02 30 00 SUBSURFACE INVESTIGATION

1. SCOPE OF WORK

1.1 Use of Information Provided

1.1.1 Information included is provided by the Owner for reference only and is not part of the Contract Documents.

1.1.2 Bidders are urged to examine the information provided, make their own investigation of the site before bidding, and obtain additional geotechnical information should they desire. No consideration will be given for additional compensation for extra work for conditions which could reasonably have been anticipated from this geotechnical information.

1.2 Interpretation

1.2.1 Geotechnical data is provided only for information and convenience of Bidders. The Owner disclaims any responsibility for accuracy, true location and extent of geotechnical investigation that has been prepared by others. They further disclaim responsibility for interpretation of that data by Bidders.

1.3 Geotechnical Report

1.3.1 Reproduced on the following pages is the geotechnical report, entitled:

A Geotechnical Evaluation for:
Proposed Commercial Addition
4701 Humboldt Avenue North
Minneapolis, Minnesota

Prepared by: Haugo Geotechnical Services

Prepared For: Broadway Equipment
4701 Humboldt Avenue North
Minneapolis, Minnesota

END SECTION

DIVISION 03 CONCRETE

The General Conditions of the Contract, Supplementary Conditions, and Division 0l General Requirements, apply to all work of this section. Refer to other sections, divisions, and schedules for other work in connection with this work.

03 03 30 CONCRETE FORMING

1. SCOPE OF WORK

1.1 Provide labor, materials, equipment, and services necessary to furnish and install concrete formwork indicated and specified herein.

2. STANDARDS

2.1 Meet requirements and recommended practice for concrete formwork ACI 347-78, except as specified in other sections.

3. MATERIALS

3.1 Provide forms for all concrete work. Earth cuts shall not be used as forms to vertical surfaces.

3.2 All forms shall be suitable for the purpose intended according to the plans and other sections of the specifications. Verify with Civil Engineer.

3.3 Required forming accessories of approved manufacturer.

3.4 Approved form releasing agent equal to "Nox-Crete".

4. DESIGN

4.1 Formwork shall be designed for loads and lateral pressures scheduled in ACI 347-78.

4.2 Temporary openings shall be provided in forms where necessary to facilitate cleaning and observation before concrete is deposited.

4.3 Form accessories partially or wholly embedded in the concrete shall be manufactured type approved (non-fabricated wire ties are not acceptable). Portion remaining in concrete shall have no metal within 1" of surface.

4.4 Design forms so they can be removed in proper sequence without damage to the finished work.

5. CONSTRUCTION OF TEMPORARY FORMWORK

5.1 The design and construction of forms and supports shall conform to the requirements of ACI 301 and ACI 347 as a minimum standard.

5.2 Construct forms so that completed concrete will conform to shapes, lines, grades, and dimensions indicated on plans and required. Forms shall be true, plumb, and level with reasonably tight joints. Adequately support and brace forms to safely support the loads occurring during construction without appreciable bleeding or loss of mortar when the concrete is thoroughly compacted by internal high cycle vibration.

5.3 Forms shall be sufficiently tight to prevent leakage of grout or cement paste. Board forms of open joints shall be swelled until closed by wetting before concrete is placed.

5.4 Plywood and other surfaces not subject to shrinkage shall be sealed against absorption of moisture from concrete by sealer or applied nonabsorptive liner.

5.5 Form coating shall be done prior to reinforcement placing. Excess coating shall not be allowed to stand in puddles nor allowed to come in contact with concrete against which fresh concrete will be placed.

5.6 Form coatings for as-cast finishes must be compatible with type of paint or finish scheduled and specified in other sections. Coatings and release agent shall be non-staining. On lumber forms, prior to first use, coat three times--once 36 hours prior to first use, once l hour prior, and once in between. After stripping forms, clean immediately, repair, protect and re-oil prior to re-use. Protect forms from rain, dirt, etc.

5.7 Box out and provide openings as required. Leave openings for cleaning of forms and proper placement of concrete.

5.8 Build in anchors, inserts, bolts, and other devices indicated or required for the various portions of the work. Build in sleeves, thimbles, and other items furnished or set in place by other trades.

6. TOLERANCES

6.1 Tolerances for formed concrete surfaces shall be as specified in ACI 347-78, Article 2.4.1.

7. REMOVAL OF FORMS

7.1 Forms shall be removed in accordance with the requirements of ACI 347-78, Article 2.7, without damage to concrete and in a manner to insure complete safety of the structure.

7.2 Do not remove forms or supports until concrete has acquired sufficient strength to safely support its own weight and the superimposed loads.

7.3 Formwork for other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.

7.4 Thoroughly clean forms before re-use.

END SECTION

03 11 13 CAST-IN-PLACE CONCRETE

1. SCOPE OF WORK

1.1. Provide labor, materials, equipment, and services required to furnish and install cast-in-place concrete indicated and specified herein.

1.2. Work shall include, but not be limited to:

1.2.1. Slabs on grade.

1.2.2. Control, expansion and contraction joint devices.

1.2.3. Equipment pads.

1.2.4. Light pole base.

1.2.5. Manholes.

1.2.6. Sidewalks.

1.2.7. Curbs and Gutters.

1.2.8. Driveways.

1.3. References

1.3.1. References to "Mn/DOT" mean the Minnesota Department of Transportation. References to "Mn/DOT Spec." mean the Minnesota Department of Transportation Standard Specifications for Construction, 2014 Edition.

1.3.2. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

1.3.3. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

1.3.4. ASTM C150 - Standard Specification for Portland Cement.

1.3.5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

1.3.6. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-

Cement Grout (Nonshrink).

1.4. Submittals

1.4.1. Section 01330 - Submittal Procedures

1.4.2. Manufactures' certificates and data certifying that the following materials conform to the requirements specified:

1.4.2.1. Expansion joint filler.

1.4.2.2. Hot poured sealing compound.

1.4.2.3. Reinforcement.

1.4.2.4. Curing materials.

1.4.2.5. Concrete protective coating.

1.5. Design Data:

1.5.1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:

1.5.1.1. Hot and cold weather concrete work.

1.5.1.2. Air entrained concrete work.

1.5.2. Identify mix ingredients and proportions, including admixtures.

1.5.3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.6. Closeout Submittals

1.6.1. 01700 – Execution and Closeout Requirements: Closeout procedures.

1.6.2. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.7. Quality Assurance

1.7.1. Perform Work in accordance with Mn/DOT Spec. 2521 and 2531.

1.7.2. Acquire cement and aggregate from one source for Work.

1.8. Environmental Requirements

1.8.1. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.8.2. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

2. MATERIALS

2.1. Concrete Materials

2.1.1. Cement: Mn/DOT Specs., Type 3 air-entrained.

2.1.2. Expansive Hydraulic Cement: ASTM C845.

2.1.3. Coarse Aggregates: Mn/DOT Spec. 2461.

2.1.4. Fine Aggregate: Mn/DOT Spec. 2461.

2.1.5. Water: Mn/DOT Spec. 2461.

2.2. Admixtures

2.2.1. Furnish materials in accordance with Mn/DOT Spec. 2461.

2.2.2. Air Entrainment: ASTM C260.

2.3. Accessories

2.3.1. Non-Shrink Grout: ASTM C1107, Grade A; premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4000 PSI in 28 days.

2.4. Joint Devices and Filler Materials

2.4.1. Joint Filler: Complying with Mn/DOT Spec. 3702.

2.4.2. Sealant and Primer: Mn/DOT Spec. 3719.

2.5. Concrete Mix

2.5.1. Manual Placement: Mn/DOT Mix No. 3A32.

2.5.2. Slip-form Placement: Mn/DOT Mix No. 3A22.

2.6. Reinforcement

2.6.1. Type, amount, and locations of steel reinforcement shall be as shown on the Drawings and in the specifications.

2.6.2. Comply with Mn/DOT Spec. 2472

2.7. Concrete Curing and Protection

2.7.1. Comply with Mn/DOT Spec. 5221.3E

3. **EXECUTION**

3.1. Examination

3.1.1. 00 72 00 - Administrative Requirements: Coordination and project conditions.

3.1.2. Verify requirements for concrete cover over reinforcement.

3.1.3. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2. Preparation

3.2.1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

3.2.2. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.2.3. Remove debris and ice from formwork, reinforcement, and concrete substrates.

3.2.4. Remove water from areas receiving concrete before concrete is placed.

3.3. Placing Concrete

3.3.1. Place concrete in accordance with Mn/DOT Spec. 2531.

3.3.2. Notify Civil Engineer minimum 48 hours prior to commencement of operations.

3.3.3. Ensure reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.

3.3.4. Install construction joint devices in accordance with Mn/DOT Specs. Set top to required elevations. Secure to resist movement by wet concrete.

3.3.4.1. Sidewalk: Mn/DOT Spec. 2521.2A.1

3.3.4.1.1. Curb and gutter, driveways, equipment pads: Mn/DOT Spec. 2531

3.3.5. Install joint device anchors. Maintain correct position to allow joint cover to be flush with finish.

3.3.6. Apply sealants in joint devices.

3.3.7. Deposit concrete at final position. Prevent segregation of mix.

3.3.8. Place concrete in continuous operation for each panel or section determined by predetermined joints.

3.3.9. Consolidate concrete.

3.3.10. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.3.11. Place concrete continuously between predetermined expansion, control, and construction joints.

3.3.12. Do not interrupt successive placement; do not permit cold joints to occur.

3.4. Concrete Finishing

3.4.1. Provide formed concrete surfaces to be left exposed with finish as scheduled in this section.

3.4.1.1. Sidewalk: Mn/DOT Spec. 2521

3.5. Curing and Protection

3.5.1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

3.5.1.1. Protect concrete from freezing for minimum 7 days.

3.5.2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.5.3. Cure concrete in accordance with Mn/DOT Specs.

3.5.3.1. Sidewalk: Mn/DOT Spec. 2521.3E

3.5.3.2. Curb and gutter, light pole bases: Mn/DOT Spec. 2531.3G

3.6. Field Quality Control

3.6.1. Section 01 45 00 - Quality Control, and 01 77 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

3.6.2. Field inspection and testing will be performed by qualified construction testing company hired by Contractor or Owner.

3.6.3. Provide free access to Work and cooperate with appointed firm.

3.6.4. Submit proposed mix design of each class of concrete to testing company for review prior to commencement of Work.

3.6.5. Concrete Inspections:

3.6.5.1. Continuous Placement Inspection: Inspect for proper installation procedures.

3.6.5.2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

3.6.6. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7. Patching

3.7.1. Allow Civil Engineer to inspect concrete surfaces immediately upon removal of forms.

3.7.2. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Civil Engineer upon discovery.

3.7.3. Patch imperfections as directed by Civil Engineer.

3.8. Defective Concrete

3.8.1. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

3.8.2. Repair or replacement of defective concrete will be determined by Civil Engineer.

3.8.3. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Civil Engineer for each individual area.

END SECTION

03 15 00 CONCRETE ACCESSORIES

1. SCOPE OF WORK

1.1 Provide all labor, materials, equipment, and services required to furnish and install expansion and contraction joints as indicated or specified herein.

1.2 The work of this section includes, but not be limited to:

1.2.1 Expansion Joints

1.2.2 Contraction Joints

1.2.3 Rebar

1.2.4 Zip Strips

2. SUBMITTALS

2.1 Make submittals in accord with Section 01 33 00 and Section 01 33 23.

2.2 Samples of tool joint (9 LF on concrete sample and when approved shall become part of work).

3. MATERIALS

3.1 Expansion Joints

3.1.1 Expansion joints for concrete shall be 1/2" preformed, non-impregnated fiberboard or other resilient, rigid expansion material approved as equal.

3.2 Submit shop drawing schedule indicating proposed joint locations on all flat concrete work to Civil Engineer.

3.3 Contraction Joints

3.3.1 Contraction joints shall be hand tooled. Submit shop drawing schedule for all proposed contraction joints and type proposed.

3.3.2 Zip strips used for contraction joints shall be commercially available units suitable for this work.

3.4 Rebar

Contractor to provide rebar plans and details for approval by Civil Engineer.

4. INSTALLATION

4.1 Expansion Joints

4.1.1 Expansion joints shall be installed as indicated on drawings. Submit expansion joint shop drawings for approval by Civil Engineer.

4.1.2 In all cases, expansion joints shall be formed by placing the filler material in the forms before the concrete is formed.

4.1.3 Expansion joints formed with Keyway units shall be installed as per MnDOT 2301.3C.

4.2 Contraction Joints

4.2.1 Contraction joints shall be installed where indicated on plans or where required to insure surface stability.

4.2.2 Joints shall be tooled to depth of 1/3 of concrete thickness and shall be 3/8" wide.

4.2.3 Joints requiring hand tooling shall be to 1/3" depth, 3/8" wide at 1/4" from surface. Use only where sawcutting is not practical due to field conditions.

4.3 Zip Strips

4.3.1 Contractor shall pull zip strips and follow up by hand tooling exact alignment.

END SECTION

DIVISION 31 EARTHWORK

The General Conditions of the Contract, Supplementary Conditions, and Division 0l General Requirements, apply to all work of this section. Refer to other sections, divisions, and schedules for other work in connection with this work.

31 11 00 CLEARING AND GRUBBING

1. GENERAL

1.1 Scope of Work

1.1.1 Work under this section includes all labor, materials, services, and equipment required to perform clearing and grubbing of the site as indicated and specified herein.

1.1.2 This work includes, but is not limited to:

1.1.2.1 Clearing Operations

1.1.2.2 Grubbing Operations

1.1.2.3 Clean-Up Operations

1.1.3 Related Sections

1.1.3.1 Section 01 50 00 – Temporary Barriers and Enclosures

1.1.3.2 Section 31 20 00 – Earthwork

1.1.3.3 Section 31 25 00 – Erosion and Sediment Control

1.2 References

1.2.1 MnDOT, Minnesota Department of Transportation Standard Specifications for Construction, 2014 edition, and its corresponding Supplemental Conditions. Only applicable portions of construction methods and materials apply. Reference to methods of measurement or payment are not applicable

.

1.3 Project Site Conditions

1.3.1 All existing utilities shall be identified, located, and protected by the Contractor.

1.3.2 All public right-of-way facilities (signage, lighting, signals, etc.) shall be protected.

1.3.3 See Section 01 50 00 for protection of the public utilities, and for protection of monuments and other site elements not designated for removal.

