

Professional

Engineering

Services

# Town of Brookfield Technical Specifications

## Project Manual

Town of Brookfield

Brookfield, Wisconsin

Issued August 2023



TOWN OF BROOKFIELD  
BROOKFIELD, WISCONSIN  
TOWN OF BROOKFIELD TECHNICAL SPECIFICATIONS



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## **SPECIFICATIONS**

## SECTION 01 11 00

### SUMMARY OF WORK

#### PART 1–GENERAL

##### 1.01 DIVISION ONE

- A. The requirements of Division 01 apply to all pertinent sections of the Town Specifications.

##### 1.02 PROJECT SCOPE

- A. CONTRACTOR shall provide all items, articles, materials, operations or methods mentioned or scheduled on the Drawings or herein specified: including all labor, supervision, equipment, incidentals, taxes, and permits necessary to complete the Work as described within the Contract Documents. CONTRACTOR shall install all items provided by OWNER as mentioned or scheduled on the Drawings or herein specified.

##### 1.03 CONTRACT DOCUMENTS–INTENT AND USE

###### A. Intent of Documents:

1. Singular notations and specifications shall be considered plural where application is reasonably inferred.
2. Mention or indication of extent of work under any division or Specification section is done only for convenience of CONTRACTOR and shall not be construed as describing all work required under that division or section.
3. Some individual sections may contain a list of related sections. The list of related sections in individual sections is provided for the convenience of CONTRACTOR and is not necessarily all-inclusive. CONTRACTOR may not rely upon this listing for determination of scope of work. Other sections of the Specifications not referenced in individual sections shall apply as required for proper performance of the Work.
4. Command type sentences may be used in the Specifications. These sentences refer to and are directed to CONTRACTOR.
5. Symbols for various elements and systems are shown on the Drawings. Should there be any doubt regarding the meaning or intent of the symbols used, a written interpretation shall be obtained from ENGINEER.

###### B. Use of Documents:

1. CONTRACTOR shall examine all Specifications and Drawings for the Work, including those that may pertain to Work CONTRACTOR does not normally perform with its own forces.
2. CONTRACTOR shall use all of the Project Drawings and Specifications:
  - a. For a complete understanding of the Project.
  - b. To determine the type of construction and systems required.
  - c. For coordination with other contractors.
  - d. To determine what other work may be involved in various parts or phases.
  - e. To anticipate and notify others when work by others will be required.
  - f. And all other relevant matters related to the project.
3. CONTRACTOR is also bound by all requirements of the Contract Documents which are applicable to, pertain to, or affect its Work as may be shown or inferred by the entire set of Project Drawings and Specifications.

#### 1.04 CONTRACTOR USE OF SITE

##### A. General:

1. The "area of the site" referred to in these Specifications shall be as shown on the Drawings. If the "area of the site" is not shown, OWNER's property lines, the Project right-of-way and/or any easements obtained for the Project shall be considered the "area of the site."
2. Construction activities shall be confined within the "area of the site" limits.
3. From the start of work to completion CONTRACTOR is responsible for the care of the site and the premises which are affected by operations of Work of this Contract.
4. Except for permanent site improvements provided under the Contract, CONTRACTOR shall restore property disturbed during the Work, to the conditions which previously existed.
5. Work in occupied spaces shall be restricted to specified Work and essential activities, such as making necessary connections and extending services or constructing temporary access ways. Such work shall be scheduled in advance with OWNER.

##### B. Parking and Deliveries:

1. CONTRACTOR is responsible for control of traffic by vehicles and persons within the limits of its operations.
2. Parking for employees, subcontractors, and agents of CONTRACTOR shall be in areas subject to approval of OWNER.
3. Access to the site for delivery of construction material or equipment shall be subject to approval of OWNER.

#### 1.05 EXISTING SERVICES, OVERHEAD UTILITIES, AND UNDERGROUND FACILITIES INCLUDING STRUCTURES

- A. Interruption of existing services and systems including heating, ventilating, air conditioning, water, sanitary, lighting and power, signal and security systems, and similar work shall be kept to an absolute minimum and shall be limited to times approved by OWNER.
- B. If deemed necessary by OWNER, such work shall be accomplished after OWNER's normal office hours.
- C. Work shall not commence until all labor, materials, and equipment are available so Work can continue without interruption or delay.
- D. Should uncharted or incorrectly charted services or Underground Facilities be encountered during installation, notify OWNER and consult with utility owner immediately.
- E. Cooperate with OWNER and utility companies in keeping respective services and Underground Facilities in operation and repair any damage.
- F. CONTRACTOR shall not interrupt existing services and Underground Facilities occupied and used by OWNER or others, except when permitted in writing by OWNER.
- G. Any accidental interruption of services and Underground Facilities shall be repaired immediately, including provision of temporary facilities until permanent repairs can be made.

- H. Wisconsin Statute 182.0175(2) requires, among other provisions, that before excavation or demolition begins, reasonable advance notice not less than three working days prior to the start of the excavation or demolition of the intent to excavate or demolish and the commencement date be provided to the owners of the Underground Facilities in and near the construction area whose facilities may be affected by the excavation or demolition. As part of this notification requirement, CONTRACTOR shall contact Digger's Hotline (811 or 1-800-242-8511). CONTRACTOR shall be aware that not all owners participate in the Digger's Hotline program. A call to this agency shall not absolve CONTRACTOR of the requirements of this statute. CONTRACTOR shall comply with all other provisions of the statute though not enumerated herein.
- I. Locations and elevations of services and Underground Facilities as shown on the Drawings are approximate. It shall be CONTRACTOR's responsibility to determine their exact location when in their vicinity. To this end, CONTRACTOR shall proceed with caution in the excavation and preparation of the Site so the exact location of services and Underground Facilities can be determined. CONTRACTOR shall include in the Contract Price any costs for temporary or permanent relocations of such services and Underground Facilities required to complete the Work unless specifically indicated otherwise in the Specifications.
- J. Where potential grade conflicts might occur with existing services and Underground Facilities, CONTRACTOR shall uncover such services and Underground Facilities sufficiently in advance of construction so that elevations may be determined to allow any necessary adjustments to be made.
- K. CONTRACTOR shall coordinate with overhead utility companies prior to the Work. CONTRACTOR shall provide all necessary temporary and permanent support relocation or temporary and permanent restraint to maintain overhead utilities in service.
- L. CONTRACTOR shall keep an accurate and complete record of all such services and Underground Facilities encountered and shall provide OWNER a copy of this record. The record shall include a description of the item encountered, opinion as to conditions, and adequate measurements and depths so that the item can be located in the future.
- M. CONTRACTOR shall inspect all services and Underground Facilities for condition and soundness. Unsound conditions shall be reported to OWNER immediately after exposing. CONTRACTOR shall not proceed with the Work until the service or facility owner has been notified. Service or facility owner shall then be given time to inspect and correct, if required, the service or Underground Facility. CONTRACTOR may make claim under the provisions of the general contract documents should CONTRACTOR feel a price or time adjustment is justified.
- N. Any additional costs incurred because of failure of CONTRACTOR to report the condition of any and all existing services and Underground Facility encountered shall be paid for by CONTRACTOR.
- O. Whenever ENGINEER feels it is necessary to explore and excavate to determine the location of existing services and Underground Facilities, CONTRACTOR shall make explorations and excavations for such purposes. If CONTRACTOR is required to perform additional Work in making the explorations and excavations, extra compensation will be allowed as provided for in the general contract documents.

1.06 PROTECTION OF WORK AND IMPROVEMENTS

- A. CONTRACTOR shall protect the property of OWNER, existing improvements, and the Work installed by CONTRACTOR and others from abuse, damage, dust, debris, and other objectionable materials resulting from construction activities.
- B. CONTRACTOR shall provide suitable covers, partitions, or other dust and fume containment devices to suit construction operations.
- C. CONTRACTOR shall keep property, existing improvements, and the Work including structures, mains, fittings, and accessories free from dirt and foreign matter at all times.
- D. CONTRACTOR shall provide temporary plugging of openings, holes, and pipe ends that are existing or that CONTRACTOR has installed.
- E. Property, improvements, and Work damaged by CONTRACTOR shall be repaired or replaced by CONTRACTOR to the satisfaction of OWNER.
- F. If more than one contractor is responsible, the cost shall be shared. ENGINEER will determine responsibility for damages. All repair and replacement methods shall be acceptable to OWNER.
- G. CONTRACTOR is cautioned that existing private and public roads and shoulders may not hold up to typical construction traffic or activities. CONTRACTOR shall replace all roads, shoulders, and paved areas damaged during the project in accordance with this section. Gravel shoulders, gravel roads, and parking areas shall be repaired in accordance with Section 32 11 23–Dense-Graded Base.

1.07 AVAILABILITY OF LANDS

- A. CONTRACTOR shall confine its operations, equipment and storage areas to the easements, lands and rights-of-way in which the Project is to be located. CONTRACTOR may enter into written agreements with property owners for use of other lands during construction. Copies of such agreements shall be provided to OWNER.

PART 2–PRODUCTS

NOT APPLICABLE

PART 3–EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 31 00

### COORDINATION, FIELD ENGINEERING, AND MEETINGS

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Coordination.
  - 2. Field Engineering.
  - 3. Progress Meetings.

##### 1.02 COORDINATION

- A. CONTRACTOR shall coordinate scheduling, submittals, and work of the various sections of the work to provide an efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

##### 1.03 FIELD ENGINEERING

- A. CONTRACTOR shall locate and protect property stakes, legal survey monuments, benchmarks, and survey control and reference points. CONTRACTOR shall pay for replacement of disturbed property stakes and legal survey monuments by a Registered Land Surveyor acceptable to OWNER and for replacement of benchmarks and survey control and reference points provided by ENGINEER.
- B. CONTRACTOR shall provide field engineering services as required to establish elevations, lines, and levels utilizing recognized engineering survey practices.
- C. CONTRACTOR shall furnish all required plummets and graduated poles to check all Work.
- D. If stakes and boards have to be reset because of negligence of CONTRACTOR, CONTRACTOR shall bear the cost of such work.
- E. If laser beam is used, CONTRACTOR shall check its Work against intermediate grade stakes provided between manholes. Prior to initial use of the laser, CONTRACTOR shall set up laser on ground surface and check line and gradient controls. Lasers not functioning properly shall be immediately removed.
- F. CONTRACTOR shall be responsible for all lines, elevations, and measurements of buildings, structures, piping, utilities, and other work executed by CONTRACTOR under the Contract. CONTRACTOR must exercise proper precaution to verify figures before laying out the Work and will be held responsible for any error resulting from its failure to exercise such precaution.

##### 1.04 PROGRESS MEETINGS

- A. Progress meetings will be held throughout progress of the Work at intervals agreed to by OWNER, ENGINEER, and CONTRACTOR. Interval will generally be monthly.

- B. CONTRACTOR's project manager, job superintendent, major subcontractors, and suppliers shall attend as appropriate to address agenda topics for each meeting. CONTRACTOR's representatives shall have authority to bind CONTRACTOR to decisions at the meetings.
- C. The project schedule shall be updated monthly and shall be reviewed at each progress meeting.
- D. CONTRACTOR shall also provide the following information in written form at each meeting.
  - 1. Construction progress, including:
    - a. Activities completed this reporting period.
    - b. Activities in progress this reporting period.
    - c. Activities scheduled to commence this reporting period.
  - 2. Description of problem areas.
  - 3. Current and anticipated delays.
    - a. Cause of the delay.
    - b. Corrective action and schedule adjustments to correct the delay.
    - c. Impact of the delay on other activities, on milestones, and on completion dates.
  - 4. Changes in construction sequence.
- E. ENGINEER will prepare and distribute minutes to all attending parties.

PART 2-PRODUCTS

NOT APPLICABLE

PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 33 00

### SUBMITTALS

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Whenever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards.
  - 2. To facilitate CONTRACTOR's understanding of the design intent, procedures have been established for advance submittal of design data and for its review or rejection by ENGINEER.
  - 3. The type of submittal requirements specified in this section include construction progress schedule, submittal schedule, shop drawings, product data, samples, maintenance manuals, and other miscellaneous work-related submittals.
- B. Related work described elsewhere: More detailed requirements for submittals are described in other sections of these specifications for some materials and equipment. They are to be considered additional requirements to supplement the requirements specified in this section. Submittals shall conform to the general contract documents.
- C. Definitions: "Electronic Submittal" is defined as any submittal transmitted electronically to ENGINEER for review.

##### 1.02 IDENTIFICATION OF SUBMITTALS

- A. CONTRACTOR shall completely identify each submittal and resubmittal by showing at least the following information:
  - 1. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.
  - 2. Name and location of project and identification number.
  - 3. Drawing number and specifications section number to which the submittal applies.
  - 4. Include the date of each submittal or resubmittal.

##### 1.03 GROUPING OF SUBMITTALS

- A. Unless otherwise specifically permitted by ENGINEER, CONTRACTOR shall make all submittals in groups containing all associated items so that information is available for checking each item when it is received.
- B. Partial submittals may be rejected as not complying with the provisions of the Contract Documents.

##### 1.04 TIMING OF SUBMITTALS

- A. CONTRACTOR shall make all submittals far enough in advance of scheduled dates of installation to provide required time for reviews, for securing necessary approval, for possible revision and resubmittal, and for placing orders and securing delivery.

- B. The review period for submittals that are received after 3 P.M. shall commence on the following business day.

#### 1.05 CONSTRUCTION PROGRESS AND SUBMITTAL SCHEDULES

- A. Submit preliminary schedules within 10 days of the Effective Date of the Contract.
- B. Revise schedules incorporating any comments provided at the schedule review conference and resubmit.
- C. As a minimum, the construction progress schedule shall consist of a horizontal bar chart with a separate line for each major portion of Work or operation, identifying first workday of each week.
- D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration for each activity. Identify activities that are on the critical path.
- E. Include line items for milestones (if any), Substantial, and Final Completion.
- F. Submit updated schedules with each Application for Payment, identifying changes since previous version.
- G. Indicate estimated percentage of completion for each item of Work at each submission.
- H. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

#### 1.06 SHOP DRAWINGS

- A. Shop drawings shall include specially prepared technical data for this project including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements, and similar information not in standard printed form for general application to a range of similar projects. Shop drawings shall be submitted for all manufactured or fabricated items. See individual technical sections for special requirements.
- B. CONTRACTOR shall make all shop drawings accurately to scale and sufficiently large to show all pertinent aspects of the item and its method of connection to the work.
- C. Shop drawings shall be checked, approved, and stamped by CONTRACTOR in accordance with the general contract documents before transmittal to ENGINEER for review and approval.
- D. Complete shop drawings and descriptive data shall be submitted on all manufactured or fabricated items prior to 50% completion of the Work. Applications for payment beyond 50% of the Contract amount will not be recommended for payment until all shop drawings are submitted, including color hard copies if requested by OWNER, or a revised schedule for any remaining submittals is agreed to by OWNER and ENGINEER.
- E. CONTRACTOR shall submit shop drawings following the electronic submittal procedure described below.

- F. Shop drawings submitted to ENGINEER will be reviewed and stamped "Approved," "Approved as Noted," "Approved as Noted-Resubmit," or "Not Approved." CONTRACTOR shall resubmit shop drawings stamped "Approved as Noted-Resubmit" and "Not Approved," and will continue this process until shop drawings are stamped "Approved" or "Approved as Noted." If drawings are stamped "Approved as Noted-Resubmit," fabrication may proceed in accordance with the marked-up shop drawings. Installation shall not proceed until shop drawings have been resubmitted and stamped "Approved" or "Approved as Noted."
- G. If shop drawings are stamped "Approved as Noted" or "Approved as Noted-Resubmit" and CONTRACTOR does not agree with revisions or cannot conform with revisions, fabrication shall not proceed and shop drawings shall be resubmitted with explanation of CONTRACTOR's position.
- H. All shop drawings used for construction site activities shall bear the "Approved" or "Approved as Noted" stamp of ENGINEER.
- I. PDF Submittal Procedures:
1. Summary:
    - a. Shop drawing and product data submittals shall be transmitted to ENGINEER in electronic (PDF) format.
    - b. The intent of PDF submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
    - c. The PDF submittal process is not intended for color samples, color charts, or physical material samples.
  2. Procedures:
    - a. CONTRACTOR shall review and apply a stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer/product, dimensions and coordination of information with other parts of the work.
    - b. CONTRACTOR shall transmit each cover letter and submittal to ENGINEER as an e-mail attachment.
    - c. ENGINEER will return the reviewed shop drawing via e-mail with a transmittal letter, after review, indicating the status of the shop drawing review.
    - d. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of CONTRACTOR.
    - e. Electronically submitted shop drawings shall follow the following format:
      - (1) All files shall be delivered in PDF format with a minimum resolution of 300 dpi unless otherwise requested by ENGINEER. Scanned in material shall be scanned in color and any markings by CONTRACTOR shall be made in red. Pages shall be rotated to the appropriate position for easy reading on a computer monitor such that the majority of text is vertical.
      - (2) Files shall be delivered without security features activated.
      - (3) Shop Drawings shall be uploaded as individual files. All pages of one submittal should be contained in one file.
      - (4) The file shall open to a cover page containing, at a minimum, the following information:
        - (a) CONTRACTOR's stamp.
        - (b) Name, e-mail, and telephone number of the individual who may be contacted for further information.
        - (c) Project number.
        - (d) Submittal number.

- (e) Submission date, if resubmittal, all previous submission dates.
- (f) Index detailing contents and the total number of pages in the submittal.

J. Shop drawings shall include verification that the item meets applicable codes and standards.

#### 1.07 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, whenever a choice of color or pattern is available in a specified product, CONTRACTOR shall submit accurate color charts and pattern charts to ENGINEER for OWNER's review and selection.
- B. Unless all available colors and patterns have identical wearing capabilities and are identically suited for the installation, CONTRACTOR shall completely describe the relative capabilities of each.

#### 1.08 PRODUCT DATA

- A. CONTRACTOR shall provide product data as required to supplement shop drawings.
- B. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by CONTRACTOR to illustrate a material, product, or system for some portion of the work.
- C. CONTRACTOR shall collect required product data into one submittal for each unit of work or system.
- D. CONTRACTOR shall include manufacturer's standard printed recommendations for application and use, compliance with standards, performance characteristics, wiring and piping diagrams and controls, component parts, finishes, dimensions, required clearances, and other special coordination requirements.
- E. CONTRACTOR shall mark each copy of standard printed data to identify pertinent products, models, options, and other data.
- F. CONTRACTOR shall supplement manufacturer's standard data to provide information unique to the work.

