engineer, the Contractor shall excavate and expose the pipe previously laid at any point.

1.02 PAYMENT:

- A. Trenching, backfilling and compacting, disposition of excess excavated material, sedimentation and siltation control, and clean-up are considered incidental Work with no separate measurement and payment to be made.

PART 2 - PRODUCTS

2.01 TRENCHING METHODS:

- A. Open trenching shall be done with a ladder or wheel type trencher where possible. The use of other type equipment such as a backhoe or excavator will be permitted for 6" and larger diameter pipe when conditions permit or necessitate and by authorization from the Engineer or Resident Project Representative.
- B. Trenching work shall include the removal, handling, and disposal of all materials so removed and shall further include:
 - 1. Stripping of the trench and other areas, including trees, stumps, brush, debris, and roots within the construction limits.
 - 2. Removal of pavement as required.
 - 3. Removal of debris and structures or portions thereof.
 - 4. Sheet piling, shoring, bracing, and protection of adjacent property, trees and structures.

5. Protection or repair/replacement (if required) of existing pipelines, electric lines, buried telephone cables, drains, field drain tiles, conduits, culverts, sewers, poles, road signs, overhead utilities, fences, etc.
6. Removal of rocks encountered greater than twelve (12) inches in diameter.
7. Preparation of subgrades, pipe embedment, backfilling, and disposal of excess excavation and other materials.
8. Assurance that pipe is being installed at proper depth and debris is not entering pipe whenever groundwater is encountered.

2.02 DEWATERING:

- A. Do all work in dry conditions; do not install pipes on excessively wet soil.
- B. Submit dewatering and bypass pumping methods to Engineer/Owner for review.
- C. Install dewatering system approximate for the soil conditions.
- D. Maintain water levels sufficiently below the bottom of trench excavation to prevent upward seepage.
- E. Provide for handling water encountered during construction.
 1. Prevent surface water from flowing into excavation. Remove water as it accumulates.
 2. Avoid using sanitary sewers for disposal of ground water. Some ground water flow into the sanitary sewer is expected. Discharging water into storm sewers requires Engineer's/Owner's approval. Do not discharge sanitary sewer water into the storm sewer system.
 3. Do not discharge water onto adjacent property without property owner's approval.
- F. Backfill pipes prior to stopping dewatering operations.
- G. All dewatering shall be incidental if a bid item is not provided.
- H. Dewatering discharge shall be filtered and treated according to MPCA Standards as required in the project SWPPP permit.
- I. Special Rock bedding placed due to inadequate dewatering will not be reimbursed for payment.

PART 3 - EXECUTION

3.01 TRENCHING:

A. Open Trenching:

1. Place excavated material suitable for backfilling in an orderly manner sufficiently away from banks of excavation to avoid overloading and prevent slides or cave-ins.
 - a. Keep banks as nearly vertical as practicable while complying with all safety requirements.
 - b. Assure that all shoring and sheeting required complies with applicable local, state, and federal regulations.
2. Trenches shall be of sufficient width to provide ample room for workmen engaged in the handling of pipe and making the joints. Trench shall not be wider than 12 inches on either side of pipe.
3. Minimum pipe cover for water main shall be:
 - a. Eighty-four (84) inches for all pipe except as modified below as measured from original ground level to nearest surface of pipe.
 - b. Where the pipe elevation is determined by minimum depth only, excavation at all points shall be of sufficient depths to properly grade the pipe on tangents and vertical curves dictated by the minimum bending radius of the pipe recommended by the manufacturer.
4. Accurately grade trench bottom to provide uniform bearing and support for each pipe section.
 - a. Backfill unauthorized over depth excavation to the proper grade with tamped backfill.
 - b. Protect trench bottom from frost and freezing.
5. The Contractor shall excavate under existing utilities as required to maintain or exceed minimum cover.

3.02 LAYING OF PIPE - OPEN TRENCH:

A. General:

1. Only competent and experienced individuals at laying pipe shall be employed on this phase of work. Any incompetent individuals or work observed by the Engineer shall be replaced at his request.
2. Perform dewatering operations as required.
3. Remove all unsuitable bedding material.
4. All material including pipe, fittings, valves, etc., shall be placed with care. Under no circumstances shall material be dumped or dropped into the trench.
5. Pipe shall be thoroughly cleaned of all foreign material before lowering into the trench and shall be kept clean during all laying operations.
6. Pipe shall lay on suitable soil at every point along its length.

B. Installation:

1. See appropriate pipe section of Specifications.

3.03 BACKFILLING AND COMPACTING - OPEN TRENCH:

A. General:

1. All backfilling shall be carefully done in a manner that will not harm the pipe and be satisfactory to the Engineer.
2. Backfilling in yards or any landscaped area shall be done with rubber tired equipment.

B. Initial Backfill of Pipe:

1. Placing of initial backfill shall be done by hand or a mechanical method approved by the Engineer.
 - a. The method selected and approved shall be such that material is not dropped from the top of the trench.
 - b. Deposit selected earth or sand at the sides of the pipe and to a depth of not less than twelve (12) inches above the top of the pipe.
2. Backfill material to be utilized for mechanical methods shall contain no stones which may damage the pipe and shall be free from large clods and frozen material.

C. Final Backfill and Compaction of Trenches:

1. Backfilling and compacting shall be completed immediately after placement of the pipe.
 - a. Backfill shall be free from boulders, frozen clods, large roots, excessive sod or other vegetation.
 - b. The backfill material shall be placed in such a manner that it is not dropped from the top of trench onto the unprotected pipe.
 - c. Hand tamp backfill under and around pipes to 6 inches above top of pipe in lifts not exceeding 4 inch loose thickness.
 - d. Do not disturb joint alignment or grade of pipe during backfill operation.
 - e. Continue backfill and compaction process in 6 inch lifts.
 - f. Backfill and compact remaining trench. Moisten, aerate or dry backfill material and tamp as required to assure no backfill settlement in trenches under paved or graveled surfaces or other areas subject to vehicular traffic. Backfill settlement in trenches under sodded areas shall not exceed 2 percent of the trench depth.
 - (1) Where backfill settlement exceeding these specification requirements occurs during the contract guarantee periods, the Contractor shall remove street surfaces, remove and replace backfill material, and replace street surfaces as required to meet the requirements of this specification section.
 - (2) Corrective work required shall be performed at the Contractor's expense.
 - g. Standard soil density tests may be run at all installations. **Backfill shall be compacted to a minimum of 95% of Standard Proctor Density and a minimum of 98 percent of Standard Proctor Density as determined by ASTM D698 for the top foot where the trench is beneath a street, driveway, parking lot, sidewalk or other traveled surface. Moisture content shall be -4% to -1% of optimum. A minimum density of 95 percent of Standard Proctor (ASTM 698) shall be provided beneath grassed or untraveled areas. Moisture content shall be -4% to -1% of optimum.**

- (1) All tests that initially meet the specifications shall be paid for by the **Contractor**.
 - (2) All tests that fail to meet the specifications and all subsequent retesting costs including additional engineering costs shall be paid for by the Contractor.
 - (3) Contractor shall be responsible for scheduling the work, notifying the testing laboratory and engineer, and allowing adequate time for all tests.
 - (4) Tests shall be taken during the compaction process, not in a single trip and not pot holed.
- h. Conduct backfill operations so that no more than 100 feet of trench will be left open at any one time.
 - i. Remove and dispose of excess or unsuitable backfill material, at no expense to the Owner.
2. Gravel and paved surfaces disturbed shall be replaced or repaired immediately upon completion of the Work.

3.04 CLEAN-UP:

A. Initial Clean-Up:

1. The accomplishment of initial clean-up by the Contractor shall be made daily and shall be considered as a factor of prime importance in the completion of the project.
 - a. The backfill requirements shall be strictly adhered to as specified herein.
 - b. Any excavated material not meeting the backfill provisions as herein specified and/or inconsistent with surrounding surface material shall be removed from the site at no expense to the Owner.
2. Initial clean-up must be completed as a prerequisite to Substantial Completion. **Prior to the end of day's construction, remove and sweep any trench backfill material that is on existing paved streets, incidental.**

B. Final Clean-Up:

1. Final clean-up and seeding shall be completed prior to final inspection and final acceptance and shall include as a minimum:
 - a. Restoration of the specified mounds should backfill settlement occur between initial and final clean-up.
 - b. At least two (2) passes with a small tandem disk followed by a thorough dragging in uncultivated areas such as public right-of-way (road ditches) and pasture ground.
 - c. All 2" and larger rock at the surface and all other materials not consistent with the surrounding ground surface shall be stockpiled and removed by the Contractor.
 - d. All backfill around structures and through maintained yards/lawns shall be left in such a manner that the land owner may re-establish his yard or lawn.
2. The Contractor shall notify the Engineer of his request for final inspection for the project or part of the project if so sectionalized by the Engineer.
 - a. The Engineer, Owner, Contractor, and a representative of any applicable governing agency shall be present for the inspection.
 - b. The Engineer shall have the authorization for the on-sight acceptance of the Contractor's clean-up.
 - c. Any expense involved on the part of the Engineer to make return inspections due to the Contractor's presenting the project in a known unacceptable manner shall be compensated for by the Contractor prior to final payment.
3. Final repair of backfill settlement shall be accomplished prior to the end of the warranty period.
 - a. Backfill shall be allowed to settle over one growing season prior to final repair.
 - b. The Contractor shall begin final repair not less than 20 calendar days following the Owner's notification that job conditions are ready for final repair, and shall complete final repair not more than 30 calendar days after beginning.

- c. If the Contractor is unable to mobilize sufficient equipment to the site to accomplish the work in a timely manner, the Owner may notify the Contractor of Owner's intent to complete final repair. If the Contractor does not respond with additional equipment within 7 days, the Owner may proceed with final repair and bill the costs thereof to the Contractor and/or Bonding Company.

* * * END OF SECTION * * *

SECTION 03440

PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.01 GENERAL:

- A. Related requirements specified elsewhere:
 - 1. Shop Drawings, Project Data and Samples: Section 01340.
 - 2. Trenching, Backfilling and Compacting: Section 02221.
 - 3. Plastic Pipe: Section 15064. (water main)
 - 4. Plastic Pipe: Section 15065. (sanitary sewer)

PART 2 - PRODUCTS

2.01 MANHOLE SECTIONS:

- A. Precast reinforced concrete risers, tops, and adjustment rings, ASTM C478, minimum diameter 48 inches and eccentric cone tops unless otherwise noted on the Drawings.

2.02 RING AND COVER:

- A. Neenah R-1668 or R-1733 machined, non-vented, non-rocking cover, or approved equal. Water manhole shall have the word "WATER" on the lid. Sanitary Sewer manhole shall have the word "SEWER" on the lid.
- B. Provide and install Cretex external chimney seal on all project castings.

2.03 STEPS:

- A. Polypropylene plastic with ½" Grade 60 steel core reinforcement.

PART 3 - EXECUTION

3.01 INVERT CONSTRUCTION OPTIONS:

- A. Half-tile laid in concrete of manhole base.

- B. Lay full tile through manhole, pour base, allow concrete to set and break or saw out top half of tile.
- C. Hand form smooth semi-circular invert of same size as pipe in concrete manhole base. Carry edge to at least level with the top of pipe.
- D. Regardless of the invert construction option used, all water shall freely drain from the manhole.

3.02 BASE CONSTRUCTION:

- A. Bases may be poured-in-place or integral with bottom manhole section. Groundwater shall be kept below bottom of base for 24 hours following pouring of base. Base to be minimum of 6 inches in thickness - diameter of poured-in-place shall be 12 inches greater than barrel O.D.
- B. Where soil conditions are not adequate to support the manhole without settlement, the unsuitable soils shall be over-excavated and replaced with compacted granular or rock fill material on which the bases shall be constructed.

3.03 CHANGES IN FLOW DIRECTION:

- A. Make smooth, semi-circular curve of as large a radius as practical.

3.04 JOINT CONSTRUCTION:

- A. Construct joints between precast concrete manhole wall sections with Tylox rubber gaskets, Ram-Nek plastic gaskets or waterproofing mastic to insure a watertight joint. Additional joint material or gaskets may be required to produce a watertight manhole.
- B. Manhole section lifting holes/inserts shall not extend through walls of manhole section.
- C. Completely fill manhole section lifting holes to achieve watertight construction.

3.05 PIPE CONNECTION TO MANHOLE:

- A. Install flexible, watertight connection for joining pipe to manhole as specified.

3.06 ADJUSTMENT RINGS:

- A. Finish manholes below frame and cover with **8 inches of removable polybutylene** rings to facilitate future adjustment.

- B. Caulk to secure polybutylene rings and frame in place.

3.07 EXTERIOR WATERPROOFING

- A. Thoroughly coat exterior surfaces of sanitary sewer manholes with two coats of a heavy bodied tar or bituminous paint including all pores, chips and voids to prevent manhole section from moisture penetration.
- B. Provide and install Cretex external chimney seal on all project castings (new and existing).

* * * END OF SECTION * * *

SECTION 15042-S

TESTING

(Leakage Testing for Sanitary Sewer)

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. This Section includes all labor, materials, equipment and related services necessary to pressure test the installed pipe, fittings and appurtenances.

1.02 SUBMITTALS:

- A. Prior to testing the system, the proposed procedures shall be submitted for review and acceptance by the Engineer.

1.03 PAYMENT:

- A. The requirements of this Section are considered incidental to the Work with no separate measurement or payment to be made.

1.04 TESTING:

- A. Contractor shall furnish all required test equipment and conduct tests.
- B. Testing shall be observed by the Engineer. Contractor shall notify Engineer 48 hours in advance of conducting tests.
- C. Corrective work required shall be performed at the Contractor's expense.
- D. Contractor shall perform tests until satisfactory results are obtained.

PART 2 - PRODUCTS

- A. The Contractor shall furnish all materials and apparatus required to conduct:
 - 1. Cleaning and flushing.
 - 2. Leakage testing.