1.3.4 See Section 31 25 00 regarding the erection of silt fence for protection of public waters.

2. **MATERIALS** –Not Used

3. **EXECUTION**

3.1 Clearing

3.1.1 This work shall consist of cutting and removing all trees and shrubs, as designated on the plans. It is the responsibility of the Contactor (prior to bid) to field verify and investigate plant removals. Field conditions may vary from record survey.

3.1.2 Any trees or shrubs removed or significantly damaged during clearing operations which are not indicated and marked for removal shall be replaced at Contractor's expense.

3.2 Grubbing

3.2.1 This work shall consist of removing stumps and roots in their entirety of cleared trees and shrubs and as indicated on the drawings.

3.2.2 Removal shall be to a minimum depth of 12" below existing or proposed finish grade, whichever is deeper. Contractor shall collect and remove from the site all grubbed material.

3.2.3 Backfill all depressions created by stump and root removal with clean fill in accordance with Section 31 20 00 Earthwork.

3.3 Cleanup

3.3.1 All timber, stumps, roots and miscellaneous debris from the clearing and grubbing operations shall become the property of the Contractor and shall be removed from the site.

3.3.2 No burning or burial will be permitted on the site.

END SECTION

31 20 00 EARTHWORK

1. SCOPE OF WORK

1.1 Include labor, materials, equipment and services required to perform the earthwork indicated and specified herein.

1.2 The work includes, but is not limited to:

1.2.1 Grade Elevations
1.2.2 Protection
1.2.3 Cutting and Filling
1.2.4 Excavation
1.2.5 Dewatering
1.2.6 Backfilling
1.2.7 Rough Grading
1.2.8 Finish Work
1.2.9 Fill Materials

2. GENERAL EARTHWORK

2.1 Grade Elevations

2.1.1 The Contractor shall assume and be responsible for all grades as taken from the established elevation as provided by the Surveyor. The grade stakes shall be furnished and set by the Contractor.

2.2 Protection

2.2.1 Protect all existing trees, walks, and other items not designated to be removed and all monuments, benchmarks, and buildings.

2.2.2 Sediment fence shall be installed as indicated on plans. Install prior to starting of grading. See Section 31 25 00.

2.2.3 Erosion and sediment control practices shall be installed as indicated on the plans prior to starting of grading.

2.3 Cutting and Filling

2.3.1 Contractor shall do all cutting and filling necessary to establish the proper subgrade for the entire area within the construction limits. All additional fill, if necessary for this work, shall be supplied by the Contractor.

2.3.2 All organic and unstable material encountered at subgrade depths shall be excavated to full depth and backfilled in specified manner.

2.4 Excavation

2.4.1 Excavate to elevations and dimensions indicated on drawings. Allow additional space as required for construction operations. Remove rocks, boulders, stumps, and other obstructions encountered below the surface of the ground.

2.4.2 Excavated materials suitable for re-use shall be stored in proposed stockpile areas for this project. All other debris and unsuitable material shall be removed from the site.

2.4.3 Remove any and all unstable and unsuitable materials encountered during excavation to their full depth.

2.5 Dewatering

2.5.1 Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

2.5.2 Do not allow water to accumulate in excavations. Remove water to prevent softening of excavation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.

2.5.3 Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2.5.4 Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

2.6 Backfilling and Compaction

2.6.1 Backfill shall be approved material as indicated or specified and placed in successive horizontal layers not exceeding 6" in depth before compacting. Spread evenly and compact each layer.

2.6.2 Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density in accordance with ASTM D 1557.

2.6.2.1 Structures, Building Slabs and Steps, Pavements, Walkways: Compact top 24" of subgrade and each layer of backfill or fill material at 100% maximum density.

2.6.2.2 Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density.

2.6.3 Complete backfilling to elevations required for finish grading or other surface treatments shown.

2.7 Rough Grading

2.7.1 The site shall be rough graded to permit the finish grades shown on the plans. Rough grading shall be carried to such elevations as are necessary to accommodate finishes as specified on plans.

2.7.2 All grading to be accomplished under this contract shall be worked carefully such that smooth contours will result that conform to the plans. Final rough grades shall be verified by Civil Engineer prior to fine grading. Verification by the Civil Engineer shall not relieve the Contractor of any responsibility to provide the general grades and drainage as indicated or specified.

2.7.3 The rough grade elevations shall be:

2.7.3.1 Six (6) inches below finish grade for areas to receive topsoil.

2.7.3.2 Minimum eighteen (18) inches below finish grade for pavement.

2.8 Finish Work

2.8.1 The Contractor shall do all fine grading necessary prior to sodding and seeding to bring the areas to the final grades as indicated on the drawings. All grading shall be finished smooth and free from any extraneous debris, roots, concrete, rubble or rock larger than ½" diameter.

2.8.2 Tolerance of finish grading shall be +/- 0.1 ft. (1/10th ft.) from grades indicated in the plans.

2.8.3 Irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent formation of depressions or water pockets.

2.8.4 The Contractor shall fill and grade all existing topography which is necessary to achieve smooth grades as indicated on plans or directed by the Civil Engineer.

2.8.5 All new grades shall blend into existing surrounding grades so as to form smooth transitions to existing surfaces and slopes.

2.9 Fill Material

2.9.1 Nonfrost-susceptible fill shall be defined as sand, gravelly sand, or gravel having less than 50 percent of the particles by weight passing a 40 sieve, and less than 5 percent of particles by weight passing a 200 sieve. Existing on-site soils meeting this specification may be used.

2.9.2 Clean fill for backfilling shall meet requirements of MnDOT Specifications 2105-1 for common borrow. All fill shall be free of large rocks, miscellaneous debris and large amounts of organic matter.

2.9.3 Topsoil shall be loam, sandy loam, or sandy clay loam meeting the requirements of MnDOT Specification 3877 and approved by the Landscape Architect. Topsoil shall be free of extraneous materials larger than ½ (0.50) inch diameter. It shall be free of viable plants or plant parts.

END SECTION

31 22 00 GRADING

1. SCOPE OF WORK

1.1 The work under this section includes, but is not limited to:

1.1.1 Rough grading and preparing the site for building, parking lot, and landscaped areas.

1.1.2 Finish grading.

2. MATERIALS

2.1 Topsoil: See Section 32 91 13.1.

2.2 Other Fill Materials: See Section 31 23 00.

3. INSTALLATION

3.1 Examination

3.1.1 Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 Preparation

3.2.1 Identify required lines, levels, contours, and datum.

3.2.2 Stake and flag locations of known utilities.

3.2.3 Locate, identify, and protect from damage above- and below-grade utilities to remain.

3.2.3.1 Contractor shall utilize the Minnesota Gopher State One Call, 1-800-252-1166 for locating and marking of all utility within the work area prior to any excavation on the project site.

3.2.3.2 Contractor shall hire a private utility locator to locate private utilities.

3.2.4 Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by construction equipment and vehicular traffic.

3.2.5 Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside these lines.

3.2.6 Protect plants, lawns, landscape beds, and other features to remain as a portion of final landscaping.

3.3 Rough Grading

3.3.1 Remove all unsuitable soils (topsoil, soils with trace organics, wet or otherwise disturbed soils).

3.3.2 Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

3.3.3 Do not remove topsoil when wet.

3.3.4 Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

3.3.5 Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

3.3.6 When excavating through roots, perform work by hand and cut roots with sharp axe.

3.3.7 See Section 31 23 00 for filling procedures.

3.3.8 Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

3.3.9 Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 Finish Grading

3.4.1 Before Finish Grading:

3.5.1.1 Verify trench backfilling has been inspected by Civil Engineer.

3.5.1.2 Verify subgrade has been contoured and compacted.

3.4.2 Remove debris, roots, branches, stones, in excess of ½-inch diameter in size. Remove soil contaminated with petroleum products from construction activities.

3.4.3 Place topsoil in planting beds as indicated on plans.

3.4.4 Place topsoil during dry weather.

3.4.5 Remove roots, weeds, rocks, and foreign material while spreading topsoil.

3.4.6 Near plants, spread topsoil manually to prevent damage.

3.4.7 Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contours of subgrade.

3.4.8 Lightly compact placed topsoil.

3.5 Tolerances

3.5.1 Top Surface of Subgrade: Plus or minus 0.10 foot (1.2 inches) from required

elevation.

3.5.2 Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.6 Repair and Restoration

3.6.1 Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition at Contractor's expense.

3.6.2 Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Landscape Architect as to remedy.

3.6.3 Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size and as approved by Landscape Architect.

3.7 Field Quality Control

3.7.1 See Section 31 23 00 for compaction density testing.

3.8 Cleaning

3.8.1 Leave site clean and raked, ready to receive landscaping.

END OF SECTION

31 23 00 EXCAVATION AND FILL

1. SCOPE OF WORK

1.1 All Work included in this Section shall be performed in accordance with the following paragraphs, the General Requirements of these Specifications, and the provisions of the other Contract Documents.

1.2 Work covered by this Section includes furnishing all supervision, labor, materials, and equipment required to complete all general or miscellaneous Excavation and Filling at the site including, but not limited to:

1.2.1 Performing all excavation, disposing of excavated materials, loosening subgrade, importing and placing fill/soils to final grades to conform to the finished site grading, elevations and slopes shown in the Plans.

1.2.2 Performing all excavation, backfilling and compaction required to install utility pipes, manholes and fittings.

1.2.3 Performing all excavation, backfilling and compaction of subgrade required to install concrete and bituminous paving.

1.2.4 Furnishing and installing all pipe bedding material, stabilizing aggregate, and aggregate base to complete the Work in accordance with the contract documents.

1.2.5 Coordinating work with utility companies where utility crossings occur through or below planned excavated areas, including gas, electric , communications, watermains, storm sewer, and sanitary sewer lines.

1.2.6 Performing any miscellaneous excavations, fill and grading required to complete the Work in accordance with the Plans and Contract Documents

1.3 References

1.3.1 Minnesota Department of Transportation Standard Specifications for Construction, 2014 Edition, hereafter referred to as MN/DOT Standard Specifications.

1.3.2 American Society for Testing and Materials, Current Edition, hereafter

referred to as ASTM.

1.3.2.1 ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

1.3.2.2 ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

1.3.2.3 ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

1.3.2.4 ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 Sequence of Schedule of Work

1.4.1 Sequence and schedule of Work on the site must be approved by Architect and Civil Engineer.

1.4.2 Contractor is to install all temporary erosion control measures prior to beginning any earthwork operations as shown on the Plans. Erosion control BMPs shall only be installed at active project areas as work progresses and removed after the site reaches final stabilization.

1.4.3 Contractor shall not block or obstruct access roads with excavated materials or equipment, except as authorized by Civil Engineer.

1.4.4 At the end of each work day, Contractor shall recycle or dispose of unused material, debris, and containers at Contractor's expense.

1.5 Submittals and Testing

1.5.1 Contractor shall submit a list of all off-site and on-site sources of materials specified in this Section to Architect and Civil Engineer for documentation, in accordance with these Specifications

1.5.2 Contractor shall provide, for documentation, certificates for materials, including gradation test results, obtained from off-site sources indicating compliance of materials with Specifications and Plans. Civil Engineer may take random samples of the material during the progression of the Work to verify compliance with the specifications. Materials not meeting the specifications shall be removed and replaced at the Contractor's

expense, including the cost for testing.

1.6 Delivery, Storage, and Handling

1.6.1 Contractor shall schedule delivery of materials so that they are incorporated into the Work and not stored on site.

1.6.2 Material storage shall be limited to the construction limits.

1.6.3 Trucking operations shall be conducted such that they will limit the disruption to traffic on the adjacent roads and such that they will limit stacking of off-loading or loading trucks in roads.

1.6.4 Contractor shall restore and clean all construction and staging areas that are used for storing materials back to their original condition upon completion of the Work at Contractor's expense.

1.7 Measurement and Payment

1.7.1 Compensation for all Work covered under this Section of these Specifications shall be in accordance with the construction contract documents.

2. MATERIALS

2.1 Clean Fill

2.1.1 Suitable Soils

2.1.1.1 Those soil materials which in the opinion of the Civil Engineer contain an adequate fraction of mineral soil particles to serve the purposes of mineral soils in the foundation and backfill zones of the Work. Mineral soils considered acceptable for the Work would have a Unified Soil Classification of: GP, GM, SP, SM, and SC

2.1.1.2 Imported topsoil borrow shall meet the requirements of Mn/DOT Standard Specification 3877-B for Premium topsoil Borrow except for as modified below and supplied by Plaisted Companies or approved equal:

Material Passing 2.00 mm (# 10) Sieve	Size	Percent (%)
Clay	<0.002 mm	5 – 20 %
Silt	0.002 - 0.085 mm	10 – 50 %
Sand	0.085 – 4.5	30 – 70 %
Organic Matter		3 – 20 %

Soil Ph: 6.1 -7.5

2.2. Sand and Aggregate

2.2.1 Select Granular Borrow

2.2.1.1 Shall be a natural sand washed and free of any organic impurities and meeting the requirements of Mn/DOT Standard Specification 3149-B2 for select granular borrow.

2.3. Geotextile Fabric

2.3.1 Geotextile Mn/DOT Type 1

2.3.1.1 Shall be a woven or knit fabric of polymeric filaments of polypropylene, polyethylene, polyester, or polyamide and shall meet the requirements of Mn/DOT Standard Specification 3733.1 for geotextile fabrics.

3. **EXECUTION**

3.1. Location of Work

3.1.1 The Work shall be located as shown on the Plans.

3.1.2 It may be necessary for Civil Engineer to shift lines a reasonable amount to avoid an obstruction to the construction work. Contractor will not be allowed any additional compensation due to minor shift of lines. Additional compensation will be allowed only for lengthening of lines, or for providing additional fittings.

3.2. Examination

3.2.1 Contractor shall examine the areas and conditions for performing earthwork. If unsatisfactory conditions occur during the Work, Contractor shall not proceed with the work until unsatisfactory conditions have been corrected and approved by Civil Engineer.

3.2.2 It shall be the Contractor's responsibility to determine to its own satisfaction the location and nature of all surface and subsurface obstacles and the soil and water conditions that will be encountered during construction.