#### 1.09 RESUBMISSION REQUIREMENTS

- A. Make any corrections or changes in the submittals required by ENGINEER.
- B. Shop Drawings and Product Data:
  - 1. Revise initial drawings or data and resubmit as specified for initial submittal.
  - 2. Itemize in a cover letter any changes which have been made other than those requested by ENGINEER.
- C. CONTRACTOR shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than three submittals. ENGINEER will record ENGINEER's time for review subsequent submittals of shop drawings, samples, or other items required for approval and CONTRACTOR shall reimburse OWNER and ENGINEER's charges for such time.

- D. In the event that CONTRACTOR requests a substitution for previously approved item, CONTRACTOR shall reimburse OWNER for ENGINEER's charges for its review time unless the need for such change is beyond control of CONTRACTOR.

PART 2-PRODUCTS

NOT APPLICABLE

PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 41 00

### REGULATORY REQUIREMENTS

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. OSHA Requirements.
  - 2. Roadway Limits.
  - 3. Permits.
  - 4. Wage Rates.

##### 1.02 OSHA REQUIREMENTS

- A. All work including site safety, equipment, materials, and fabricated items provided under the Contract shall comply with the provisions of the "Occupational Safety and Health Act."

##### 1.03 ROADWAY LIMITS

- A. CONTRACTOR shall comply with roadway weight restrictions including seasonal weight restrictions.

##### 1.04 PERMITS

- A. No permits were obtained by OWNER for this Project. CONTRACTOR shall obtain required permits. Where the requirements of any permit are more restrictive than the Drawings or the Specifications, the permit requirements shall govern.
- B. Any permits required for dewatering operations shall be obtained and paid for by CONTRACTOR.
- C. For dewatering operations, if dewatering wells singly or in aggregate produce 70 or more gallons per minute, CONTRACTOR shall obtain from the Wisconsin Department of Natural Resources, in accordance with Paragraph 281.17(1), Wisconsin Statutes, a permit for dewatering. The Department's private water supply section's address for Well Permits is: Wisconsin Department of Natural Resources, Private Water Supply Section, P.O. Box 7921, Madison, WI 53707. All wells shall be drilled and closed in accordance with DNR requirements for installing and abandoning wells.
- D. CONTRACTOR shall comply with the provisions of Chapter 283, Wisconsin Statutes, regulating the discharge of effluent from construction pit trench dewatering. These provisions provide for the removal of suspended solids from dewatering effluent prior to the direct discharge to surface waters or wetlands. CONTRACTOR shall apply as necessary to the Department of Natural Resources for a permit to discharge effluent from construction pit or trench dewatering. This discharge may be covered by an existing state general permit for discharging contaminated stormwater runoff/or construction pit dewatering. Information about and application forms for this permit(s) may be obtained at the following address shown.

Southeast Region:  
Department of Natural Resources  
2300 North Dr. Martin Luther King Jr. Drive  
Milwaukee, WI 53212  
(414) 263 8500

1.05 WAGE RATES

- A. A wage rate determination is not a requirement of this Project.

PART 2-PRODUCTS

NOT APPLICABLE

PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 42 00

### REFERENCE STANDARDS AND DEFINITIONS

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Reference Standards:
    - a. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
    - b. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is CONTRACTOR's responsibility to provide materials and workmanship which meet or exceed that specifically named code or standard.
    - c. It is also CONTRACTOR's responsibility, when so required by the Contract Documents, to deliver to ENGINEER all required proof that the material or workmanship, or both, meet or exceed the requirements of the specifically named code or standard.
  - 2. Definitions:
    - a. A substantial amount of specification language constitutes definitions for terms found in other Contract Documents, including the Drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon.
    - b. Certain terms used in the Contract Documents are defined generally in this section to supplement definitions of the Agreement and other general contract documents.
    - c. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the Work.
- B. Related Work Described Elsewhere: The specific naming of codes or standards occurs on the Drawings and in other sections of these Specifications.

##### 1.02 QUALITY ASSURANCE

- A. Familiarity with Pertinent Codes and Standards:
  - 1. It is CONTRACTOR's responsibility to verify the requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.
  - 2. When required by individual sections of these specifications, CONTRACTOR shall obtain a copy of each pertinent code or standard and maintain the copies at the job site during submittals, planning, and progress of the Work until Substantial Completion of the Work is attained.
- B. Overlapping or Conflicting Requirements:
  - 1. Where compliance with two or more industry standards or sets of requirements are specified, and the overlapping of those standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement (which is generally recognized to be also most costly) is intended and will be enforced, unless

more detailed language written directly into Contract Documents clearly indicates that a less stringent requirement is acceptable.

2. Refer all uncertainties to ENGINEER for decision before proceeding.

### 1.03 REFERENCE STANDARDS

- A. Applicable standards of the construction industry are made a part of the Contract Documents by reference as if copied directly into the Contract Documents, or as if published copies were bound herewith. See the general contract documents for additional provisions regarding references.
- B. Standards referenced directly in the Contract Documents or by governing regulation, have precedence over nonreferenced standards which are recognized in industry for applicability to the Work.
- C. Nonreference standards are hereby defined to have no particular applicability to the Work except as a general measurement of whether the Work complies with standards recognized in the construction industry.
- D. Reference standards and codes listed in these specifications may include, but are not necessarily limited to, standards or codes published by the following agencies and organizations:

1. AA            Aluminum Association  
1525 Wilson Boulevard, Arlington, VA 22209
2. AAMA        American Architectural Manufacturer's Association  
1827 Walden Office Square Suite 550, Schaumburg, IL 60173-4268
3. AASHTO     American Association of State Highway & Transportation Officials  
444 North Capitol Street NW Suite 249, Washington, DC 20001
4. ACI          American Concrete Institute  
38800 Country Club Drive, Farmington Hills, MI 48331-3439
5. AI            Asphalt Institute  
2696 Research Park Drive, Lexington, KY 40511-8480
6. AISC         American Institute of Steel Construction  
One East Wacker Drive Suite 700, Chicago, IL 60601-1802
7. AISI         American Iron and Steel Institute  
25 Massachusetts Avenue NW Suite 800, Washington, DC 20001
8. ANSI         American National Standards Institute  
25 West 43rd Street, New York, NY 10036
9. APA          American Plywood Association  
7011 South 19th, Tacoma, WA 98466-5333

10. API American Petroleum Institute  
1220 L Street NW, Washington, DC 20005-4070
11. ARI Air-Conditioning & Refrigeration Institute  
4100 North Fairfax Drive Suite 200, Arlington, VA 22203
12. ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers  
1791 Tullie Circle NE, Atlanta, GA 30329
13. ASME American Society of Mechanical Engineers  
Two Park Avenue, New York, NY 10016-5990
14. ASSE American Society of Sanitary Engineering  
901 Canterbury Suite A, Westlake, OH 44145
15. ASTM ASTM International  
100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
16. AWI Architectural Woodwork Institute  
46179 Westlake Drive Suite 120, Potomac Falls, VA 20165-5874
17. AWPA American Wood Protection Association  
P.O. Box 361784, Birmingham, AL 35236-1784
18. AWS American Welding Society  
8669 Doral Boulevard Suite 130, Doral, FL 33166
19. AWWA American Water Works Association  
6666 West Quincy Avenue, Denver, CO 80235
20. BHMA Builder's Hardware Manufacturers Association  
355 Lexington Avenue 15th floor, New York, NY 10017
21. BIA Brick Industry Association  
1850 Centennial Park Drive Suite 301, Reston, VA 20191
22. CRSI Concrete Reinforcing Steel Institute  
9333 North Plum Grove Road, Schaumburg, IL 60173
23. DOT U.S. Department of Transportation  
1200 New Jersey Avenue, SE, Washington, DC 20590
24. EJMA Expansion Joint Manufacturers Association  
25 North Broadway, Tarrytown, NY 10591
25. FM FM Global  
FM Global Corporate Offices, 270 Central Avenue, Johnston, RI 02919

26. FTI Facing Tile Institute  
Box 8880, Canton, OH 44711
27. GA Gypsum Association  
6525 Belcrest Road Suite 480, Hyattsville, MD 20782
28. GANA Glass Association of North America  
800 SW Jackson Street Suite 1500, Topeka, KS 66612-1200
29. ICC International Code Council  
500 New Jersey Avenue NW 6th Floor, Washington, DC 20001
30. IES Illuminating Engineering Society  
120 Wall Street, Floor 17, New York, NY 10005-4001
31. MIL Military Specifications  
Naval Publications and Forms Center  
5801 Tabor Avenue, Philadelphia, PA 19120
32. NAAMM National Association of Architectural Metal Manufacturers  
800 Roosevelt Road Building C Suite 312, Glen Ellyn, IL 60137
33. NCMA National Concrete Masonry Association  
13750 Sunrise Valley Drive, Herndon, VA 20171-4662
34. NECA NECA  
National Electrical Contractors Association  
3 Bethesda Metro Center Suite 1100, Bethesda, MD 20814
35. NEMA National Electrical Manufacturers Association  
1300 North 17th Street Suite 1752, Rosslyn, VA 22209
36. NFPA National Fire Protection Association  
1 Batterymarch Park, Quincy, MA 02169-7471
37. NIST National Institute of Standards and Technology  
(U.S. Department of Commerce), 100 Bureau Drive, Stop 1070  
Gaithersburg, MD 20899-1070
38. NRCA National Roofing Contractors Association  
10255 West Higgins Road Suite 600, Rosemont, IL 60018-5607
39. NSF National Sanitation Foundation International  
P.O. Box 130140, 789 North Dixboro Road, Ann Arbor, MI 48113-0140
40. OSHA Occupational Safety & Health Administration  
200 Constitution Avenue NW, Washington, DC 20210
41. PCA Portland Cement Association  
5420 Old Orchard Road, Skokie, IL 60077

- 42. PCI            Prestressed Concrete Institute  
200 West Adams Street Suite 2100, Chicago, IL 60606
- 43. SAE            Society of Automotive Engineers  
SAE World Headquarters  
400 Commonwealth Drive, Warrendale, PA 15096-0001
- 44. SDI            Steel Deck Institute  
P.O. Box 25, Fox River Grove, IL 60021
- 45. SDI            Steel Door Institute  
30200 Detroit Road, Westlake, OH 44145-1987
- 46. SIGMA        Sealed Insulating Glass Manufacturers Assoc.  
401 North Michigan Avenue Suite 2400, Chicago, IL 60611
- 47. SJI            Steel Joist Institute  
234 Cheves Street, Florence, SC 29501
- 48. SMACNA      Sheet Metal and Air Conditioning  
Contractor's National Association  
4201 Lafayette Center Drive, Chantilly, VA 20151-1219
- 49. SSPC         Society for Protective Coatings  
40 24th Street 6th Floor, Pittsburgh, PA 15222-4656
- 50. TCA           Tile Council of America  
100 Clemson Research Boulevard, Anderson, SC 29625
- 51. UL            Underwriters Laboratories  
333 Pfingston Road; Northbrook, IL 60062

#### 1.04 SUBMITTALS

- A. For OWNER's records, CONTRACTOR shall submit copies of permits, licenses, certifications, inspection reports, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

#### 1.05 DEFINITIONS

- A. Indicated:
  1. The term "indicated" is a cross-reference to details, notes, or schedules on the drawings, to other paragraphs or schedules in the specifications and to similar means of recording requirements in the Contract Documents.
  2. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate cross-reference, and no limitation is intended except as specifically noted.

- B. Approve (or Words of Similar Nature):
1. Where used in conjunction with ENGINEER's response to submittals, requests, applications, inquiries, reports, and claims by CONTRACTOR, the meaning of the term "approve" will be held to the limitation of ENGINEER's responsibilities and duties as specified in the general contract documents.
  2. In no case will "approval" by ENGINEER be interpreted as a release of CONTRACTOR from responsibility to fulfill requirements of the Contract Documents.
- C. Minimum Requirements:
1. Indicated requirements are for a specific minimum acceptable level of quality or quantity, as recognized in the industry.
  2. Actual work must comply with (or within specified tolerances) or exceed minimums.
  3. CONTRACTOR shall refer uncertainties to ENGINEER before proceeding.
- D. Abbreviations: Abbreviations, where not defined in the Contract Documents, will be interpreted to mean the normal construction industry terminology.

PART 2-PRODUCTS

NOT APPLICABLE

PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 45 00

### QUALITY CONTROL

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Includes:
  - 1. Quality Assurance–Control of Installation.
  - 2. Tolerances.
  - 3. Manufacturers' Field Services and Reports.

##### 1.02 QUALITY ASSURANCE–CONTROL OF INSTALLATION

- A. CONTRACTOR shall monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.
- B. CONTRACTOR shall comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, CONTRACTOR shall request clarification from ENGINEER before proceeding.
- D. CONTRACTOR shall comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Work shall be performed by persons qualified to produce workmanship of specified quality.
- F. CONTRACTOR shall secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

##### 1.03 TOLERANCES

- A. CONTRACTOR shall monitor tolerance control of installed products to produce acceptable work and shall not permit tolerances to accumulate.
- B. CONTRACTOR shall comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, CONTRACTOR shall request clarification from ENGINEER before proceeding.
- C. CONTRACTOR shall adjust products to appropriate dimensions; position before securing products in place.

##### 1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections or when requested by ENGINEER, CONTRACTOR shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, and quality of workmanship.

- B. CONTRACTOR shall submit qualifications of observer to ENGINEER 30 days in advance of required observations.
- C. CONTRACTOR shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. CONTRACTOR shall submit report in duplicate within 30 days of observation to ENGINEER for information.

PART 2-PRODUCTS

NOT APPLICABLE

PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 50 00

### TEMPORARY FACILITIES

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Temporary Utilities.
  - 2. Temporary Support Facilities.
  - 3. Removal of Temporary Facilities.
- B. CONTRACTOR shall arrange for and provide temporary facilities as required for proper and expeditious prosecution of the Work.
- C. CONTRACTOR shall pay all costs, except as otherwise specified, until final acceptance of the Work unless OWNER makes arrangements for use of completed portions of the Work after substantial completion in accordance with the provisions of the general contract documents.
- D. CONTRACTOR shall make all temporary connections to utilities and services in locations acceptable to OWNER and local authorities having appropriate jurisdiction.
  - 1. Furnish all necessary labor and materials.
  - 2. Make all installations in a manner subject to the acceptance of such authorities and OWNER.
  - 3. Maintain such connections.
  - 4. Remove temporary installation and connection when no longer required.
  - 5. Restore services and sources of supply to proper operating conditions.

##### 1.02 TEMPORARY UTILITIES

- A. Temporary Toilets: CONTRACTOR shall provide and maintain sanitary temporary chemical toilets located where approved by OWNER and in sufficient number required for the work force employed by CONTRACTOR.
- B. Weather Protection and Temporary Heat: CONTRACTOR shall provide weather protection to protect the Work from damage because of freezing, rain, snow, and other inclement weather.
- C. Temporary Water: CONTRACTOR shall supply its own water during construction. CONTRACTOR shall also provide its own piping, valves, and appurtenances for its requirements.
- D. Temporary Fire Protection: CONTRACTOR and Subcontractor(s) who maintain or provide an enclosed shed or trailer shall provide and maintain in operating order in each shed or trailer a minimum of one fire extinguisher. More extinguishers shall be provided as necessary. Fire extinguishers shall be minimum dry chemical, nonfreezing-type, UL rating 2A-30BC, with 10-pound capacity for Class A, B, and C fires.

- E. CONTRACTOR's and Subcontractor(s)' personnel shall refrain from smoking during excavation, laying pipe, backfilling, and other work at the Site which may involve potential contact with explosive vapors or gasoline products.

#### 1.03 TEMPORARY SUPPORT FACILITIES

- A. CONTRACTOR shall provide whatever facilities and services which may be needed to properly support primary construction process and meet compliance requirements and governing regulations.
- B. CONTRACTOR shall not use permanent facilities except as otherwise indicated, unless authorized by OWNER.

#### 1.04 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary materials, equipment, services, and construction as soon as practicable but no later than just prior to final completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities and restore existing facilities used during construction to specified, or to original, condition.
- C. Minor temporary facilities which interfere with OWNER's operations shall be removed at the end of each Work period.

### PART 2-PRODUCTS

NOT APPLICABLE

### PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

SECTION 01 57 00  
TEMPORARY CONTROLS

PART 1–GENERAL

1.01 SUMMARY

- A. Work Included:
  - 1. Dust Control.
  - 2. Water, Erosion, and Sediment Control.
  - 3. Noise Control.
  - 4. Traffic Control.
  - 5. Site Security.
  - 6. Daily Cleanup.

PART 2–PRODUCTS

NOT APPLICABLE

PART 3–EXECUTION

3.01 DUST CONTROL

- A. CONTRACTOR shall execute the Work by methods to minimize raising dust from construction operations.
- B. CONTRACTOR shall provide positive means to prevent airborne dust from dispersing into atmosphere.
- C. CONTRACTOR shall provide partitions, enclosures, etc., within buildings as necessary to confine dust and protect adjacent areas.

3.02 WATER, EROSION, AND SEDIMENT CONTROL

- A. CONTRACTOR shall grade site to drain and shall maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. CONTRACTOR shall protect Site from puddling or running water.
- C. CONTRACTOR shall provide erosion control measures as necessary to control discharge of sediment laden water to surface waters and wetlands.
- D. Except as provided for in the document, overland discharge of water from dewatering operations shall not be allowed. Depending on water quality, such water shall either be piped directly to the surface water or shall be directed to sedimentation basins or other such structures or features prior to discharge to surface waters so as not to cause damage to existing ground and improvements, erosion, or deposition in the discharge area.
- E. CONTRACTOR shall use jute or synthetic netting, silt fences, straw bales, dikes, channels, and other applicable measures to prevent erosion of soils disturbed by its construction operation.

- F. Restoration of the Site shall proceed concurrently with the construction operation. See Drawings and Specifications for erosion control measures in addition to that which may be required above.
- G. Erosion control measures shall comply with DNR Conservation Practice Standards-Construction Site Erosion and Sediment Controls.