3. Sealing of leaks including manholes.

PART 3 - EXECUTION

- A. Leakage testing for gravity sanitary sewer, including service lines:
 1. Maximum infiltration or exfiltration in any section of sanitary sewer, including manholes, shall not exceed 200 gallons per inch of pipe diameter per day per mile of sewer.
- B. Low pressure air test for gravity sanitary sewers, including service lines:
 1. Air test must be used in addition to infiltration/exfiltration test.
 2. Conduct in accordance with ASTM F1417-92 for PVC sanitary sewer. For vitrified clay pipe, conduct in accordance with ASTM C828.
 3. Plug the ends of the section to be tested with airtight plugs. Brace plugs to prevent slippage due to internal pressure. One plug must have provisions for connecting an air hose.
 4. Connect air hose to plug and to portable air control equipment consisting of valves and pressure gauges to control the rate of air flow into the test section and monitor air pressure inside the pipe.
 5. Supply air to test section such that internal pressure in the pipe section does not exceed 5 psig. When pressure reaches 4.0 psig, throttle air supply to maintain internal pressure between 3.5 and 4.0 psig for minimum of 2 minutes.
 6. Disconnect air supply and allow pressure to drop to 3.5 psig. At 3.5 psig start a stop watch and determine the time required for the pressure to drop to 2.5 psig.
 7. Minimum allowable time for pressure drop to occur shall be as follows:

Vitrified Clay Pipe

Pipe Size	Minimum Time (minutes)	Length for Minimum Time, ft.	Time for Longer Length, min.
4"	3:46	597	0.0063L
6"	5:40	398	0.00142L
8"	7:34	298	0.00253L
10"	9:26	239	0.00396L
12"	11:20	199	0.0570L
15"	14:10	159	0.0890L
18"	17:00	133	0.1282L
21"	19:50	114	0.1745L
24"	22:40	99	0.2279L

PVC Pipe Pipe Size

Time (minutes/100 feet)

6"	0.7
8"	1.2
10"	1.5
12"	1.8
15"	2.1
18"	2.4
21"	3.0
24"	3.6

8. Locate and repair leaks and retest until requirements of this Section are met.

C. Alignment Test:

1. Completed sewers shall be checked for alignment using either a laser beam or lamping.
2. Completed sewers that do not show artificial light from manhole to manhole may be rejected.

3.01 DEFLECTION TEST (PLASTIC SEWER PIPE):

- A. Conduct deflection test on sanitary sewers constructed of plastic pipe (PVC).
- B. Conduct deflection test after final backfill has been in place at least 30 days.
- C. Maximum deflection shall not exceed 5 percent of the inside diameter of the pipe being tested.
- D. Conduct deflection test using Go No Go deflection testing gauge or mandrel with dimensions as shown in the Standard Drawings. Outside diameter of mandrel shall not be less than 95 percent of the specified inside diameter of the pipe being tested.
- E. Thoroughly flush line prior to testing to remove dirt, foreign materials, and debris.
- F. Float a pull rope from upstream manhole to downstream manhole of section being tested and attach mandrel to pull rope. Attach a second rope to back of mandrel to retrieve mandrel if blockage is encountered.
- G. Mark pull rope so that if blockage is encountered, the location of blockage can be determined.
- H. Pull mandrel through the sewer line. Mechanical pulling devices shall not be used.
- I. If resistance to pulling or blockage is encountered, remove mandrel and reflush or clean sewer line, if necessary.
- J. If blockage remains, locate and determine cause of blockage and made necessary repairs. Repeat test until requirements of this Section are met.

* * * END OF SECTION * * *

SECTION 15042-W

TESTING AND DISINFECTION (Water Main and Water Services)

PART 1 - GENERAL

1.01 SCOPE:

- A. This Section includes all labor, materials, equipment and related services necessary to complete filling, flushing, pressure testing and disinfecting of the installed water pipe (including water service lines), fittings, appurtenances, and equipment.

1.02 SUBMITTALS:

- A. Prior to filling, flushing, testing and disinfecting the system, the proposed procedures shall be submitted for review and acceptance by the Engineer.
- B. Copies of all bacteriological test reports shall be furnished to the Engineer.

1.02 PAYMENT:

- A. The requirements of this Section are considered incidental to the Work with no separate measurement or payment to be made.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. The Contractor shall furnish all materials and apparatus required to conduct:
 - 1. Filling and flushing:
 - 2. Pressure testing.
 - 3. Disinfecting.

PART 3 - EXECUTION

3.01 FILLING AND FLUSHING:

- A. The Contractor's responsibility includes flushing to the extent that all deleterious materials are removed.

1. Pipe interior, fittings, valves and equipment shall be protected against contamination during delivery, storage and installation.
 2. New lines and equipment shall be flushed thoroughly prior to disinfection until all traces of construction materials and soil or other foreign matter have been removed.
 3. Each new service line shall be extended above grade temporarily prior to connection to existing service lines and flushed.
- B. Damages caused by water-carried deleterious materials to other facilities shall be the responsibility of the Contractor.

3.02 TESTING: (Water Main and Force Main)

- A. All pressure pipelines shall be tested with water and proven watertight under a hydrostatic pressure of 150 psi for two (2) hours.
- B. No loss of pressure during the test period, after isolation of the test section, will be allowed.
- C. Any pipe section not meeting these test requirements shall be repaired and retested until the test requirements are met.
- D. Backfill buried pipe and provide temporary thrust blocking prior for testing if necessary to prevent separation of joints.
- E. Withdrawal of allowable leakage with no gage movement will be considered evidence of excessive air.
- F. Install test caps (Clow F-1175), plugs, or other fittings as appropriate on open-ended lines as required to pressure test each line.
- G. Allowable leakage may be considered if test section does not hold static pressure:
 1. Repressure to the test pressure by pumping from a measured container.
 2. Record the amount of water required from the measured container to repressure pipe.
 3. Repressurization to the test pressure using an amount equal to or less than the allowable leakage per the following formulas shall be acceptable:
 - a. $L-GJ = NDPI/2/7,400$ where:

L-GJ = allowable leakage for gasket
joint pipe, gallons per hour.
N = number of joints in section
under test.
D = pipe diameter, inches.
P = test pressure, pounds per
square inch.

3.03 DISINFECTION:

- A. Flush thoroughly after pressure testing and, if applicable, backfilling.
- B. Disinfect by injecting a solution of sodium hypochlorite or calcium hypochlorite and water at a slow rate.
 - 1. Conform to AWWA C651.
 - 2. Retain solution in lines for 24 hours.
 - 3. Minimum residual after 24 hours shall be 20 parts per million.
- C. After the retention period, thoroughly flush all lines containing the heavily chlorinated water until a chlorine residual determination shows the residual chlorine at any point is not over 1 part per million.
 - 1. The environment to which the chlorinated water is to be discharged shall be inspected and if there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.
 - 2. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.
- D. After final flushing, and before the piping system is placed in service, a sample shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms.
 - 1. Testing laboratory shall be State approved for performing such tests.
 - 2. Sample collection shall be in a manner as prescribed by and shall use sample bottles provided by the testing laboratory.
 - 3. Submit laboratory results to Engineer and Owner.

- E. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained.
- F. Disinfection procedures when cutting into or repairing existing mains:
 - 1. When an old main is opened, liberal quantities of hypochlorite shall be applied to open trench areas.
 - 2. The interior of all pipe and fittings used in making a repair or tie-in shall be swabbed or sprayed with a 2 percent hypochlorite solution before they are installed.
 - 3. Flushing toward the work location from both directions shall be started as soon as the repairs or tie-ins are completed and shall be continued until discolored water is eliminated.
 - 4. Where practical, in addition to the procedures above, a section of main in which the break or tie-in is located shall be isolated, all service connections shut off, and the section flushed and chlorinated.
 - 5. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

3.04 BACTERIOLOGICAL TESTS:

- A. Bacteriological tests shall be performed in accordance with AWWA C651, Sections 7 and 8.
 - 1. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line, shall be tested for bacteriologic quality in accordance with Standard Methods, and shall show the absence of coliform organisms.
 - 2. If the main is longer than one mile, additional samples shall be collected at regular intervals a number equal to approximately one sample per mile or fraction thereof.
 - 3. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods.
 - 4. If the initial disinfection fails to produce satisfactory bacteriological samples, the main may be refushed and shall be resampled.

- a. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.
- b. When check samples are taken, water entering the new main may be sampled and tested for bacteriological quality.

* * * END OF SECTION * * *

SECTION 15064

PLASTIC PIPE (PVC - DR AND SDR) (Water Main and Force Main)

PART 1 - GENERAL

1.01 SCOPE:

- A. This Section includes all labor, materials, equipment and related services necessary to complete installation of plastic pipe.
- B. Related requirements specified elsewhere:
 - 1. Testing and Disinfection: Section 15042.
 - 2. Thrust Blocks: Section 15090.
 - 3. Joint Restraint: Section 15091.

1.02 REFERENCE STANDARDS:

- A. DR-Pressure Class PVC pipe shall conform to AWWA C900 and fittings to AWWA C100, latest edition, unless otherwise modified herein.
- B. SDR-Pressure rated PVC pipe, joints, and fittings shall conform to ASTM D2241, D1869, D2241, D2564, D2672, D3036 or D3139, latest edition, unless otherwise modified herein.
- C. Installation shall comply with ASTM D2774.

1.03 SUBMITTALS:

- A. Provide manufacturer's certificate that materials meet or exceed requirements as specified.
- B. Manufacturer's installation recommendations.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Exercise care in transporting and handling to avoid damage to pipe and fittings.
 - 1. Pipe ends shall be covered during delivery from the manufacturer to the job site.

2. Do not drop pipe or fittings.
3. Assure that materials are kept clean and dry. Keep inside of pipes and fittings free of dirt and debris.

1.05 PAYMENT:

- A. Payment shall be at the Contract unit prices as shown on the Bid Schedule.
- B. Incidental items associated with PVC pipe for which no separate measurement and payment will be made include, but are not limited to:
 1. Lubricant.

PART 2 - PRODUCTS

2.01 PVC PIPE AWWA C900: (Water Main and Force Main)

- A. DR-Pressure Class PVC pipe shall be DR 18 (Class 235) with elastomeric gasket joints.

2.02 JOINTS:

- A. PVC pipe to be buried shall have gasket joints.
- B. Gasket joints:
 1. Shall comply with ASTM D3139.
 2. Rubber gaskets shall comply with ASTM F477.
 3. Gaskets shall be steel-reinforced Rieber or preapproved equal.
 4. Where gasket joints do not maintain SDR throughout, submit manufacturer's proof of design test and joint dimensions for Engineer's review.
 5. Where gasket joint couplings are used for plain end pipe, couplings shall have a pressure rating equal to the pipe for which they are used and shall have a positive stop to assure centering of the pipe within the coupling. Single gasket couplings welded to one end of the pipe shall not be used. Gasket couplings shall be used for specific individual construction applications only. Pipe shall be of integral bell design.
 6. All couplings or bells shall have a seating depth equal to manufactures recommendation for the pipe size to be installed.

7. Male ends for full pipe lengths shall be factory beveled and marked with a ring around the end of the pipe to allow field checking of the setting depth of pipe in the socket.
8. Lubricant for gasket joints shall be approved by the pipe and fitting manufacturer.
9. Joints shall be designed to allow at least 1.5 degrees of joint deflection.

2.03 RESTRAINED JOINT PVC PIPE:

- A. Material: Type 1, Grade 1, 2,000 psi design stress Poly (Vinyl Chloride), Class 12454B in accordance with ASTM D-1784, with added impact modifiers and ultraviolet inhibitors.
- B. Provide DR18 (Class 235) pipe sizes 6 inches and larger and Class 250 for 4 inches and smaller.
- C. Restrained joint pipe shall have a splined coupling system which shall provide a positive restraint against joint separation.
- D. Provide CertainTeed restrained joint pipe with Certa-Lok joints and fittings.
- E. Pipe shall meet NSF standards for Potable Water.

2.04 FITTINGS:

- A. DR-Pressure Class PVC fittings shall be ductile iron with mechanical joint ends.
- B. Fittings shall conform to ASTM D2241 where applicable.
- C. Ductile Iron Mechanical Joint Fittings:
 1. Provide Ductile Iron mechanical joint fittings. All mechanical joints shall be restrained and thrust blocked. All mechanical joints shall use core blue bolts and mega lug (or equal) restrainers.
 2. AWWA C110/ANSI 21.10, Class 250, Mechanical Joint; or AWWA C153/ANSI A21.53, Class 350, Mechanical Joint.
 - a. Wrap fittings in 8 mil polyethylene encasement in accordance with AWWA C105. Encasement shall extend 1 ft. beyond fitting and all ends shall be secured with adhesive tape.

- b. All DIP fittings shall be mechanical joint. All mechanical joints shall be restrained and thrust blocked.
 - c. Provide Cor Blue "T" bolts for all mechanical joint connections.
 - d. Provide restraint joint for all MJ fittings and joints adjacent to a valve, hydrant, or within twenty (20) feet of a building. All mechanical joints shall be restrained.
 - e. All ductile iron fittings shall have 6 oz. Zinc Anode Caps on all bolts for corrosion protection.
- D. PVC fittings shall conform to ASTM D2241 where applicable.
- E. All dead-end lines or fittings shall be capped and force blocked. Furnishing and installing caps and miscellaneous fittings shall be incidental to water main unless a bid item is provided.

2.05 TAPPING SLEEVE

- A. Ford FTSAS-1787-8, stainless steel tapping sleeve with Buna-N gasket.

2.06 TRACER WIRE:

- A. **Tracer wire is required on all utilities and service lines** (incidental to utility) and shall be installed as follows:
 - 1. Tracer System Materials:
 - a. Tracer Wire: No. 12 HS-CCS with 30 mil HDPE jacket.
 - b. Ground Rod: 1.5 lb drive-in magnesium ground rod with HDPE cap and 20 feet of 12-AWG Copperhead CCS Wire. Copperhead Industries ANO-12, or equal.
 - c. Splice Kit: Copperhead LSC1230C, 3M Scotchlok DBY Y connectors or equal.
 - d. Access Box: Copperhead Snake Pit Lite Duty Adjustable LD14B2T-ADJ-SW or Copperhead Snake Pit Concrete/Driveway Access Point CD14B2T-SW with SnakePit Two-terminal Switchable Lid SP-SWLID-B2. Contractor shall determine appropriate box for the field situation in each case.