3.2.3 Locations of utilities and underground facilities shown on the Plans are approximate and neither Civil Engineer nor Owner makes any representations as to the accuracy or completeness thereof. It shall be Contractor's sole responsibility to determine the exact locations of all utilities and underground facilities prior to performing the Work.

3.3. Preparation

3.3.1 The Contractor shall make arrangements to locate all existing utilities and underground facilities in the areas of work. For utilities and underground facilities to remain in place, Contractor shall provide adequate means to assure protection of utilities and underground facilities during earthwork operations. If utilities need to be moved to allow the completion of the Work, Contractor shall coordinate as needed with utility companies.

3.3.2 Contractor shall protect structures, roads, fences, utilities and other facilities from damage caused by settlement, lateral movement, stockpiling, undermining, washout and other hazards created by earthwork operations.

3.3.3 Contractor shall remove all specified trees, shrubs and plants prior to excavation and dispose of these materials offsite at a compost facility at Contractor's expense.

3.4. General

3.4.1 In order to maximize the infiltration rate of the soils, the Contractor shall make every effort possible to avoid compaction of the subsoils.

3.4.2 Excess excavated material and unsuitable material that cannot be used as fill on the site shall become the property of the Contractor and disposed of offsite at Contractor's expense.

3.5. Site Grading

3.5.1 Excavation

Contractor shall:

3.5.1.1 Excavate to the lines, elevation, grades, and dimensions shown on the Plans, or as necessary to complete the work shown on the Plans. Excavation beyond the lines and grades

shown in the Plans or described herein without the specific direction of Civil Engineer will be considered unauthorized excavation and shall be remedied at Contractor's expense by backfilling and compacting as specified for the appropriate situation described herein or shown on the Plans.

3.5.1.2 Use only rubber-tired construction equipment when working from the pavement.

3.5.1.3 Stability of Excavations:

3.5.1.3.1 Slope sides of excavations to comply with applicable Laws and Regulations and to provide access for compaction equipment.

3.5.1.3.2 Provide shoring and bracing where required to comply with Laws and Regulations, or to protect adjacent surface or subsurface features, or to limit activity within construction limits. Contractor shall design shoring and bracing and provide all materials, including piling, uprights, stringers, and cross-bracing in good condition at no additional cost to Owner.

3.5.1.3.3 Remove all temporary shoring and bracing after construction is completed.

3.5.2 Water Controls:

3.5.2.1 Provide all temporary water controls, including diversions as Contractor deems necessary, to prevent surface water from flowing into excavations.

3.5.2.2 Contractor shall dewater any of the work areas that become inundated with water from rainfall or ground water and this work shall be incidental.

3.5.3 Material Storage:

3.5.3.1 Stockpile materials away from edge of excavations and trenches. Shape and grade to provide drainage and minimize erosion. Provide temporary erosion control and diversions around base as necessary. Materials should be stockpiled within construction limits.

3.5.3.2 Dispose of demolition debris, excess and unsuitable material

off-site promptly following excavation.

3.5.4 Protect excavation bottoms against freezing when atmospheric temperature is below 35ºF.

3.5.5 Backfill (Fill)

Contractor shall:

3.5.5.1 Provide compaction appropriate for the location as specified elsewhere in this Section.

3.5.5.2 Backfill shall be deposited, spread, and compacted to the total specified thickness shown on the Plans.

3.5.5.3 Backfill shall proceed as promptly as possible, but not before completion of the following:

3.5.5.3.1 Removal of temporary bracing, and backfilling of voids with satisfactory materials.

3.5.5.3.2 Removal of trash and debris.

3.5.5.3.3 Permanent or temporary bracing is in place to support walls or other components.

3.5.5.4 Place backfill and fill materials in layers not more than 6 inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are soft, muddy, frozen, or contain frost or ice.

3.5.5.5 Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift. Notify Civil Engineer of any damage and repair as approved before proceeding.

3.5.5.6 Do not place frozen soil or any material containing organic matter, trash, debris, large rocks, or other deleterious substances in the backfill area.

3.5.6 Compaction Around Structures

Contractor shall:

3.5.6.1 Furnish equipment suitable for soil conditions and compactive effort required to meet compaction criteria specified herein.

3.5.6.2 Control moisture content for placement at optimum (plus 3 percent, minus 2 percent).

3.5.6.2.1 Where backfill, subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of backfill, subgrade or layer of soil to prevent free water appearing on surface during or subsequent to compaction operations. Disc or otherwise thoroughly mix to distribute added water.

3.5.6.2.2 Remove and replace soil material that is too wet to permit compaction as specified.

Around Structures: Contractor shall:

3.5.6.3 Compact fill around structures (including culverts, manholes, walls, piles, etc.) as specified in the Drawings to an in place density as measured by ASTM D1556 of 100 percent of Standard Proctor density.

3.5.6.4 Prior to placement of fill, compact native subsoil to obtain 100 percent of Standard Proctor density at depth of 36 inches.

3.5.7 Tolerances

Vertical and horizontal tolerances for grading (relative to grades shown on the Plans) shall be as follows:

Vertical: +/- 0.10 ft

Horizontal: +/- 0.50 ft

Any changes to grade in any area must be approved by the Civil Engineer.

3.5.8 Field Quality Control

3.5.8.1 The Contractor shall utilize equipment, materials, and procedures which are anticipated to meet the quality

requirements specified.

3.5.8.2 The Contractor shall permit Civil Engineer to observe subgrades and fill layers before further construction work is performed thereon. Tests and/or surveys of subgrade and fill layers may be taken by Civil Engineer.

3.5.8.3 Random field tests at the source location may also be conducted by the Civil Engineer. If any of the gradation tests fail, delivery will be halted until such time that testing passes the specification listed in Part 2 of this Section.

3.5.9 Maintenance

3.5.9.1 The Contractor shall repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances at Contractor's expense.

3.5.9.2 The Contractor shall maintain temporary erosion control until seeding and planting is accepted by Landscape Architect.

3.5.9.3 Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, the Contractor shall scarify surface, reshape, and compact to required density prior to further construction at Contractor's expense.

3.5.10 Dust Control

3.5.10.1 Contractor shall keep the surface of any and all construction work areas and haul roads moist by spraying with uncontaminated water so as to prevent, not just reduce, airborne dust. This responsibility shall require Contractor to suspend construction or haul traffic until such time as Contractor can and does prevent airborne dust.

END SECTION

31 25 00 EROSION AND SEDIMENTATION CONTROLS

1. SCOPE OF WORK

1.1 Provide labor, materials, equipment and services to furnish and install temporary erosion and sedimentation controls as indicated on the plans and specified herein.

1.2 The work under this section includes, but is not limited to:

1.2.1 Silt Fence

1.2.2 Rock Construction Entrance

1.2.3 Catch Basin Insert

1.2.4 Bio Log Barrier/Sediment Control

1.3 References

1.3.1 MnDOT, Minnesota Department of Transportation Standard Specifications for Construction 2014 edition, and its corresponding Supplemental Conditions. Only applicable portions of construction methods and materials apply. Reference to methods of measurement or payment are not applicable.

A. MnDOT 3885 – Rolled Erosion Control Products
B. MnDOT 3886 - Silt Fence

1.4 Related Sections:

1.4.1 SECTION 31 20 00 – Earthwork

1.5 Submittals

1.5.1 Submit complete list of products, product data, and source for each product listed.

2. MATERIALS

2.1 Silt Fence

2.1.1 Stronghold brand or equal, three (3) feet high with four (4) foot long hardwood stakes.

2.2 Rock Construction Entrance

2.2.1 2" - 3" crushed angular rock (limestone or approved equal).

2.3 Catch Basin Insert

2.3.1 See details in plans.

2.4 Bio Log Barrier/Sediment Control

2.4.1 12-inch diameter bio logs comprised of biodegradable sleeve, compost and seed.

2.5 Erosion Control Blanket

2.5.1 Biodegradable open weave blankets for erosion control during vegetation establishment on slopes shall conform to MnDOT Specification 3885, Category 3 or higher.

3. INSTALLATION

3.1 Erosion and sedimentation control measures shall be installed as per the specifications, plans, and details.

3.2 Catch Basin Insert to be installed as per manufacturer's direction. Empty as required in order to allow sediment accumulation of at least 50 % capacity.

3.3 12 inch diameter bio logs shall be installed where indicated on plans. Contractor shall install additional bio logs or other approved erosion control devises as required in order to meet all NPDES, State and local requirements.

3.4 Erosion and sedimentation controls that become damaged or are removed prior to stabilization of site shall be reinstalled immediately.

3.5 The Contractor shall comply with applicable erosion and sedimentation control directives from agencies having jurisdiction over this project and shall be required to certify compliance with terms and conditions of NPDES storm water permit for construction activity.

3.6 See also Specification Section 31 11 00, Clearing and Grubbing.

END SECTION

DIVISION 32 EXTERIOR IMPROVEMENTS

The General Conditions of the Contract, Supplementary Conditions, and Division 0l General Requirements, apply to all work of this section. Refer to other sections, divisions, and schedules for other work in connection with this work.

32 01 16.72 ASPHALT PAVING REUSE

1. **SCOPE OF WORK**

1.1. Include labor, materials, equipment, and services required to mill/plane or grind existing bituminous paving and surfacing as indicated and specified herein.

1.2. The work includes, but is not limited to:

1.2.1. Reclaiming existing bituminous pavement.

1.3. Related sections:

1.3.1. Section 31 20 00 – Earthwork

1.3.2. Section 32 12 16 - Asphalt Paving

1.4. References

1.4.1. Minnesota Department of Transportation (MnDOT) 2014 Edition.

1.4.1.1. Section 2232, Mill Pavement Surface

1.5. Quality Assurance

1.5.1. Request approval of finish plane by Civil Engineer.

2. **MATERIALS** - not used

3. **INSTALLATION**

3.1. Equipment

3.1.1. Equipment shall be a power operated, self-propelled cold milling machine or roto-grinding machine capable of removing desired profile of existing surface or grinding in place to produce the specified cross-section. Equipment used to grind in place shall produce particle gradation not exceeding 1" maximum size.

3.2. Reclaiming Asphalt Pavement

3.2.1. If Contractor provides milling operations, materials removed shall become property of the Contractor, and shall be disposed of legally or recycled for other use or project use as specified.

3.2.2. If Contractor provides grinding in place, grinding shall be to a depth of 3-5 inches into aggregate base such that the resulting surface will be a mixture of ground bituminous mixed with a minimum of 50% of aggregate base. Any resulting excess of material shall be removed by the Contractor to provide specified paving base grade.

3.2.3. If Contractor, as an alternate to milling or grinding, proposes to remove the existing bituminous surface, materials removed shall become property of the Contractor, and shall be disposed of legally or recycled for other uses. Contractor shall provide all make-up aggregate base required to provide specified paving base grade.

3.3. Cleanup

3.3.1. Remove all rubble and oversized (greater than 1" diameter) paving particles resulting from operations from the site.

3.3.2. Remove any timber, tree roots, rock, and miscellaneous debris resulting from milling/grinding operations from the site.

3.3.3. Clean streets and hauling routes of spillage of removed materials. Promptly clean up any spillage occurring near a storm water catch basin, and remove any spillage which enters catch basins or sewer piping. Immediately clean any spillage in a flow route leading to water bodies to prevent contamination; failure to prevent contamination may subject Contractor to regulatory response, and require remediation actions.

END SECTION

32 11 16 SUBBASE COURSES

1. SCOPE OF WORK

1.1. This section includes scarifying, blading and rolling the sub-grade to obtain a uniform texture and a uniform density for the drive lanes, walkways, parking lot and other paved areas as shown on the Plans.

2. MATERIALS

N/A

3. INSTALLATION

3.1. General

3.1.1 The drive lanes, parking lot, and walkways shall be excavated and shaped in conformity with the Plans and to the lines and grades established by the Civil Engineer. The entire cross-section including an area two (2) feet back of the proposed curb/pavement line shall be bladed clear of vegetation and scarified per Plans. All unstable or otherwise objectionable material shall be removed or broken off to a depth of not less than twelve (12) inches below the surface of the sub-grade. Holes or depressions resulting from the removal of such material shall be backfilled with suitable material compacted in layers not to exceed six (6) inches deep. All soft and unstable material and other portions of the sub-grade which will not compact readily or serve the intended purpose shall be removed as directed.

3.1.2 The surface of the sub-grade shall be finished to line and grade as established on Plans, and be in conformity with the typical sections shown on the Details. Any deviation in excess of one-half inch (1/2") in cross-section over a length of ten (10) feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping or compacting by sprinkling and rolling. Material excavated in the preparation of the sub-grade shall be disposed of as directed by the Civil Engineer.

3.2. Finishing and Compaction

3.2.1 The sub-grade course, including an area two (2) feet back of the proposed curb/pavement line, shall be sprinkled as required and rolled as directed until a uniform compaction and required density is obtained. Should the

Civil Engineer feel that too much time is being required to obtain those densities, he can require that a heavy pneumatic roller be applied. Rolling shall continue until the sub-grade has been compacted to one-hundred percent (100%) of the Standard Density (A.S.T.M. Method D-698). The allowable deviation from optimum moisture content is 0 to +4%.

3.2.2 Rolling shall progress gradually from the sides to the center of the lane under construction, by lapping uniformly each proceeding track by at least twelve (12) inches.

3.2.3 After rolling and watering, the sub-grade shall be checked by the use of string line or instrument. All portions that do not conform to the lines and grades as shown on the Plans, shall be scarified for at least six (6) inches and re-compacted to correct elevation.

3.2.4 Until the base course or pavement is placed, the sub-grade shall be maintained free from ruts and depressions, in a smooth and compacted condition true to lines and grade and to the density requirements contained herein. All of the Contractor's hauling and other equipment used in such a way as to cause rutting and raveling of the sub-grade shall either be removed from the work or suitable runways or other equivalent means shall be provided to prevent rutting.

3.2.5 The Contractor shall be responsible for maintaining and protecting the roadbeds, walkway corridors, parking lot and other areas for the entire length of the project at Contractor’s expense.

3.2.6 During construction, grading of the sub-grade shall be conducted so that the berm of earth or other material does not prevent immediate drainage of water. Ditches and drains along the sub-grade shall be maintained so as to drain effectively.