### 3.03 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by construction operations.

### 3.04 TRAFFIC CONTROL

- A. CONTRACTOR shall be responsible for providing all signs, barricades, flagmen, and other traffic control devices in the construction zone.
- B. All traffic control measures shall meet the requirements of Part 6 of the Manual on Uniform Traffic Control Devices of the State of Wisconsin.
- C. Do not close or obstruct roadways without approval of OWNER.
- D. Conduct operations with minimum interference to roadways.
- E. Maintain two-way traffic on streets at all times.

### 3.05 SITE SECURITY

- A. CONTRACTOR shall have the sole responsibility of safeguarding the Site perimeter to prevent unauthorized entry to the Site throughout the duration of the Project. CONTRACTOR shall at all times provide such permanent and temporary fencing or barricades or other measures as may be necessary to restrict unauthorized entry to its construction area including construction in public rights-of-way or easements. Site security measures shall include safeguards against attractive nuisance hazards as a result of construction activity.
- B. CONTRACTOR shall at all times be responsible for the security of the Work including materials and equipment. OWNER will not take any responsibility for missing or damaged equipment, tools, or personal belongings. CONTRACTOR shall have the sole responsibility of safeguarding the Work and the Site throughout the duration of the Project.

### 3.06 DAILY CLEANUP

- A. CONTRACTOR shall clean up the Site and remove all rubbish on a daily basis.
- B. CONTRACTOR shall clean up public streets and highways and remove any dirt, mud, or other materials due to project traffic on daily basis and shall comply with all local and state ordinances and permit requirements.

END OF SECTION

## SECTION 01 60 00

### MATERIALS AND EQUIPMENT

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included: CONTRACTOR shall be responsible for the delivery, handling, storage and protection of all material and equipment required to complete the Work as specified herein.
- B. Related Sections and Divisions: Specific requirements for the handling and storage of material and equipment are described in other sections of these Specifications.

##### 1.02 PRODUCTS

- A. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.
- B. CONTRACTOR shall not use materials and equipment removed from existing construction, except as specifically required, or allowed, by the Contract Documents.
- C. When any construction deviations from the Drawings and/or Specifications necessary to accommodate equipment supplied by CONTRACTOR, result in additional costs to CONTRACTOR or other contractors, such additional costs shall be borne by CONTRACTOR. CONTRACTOR shall also pay any additional costs necessary for revisions of Drawings and/or Specifications by ENGINEER.
- D. Each major component of equipment shall bear a nameplate giving the name and address of the manufacturer and the catalogue number or designation.

##### 1.03 TRANSPORTATION AND HANDLING

- A. Materials, products and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.
- B. CONTRACTOR shall not overload any portion of the structure in the transporting or storage of materials.
- C. CONTRACTOR shall not damage other construction by careless transportation, handling, spillage, staining or impact of materials.
- D. CONTRACTOR shall provide equipment and personnel to handle products, including those provided by OWNER, by methods to prevent soiling and damage.
- E. CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
- F. CONTRACTOR shall handle product by methods to avoid bending or overstressing. Lift large and heavy components only at designated lift points.

#### 1.04 DELIVERY AND RECEIVING

- A. CONTRACTOR shall arrange deliveries of products in accordance with the Progress Schedule, allowing time for observation prior to installation.
- B. CONTRACTOR shall coordinate deliveries to avoid conflict with the Work and conditions at the Site; work activities of other contractors or OWNER; limitations on storage space; availability of personnel and handling equipment and OWNER's use of premises.
- C. CONTRACTOR shall deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.
- D. CONTRACTOR shall clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.
- E. Immediately on delivery, CONTRACTOR shall inspect shipment to review that:
  - 1. Product complies with requirements of Contract Documents and reviewed submittals.
  - 2. Quantities are correct.
  - 3. Accessories and installation hardware are correct.
  - 4. Containers and packages are intact and labels legible.
  - 5. Products are protected and undamaged.

#### 1.05 STORAGE AND PROTECTION

- A. General:
  - 1. CONTRACTOR shall store products, immediately on delivery, in accordance with manufacturer's instructions, with all seals and labels intact and legible.
  - 2. Any additional off-site space required shall be arranged by CONTRACTOR.
  - 3. CONTRACTOR shall allocate the available storage areas and coordinate their use by the trades on the job.
  - 4. CONTRACTOR shall arrange storage in a manner to provide access for maintenance of stored items and for observation.
- B. In enclosed storage, CONTRACTOR shall:
  - 1. Provide suitable temporary weather tight storage facilities as may be required for materials that will be damaged by storage in the open.
  - 2. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
  - 3. Provide ventilation for sensitive products as required by manufacturer's instructions.
  - 4. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
  - 5. Store solid materials such as insulation, tile, mechanical and electrical equipment, fittings, and fixtures under shelter, in original packages, away from dampness and other hazards.
  - 6. Store liquid materials away from fire or intense heat and protect from freezing.
- C. At exterior storage, CONTRACTOR shall:
  - 1. Store unit materials such as concrete block, brick, steel, pipe, conduit, door frames, and lumber off ground, out of reach of dirt, water, mud and splashing.
  - 2. Store tools or equipment that carry dirt outside.
  - 3. Store large equipment so as not to damage the Work or present a fire hazard.
  - 4. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet material and provide ventilation to avoid condensation.

5. Completely cover and protect any equipment or material which is prime coated or finish painted with secured plastic or cloth tarps. Store out of reach of dirt, water, mud and splashing.
6. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
7. Provide surface drainage to prevent erosion and ponding of water.
8. Prevent mixing of refuse or chemically injurious materials or liquids.
9. Cover aggregates such as sand and gravel in cold wet weather.
10. Remove all traces of piled bulk materials at completion of work and return site to original or indicated condition.

#### 1.06 MAINTENANCE OF STORAGE

- A. CONTRACTOR shall periodically inspect stored products on a scheduled basis.
- B. CONTRACTOR shall verify that storage facilities comply with manufacturer's product storage requirements, and verify that manufacturer required environmental conditions are maintained continually.
- C. CONTRACTOR shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.
- D. CONTRACTOR shall perform scheduled maintenance of equipment in storage as recommended by the manufacturer. A record of the maintenance shall be kept and turned over to ENGINEER when the equipment is installed.

#### 1.07 INSTALLATION REQUIREMENTS

- A. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified.
- B. After installation, CONTRACTOR shall protect all materials and equipment against weather, dust, moisture, and mechanical damage.
- C. CONTRACTOR shall be responsible for all damages that occur in connection with the care and protection of all materials and equipment until completion and final acceptance of the Work by OWNER. Damaged material and equipment shall be immediately removed from the Site.

### PART 2-PRODUCTS

NOT APPLICABLE

### PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

Section 01 60 00-3

1127.001

SECTION 01 77 00  
CONTRACT CLOSEOUT

PART 1—GENERAL

1.01 SUMMARY

- A. Work Included:
  - 1. Closeout Procedures.
  - 2. Final Cleaning.
  - 3. Adjusting.
  - 4. Project Record Documents.
  - 5. Warranties.

1.02 CLOSEOUT PROCEDURES

- A. CONTRACTOR shall provide submittals to ENGINEER that are required by governing or other authorities.
- B. CONTRACTOR shall comply with the general contract documents and complete the following before requesting ENGINEER's observation of the Work or designated portion thereof for substantial completion.
  - 1. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates, and similar required documentation for specific units of Work, enabling OWNER's unrestricted occupancy and use.
  - 2. Submit record documentation, maintenance manuals, tools, spare parts, keys, and similar operational items.
  - 3. Submit consent of surety (if surety required in Contract).
  - 4. Complete final cleaning, touch-up work of marred surfaces, and remove temporary facilities and tools.

1.03 FINAL CLEANING

- A. It is CONTRACTOR's responsibility to completely clean up the construction site at the completion of the Work.

1.04 ADJUSTING

- A. CONTRACTOR shall adjust operating products and equipment to provide smooth and unhindered operation.

1.05 PROJECT RECORD DOCUMENTS

- A. CONTRACTOR shall maintain on Site one set of the following record documents to record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. CONTRACTOR shall make entries that are complete and accurate, enabling future reference by OWNER.
- C. CONTRACTOR shall store record documents separate from documents used for construction.
- D. CONTRACTOR shall record information concurrent with construction progress.
- E. Specifications: CONTRACTOR shall legibly mark and record at each Product section description of actual products installed, including the following:
  1. Manufacturer's name and product model and number.
  2. Product substitutions or alternates utilized.
  3. Changes made by addenda and modifications.
- F. Record Drawings: CONTRACTOR shall legibly mark each item to record actual construction including:
  1. Measured depths of foundations in relation to finish floor datum.
  2. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
  3. Measured locations of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of the Work.
  4. Field changes of dimension and detail.
  5. Details not on original Contract drawings.

#### 1.06 WARRANTIES

- A. CONTRACTOR shall provide warranties beyond project one-year warranty as required by technical sections.
- B. Submit warranty information as follows:
  1. Provide original copies bearing authorized signatures.
  2. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers, and provide Table of Contents and assemble in three-ring binder with durable cover.
  3. Submit with request for certificate of Substantial Completion.
  4. For items of work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance listing date of acceptance as start of warranty period.

#### PART 2-PRODUCTS

NOT APPLICABLE

#### PART 3-EXECUTION

NOT APPLICABLE

END OF SECTION

Section 01 77 00-2

1127.001

## SECTION 02 41 00

### DEMOLITION

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included: All demolition, removal, and salvage work as shown on the Drawings.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 SUBMITTALS

- A. CONTRACTOR shall submit permits and notices, if required, authorizing building demolition.

##### 1.03 QUALITY ASSURANCE

- A. CONTRACTOR shall perform demolition, removal, and salvage in conformity with applicable federal, state, and local safety practices and code requirements.
- B. CONTRACTOR shall contact all public utilities and shall shut off, cut, and cap all utility services in accordance with utility requirements, codes, rules and regulations.
- C. Obtain and pay for all necessary permits, licenses, and certificates required.
- D. Removal of flammable and combustible liquid storage tanks shall be by a State of Wisconsin Department of Commerce- certified remover.
- E. Flammable and combustible liquid storage tank removal shall be in accordance with all applicable codes including State of Wisconsin COMM Chapter 10.

##### 1.04 SEQUENCE

- A. No demolition, removal, or salvage work shall commence until approval to proceed has been granted by OWNER. Such work shall be completed in accordance with the construction sequence included in Division 01 of these specifications and in accordance with the construction phases of this project and work to be done by other contractors.

#### PART 2–PRODUCTS

##### 2.01 GENERAL

- A. Compacted fill shall meet the requirements of Section 31 23 00–Excavation, Fill, Backfill, and Grading.
- B. Pipe fittings and materials shall meet the requirements of Section 33 00 10–Buried Piping and Appurtenances.

## PART 3-EXECUTION

### 3.01 BREAKING DOWN AND REMOVING STRUCTURES

#### A. General:

1. All existing structures, with all attached parts and connections, shown on the drawings or specified to be removed or that interfere with the new construction, shall be entirely removed within the limits shown or specified, unless otherwise provided.
2. When a portion of any existing structure is to be retained, CONTRACTOR shall take care during construction operations so as not to impair the value of the retained portion.
  - a. Complete all operations necessary for the removal of any existing structure which might endanger the new construction prior to the construction of the new work.
  - b. Do not use any equipment or devices which might damage structures, facilities, or property which are to be preserved and retained.
3. When existing reinforcing is exposed at the surface of removal areas, CONTRACTOR shall burn back the reinforcing bars 2 inches and patch with nonshrink grout, unless noted otherwise.

#### B. Pavement, Curb, Gutter, Sidewalk, Driveways, Crosswalk, and Similar Structures:

1. Where portions of the existing structure are to be left in the surface of the finished work, CONTRACTOR shall remove the structure to an existing joint, or saw and chip the structure to a true line.
2. Sufficient removal shall be made to provide for proper grades and connections in the new work.

#### C. Walls, Piers, Surface Drains, Foundations, and Similar Masonry Structures:

1. Remove entirely or break down to an elevation at least 2 feet below the earth subgrade within the areas of a road bed and elsewhere to 2 feet below the finished slopes or natural ground, as the case may be.
2. Remove existing construction as required to clear new construction.

#### D. Underground Tanks (Other than Septic Tanks):

1. Remove the contents of underground tanks to allow the complete removal of such tanks.
2. Backfill the resulting hole or pit in accordance with the backfill portion of this section.

#### E. Pipe Culverts:

1. Remove entirely all culverts that are to be removed, except as hereinafter provided for closing culverts.
2. Remove sidewalls or substructure units in water to an elevation no higher than the elevation of the natural stream or lake bed.
  - a. Where grading of the channel is required, remove such units to the proposed finished grade of the stream or lake bed.
  - b. Remove all other endwalls or substructure units down to at least 2 feet below natural or finished ground line, as the case may be.
3. Where existing culverts are to be extended or otherwise incorporated into the new work, remove only such part or parts of the existing culvert as necessary to provide a proper connection to the new work.
4. Remove pipe culverts designated for salvage in a manner that will preclude damage to the culverts.
5. Closing culverts:
  - a. A culvert may be closed instead of being removed if the following conditions apply:
    - (1) If the diameter of the culvert is less than 48 inches.

- (2) If the top thereof does not come within 5 feet of the elevation of the finished grade line.
- (3) If the culvert is in suitable condition.
- b. Remove the headwall and such parts as would be within 2 feet of the finished grade line.
- c. Completely fill each end of the culvert with concrete for a distance from each end of at least 2 feet plus the height of the opening of the structure.

### 3.02 ABANDONING STRUCTURES

- A. Tanks, Manholes, Catch Basins, and Inlets:
  - 1. CONTRACTOR shall thoroughly clean structures to be abandoned.
  - 2. CONTRACTOR shall plug existing pipe connections with brick or concrete block masonry or with any grade of concrete having a 28-day compressive strength in excess of 2,000 psi.
  - 3. CONTRACTOR shall remove the walls of the structures to an elevation at least 2 feet below the finished grade line, or to such elevation that may be designated on the drawings or as necessary to clear new construction.

### 3.03 ABANDONING AND REMOVING UTILITIES AND UNDERGROUND PROCESS PIPING

- A. CONTRACTOR shall be responsible for the turning off or unhooking of all utilities and process piping before starting the demolition work. Remove all utility lines, including electrical services and process piping that are shown or specified to be removed. Remove utility lines that are to be abandoned as needed to clear new construction.
- B. The ends of utility lines and process piping shown or specified to be abandoned that are exposed by excavation shall be plugged with concrete to prevent soil infiltration into the pipes.

### 3.04 EQUIPMENT

- A. CONTRACTOR shall remove all equipment specified herein or indicated.
- B. CONTRACTOR shall remove associated exposed conduit, power wiring, controls, switches, instrumentation, control wiring, control boxes, appurtenances, and their supports serving equipment to be removed. Electrical items shall be removed to their junction with motor control center, control panel, or their junction with conduit serving other equipment that is to remain.
- C. CONTRACTOR shall remove all piping and appurtenances and their supports serving equipment indicated to be removed. Piping shall be removed to its junction with the main service header serving other equipment that is to remain or new equipment as indicated. Remaining piping and tubing shall be fitted with an appropriate blind flange or plug and insulated as required.
- D. CONTRACTOR shall remove equipment bases, anchor bolts, and other supports serving equipment to be removed. Concrete bases shall be removed to 1 inch below floor elevation and repaired with nonshrink grout plus surfacing to match existing.
- E. CONTRACTOR shall patch floors, walls, and ceilings as required to match existing or as indicated where equipment, piping, electrical, bases, or supports are removed.

### 3.05 INTERIOR PIPING, DUCTWORK, AND APPURTENANCES

- A. CONTRACTOR shall remove all piping, ductwork, and appurtenances as indicated. The location and elevations of existing piping are approximate.
- B. CONTRACTOR shall remove all supports for piping, ductwork, and appurtenances indicated to be removed. Repiping and connections to new piping shall be as specified for new piping. Remaining piping and tubing, not reconnected for new piping, shall be fitted with an appropriate blind flange or plugged and insulated as required.
- C. CONTRACTOR shall patch all holes resulting from removal of piping, ductwork, appurtenances, and their supports. Patching of concrete shall be with nonshrink grout and as indicated. Patching of masonry shall be with matching material toothed in. Patch other material as indicated.

### 3.06 SALVAGE

- A. OWNER has first right of refusal to all material, piping, and equipment removed.
- B. All equipment, material, and piping, except as specified hereinafter, within the buildings and structures to be demolished and additional items as noted shall be removed by CONTRACTOR. CONTRACTOR shall inspect each structure and determine the type and amount of equipment, materials, and piping to be removed.
- C. All equipment, material, and piping, except as specified hereinafter, within the limits of the demolition and additional items noted to be removed, will become the property of CONTRACTOR if OWNER does not claim under first right of refusal and shall be removed from the project site. Comply with State and local ordinances and regulations for disposing of materials.

### 3.07 BACKFILL

- A. CONTRACTOR shall fill all abandoned structures and excavations resulting from removal of structures and utilities with compacted fill. See Section 31 23 00—Excavation, Fill, Backfill, and Grading for required degree of compaction.
- B. Prior to filling, CONTRACTOR shall break one opening in the floor or wall near the base of each compartment to allow groundwater to freely migrate through the structure.

END OF SECTION

SECTION 31 10 00  
CLEARING AND GRUBBING

PART 1–GENERAL

1.01 SUMMARY

- A. Work Included:
  - 1. Cutting and disposing of trees, brush, windfalls, logs, and other vegetation.
  - 2. Removing and disposing of roots, stumps, stubs, logs, and other timber.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Payment: Payment for clearing and grubbing will be at the Unit Price Bid. Tree protection shall be incidental to area work.

PART 2–PRODUCTS

NOT APPLICABLE

PART 3–EXECUTION

3.01 PREPARATION

- A. CONTRACTOR shall identify existing plant life to remain and shall tag accordingly.

3.02 PROTECTION

- A. CONTRACTOR shall protect from damage utilities and structures that are to remain.
- B. CONTRACTOR shall protect trees, plant growth, and features designated to remain as final landscaping.
- C. See Division 01 for protection of survey monumentation.