2. Tracer System Installation:

- a. See detail with drawings.
- b. Install tracer wire with all buried piping.
- c. Install wire continuously along lower quadrant of pipe. Do not install wire along bottom of pipe. Attach wire to pipe at midpoint of each pipe length; use two (2) inch wide ten (10) mil thickness polyethylene pressure sensitive tape.
- d. Install ground rods adjacent to connections to existing piping, adjacent hydrants and at service connections.
- e. Terminate wire at an approved tracer wire access box at each fire hydrant and service line.
- f. Splice tracer wire only if approved by Owner. Allow Engineer or Owner to inspect underground splices prior to backfilling.
- g. **Tracer wire system shall be tested for electrical continuity in the presence of the Owner prior to final acceptance. Repair any discontinuities.**

2.07 PIPE BEDDING:

- A. Pipe Bedding shall be Class B(b) of ASCE Manual No. 37, 1969, and bedding materials equal to Class II of ASTM D2321. Class II bedding materials - course sands and gravels with maximum particle size of 1-½ inches (Incidental to Pipe).

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Examine areas to receive piping for:
 - 1. Defects that adversely affect execution and quality of work.
 - 2. Deviations beyond allowable tolerances for piping clearances.
- B. Start work only when conditions are corrected satisfactorily.

3.02 INSTALLATION:

- A. Workmanship:

1. Examine pipe and fittings before installation and assure no defective materials are incorporated.
2. Keep inside of pipes and fittings free of dirt and debris.
3. Cut pipe in a neat workmanlike manner without damage to pipe.
4. All field cut carrier pipe must be leveled.

B. Placement:

1. Install in accordance with ASTM D2774 and manufacturer's recommendations.
2. Lay piping with minimum earth cover of 84 inches above top of pipe, except where specifically shown otherwise on the drawings.
3. Place the pipe, fittings and valves in the trench with care; under no circumstances shall the pipe or other materials be dropped into the trench.
4. The pipe shall not be dragged in such a manner as to scratch the pipe surface; an excessive amount of scratching or any deep scratches shall be cause for rejection of the pipe.
5. The bottom of the trench shall be free from rocks, clods, or other sharp-edged objects.
6. Each section of pipe in the trench shall rest upon the pipe bed for the full length of its barrel.
7. The subgrade upon which the pipe is placed shall consist of materials suitable for supporting the pipe without excessive settlement or stress development.
8. If uniform bearing and support cannot be obtained along the entire length of pipe due to hardness of ground, excavate to a depth of not less than two (2) inches nor more than six (6) inches below grade and provide a sand fill or cushion for the purpose of grading and bedding the pipe.
 - a. Bedding material shall be sufficiently damp to insure proper compaction and shaping of the bed.
 - b. The cushion material and additional excavation work shall be performed at no additional cost to the Owner.

9. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other suitable means to prevent the ingress of foreign materials. This stipulation shall apply during noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped dry.
10. Provide thrust blocks or anchors to restrain piping at all abrupt changes in direction, tees, bends, deadends and hydrants.
11. The placement of backfill shall be done as per Section 02221.
12. All valves and necessary fittings shall be installed with the pipe in a continuous operation.

C. Tie-ins:

1. As soon as possible after installation and backfilling, the Contractor shall complete all tie-ins to accommodate the filling and flushing operation.
2. Tee-type tie-ins shall be completed in such a manner as to minimize service interruptions to existing users.
3. The Contractor shall verify the size, type, and appropriate fitting necessary prior to completing the tie-in to existing pipe. All costs in exploratory digging, fittings to match existing, and cleaning the existing pipe are incidental to the applicable bid item.

D. Tracer System Installation:

1. Tracer wire shall be installed with all underground piping. Loop wire into pedestals or valve boxes at 1/4 to 1/2 mile intervals as directed by the Resident Project Representative.
2. Pedestals shall reach from pipeline bury depth to 3 feet above grade.
3. The wire is to be used for location purposes with the use of electronic equipment.
 - a. The finished installation must pass a conductor continuity test prior to acceptance.
 - b. Contractor shall install a new wire at minimum 36" depth at any segments which fail the continuity test.

E. Sequence of Construction:

1. The Contractor shall use a sequence of construction which provides for filling, flushing and testing of installed pipeline immediately following installation.
2. For pipelines constructed out of sequence, without provision for prompt filling, flushing and testing, the provisions of Section 01760 shall apply.

F. Transition Coupling:

1. Coupling to transition from DIP to PVC shall consist of a long sleeve restrained coupling with an epoxy coated ductile iron body with stainless steel nuts and bolts.

* * * END OF SECTION * * *

SECTION 15065

PLASTIC PIPE (Sewer Only)

PART 1 - GENERAL

1.01 SCOPE:

A. Related requirements specified elsewhere:

1. Soil Testing: 312326

1.02 QUALITY ASSURANCE:

A. Provide manufacturer's certificate that materials meet or exceed minimum requirements as specified.

1.03 SUBMITTALS:

A. Certificates: Submit manufacturer's certificates of conformance.

B. Test Reports: Submit copies of test reports.

C. Manufacturer's Recommendations: Submit manufacturer's gasket lubricant recommendations for review of Engineer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Exercise care in transporting and handling to avoid damage to pipe and fittings.

B. Pipe ends shall be covered during delivery from the manufacturer to the job site.

C. Store materials on site in enclosure or under protective coverings.

D. Do not store materials directly on the ground.

E. Keep inside of pipes and fittings free of dirt and debris.

F. Do not drop pipe or fittings.

PART 2 - PRODUCTS

2.01 PIPE:

A. General:

1. The pipe shall be precision extruded from new polyvinyl chloride material and shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be extruded in strict accordance with the raw material manufacturer's recommendations and specifications.
2. Pipe shall be marked to indicate nominal pipe size, material code designation, standard dimension ratio, pressure rating, manufacturer's name or trademark, National Sanitation Foundation seal and appropriate ASTM or AWWA designation numbers.
3. The PVC pipe shall be supplied in standard laying lengths of 20 or 40 feet. However, 40 feet or longer lengths of pipe will be approved only upon adequate information the Installer has equipment capable of fully supporting the pipe while being transported and distributed over the project.
4. Rubber gasketing shall conform to ASTM D1869.

B. Polyvinyl Chloride Pipe for Gravity Sanitary Sewers:

NOTICE: PVC sewer pipe shall not be used in line segments (manhole) where the depth of bury at any point, exceeds fifteen (15) feet.

1. Gasketed PVC pipe for gravity sanitary sewer mains.
2. Gasketed PVC pipe for house service connections and branch lines.
3. Pipe and fittings shall meet requirement of ASTM D3034, but shall conform to a minimum pipe nominal diameter ratio to wall thickness (SDR) of 26 for the pipe and all fittings shall be heavy wall type. Type PSM (XH) (Poly Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
4. Joints shall be gasketed, push-on type in accordance with ASTM D3212.
5. Material used to produce pipe and fittings shall conform to ASTM D1784 for Rigid Poly (vinyl chloride) compounds and Chlorinated Poly (vinyl chloride Compounds).
6. Rings for gasketing shall be locked-in rubber sealing rings and shall conform to ASTM D1869.
7. Pipe shall be supplied in standard laying lengths of 12.5 and 20 feet.
8. Wyres shall be Heavy Wall and shall conform to ASTM F1336.

2.02 COUPLINGS:

A. Use gasket joint coupling.

1. Couplings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used.
2. Couplings shall have a minimum pressure rating equal to that of the pipe.
3. Couplings used shall be twin gasketed coupling with a positive stop in the center that will automatically position the pipe ends within the coupling. Single gasket couplings welded to one end of the pipe will not be accepted.
4. Pipe that has an integral bell, designed to be at least as strong as the pipe wall, as a part of the pipe with a single gasket shall be approved.
5. All couplings or bells shall have a seating depth of at least one diameter of the pipe.
6. The male ends of the pipe shall be beveled at the factory for ease of entry into the coupling and shall have a ring painted around the end in such a manner as to allow field checking of the setting depth of pipe in the socket.

2.03 FITTINGS:

A. PVC Fittings:

1. Fittings shall be furnished or approved by the pipe manufacturer and shall accommodate the pipe for which they are to be used.
2. Fittings shall have wall thickness no less than that for the specified pipe and shall have a minimum pressure rating equal to that of the pipe.
3. The fittings shall be socket type with the same gasket design as used on the pipe coupling. The socket depths shall meet all of the requirements listed for the adjoining pipe.

2.04 PIPE CONNECTION TO MANHOLE:

A. Provide a flexible, watertight connection joining pipe to manhole. Connection shall be one of the following:

1. A-Lok or A-Lok X-Cel as manufactured by A-Lok Products, Inc.

2. Press Seal Boots or equal as manufactured by Press-Seal Gasket Corporation.
3. Link-Seal or equal as manufactured by Thunderline Corporation.
4. Lock Joint or equal Flexible Manhole Sleeve as manufactured by Interpace Corporation.
5. An equivalent flexible, watertight connection method may be used upon prior approval by the Engineer.

2.05 TRACER WIRE:

- A. **Tracer wire is required on all sanitary sewer main and service lines (incidental to sanitary sewer). Tracer wire system shall be tested for electrical continuity in the presence of the Owner prior to final acceptance. Repair any discontinuities.**
- B. Tracer Wire Terminal Box shall be installed at ground level above each connection to the existing service and shall be Copperhead Snake Pit Lite Duty Adjustable Access Point with a SnakePit Two-Terminal Switchable Lid SP-SWLID-G2 or Copperhead Snake Pit Concrete / Driveway Access Point with a SnakePit Two-Terminal Switchable Lid SP-SWLID-G2. Contractor shall determine appropriate box for the field situation in each case.

2.06 PIPE BEDDING:

- A. Granular Bedding with the following gradation (Incidental to Pipe):

<u>Sieve</u>	<u>Percent Passing</u>
1-1/2"	100%
1"	95 to 100%
1/2"	25 to 60%
No. 4	0 to 10%
No. 8	0 to 5%

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Examine areas to receive piping for:
 1. Defects that adversely affect execution and quality of work.

2. Deviations beyond allowable tolerances for piping clearances.
- B. Start work only when conditions are corrected satisfactorily.

3.02 INSTALLATION:

A. Workmanship:

1. Examine pipe and fittings before installation and assure no defective materials are incorporated.
2. Keep inside of pipe and fittings free of dirt and debris.
3. Cut pipe in a neat workmanlike manner without damage to pipe.

B. Placement of Gravity Sanitary Sewers:

1. Each pipe shall be laid true to line and grade by use of an in-line laser beam.
 - a. Actual line and grade shall be accurate within 0.02 feet of staked line and grade at any point.
2. Commence pipe laying at lowest point, with spigot ends pointing in the direction of flow.
3. Lay piping on compacted granular material bed for entire length of trench. Assure bedding conditions equal to Class B(b) of ASCE Manual No. 37, 1969, and bedding materials equal to Class II of ASTM D2321.
 - a. Class II bedding materials - course sands and gravels with maximum particle size of 2-½ inches.
 - b. See Standard Drawings for Class B(b) bedding conditions.
4. Unstable trench conditions may require special rock bedding in lieu of granular bedding on the trench bottom. Where authorized by the Engineer, remove unsuitable material below the sewer invert elevation and replace with special rock bedding to the sewer invert elevation.

Special rock shall be ½ inch to 2 inch screen or crushed rock with maximum 5% passing the 3/8" sieve. Rock shall be a minimum of 6 inches in thickness. **Payment shall be made for special rock bedding only where its use is authorized by the Engineer.**

5. Employ partial backfilling and cradling to hold pipe in secure position during backfilling operations.

6. Compression Joint Installation:
 - a. Clean hub and spigot.
 - b. Apply joint lubricant to spigot and inside of hub.
 - c. Drive spigot into hub with pulling tool or suitable device.
7. Solvent weld water stops to outside of PVC pipe at points where pipe penetrates concrete manholes prior to cementing space between outside of pipe and manhole wall.
8. Commence pipe laying at lowest point, with spigot ends pointing in the direction of flow.
9. The subgrade upon which the pipe is placed shall consist of materials suitable for supporting the pipe without excessive settlement or stress development.
10. Place the pipe and fittings in the trench with care; under no circumstances shall the pipe or other materials be dropped into the trench. Pipe shall lay on trench bottom at every point along its length except for bell holes. The bottom of the trench shall be free from rocks, clods, or other sharp-edged objects.
11. Connections to existing sewer main and service lines shall be done using a Fernco Strong Back RC Series coupling. Contractor shall install coupling as directed by the manufacturer's recommendations. Sizes of couplings will be as follows:

<u>Coupling</u>	<u>Description</u>
1002-44RC	4" clay to 4" plastic
1002-66RC	6" clay to 6" plastic
1002-88RC	8" clay to 8" plastic

12. The Contractor shall verify the size, type, and appropriate fitting necessary prior to completing the tie-in to existing pipe. All costs in exploratory digging, fittings to match existing, and cleaning the existing pipe are incidental to the applicable bid item.
13. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other suitable means to prevent the ingress of ground water and other foreign materials. This stipulation shall apply during noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped dry.

14. All service wyes, tees and lines shall be capped with a watertight plug to keep the lines clean and for Leakage Testing. All watertight plugs shall be in accordance with the manufacturer's recommendation for materials, size and watertight installation. The ends of new home service lines shall be marked by the contractor with a 6' steel fence post extending from the invert of the service line to 6' above the service line. Contractor shall install a 2" Plastic pipe vertically from the end of all service lines to the finished surface grade. End plastic pipe adjacent the tracer wire location box.
15. Backfill the trench as per Section 02221.

3.03 TESTING:

- A. Leakage Air Test for Gravity Sanitary Sewers:
 1. Perform in accordance with Section 15042-S.
- B. Trench Compaction Testing:
 1. Soil Testing: 312326

* * * END OF SECTION * * *

SECTION 15090

THRUST BLOCKS

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. Work under this Section includes furnishing and installing thrust blocks at all points where the pipe changes direction including but not limited to the following:
 - 1. Tees.
 - 2. Elbows.
 - 3. Valves.
 - 4. Hydrants.
 - 5. Cleanouts.
 - 6. Deadends.
- C. Related requirements specified elsewhere:
 - 1. Joint Restraint: Section 15092.
 - 2. Drawing Details.

1.02 PAYMENT:

- A. Thrust blocks are considered incidental Work with no separate measurement and payment to be made.