END OF SECTION

32 11 23 AGGREGATE BASE COURSES

1. SCOPE OF WORK

1.1. The work includes, but is not limited to:

1.1.1. Exterior subbase and base course construction.

1.2. Reference Standards

1.2.1. References to "Mn/DOT" mean the Minnesota Department of Transportation and/or the State of Minnesota Highways, and vice versa. References to "Mn/DOT Spec." mean the Minnesota Department of Transportation Standard Specifications for Construction, 2014 Edition.

1.2.2. ASTM INTERNATIONAL: ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

1.2.3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

1.2.4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.2.5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3. Submittals

1.3.1. Independent testing laboratory to collect samples, perform tests and prepare reports for required material qualification testing; Contractor to review and stamp prior to submission to Civil Engineer.

1.3.2. Following submittals are required for portions of Work specified in this Section.

1.3.2.1. Materials Qualification Test: Submittal prepared by independent testing lab to indicate that proposed material complies with contract document requirements.

1.3.2.1.1. Provide following information and qualification tests for each specified aggregate material and obtain approval prior to delivery to site.

1.3.2.1.2. Source Location.

1.3.2.1.3. Gradation analysis, ASTM D422.

1.3.2.1.4. Proctor density information per test method identified in compaction requirements paragraph.

1.3.2.2. Soils Engineer Certification: Provide following submittal directly from soils engineer or soils engineer's authorized technician indicating required observation and Contract Document requirement compliance.

1.3.2.2.1. Subbase/base course subgrade acceptability verification.

1.3.2.3. Testing Reports: Submittal tests reports for Field Density Tests.

2. MATERIALS

2.1. Coarse Aggregates:

2.1.1 Provide coarse aggregate consisting of hard, durable particles of stone, reasonably free from soft, thin, elongated or laminated pieces and deleterious substances.

2.1.2 Provide aggregate with an abrasion loss of less than 65 percent.

2.2 Fine Aggregates

2.2.1 Provide fine aggregate consisting of material produced by stone crushing operations.

2.2.2 Liquid Limit: Do not exceed 25 percent.

2.2.3 Plasticity Index: Do not exceed 6 when tested per AASHTO T-89 and T-90.

2.3 Aggregate Base Materials

2.3.1 Unless otherwise indicated, aggregate materials are assumed to be imported.

2.3.2 Aggregate Subbase Material: Mn/DOT specification 3149.

2.3.3 Aggregate Base Class 5 Material: Clean, 100 percent crushed mineral aggregate, thoroughly mixed with particle sizes uniformly distributed and conforming Mn/DOT specification 3138 and to the following gradation:

Sieve Size	Percent Passing By Weight
1 inch	100
3/4 inch	90 TO 100
3/8 inch	50 TO 90
no. 4	35 TO 80
no. 10	20 TO 65
no. 40	10 TO 35
no. 200	3 TO 10

3. **INSTALLATION**

3.1 Examination

3.1.1 Examine areas and conditions under which subbase and base course Work is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected and approved by Civil Engineer.

3.2 Preparation

3.2.1 Coordination: Coordinate base course operations to protect existing and new concurrent construction.

3.2.2 Alignment and Grade Stakes:

3.2.2.1 Contractor to provide the necessary alignment and grade stakes to do Work

3.2.2.2 Set stakes at minimum intervals of 20 feet for roads, walks, or parking aisles (gutters and crown) and every 1,000 square feet for parking areas, and at spot elevations indicated on Drawings.

3.3 Preparation of Subgrade

3.3.1 Prepare subgrade and verify subgrade elevation with level checks to a tolerance of plus or minus 0.25 inches (6.3mm).

3.3.2 Obtain (or verify existence if Owner is providing testing) the required passing density tests and proof roll per requirements and in presence of soils engineer before starting subbase or base course Work.

3.3.3 Correct failing density and yielding areas before proceeding with base or subbase course Work.

3.3.4 Proof roll areas to receive crushed stone base course.

3.3.4.1 Make not less than 3 passes over full area, in at least 2 different directions, using a 25-ton to 50-ton rubber-tired roller or approved dump truck.

3.3.5 Remove soft, unstable, or unsuitable material that will not compact readily. This includes any rutting or depressions that exceed one (1) inch deep.

3.3.5.1 Remove to full depth of unsuitable material, or to a depth of 36 inches.

3.3.5.2 Replace with satisfactory materials and compact to specified levels.

3.3.6 Fill holes, ruts, or depressions that develop in subgrade with approved on-site material, bringing subgrade to indicated lines and grades per the Plans.

3.3.7 Compact subgrade using suitable construction equipment and procedures to provide not less than 100 percent Standard Proctor Maximum Dry Density.

3.3.8 Correction of deterioration of subgrade before or after acceptance by soils engineer, and whether due to contractor operations or weather, is incidental to Work and no change in Contract time or amount will be considered.

3.3.9 Repair or replace subbase and base courses placed on incorrect or inadequate subgrade at Contractor's expense.

3.3.10 Regrade, shape, and recompact subgrade just prior to construction of subbase and/or base course.

3.3.11 Wet or dry material to obtain specified density.

3.4 Aggregate Subbase and Base Construction Requirements

3.4.1 Compact aggregate in layers of 3 to 6 inches loose thickness to minimum required total depths.

3.4.1.1 Add water or dry aggregate to obtain moisture content within 3 percent of optimum moisture before compacting.

3.4.1.2 Work added water or dry aggregate into in-place aggregate by scarifying and re-rolling to obtain required density and elevation.

3.4.1.3 Blade, compact with tamping roller, and roll each separate aggregate course to obtain required section and elevation. Use smooth steel wheel or pneumatic tire roller for final rolling.

3.4.1.4 Immediately correct ruts or soft yielding areas appearing in course by excavation, replacement with satisfactory material, and recompaction.

3.4.2 Compact subbase and base materials to minimum of 100 percent of Standard Proctor Density, ASTM D698, as appropriate for material tested.

3.5 Allowable Tolerances

3.5.1 Thickness Tolerance: Provide compacted thicknesses indicated on Plans, within tolerance of minus 1/2 inch.

3.5.1.1 Take depth measurements by digging through base at intervals no closer than 50 feet, nor greater than 100 feet apart.

3.5.1.2 Where thickness is less than depth specified minus 1/2 inch, it shall be corrected as directed by Civil Engineer.

3.5.2 Smoothness Tolerance: Provide lines and grades indicated on Plans, within tolerance of 1/4 inch in 10 linear feet, parallel to center line of roadway or not more than 1/2 inch from template conforming to cross sections shown on Plans.

3.5.3 Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required at Contractor’s expense.

3.6 Field Quality Control

3.6.1 Testing and Inspecting: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

3.6.2 Field Density Tests for subgrades and aggregate subbase and base course construction:

3.6.2.1 Use only 1 of following methods for entire Project:

3.6.2.1.1 Sand cone, ASTM D1556.

3.6.2.1.2 Nuclear methods, ASTM D2922.

3.6.2.2 Provide 1 passing field density test for each 200 square yards of each separate aggregate course.

3.6.2.3 Excavate, replace at near optimum moisture, recompact, and retest areas failing to meet compaction requirements at Contractor's expense.

3.6.2.4 Comply with requirements indicated in Section 312000 for field density test reports.

3.7 Adjusting

3.7.1 Replace defective Work with new Work that complies with this Section at Contractor's expense.

END OF SECTION

32 12 16 ASPHALT PAVING

1. SCOPE OF WORK

1.1 The work includes, but is not limited to:

1.1.1 Bituminous asphalt paving.

1.2 Submittals

1.2.1 Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1.2.2 Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

1.2.3 Material certificates.

1.3 Quality Assurance

1.3.1 Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.4 Project Conditions

1.4.1 Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1.4.1.1 Tack Coat: Minimum surface temperature of 60 deg F.
1.4.1.2 Asphalt Base Course: Minimum surface temperature of 50 deg F and rising at time of placement.
1.4.1.3 Asphalt Wear Course: Minimum surface temperature of 60 deg F at time of placement.

1.4.2 Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient and surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

2. **MATERIALS**

2.1 Aggregates

2.1.1 Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

2.1.2 Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.

2.1.3 Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 Asphalt Materials

2.2.1 Asphalt Binder: AASHTO MP 1, PG 64-22.

2.2.2 Tack Coat: ASTM D 977 or AASHTO M 140, emulsified asphalt or ASTM D 2397 or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 Auxiliary Materials

2.3.1 Pavement-Marking Paint: Latex, comply with Section 32 17 23.13.

2.3.1.1 Color: White – Standard Parking Spaces

2.3.1.2 Color: Blue – Accessible Parking Spaces

2.3.1.3 Color: Yellow – No Parking Areas

2.3 Mixes

2.3.1 Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
2.3.1.1 Base Course: MNDOT 2360 Type LV3
2.3.1.2 Wear Course: MNDOT 2360 Type LV4 (SPWEA240C)

3. **INSTALLATION**

3.1 Surface Preparation

3.1.1 Existing pavement to remain abutting new asphalt pavement shall be "saw cut" to full extent of pavement

3.1.2 Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Perform proof-roll with Civil Engineer present.

3.1.3 Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

3.1.3.1 Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.1.4 Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

3.1.4.1 Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

3.1.4.2 Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.1.4.3 Tack Coat shall be placed between all lifts in accordance with MnDOT 2357.

3.2 Hot-Mix Asphalt Placing

3.2.1 Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand only in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

3.2.1.1 Spread mix at minimum temperature of 250 deg F.

3.2.1.2 Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

3.2.2 Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

3.2.3 Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill

depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.3 Compaction

3.3.1 General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

3.3.1.1 Complete compaction before mix temperature cools to 185 deg F.

3.3.2 Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

3.3.3 Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

3.3.3.1 Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

3.3.4 Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

3.3.5 Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.3.6 Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.4 Installation Tolerances

3.4.1 Thickness: Compact each course to produce the minimum thickness indicated on the Plans.

3.4.2 Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

3.4.2.1 Base Course: 1/4 inch.

3.4.2.2 Wear Course: 1/8 inch.

3.4.3 All surfaces shall drain. Any area failing to drain, including sections against curbs or minor depressions shall be repaired to the satisfaction of the City Inspector

3.5 Pavement Marking

3.5.1 Do not apply pavement-marking paint until layout, colors, and placement have been verified with Civil Engineer.

3.5.2 See Section 32 17 23.13.

3.5.3 Sweep and clean surface to eliminate loose material and dust.

3.5.4 Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.6 Field Quality Control

3.6.1 Remove and replace hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.7 Disposal

3.7.1 Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them at an approved landfill.

END OF SECTION

32 13 13 CONCRETE PAVING

1. SCOPE OF WORK

1.1 Include labor, materials, equipment and services required to furnish and install concrete paving and surfacing as indicated and specified herein.

1.2 The work includes, but is not limited to:

1.2.1 Subgrade

1.2.3 Concrete Walks

1.2.4 Aggregate Base for Concrete Paving

2. MATERIALS

2.1 Subgrade

2.1.1 Refer to Subsection 3 - Installation.

2.4 Aggregate Base for Concrete Paving

2.4.1 Aggregate shall be MN/DOT Class-5

3. INSTALLATION

3.1 Subgrade

3.1.1 The subgrade for all concrete pavings shall be compacted to at least 100 percent of the maximum density as determined by ASTM Designation D698-70, Method A.

3.3 Concrete Paving

3.3.1 Concrete shall be installed as per Division 03.

3.4 Aggregate Base for Concrete Paving

3.4.1 All base material shall be furnished and placed as specified and shown on the drawings.

3.4.2 All base material shall be compacted to at least 100 percent of the maximum density as determined by ASTM Designation D698-70T, Method A.

3.4.3 Field density tests in accordance with ASTM D1556-64 shall be made on the base course if requested by Civil Engineer. These tests shall be made by an independent testing laboratory approved by the Civil Engineer and shall be paid for by the Contractor.

3.4.4 All base material shall be compacted to the specific density, using suitable equipment designed for compacting base materials. If the moisture content of the material is such that the required compaction cannot be obtained, the Contractor shall be required to either add water or dry out material, as may be required.

4. INSTALLATION - GENERAL

4.1 The exact configuration, alignment and termination of all surfacing shall be verified in the field by the Contractor with the Civil Engineer prior to and during construction.

4.2 All staking of alignments shall be the responsibility of the Contractor.

4.3 The finish work shall be a true alignment and proper grade, free from high spots and depressions.

END SECTION

32 17 23.13 PAINTED PAVEMENT MARKINGS

1. SCOPE OF WORK

1.1. Provide labor, materials, equipment, and services required to furnish and install painted pavement markings indicated and specified herein.

1.2. Work shall include, but not be limited to:

1.2.1. Parking lot pavement markings

1.3. References pertaining to this document include:

1.3.1. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

1.3.2. MN MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; MN Department of Transportation; http://www.dot.state.mn.us/trafficeng/publ/mutcd/; current edition.

1.3.3. MNDOT Standard Specifications for Road Construction; Minnesota Department of Transportation, 2014 Edition

1.4. Submittals:

1.4.1. Product Data: Manufacturer's data sheets on each product to be used, including:

1.4.1.1. Preparation instructions and recommendations.

1.4.1.2. Storage and handling requirements and recommendations.

1.4.1.3. Installation methods.

1.5. Delivery, Storage, and Handling

1.5.1. Deliver paint in containers of at least 5 gallons.

1.5.2. Store products in manufacturer's unopened packaging until ready for installation.

1.5.3. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6. Field Conditions

1.6.1. Do not install products under environmental conditions outside manufacturer's absolute limits.

2. MATERIALS

2.1. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.

2.1.1. Parking Spaces: White.

2.1.2. Accessible Parking Spaces: Blue.

2.1.3. No Parking Areas: Yellow.

3. EXECUTION

3.1. Examination

3.1.1. Do not begin installation until substrates have been properly prepared.

3.1.2. If substrate preparation is the responsibility of another installer, notify Civil Engineer of unsatisfactory preparation before proceeding.

3.2. Preparation

3.2.1. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

3.2.2. Sandblast concrete surface areas to receive pavement markings.

3.2.3. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.3. Installation

3.3.1. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

3.3.2. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

3.3.3. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking

layouts.

3.3.4. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

3.3.5. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

3.3.6. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.