3.03 CLEARING AND GRUBBING

- A. Clearing and grubbing shall consist of cutting and disposing of trees, brush, windfalls, logs, and other vegetation, and the removing and disposing of roots, stumps, stubs, grubs, logs, and other timber from within the clearing limits as defined on the Drawings, designated to be removed on the Drawings or in the Specifications, or fall within the excavation, embankment, or improved areas of the site.
- B. All roots and stumps shall be removed to a depth of not less than 12 inches below the original ground surface in embankment areas. In cut areas, such material shall be removed to a depth of not less than 12 inches below the subgrade.

- C. Disposal by burning or burying clearing and grubbing items within the project limits is not allowed.

#### 3.04 TREE PROTECTION

- A. Trees shall be protected when construction activities affect the root zones and limbs.
- B. Minimize storage and use of heavy equipment and materials within Critical Root Zone (CRZ), which is considered 1 to 1.5x the diameter (in) at breast height of tree. For example, a 10-inch-diameter tree would require a 10- to 15-foot diameter of protection.
- C. Any exposed fine roots shall be kept damp. Any damaged roots above 1-inch diameter shall be cut clean.
- D. Tree branches damaged as a result of construction activity shall be cut clean. CONTRACTOR shall make a good faith effort to follow and implement the tree protection plan.

END OF SECTION

## SECTION 31 23 00

### EXCAVATION, FILL, BACKFILL, AND GRADING

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included: Excavating, filling, backfilling, and grading for this work includes, but is not necessarily limited to:
1. Excavating for footings, foundations, roads, utilities, sidewalks, driveways, parking lots, restoration, and miscellaneous areas.
  2. Furnishing and placing all fill and backfill.
  3. Provide compaction of all fill and backfill.
  4. Furnishing and placing vapor barrier and granular cushion below interior slabs on grade.
  5. Furnishing and placing of crushed stone mat below tank slabs and manhole/vault slabs, basement floors, or other structures where required.
  6. Rough and finish grading prior to paving, seeding, etc.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Allowances:
1. CONTRACTOR shall INCLUDE in the Bid the cost of removing, hauling, and disposing of in a licensed landfill excavated solid waste fill material as defined in this section. The cost shall include excavation, any testing required by the landfill, transportation, additional safety considerations, and disposal fees. Payment for fill material excavation and disposal will be adjusted, add or deduct, based upon the actual amount of fill material excavation and disposal and the unit price for excavation and disposal of solid waste fill materials. Landfill tonnage shall be based on weight tickets. Copies of all weight tickets for landfilled material shall be provided to OWNER for documentation purposes to calculate actual quantities. Weight tickets shall be duly and accurately completed. Weight tickets with incomplete or illegible information shall not be acceptable.
  2. CONTRACTOR shall INCLUDE in the Bid, the cost of excavating, transferring, and stockpiling potentially hazardous waste, including impacted surrounding material, as defined in this section. The cost shall include excavation; field testing; photoionization detector rental, calibration and operation; sample collection; and transportation; safety considerations; standby time as described; and placement of the material in the temporary storage area. Payment for excavation and stockpiling of potentially hazardous materials shall be adjusted, add or deduct, based on the actual volume of fill material excavation and stockpiling and on the unit price for excavation and stockpiling of potentially hazardous materials. Measurement shall be stockpile volume.
- D. Payment: Common excavation shall include all excavation specified, undercutting, fill, backfill and grading, except rock excavation and unsuitable foundation material, as hereinafter described.

## 1.02 REFERENCED STANDARDS

- A. Standard specifications, where referenced, shall refer to the State of Wisconsin Department of Transportation, Standard Specifications For Highway and Structure Construction, Current Edition, including all issued supplemental specifications.
- B. ASTM C33—Standard Specification for Concrete Aggregates.
- C. ASTM D698—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- D. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).

## 1.03 SUBMITTALS

- A. Submit sources and gradations for materials proposed for use as compacted fill, utility trench backfill, trench bedding and cover material, crushed stone mat, and granular cushion.
- B. Submit samples of materials proposed for use in Paragraph 1.03.A to a soils testing laboratory for analysis of its suitability and for recommendations on moisture content during compaction, compaction methods, or other appropriate information.
- C. Submit sufficient samples of each different type or classification of soil to obtain representative values.

## 1.04 JOB CONDITIONS

- A. The elevations shown for existing work and ground are reasonably correct, but are not guaranteed to be absolutely accurate. No extras will be allowed because of variations between drawings and actual grades.
- B. No soil borings were made for this project. CONTRACTOR shall conduct its own investigation to determine physical conditions at the site which may affect the work.

## PART 2—PRODUCTS

### 2.01 COMPACTED FILL

- A. All fill and backfill material designated to be compacted fill shall be granular with no stones larger than 4 inches and shall be reasonably well-graded throughout the particle size range. A minimum 65% of the material shall pass the 3/4-inch sieve, and the material shall be capable of being compaction tested in accordance with ASTM D1557, as determined by the Project Soils Engineer. Of that portion of the material passing the No. 4 sieve, not more than 25% shall pass the No. 200 sieve, and material shall have less than 5% clay content. When placing fill during wet weather or in wet areas, this requirement shall be modified to not more than 5% passing the No. 200 sieve. Adequately dewatered areas are not defined as wet areas.
- B. Native material may be used as compacted fill if it meets the above specification. CONTRACTOR shall determine whether native material meets the above specification.

CONTRACTOR shall provide all needed fill material whether from on-site or off-site at no additional cost to OWNER.

## 2.02 CRUSHED STONE MAT

- A. Crushed stone mat below tank slabs, manholes, vault slabs and basement floors shall be 3/4-inch clear crushed stone and shall meet all requirements of ASTM C33 size No. 67.

## 2.03 GRANULAR CUSHION

- A. Granular cushion beneath floor slabs-on-grade shall meet requirements of Section 305 of Standard Specifications for WisDOT Base Aggregate Dense, 3/4 inch.

## 2.04 EMBANKMENT FILL

- A. Embankment fill shall contain no stumps, brush, rubbish, or other perishable material. The top 12 inches of the earth embankment shall be earthy material free from large stones.

## 2.05 CLAY FILL

- A. Clay fill shall contain at least 25% clay minerals (material finer than 0.002 mm).

## 2.06 FLOWABLE FILL

- A. Flowable fill shall be a self-compacting, self-leveling, material consisting of a mixture of fine aggregate and filler (as needed), water, and cementitious materials (Portland cement, fly ash, granulated blast furnace slag) that is in a flowable state at the time of placement meeting the requirements of the National Ready Mixed Concrete Association Guide Specification for Controlled Low Strength Materials (CLSM). The flowable fill shall be proportioned by the ready mixed concrete supplier on the basis of field experience and/or laboratory trial mixtures to produce a cohesive and nonsegregating mixture which has the following properties:
  - 1. Minimum compressive strength: 50 psi.
  - 2. Maximum compressive strength: 150 psi.
- B. CONTRACTOR shall submit the following information well in advance of fill placement to avoid any delay in construction:
  - 1. Gradation of fine aggregate.
  - 2. Design mix.
  - 3. Previous test results with 7- and 28-day compressive strengths.
  - 4. Certified mill test results for cement identifying brand, type, and chemistry of cement to be used.
  - 5. Brand, type, principle ingredient, and amount of each admixture if used.

## 2.07 TRENCH BEDDING MATERIAL

- A. Bedding material shall be hard and durable and shall be made by crushing sound limestone or dolomite ledge rock, or crushed gravel aggregate. Bedding material shall conform to the requirements of ASTM C33 and shall conform to gradations shown in the following table. No native soil shall be used for bedding material.

PERCENTAGE BY WEIGHT PASSING INDICATED SIEVE

Size	2 1/2 IN	2 IN	1 1/2 IN	1 IN	3/4 IN	1/2 IN	3/8 IN	No. 4	No. 8	No. 16	No. 30	No. 100	No. 200
57			100	95-100		25-60		0-10	0-5				
8						100	85-100	10-30	0-10	0-5			
9						100	75-100	0-25	0-5				
10							100	85-100				10-30	

- B. All rigid sanitary sewer pipe and related appurtenances shall be bedded and covered in accordance with the Class B bedding detail as shown on Drawing 01-975-43A. Bedding material shall conform to Size No. 8 or No. 9. With pipes greater than 15 inches, Size No. 57 may be used.
- C. Concrete and other rigid pipe used in nonsanitary sewer applications may be bedded using the Class C bedding detail as shown on Drawing 01-975-43A. Bedding material shall conform to Size No. 8 or No. 9. With pipes greater than 15 inches, Size No. 57 may be used.
- D. Ductile and cast iron pipe shall be bedded in accordance with Class C bedding detail as shown on Drawing 01-975-43A, or the Type 4 laying condition of AWWA C600. Bedding material shall conform to Size No. 57, No. 8, or No. 9. Where ductile iron pipe is polyethylene encased, bedding material shall conform to Size No. 8 or No. 9.
- E. Thermoplastic sanitary sewer pipe and related appurtenances shall be bedded and covered in accordance with the Thermoplastic Pipe Bedding Detail on Drawing 01-975-43A. Bedding material shall conform to Size No. 8 or No. 9. With pipes greater than 15 inches, Size No. 57 may be used.
- F. All other sanitary sewer pipe and related appurtenances shall be bedded and covered in accordance with the Class B bedding detail as shown on Drawing 01-975-43A. Bedding material shall conform to Size No. 8 or No. 9. With pipes greater than 15 inches, Size No. 57 may be used.
- G. PVC water main or force main shall be bedded and covered in accordance with the Thermoplastic Pipe Bedding Detail on Drawing 01-975-43A or in accordance with the Type 4 laying condition of AWWA C605. HDPE water main or force main shall be bedded and covered in accordance with the Thermoplastic Pipe Bedding Detail on Drawing 01-975-43A or in accordance with ASTM D2774. Bedding material shall conform to Size No. 8 or No. 9. With pipes greater than 15 inches, Size No. 57 may be used. No native materials may be used.
- H. Bedding material for copper water services shall conform to Size No. 9 or No. 10.

2.08 TRENCH COVER MATERIAL

- A. Material which is to be placed from the bedding material to 1 foot above the top of the pipe shall be termed cover material. All trenches shall be backfilled by hand to 1 foot above the top of the pipe with cover material. Cover material shall be deposited in the trench for its full width on each side of the pipe, fittings and appurtenances simultaneously in 6-inch layers and shall be compacted using hand tamping bars and/or mechanical tampers. Use special care in placing cover material to avoid injury to or movement of the pipe. Cover material shall consist of durable granular particles ranging in size from fine to a maximum size of 3/4 inch. Unwashed bank run sand and crushed bank run gravel will be considered generally

acceptable cover material. Cover material shall generally conform to the following gradation specifications:

COVER MATERIAL GRADATION

Sieve Size	Percentage by Weight Passing
1 inch	100
3/4 inches	85 to 100
3/8 inches	50 to 80
No. 4	35 to 65
No. 30	--
No. 40	15 to 30
No. 200	5 to 15

- B. Native trench materials may be used for cover material if they substantially conform to the above gradation specifications and a suitable credit is extended to OWNER.
- C. All bedding materials may be substituted for cover material when requested by CONTRACTOR except where polyethylene encasement is used. In such case, only those bedding materials specifically noted for polyethylene encasement may be used.
- D. Material that is to be placed from the bedding material around and to 1 foot above the top of all pipes shall be termed cover material. Except as otherwise specified, (a) cover material shall consist of durable granular particles ranging in size from fine to coarse in a substantially uniform combination, (b) unwashed bank-run sand and crushed bank-run gravel will be considered generally acceptable for cover material, (c) no stones larger than 3/4 inch in their greatest dimension shall be allowed in the cover material, and (d) native materials may be used if they conform to the above specifications. Cover material for copper piping shall be Size No. 10. Cover material for PVC pressure or other thermoplastic piping may be Size No. 10.

2.09 TRENCH BACKFILL MATERIAL

- A. Backfill shall be that material placed between the top of cover material up to subgrade for placement of restoration materials. Backfill for storm inlets shall be bedding material.
- B. When the type of backfill material is not otherwise specified or shown on the Drawings, CONTRACTOR may backfill with the excavated material, provided that such material consists of loam clay, sand, gravel, or other materials which, in the opinion of Project Soils Engineer, are suitable for backfilling.
- C. All backfill material shall exceed a temperature of 35°F and be free from frost, cinders, ashes, refuse, vegetable or organic matter, boulders, rocks, or stone, frozen lumps, or other material which in the opinion of Project Soils Engineer is unsuitable. From 1 foot above the top of the pipe to the trench subgrade, well-graded material containing stones up to 8 inches in their greatest dimension may be used, unless otherwise specified. Care should be taken in backfilling so as not to damage the installed pipe.
- D. In refilling the trench, if there is not sufficient material excavated therefrom suitable for refilling, CONTRACTOR shall, without extra compensation, furnish the deficiency. Where indicated on the Drawings, fill shall be provided over projecting conduits. Such fill shall be

free of large boulders, and the top 6 inches shall be of suitable material to fit the adjoining ground.

- E. When called for on the Drawings, in the Specifications, or requested by ENGINEER, backfill material shall be granular and shall consist of durable particles ranging in size from fine to coarse in a substantially uniform combination. Sufficient fine material shall be present to fill all the voids in the coarse material. No stones over 3 inches or clay lumps shall be present. Unless otherwise allowed by ENGINEER, granular backfill shall generally conform to the following gradation specification:

#### GRANULAR BACKFILL

Sieve Size	Percentage by Weight Passing
3 inches	100
2 inches	95 to 100
No. 4	35 to 60
No. 200	5 to 10

### PART 3-EXECUTION

#### 3.01 GENERAL

- A. Prior to all excavating, CONTRACTOR shall become thoroughly familiar with the site and site conditions.

#### 3.02 PROTECTION

- A. CONTRACTOR shall provide all necessary sheeting, shoring, or other soil retention systems including all labor, material, equipment, and tools required, or as necessary to maintain the excavation in a condition to provide safe working conditions, to permit the safe and efficient installation of all items of Contract work, and to protect adjacent property. CONTRACTOR shall be held liable for any damage which may result to property from excavation or construction operations. Sheeting, shoring, and other soil retainage systems shall be withdrawn or removed in a manner so as to prevent subsequent settlement of structures, utilities, and other improvements.
- B. Design of sheet piling and other soil retaining systems shall be the sole responsibility of CONTRACTOR. Where such systems are shown on the Drawings, no parameters such as embedment depth, section profile, presence or lack of walers, etc., nor system type or suitability shall be inferred. CONTRACTOR is responsible for designing and providing a fully functional system compatible with construction and site requirements.
- C. Nothing in this specification shall be deemed to allow the use of protective systems less effective than those required by the Occupational Safety and Health Administration (OSHA) and other applicable code requirements.

#### 3.03 FINISH ELEVATIONS AND LINES

- A. CONTRACTOR is responsible for setting and establishing finish elevations and lines.

- B. If existing property stakes, not within the limits of the trench or street slope limits, are removed or damaged by CONTRACTOR, CONTRACTOR shall bear the cost of replacement. Replacement shall be made by a legal survey performed by a licensed Land Surveyor hired by OWNER. Cost for survey shall be deducted from the Contract Price.

### 3.04 COMMON EXCAVATION

- A. After the site has been cleared and stripped, the site shall be cut and filled to the indicated subgrade as shown or specified.
- B. All excavated material that does not meet the specification for compacted fill or embankment fill or meets the specification but is not required for backfill or fill shall be classified as excess material and shall be removed from the site and disposed of at CONTRACTOR's expense.
- C. CONTRACTOR shall place the excess material on the site in locations as designated by OWNER. The hauling cost shall be at CONTRACTOR's expense unless otherwise specified.
- D. All material other than suitable bearing soil or bedrock, as determined by the Project Soils Engineer, shall be removed from under concrete to be poured on ground.
- E. Excavation for all footings, foundation walls, pits, etc., shall be large enough to provide adequate clearance for the proper execution for the work within them.
- F. Excavations scheduled to extend below groundwater shall not be started until the area has been dewatered. See Section 31 23 19—Dewatering.
- G. No footings or slabs shall bear on the top 2 feet of existing soil. Where planned subgrade is within 2 feet of existing grade, remove soils to 2 feet below existing grade and backfill with compacted fill up to subgrade elevation.
- H. When excavations reach subgrade elevations as shown on the Drawings or as specified herein, the Project Soils Engineer will observe the bottom material. Where, in the opinion of the Project Soils Engineer, unsuitable foundation material is found at the level of the subgrade, original material below the excavation necessary for construction according to grades shown or specified, shall be removed and replaced with material and placing methods as specified under compacted fill and backfill.
- I. Excavations that are undercut beneath the foundation shall extend beyond the perimeter of the foundation 1 foot plus a distance at least equal to the depth of undercut below footing grade.
- J. CONTRACTOR shall backfill and compact all overexcavated areas.
- K. All street excavation shall be performed as called for in Section 205 of the Standard Specifications and as herein modified.
- L. The following items of Work shall be included in common excavation:
  - 1. The excavation to subgrade elevations as detailed in the Drawings including road bed areas, terraces, sidewalks, bike paths, driveways, and other miscellaneous surface improvements.

2. Removal (and stockpiling, if the use of salvaged topsoil is required) of topsoil from all cut areas and fill areas within a 1:1 slope of finished street, sidewalks, bike paths, driveways, and other miscellaneous surface improvements.
  3. The preparation, grading, compaction, and proof-rolling of subgrade areas for roadbed, sidewalks, bike paths, driveways, and other miscellaneous surface improvements to the elevations detailed on the Drawings.
  4. Excavation and grading required to realign and/or create ditch lines and drainage ways to route drainage to or from storm facilities as shown on the Drawings, or as necessary to maintain positive drainage.
  5. Removal of temporary backfill placed in new utility trenches above the subgrade.
  6. The removal and disposal of all undesirable and surplus materials.
- M. Common excavation may be completed as part of utility construction prior to initiating general street excavation activities.
- N. All subgrade areas in streets and parking lots, including utility trench restoration areas, shall be proof-rolled with a heavily loaded triaxle dump truck or other similar equipment requested by ENGINEER prior to the placement of any fill materials or base course. ENGINEER must be present during proof-rolling to review the Work necessary for the stabilization of any unstable areas identified.
- O. Saw cuts shall be made in existing pavement, driveways, curb and gutter, and sidewalks to allow restoration to neat straight lines. Saw cuts damaged during construction shall be recut prior to beginning restoration.
- P. CONTRACTOR shall salvage suitable materials from utility and street construction activities to provide fill for street construction. Where sufficient quantities of materials suitable for street construction are not available from areas of the site, CONTRACTOR shall perform borrow excavation to make up the deficit in accordance with Section 208 of the Standard Specifications.