PART 2 - PRODUCTS

2.01 PRODUCTS:

- A. Precast concrete slabs having a compressive strength of at least 2,000 psi.

- B. Cast-in-place concrete shall be composed of one part cement, two parts washed sand, and five parts gravel.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The thrust blocks shall be constructed and/or placed so that the bearing surface is in direct line with the major force created by the pipe or fitting.
 - 1. The earth bearing surface shall be undisturbed.
 - 2. If the character of the soil is such that adequate bearing may not be obtained the Engineer may direct the placement of thrust restraint rods.
- B. Precast concrete slabs shall be firmly wedged between the fitting and trench surface.
- C. Cast-in-place thrust blocking shall consist of pouring concrete between the fitting and the trench wall using simple forms. Fittings are to be wrapped in poly-sheeting before concrete is poured.
- D. Use cast-in-place thrust blocking for pipe and fittings of 6-inch size and larger.
- E. With high bearing strength soil use not less than the minimum bearing area of precast or cast-in-place thrust blocks shown in standard drawings, against undisturbed or thoroughly compacted trench wall. Additional blocking or over excavation and backfill with compacted granular materials may be required in soil or low bearing strength.

* * * END OF SECTION * * *

SECTION 15092

JOINT RESTRAINT

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (DIVISION 1) are hereby made part of this Section.
- B. Work under this Section includes furnishing and installing joint restraint where necessary.

1.02 PAYMENT:

- A. Joint restraint is considered incidental Work with no separate measurement and payment to be made.

PART 2 - PRODUCTS

2.01 JOINT RESTRAINT:

- A. As supplied by:
 - 1. DIP - Megalug, Series 1100 as manufactured by EBAA Iron Sales, Inc., Grip Ring as manufactured by Romac Industries, or approved equal.
 - 2. PVC - Megalug, Series 2000 as manufactured by EBAA Iron Sales, Inc., Grip Ring as manufactured by Romac Industries, or approved equal.
- B. Size shall be same as mainline pipe size.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Where necessary or as shown on the Drawings, joint restraint shall be installed per the manufacturer's recommendations.
- B. Provide joint restraint for all fittings and for joints adjacent to a valve, hydrant, or within twenty (20) feet of a building.

* * * END OF SECTION * * *

SECTION 15101

GATE VALVES

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. Work under this includes furnishing and installing gate valves as herein specified and shown on the Drawings.
- C. Related requirements specified elsewhere:
 - 1. Plastic Pipe: Section 15064.
 - 2. Thrust Blocks: Section 15090.
 - 3. Joint Restraints: Section 15092.
 - 4. Detail Drawing.

1.02 SUBMITTALS:

- A. Catalog Data: Obtain manufacturer's literature and illustrations.
- B. Weights: Statement of net assembled weight of each size of valve furnished.
- C. Shop Drawings of Valve and Operators:
 - 1. Dimensions.
 - 2. Construction details.
 - 3. Materials.
- D. Installation Instructions: Complete manufacturer's installation instructions.
- E. Maintenance Data:
 - 1. Maintenance instructions.

2. Parts list.

F. Certificates: Obtain manufacturer's certification that valves and accessories meet or exceed specification requirements.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Prepare valves and accessories for shipment according to AWWA C509 or AWWA C515 and:

1. Seal valve ends to prevent entry of foreign matter into valve body.
2. Box, crate, completely enclose, and protect valves and accessories from accumulations of foreign matter.

B. Store valves and accessories in area protected from weather, moisture, or possible damage. Do not store materials directly on ground.

C. Handle items to prevent damage to interior or exterior surfaces.

1.04 PAYMENT:

A. Payment will be made at the Contract unit price as shown on the Bid Schedule.

B. Incidental items for which no separate measurement and payment will be made include but not limited to:

1. Valve box.

PART 2 - PRODUCTS

2.01 GATE VALVES:

A. Valves may be Mueller Resilient Seat Gate Valves as manufactured by Mueller Co., Decatur, Illinois or American AVK, Series 65 Resilient Seated Gate Valve as manufactured by American AVK Co., Fresno, CA or Clow Resilient Wedge Valves as manufactured by Clow Corporation, Oskaloosa, Iowa or approved equal. Valves shall comply with all applicable parts of AWWA C509 or AWWA C515, constructed of ductile iron materials.

B. Valves shall comply with all applicable parts of AWWA C509 or AWWA C515 constructed of ductile materials.

C. Valve size shall be the same as the nominal pipe diameter.

D. End Connections:

1. Direct Bury Valves:
 - a. Shall be mechanical joint and shall be restrained and thrust blocked. Connect with Core Blue 'T' Bolts.
 2. Above Ground Installation Valves:
 - a. Flanged.
- E. Clear waterway through the valve shall be the full nominal diameter of the valve.
- F. Operator shall be opened by turning counter clockwise.
1. Direct Bury Valves:
 - a. Provide a standard AWWA two (2) inch operating nut.
 2. Above Ground Installation Valves:
 - a. Provide a standard operating wheel and have an arrow indicating the direction of opening.
- G. Valves shall be designed for no less than 200 psi working pressure.
1. Prior to factory shipment, valves shall be tested by hydraulic pressure equal to twice the specified working pressure.
- H. Provide fusion bonded epoxy interior and exterior coating according to AWWA C550. Provide stainless steel bolts for bonnet.
- I. Valve Stem shall be stainless steel.

2.02 VALVE BOXES:

- A. Tyler 666-S, Mueller Cat. No. H-10360, Buffalo type or equal, 5-1/4 inch shaft, two piece, screw type (incidental to Valve).
- B. Provide non-locking cover - cast iron, drop in lid, "WATER" clearly stamped on the lid.
- C. Provide locking cover where indicated on the drawings.
- D. All water valves shall have a **valve box adapter** (Adapter II) to ensure the centering of the valve box on the valve. Adapters shall be incidental to the cost of the valve.

- E. Valve Stem Extensions shall not be provided.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION:

- A. Locate where indicated on the Drawing or where designated by Engineer/Owner.
- B. Direct Bury Valves:
 - 1. Valves shall be installed to bear on two (2) 8 x 4 x 16 concrete blocks set transversely to the pipe line and dug in to the trench bottom so that pipe line connecting to valves bears fully on the trench bottom.
 - 2. Installed according to manufacturer's recommendation.
- C. Above Ground Installation Valves:
 - 1. As shown on the Drawings and according to the manufacturer's recommendation.

3.02 VALVE BOX INSTALLATION:

- A. All foreign material shall be removed from the top of the valve prior to setting the valve box.
- B. The valve box shall be set plumb with the valve.
- C. Earth fill shall be carefully tamped on all sides of the box.
- D. The top of the valve box shall be flush with the surrounding finished ground level.

3.03 ADJUSTMENT:

- A. Check and adjust valves and accessories for smooth operation.
- B. Operate the valve several times to complete open and closed positions.

* * * END OF SECTION * * *

SECTION 15109

HYDRANTS

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. Work under this Section includes furnishing and installing hydrants as herein specified and shown on the Drawings.

1.02 SUBMITTALS:

- A. Catalog Data: Obtain manufacturer's literature and illustrations.
- B. Shop Drawings.
 - 1. Dimensions.
 - 2. Construction details.
 - 3. Materials.
- C. Installation Instructions: Complete manufacturer's installation instructions.
- D. Maintenance Data:
 - 1. Maintenance instructions.
 - 2. Parts list.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Prepare hydrants for shipping according to AWWA C502.
- B. Store hydrants in area protected from weather, moisture or possible damage. Do not store materials directly on ground.
- C. Handle items to prevent damage to interior or exterior surfaces.

1.04 PAYMENT:

- A. Payment will be made at the Contract unit price as shown on the Bid Schedule.
- B. Where existing hydrants are to be removed, removal is an incidental cost to the installation of a new hydrant or mainline work, and no separate measurements or payment will be made.
- C. Existing hydrant tops (above the grade line) shall be salvaged and provided to the City.

PART 2 - PRODUCTS

2.01 FIRE HYDRANTS:

- A. American-Darling B-84-B-5.
- B. Shall meet requirements of AWWA C502.
- C. Weather cap to prevent water from entering the bonnet section and freezing the operating nut.
- D. Sealed oil reservoir to lubricate all stem threads and bearing surfaces each time hydrant is operated.
 - 1. Oil filler plug.
 - 2. "O" ring seals.
- E. Duct iron body, style to be approved by Engineer.
- F. Safety flange to minimize traffic damage.
- G. Bronze seat and drain ring.
- H. Compression type main valve.
- I. Furnish with two 2-1/2 inch male NST hose nozzles with caps and one 4-1/2" male NST pumper fitting nozzle with cap. Verify type of thread (National Standard) with the Owner before ordering.
- J. Size and type of inlet connection.
 - 1. Hydrant shall have 5-1/4 inch valve opening and six (6) inch mechanical joint inlet.

2.02 LEAD PIPE:

- A. Lead pipe to the hydrant shall have a pressure rating equivalent to the main line pipe or greater.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Hydrants shall be installed and located as shown on the Drawings or as directed by the Resident Project Representative.
- B. Hydrants shall be set at such an elevation to have the depth of cover as shown on the Drawings **but not less than 84"**. Note the depths of hydrants vary by location. Extensions shall be incidental to the project.
- C. Distance between centerline of nozzles and surrounding surface shall be from 18" to 36".
- D. Care shall be taken to see that all foreign material and objects are removed from the barrel.
- E. All moving parts shall be examined to insure working order.
- F. The hydrant shall be placed upon a concrete slab or concrete blocks not less than four (4) inches thick and 12 x 24 inches.
- G. A drainage pit two feet in diameter and three feet in depth shall be excavated below the hydrant base and the pit shall be filled with crushed rock, firmly compacted under and around the hydrant base and to a level six inches above the waste opening. The crushed rock shall be covered with at least two layers of tar paper prior to placing backfill thereon.
- H. Thrust blocks or anchors shall be installed as specified in Section 15090. Cast-in-place thrust blocks will not be acceptable.
- I. With the hydrant setting plumb, backfill shall be carefully placed and thoroughly compacted to insure the completed installation is plumb and the proper elevation above finished grade.
- J. Fire Hydrant Depth Setting: Nozzle not less than 1'-6" nor more than 1'-11" above grade, measured from centerline of nozzle to grade. Adjust barrel length, or add or remove extensions as required.
- K. Orient fire hydrant nozzles toward street or as directed by Engineer/Owner.

3.02 ADJUSTMENTS:

- A. Check and adjust hydrants and accessories for smooth operation.

3.03 GROUNDWATER:

- A. Hydrants placed where the groundwater table is less than 8 feet below the ground surface shall have the drain hole plugged and be equipped with a tag stating the need for pumping after use.

* * * END OF SECTION * * *

SECTION 15160

WATER SERVICE LINE WORK

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL, and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS are hereby made part of this Section.
- B. This Section includes all labor, materials, equipment, and related services necessary to connect water service lines to newly installed water main.
- C. Related requirements specified elsewhere:
 - 1. Testing and Disinfection: Section 15042.
 - 2. Soil Testing: 312326.

1.02 SUBMITTALS:

- A. Catalog data, manufacturer's literature and illustrations of materials.
- B. Complete manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 SERVICE FITTINGS:

- A. Submittals:
 - 1. Catalog data, manufacturer's literature and illustrations of materials.
 - 2. Complete manufacturer's installation instructions.

- B. Service Fittings:

All service lines and fittings shall have an inside diameter of 1.0”.

- 1. Saddles:
 - a. Taps shall be installed with a pipe saddle and shall be installed while the main is in operation.

- b. Ford FC202 or McDonald 3325 #” x 1” for C900 pipe. # is as shown on each location of the plans.
 - 2. Corporation stops:
 - a. FB1000-4 or McDonald 74701B-22 (1” inside diameters).
 - b. Size: 1-inch (inside diameters).
 - 3. Service line shall be 1” (inside diameters) SDR9 Municipex pipe (no splices) with stainless steel stiffeners at corp. & curb stop connections.
 - 4. Curb Stops: Ford B44-444M or McDonald 76104Q, 1” (inside diameters), Minneapolis pattern.
 - 5. Curb Boxes: McDonald 5614 Minneapolis pattern base, length 7 feet, size 1-1/4 inch.
 - 6. Stationary Rod: McDonald 5660, no extension.
 - 7. Stainless Steel Stiffeners: McDonald 6136.
- C. Service Connections:
- 1. Corporation stops shall be used where directed by the Engineer or Owner.
 - 2. Flush, test and disinfect new line before connecting service connections.
 - 3. No splices allowed in the service line.
 - 4. The Contractor shall verify the size, type, and appropriate fitting necessary prior to completing the tie-in to existing pipe. All costs in exploratory digging, fittings to match existing, and cleaning existing pipe are incidental to the applicable bid item.
 - 5. Connection to the water main tracer wire shall be Copperhead 3WB-01 Splice Kit or approved equal. The water main tracer wire shall not be cut or spliced to make the connection.
 - 6. Tracer wire shall terminate at the Water Tracer Wire Terminal Box.

PART 3 - EXECUTION

3.01 SERVICE CONNECTIONS

- A. Corporation stops shall be used where directed by the Engineer or Owner.
- B. Flush, test, and disinfect new line before connecting service connections.
- C. Coordinate water service locations and connections with City.

* * * END OF SECTION * * *

SECTION 13900

CORROSION PROTECTION

PART 1 - GENERAL

1.02 SCOPE:

- B. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- C. Work under this Section includes furnishing and installing corrosion protection at all points where ductile iron fittings are used in the project construction including but not limited to the following:
 - 1. Tees.
 - 2. Elbows.
 - 3. Valves.
 - 4. Hydrants.
 - 5. Fittings.
 - 6. Joint Restraint.
- D. Related requirements specified elsewhere:
 - 1. Joint Restraint: Section 15092.
 - 2. Drawing Details.

1.03 PAYMENT:

- A. Zinc Anode Caps are considered incidental Work with no separate measurement and payment to be made.

PART 2 - PRODUCTS

2.02 PRODUCTS:

- A. Zinc Anode Caps on all mechanical ductile iron fitting bolts.

- B. Shall be Trumbull **6 oz** Zinc Anode Caps or an approved equal meeting chemical requirements of ASTM B418-88 and US Navy Specification MII-18001 H.