3.3.6.1. Apply paint in one coat only

3.3.6.2. Wet Film Thickness: 0.015 inch, minimum.

3.3.6.3. Width Tolerance: Plus or minus 1/8 inch.

3.3.7. Parking Lots: Apply parking space lines, and other markings indicated on drawings.

3.3.7.1. Hand application by pneumatic spray is acceptable.

3.4. Drying, Replacement, and Protection

3.4.1. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

3.4.2. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

3.4.3. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

3.4.4. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

3.4.5. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

3.4.6. Replace removed markings at no additional cost to Owner.

END OF SECTION

32 91 13 SOIL PREPARATION

1. SCOPE OF WORK

1.1 Provide labor, materials, equipment, and services required to perform the work of soil preparation for seeding and/or sodding as indicated and specified herein.

1.2 The work of this section includes, but is not limited to:

1.2.1. Subgrade Preparation

1.2.2. Topsoil

1.2.3. Fertilizer

1.2.4. Agricultural Lime

1.3 Submittals

1.2.1 Submit soil test results to Landscape Architect.

1.2.2 Submit fertilizer invoice showing type and quantity to Landscape Architect.

1.2.3 Submit agricultural lime invoice showing type and quantity to Landscape Architect

2. MATERIALS

2.1 Subgrade

2.1.1 Where subsoil originates from deep building excavation or is otherwise suspected of being highly acidic (with a pH of 5.5 or less), a representative subsoil sample shall be submitted to the Landscape Architect for testing to determine the lime and fertilizer requirements for new seeding and/or sodding.

2.2 Hauled in Topsoil

2.2.1 Hauled in topsoil shall meet the requirements of MnDOT 3877-B, Topsoil Borrow, and shall be free of viable plants, plant parts and extraneous materials.

2.4 Fertilizer

2.4.1 Fertilizer shall meet the requirements of MnDOT 3881.

2.5 Agricultural Lime

2.5.1 Agricultural Lime shall meet the requirement of MnDOT 3879.

2.6 Sampling and Testing

2.6.1 The Contractor shall submit to the Landscape Architect a list of prospective sources for topsoil borrow at least two (2) weeks prior to time of use to allow adequate time for inspecting, testing, and approving the sources.

2.6.2 Texture of the topsoil shall be classified according to the Engineering definition of particle size. Texture shall be determined by the method described in AASHTO T 88.

2.6.3 Representative samples of hauled in topsoil shall be sent to the soils testing laboratory. The results of these tests shall determine the specific fertilizer requirement and application rates to be used on the site.

3. **INSTALLATION**

3.1 Installation

3.1.1 Subgrade work shall be completed prior to topsoiling, including all excavations, trenching, installation of subsurface structures, backfilling and compaction. Any required soil testing shall be completed. If subsoil test results indicate a pH of less than 5.5, the subsoil shall be corrected with the test recommended rates of agricultural lime. Lime shall be spread evenly and tilled into the top 3" of the subgrade.

3.1.2 Subgrade areas to be topsoiled which have not been previously loosened by grading or tilling operations shall be scarified to a depth of 4" to permit bonding of the topsoil to the subsoil.

3.1.3 Rocks and deleterious materials over 1" in diameter shall be removed from the subsoil surface.

3.1.4 Subgrade elevation shall be established at a grade 4" below finished grades shown on the Plans.

3.1.5 Topsoil shall be uniformly distributed on the prepared subgrade to a minimum depth of 4" inches after firming and settlement. Correct all irregularities in the soil surface resulting from topsoiling or other operations. Apply fertilizer and lime, if required, by mechanical spreader or other approved means at the rate

recommended by the soil test results.

3.1.6 Finished surface shall be in a fine mellow condition as required for seeding or sodding. The soil surface shall be cleared of all debris and stones larger than 1" in diameter. Finished grade shall be jointly inspected by the Landscape Architect and the Contractor to verify its readiness or determine if additional preparation work is required.

3.1.7 Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading, seeding or sodding.

3.1.8 Paved areas over which hauling operations are conducted shall be kept clean, and any soil which may be brought upon the surfacing shall be promptly removed.

END SECTION

32 91 13.1 TOPSOIL MIXTURE

1. SCOPE OF WORK

1.1 Provide labor, materials, equipment, and services required to provide and install Topsoil Mix as indicated and specified herein.

1.2 The work of this section includes, but is not limited to:

1.2.1 Topsoil Soil Mix for all sodded areas

1.2.2 Fertilizer

1.3 The work in this section is to be carefully coordinated with other work specified, particularly Sections 31 20 00, 32 93 00, 32 92 00.

2. MATERIALS

2.1 Topsoil Mix

2.1.1 Topsoil used in this mixture shall meet the requirements of MnDOT 3877-B, Loam Topsoil Borrow.

3. INSTALLATION

3.1 All areas disturbed by construction activities and all areas within the construction limits shall receive min. 4" of Topsoil Mixture. Scarify exposed subgrade to a depth of 4" to permit bonding of the special topsoil mix to the subsoil. Remove all debris prior to placement of Topsoil mixture. Remove all rock in excess of 1 inch in size.

3.2 Paved areas over which hauling operations are conducted shall be kept clean and any soil that may be brought upon the surface shall be promptly removed.

3.3 Subgrade and Finished grade shall be jointly inspected by the Contractor and the Landscape Architect prior to the placement of Topsoil mixture and again prior to the placement of sod.

4. SUBMITTALS

4.1 Topsoil invoice showing type and Topsoil mix.

4.2 Fertilizer invoice showing type of fertilizer and quantity.

END SECTION

32 92 00 TURF AND GRASSES

1. SCOPE OF WORK

1.1. Provide labor, materials, equipment, and services required to furnish and install the turf and grasses indicated and specified herein.

1.2. Work shall include, but not be limited to:

1.2.1. Sodding.

1.2.2. Fertilizing.

1.2.3. Watering and mowing.

1.3. Related Sections

1.3.1. Section 31 2000 - Earthwork.

1.3.2. Section 32 9113 – Soil Preparation.

1.3.3. Section 32 9300 - Plants.

1.4. References

1.4.1. Mn/DOT Standard Specifications for Construction, 2014 Edition.

1.4.2. American Sod Producers Association, Inc. (ASPA): Guideline Specifications to Sodding (undated).

1.4.3. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding; Turfgrass Producers International, 1995.

1.4.4. Federal Specifications (Fed. Spec.): O-F-241D; Fertilizers, Mixed, Commercial.

1.5. Protection

1.5.1. Monuments: Carefully maintain benchmarks, monuments and other reference points, if disturbed or destroyed, have replaced or relocated by a registered surveyor at Contractor's expense.

1.5.2. Protection: Contractor shall protect all that is to remain and shall conduct all sodding operations in a manner that will not damage or jeopardize the

surrounding plant life designated on the Drawings as proposed or to remain.

1.6. Coordination

1.6.1. Coordinate timing of topsoil installation with sod.

1.7. Limits of Work

1.7.1. All disturbed areas are to be sodded. Sod areas between the site and public road that is disturbed during construction. Any sod or seed that is placed on site by the excavator for erosion control and subsequently disturbed shall be removed and/or replaced by the landscape contractor.

1.7.2. Restore all lawn and surface areas, whether within the contract limits or not, disturbed as a result of earthwork operations of this job. Restoration shall be by sod unless otherwise noted on the plans.

2. **MATERIALS**

2.1. Sod

2.1.1. Sod shall include a maximum of 2" of well established cultured sod consisting of 100% on a red variety of Kentucky Bluegrass. Acceptable varieties include Classic, Eclipse, Glade and Monopoly. Sod shall be free from noxious weeds, relatively free from all other weeds and free from roots, stones and any other objectionable materials. Sod shall resist normal handling without undue breaking or tearing.

2.1.2. Before sod is cut, it shall be raked free of debris and the top growth trimmed to a height of approximately 2".

2.1.3. Sod shall be cut in uniform strips 18" minimum width and to a uniform thickness so a dense root system will be retained, but be exposed on the bottom side of the sod. When sod is cut, it shall be sufficiently moist to withstand exposure and handling during transplant operations. If necessary, sod shall be watered before cutting.

2.1.4. For topsoil, refer to Section 32 9113.1

2.2. Fertilizer

2.2.1. Fertilizer shall be a commercial formula containing at least the minimum analysis of 10-10-10 (10% total Nitrogen, 10% Phosphoric Acid, and 10% water soluble Potash) or comparable fertilizer, applied at the rate of 30 pounds per 1,000 square feet.

2.3. Water

2.3.1. Water for the execution of this work and maintenance shall be clean, fresh, and free of deleterious substances. The Contractor shall be required to furnish his own hose and hose connection from hydrants and/or outlets where the water will be furnished. It is the responsibility of the Contractor to verify source of water and its availability prior to its use.

2.4. Topsoil

2.4.1. See Specifications for Earthwork (31 2000) and Soil Preparation (32 9113). Landscape contractor shall rake out and remove all objectionable matter in the topsoil and level soil prior to installing sod.

3. INSTALLATION

3.1. Ground Preparation

3.1.1. The grading of all areas to within 6" of final grade and the placing of 4" of topsoil for final grading is specified in Section 32 91 13.1. The landscape contractor shall fine grade as needed in preparation for their plantings.

3.1.2. Prior to placement of sod, the Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper installation of his work and shall not proceed until all unsatisfactory conditions have been corrected.

3.1.3. Immediately prior to sodding, Contractor shall loosen the topsoil placed by the earthwork contractor to a depth of 3" on all areas except slopes steeper than 3 horizontally to 1 vertically, using discs, harrows and tiller rakes to produce fine grade. On slopes steeper than 3 to 1, use cultivating equipment in general direction at right angles to the direction of surface drainage wherever practical. The landscape contractor shall top-off the soil with an average of 2" of top soil to raise grades to the final elevations. On slopes steeper than 3 to 1, use cultivating equipment in general direction at right angles to the direction of surface drainage wherever practical.

3.2. Fertilizing

3.2.1. Fertilizer shall be applied to a properly prepared soil bed prior to sodding with a mechanical spreader and thoroughly mixed in top 3" by means of a meeker harrow, by weighted chain link fence, or other approved method. Fertilizer must be dry and free flowing when applied.

3.2.2. Apply fertilizer no more than 48 hours before laying sod.

3.2.3. Lightly water to aid the dissipation of fertilizer.

3.3. Sodding

3.3.1. Precautions shall be taken to prevent sod from drying out and from heating. Sod that shows visible signs of heating shall not be incorporated in the project.

3.3.2. Strips shall be placed tightly against each other so that no open joints are apparent. Joints between ends of strips shall be staggered at least one foot between adjacent rows. Sod shall be placed without stretching on topsoil. Lay smooth and align with adjoining grass areas.

3.3.3. On slopes, the sodding shall begin at the bottom and progress upward with strips laid transverse to the flow of water. If necessary to protect sod already laid, the Contractor shall furnish ladders or treaded planks for workmen.

3.3.4. At the top of the slopes, sod will be laid so water from adjacent areas will have free flow into sodded areas.

3.3.5. No sodding shall be done earlier than August 15th nor later than October 15th, for fall sodding; or earlier than April 15th and not later than June 1st for spring sodding. Changes in above dates allowed only if directed in writing by the Landscape Architect, specifying exact date of installation and length of guarantee period.

3.3.6. If the project manager determines that sod cannot be placed based on the timelines referenced above. The contractor shall provide type 5 green colored hydromulch over all areas disturbed by construction activities and all areas within the project boundaries so that soils are not visible. All hydromulching shall be governed by 2014 MN DOT specifications. If areas become loose, bare or free from hydromulch cover the contractor shall reapply and maintain hydromulch until the time of sod placement.

3.3.7. Sod placed on slopes steeper than 3:1 (Horizontal:Vertical) or in drainage swales shall be staked. Sod shall be staked with five (5) 6-inch steel U-staples per roll. Stakes shall be placed at an angle against the flow of the water.

3.3.8. Sod shall be watered and compressed into the underlying soil by rolling, or tamping into place. The initial watering and rolling shall provide firm contact and bond between the sod and the underlying soil. The rolling shall result in a smooth, even surface free of humps and depressions but shall not cause excessive compaction. Water sodded areas immediately after

installation. Saturate sod to 4 inches of soil.

3.3.9. Keep sod continuously moist and well watered for 30 days after laying. Thereafter, water sod until soil is soaked at least once every 4 days unless natural rainfall has provided equivalent water.

3.3.10. Protect sodded areas with warning signs during maintenance period.

3.4. Watering and Mowing

3.4.1. Watering of all turf areas shall be performed by the Contractor as necessary to assure that sodded areas are uniformly moistened and maintained in a moist condition until the work has been approved by the Landscape Architect and responsibility for maintenance accepted by the Owner.

3.4.2. Sodded areas shall be kept trimmed to a height not to exceed 3" during the construction period and prior to acceptance by the Owner. Immediately remove heavy clippings after mowing and trimming.

3.5. Establishment and Replacement

3.5.1. Any sod which fails to become established during the first 60 days after the date of substantial completion shall be replaced immediately by the Contractor at the direction of the Landscape Architect. A new establishment period of 60 days will commence upon the date the re-sodding is complete.

3.5.2. Any lawn seed which fails to germinate within 3 weeks shall be re-seeded as soon as weather and seasons permit. Spots larger than 1' in diameter which are bare or thinly germinated shall be re-seeded.

3.5.3. The Contractor shall maintain by watering, weeding and cutting all sodded areas until Owner acceptance of the project.

3.6. Clean-Up

3.6.1. All soil manure, or similar material brought into paved areas by work operations shall be removed promptly, keeping these areas clean at all times. Upon completion of sodding, excess soil, stones, and debris not previously cleaned up shall be disposed of off-site.

3.6.2. All ground areas disturbed as a result of sodding shall be restored to their original condition or to the desired new appearance.

END OF SECTION

32 93 00 PLANTS

1. SCOPE OF WORK

1.1. Provide labor, materials, equipment, and services required to furnish and install the plants indicated and specified herein.

1.2. Scope includes new trees, plants, and groundcover and associated work:

1.2.1. Excavation below grade for trees and shrubs.

1.2.2. Planting soil.

1.2.3. The furnishing, planting, wrapping and pruning of plant materials.

1.2.4. Fertilizing.

1.2.5. Edging.

1.2.6. Mulching.

1.2.7. Clean-up.

1.3. Related Sections

1.3.1. Section 32 91 13 – Soil Preparation.

1.3.2. Section 32 9200 - Turf and Grasses.

1.3.3. Section 32 9113.1: -Topsoil material.

1.4. Reference Standards

1.4.1. Minnesota Department of Transportation (Mn/DOT), Standard Specifications for Construction, 2014 Edition.

1.4.2. American National Standards Institute (ANSI): 260.1-1986, American Standard for Nursery Stock, 2004 Edition.

1.4.3. American Society for Testing and Materials (ASTM): D 2607-69; Peats, Mosses, Humus and related products.

1.4.4. Federal Specification (Fed. Spec.): 02-F-241D; Fertilizers, Mixed,

Commercial.