### 3.05 UTILITY TRENCH EXCAVATIONS

- A. Caution In Excavation; CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures may be determined and shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on its part.
- B. Subsurface Exploration: When determined that it is necessary to explore and excavate to determine the location of existing underground facilities, CONTRACTOR shall make explorations and excavations for such purposes. If CONTRACTOR is asked to perform additional Work in making the explorations and excavations, extra compensation will be allowed as specified in the general contract documents.
- C. The trench shall be dug so that the utilities can be laid to the alignment and depth specified. Unless otherwise allowed by ENGINEER, trenches shall not be excavated more than 100 feet in advance of pipe laying. Earth excavation shall include all excavation except rock. Included in earth excavation shall be removal of street paving of all types, existing structures, existing improvements and trees smaller than 4 inches in diameter measured 4 feet above the ground, all as necessary to complete the pipe installation.

- D. The trench shall be finished to the depth necessary to provide a uniform and continuous bearing and support for the pipe on the bedding material provided at every point between bell holes. Any part of the bottom of trench excavated below the specified grade shall be corrected with bedding material, thoroughly compacted in place. The bedding shall be shaped and finished with hand tools to fit the bottom quadrant to the pipe.
- E. If unstable soil conditions are encountered at subgrade, CONTRACTOR shall replace the unstable soil with special bedding. CONTRACTOR shall be allowed extra compensation for the special bedding, unless the unstable soil conditions are caused by CONTRACTOR's failure to adequately dewater the trench, in which case CONTRACTOR shall bear the entire cost.
- F. All excavated material shall be piled in a manner that will not endanger the Work. Stockpiles not for immediate backfilling shall have silt fences placed around their perimeter for erosion control. The Work shall be conducted in such a manner that pedestrian and motor traffic is not unnecessarily disrupted. Fire hydrants, valve boxes and manholes shall be left unobstructed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural water courses shall not be obstructed.
- G. Excavated material designated by ENGINEER as being undesirable for backfilling and all surplus excavated material shall be immediately removed as excavation progresses. All such material shall be disposed of in an environmentally safe manner in accordance with local, state, and federal regulations. No such materials shall be disposed of in wetlands, floodplains, or other environmentally sensitive areas. Disposal sites are also subject to approval of OWNER. All undesirable and surplus material disposed of must be leveled off and graded to rough elevations as determined by OWNER. Appropriate erosion control measures shall be provided and maintained at disposal sites until disposal is complete and the disposal site is permanently stabilized.
- H. CONTRACTOR shall remove bituminous pavement and road surface as a part of the trench excavation. The width of pavement removed shall be the minimum possible, and acceptable, for convenient and safe installation of utilities and appurtenances.
- I. All bituminous pavement shall be cut on neat, straight lines and shall not be damaged beyond the limits of the trench.
- J. Where it is necessary to trench through concrete pavement, a strip shall be sawed and removed in such a manner as not to disturb the remainder of the pavement. Paving and undermining of existing concrete pavement shall be prevented by CONTRACTOR. If CONTRACTOR unnecessarily removes or damages pavement or surfaces beyond limits acceptable to ENGINEER, such pavement and surfaces shall be replaced or repaired at the expense of CONTRACTOR.
- K. All trees, shrubs, and improved areas outside the excavation shall be protected from damage.
- L. Pipe shall be placed only on dry foundations.
- M. Excavation shall include all necessary incidental work such as tunneling, sheet piling, shoring, underpinning, pumping, bailing, transportation, and all fill and backfilling.

- N. CONTRACTOR shall excavate whatever materials, are encountered as required to place at the elevations shown, all pipe, manholes, and other work as required to complete the project as shown.
- O. The excavation at the crossing of all underground utility services in place shall be as narrow as practicable. All underground services shall be protected from damage and maintained in service at their original location and grade during the process of the work. Any damage to underground services shall be replaced or repaired at no cost to OWNER or to the owner of the service. The present underground services shown on the Drawings are located in accordance with available data. Encountering these services at a different location or encountering services not shown shall not release CONTRACTOR from the above-stated conditions.
- P. Any water, drainage, gas, sewer, or electric lines encountered in the excavation that are not to be disturbed shall be properly underpinned and supported. Any service connections encountered that are to be removed shall be cut off at limits of the excavation and capped in accordance within the requirements of or permits governing such removals. Any permits required for this work will be obtained by OWNER upon request of CONTRACTOR.
- Q. CONTRACTOR shall be responsible for determining and providing the minimum width necessary to provide a safe trench in accordance with current OSHA standards and all other applicable standards. The top width of trench excavation shall be kept as narrow as is reasonably possible and acceptable to minimize pavement damage. Pay items related to maximum trench widths shall not limit CONTRACTOR's responsibility to provide safe trench conditions.
- R. Width of Trench–Rigid Pipe: The width of trench below the outside top of the pipe shall be as shown in the following table for the sizes listed. A minimum clearance of 8 inches between the outside of the pipe barrel and the trench wall at the pipe spring line shall be maintained to allow for bedding and haunching. If sheeting is used and is going to remain in place, the trench width shall be measured as the clear distance between inside faces of the sheeting. Otherwise, the trench width shall be based on the width between stable trench walls after sheeting is removed.

MAXIMUM WIDTH OF TRENCH BELOW TOP OF PIPE

Nominal Pipe Diameter (Inches)	Trench Width (Inches)
4	30
6	30
8	36
10	36
12	36
15	36
18 and larger	Pipe O.D. Plus 16 (Minimum 36)

- S. Where the width of trench below the outside top of the pipe barrel cannot be otherwise maintained within the limits shown above, CONTRACTOR, at its own expense, shall furnish an adequate pipe installation for the actual trench width which will meet design conditions. This may be accomplished by furnishing higher class bedding, a stronger pipe, concrete cradle, cap or envelope or by driving sheeting prior to excavation to subgrade. Removal of

sheeting below the top of the pipe, if allowed by ENGINEER, shall be gradual during backfilling.

- T. If the maximum trench width is exceeded for any reason other than by request of ENGINEER, the concrete cradle, cap, sheeting, bedding or the stronger pipe shall be placed by CONTRACTOR at its own expense. Where the maximum trench width is exceeded at the written request of ENGINEER, the concrete cradle, cap, sheeting, bedding or stronger pipe will be paid for on the basis of the price bid.
- U. Width of Trench—Thermoplastic and Ductile Iron Pipe: The trench width for flexible pipe shall be minimum three times the pipe outside diameter or the maximum trench width specified for rigid pipe, whichever is greater. A minimum clearance of 8 inches between the outside of the pipe barrel and the trench wall at the pipe spring line shall be maintained to allow for bedding and haunching.
- V. Special bedding shall consist of stone material and filter fabric as described herein. Where the bottom of the trench at subgrade is found to be unstable or of unsuitable material, which should be removed, CONTRACTOR shall excavate and remove such unstable or unsuitable material to the trench width and to a depth of 2 feet. The excavated area shall be lined with filter fabric, Mirafi 140 N, US Fabrics US 120NW, Propex Geotex 401, or equal, and backfilled with bedding material in maximum 12-inch layers. At subgrade the filter fabric shall be wrapped over the special bedding with an 18-inch overlap. Bedding material shall then be placed over the special bedding to support the piping. See Dewatering and Excavation to Subgrade sections for additional conditions.
- W. If soil conditions require it, concrete cradle or encasement shall be placed around the pipe as shown on Drawing 01-975-43A. Excavation shall be carried below the grade line to a depth requested by ENGINEER and concrete cradle or encasement placed. Before the concrete is placed, the pipe shall be laid to line and grade, blocked and braced, and the joint made. The cradle shall then be placed, taking care not to disturb the pipe. Concrete shall have a minimum 28-day compressive strength of 4,000 psi. Concrete cradle shall not be used for thermoplastic piping. See Trench Width section for additional conditions.
- X. Open-cut trenches shall be sheeted and braced as required by any governing federal regulations including OSHA, state laws, and municipal ordinances; and as may be necessary to protect life, property, improvements or the Work. Underground or aboveground improvements to be left in place shall be protected and, if damaged, shall be repaired or replaced at the expense of CONTRACTOR.
- Y. Sheeting and bracing which is to be left in place must be removed for a distance of 4 feet below the present or proposed final grade of the street, road, or land, whichever is lower. Trench bracing, except that which shall be left in place, may be removed after backfilling has been completed or has been brought up to such an elevation as to permit its safe removal.
- Z. Portable Trench Box: Whenever a portable trench box or shield is used, special precautions shall be taken so as not to pull already jointed pipe apart or leave voids around the pipe wall. Whenever possible, the bottom edge of the box shall be kept at a level approximately even with the top of pipe. Cover material shall be placed to at least the top of pipe before moving the box ahead.
- AA. All trenches shall be backfilled using specified material so that excessive lengths of trench are not left open. In general, the backfilling operation shall proceed so that no more than 100 feet of trench is open behind the pipe laying operation.

- BB. Backfill shall be left below the original surface to allow for placement of restoration materials including pavement, base course, concrete, topsoil, sod, plus any pavement replacement specified in accordance with the Asphaltic Paving section herein. When settlement occurs, CONTRACTOR shall restore the surface improvements at its expense to maintain the finished surface.

### 3.06 PREPARATION OF SUBGRADE

- A. After the site has been cleared, stripped, and excavated to subgrade, thoroughly compact subgrade to the requirements specified for compacted fill below. Scarify and moisture condition the subgrade as recommended by the Project Soils Engineer.
- B. Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.
- C. All slab-on-grade and road subgrades shall be proofrolled with a heavy rubber-tired construction vehicle (such as a fully loaded tandem-axle dump truck) in the presence of the Project Soils Engineer.
- D. ENGINEER may request the excavation of unsuitable materials in areas of unstable subgrade. The excavation of such materials, except in areas where CONTRACTOR has completed utility construction or placed street fill, shall be measured by ENGINEER for payment.
- E. The excavation and replacement of unstable utility trench backfill and/or street fill placed by CONTRACTOR shall be at CONTRACTOR's expense.
- F. Base course placed on unstable foundation shall be removed and replaced at CONTRACTOR's cost following excavation of the affected area.
- G. Where requested by ENGINEER in the field, excavation below subgrade areas shall be lined with geotextile material as specified in Section 31 32 19–Geotextiles and backfilled with 3-inch crushed stone dense graded base as specified herein.
- H. Geotextile shall be placed where requested by ENGINEER to stabilize street subgrade areas. Fabric shall be as specified in Section 31 32 19–Geotextiles. Vibratory compaction shall not be used in the compaction of base course in areas where geotextile fabrics are used.

### 3.07 COMPACTED FILL AND BACKFILL

- A. All fill and backfill, except as otherwise specified, shall be compacted fill placed to within 4 inches of the bottom of the topsoil or to the bottom of the structure or other improvement.
- B. Unless otherwise noted, structures with a top slab shall not be backfilled until the slab is in place and has reached its specified 28-day strength.
- C. In fill areas above existing grade around structures, compacted fill shall be placed within a minimum of 10 feet from the structure.
- D. No fill shall be placed under water or over unsuitable subgrade conditions.

- E. All fill and backfill, except embankment fill and clay fill, shall be compacted as follows:
  - 1. Class 1 Compaction: This class of compaction shall apply to all fill areas under buildings, structures, piping, bituminous roadway and parking areas, curb and gutter, and backfill within 10 feet of structure walls. All compacted material shall be placed in uniform layers not exceeding 8 inches in loose thickness prior to compaction. Each layer shall be uniformly compacted to a dry density at least 95% of the maximum dry density as determined by a laboratory compaction test at the optimum moisture content (ASTM Test Designation D1557). Compaction shall be obtained by compaction equipment appropriate for the conditions.
  - 2. Class 2 Compaction: This class of compaction shall be used in excavated areas beyond 10 feet of structures without any piping or adjacent foundations. Material for backfill shall be granular material as specified above. The material shall be deposited, spread, and leveled in layers generally not exceeding 12 inches in thickness before compaction. Each layer of the fill shall be compacted to at least 90% of the maximum dry density (testing same as Class 1). Compaction shall be obtained by compaction equipment appropriate for the conditions.
- F. No frozen material shall be placed nor shall any material be placed on frozen ground.
- G. Four inches of clay fill shall be placed and compacted to at least a firm consistency in areas to be seeded or sodded prior to placement of topsoil.

### 3.08 EMBANKMENT FILL

- A. Embankment fill may be placed in fill areas to be seeded or sodded if no piping exists in the fill and the areas are at least 10 feet from any structure.
- B. Embankment fill shall be deposited, spread, and leveled in layers generally not exceeding 12 inches in thickness before compaction. Each layer shall be compacted to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment. The required compaction shall be obtained for each layer before any material for a succeeding layer is placed thereon. Compaction shall be obtained using the hauling and leveling equipment, and in addition, tamping rollers, pneumatic-tired rollers, vibratory rollers, or other types of equipment required to produce the desired results.

### 3.09 PLACING CRUSHED STONE AND GEOTEXTILE FABRIC

- A. The same day that the subgrade is exposed, place geotextile fabric on subgrade, and place 12 inches of crushed stone mat below tank slabs, manholes, vault slabs, and basement floors. Compact in place.
- B. Geotechnical fabric shall extend up the side edge of the stone mat and extend across the top of the stone to a minimum of 12 inches past the edge of base slab.

### 3.10 PIPE BEDDING AND COVER

- A. Immediately prior to placing the pipe, the trench bottom shall be shaped by hand to fit the entire bottom quadrant of the pipe. If pipe is of the bell and spigot type; bell holes shall be provided to prevent the bell from supporting the backfill load. Bell holes shall be large enough to permit proper making of the joint, but not larger than necessary to make the joint. All adjustments to line and grade must be done by scraping away or filling in bedding material under the body of the pipe. Any fill used must be bedding material. If necessary to obtain

uniform contact of the pipe with the subgrade, a template shall be used to shape the bedding material. All pipe shall be placed on bedding material at least 4 inches thick. See Drawing 01-975-43A. Bedding material shall then be placed and tamped into place up alongside the pipe in maximum 6-inch layers shovel slicing the bedding material under the haunches to provide firm contact with the pipe. CONTRACTOR shall perform all necessary excavation and shall furnish all necessary material to provide this bedding.

- B. Trenches shall be kept water-free and dry during bedding, laying, and jointing. CONTRACTOR shall provide, operate, and maintain all pumps or other equipment necessary to drain and keep all excavation pits and trenches and the entire subgrade area free from water under any and all circumstances that may arise.

### 3.11 TRENCH BACKFILL CONSOLIDATION

- A. All trenches shall be consolidated as specified in this section for the entire depth and width of the trench.
- B. Consolidation shall be achieved by use of smooth surface vibratory compactors or backhoe operated hydraulic compactors for granular materials and rotating sheepsfoot type mechanisms for loam/clay soils. The lift height shall not exceed 8 inches for walk behind, hand operated, vibratory compactors and sheepsfoot. Lift height shall not exceed 24 inches for self-propelled vibratory drum or backhoe operated hydraulic compactors. Smaller lift heights shall be provided as necessary to achieve the degree of compaction specified.
- C. Unless specified otherwise, backfill material beneath paved areas or future paved areas and within 5 feet of paved areas or future paved areas shall be consolidated as follows: Within 3 feet of the surface 95% of maximum dry density, below 3 feet from the surface to 1 foot above the pipe 90% of maximum dry density, as determined by the modified Proctor Test (ASTM D1557).
- D. Unless otherwise specified, backfill material placed in all other areas shall be compacted to the point where no additional consolidation can be observed from the compaction and backfill equipment being used.
- E. Backfill material not meeting the compaction specification shall be recompacted by CONTRACTOR at no cost to OWNER. Cost for additional testing on recompacted material shall be at CONTRACTOR's expense.

### 3.12 GRADING

- A. CONTRACTOR shall perform all rough and finish grading required to attain the elevations shown on the Drawings.
- B. Grading Tolerances:
  - 1. Rough Grade: Buildings, parking areas, and sidewalks— $\pm 0.1$  feet.
  - 2. Finish Grade: Granular cushion or crushed stone mat under concrete slabs— $\pm 0.03$  feet.
  - 3. Lawn areas away from buildings, parking areas, and sidewalks— $\pm 0.25$  feet.

### 3.13 MAINTENANCE OF SURFACE

- A. CONTRACTOR shall maintain all backfilling, resurfacing, repaving, and other surface improvements constructed under this Contract. CONTRACTOR shall, upon proper notice

from OWNER, make all repairs in surfaces of trenches and excavations. All expenses incurred by OWNER and/or CONTRACTOR in making repairs and all expenses in maintaining trench and excavation surfaces shall be at the expense of CONTRACTOR regardless of the material used in backfilling trench excavations. OWNER reserves the right to make all emergency repairs necessary to make safe all streets and walks at the expense of CONTRACTOR regardless of the material used in backfilling trench excavations. A maintenance guarantee fund, if specified, will be withheld from the final amount due CONTRACTOR for a period of 6 months, after acceptance of the Work, to provide such maintenance.

- B. CONTRACTOR shall be responsible for controlling dust dispersion during utility and street construction. Remedial actions required as a result of inadequate dust control shall be CONTRACTOR's responsibility. To control dust, CONTRACTOR shall apply calcium chloride or ammonium lignin sulfonate in 12 to 14% solution or other dust control palliative acceptable to OWNER. Prior to application of dust palliative, the street shall be graded smooth.

### 3.14 COMPACTION TESTING

- A. Compaction tests shall be done by the Project Soils Engineer. Location and frequency of the tests shall be as recommended by the Project Soils Engineer and paid for by OWNER.

### 3.15 EXCAVATED SOLID WASTE FILL MATERIALS TO BE LANDFILLED

- A. If any solid waste fill materials are encountered, they shall be excavated and removed to a licensed sanitary landfill. Solid waste fill material is defined as any construction or demolition debris, household refuse, glass, metal, plastic, or similar material not native to the site, but having been placed on-site during past filling operations and mixed with soil.