PART 3 - EXECUTION

3.02 INSTALLATION:

- A. 6 oz Zinc Anode Hex Caps shall be securely threaded onto all bolts included on ductile iron fittings included in the project.
- B. Size and number shall be included in the separate bid cost of each of the water main fitting items with no separate measurement to be made.
- C. Conform to manufacturer's recommendations on installation details.

* * * END OF SECTION * * *

DIVISION S – STREETS
(Pavement)

SECTION 033000

PCC PAVEMENT

PART 1 – GENERAL

- A. The PCC pavement shall be constructed in accordance with LTAP Local Road Specifications for the State of Minnesota.
- B. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS are hereby made part of this Section.
- C. Material batching requirements intended adhere to MnDot 3F32 for slipform paving and 3F52 for handwork, rectify and inconsistencies with the Engineer during the shop drawing review process.

PART 2 – PRODUCTS

2.01 PORTLAND CEMENT

Shall be Type I and conform to the requirements of ASTM C150. Cement which has been certified by the producer to comply with the above test requirements may be accepted without further testing if the cement is used within 90 days of the date of testing. At the option of the Engineer, all sampling and retesting of cement will be conducted by an approved commercial testing firm at the Contractor's expense.

The Contractor or ready-mix supplier shall provide suitable means for storing and protecting the cement against dampness. Cement that for any reason has become partially set or that contains lumps or caked cement shall be rejected.

Cement produced outside the United States shall not be used unless written certification from an independent testing laboratory is submitted that it conforms to ASTM C150.

2.02 FINE AGGREGATE

Fine aggregate shall consist of sand conforming to the following requirements and subject to the approval of the Engineer. Sand shall be composed of clean, hard, durable, uncoated pebbles free from injurious amounts of clay, dust coal, soft or flaky particles, loam, shale, alkali, organic matter or other deleterious material. Fine aggregate for concrete pavement shall conform to MnDOT Standard Specification (2016) Section 3126.

Gradation:

<u>Sieve Designation</u> <u>U.S. Std. Square Mesh</u>	<u>Percentage Passing</u> <u>by Weight</u>
3/8"	100
No. 4	95-100
No. 8	80-100
No. 200	0-2.5

When fine aggregate is sieved through the following numbered sieves, 4, 8, 16, 30, 50 and 100, not more than 40 percent shall pass one sieve and be retained on the sieve with the next higher number.

Percent by weight of clay lumps not more than 1.0. Fineness modules not less than 2.3 nor greater than 2.9.

2.03 COARSE AGGREGATE

Coarse aggregate shall consist of either crushed stone, crushed gravel, gravel, or a combination thereof. Be clean, hard, unweathered and uncoated. Be generally spherical or cubical in shape. Contain no vegetable matter. Be reasonably free from soft, friable, thin or elongated pieces. Los Angeles Abrasion Test loss not more than 50.0 percent. Absorption not more than 3.0 percent. Deleterious materials in the coarse aggregate shall not exceed the following by weight:

Particle pass No. 200 sieve	1.5%
Soft fragments	2.0%
Clay lumps (ASTM C142)	0.5%
Removed by decantation (ASTM C177)	1.0%
Chert which will disintegrate in 5 cycles of soundness test	1.0%

Gradation:

<u>Sieve Designation</u> <u>U.S. Std. Square Mesh</u>	<u>Percentage Passing</u> <u>by Weight</u>
1"	100
3/4"	95-100
3/8"	20- 55
No. 4	0- 10

Any material that does not come within the limits herein specified shall be used only upon the written order of the Engineer. Coarse aggregate shall be Class A, **crushed quartzite**.

Aggregate shall be measured by weight. Batch weight shall be based on dry materials and shall be the required weights of dry materials plus the total weight of moisture (both absorbed and surface) contained in the aggregate. The Contractor shall provide two stockpiles for each class of aggregate. Aggregates shall not be transferred to the batch bins until they have dried on the plant site for 24 hours.

2.04 CHEMICAL ADMIXTURES

Air Entrainment: Air entraining agents shall conform to ASTM C260. The total air content of unconsolidated concrete shall be within the limits of 6 percent to 8.5 percent by volume.

Water Reducer: Water-reducing, retarding, and accelerating admixtures shall conform to ASTM C494. When one or more of the above mixtures is approved, a design mix must be prepared by a testing laboratory approved by the Engineer before the concrete mix is incorporated into the project. Any approved water-reducing agent cannot reduce the cement content by more than 5 percent.

Fly Ash: Fly ash shall conform to ASTM C618, Type C, when use is approved by the Engineer.

The addition of fly ash shall not reduce the air content of the concrete, additional air entraining agent may need to be added to meet the specified air content. Refer to Minnesota Department of Transportation Standard Specifications Section 3115.

2.05 CONCRETE READY-MIX PROPORTIONS:

Concrete shall develop a minimum 28 day strength of 4,500 psi in compression. In general the following proportions shall apply:

- | | | |
|----|----------------------------------|---|
| 1. | Cement, per cubic yard | 624 lb. |
| 2. | Total water-cement-ratio | Maximum 0.42 |
| 3. | Fine aggregate | 50% |
| 4. | Coarse aggregate | 50% |
| 5. | Air content by volume | 6% - 8.5% |
| 6. | Water reducer | No reduction of cement content |
| 7. | Maximum allowable slump - inches | Not less than 1/2" or more than 3" for machine-finish using fixed forms; 2" max. for slip form; and 4" for hand finish. |

Contractor to submit samples of cement, admixtures, and aggregate to the testing firm for trial batch design which will produce results within the specified limits. Contractor to pay all costs.

The following test procedures shall be followed for all concrete tests.

- | | | |
|----|--|-----------|
| 1. | Making and curing laboratory specimens | ASTM C192 |
| 2. | Making and curing field specimens | ASTM C31 |
| 3. | Compressive strength | ASTM C39 |
| 4. | Flexural strength | ASTM C78 |
| 5. | Slump test | ASTM C143 |

Measurement of Ingredients:

1. Cement shall be measured by weight.
2. Water shall be measured by weight or volume and one gallon of water shall be equivalent to 8.34 pounds.
3. Powdered admixtures shall be measured by weight and paste or liquid admixtures shall be measured by weight or volume.
4. Aggregate shall be measured by weight. Batch weight shall be based on dry materials and shall be the required weights of dry materials plus the total weight of moisture (both absorbed and surface) contained in the aggregate.

PART 3 – EXECUTION

3.01 PAVEMENT JOINTS:

Joints shall be placed and finished as shown on the Drawings or as directed by the Engineer. All joints shall be perpendicular or parallel to the finished pavement edge, except where special jointing arrangements are required. Finished surfaces of adjacent slabs shall not vary from a straightedge laid across the joint by more than 1/8 inch. Joints in abutting pavements shall not be staggered. Unless specifically permitted by the Engineer joints shall be located as shown on the standard details.

Dowel Bars: Dowel bars shall new deformed billet steel, ASTM A615-72, grade 40 and conform to the requirements of MnDOT Standard Specifications, Section 3302, epoxy coated.

Contraction Joints: Extend joints entirely across pavement. Sawing of the joints at specified intervals shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracks occur. All sawed joints shall have a depth equal to 1/3 of the slab thickness.

Construction Joints: Shall be installed where shown on Drawings or as directed by Engineer. All construction joints shall be edged with a grooving tool of sufficient width and depth to receive and retain joint sealing material. All construction joints shall contain 30" epoxy coated pins at 30" spacing each way.

Transverse Construction Joints: Locate where concrete placement has stopped long enough for concrete to harden and at end of day's work. Provide bulkhead with holes for required steel reinforcing bars. All construction joints shall contain 30" epoxy coated pins at 30" spacing each way.

Expansion Joints: Expansion joints shall be prepared and placed as indicated on the standard details. The expansion joint filler shall be continuous from form to form, shaped to the subgrade and to the keyway along the form. The expansion joint filler shall be held in a vertical position. Finished joints shall not deviate in horizontal alignment more than 1/4 inch from a straight line.

Sealing Joints: Joint Sealing Material shall be elastomeric sealing compound. All joints and shrinkage cracks which may occasionally occur shall be filled with approved sealing material. Before sealing, each joint shall be cleaned of foreign material, including curing compound by sandblasting, joint faces cleaned and surface-dry when seal is applied. The joints shall be filled immediately following the curing period or as soon thereafter as weather conditions permit, or as directed by the Engineer. Sealing material to be heated to temperature specified by manufacturer with temperature maintained during pouring period.

3.02 CONCRETE TESTING:

The Contractor will be required to coordinate preparation and arrange for the transportation of compressive strength cylinders to the testing laboratory. The Owner will pay for cylinder molds and transportation costs. Cost of protecting cylinders prior to shipment to be included in unit price for concrete paving. The Owner will be responsible for cost of cylinder testing at the testing laboratory. The Owners representative shall be responsible for making three representative cylinder samples for each 250 cubic yards of pavement placed. The Owner will have these cylinders tested at 7 days and 28 days.

3.03 PAVEMENT PROTECTION:

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Owner. Traffic shall be excluded from the pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed by the Engineer.

The concrete finishing machine, and similar equipment may be permitted to ride upon the edges of previously constructed slabs provided the concrete is more than 72 hours old and has attained a minimum flexural strength of 500 pounds per square inch and provided further, that adequate means are employed to prevent damage to the slab edges.

Sufficient burlap, canvas or other approved material shall be kept at hand at all times to prevent fresh concrete from being damaged by sudden showers or rainfall.

Failure to properly protect unhardened concrete will constitute cause for the removal and replacement of defective pavement at the Contractor's expense.

The Contractor shall also, at his own expense, protect fresh pavement surfaces that may be damaged from pedestrians, bicycles, malicious mischief and similar occurrences, until the pavement surface has hardened.

Any pavement surfaces which are damaged shall be removed and replaced, or repaired to the Engineer's satisfaction, at the Contractor's expense.

3.04 PAVEMENT QUALITY REQUIREMENTS:

Additional testing of the cured concrete slab may be taken at the Engineer's option when:

Any field cured cylinder tested for one day's pour falls below the specified strength. The Engineer will then have the Contractor take and pay for in place core samples in the area of question.

The Engineer reserves the right to require the Contractor to take and pay for additional cores for any area of a given day's pour when any cylinder from this day's pour fails to meet the specified 28 day strength.

Should any field cured cylinders or cores for one day's pour fall below the specified strength, the Owner may at his option reduce the unit price as follows:

<u>Ratio of Average Actual Strength to Specified Strength</u>		<u>Percent Reduction in Unit Price</u>
Greater than or equal to	1.0	0%
Greater than .90 and less than	1.0	5%
Greater than .80 or equal to	0.90	25%
Greater than .75 or equal to	0.80	50%
Less than or equal to	0.75	100%

3.05 PAVEMENT THICKNESS REQUIREMENTS:

Deficient Pavement Thickness: The Engineer may at his discretion require the Contractor to take core samples to determine pavement thickness. The Contractor shall pay for the cost of coring for all cores that prove deficient. The Owner shall pay for the cost of coring for all cores that are at or above design thickness. Payment for deficient thickness pavement shall comply with MnDOT Standard Specification Table 2301-3. Pavement that is deficient by more than 0.4" shall require removal and replacement at no cost to the Owner.

3.06 PAVEMENT SMOOTHNESS REQUIREMENTS:

In the event that the smoothness of the pavement is questionable to the Engineer and/or the Owner, the pavement shall be checked in accordance with Section 2301 of the MnDOT Specifications for Pavement Smoothness. Testing will be at longitudinal lines located parallel to the pavement centerline. Appropriate remedial action shall be taken by the Contractor in accordance with said Section 2301 after which the Contractor will be compensated for the pavement in accordance with said Section 2301. The cost of the original California profilograph test will be paid for by the Owner. The cost of additional California Profilograph tests, such as those required after corrective work has been performed, shall be paid by the Contractor. The unit bid price will be the maximum payment for completed pavement, no smoothness incentive pay shall apply.

3.07 MIXING-JOB, READY-MIX, OR PRE-BATCH

All batching and transporting equipment shall conform to MnDOT Standard Specifications, Section 2301. Water used in mixing concrete shall be potable, clean and free from deleterious amounts of acids, alkalies or organic material. The method of handling batches and charging the mixer shall insure complete introduction of each batch separately without loss of materials. The concrete, as discharged from the mixer, shall be uniform in composition and consistency.

Ready-mix concrete shall conform to ASTM C94. Ready-mix concrete shall be prepared and delivered only by an organization which will assign sufficient capacity and transporting equipment to the work to insure delivery at a rate required to insure efficient and proper handling, placing and finishing of the concrete. The agitating delivery units shall be rotated at their rated mixing speed for one minute immediately prior to placement of concrete.

Maximum Time before Placement: Concrete transported without continuous agitation shall not be used if the period elapsed between the time the concrete is mixed and the time it is placed is greater than 30 minutes. Concrete transported with agitation shall not be used when the cement has been in contact with the aggregate more than 1-1/2 hours before it is placed.

3.08 PLACING - CHUTING, CONVEYING AND PUMPING

Placement of Concrete: The concrete shall be placed in such manner as to require as little rehandling as possible. The subgrade, at the time of placing concrete, shall be in a uniformly moist but not muddy condition to a depth of not less than 1 inch (acceptable in early spring and late fall) or shall be covered with a single layer of plastic film (to be used during periods of hot dry weather) meeting requirements of Section 4107, IDOT Standard Specifications for Highway and Bridge Construction.

The concrete shall be distributed such that when consolidated and finished, the slab thickness and surface grade required by the Drawings will be obtained at all points. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances. Concrete shall be thoroughly vibrated and consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies.

Vibrators: Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. The vibrator shall not be operated longer than 15 seconds in any one location.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them but shall not be dumped onto a joint assembly.

Weather Limitations: Concrete placement will not be permitted, when in the opinion of the Engineer, weather limitations prevent proper finishing and curing of the concrete. In hot weather, concrete placement shall be discontinued when weather conditions such as high concrete temperature, high air temperature, low humidity, and high winds prevent proper finishing, curing and a surface free of cracks. In cold weather the subgrade shall be so treated, protected and prepared to produce a frost free subgrade when the concrete is deposited. Concrete shall not be placed when the ambient temperature is below 40 degrees F. Concrete shall not be placed when it is likely to be subject to freezing temperature before final set has occurred. The concrete temperature when placed in the

pavement shall not be less than 50 degrees F. nor more than 90 degrees F. Suitable means must be provided for maintaining the concrete at a temperature of at least 50 degrees F., for not less than 72 hours after placing. Concrete damaged by freezing shall be removed and replaced at the expense of the Contractor. When approved by the Engineer, an approved retarding admixture may be used to delay the initial concrete set during extremely hot weather.