1.5. Submittals

1.5.1. See Section 01 3323 - Shop Drawings, Product Data and Samples for administrative requirements for submittal procedures.

1.5.2. Plant installation schedule: Plant installation schedule shall be submitted to Landscape Architect a minimum of 15 days before beginning plant installation. Schedule shall specify planting season (spring or fall), dates, locations, and plant materials to be installed. Once accepted, revise only as approved in writing by Landscape Architect, after documentation of reasons for delays.

1.5.3. Substitutions will not be permitted. If proof is submitted that any plant specified is not obtainable, a written proposal to Landscape Architect will be considered for use of the nearest equivalent size or variety with an equitable adjustment of contract price.

1.6. Quality Assurance

1.6.1. Codes: Plant materials shall comply with local, state and federal laws relating to inspection for diseases and insect infestation.

1.6.2. Grading Standards: Plant stock shall conform to the code of standards set forth in the current edition of American Standards for Nursery Stock (ANSI).

1.6.3. Plant Names and Labels: The nomenclature used in the Drawings and Specifications conforms, with few exceptions, to that of the current edition of Standardized Plant Names as adopted by the American Joint Committee on Horticultural Nomenclature.

1.6.4. Workmen: Landscaping work shall be performed by personnel familiar with planting procedures, and work shall be carried out under the supervision of a qualified planting foreman.

1.6.5. Labeling: Label at least one tree and one shrub per shrub bed of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

1.6.6. Inspection: The Landscape Architect may inspect trees and shrubs (at place of growth or at site before planting) for compliance with requirements for genus, species, variety, size and quality. Landscape Architect retains right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs

immediately from project site.

1.7. Delivery, Storage, and Handling

1.7.1. Notify Landscape Architect at least 4 days in advance of delivery of trees, shrubs and other plant material and manner of shipment. Furnish itemized list of actual quantities and sizes.

1.7.2. When shipment of plant material is made by truck, pack to provide adequate protection against climate and breakage during transit and tie to prevent whipping. Cover tops to prevent damage.

1.7.3. Deliver all packaged material in original, undamaged containers. Packaging to clearly identify manufacturer, brand, name, analysis of contents and net weight.

1.7.4. Deliver plant material direct from nursery. Heel-in immediately upon delivery if not to be planted within four hours, covering with moist soil, mulch or other approved medium to protect from drying. Store plants in shade and protect from weather.

1.7.5. Deliver plant material direct from nursery. Heel-in immediately upon delivery if not to be planted within four hours, covering with moist soil, mulch or other approved medium to protect from drying. Store plants in shade and protect from weather.

1.7.6. Do not drop plant materials or pick up balled plants by stems or trunks.

1.7.7. Handle packaged materials in such a manner as to prevent contamination or spillage.

1.7.8. No plant shall be bound with wire or rope so as to damage the bark or spread of the branches.

1.7.9. If required by Landscape Architect, apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting. Spray coniferous plants that are planted in the fall.

1.7.10. All materials used for balled and burlapped plants shall be natural (non-synthetic) and biodegradable. Wire baskets shall not be galvanized.

1.7.11. All plant materials shall be assembled in one location on the job site to permit inspection and approval by the Landscape Architect. Stock with broken root balls or loose containers, and stock which shows evidence of being root

bound, overgrown or recently canned, or damaged, shall be removed from the site immediately and replaced at the Contractor's expense with another plant meeting the original Specifications.

1.7.12. Dig balled and burlapped (B&B) plants with firm natural balls of earth of sufficient diameter and depth to include all fibrous and feeding roots. No plants moved with a ball will be accepted if the ball is cracked or broken before or during planting operations.

1.7.13. Roots or balls of plants shall be adequately protected at all times from sun and drying winds.

1.7.14. All balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected with soil, wet moss, or other acceptable material. Bare rooted plants which cannot be planted immediately shall be protected with soil, wet moss or heeled in trenches immediately upon delivery.

1.8. Job Conditions

1.8.1. Proceed with the complete landscape work as rapidly as portions of site become available, working within seasonal limitations.

1.8.2. Utilities: Call Gopher State One Call (800-252-1166) and locate all other underground utilities. Perform work in a manner which will avoid possible damage. Notify Landscape Architect if conflict exists before excavating planting pits. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by both parties concerned.

1.8.3. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting and proceed as directed.

1.8.4. Planting options shall be conducted under favorable weather conditions during either the Spring planting season, from time ground has thawed to June 1, or the Fall planting season, August 21 until October 31. During the Fall planting season, coniferous material planting shall be conducted August 21 to October 1. Coordinate planting with specified maintenance periods to provide maintenance up to date of Owner's acceptance. Contractor may elect to plant in off seasons at his/her own risk.

1.8.5. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Landscape Architect. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.9. Field Conditions

1.9.1. Do not install plant life when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C).

1.9.2. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

1.10. Warranty

1.10.1. See Section 01 77 00 - Closeout Submittals, for additional warranty requirements.

1.10.2. Provide one (1) year warranty from the date of substantial completion.

1.10.3. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants at Contractor's expense.

1.10.4. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

2. MATERIALS

2.1. Planting Soil

2.1.1. A uniform mixture of 1 part washed sand(Comply with MnDOT 3149-B2), 1 part compost(Comply with MnDOT 3890 Grade 2) and 1 part topsoil borrow (Comply with MnDOT 3877-B) by volume.

2.2. Planting Materials

2.2.1. Deciduous Trees: Provide balled and burlapped (B & B) deciduous trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.

2.2.2. Deciduous Shrubs & Perennials: Provide potted shrubs and perennials of the height shown or listed on the plant schedule and with not less than minimum number of canes required by ANSI Z60.1 for type and height of shrub required.

2.2.3. Coniferous and Broad-Leafed Evergreens: Provide balled and burlapped evergreens of sizes shown or listed. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad up-right, and columnar. Provide

normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.

2.3. Miscellaneous Landscape Materials

2.3.1. Stakes and Braces: Wood stakes and braces shall be common lumber of the sizes in the following table. It shall be the Contractor's option to stake trees, however, Contractor shall maintain trees in a plumb position during guarantee/warrantee period.

2.3.1.1. Tree Size Brace Stakes Guy Stakes

2.3.1.2. 1" - 3-1/2"2" X 2" X 9'-0"2" X 2" X 2'-0"

2.3.1.3. 4" & over Not applicable2" X 2" X 3'-0"

2.3.1.4. Conifers Not applicable2" X 2" X 3'-0"

2.3.2. Guy Wires: Guy wires shall be a good commercial quality of galvanized wire. Wire used to guy trees up to four inches shall be No. 12 gauge; wire used to guy trees four inches and over shall be No. 9 gauge.

2.3.3. Webbing: Shall be 3" wide nylon with grommets or 16" long polypropylene or polyethylene 40 mil. 3" wide straps. Requests for standard hose and wire guying systems will not be approved. See detail.

2.3.4. Tree Wrapping Material: Material shall be first quality four inch wide rolls of bituminous impregnated tape, corrugated or crepe paper, specifically manufactured for tree wrapping, and having qualities to resist insect infestation.

2.3.5. Weed Control: Pellet Weed Preventor, pre-emergent type (Preen or Approved equal).

2.3.6. Shredded Hardwood Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants and consisting of shredded hardwood in all plant beds unless noted otherwise.

2.3.7. Anti-desiccant: Wiltpruf or approved equal.

2.4. Fertilizer

2.4.1. Fertilizer: Shall be a commercial formula containing at least the minimum analysis of 10% total Nitrogen, 0% Phosphoric Acid, 10% water soluble Potash (10-0-10) applied at the rate of 3 pounds per cu. yd.

2.5. Water

2.5.1. Water for the execution of this work and maintenance may be obtained from the existing water supply system free of charge. The Contractor shall be required to furnish his own hose and hose connection from hydrants and/or outlets where the water will be furnished. It is the responsibility of the Contractor to verify source of water and its availability prior to its use.

2.6. Trees, Plants, and Ground Cover

2.6.1. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

3. INSTALLATION

3.1. Obstructions Below Ground

3.1.1. In the event that rock or underground construction work or obstructions are encountered in any plant pit excavation work to be done under this Contract, alternate locations may be selected by the Landscape Architect. Where locations cannot be changed, the obstructions shall be removed to a depth of not less than three (3) feet below grade and no less than six (6) inches below bottom of ball or roots when plant is properly set at the required grade The Contractor shall be responsible for the removal of such rock or underground obstructions encountered.

3.2. Shrub & Perennial Planting

3.2.1. Layout: All shrub bed locations shall conform to the Plans.

3.2.2. Planting Holes: Conform to the minimum dimensions indicated in the Details.

3.2.3. Spaded Edges: Neatline planting bed edges with straight edge spade.

3.2.4. Planting: Scarify bottom of plant holes or beds. Set plants at correct spacing, remove containers, and fill with planting soil. set plants plumb.

3.2.5. Mulch: Install mulch at 3” depth throughout planting beds after spreading pre-emergent weed preventor evenly across planted beds. Only spread pre-emergent material during dry condtions with wind speeds less than 10 MPH..

3.3. Tree Planting

3.3.1. Layout: All tree locations will be staked by the Contractor in the field to conform to the plans. Locations shall be approved by the Landscape Architect prior to digging and placement. No material shall be planted without approval

of the Landscape Architect. Where overhead obstructions are encountered, tree relocation shall be designated by the Landscape Architect. It is the responsibility of the Contractor to coordinate staking and field approvals prior to planting.

3.3.2. Planting Holes: Shall be essentially circular with a diameter two feet greater than the diameter of the ball of the tree. The depth of the pit shall be enough to set the flare of the tree to its original grade. The flare of the tree shall not be set below grade. If the native soil at the site is heavy or wet, consult with the Landscape Architect to determine correct setting height of the tree.

3.3.3. The side walls of the planting pits shall be scarified with a mattock, pick axe, spade or other appropriate tool.

3.3.4. Planting Soil Preparation using Compost Amendment: Prior to delivery to the Project, the compost for soil amending shall be tested and the test results shall be approved by the Landscape Architect in accord with the following:

3.3.4.1. The Contractor shall furnish a certification from the supplier that the materials have been produced by accepted aerobic composting techniques employing turning or aeration, pathogen reduction and curing.

3.3.4.2. Prospective sources should be indicated to the Landscape Architect allowing at least four (4) weeks prior to delivery for testing and approval. The Contractor shall bear all testing costs.

3.3.4.3. All compost must be visually inspected upon delivery to the Project. Regardless of test results compost failing visual inspection for texture, total decomposition of raw materials and lack of odor, heat generation, pathogens, weed seed and extraneous matter shall be rejected.

3.3.4.4. In amending in-place soil for individual planting holes or beds, Grade 2 Compost (Mn/DOT Spec. 3890) shall be blended with the in-place soil at a mix ratio of 2 parts soil to 1 part compost. Proportioning may be by loose volume or weight. Mixing shall be sufficient to produce a uniform blend of the mixture components.

3.3.4.5. All on-site amending must meet the specified Planting Soil mix listed in Part 2, 2.01 of this specification.

3.3.5. Setting of Trees

3.3.5.1. Dig planting hole to size specified in Planting Hole Dimensions Schedule and/or Planting Details on Drawings.

3.3.5.2. Scarify sides and bottom of hole.

3.3.5.3. Set tree on undisturbed native soil or thoroughly compacted backfill soil at the same depth it was grown in the nursery. In no case shall the flare of the tree root be set below grade.

3.3.5.4. Lifting from the bottom of the root ball, the tree shall be placed in planting hole with burlap and wire basket, if used, intact. Once in place the plant shall be backfilled to within 12" of the top of the rootball and watered. Burlap shall be removed from the top of balls and adjusted to prevent air pockets. No burlap shall be pulled from under the balls.

3.3.5.5. Plumb and backfill with backfill soil specified in the plans.

3.3.5.6. Apply water to settle plants and fill voids.

3.3.5.7. Water thoroughly within 2 hours.

3.3.5.8. Place 3" of shredded hardwood mulch within 48 hours of the second watering unless soil moisture is excessive. Use the diameter of planting hole width as the mulch area around every tree. Pull all mulch away from the trunk.

3.3.5.9. If the native or in-place soils are of clay origin, set the plant 1-2" above grade or as directed by the Landscape Architect.

3.3.5.10. If the Contractor encounters poorly drained soils, do not complete planting and contact the Landscape Architect. If the Contractor is authorized to proceed with planting on wet, poorly drained soils (indicated by mottled soils) do not construct watering basin; instead leave a two-inch high pedestal on the bottom of the planting pit.

3.3.6. Pruning: Remove dead or damaged branches only. Do not cover any cuts. No leaders shall be cut. All pruning shall be done with clean, sharp tools.

3.3.7. Tree Wrapping: No tree shall be wrapped before November 15th. Contractor shall remove all wrapping the following spring by April 15th. All deciduous trees shall be wrapped with material as specified. The wrapping bandage shall be secured at top and bottom of the trunk. The bandage shall cover the entire surface of the trunk to the height of the first branches. Bandaging shall start at the base of the tree unless otherwise specified and be made secure by taping off the top with duct tape.

3.3.8. Tree Painting: The following trees are to be painted in all cases: oaks (except bur oak), lindens, locusts, maples, crabapples and mountain ash. Paint shall be undiluted exterior grade white latex paint. Apply with brush to achieve full coverage to first set of branches on tree. The Contractor shall be responsible

for maintaining this condition for the duration of the warrantee period.

3.3.9. Tree Collar: Gently set plastic perforated corrugated pipe collar into top of root ball and surround with mulch. There shall be no mulch between collar and trunk of tree. The Contractor shall be responsible for maintaining this condition for the duration of the warranty.