### 3.16 POTENTIALLY HAZARDOUS WASTE

- A. If CONTRACTOR encounters during excavation or trenching activities any potentially hazardous waste as defined in this section, and the materials are within the limits of the site excavation or trenching work, the materials shall be handled as specified in this section. Potentially hazardous waste is defined as any drums, containerized waste, or organic liquid waste or surrounding impacted material. Such materials have not been found during investigations performed to date but could potentially be encountered.
- B. Should potentially hazardous waste be encountered, excavation activities in that portion of the site shall be placed on standby pending removal of the material, receipt of test results, and determination by the DNR and OWNER on whether work may proceed. It is anticipated that this standby time will be approximately 48 hours per occurrence, exclusive of weekends and holidays.
- C. Potentially hazardous waste defined above shall be carefully excavated, stockpiled, and tested to determine if they exhibit the characteristics of a hazardous waste as defined by the Wisconsin Administrative Code NR 500, 600, and 700 Series. Such materials shall be handled according to applicable DNR, USEPA, and OSHA regulations and shall be stockpiled in a "Temporary Excavated Material Storage Area" as specified in Division 01. Stockpiling shall meet the requirements of NR 700.

END OF SECTION

## SECTION 31 23 16.26

### ROCK REMOVAL

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Removal of rock during excavation for structures and roads.
  - 2. Removal of rock during excavation for utility trenches.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Payment: CONTRACTOR shall INCLUDE in its Bid the cost of removing rock for structures and roads as defined in this section. Payment for rock excavation for structures and roads will be adjusted, add or deduct, based upon the actual rock excavation and the cash allowance unit price for rock excavation for structures and roads.
- D. Measurement:
  - 1. In calculating the volume of rock excavation for dimensioned structures and roads the amount paid for rock excavation will be limited to an area extending 1 foot beyond the perimeter of the bottom slab on all sides and a height equal to the average depth from the surface of the rock to 6 inches below the bottom of the floor slab or as shown on the Drawings. For circular structures, the amount paid for rock excavation will not exceed the volume of a cylinder of diameter equal to the external diameter of the structure plus 4 feet and height equal to the average depth from the surface of the rock to 6 inches below the bottom of the base slab.
  - 2. In calculating the volume of excavation in rock for utility trenches the amount allowed will not exceed the volume in a width equal to the specified trench width for the pipe and height equal to the average depth from the surface of the rock to a point 6 inches below the outside bottom of the pipe.
  - 3. In calculating the length of utility trenches when the length method of measurement is specified, the measured length of trench will be the lengths of pipe installed, minus the width of overlapping trenches.
  - 4. When rock is encountered, it shall be stripped of earth and ENGINEER notified and given proper time to measure the same before removal. Any rock which has been removed prior to measurement by ENGINEER will not be classified as rock excavation.
  - 5. The above paragraphs list the methodology for determining the payable quantity of rock removed. It is CONTRACTOR's responsibility to remove the quantity of rock needed to result in a trench that meets OSHA's requirements.

##### 1.02 DEFINITIONS

- A. Rock excavation for structures, roads, and utility trenches shall include all hard, solid rock ledges, bedded deposits and unstratified masses, and all conglomerate deposits or any other material so firmly cemented that it is not practical to excavate and remove same with a 270-net flywheel horsepower tractor (Caterpillar D-8 with power shift, or equal) equipped with dozer blade and hydraulic-mounted parallelogram ripper; 225-net flywheel horsepower hydraulic backhoe, or equal, except after continuous drilling and blasting. No soft or

disintegrated rock which can be removed with a pick; no loose, shaken, or previously broken rock; and no rock which may fall into the excavation from outside the limits of excavation will be classified as rock excavation. Rock excavation shall also include all rock boulders necessary to be removed having a volume of one cubic yard or more.

### 1.03 QUALITY ASSURANCE

- A. Use of explosives for rock excavation will be permitted only after securing the written approval of OWNER and only after proper precautions are taken for the protection of persons and property. The hours of blasting will be fixed by OWNER. Any damage caused by blasting shall be repaired by CONTRACTOR at its expense. CONTRACTOR's method and procedure of blasting shall conform to state laws and municipal ordinances.
- B. If explosives are to be used, CONTRACTOR shall employ a seismic survey firm that specializes in and has five years of documented experience in seismic surveys.
- C. CONTRACTOR shall provide a copy of Blaster License as required by the licensing agencies to OWNER prior to commencement of blasting.
- D. If explosives are to be used, CONTRACTOR or its rock removal subcontractor shall have five years of experience with use of explosives for rock removal.

### 1.04 REGULATORY REQUIREMENTS

- A. CONTRACTOR shall conform to applicable federal, state, and local codes for explosive disintegration of rock.
- B. CONTRACTOR shall obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.
- C. No explosives shall be used without written permission from OWNER.

### 1.05 PROJECT CONDITIONS

- A. CONTRACTOR shall conduct survey and document conditions of buildings near locations of rock removal, both prior to and after blasting, in the presence of adjacent property owners and shall advise owners of adjacent buildings or structures, in writing, prior to executing seismographic survey.
- B. CONTRACTOR shall obtain a seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

## PART 2--PRODUCTS

NOT APPLICABLE

## PART 3-EXECUTION

### 3.01 ROCK REMOVAL

- A. When rock is encountered, it shall be stripped of earth and ENGINEER or OWNER's representative notified and given proper time to evaluate same before removal. Any rock removed which has not been measured by ENGINEER or OWNER's representative will not be classified as rock excavation.
- B. CONTRACTOR shall provide seismographic monitoring during progress of blasting operations.
- C. Disintegrate rock and remove from excavation.
- D. Remove rock at excavation bottom to form level bearing surface.
- E. The depth of trench in rock shall be 6 inches below the lowest outside bottom of the pipe.
- F. Rock excavation for streets shall include removal of rock to subgrade elevations.
- G. Rock shall be removed 2 feet below finish grade in areas to receive seed, sod, or trees.
- H. Remove shaled layers to provide a sound and unshattered base for foundations.
- I. Unauthorized rock removal shall be corrected in accordance with backfilling and compacting requirements of Section 31 23 00-Excavation, Fill, Backfill, and Grading or with concrete fill.
- J. All excavated rock shall be classified as undesirable backfill material and shall be disposed of as specified in Section 31 23 00-Excavation, Fill, Backfill, and Grading, unless it is crushed and screened to meet backfill requirements for use on-site.
- K. All excavations and trenches in rock shall be backfilled with approved backfill materials furnished by CONTRACTOR. Costs for such materials shall be included in the price bid for rock excavation.

END OF SECTION

## SECTION 31 23 19

### DEWATERING

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Removal of groundwater to allow belowgrade construction.
  - 2. Site grading to prevent surface water from entering the excavation.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Payment:
  - 1. The expense for making all extra excavations necessary to prevent water from interfering with the proper construction of the work and for forming all dams or diversions, digging of sumps or pump wells, bailing, and installation and pumping of wells shall be borne by CONTRACTOR.
  - 2. The cost for removal of groundwater and surface water shall be included in the prices bid for the work. No separate payment will be made for dewatering whether accomplished by use of sumps and pumps, well point systems, deep wells, or any other method.
  - 3. Any permits necessary for the dewatering operations shall be obtained and paid for by CONTRACTOR.

##### 1.02 REFERENCES

- A. Wisconsin Administrative Code Chapter NR 141.
- B. See Division 01, Regulatory Requirements for permit requirements and water, erosion, and sediment control.

##### 1.03 SYSTEM REQUIREMENTS

- A. CONTRACTOR shall, at its own expense, keep the excavation clear of water while structures, mains, and appurtenances are being built, utilities are being installed, and fill and backfill are being compacted. Under no conditions shall the work be laid in or under water. No water shall flow over the work until the joints are complete or the concrete has set.
- B. Wherever necessary, CONTRACTOR shall excavate in advance of the completed work, lead the water into sumps or pump wells, and provide erosion control measures to prevent water or sediment damage.
- C. CONTRACTOR's dewatering system shall perform so that the soils within the trench will not be destabilized by hydrostatic uplift pressures from adjacent groundwater. If conditions warrant, CONTRACTOR shall furnish and install well point systems or deep wells.

- D. Dewatering shall be sufficient to lower the piezometric level to at least 2 feet below the bottom of the excavation. Additional lowering shall be provided as necessary to create a stable subgrade.
- E. In areas where rock is encountered, the water level shall be kept at or below top of rock, but at least 6 inches below bottom of concrete. Additional rock shall be removed as needed to provide clearances.
- F. The control of groundwater shall be such that softening or heaving of the bottom of excavations or formation of “quick” conditions or “boils” shall be prevented.
- G. Dewatering systems shall be designed and operated so as to prevent the migration or removal of soils.

#### 1.04 QUALITY ASSURANCE

- A. All dewatering shall be done in accordance with applicable federal, state, and local code requirements.
- B. In particular, groundwater observation wells shall be provided and subsequently abandoned in accordance with NR 141. CONTRACTOR shall complete all observation well construction and abandonment forms as required by NR 141 and shall submit the forms to OWNER within 15 days of construction or abandonment activities.

### PART 2–PRODUCTS

NOT APPLICABLE

### PART 3–EXECUTION

#### 3.01 DEWATERING

- A. Dewatering shall be started, and the water level shall be lowered as specified herein prior to beginning excavation and shall be continued until structure, main, or appurtenance has been completed and fill has been placed and compacted to final grade.
- B. CONTRACTOR shall provide at least two groundwater observation wells near each area to be excavated to aid CONTRACTOR in determining whether the minimum specified requirements have been met prior to excavation. The observation well shall be a minimum 2-inch-diameter slotted PVC pipe. The observation well shall be installed and backfilled in such a way as to allow an accurate determination of actual groundwater levels. The observation well shall be properly abandoned after use unless specified otherwise.
- C. CONTRACTOR shall provide all necessary materials and equipment to keep the excavation free from water during construction. CONTRACTOR shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outages, and shall have available at all times competent workers for the operation of the pumping equipment. The dewatering systems shall not be shut down between shifts, on holidays or weekends, or during the work stoppages.

- D. CONTRACTOR shall meet all requirements of applicable WDNR permits for construction pit or trench dewatering.
- E. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted fill or backfill, and prevent floatation or movement of all structures and pipelines.

### 3.02 PROTECTION

- A. CONTRACTOR shall take all necessary precautions during the dewatering operation to protect adjacent structures against subsidence, flooding, or other damage. The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. Any such facilities and structures damaged shall be repaired or replaced to the satisfaction of their owner.
- B. Prior to dewatering, CONTRACTOR shall take into account the effect of its proposed dewatering operation on existing private water supply systems and shall make arrangements with property owners for protecting their supplies or providing alternative means of supply.
- C. In the event that CONTRACTOR's dewatering operation adversely affects private water supply systems, CONTRACTOR shall provide property owners with alternative potable and nonpotable supplies until dewatering operations are ceased and groundwater levels return to normal. If the water in private water supply wells is contaminated, through no fault of CONTRACTOR after restoration of original groundwater levels, OWNER will provide measures to restore water potability. CONTRACTOR is responsible for restoration of the water supply, not its potability after restoration.
- D. In areas where continuous operation of dewatering pumps is required, CONTRACTOR shall avoid noise disturbance to nearby residences to the greatest extent possible by using electric-driven pumps, or intake and exhaust silencers or housing to minimize noise from engine-driven generators or engine-driven pumps.

END OF SECTION

## SECTION 31 25 00

### SLOPE PROTECTION AND EROSION CONTROL

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included: Erosion control devices.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 PAYMENT

- A. All costs associated with slope protection and erosion control shall be included in CONTRACTOR's Bid. This work shall include, but is not limited to, erecting fence, excavation, placing posts, backfilling, attaching woven wire and geotextile fabric; placing ditch checks; installing sediment traps; removing the fence at completion of project; cleaning and repairing; removing or spreading accumulated sediment to form a surface suitable for seeding; replacing silt fence and damages caused by overloading of sediment material or ponding of water adjacent to silt fence; and furnishing labor, tools, equipment, and incidentals necessary to complete the work in accordance with the Contract.

##### 1.03 REFERENCES

- A. Wisconsin Department of Natural Resources Conservation Practice Standards-Construction Site Erosion and Sediment Control (Conservation Practice Standards).
- B. Erosion Control Product Applicability List (PAL) for Multi-Modal Applications (PAL) Wisconsin Department of Transportation.
- C. Town of Brookfield Erosion Control Ordinance (Chapter 30).

##### 1.04 REGULATORY REQUIREMENTS

- A. Land disturbance greater than one acre and OWNER obtains "Notice of Intent" (NOI). OWNER has prepared a Storm Water Management and Erosion Control Plan in conjunction with the development of the Contract Documents and has submitted a NOI for Storm Water Discharges Associated with Land Disturbing Activities. The NOI is included as an attachment to the Contract Documents. CONTRACTOR as designated operator of activities at the construction site shall be responsible for compliance with all permit conditions. This includes but is not limited to the following:
  - 1. Implement erosion and sediment control practices necessary to meet federal, state, and local performance standards.
  - 2. Receive required approvals from OWNER and regulatory agencies for any modifications to the erosion control plan necessitated by site conditions or CONTRACTOR's operations.
  - 3. Provide a "qualified" inspector to inspect erosion control and sediment controls. Inspector shall have prior experience with and knowledge of installation and maintenance of erosion and sediment controls. Inspector shall be identified to OWNER.

4. Perform all inspection, maintenance, and record keeping activities required by the permit. This shall include inspecting erosion and sediment control facilities weekly and within 24 hours after a precipitation event of 0.5 inch or greater. CONTRACTOR shall maintain weekly written reports of all inspections.
5. CONTRACTOR shall respond within 24 hours to all corrective measures noted on the inspection report to address pollution issues.
6. CONTRACTOR shall submit to OWNER a written notice stating the times, dates and actions taken to rectify the defective pollution and erosion controls.
7. Pay any fines or other fees resulting from failure of CONTRACTOR to comply with the permit requirements.
8. Submit a "Notice of Termination" (NOT) to DNR at end of the Project.

B. CONTRACTOR and its subcontractors shall execute and sign the following certification:

"I certify under penalty of law that I understand the terms and conditions of the General Pollutant Discharge Elimination System Permit that authorizes the storm water discharges associated with industrial activities from the construction site and as may be detailed in the Contract Documents. I agree to indemnify and hold OWNER harmless from any claims, demands, suits, causes of action, settlements, fines, or judgments and the costs of litigation, including, but not limited to, reasonable attorneys fees and costs of investigation and arising from a condition, obligation or requirement assumed or to be performed by CONTRACTOR for storm water pollution and erosion control."

C. CONTRACTOR shall pay any fines or other fees resulting from failure of CONTRACTOR to comply with the permit requirements.

#### 1.05 QUALITY CONTROL

- A. Construct and maintain erosion sediment control measures in accordance with the Conservation Practice Standards.
- B. Check facilities weekly and after any rainfall event, and make needed repairs within 24 hours.

### PART 2-PRODUCTS

#### 2.01 EROSION CONTROL PRODUCTS

- A. Erosion control products shall be as listed in the *Erosion Control Product Acceptability List (PAL)* of the Wisconsin Department of Transportation. Contractors may obtain copies of the PAL and PAL qualification procedures from the WisDOT Bureau of Highway Construction.

#### 2.02 EROSION MATS

- A. Erosion mat products shall be selected from the PAL in conformance with criteria specified in Conservation Practice Standard 1052 (Nonchannel Erosion Mat) and 1053 (Channel Erosion Mat).
- B. Unless designated on the Drawings or specified, CONTRACTOR may furnish any prequalified erosion mat product of the class and type listed in the PAL.

- C. A 300 mm by 300 mm sample of a product proposed for erosion mat may be required to verify that it is prequalified. When a sample is required, it shall be accompanied by the manufacturer's literature for the proposed product.

### 2.03 SILT FENCE

- A. Silt fence shall conform to Conservation Practice Standard 1056–Silt Fence and as shown on Drawing 01-975-111A. Silt fence shall conform to Table 2 of Conservation Practice Standard 1056.
- B. Furnish wrapping on each roll of fabric to protect the fabric from ultraviolet radiation and from abrasion during shipping and handling. Keep geotextile dry until installed.

### 2.04 SOIL STABILIZER

- A. Soil stabilizer shall be Type A or Type B. Type A is either a cementitious soil binder added to wood cellulose fiber mulch or a bonded fiber matrix. Type B is a water soluble anionic polyacrylamide meeting requirements specified in Conservation Practice Standard 1050–Land Application of Anionic Polyacrylamide. CONTRACTOR shall provide soil stabilizer products from the PAL.

### 2.05 INLET PROTECTION

- A. Inlet protection shall conform to Conservation Practice Standard 1060-Storm Drain Inlet Protection for Construction Sites and as shown on Drawing 01-975-110A. Manufactured bags shall conform to Table 1 of Conservation Practice Standard 1060.

### 2.06 STONE TRACKING PADS AND TIRE WASHING STATION

- A. Stone tracking pads and tire washing stations shall conform to Conservation Practice Standard 1057–Stone Tracking Pad and Tire Washing.

### 2.07 DITCH CHECKS

- A. Ditch checks shall conform to Conservation Practice Standard 1062–Ditch Check (Channel) and as shown on Drawing 01-975-113A.

### 2.08 MULCHING

- A. Mulching for construction sites shall conform to Conservation Standard Practice 1058–Mulching for Construction Sites.

### 2.09 VEGETATIVE BUFFER FOR CONSTRUCTION SITES

- A. Vegetative buffer shall conform to Conservation Standard Practice 1054–Vegetative Buffer for Construction Sites.

### 2.10 TEMPORARY SEEDING

- A. Temporary seeding for construction site erosion control shall conform to Conservation Standard Practice 1059–Seeding for Construction Site Erosion Control.

## 2.11 BEDDING DIKE

- A. Where shown on the Drawings or requested by ENGINEER in the field, CONTRACTOR shall install clay bedding dikes to prevent groundwater from flowing continuously through the bedding material installed for the sanitary sewer. Bedding dikes shall be 4 feet long and shall extend from the bottom of the trench excavation to within 2 feet of the ground surface and 1 foot beyond the normal trench width on both sides of the trench.

## 2.12 GEOTEXTILE FABRIC

- A. See Section 31 32 19–Geotextiles for fabric under riprap.

## 2.13 RIPRAP

- A. See Section 31 37 00–Riprap.