3.09 FINISHING

The concrete shall be struck-off, consolidated, and finished to the pavement cross section shown on the plans. Hand finishing will be permitted in the event of breakdowns, narrow widths and areas of irregular dimensions, to finish the concrete already in place. The finished concrete shall be smooth within the tolerance specified on these specifications. Pavement Crown: The pavement crown shall be as shown on the standard details unless otherwise specified by Engineer. Pavement Finish: The final surface of the pavement shall be transverse grooving using a broom or carpet drag to produce a uniform, skid-resistant texture.

Finishing Integral Curb or Curb and Gutter: Curbs or curb and gutter shall be required along the edges of the paving where shown on the plans. Curbs or curb and gutter shall be formed in accordance with the standard details. The finished curb or curb and gutter shall be protected by a suitable curing compound on all exposed surfaces. Joints shall be placed in line with joints occurring in the pavement or in 10 ft. increments. Joints shall be in alignment with each other across the street where practical. The curb or curb and gutter shall be given a textured finish (light brooming) to match the pavement. All joints in curb and gutter, driveways and pavement back of curb shall be sealed with rubberized asphalt joint sealant (Crafco, or approved equal).

Integral Curb: Integral curb may be constructed integrally with the pavement using slip-form or extrusion equipment, or placed immediately after finishing operations by hand-forming or using facing forms.

Curb and Gutter: Curb and gutter may be constructed as a separate operation before pavement construction. Curb and gutter may be formed using forms, self-propelled slip-form or extrusion methods. The edge of the gutter line of curb and gutter may be used as a form for finishing the pavement slab. The joint between curb and gutter and concrete pavement shall be continuously keyed and contain bars at intervals not to exceed 3.0 feet. curb and gutter operations are suspended long enough for concrete to attain an initial set, two ½ inch diameter reinforcing bars 30 inches long shall be embedded in the concrete.

The Contractor may with the Engineer's approval place concrete with a slip-form paver designed to spread, consolidate, screed and float finish the freshly placed concrete in one complete pass of the machine. The proximity of utility poles may prevent the use of a slip form paver.

3.10 CONCRETE CURING:

Membrane curing compounds shall be applied immediately after final finishing of the new concrete at a rate of 15 square yards per gallon. The compound shall contain a white pigment to easily detect the areas which has been covered. The compound shall be applied to all exposed surfaces immediately after the removal of all forms. The finished concrete shall be cured with a liquid curing compound. Concrete surfaces, to which membrane compounds have been applied, shall be kept free from all foot and vehicular traffic and all other sources of abrasion for a minimum period of 72 hours. The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Owner.

Opening to Traffic: The Contractor shall exclude traffic from the pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed by the Engineer. part of the pavement shall be used, for even the lightest vehicles, until the concrete is 72 hours old. The Contractor may allow his equipment to run up on the edge of a new concrete slab at least 72 hours old, if he provides adequate means to protect the slab. Sufficient burlap, canvas, or other approved material shall be kept on hand at all times to prevent fresh concrete from being damaged due to showers or rainfall. Failure to properly protect unhardened concrete will constitute cause for the removal and replacement of defective pavement at the Contractor's expense.

(2360) PLANT MIXED ASPHALT PAVEMENT (LOCAL AGENCY)

MnDOT 2360 is modified and/or supplemented with the following:

Mix Designation Numbers for the bituminous mixtures on this Project are as follows:

Type SP 12.5 Wearing Course	SPWEB240C
Type SP 12.5 Non-Wearing Course	SPNWB240C

NOT APPLICABLE

NOT APPLICABLE

S-1.4 The sentence “In addition to the list the above the pavement surface must meet requirements of 2399 (Pavement Surface Smoothness) requirements.” is deleted from MnDOT 2360.3.E Surface Requirements. The requirements of MnDOT 2360.3.E Surface Requirements will apply.

S-1.5 NOT APPLICABLE

S-1.6 **The first paragraph of MnDOT 2360.3.D.1** is hereby deleted and replaced with the following:

D.1 Maximum Density

Compact the pavement to at least the minimum required maximum density values in accordance with Table 2360-19, “Required Minimum Lot Density (Mat)”.

S-1.7 **MnDOT Table 2360-20 Longitudinal Joint Density Requirement** is hereby deleted.

MnDOT 2360.3.D.1.h Mat Density Cores is hereby deleted and replaced with the following:

D.1.h Mat Density Cores

Obtain four cores in each lot. Take two cores from random locations as directed by the Engineer. Take the third and fourth cores, the companion cores, within 1 foot [0.3 m] longitudinally from the first two cores. Submit the companion cores to the Engineer immediately after coring and sawing. If the random core location falls on an unsupported joint, at the time of compaction, (the edge of the mat being placed does not butt up against another mat, pavement surface, etc.) cut the core with the outer edge of the core barrel 1 foot [0.3 meters] away (laterally) from the edge of the top of the mat (joint). If the random core location falls on a confined joint (edge of the mat being placed butts up against another mat, pavement surface, curb and gutter, or fixed face), cut with the outer edge of the core barrel 6 inches $\pm$ 0.5 inch [150 mm $\pm$ 12.5 mm] from the edge of the top of the mat (ex. center of 4 inch [100 mm] core barrel 8 $\pm$ 0.5 inches [200 mm $\pm$ 12.5 mm] from the edge of the top of the mat). Cores will not be taken within 1 foot [300 mm] of any unsupported edge. The Contractor is responsible for maintaining traffic, coring, patching the core holes, and sawing the cores to the paved lift thickness before density testing.

The Engineer may require additional density lots to isolate areas affected by equipment malfunction, heavy rain, or other factors affecting normal compaction operations.

MnDOT 2360.3.D.1.j Companion Core Testing is hereby deleted and replaced with the following:

The Department may select at least one of the two companion cores per lot to test for verification.

MnDOT 2360.3.D.1.n Longitudinal Joint Density is hereby deleted.

MnDOT 2360.3.D.1.p Shoulders is hereby deleted.

MnDOT Table 2360-24 Payment Schedule for Longitudinal Joint Density (SP Non-Wear and SP Shoulders, 4% Void) is hereby deleted.

MnDOT Table 2360-25 Payment Schedule for Longitudinal Joint Density (SP Non-wear and SP Shoulders, 3% Void) is hereby deleted.

MnDOT 2360.3.D.1.r Pay Factor Determination is hereby deleted.

DIVISION E – EARTHWORK

SECTION 310113

SUBSURFACE INFORMATION

PART 1 - GENERAL

1.01 GENERAL:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS are hereby made part of this Section.
- B. Soil borings have been performed for this project and are included in the Appendix of this project manual.
- C. Additional Investigation:
 - 1. Contractor should visit site and acquaint himself with site conditions.
 - 2. Prior to bidding, Contractor may make subsurface investigations to satisfy himself with site and subsurface conditions.

1.02 QUALITY ASSURANCE:

- A. Readjust work performed that does not meet technical or design requirements.
- B. Make no deviations from the Contract Documents without specific and written approval of Owner.

* * * END OF SECTION * * *

SECTION 310116

EXISTING UTILITIES, UNDERGROUND OBSTRUCTIONS, AND SUBSURFACE CONDITIONS

PART 1 - GENERAL

1.01 SCOPE:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. This Section describes, but is not limited to, the contact to be made with existing utilities and the Work associated with location, adjustment and repair of underground utilities and obstructions.
- C. Information or data presented herein relative to existing subsurface utilities are not a part of the Contract Documents and shall not be used by the Contractor for reference during construction of the work.

1.02 PAYMENT:

- A. Repair by the Contractor of any utilities, sewer service lines and main, field and drain tiles and other underground obstructions damaged by the Contractor's activities is considered incidental Work with no separate measurement and payment to be made.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

- A. The Contractor shall take all necessary precautions to locate, protect and repair existing utilities, underground obstructions and structures.
- B. The Contractor shall be responsible for all damage to field tiles, streets, roads, highways, ditches, shoulders, embankments, culverts, bridges or other public or private property or facility, regardless of location or character, which may be caused by moving, hauling, or otherwise transporting equipment, materials or men to or from the work or any site thereof, whether by him or his subcontractor(s).
- C. The Contractor shall protect, shore, brace, support and maintain all underground pipes, conduits, drains and other underground construction uncovered or otherwise affected by the construction work performed by him. All pavements,

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surfacing, driveways, curbs, walks, buildings, utility poles, guy wires and other surface structures affected by construction operations in connection with the performance of the contract, together with all shrubs in yards and parking crossed by or adjacent to the pipeline shall be maintained, and if removed or otherwise damaged, shall be restored to the original condition thereof as determined and approved by the Resident Project Representative. All replacements of such underground construction and surface structures or replacements of such underground construction and surface structures or parts thereof shall be made with new materials conforming to the requirements of these specifications or, if not specified, as approved by the Engineer.

- D. Information and data shown or indicated on drawings of the site with respect to existing underground facilities or utilities are based on information and data furnished to the Owner or Engineer by owners of such underground facilities or by others.
- E. The Owner and Engineer are not responsible for the accuracy, completeness or precision of any such information, data or drawings. In general, it is not the intent of the Owner or Engineer to provide complete information relative to existing utilities on the Drawings.
- F. The Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all existing underground facilities including water drainage projects affected by construction, for contact with owners of affected underground facilities, and for such other requirements as may be included in the specifications, the cost of all of which will be considered as incidental to the Contract Price.
- G. Information, data or drawings describing existing underground facilities or utilities are not a part of the Contract Documents.
- H. If, during the course of any land disturbance related to the project, any bones, artifacts, foundations, or other indications of past human occupation of the area are uncovered, work at this location shall be temporarily stopped and the Engineer shall be notified at once to ensure notification of appropriate state authorities.

3.02 SUBSURFACE CONDITIONS:

- A. In the preparation of Drawings and Specifications, the Engineer may have obtained, reviewed or been informed of subsurface information not specifically collected for design or construction of this project. Such information was of a general nature and available from sources normally open to the general public.
- B. Printed information available to the Engineer during project design, including reports referenced above, are available at the office of the Engineer for examination during regular business hours.
- C. Subsurface information or data referenced herein are not a part of the Contract

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Documents.

3.03 UTILITY CONTACT:

- A. Prior to any Work, a preconstruction conference may be scheduled by the Engineer to include involvement by affected utilities. Failure of any utility to be represented at the preconstruction conference, for any reason, shall not relieve the Contractor of any responsibility described herein.
- B. Prior to Work in a specific area affecting underground utilities, all utilities shall be notified by the Contractor.

3.04 UTILITY REPAIR:

- A. When a utility line or cable is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.
- B. When a utility cable is exposed, the Contractor shall compact the backfill beneath the exposed cable before completion of the backfill operation.
- C. The Contractor shall make, without delay, satisfactory and acceptable arrangement with the owner(s) of or the agency or authority having jurisdiction over damaged property, surface, structure, or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

3.05 OTHER OBSTRUCTION CONTACT AND REPAIR:

- A. Where field and drain tiles are suspected, property owners shall be contacted by the Contractor.
 - 1. To locate and prevent damage to known tile, the Contractor shall not be required to excavate beyond twenty-five (25) feet either side of the reported centerline without additional compensation.
 - 2. Should additional excavation be required and compensation is desired, a Field Order shall be prepared as documentation prior to commencing the Work.
- B. Where county tile have been damaged, these shall be repaired according to county specifications and requirements.
- C. The Contractor shall notify the Owner when field tile have been damaged and provide drawings showing the location of repaired field tile.

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D. Field and Drain Tile Repair:

1. Butt-joint Method:

- a. Expose and remove damaged sections of tile so that sound, undisturbed tile lies on both sides of trench.
- b. Connect the two sides using PVC pipe butted against both sides of the existing tile.
- c. Seal and secure joint with concrete. One bag "Sacrete" mixed with water will be considered adequate for all tile 16 inches and smaller.
- d. Replace and hand tamp the soil in twelve (12) inch lifts up to the bottom of the repaired section of tile.
- e. Continue with trench backfill as per normal procedure.
- f. All tile shall be repaired within 24 hours of the time it was damaged or disturbed.

* * * END OF SECTION * * *

SECTION 311100

MAINTENANCE OF CLEARING

PART 1 - GENERAL

1.01 CONDITIONS OF THE CONTRACT:

- A. The GENERAL, SUPPLEMENTAL and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS are hereby made part of this Section.
- B. The articles contained in this Section may amend, modify, supersede, void or supplement the articles of the General Conditions, and shall take precedence over the provisions of the General Conditions. Where any part of an article of the General Conditions is amended, modified, superseded or voided by a provision of this Section, provisions of such article not so specifically amended, modified, superseded or voided shall remain in effect. Where any article of the General Conditions is supplemented by this Section, all provisions of such article shall remain in effect, and the supplementary provisions of this Section shall be considered as added thereto.

1.02 SCOPE:

- A. Related requirements specified elsewhere:
 - 1. Summary of Work: Section 011100.
 - 2. Cleaning for Specific Products or Work: Project Manual section for that Work.
- B. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
- C. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

1.03 SAFETY REQUIREMENTS:

- A. Standards: Maintain project in accordance with safety and insurance standards.
- B. Hazards Control:
 - 1. Store volatile wastes in covered metal containers, and remove from premises daily.
 - 2. Prevent accumulation of wastes which create hazardous conditions.

SECTION 311100

- C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 1. Do not burn or bury rubbish and waste materials on project site.
 - 2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION:

- A. Execute cleaning to insure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- C. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.
- D. Provide on-site containers for collection of waste materials, debris and rubbish.
- E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.
- F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- H. Protect all structures within the construction limits.

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- I. The Contractor shall manage his activities and implement protective measures as necessary to minimize soil erosion during the construction process.
- J. At the end of each day's work leave construction area in such a condition so to permit unencumbered access to all private properties in vicinity of Project.