3.3.10. Staking: The Contractor shall stake all evergreen trees planted after October 1st. The stakes and guy wires shall be removed the following spring. The Contractor is responsible for maintaining all other trees in a upright position for the maintenance period. If the trees begin to lean during that period, the Contractor shall stake the trees using the methods described in the Drawings and use the materials described in the definitions above. The Contractor shall remove all staking in the spring following the planting.

3.4. Maintenance

3.4.1. The Contractor shall be required to make periodic checks on the total project to make certain that the materials are properly watered, cultivated, pruned, and that all guys and stakes are in proper adjustment, and that the sum of all conditions are contributing to the satisfactory progress of the materials, until such time as the work is approved by the Landscape Architect and accepted by the Owner.

3.5. Plant Watering and Maintenance

3.5.1. The Contractor shall be required to make periodic checks on the total project to make certain that the materials are properly cultivated and pruned and that all guys and stakes are in proper adjustment, and that the sum of all conditions are contributing to the satisfactory progress of the materials.

3.5.2. The Contractor is responsible to maintain and water the plant material until such time as the work is approved by the Landscape Architect and accepted by the Owner. Rainfall of 1” or more per week is equal to due watering. Rainfall shall be gauged at the site. Planting beds shall be maintained weed-free until final project completion.

3.5.3. The Contractor shall monitor the planting material to assure that, if the site is irrigated, overwatering does not occur. Contractor shall be responsible for providing the owner a watering schedule for trees, shrubs and groundcover.

3.6. Inspection and Acceptance

3.6.1. Inspection of this work will be made by the Landscape Architect at the conclusion of the planting period upon written notice by the Contractor at least five (5) days prior to anticipated date. Condition of shrubs and trees will

be noted and recorded for reference at end of guarantee period.

3.6.2. After inspection, the Contractor will be notified in writing by the Landscape Architect if there are any deficiencies of the requirements for Owner acceptance of the work.

3.7. Guarantee and Replacement

3.7.1. Plants and trees shall be guaranteed for a one (1) year period after the date of substantial completion and shall be alive and in satisfactory condition at the end of guarantee period. Such guarantee excludes vandalism.

3.7.2. At the end of the guarantee period, inspection will be made by the Landscape Architect upon written notice by the Contractor at least five (5) days before the anticipated date. Any shrub or tree required under this Contract that is dead or not in satisfactory condition, as determined by the Landscape Architect, shall be removed from the site, and shall be replaced as soon as conditions permit during the normal planting season.

3.7.3. If there is dispute regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such plant to remain through another complete growing season at which time the rejected plant or tree shall be replaced if found to be dead, unhealthy or badly impaired.

3.7.4. All replacements shall be shrubs and trees of the same kind and size as specified in the plant list. Replacement costs shall be borne by the Contractor.

3.7.5. Replacement plantings required at the end of the guarantee period are to be guaranteed for one (1) additional year. These trees and shrubs are subject to inspection and rejection by the Landscape Architect before and after planting.

3.8. Clean-Up

3.8.1. Any soil, manure, peat or similar material which has been brought onto paved areas by hauling operations or otherwise shall be removed promptly, keeping the area clean at all times. Upon completion of the planting, all excess soil, stones, and debris which have not previously been cleaned up shall be removed from site or disposed of at Contractor’s expense.

3.8.2. All ground area disturbed as a result of planting operations shall be restored to their original condition or to the desired new appearance.

END OF SECTION

DIVISION 33 UTILITIES

The General Conditions of the Contract, Supplementary Conditions, and Division 0l General Requirements, apply to all work of this section. Refer to other sections, divisions, and schedules for other work in connection with this work.

33 00 01 UTILITY SLEEVING

1. SCOPE OF WORK

1.1 Work under this section shall consist of furnishing all labor, materials, equipment and services required for the complete installation of utility pipe sleeving.

2. MATERIALS

2.1 Sleeving shall be a size to be determined by appropriate utility company or related engineer.

2.2 Tracer wire shall be insulated copper type no. 14 AWG - color orange.

3. INSTALLATION

3.1 Conduct trenching operations so as to carefully expose all in-place underground structures without damage. Whenever trenching extends under or approaches so close to an existing structure as to endanger it in any way, precautions and measures shall be taken as necessary to preserve the structure and provide temporary support.

3.2 Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations such as gas, water, and sewer mains and services, power, telephone, street lighting and traffic cables and conduits.

3.3 Pipe placement shall be minimum 12" below finished grade.

3.4 Lay pipe in excavated trench. Cap pipe ends and lay tracer wire on top of pipe for the full length of pipe section and backfill. Backfill shall be placed and compacted in uniform layers not exceeding 6" in loose thickness. Each layer of backfill shall be compacted thoroughly.

END SECTION

33 05 13 MANHOLES AND STRUCTURES

1. **SCOPE OF WORK**

1.1 This section includes:

1.1.1 Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.2 Reference Standards

1.2.1 ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2012.

1.2.2 ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008.

1.2.3 ASTM C1634 - Standard Specification for Concrete Facing Brick; 2011.

1.3 Submittals

1.3.1 See Section 01 33 00 - Submittal Procedures, for submittal procedures.

1.3.2 Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations for approval by Civil Engineer.

1.3.3 Product Data: Provide manhole covers, component construction, features, configuration, and dimensions for approval by Civil Engineer.

1.4 Quality Assurance

1.4.1 Manhole construction and reconstruction shall be in conformance with MnDOT Section 3622.

1.4.2 Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

2. **MATERIALS**

2.1 Manhole Sections

2.1.1 All storm sewer manholes shall meet the requirements of MnDOT 3622 and City Standard Details. "O" ring gaskets shall be used in the joints in the barrel sections. The cone sections shall be concentric (Type A).

2.2 Catch Basins

2.2.1 Catch basins: As indicated in the Plans.

2.2.2 Grate and Frame: As indicated in the Plans.

2.3 Non-Shrink Grout or Cement-Base Polymer Modified Patching Mortar

2.3.1 Non-shrink grout shall be a non-metallic type grout which is durable in wetting and drying, freezing and thawing conditions and shall conform to the requirements set forth in ASTM C 1107-91. Cement-based polymer modified patching mortar shall conform to the requirements set forth in ASTM C 109, ASTM C 490-77, and ASTM C 807-83 (modified).

2.4 Adjusting Rings: Shall meet requirements of City standard details.

2.5 Trench Drain: As indicated in the Plans.

2.6 Components

2.6.1 Water Tight Seal: Water tight seal at pipe penetration including an internal expanding locking band creating a positive mechanical seal, flexible sleeve and a stainless steel exterior clamp. Seal shall be installed according to manufacturers instructions.

2.7 Configuration

2.7.1 Shaft Construction: Concentric with concentric cone top section; lipped male/female dryjoints; sleeved to receive pipe sections.

2.7.2 Shape: Cylindrical.

2.7.3 Clear Inside Dimensions: As indicated on the plans, 48 inch diameter minimum.

2.7.4 Design Depth: As indicated on plans.

2.7.5 Clear Lid Opening: 27 inches diameter.

3. **INSTALLATION**

3.1 Manholes

3.1.1 Manholes shall be bedded on 6-inch deep minimum of Class-5 Aggregate Base.

3.1.2 Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

3.1.3 Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.

3.1.4 Cut and fit for pipe.

3.1.5 Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

3.1.6 Set cover frames and covers level without tipping, to correct elevations.

3.1.7 Coordinate with other sections of work to provide correct size, shape, and location.

3.1.8 When using plastic pipe, manhole water stops supplied by the manufacturer shall be installed.

3.1.9 All annular wall space surrounding the in-place pipes shall be completely filled with mortar or concrete and the inside bottom of each manhole shall be shaped with fresh concrete to form free flow through troughs as directed. The troughs shall be as deep as a half-pipe and the shelves shall slope up 3 inches from the trough to the wall.

3.1.10 When a sewer connects with an existing manhole or catch basin, the Contractor shall make a suitable connection through the wall of the manhole or catch basin and shall reshape the invert to assure a smooth and unobstructed flow line through.

3.1.11 Non-shrink grout or cement-based polymer modified patching mortar shall be used to patch lifting holes in manholes and catch basins.

3.1.12 Adjusting rings shall be sealed to the manhole structure, casting and one another by means of an approved butyl sealant. Utilize a combination of flat and sloping rings to adjust the casting to the slope and grade of the adjacent surface. The top of casting shall be installed uniformly 3/8 inch lower than the adjacent grade.

3.2 Field Quality Control

3.2.1 Perform field inspection and testing in accordance with Section 01 45 00.

3.2.2 If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

33 30 00 SANITARY SEWERAGE UTILITES

1. SCOPE OF WORK

1.1 The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the sanitary sewer work required in these specifications and on the Plans. This specification shall apply to all sanitary sewer work beginning at a point five (5) feet outside of the building wall

1.2 Reference Standards

1.2.1 Reference City of Minneapolis Standards for the installation of sanitary sewers.

1.3 Submittals

1.3.1 Provide manufacturers product information (cut sheets), shop drawings, construction details and O&M information for sewer materials including:

1.3.1.1 Pipe
1.3.1.2 Fittings
1.3.1.3 Structures
1.3.1.4 Castings

1.3.2 Provide reports documenting pressure testing, mandrel testing, and televising.

1.3.3 Provide copies of as-built record drawings

1.4 Quality Assurance

1.4.1 Administrative Requirements

1.4.1.1 Pre-Excavation Meeting: Conduct meeting at Project site with Contractor and Civil Engineer.

MATERIALS

2.1 Poly vinyl chloride (PVC) Pipe

2.1.1 Sanitary sewer service pipe shall be poly-vinyl chloride (PVC) sewer pipe in accordance with ASTM Specifications F-679 or 3034 with a schedule 40 wall and rubber gasket joints.

2.1.2 Sanitary sewer service pipe shall be properly glued the entire way from the connection in the street to the building foundation wall.

2. INSTALLATION

2.1 Notification

2.1.1 Contractor, prior to excavation work, shall notify all utilities, governmental agencies, or entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures or similar items within limits of project, to locate and mark location of such items. The contractor shall expose potential pipe conflicts prior to installation of sewers to allow for any field changes to the design to be made.

2.2 Laying Pipe

2.2.1 Install all pipe in accordance with ASTM specifications which pertain to the specified type of pipe material and the installation situation.

2.2.2 Do not use any pipe or fittings cracked in cutting or handling or otherwise not free from defects.

2.2.3 Clean all pipe of any dirt and/or debris both inside and outside prior to placing in the trench.

2.2.4 Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

2.2.5 Cut pipe only according to manufacturer's directions.

2.2.6 Lay all sewer pipes to horizontal alignment and grade shown on the Plans with bell ends up hill. Establish and maintain horizontal alignment using total station, GPS unit or other approved surveying equipment. Make sure to establish and maintain grade of pipe. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than plus or minus 0.10 feet.

2.2.7 Do not exceed specified trench widths.

2.3 Bedding/Initial Cover

2.3.1 Provide bedding and initial cover in accordance with the applicable CITY OF MINNEAPOLIS requirements.

2.3.2 Sanitary sewer and sewer services shall be provided with 4” of bedding material and 12” of initial cover material (both measured at the bell of

the pipe). Crushed stone bedding shall be used for both bedding and initial cover.

2.4 Manholes

2.4.1 Contractor shall confirm the proper location, size, elevation, and orientation of all pipes entering new manholes before ordering. Do not connect abandoned pipes to new manholes. Manholes having improper location and/or orientation of the pipe connections can be rejected by City or Civl Engineer. Any necessary repair work shall be at the expense of the Contractor.

2.4.2 Limit the excavation for manholes so as to provide only the necessary amount of space to sufficiently prepare the subgrade, set the base, set the manhole or structure, and lay pipe. Provide a minimum of 1’ of clearance between structure and trench wall for adequate backfilling and compaction.

2.4.3 Where excavation occurs below the bottom elevation of the structure's base, bring the excavation to the required elevation by using compacted crushed stone as bedding material. A minimum of 12 inches of compacted crushed stone bedding shall be placed below manhole base.

2.4.4 Set manhole base in accordance with elevation and location as indicated on the plans. Install base plumb and level. Install subsequent pre-cast manhole sections in accordance with shop drawing layout. Provide watertight gaskets between each manhole section.

2.4.5 Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an angle, provide curved channel. Slope manhole bench at 2 inches per foot towards flow channel.

2.4.6 Manholes shall be provided with between 4” and 8” of adjusting rings, with the top adjusting ring being 2” thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of mortar.

2.4.7 When indicated on the drawings, the manhole frame shall be set with a frame/chimney. The frame and adjusting rings shall be sealed with an internal rubber sleeve as needed.

2.5 Casting Installation

2.5.1 Install casting type as indicated on the Plans.

2.5.2 Provide butyl sealant material between last adjusting ring and casting base. Adjust casting elevation and slope to match adjacent proposed grades.

2.6 Connections to Existing Structures

2.6.1 Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, or hydraulic cement and waterstops, or for sanitary sewers, hydraulic cement and flexible watertight boot.

2.7 Sewer Laterals

2.7.1 Connect existing sewer laterals in accordance with all of the requirements of the sewer mains, including bedding, backfill, compaction, and jointing of the pipe. Connect sewer laterals to the sewer main by means of an approved "wye" fitting. Connect the new pipe to the existing lateral material using a no-hub coupling or approved transition fitting. Coupling/fitting shall be selected for the specific pipe material being connected

2.7.2 Subject to City requirements – Contractor must confirm sewer lateral codes, construction details and permits as needed.

2.8 Pipe Insulations

2.8.1 Provide 2” thick insulation when indicated on the Plans, or where depth of cover is less than 6’ feet. Unless otherwise noted.

2.8.2 Install insulation on compacted initial cover material, 6” above the top of the pipe. Stagger joints where more than one layer of insulation is required. Provide insulation with a minimum of 1’ foot of initial cover material. Place cover and backfill material in manner that does not damage insulation; replace any damaged insulation.

2.9 Locator Tape

2.9.1 Provide locator tape when indicated on the Plans or as directed by City or Civil Engineer. Install locator tape approximately 2’ feet above the top of the pipe.

2.10 Deflection Testing

2.10.1 Test all PVC sewer pipe in the presence of Civil Engineer representative by a deflection test mandrel furnished by the contractor. Do not perform deflection testing any sooner than 30 days following the installation of the pipe. Pull the mandrel by hand, or hand operated winch so as to avoid any damages to the pipe that may be caused by mechanized pulling equipment.