## 2.14 SEDIMENT TRAPS AND SEDIMENT BASINS

- A. Sediment traps and sediment basins shall conform to WDNR Technical Standards Sediment Trap No. 1063 and Sediment Basin No. 1064.

## 2.15 CONCRETE WASHOUT FACILITY

- A. CONTRACTOR shall provide a temporary concrete washout facility in accordance with the National Pollutant Discharge Elimination System (NPDES). Concrete washout facility shall be located a minimum of 50 feet from any storm drain inlet, open drainage facility, water body, construction traffic, and access area. Provide appropriate signage to inform equipment operators of the washout location.

## 2.16 DUST CONTROL

- A. Dust control shall conform to WDNR Technical Standard Dust Control on Construction Sites No. 1068.

## PART 3–EXECUTION

### 3.01 GENERAL

- A. Install erosion control devices before any soil disturbance or construction activities begin.
- B. Proceed carefully with construction adjacent to stream channels to avoid washing, sloughing, or deposition of materials into the stream. If possible, the work area should be diked off and the volume and velocity of water that crosses disturbed areas be reduced by means of planned engineering works (diversion, detention basins, berms).
- C. Unless noted on Drawings, do not remove trees and surface vegetation.
- D. Stage Construction grading activities to minimize the cumulative exposed area. Conduct temporary grading for erosion control per WDNR Technical Standard Temporary Grading Practices for Erosion Control No. 1067.

- E. Expose the smallest practical area of soil at any given time through construction scheduling. Make the duration of such exposure before application of temporary erosion control measures or final revegetation as short as practicable. CONTRACTOR shall limit section area of disturbance in channels to a maximum of 300 feet per crew. In general, it is expected that streambank stabilization measures will be installed within 5 days of initial disturbance.
- F. CONTRACTOR shall provide a "qualified" inspector to inspect erosion control and sediment controls once in place. Inspector shall have prior experience with and knowledge of installation and maintenance of erosion and pollution controls. Unless stricter requirements are mandated by DNR or by any local permits, project site erosion control inspection shall be conducted every seven days and after each one-half-inch rainfall or greater. CONTRACTOR shall maintain hard copies of the inspection reports for the duration of the Project.
- G. Any necessary repairs to erosion and sediment control facilities shall be provided within 24 hours to all corrective measures noted on the inspection reports to address pollution issues. CONTRACTOR shall submit to OWNER a written notice stating the times, dates and actions taken to rectify the defective erosion and sediment controls.
- H. CONTRACTOR shall also make any necessary additions for erosion and sediment control as may result from on-site conditions or the progress of the Work or as may be required by DNR or OWNER.
- I. Disturbed areas shall be stabilized with temporary or permanent measures within 14 calendar days of the soil disturbance or redisturbance.
- J. All temporary erosion and sediment control measures shall be removed within 30 days after final stabilization is achieved or after the temporary measures are no longer needed. All sediment accumulated in temporary and permanent facilities shall be removed and properly disposed of and the area restored.
- K. Immediately stabilize stockpile and surround stockpiles as needed with silt fence or other perimeter control if stockpiles will remain inactive for 7 days or longer.
- L. Sweep and clean up all sedimentation and trash that moves off-site due to construction activity or storm events before the end of the same workday.
- M. Temporary restrooms are to be located a minimum of 50 feet away from any storm drain inlet, open drainage facility, or water body. The location of the temporary rest rooms must be approved by OWNER. Sanitary waste shall be collected from portable units provided by CONTRACTOR a minimum of two times per week to avoid overflowing and maintain sanitary conditions around the unit.
- N. All petroleum products stored on-site shall be stored in adequate containers. All fueling sources shall have spill kits immediately available. All hazardous storage areas must be placed in areas away from stormwater flow patterns and storm sewer basins and inlets.
- O. Concrete trucks shall not be permitted to wash out or discharge surplus concrete or drum wash water on the site. Specific areas for this activity shall be designated by CONTRACTOR and provided with adequate siltation basins and other facilities so that discharge is contained and cleansed before entering the site storm sewer system.

- P. The vegetative growth associated with temporary and permanent seeding, sodding, vegetative channels, etc. shall be maintained periodically and supplied with adequate water and fertilizer nutrients. If necessary, the vegetative cover shall be removed and reseeded as needed.
- Q. The conditions of the construction site for the winter shut down period shall address proper sediment and erosion control early in the fall growing season so that slopes and other bare earth areas may be stabilized. Stabilization shall be land applied soil stabilizer Type B and/or erosion mat urban Class I, Type B for non-channel. Erosion mat Class II, Type B shall be used for channel use. Soil stabilizers and erosion mat shall be in accordance with the Wisconsin Department of Transportation erosion control and stormwater product acceptability lists to provide a stable, temporary, and/or permanent vegetative cover. All areas to be worked beyond the end of the growing season must incorporate soil stabilization measures.
- R. Disturbed areas and areas used for storage of materials and equipment that are exposed to precipitation shall be inspected for evidence of, or the potential for pollutants entering the drainage system. Erosion and sedimentation control measures shall be observed to review that they are operating correctly. Where discharge locations or points are accessible they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impact to receiving waters and adjacent properties. Locations where vehicles enter or leave the site shall be inspected for evidence of off-site sediment tracking.
- S. Make provisions for watering following seeding or planting of disturbed areas whenever more than seven consecutive days of dry weather occur.

### 3.02 EROSION MAT

- A. Erosion mats shall be installed in accordance with manufacturer's requirements and with Conservation Practices Standards 1052 and 1053 and as shown on Drawing 01-975-112A.
- B. Place erosion mats immediately after seeding operations have been completed. Before mat placement, remove all material or clods over 1 1/2 inches in diameter and all organic material or other foreign material which may interfere with the mat bearing completely on the soil.
- C. Any small stones or clods which prevent contact of the mat with the soil shall be pressed in the soil with a small lawn-type roller or by other means. The mat shall have its lateral edge so impressed in the soil so as to permit runoff water to flow over it.
- D. The matting strips shall be rolled on or laid in direction of flow. Spread mat evenly and smoothly in a natural position without stretching and with all parts bearing on soil. Place blanket with netting on top. Overlap adjacent strips at least 4 inches. Overlap strip ends at least 10 inches. Make overlaps with upgrade section on top.
- E. Bury upgrade end of each strip of fabric or blanket at least 6 inches in a vertical slot cut in the soil and press soil firmly against the imbedded fabric or blanket.
- F. Anchor mats in place with vertically driven staples, driven until their tops are flush with the soil. Space staples on 3-foot centers along mat edges and stagger space at 3-foot centers through the center. Place staples at 10-inch centers at end or junction slots.
- G. Reseed areas damaged or destroyed during erosion mat placing operations as specified for original seeding.

- H. Dispose of surplus excavated materials during erosion mat placing operation as specified for original seeding.
- I. Following mat placement, uniformly apply water to the area to moisten seed bed to 2-inch depth and in a manner to avoid erosion.
- J. Maintain erosion mat and make satisfactory repairs of damage from erosion, traffic, fires, or other causes until Work is accepted.

### 3.03 SILT FENCE

- A. Silt fence shall be constructed in conformance with the criteria specified in Conservation Practice Standard 1056–Silt Fence.
- B. Remove sediment from behind silt fences and sediment barriers before sediment reaches a depth that is equal to one-half of the fence and/or barrier height. Repair breaks and gaps in silt fence and barriers immediately.

### 3.04 SOIL STABILIZER

- A. Soil Stabilizer Type A shall be applied with conventional hydraulic seeding equipment. CONTRACTOR shall take care so that surrounding surfaces, structures, trees, and shrubs are not over-sprayed. Before Work is accepted any over-spray must be satisfactorily cleaned from surfaces. The finished application shall be 3/16-inch to 1/4-inch thick. For permanent slope applications, CONTRACTOR shall sow seed separately before applying the soil stabilizer so that the seed has direct contact with the soil.
- B. Soil Stabilizer Type B shall be applied with conventional hydraulic seeding equipment or by dry spreading. CONTRACTOR shall apply material at the manufacturer's recommended rate. For permanent slope applications, CONTRACTOR shall apply an approved mulch when the soil stabilizer is applied or after it is applied to protect the seed.

### 3.05 INLET PROTECTION

- A. All storm drains that are or will be functioning during construction shall be provided with inlet protection. Inlet protection shall be provided in conformance with the criteria specified in Conservation Practice Standard 1060–Storm Drain Inlet Protection for Construction Sites.

### 3.06 STONE TRACKING PADS AND TIRE WASHING

- A. Tracking pads (tire washing stations as required) shall be installed in accordance with the criteria in Conservation Practice Standard 1057–Stone Tracking Pad and Tire Washing.
- B. Surface water must be prevented from passing through tracking pads. Flows shall be diverted away from tracking pads and conveyed under and around them such as with culverts.
- C. Any sediment tracked onto a road shall be removed before the end of each day. Flushing sediment shall not be allowed.

### 3.07 DITCH CHECKS

- A. Ditch checks shall be provided in conformance with the criteria specified in Conservation Practice Standard 1062–Ditch Checks.

### 3.08 MULCHING

- A. Mulching shall be provided in conformance with the criteria specified in Conservation Practice Standard 1058–Mulching for Construction Sites.

### 3.09 VEGETATIVE BUFFER

- A. Vegetative buffer shall be provided in conformance with the criteria specified in Conservation Practice Standard 1060–Vegetative Buffer for Construction Sites.

### 3.10 SEEDING FOR EROSION CONTROL

- A. Temporary seeding for erosion control shall be provided in conformance with the criteria specified in Conservation Practice Standard 1059–Seeding for Construction Site Erosion Control.

### 3.11 SEDIMENT TRAPS AND SEDIMENT BASINS

- A. Sediment traps for erosion and sedimentation control during interim construction stages shall be installed in accordance with the criteria in Conservation Practice Standard 1063–Sediment Trap and sediment basins with the criteria in 1064–Sediment Basin. They shall be constructed prior to any disturbances and shall be placed so they function during all phases of the Work.

END OF SECTION

## SECTION 31 32 19

### GEOTEXTILES

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included: Geotextiles for areas below structures, at perforated drain pipe trenches, pressure relief valves, below base course, and below riprap.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Payment: Payment for geotextile shall be at the Unit Price Bid.

#### PART 2–PRODUCTS

##### 2.01 MATERIALS

- A. Geotextile for areas below structures for use at perforated drain pipe trenches and pressure relief valves and as specified elsewhere, shall be Mirafi 140N, or equal.
- B. Geotextile below riprap shall be Mirafi 180N, or equal.
- C. Geotextile below base course shall be Mirafi 600X, or equal.

#### PART 3–EXECUTION

##### 3.01 INSTALLATION

- A. Geotextile shall be installed in accordance with manufacturer's recommendations.
- B. Geotextile shall be lapped a minimum of 24 inches.
- C. If extensive areas of unstable subgrade are encountered on street areas, ENGINEER may request the furnishing and installation of construction fabric to obtain the necessary subgrade support for the roadway structure. Vibratory compaction shall not be used in the compaction of base course in areas where construction fabrics are used.
- D. CONTRACTOR shall protect the construction fabric from exposure to the sun until installation. Construction fabric shall be covered with stone or soil immediately upon placement.

END OF SECTION

## SECTION 31 37 00

### RIPRAP

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included: Furnishing and placing riprap.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Payment: Riprap will be paid for by the cubic yard at the Unit Price Bid.

##### 1.02 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.

#### PART 2—PRODUCTS

##### 2.01 MATERIALS

- A. Stone for riprap shall be durable quarry stone of approved quality. It shall be sound, hard, dense, resistant to the action of air and water, and free from seams, cracks, or other structural defects.
- B. Stone for riprap shall be in accordance with Standard Specifications, Section 606 Riprap Medium.

#### PART 3—EXECUTION

##### 3.01 PREPARATION

- A. The bed for the riprap shall be properly trimmed and shaped before geotextile and stone is placed. Bed shall be minimum 6 inches thick.
- B. Geotextile shall be placed below riprap. See Section 31 32 19—Geotextiles.

##### 3.02 INSTALLATION

- A. Riprap shall be provided in areas as designated on the Drawings and in accordance with Drawing 01-975-149A.
- B. Stone placed above the water line shall be placed by hand. It shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. The stones shall be laid perpendicular to the slope with ends in contact.

- C. The riprap shall be thoroughly compacted as construction progresses, and the finished surface shall present an even, tight surface.
- D. The large stone shall be placed in the lower courses. Interstices between stones shall be chinked with spalls firmly rammed into place.
- E. Unless otherwise shown or specified, riprap shall be at least 18 inches in thickness, measured perpendicular to the slope.

END OF SECTION

## SECTION 32 11 23

### DENSE-GRADED BASE

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Dense-graded base for streets, roads, and parking areas.
  - 2. Gravel roads.
  - 3. Paths, sidewalks, driveways, and miscellaneous areas as shown on the Drawings or specified.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. CONTRACTOR is cautioned that existing public and private streets, alleyways, and roads may not hold up to typical construction traffic or activities. CONTRACTOR shall repair or replace streets, alleyways, roads, and shoulders damaged by its construction activities to their original condition at CONTRACTOR's expense.

##### 1.02 MEASUREMENT AND PAYMENT

- A. Payment: Payment for dense-graded base shall be made at the Unit Price Bid and shall include all labor, materials, and work necessary for complete installation. Payment will be made based on weight tickets delivered with each truckload of dense-graded base. All costs for base course beneath concrete sidewalk and driveway aprons shall be considered incidental to the work being completed.
- B. All costs associated with pulverizing and reshaping, fine grading, material, labor, equipment, and miscellaneous appurtenances shall be included in the Unit Bid Price for Pulverize and Reshape.

##### 1.03 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.

##### 1.04 DEFINITIONS

- A. Street or road shall include streets, roads, driveways, sidewalks, paths, gravel roads, and parking lots.

##### 1.05 SUBMITTALS

- A. Submit sieve analysis for proposed materials in accordance with Section 01 33 00—Submittals.

## 1.06 DRAINAGE DURING CONSTRUCTION

- A. CONTRACTOR shall comply with the provisions of Section 205.3.3 of the Standard Specifications.

## 1.07 QUALITY MANAGEMENT PROGRAM

- A. CONTRACTOR shall comply with the provisions of Section 730 of the Standard Specifications.

## PART 2-PRODUCTS

### 2.01 AGGREGATES

- A. Aggregate for dense-graded base shall consist of crushed stone and shall meet the requirements of Sections 301 and 305 of the Standard Specifications. The material furnished shall be uniformly graded and shall conform to ASTM C33.
- B. Dense-graded base shall conform to the requirements for 3/4-inch dense-graded base, 1 1/4-inch dense-graded base, or 3-inch dense-graded base or as otherwise specified or indicated on the Drawings.
- C. Dense-graded base for top layer of shoulders and for beneath sidewalks, driveways, and paths shall meet the requirements of 3/4-inch dense-graded base unless indicated otherwise on the Drawings.
- D. Salvaged Asphalt Pavement Base:
  - 1. Where indicated on the Drawings, CONTRACTOR shall salvage existing asphaltic pavement for use as dense-graded base for street construction and/or restoration. Work shall be completed in accordance with Section 305 and Section 325 of Standard Specifications as amended herein.
  - 2. Pulverized asphalt millings shall consist of asphalt pavement that has been pulverized in place to the full depth of existing pavement. Pulverized millings shall be graded and compacted to the grades established prior to placement of new asphaltic pavement. Ninety-seven percent (97%) of pulverized millings shall pass a 2-inch screen with all material less than 4 inches in its longest dimension.
  - 3. Reclaimed asphalt millings shall consist of asphalt pavement that has been milled and transported for use as base course for street construction and/or restoration. One hundred percent (100%) of salvaged millings shall pass a 1 1/4-inch screen.

## PART 3-EXECUTION

### 3.01 PREPARATION

- A. The subgrade shall be graded and rolled to provide uniform density and shall comply with the profile and cross sections contained in the Drawings. All street subgrade in cut areas and all areas to receive fill shall be proof-rolled in the presence of OWNER or ENGINEER with a heavily loaded triaxle dump truck or similar equipment prior to the placement of any fill materials or base course. The subgrade shall be prepared in accordance with Section 211 of the Standard Specifications.

### 3.02 CONSTRUCTION

- A. CONTRACTOR shall comply with the provisions of Section 305.3 of the Standard Specifications.
- B. Dense-graded base grade shall be set to allow placement of thickness of asphaltic pavement shown or specified.
- C. Depth of dense-graded base shall be provided according to the typical sections or details provided on the Drawings.
- D. Where typical sections or details are not provided, depth of dense-graded base for streets and roadways shall be the existing depth or 12 inches, whichever is greater, and depth of base course for sidewalks, driveways, or paths shall be minimum 4 inches.
- E. The top 4 inches of dense-graded base course for streets and roadways shall be 1 1/4-inch dense grade base. The remaining base course shall be 1 1/4-inch dense grade base. The term Breaker Run Stone where referred to in the Drawings, WisDOT Specifications, and Bid, shall mean 3-Inch Crushed Stone Dense Graded Base, unless otherwise stated.
- F. For excavation below subgrade, 3-inch dense graded base shall be placed on a geotextile fabric, if included, and backfilled to the depth of the excavation below subgrade.
- G. Dense-graded base shall be placed directly on subgrade areas or on top of salvaged asphaltic millings unless otherwise indicated on the Drawings.
- H. Each layer of dense-graded base shall be wetted and rolled to provide maximum compaction in accordance with Section 305 of the Standard Specifications.
- I. The finished dense-graded base shall be fine graded in preparation for paving.
- J. After final grading, CONTRACTOR shall maintain the dense-graded base until asphaltic paving work has been completed.
- K. All gravel surfaces damaged during construction shall be replaced. The depth of aggregate shall match existing or 12 inches, whichever is greater.
- L. Dense-graded base shall be uniformly compacted to a dry density at least 95% of the maximum dry density as determined by a laboratory compaction test at the optimum moisture content (ASTM Test Designation D1557 Modified Proctor Method). Compaction shall be obtained by compaction equipment appropriate for the conditions and the material placed.
- M. Pulverizing shall be completed in accordance with Section 325 Pulverized and Re-Laid Pavement of the Standard Specifications and as modified below.
- N. CONTRACTOR shall move material from areas with surplus pulverized material to areas with a deficit of pulverized asphalt material as necessary to achieve the desired roadway section. If additional crushed aggregate is needed to achieve the desired roadway section, it shall be uniformly disturbed over the existing road and then blended into the base during the pulverization process. Excess excavated material or pulverized asphalt material that is not utilized on the project shall be removed from the site and/or disposed of by

CONTRACTOR. Points of disposal are subject to OWNER review. CONTRACTOR is responsible for any required permits. Removal of excess excavated material shall be considered incidental to adjacent work.