3.02 FINAL CLEANING:

- A. Employ experienced workmen, or professional cleaners, for final cleaning.
- B. In preparation for substantial completion or occupancy, conduct final inspection of project site.
- C. Broom clean paved surfaces; rake clean other surfaces of grounds.
- D. Maintain cleaning until project, or portion thereof, is occupied by Owner.
- E. For disturbed areas on the shoulders/terraces, replace final 6 inches with topsoil and finish grade suitable for seeding.

* * * END OF SECTION * * *

SECTION 311200

STORM SEWERS/DRAIN TILE

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONSTRUCTION AGREEMENT and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. Related requirements specified elsewhere: none.
- C. Furnish all labor, material, and equipment necessary to complete the installation of the storm sewer.
- D. Excavate all substances encountered to depths indicated on the drawings or as herein specified.
- E. Place excavated materials suitable for backfilling in orderly manner sufficiently away from banks of trench to avoid overloading and prevent slides or cave-ins.
- F. Remove and dispose of excess or unsuitable backfill materials as directed by the Engineer.
- G. Perform site grading as required to prevent surface water from entering trenches.
- H. Perform dewatering operations and/or form water diversion ditches as required to keep base for laying pipe in trench free of water.
- I. Assure that all shoring and sheeting required complies with applicable local, state and federal safety requirements.
- J. All trenching shall be open cut except where indicated otherwise on drawings.

1.02 QUALITY ASSURANCE:

- A. Provide manufacturer's certificate that materials meet or exceed minimum requirements as specified.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. During loading, transporting, and unloading, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings.

SECTION 311200

PART 2 - PRODUCTS

2.01 MATERIALS: See plan sheets for pipe material.

A. Reinforced Concrete Pipe:

1. Reinforced Concrete Pipe (RCP): ASTM C76, Class 2000 D, Wall B tongue and groove, machined ends, 6 ft. minimum laying length; provide reinforcement as set forth in Table III of ASTM C76; label each piece by class and show date of manufacturer.
2. Commercial joint sealing gaskets or mastic material shall be used in all joints.
3. Bends may be prefabricated or fabricated in the field by sawing pipe and installing a concrete collar around field joint.
4. Joints shall be watertight bell and spigot.

B. High Density Polyethylene (HDPE): Perforated drain tile/subdrain.

1. Pipe shall conform to Minnesota DOT Standard Specifications Section 2502.
2. Use manufacturer's recommended fittings and couplings (incidental to pipe).

C. Corrugated Culverts.

1. Pipe and aprons shall conform to Minnesota DOT Standard Specifications 2417.
2. Use manufacturer's recommended fittings and couplings (incidental to pipe).

D. Castings: Shall conform to standard drawings. Standard castings differing in non-essential details will be acceptable, if approved by the Engineer.

2.02 JOINT LUBRICANT:

A. As recommended by pipe manufacturer.

SECTION 311200

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION:

A. General Requirements:

1. Keep trench minimum width necessary for proper laying of pipe and to prevent movement of existing utilities.
2. Keep banks as nearly vertical as practicable while complying with safety requirements.
3. Reinforced concrete pipe shall lay on undisturbed suitable soil or bedding at every point along its length.
4. Accurately grade bedding to provide uniform bearing and support for each pipe section.
5. Unstable trench conditions may require special rock bedding in lieu of granular bedding on the trench bottom. Where authorized by the Engineer, remove unsuitable material below the sewer invert elevation and replace with special rock bedding to the sewer invert elevation.
6. Ledge rock, boulders and large stones encountered in the excavation shall be removed to provide a minimum clearance of 12 inches below and on each side of all pipe.
7. Each pipe will be carefully inspected before it is laid and defective pipe will be rejected.
8. The pipe shall be laid upgrade beginning at the lower end of the line and shall be laid true to the grades shown on the plans. Any pipe which has its grade disturbed after laying shall be taken up and relaid. No pipe shall be laid, when in the opinion of the Engineer, weather or trench conditions will not permit a satisfactory installation.
9. Laying of pipe to true line and grade shall be accomplished by the laser beam method.
10. When pipe connects with other structures, the end shall be placed or cut off flush with the face of the structure.

3.02 EXCAVATION FOR APPURTENANCES:

A. General Requirements:

1. Excavate to leave minimum 12 inch space between outer surface of appurtenance and side of trench.

SECTION 311200

2. Fill unauthorized overdepths with compacted granular material.

3.03 BACKFILLING AND COMPACTING:

A. General Requirements:

1. Trenches shall not be backfilled until the pipe is checked for alignment and grade and any required tests are performed.
2. When granular backfill is specified or authorized by the Engineer, the granular backfill shall be placed from 0.5 feet below the bottom of the pipe to 0.5 feet above the top of the pipe.
3. The earth or granular backfill shall be mechanically tamped under the "spring line" and around the pipe in 6 inch layers until the pipe has not less than 12 inches of compacted cover over the top of the pipe.
4. Trenches shall then be carefully backfilled with suitable earth or gravel free from boulders, large roots, sod, and vegetation.
5. Backfill remainder of trench in lifts not to exceed 1 foot in loose thickness. Compact using some type of mechanical devices or equipment and moisten or aerate as required to assure consolidation.
6. Each layer shall be compacted to Standard Proctor Density as determined by ASTM D698 according to the following:

a.	Unpaved areas	95 percent, with moisture -4 to -1 percent of optimum
b.	Cohesive soils under surfaced areas	98 percent, with moisture -4 to -1 percent of optimum
c.	Granular backfill under surfaced areas	100 percent with moisture -4 to -1 percent of optimum
7. Standard soil density tests shall be run in locations as specified or designated by the Engineer.

SECTION 311200

8. All standard soil density tests that initially meet the specifications shall be paid for by the Contractor. All tests that fail to meet the specifications and all subsequent retesting costs including additional engineering costs shall be paid for by the Contractor. Contractor shall be responsible for scheduling the work, notifying the testing laboratory and Engineer, and allowing adequate time for all tests.
9. Do not disturb joint alignment or grade of pipe during backfill operation.
10. Conduct backfill operations so that no more than 100 feet of trench will be left open at any one time.

3.04 INLETS, MANHOLES AND JUNCTION BOXES:

A. Storm Drain Inlets and Junction Boxes:

1. Shall be constructed of concrete, precast concrete sections, or as shown in the standard details. Precast PCC walls can be 5" thick.
2. The concrete cover over steel reinforcing shall not be less than 2 inches.
3. All inlet, manhole and junction box bases shall be poured in place concrete unless otherwise approved by the Engineer. Groundwater shall be kept below bottom of concrete base for 24 hours after pouring.
4. Hand form smooth inverts in bottom of inlets, manholes and junction boxes to permit water to flow freely.
5. Reinforced concrete lids may be precast; however, they shall be reinforced as shown on the plans and of the size required for each specific inlet or junction box.
6. Inlets, manholes and junction boxes shall be of such size and construction as shown on the detail drawings. However, in special cases the contractor shall modify dimensions as necessary to accommodate multiple pipes at the same structure.
7. Contractor shall construct intake with a fuel resistant boot providing for a watertight connection where indicated in the standard details.

3.05 DRAIN TILE:

- #### A.
- Drain tile shall be perforated and placed as shown on the plans. Encase subdrain with 3/8" pea rock with a minimum of 12" of cover. Pea rock incidental to drain tile.

SECTION 311200

3.06 EROSION AND SEDIMENT CONTROL:

- A. Protect against erosion of soils and sediment from leaving the site.
- B. Provide inlet protection once the new intake is installed. Place silt fence and rock around the inlet to prevent sediment from entering the storm sewer. Maintain silt fence and remove sediment deposits.
- C. Minimize the amount of native vegetation disturbed beyond the construction site. Vegetation will help prevent sediment from leaving the site. Install silt fence as shown on the plans and as needed to prevent sediment from running off the site. Maintain silt fence and remove sediment deposits when it reaches 1/3 the height of the silt fence.
- D. Contractor shall be careful to not track mud from trucks leaving the site. Contractor shall clean mud from trucks and clean adjacent streets and pavement immediately if tracking of soil occurs.
- E. **Contractor shall execute, pay for and submit MPCA Storm Water Permit (partially completed on the SWPPP in the Appendix).** This contract shall be completed to abide by the regulations granted as specified by the Permit.

* * * END OF SECTION * * *

SECTION 311600

SEEDING, FERTILIZING, AND HYDROMULCHING:

PART 1 - GENERAL

1.01 SCOPE:

- A. The work covered by this section of the specifications shall consist of preparing the ground surface, furnishing and applying fertilizer, furnishing and sowing seed, compacting and repairing in accordance with this specification at the locations shown on the Drawings or as directed by the Owner.

PART 2 - PRODUCTS

2.01 SEED:

The seed or seed mixture to be furnished and the minimum percentage by weight of pure live seed of each species in each lot of seed and the maximum percentage of weed seed shall be as stated below. All seed used shall be labeled in accordance with U.S. Department of Agriculture "Rules and Regulations under the Federal Seed Act" in effect on the date of the execution of this Agreement. All seed shall be furnished in standard containers, unless exception is granted by the Owner. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable.

For the designated disturbed areas the seed mixture shall be:

1. Site seeding -

Urban Turf Mix

- 70% Bluegrass, Kentucky
- 10% Ryegrass, Perennial (fine leaf variety)
- 20% Fescue, Creeping Red

Application Rate: 4 lbs. per 1,000 sq. ft.

-Alternate seed blends that are conducive to the site soils, are low maintenance, and require minimal mowing will be considered upon submittal to the Owner.

NOTE: The Contractor is reminded that the above mixtures are for live seed.

SECTION 311600

Seed Test:

1. Each lot of seed shall be subject to sampling and testing at the discretion of the Owner. Sampling and testing will be in accordance with the latest "Rules and Regulations Under the Federal Seed Act" in effect on the date of the purchase order. Tags from bags used on the project should be submitted to the Owner.
2. In the event that reports of seed analysis are not received prior to sowing, and tests made thereafter indicate the seed used did not meet the specification requirements, the Owner may require the Contractor to reseed the entire area affected during the next suitable season with sufficient seed to provide the total quantity of pure live seed specified, or will deduct from the contract payment an amount sufficient to cover the cost of seed and reseeding operations.

2.02 FERTILIZER:

Lime: No lime application is required.

Fertilizer: Fertilizers shall be commercial carriers of available plant food elements or combinations thereof, either as inorganic or organic materials, and shall conform to the applicable State fertilizer laws. The fertilizer shall be uniform in composition, dry, and free-flowing material in condition for application by suitable equipment. The fertilizer shall be delivered in unopened bags or other convenient standard containers, each fully labeled with the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable.

All areas seeded shall be fertilized with a commercial fertilizer having a nitrogen, phosphorus, potassium analysis ratio of 13-13-13 at the minimum rate of 650 lbs./acre.

Fertilizer Test:

1. The Owner shall be furnished with tags from bags of fertilizer used on the project.
2. In the event that reports of fertilizer analysis are not received prior to the application of fertilizer and tests when made show the fertilizer used did not meet the minimum specification requirement, the Contractor may be required, at the discretion of the Owner, to supply and distribute sufficient additional materials over the entire areas affected to bring the amounts up to specification requirements, or have deducted from the contract payments an amount sufficient to cover the cost of such quantities of fertilizer and the application thereof.

SECTION 311600

2.03 HYDRO-MULCHING:

- A. Required on all disturbed areas.
- B. Materials to be 3000 lb. dry cellulose fiber and 50 lb. tackifier per acre.
- C. Use a slurry that can be applied with standard hydraulic mulching equipment.
- D. Dye the slurry green to facilitate visual metering during application.
- E. Do not use materials that have growth on germination inhibiting factors or any toxic effect on plant or animal life when combined with seed or fertilizer.

PART 3 - EXECUTION

3.01 GENERAL:

Areas to be seeded, those requiring special preparation of the ground surface, and those in a satisfactory condition to remain undisturbed, will be shown on the Drawings and/or determined by the Owner prior to the seeding phase.

Suitable equipment necessary for proper preparation of the ground surface and for handling and placing all required materials shall be on hand, in good operating condition, and shall be approved by the Owner before the various operations are started. The Contractor shall demonstrate to the Owner before starting the various operations that the application of required materials will be made at the specified rates.

During the operations of distributing fertilizer, or sowing seed, the areas covered shall be checked against the quantities of material used when one-fourth, one-half, and three-fourths of the affected areas have been covered to verify the proper rate of application. Upon completion of the distributing operations, a final check of the total quantities of materials used shall be made against the total acreage fertilized, and sown. If it is determined, by this checking of quantities used or by inspection either immediately after distributing the materials or after there is a show of green, that uniform distribution at rates at least equal to the minimum required, at the discretion of the Owner, either to distribute additional quantities of these materials on the areas designated to meet the specification requirements, providing seasonal conditions are favorable, or have deducted from his payment an amount sufficient to cover the cost of the material and also the cost of distribution. Skipped areas wider than the distance between drills, in the case of drilling operations, or areas averaging more than 4 inches in width in the case of broadcasting operations, are subject also to this provision.

When conditions are such, by reasons of extreme drought, excessive moisture, or other factors, that satisfactory results are not likely to be obtained, the work shall be stopped and it shall be resumed only when the desired results are likely to be obtained.

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3.02 ORDER OF WORK:

The order of work operations shall be as follows, except as modified by the Owner.

- A. Removing of Debris: Prior to the commencement of seeding, all large stones, cables, wire, or any waste materials shall be removed from the site. All heavy growths of vegetation on the site which may interfere seriously with subsequent seeding, or sowing operations shall be mowed, raked, and used for mulch if suitable, or hauled off the site, as directed by the Owner.

During seeding operations, the ground surface shall be kept cleared of all large stones, roots, cable, wire, or any other materials which might hinder subsequent fertilizing, sowing, or maintenance operations.