2.10.2 Size to test the pipeline for a maximum allowable internal deflection of the pipe (in any direction) of not to exceed five (5) percent of the

original internal diameter for the pipelines tested, regardless of how long after installation the testing takes place

2.10.3 Deflection testing may be done concurrently with any necessary televising of the sewers. When done concurrently with sewer televising, the mandrel may be pulled by mechanized equipment, provided the mandrel is visible in the television picture during the testing and the operation of the mandrel can be quickly halted before damage to the pipe occurs.

2.10.4 Where poor trench soils conditions require the pipe excavation to be undercut and/or over excavated, the construction representative reserves the right to require an additional deflection test prior to the expiration of the Contractor's one year performance guarantee.

2.10.5 Remove and replace all pipe that fails to pass the five (5) percent vertical deflection testing until the pipe passes the deflection test.

2.11 Leakage Testing

2.11.1 All new sanitary sewer lines shall be leakage tested in accordance with City or State codes

2.12 Sewer Televising

2.12.1 Upon completion of the sewer construction all new sewers shall be televised to provide a record of the actual conditions inside the newly constructed sewers via closed circuit televising equipment. The City representative may or may not be present during sewer inspections via this method.

2.12.2 Utilize televising equipment with a color camera specially designed and equipped for the conditions of the sewers to be televised, and with a monitor screen. Provide video equipment so that the televised picture, any on-screen data, and any audio notes of the sewer inspection will be permanently recorded on DVD and another electronic format.

2.12.3 Transport the camera equipment through the sewers by means of mechanical or hand operated winches, coordinated to provide speed and directional control necessary to fully observe the sewer interior. Provide a light source for the necessary illumination.

2.12.4 Provide televising equipment equipped with an on-screen distance meter, capable of registering distances in the sewer from the starting manhole, and accurate to the nearest 0.5’ station, so as to facilitate in the locating of sewer features and/or defects from the ground surface.

2.12.5 Provide televising equipment with an on-screen date and time clock, so as to permit the verification of the date and time of the television inspection.

2.12.6 Any video tapes of the sewer inspection shall contain audio notes describing the sewer location, direction of inspection, and a description of any pertinent features observed during the televised inspection (service locations, leaking or faulty joints, debris in the line, offset joints, etc.). In addition, record this information on a written log or record, in a format of the contractor's choosing.

2.12.7 The Contractor shall provide the Owner with 2 copies of the televising DVD and appropriate electronic files.

2.13 Construction Verification

2.13.1 Contractor is responsible for verifying the location of existing utilities in the field and performing the necessary work to properly stake out, excavate and install the sanitary pipes and other components per the Plans and City of MINNEAPOLIS's sanitary sewer guidelines.

END OF SECTION

33 49 23.13 STORM DRAINAGE WATER RETENTION STRUCTURES

1. SCOPE OF WORK

1.1 This section includes:

1.1.1 This section includes stormwater drainage systems for building roof drainage and site area drainage.

1.1.2 Work includes the installation of the StormTech chamber drainage system.

1.1.3 Related work includes the installation of drainage inlet structures, manholes and outlet structures.

1.2 Reference Standards

1.2.1 American Association of State Highway and Transportation Officials (AASHTO)

1.2.1.1 AASHTO LRFD Bridge Design Specifications Section 3 – Loads and Load Factors

1.2.1.2 AASHTO LRFD Bridge Design Specifications Section 12 – Buried Structures and Tunnel Liners

1.2.1.3 AASHTO M 43 – Standard Specification for Sizes of Aggregate for Road and Bridge Construction

1.2.1.4 AASHTO M 288 – Standard Specification for Geotextile Specification for Highway Applications

1.2.1.5 AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter

1.2.2 American Society for Testing and Materials (ASTM)

1.2.2.1 ASTM F 2418 Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers

1.2.2.2 ASTM F 2787 Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers

1.2.2.3 ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.2.2.4 ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

1.3 Submittals

The following shall be submitted by contractor in accordance with Section 01 33 00 Submittal Procedures:

1.3.1 Product Specifications for the following:

1.3.1.1 StormTech chambers and end caps

1.3.1.2 ADS PE pipe

1.3.2 Product Installation Instructions for the following:

1.3.2.1 StormTech chambers and end caps

1.3.2.2 ADS PE pipe

1.3.3 Inspection and Maintenance for the following:

1.3.3.1 StormTech Isolator™ Row

1.4 Administrative Requirements

1.4.1 Preinstallation Meetings

1.4.1.1 A preinstallation meeting between StormTech representative and general contractor is recommended to discuss the chamber system installation.

1.4.1.1.1 StormTech offers installation consultations to installing contractors.

1.4.1.1.2 Contact StormTech at least 30 days prior to system installation to arrange a pre- installation consultation.

1.4.2 Sequencing

1.4.2.1 Contractor is responsible for coordinating the installation of the subsurface stormwater chamber system with the installation of permanent structures on site.

1.4.2.1.1 Construction loads for permanent structures may require the subsurface chamber system to be installed after the permanent structure(s) on site.

1.4.2.2 Coordinate stormwater chamber system connections to off-site storm sewer with the appropriate agency having jurisdiction.

1.4.2.3 Coordinate stormwater chamber system connections to existing on-site storm sewer.

1.4.2.4 Coordinate with building roof drainage systems.

1.4.2.5 Coordinate with other utility work.

1.5 Quality Assurance

1.5.1 Regulatory Agency Approvals:

1.5.1.1 Environmental agency compliance: Comply with regulations pertaining to storm drainage systems including the City of Minneapolis and Shingle Creek Watershed Management Commission.

1.5.1.2 Utility Compliance: Comply with regulations pertaining to storm drainage systems. Include standards of water and other utilities where appropriate.

1.5.2 Qualifications

1.5.2.1 Manufacturers

1.5.2.1.1 All chamber and end cap products must be produced in an ISO 9001 certified manufacturing facility or shall demonstrate at least 5 years of experience in the production of similar products.

1.6 Delivery, Storage and Handling

1.6.1 Contractor shall check all materials upon delivery to assure that the proper chamber size and plastic pipe and pipe fittings have been received.

1.6.2 Contractor shall check the chambers for shipping damage prior to installation. Units that have been damaged must not be installed. Contractor shall contact chamber manufacturer immediately upon discovery of any damage. Chambers may be left palletized until the units are ready to be installed.

1.6.3 All chambers, pipe and pipe fittings shall be delivered to the site and unloaded with handling that conforms to the manufacturer's instructions for reasonable care.

1.6.4 Protect chamber and chamber fittings from dirt and damage.

1.6.5 All pipe and chambers shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of the pipe on the job shall be in accordance with the pipe manufacturer's recommendations.

1.6.6 Contractor shall refer to the fabric manufacturer's guidance handling and storage of fabric products on site.

2. MATERIALS

2.1 Manufacturers

2.1.1 StormTech, Inc.

2.1.2 Advanced Drainage Systems, Inc.

2.1.3 Hancor, Inc.

2.2 Stormwater Chamber System

2.2.1 Chamber Options

2.2.1.1 Only stormwater chamber systems evaluated by a licensed design engineer and found to meet AASHTO section 12.12 safety factors are allowed.

2.2.1.2 Stormwater chambers must be designed in accordance with ASTM F 2418 Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.

2.2.1.3 Stormwater chambers must be designed in accordance with ASTM F 2787 Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.

2.2.1.4 Chamber systems allowed under this specification include:

2.2.1.4.1 StormTech SC-740

2.2.2 Performance

2.2.2.1 The contractor shall submit a structural evaluation by a registered structural engineer that demonstrates that the safety factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.

2.2.2.2 Only mechanical and material properties that were determined in accordance with ASTM test methods shall be allowed for structural design of the chambers

2.2.2.3 Only chambers affixed with the ASTM F 2418 designation shall be considered as meeting ASTM F 2418.

2.2.2.4 Performance of the stormwater treatment system shall be in accordance with Section 2.03 of this specification.

2.2.2.5 The contractor shall submit design summary by the manufacturer that demonstrates that the system is designed to convey peak flow rates without scour of foundation stone.

2.2.3 Materials

2.2.3.1 Chamber

2.2.3.1.1 Chambers shall be injection molded from virgin polypropylene resin and be yellow in color.

2.2.3.1.2 Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance functions.

2.2.3.1.3 Inspection ports shall be installed and constructed per project plans. Note that inspection ports shall only be installed along the Isolator® Row to allow for inspection of the sediment build up over time.

2.2.3.1.4 The chambers shall be open-bottomed.

2.2.3.1.5 The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be built.

2.2.3.2 End Caps

2.2.3.2.1 End caps shall be injection molded from polyethylene or polypropylene resin and allow pipe connections with polyethylene pipe.

2.2.3.2.2 All chamber rows shall be terminated with an end cap. End cap placement on end of chamber will vary depending on chamber model. End caps shall have a curved face capable of resisting typical horizontal and vertical loads.

2.2.3.2.3 End caps may incorporate cutting guides to allow easy field cutting for various diameters of pipe. Cutting guides shall be located at both the top and bottom of each end cap.

2.2.3.3 Manifold Piping

2.2.3.3.1 Manifold piping shall be designed to ensure that peak flows are distributed to the rows of chambers without scour of foundation stone.

2.2.3.3.2 Manifold piping shall be of HDPE piping such that accepted equations of hydraulics can be used as a basis for design.

2.2.3.4 Stone

2.2.3.4.1 The foundation, embedment and cover stone shall be in accordance with the chamber manufacturer's installation instructions.

2.2.3.5 Fabric

2.2.3.5.1 Fabric between the chamber bottom and the stone foundation located along the entire length of the Isolator Row and the first 12.5 ft (SC-740 models) of all inlet rows shall be AASHTO M288 Class 1 Woven for sediment capture, filtration and scour protection.

2.2.3.5.2 Fabric between the top of the Isolator Row chambers and the embedment stone and surrounding the entire chamber system shall be AASHTO M288 Class 2 Non-Woven for filtration. (not required over MC-3500 Isolator Row).

2.2.3.5.3 If required, a thermoplastic liner may be installed around the entire system to prevent water migration. See manufacturer's Tech Sheet #2 for guidance on thermoplastic liners for the system.

2.3 Stormwater Treatment Systems

2.3.1 The stormwater chamber system shall incorporate an Isolator Row for stormwater treatment and system maintenance. An Isolator Row is a chamber row enclosed in geotextile fabric for sediment capture and maintenance.

2.3.2 The stormwater treatment system shall remove a minimum of 80% of TSS.

2.3.3 Stormwater treatment system inspection and maintenance shall be in accordance with section 3 of this specification and the product manufacturer's published guidance.

2.4 Accessories

2.4.1 Spacers can be used to obtain the required minimum spacing between chamber rows.

2.4.2 Pipe plugs can be used during construction on all inlet pipes to the stormwater chamber system to prevent construction sediment from entering the Isolator Row system. Pipe plugs to be removed once construction of the system is complete and no further construction sediment loading is expected.

3. **INSTALLATION**

3.1 Preparation

3.1.1 General

3.1.1.1 Installing contractors are required to use and understand the latest manufacturer's installation instructions prior to beginning system installation.

3.1.1.1.1 See Section 1.06 for manufacturer pre-installation meeting information.

3.1.1.1.2 Chamber products must be designed and installed in accordance with the manufacturer's minimum requirements. Failure to do so will void the manufacturer's limited warranty.

3.1.1.2 The contractor shall install all drainage structures, pipe and chambers in the locations shown on the design engineer's drawings and/or as approved by the Owner. Pipe shall be of the type and sizes specified on the drawings and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented

3.1.1.3 Chambers, pipe and drainage structures shall be inspected prior to installation and any defective or damaged product shall be replaced accordingly.

3.1.1.4 Contact local underground utility companies prior to construction.

3.1.1.5 The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.

3.1.2 Site Preparation

3.1.2.1 Excavation must be free of standing water. Dewatering measures must be taken if required.

3.1.2.1.1 When groundwater is present in the work area, dewater to maintain stability of in- situ and imported materials. Maintain water level below pipe bedding and foundation to provide a stable trench bottom.

3.1.2.2 Prepare the chamber bed's subgrade soil as outlined in the engineer's drawings. Requirement for subgrade soil bearing capacity should meet or exceed the chamber manufacturer's required allowable subgrade soil bearing capacity. The contractor must report any discrepancies with subgrade soil's bearing capacity to the design engineer.

3.2 Chamber Installation and Backfilling

3.2.1 Install chamber system flat or at constant slope between points an elevations indicated.

3.2.2 Construct fabric and stone foundation per chamber manufacturer's installation instructions.

3.2.3 Construct the chamber bed by joining the chambers lengthwise in rows. Attach chambers by overlapping the end corrugation of one chamber onto the end corrugation of the last chamber in the row.

3.2.4 See pipe manufacturer's installation instructions for pipe assembly.

3.2.5 Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of the chamber manufacturer's installation instructions.

3.2.6 The contractor must refer to the chamber manufacturer's installation instructions for a table of acceptable vehicle loads at various depths of cover. The contractor is responsible for preventing vehicles that exceed the chamber manufacturer's requirements from traveling across or parking over the chamber system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.

3.2.7 Refer to the chamber manufacturer's installation instructions for minimum requirements for backfill material above the stormwater chamber system.

3.2.8 See pipe manufacturer's installation instructions for guidance on installing the plastic pipe fittings to the chamber system.

3.3 Protection

3.3.1 Protect all inlets to the stormwater chamber system during construction. As noted in Section 2.05, pipe plugs may be used in the inlet manhole pipes to prevent construction sediments from clogging the system. Once construction has ceased, the pipe plugs are removed to allow normal system functionality.

3.3.2 All inlet and outlet structures should be protected against construction sediments.

3.4 Inspection and Maintenance

3.4.1 As noted in Section 2.2, chambers may incorporate an optional inspection port to allow for inspection of the stormwater system during normal operations.

3.4.1.1 Inspection can also be accomplished through the inlet manhole connected to the Isolator Row which may require confined space entry certification of the inspector.

3.4.2 Refer to the chamber manufacturer's Isolator Row Operation and Maintenance manual for guidance on inspection intervals during normal system operation.

3.4.3 Maintenance of the Isolator Row shall utilize a JetVac process to remove sediments that have accumulated in the Isolator Row over time.

END OF SECTION