1. Finished Grading: Prior to seeding the areas shall be given a finished grading as needed to correct irregularities in the surface, due to previous operations or other causes and to restore the prescribed grade.
2. Discing and Harrowing: After the finish grading has been completed, the areas to be seeded shall be thoroughly prepared to a depth of 1 to 2 inches by discing or harrowing or by other means approved by the Owner.
3. Fertilizing: Fertilizer shall be distributed uniformly over the areas to be seeded at a rate which will provide not less than the minimum quantity of each fertilizer ingredient specified. Distribution shall be by hand or by a common fertilizer distributor, or other equipment approved by the Owner. Use of a grain or seed drill, equipped to sow seed and distribute fertilizer at the same time, will be permitted.
4. Sowing Seed: All sowing of seed shall be completed prior to September 28, 2012. Sowing delayed beyond the specified dates, and due to circumstances beyond the Contractor's control, may be continued upon written approval from the Owner, but in no instance more than 10 calendar days beyond the latest date. Temporary winter seeding and mulching necessary to maintain SWPPP due to delays until spring will be at no additional cost to the Owner. The Contractor shall employ a method of sowing satisfactory to the Owner, and where practical he shall make use of approved power-drawn drills or seeders, hand seeders, or other approved equipment. When sowing seed mixtures, the Contractor shall keep the seed thoroughly mixed during the sowing operations to prevent separation of species and the subsequent lack of uniform distribution of species. When drills or other sowing equipment are used, they shall be equipped with markers or other means to provide that the successive seeded strips will overlap or be separated by a space no greater than the space between drills of the equipment being used. The sowing shall be stopped when satisfactory results are not likely to be obtained due to excessive moisture conditions, high winds, or other unfavorable conditions. It shall be resumed only when conditions are favorable again or when alternate or corrective measures and procedures which are approved by the Owner have been adopted. The rates of sowing specified are on the basis of the

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minimum total of pure live seed per acre. Actual sowing rates will be in excess of this quantity because of the existence of inert materials in all lots of seed. The actual seeding rate of the seed as delivered (including the inert and other material) is determined by dividing the minimum pounds of pure live seed, as specified, by the percentage by weight of pure live seed of the delivered seed.

5. Cleaning Up: After the seed has been sown, and prior to compacting, the surface shall be cleared of all stones, or other objects larger than 2 inches in greatest diameter, and all wire, roots, brush, or other objects that may interfere with subsequent mowing operations.
6. Compacting: Immediately after the sowing operations have been completed, unless otherwise directed by the Owner, the entire area shall be compacted by means of a culti-packer, roller, or other approved equipment, in order to reduce air pockets to a minimum. When a culti-packer or other equipment that leaves a roughened surface is used, the final rolling shall be along the contour and at right angles to the existing slopes to reduce water erosion, or at right angles to the prevailing wind to reduce dust, as directed by the Owner.
7. Hydro-Mulching: Cellulose fiber mulching material shall be placed as soon as seed is sewn and final rolling is completed at a rate of 3050 pounds per acre. Mulch shall be evenly and uniformly distributed and anchored to the soil.

3.03 REPAIRING:

If the surface has become gullied or otherwise damaged, within two (2) years from the date of acceptance of this project, the affected areas shall be repaired to re-establish the grade (at no additional cost) and the condition of the soil, as directed by the Owner and provided for in this specification, and shall then be reseeded as specified herein. Later placing and compacting of fill material will be in accordance with the applicable grading specifications.

* * * END OF SECTION * * *

SECTION 312300

EARTHWORK

PART 1 - GENERAL

1.01 SCOPE:

- A. The work covered by this section of the Project Manual shall include furnishing of all labor, material and equipment necessary to complete the removal and replacements items, topsoil stripping, excavation, embankment, subgrade preparation and terrace grading necessary for construction of the project.
- B. It will be the Contractor's responsibility to protect all existing utilities. Any existing utilities damaged by the Contractor will be replaced or repaired at the Contractor's expense. The Contractor is cautioned to seek the help of the appropriate utility office in locating existing lines.
- C. No excavation or stripping shall be started until the area has been cleared and grubbed and the Contractor has staked the proposed work.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Soil Testing: Section 312326.

PART 2 - PRODUCTS - NONE

PART 3 - EXECUTION

3.01 REMOVAL, ADJUSTMENT AND REPLACEMENT ITEMS:

- A. Concrete Pavement or Asphalt Pavement:
 - 1. Concrete pavement or asphalt pavement shall be removed as shown on the plans or directed by the Engineer.
 - 2. The juncture between the existing pavement or the surfacing to remain and that to be removed shall be made by sawing or milling and carefully removing the portion required in such a manner that the remaining pavement will not be damaged.
 - 3. Street excavation material removed by the Contractor shall be used as fill in widening areas of access road. The Contractor shall place the material as specified in Paragraphs 3.02-C and D.

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4. Concrete or asphalt pavement removed shall remain the property of the Contractor. The Contractor shall dispose of pavement at a location arranged by the Contractor.
5. Replacement shall be as shown on the plans or directed by the Engineer.

B. Concrete Curb and Gutter:

1. Concrete curb and gutter shall be as shown on the plans or as marked/directed by the Engineer.
2. The juncture between the existing curb and gutter to remain and that to be removed shall be made by sawing and carefully removing the portion required in such a manner that the remaining curb and gutter will not be damaged.
3. New curb shall be tied to existing curb by drilling two No. 4 rebar 18 inches long with 9 inches inserted into the existing curb.
4. Replacement shall be as shown on the plans or as directed by the Engineer.
5. Any curb and gutter damaged or removed which has not been marked or approved by the Engineer shall be replaced at the Contractor's expense.
6. Expansion material/board (½-inch min.) shall be installed and the cost incidental, when new pavement is to abut the back of curb.

C. Sidewalks and Private Driveways:

1. The authorized removal and replacement of these items to be paid for by the Owner shall be marked in the field.
2. The outer most line of removal shall be made by neatly sawing parallel to the curb line and removing the approved portion without damaging the remaining driveway and/or sidewalk.
3. Replacement shall be from the approved line of removal to the back of curb line. Replacement thickness is to be # inches of PCC for driveways, # inches of PCC for sidewalk.
4. Immediately after placement, concrete shall be properly finished. The sequence of operations shall be as follows: machine or hand finishing, longitudinal floating, straightedge finishing, belting, broom finishing and the edging of joints. The machine method of finishing shall be employed, except that on odd widths or shapes of slab sidewalks, or where approved by the Engineer, hand methods will be permitted. All finishing equipment and tools shall be maintained clean, free from hardened concrete or grout,

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and in a condition satisfactory to the Engineer.

5. The Contractor shall protect fresh concrete surfaces that may be damaged from pedestrians, bicycles, malicious mischief and similar occurrences, until the surface has hardened. Any surfaces which are damaged shall be removed and replaced or repaired.

D. Manhole or Valve Box Adjustments:

1. The Contractor shall adjust existing manholes, inlets and valve boxes to ¼-inch below finished grade.
2. A smooth neat transition from the casting to adjacent finished surface is required.
3. All necessary materials including rings, if used, shall be furnished by the Contractor.
 - a. High density polyethylene (HDPE) rings shall be used when adjustments are made under the casting frame. Polybutene caulking compound shall be used to seal and insure watertight joints on both sides of adjustment rings.

--- or ---

- b. This includes the installation of a metal riser as manufactured by U.M.A.R., Inc., Pella, Iowa, or approved equal for manhole casting adjustments. The Contractor will be required to anchor the risers to the existing castings with spot welds. The riser shall be ½-inch below the adjacent finished street surface. Each metal riser must be custom made for each casting.
4. Any backfill disturbed during adjustment shall be carefully and thoroughly tamped to 95% Standard Proctor Density.
5. Remove Precast manhole sections as needed to provide proper height. Cost incidental to the Manhole Adjustment bid item.
6. Adapters of proper height may be used on valve boxes.
7. Install Cretex external chimney seals on all sanitary or water castings.

3.02 EXCAVATION, EMBANKMENT AND GRADING:

A. General:

1. The entire subgrade shall be graded to the elevation required prior to surfacing placement.

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2. Terraces shall be graded according to the plans, or as otherwise directed by the Engineer.
3. Utility appurtenances shall be located and clearly marked to avoid damage to same. Any items so damaged shall be repaired or replaced at the Contractor's expense.
4. Waste: Excavated material not needed for use on site shall be disposed of by the Contractor in locations designated by the Contractor.
5. A sufficient quantity of native topsoil, free from gravel and other foreign material and suitable for growing grass, shall be retained from the general excavation so that all terraces will have a surface at least 6 inches thick of this material.
6. Earthwork shall be suspended any time satisfactory results cannot be obtained because of weather conditions or inadequate equipment.
7. Suitable excavation from the site shall be used as embankment material prior to hauling embankment material from another source.

B. Excavation:

1. The Contractor shall perform all excavation, embankment and grading required for the site, including the requirements for moisture and density control as specified.
2. All suitable excavated materials shall be used on site to the extent necessary to raise the subgrade to the required elevation and to grade terraces. Topsoil with vegetation or sod shall not be used for embankment or have embankment placed thereon.

C. Street and Terrace Embankment and Grading:

1. Embankment (fill) material required for purposes of constructing the site subgrade to the required elevation and fill for terraces shall be furnished by the Contractor from site excavation.
2. Immediately prior to the placing of fill materials, the entire area upon which embankment is to be placed, except where limited by rock, shall be scarified by means of a disc harrow (or other approved equipment) to a depth of 6 inches. Scarifying shall be done approximately parallel to the axis of the fill. A thin layer (3 inches plus or minus) of fill material shall be spread over the scarified area and compacted as required in these specifications.
3. The upper 6 inches of the embankment shall be free from all rocks, wood,

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and other foreign material.

4. Site embankment material derived from excavation on the site shall not be measured for separate payment, the cost thereof shall be included in the unit price bid for excavation and embankment.
5. Upon completion of the site work, the Contractor shall excavate or fill in order to grade the terraces as described in Paragraph 3.02-A.2. or as directed by the Engineer.
6. The size and type of equipment utilized on this portion of the work shall be commensurate with the work to be accomplished.
7. Care shall be taken in working around existing utilities, trees, shrubs, and private sidewalks so as to avoid any damage to same.
8. The Contractor shall grade the gravel/rock driveways at a uniform slope as shown on the plans or as directed by the Engineer. All equipment, labor and granular material, if required; shall be incidental to the cost of Gravel Surfacing.

D. Compaction:

1. The following procedure shall apply in the compaction process to the point of finished base under the pavement and shall be paid for as subgrade preparation:
 - a. This item includes all work associated with scarifying, drying material, applying water, discing, blading, and controlling moisture as necessary to compact 12 inches of subgrade below the proposed aggregate/recycled milling base to 98% of Standard Proctor density with -4 to -1% of optimum moisture. The Contractor shall be responsible for maintaining the subgrade (shape and density) in good condition prior to special backfill or paving. All work necessary to set string line, trim the subgrade, and prepare and maintain the subgrade prior to paving shall be included in this item and paid for in bid item Subgrade Preparation.
 - b. Remove all sod, roots, and vegetation from the area in which the embankment is required and from the embankment material.
 - c. The embankment shall be built of suitable material available from the project, in successive horizontal layers not exceeding 6 inches in compacted thickness.
 - d. Add water or air dry material as required for adequate compaction.

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- e. The Contractor shall completely remove the upper 6" of material prior to scarifying and compacting the lower 6". At such time the lower 6" is at the specified density, the Contractor may proceed with building of embankment and compaction for the upper 6". Any method of subgrade preparation other than the complete removal of the top 6" of material will not be acceptable.
2. Any area not accessible to large equipment shall be compacted by hand or with smaller equipment.

E. Subgrade Preparation and Protection:

1. After the rough grading work has been completed, the entire graded area shall be smoothed and shaped to produce a finished subgrade in accordance with the elevations shown in the drawings or established by the Engineer.
2. The Contractor shall be responsible for maintaining the finished subgrade or base under the pavement in top condition until subsequent operations are performed.
3. The required moisture content of the subgrade base shall be maintained by light sprinkling immediately prior to surfacing. However, at no time shall enough water be added to soften the surface of the subgrade.
4. Areas in the subgrade, which are soft or otherwise contain unsuitable material shall be excavated and replaced with material approved by the Engineer. The replacement material will, if so directed by the Engineer, be a lean clay material capable of being compacted to 98% of Standard Proctor Density and paid for as Embankment Borrow.

F. Topsoil:

1. Topsoil shall be stripped, stockpiled and later spread over designated areas. When the topsoil cannot conveniently be stockpiled within the right-of-way, it shall be the Contractor's obligation to arrange for stockpile sites at his own expense. The stockpiles shall be shaped and smoothed to facilitate draining and to keep the area as neat as possible.
2. Topsoil stripping and stockpiling shall be included in the price for "Terrace Grading".
3. Upon completion of the pavement work outside the roadway pavement limits, 6 inches of topsoil free from gravel, sticks and other foreign material shall be placed on all newly disturbed areas behind the curb or beyond the completed surfacing. The topsoil shall be finished graded ready for seeding. All costs associated with topsoil spreading and finishing grading shall be included in Terrace Grading.

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4. Excess excavation and topsoil, if any, shall be stockpiled at a location determined by the Owner. Cost shall be incidental to common excavation.
5. The final surface finish shall be one equal to a light harrowing so that the terraces will be suitable for seeding.
6. Finish grading of topsoil shall be included in the price for Terrace grading.
7. Contractor shall furnish and install all topsoil borrow necessary for grading.

* * * END OF SECTION * * *

SECTION 312326

SOIL TESTING

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONSTRUCTION AGREEMENT and other CONDITIONS of the Contract and the GENERAL REQUIREMENTS (Division 1) are hereby made part of this Section.
- B. **The Contractor shall employ a testing laboratory for the purpose of performing soil testing throughout the project.**
- C. In-place density tests will be taken as directed below, with a nuclear density gauge.
- D. **The Contractor shall pay for the cost of all in-place density tests.**

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Earthwork: Section 312300.

PART 2 - PRODUCTS - NONE

PART 3 - EXECUTION

3.01 LOCATION OF TESTS:

- A. The in-place densities shall be taken in the finished subgrade and in maximum one foot lifts prior to the placement of surfacing in a 75' x 75' grid and in various layers in the site subgrade preparation and trench backfill for sanitary sewer mains, water mains, services and storm sewers.
- B. The in-place densities shall be performed by the independent testing firm certified by the State and locations shall be randomly selected. Test data shall be submitted to the Engineer throughout construction and will be required prior to project progress payments each period.
- C. After passing compaction testing, Contractor shall perform and pass test rolling as indicated in the plans prior to further surfacing operations.

* * * END OF SECTION * *