- O. Pulverized material shall be compacted immediately after grading in lifts no greater than 8 inches. In areas where the depth of pulverized material is greater than 8 inches, CONTRACTOR shall split the material into lifts less than or equal to 8 inches before compacting.
- P. Base course placed on unstable foundation shall be removed and replaced at CONTRACTOR's cost following excavation of the affected area.

END OF SECTION

## SECTION 32 11 26

### HOT MIX ASPHALT PAVING

#### PART 1—GENERAL

##### 1.01 SUMMARY

- A. Work includes Hot Mix Asphalt (HMA) paving, tack coat, and casting adjustments and other miscellaneous items.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 MEASUREMENT AND PAYMENT

- A. Payment: Payment for HMA pavement lower layer and HMA pavement upper layer will be at the Unit Price Bid. Payment will only be made for the quantities where weight tickets for each truckload showing the net tonnage have been delivered to ENGINEER within one week of placement. Unit Prices Bid shall include all materials, labor, and work necessary for the complete, in place, asphaltic concrete surfacing.
- B. All costs associated with adjusting castings shall be paid for at the unit bid price for Adjust Manhole Castings. All costs associated with reconstructing manholes shall be paid for at the unit bid price for Reconstruct Manholes. All costs for adjusting water valve boxes shall be considered incidental to bid.

##### 1.03 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.

##### 1.04 SUBMITTALS

- A. Prior to the commencement of paving, mix designs and aggregate sieve analysis shall be submitted to ENGINEER for approval in accordance with Section 01 33 00—Submittals.
- B. Provide documented observations, records, mixture adjustments, and test results daily. CONTRACTOR shall record process adjustments and Job Mix Formula changes.
- C. Submit copies of the running average calculation sheets for blended aggregate, mixture properties, and asphalt contents along with mixture adjustment records to ENGINEER each day.
- D. Submit test records and control charts to ENGINEER in a neat and orderly manner within 10 days after paving is complete.

## PART 2-PRODUCTS

### 2.01 HMA PAVEMENT

- A. Asphaltic pavement shall be HMA Pavement 4 LT 58-28 S for the lower and upper course for asphalt roadways. Asphalt thickness for roadways shall be 2 1/4 inches for the lower course and 1 3/4 inches for the upper course.
- B. Asphaltic driveway aprons shall be 4 LT 58-28 S and shall be 4 inches thick.

## PART 3-EXECUTION

### 3.01 ALLOWABLE REMOVAL OF PAVEMENT

- A. CONTRACTOR shall remove asphalt pavement and road structure as a part of the Common Excavation. The width of pavement removed shall be the minimum possible and acceptable for convenient and safe installation of structures, utilities, and appurtenances.
- B. All asphalt pavement shall be cut on neat, straight lines and shall not be damaged beyond the limits of the excavation. Should the cut edge be damaged, a new cut shall be made in neat, straight lines parallel to the original cut encompassing all damaged areas. Pavement removal shall be extended to a seam or joint if seam or joint is within 3 feet of damaged pavement.

### 3.02 ADJUSTING CASTINGS

- A. Adjusting manhole castings applies to those structures that must be lowered less than 6 inches or raised less than 10 inches. The maximum adjustment height after final grading shall be 10 inches. CONTRACTOR shall field verify existing chimney depth.
- B. Where upper layer paving is completed in the following construction season, castings shall initially be set to the finished lower layer grade before lower layer is placed. Where upper layer paving and lower layer paving are completed in the same construction season, castings shall be adjusted to final grade prior to paving.
- C. Where adjustments are required, they shall not be made more than 48 hours prior to the anticipated time of paving. CONTRACTOR shall furnish Class 1 barricades with flashers on all adjusted castings until paving has been completed. Tops of castings shall be oiled or protected by other methods to prevent sealing of lids and filling of lift holes during paving. Upon completing of paving operations, CONTRACTOR shall check all castings so that the lids are clean and operational.
- D. Internal/external chimney seals, where required, shall be installed after castings have been adjusted to finished grade. Chimney seal shall be adaptor internal/external adaptor seal, or equal.
- E. Valve boxes shall be adjusted by turning the box. The valve box shall be seated on the adjusting threads to prevent future settlement. The box shall be adjusted to conform to the finished pavement and shall be plumb to allow valve operation. OWNER shall be contacted by CONTRACTOR to check operation of valve after box adjustment and prior to paving.

### 3.03 RECONSTRUCT MANHOLES

- A. This item applies to those structures that must be lowered more than 6 inches or raised more than 10 inches or as identified on the Drawings. The maximum adjustment height shall be 10 inches. CONTRACTOR shall field verify existing chimney depth.
- B. Manhole barrel sections shall be constructed of precast reinforced concrete sections. Precast manholes and tops shall conform to ASTM Specifications, C4 78, latest revision.
- C. Joints for precast manholes shall meet the requirements of ASTM C 443, latest revision, except that sealant shall be butyl rubber gasket or butyl rubber rope. Flexible butyl rubber gaskets or rope shall comply with the physical requirements for Type "B" gaskets in AASHTO Designation M 198, or Federal Specification SSS 00210 A, sealing compound, preformed plastic for expansion joints and pipe joints.
- D. All manholes shall be provided with steps equally spaced vertically at 16 inches on center installed by the manufacturer. Steps shall be embedded into the riser or conical top section of the wall a minimum of 3 inches. Manhole steps shall be Neenah R 1980 C or approved equal made of gray cast iron conforming to the requirements of ASTM Designation A 48 Class No. 30B and shall have a minimum cross-sectional dimension of 1 inch in any direction. Each section of the manhole shall be aligned so the steps create a continuous ladder.
- E. Adjusting rings shall be furnished to set the manhole casting to established grade and shall be injection molded-recycled HDPE as manufactured by Ladtech, Inc., or expanded polypropylene as manufactured by Cretex Specialty Products. CONTRACTOR shall supply ring materials, adhesive, labor, and equipment to install the rings in strict accordance to manufacturer's recommendations. CONTRACTOR shall permanently install rings with adhesive so that all manhole casting rims are set level with constructed road surface. Ring inside diameter shall be 24-inch nominal, or larger to match frame. CONTRACTOR shall have all ring sizes available when rebuilding tops of manholes, including tapered sections to allow for seamless adjusting of frame elevations on flat and sloped surfaces. Concrete adjusting rings shall not be used for manhole adjustments. Substitute HDPE adjusting rings for concrete rings shown in Standard Detail Drawing 01-975-43A.
- F. CONTRACTOR shall furnish Class 1 barricades with flashers on all reconstructed manhole until paving has been completed. Tops of castings shall be oiled or protected by other methods to prevent sealing of lids and filling of lift holes during paving. Upon completion of paving operations, CONTRACTOR shall check all castings to so that the lids are dean and operational.
- G. Internal/external chimney seals shall be provided.
- H. All manhole rims shall be 1/4 inch below the finished street surface when measured from a 10-foot straight edge. CONTRACTOR shall provide concrete adjusting rings and methods to match the cross slope of the finished street surface. Any manhole rim elevation extending above the finished street surface or below the 1/4 inch maximum shall be reset at CONTRACTOR's expense.
- I. All compacted material shall be placed in uniform layers not exceeding 8 inches in loose thickness prior to compaction. Each layer shall be uniformly compacted to a dry density at least 95% of the maximum dry density as determined by a laboratory compaction test at the

optimum moisture content (ASTM Test Designation D1557). Compaction shall be obtained by compaction equipment appropriate for the conditions.

#### 3.04 FRAME/CHIMNEY SEAL

- A. Internal/external chimney seals, where required, shall be used on all new, reconstructed, or adjusted manholes. All materials, tools, labor, and miscellaneous costs associated with installing chimney seals shall be included in the Unit Bid Price for Adjust Manhole Castings and Reconstruct Manholes.

#### 3.05 TACK COAT

- A. CONTRACTOR shall provide tack coat between all layers of new asphalt and on existing pavement to be overlaid with new asphalt. Tack coat shall meet the requirements of Section 455 of the Standard Specifications.
- B. In situations where traffic must be maintained, tack coat shall not be placed on the traveled half of the street until traffic can be switched to the new pavement.

#### 3.06 JOINTS

- A. Joints between old and new pavements or between successive day's work shall be constructed and treated as to provide a thorough and continuous bond between the old and new mixtures. Transverse construction joints shall be constructed by cutting the material back for its full depth so as to expose the full depth of the course. Where a header is used, the cutting may be omitted provided the joint conforms to the specified thickness. These joints shall be treated with tack coat material applied with a hose and spray nozzle attachment to fully coat the joint surface.
- B. The longitudinal joint shall be made by overlapping the screed on the previously laid material for a width of not more than 2 inches and depositing a sufficient amount of asphaltic mixture so that the finished joint will be smooth and tight. Longitudinal joints in the upper layer shall at no time be placed immediately over similar joints in the lower layer beneath. A minimum distance of 12 inches shall be permitted between the location of the joints in the lower layer and the location of similar joints in the upper layer above.
- C. All costs for furnishing and applying tack coat to butt joints as specified above shall be considered incidental.

#### 3.07 FINISHING ROADWAY

- A. The finished dense graded base course shall be fine-graded in preparation for HMA paving. Dense graded base course ramps at all existing pavement shall be removed to provide a full depth butt joint. Dense graded base course around manhole castings and valve boxes shall be hand-trimmed and compacted with a vibratory plate compactor.
- B. This item shall include all of the following preparatory and finishing items and any other incidental items of work required for construction. Asphaltic ramps around manholes on existing lower layer to receive upper layer shall be removed. Asphaltic ramps shall be installed at all manholes and at all butt joints in areas to receive lower layer only.
- C. Finishing roadway shall be considered incidental to HMA paving.

### 3.08 TESTING HOT MIX ASPHALT

- A. ENGINEER may require samples of HMA pavement for testing. CONTRACTOR shall cut samples from the finished pavement where marked by ENGINEER and patch the sample area. Samples for sieve analysis and asphalt content will be taken by ENGINEER prior to placement.
- B. The minimum required density for HMA pavement shall be as indicated in Table 460-3 of the Standard Specifications.

### 3.09 HOT MIX ASPHALT PAVING

- A. HMA paving work shall include the construction of plant-mixed hot mix asphalt pavement in the areas shown on the Drawings. All work shall be performed in accordance with Sections 450, 455, 460, and 465 of the Standard Specifications.
- B. Prior to commencement of paving operations, CONTRACTOR shall examine the finished road bed. CONTRACTOR shall notify ENGINEER of any areas of suspected instability.
- C. The pavement structure for streets, roads, driveways, and paths shall be in accordance with the typical sections shown on the Drawings.
- D. Where standard sections are not provided, the minimum pavement structure shall be as follows:
  - 1. 2 1/4 inches of asphaltic concrete lower layer for street, roadway, and parking lot construction.
  - 2. 1 3/4 inches of asphaltic concrete upper layer for street, roadway, and parking lot construction.
  - 3. 2 1/2 inches of upper layer material for bike paths, sidewalks, and asphalt driveways.
- E. Pavement thickness for trench restoration shall match adjacent pavement thickness or minimum thickness as specified for street construction, whichever is greater.

END OF SECTION

## SECTION 32 16 13

### CONCRETE CURB AND GUTTER, SIDEWALKS, DRIVEWAYS, AND DRIVEWAY APRONS

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work includes concrete curb and gutter, sidewalks, driveways, and driveway aprons as shown on the Drawings.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 MEASUREMENT AND PAYMENT

- A. Cost for base course beneath concrete sidewalks and driveway aprons shall be included in the unit price bid for concrete work.
- B. The Work provided shall be measured and paid for at the Unit Price Bid. The Unit Price Bid shall include all labor, equipment, materials, and miscellaneous items for the Work.

##### 1.03 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. AASHTO M148 Standard Specifications for Liquid Membrane–Forming Compounds for Curing Concrete.

##### 1.04 QUALITY ASSURANCE

- A. Unless otherwise specified, all curb and gutter, sidewalks, driveway, and driveway apron construction shall meet the requirements of the Standard Specifications.

##### 1.05 QUALITY MANAGEMENT PROGRAM

- A. For concrete curb and gutter, sidewalks, driveways, and driveway aprons, CONTRACTOR shall comply with the provisions of Section 716 of the Standard Specifications for Class II concrete.
- B. For concrete pavement, CONTRACTOR shall comply with the provisions of Section 715 of the Standard Specifications for Class I concrete.

#### PART 2–PRODUCTS

##### 2.01 CONCRETE

- A. All concrete shall conform to Section 501 of the Standard Specifications for Grade A or A-FA air entrained concrete with a minimum 28-day compressive strength of 4000 psi.

## 2.02 CURING COMPOUND

- A. Liquid curing compounds shall conform to the requirements of the Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete, AASHTO Designation M148, Type 2, White Pigmented.

## PART 3–EXECUTION

### 3.01 BASE PREPARATION–CURB AND GUTTER

- A. The dense-graded base beneath the curb and gutter shall be trimmed or filled as necessary to provide a full depth of curb and gutter as detailed. In the absence of a detail, the dense graded base depth shall be to the adjacent street subgrade with a minimum of 4 inches. Prior to placement of concrete, the dense-graded base shall be thoroughly compacted and moistened.

### 3.02 BASE PREPARATION–SIDEWALKS AND DRIVEWAYS

- A. The subgrade shall be thoroughly compacted and finished to a trim, firm surface. All soft or unsuitable material shall be removed and replaced with suitable material.

### 3.03 BASE COURSE

- A. Base course beneath curb and gutter, sidewalks, and driveways shall comply with Section 32 11 23–Dense-Graded Base.

### 3.04 FORMS

- A. Forms shall be of metal and of sufficient strength to resist distortion or displacement. Metal forms shall be used to construct a curb and gutter cross section as shown on the Drawings. Forms shall be full depth of the required work. Facing boards, if used, shall be built so as to obtain the cross section called for on the Drawings. Forms shall be securely staked and held firmly to line and grade. Forms shall be cleaned thoroughly and oiled before reuse. Where machines are used, concrete mixture shall be controlled to prevent distortion from sloughing.
- B. All curved curb and gutter shall form smooth curves and shall not be a series of chords. Radius forms shall be used for all curved curb and gutter where the radius of curvature is 100 linear feet or less.

### 3.05 PLACING AND FINISHING CONCRETE

- A. Unless otherwise specified, concrete shall be placed in accordance with the Standard Specifications and as shown on Drawings 01-975-82A, 01-975-83A, and 01-975-84A.
- B. Concrete shall be thoroughly vibrated to remove all voids. The exposed surface shall be thoroughly troweled and finished with a brush at right angles to vehicular or pedestrian traffic. All edges shall be rounded with a 1/4-inch-radius edger. Honeycombed areas shall be pointed and rubbed with mortar to provide a void-free surface.

- C. Before final finishing, a 10-foot straight edge shall be used to check the surface. Any areas showing a variation of more than 1/4 inch from the straight edge shall be corrected. Final finishing shall be delayed a sufficient time so that excess water and grout will not be brought to the surface.
- D. Concrete for sidewalk shall be placed to a minimum thickness of 5 inches, except at driveways and alleys, which shall have a minimum thickness of 7 inches. Driveways, driveway aprons, and curb ramps shall have a minimum thickness of 7 inches. The concrete shall be thoroughly vibrated to remove all voids. The surface of the driveway or sidewalk shall be thoroughly troweled and finished with a brush at right angles to the driveways or sidewalk line.

### 3.06 MACHINE FORMED CURB AND GUTTER

- A. CONTRACTOR may elect to use a machine for placing, forming, and consolidating concrete curb and gutter. If a machine is used, the resulting curb and gutter shall be of such a quality as to equal or exceed that produced by the method described above.
- B. Curb and gutter where required for street construction, site Work construction, or for restoration of utility construction shall be placed using forms or a machine to the dimensions and shape shown. Where curb and gutter details are not provided, curb and gutter shape and dimensions shall match existing adjacent curb and gutter.

### 3.07 DRIVEWAY OPENINGS

- A. Driveway openings will be staked by CONTRACTOR and checked by ENGINEER and OWNER in the field. The details for concrete gutter section through a driveway are shown on the Detail Drawings.

### 3.08 REJECT SECTIONS

- A. At locations shown on the Drawings, the curb and gutter shall be warped so as to reject the flow of water. The transition from a standard section to a reject section shall not be abrupt but shall be a minimum of 10 feet in length. The reject section shall conform to the Detail Drawings.

### 3.09 JOINTING—CURB AND GUTTER

- A. A 1/2-inch expansion joint filler shall be placed through the curb and gutter at the radius points of all intersection curbs, at storm inlets, and at a maximum interval of 100 feet. This expansion joint filler shall extend through the entire thickness of concrete and shall be perpendicular to the surface and at right angles to the line of the curb and gutter.
- B. At intervals of not more than 10 feet, a contraction joint shall be tooled to a depth of one-fifth of the total concrete thickness with a 1/4-inch-radius jointer. The contraction joint shall be at right angles to the line of the curb and gutter.
- C. If machine-formed curb and gutter is provided by CONTRACTOR, CONTRACTOR shall create a plane of weakness at all joints that is sufficient to cause contraction cracking at the joints.

- D. CONTRACTOR may saw contraction joints. The depth of cut shall be a minimum of one-fifth of the total concrete thickness. Sawing shall be done as soon as practicable after the concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracking takes place in the concrete. If this method results in random cracking, CONTRACTOR will be required to tool the contraction joints as specified above.
- E. Steel separator plates of a section conforming to the curb and gutter as shown on the Drawings shall be placed directly opposite all contraction joints in abutting street pavement. After separator plates have been removed, the edges of the joints shall be rounded with a 1/4-inch radius edge. The use of steel separator plates at other locations will not be allowed.
- F. Jointing shall be included in the price bid for curb and gutter.

### 3.10 JOINTING–SIDEWALKS AND DRIVEWAYS

- A. Concrete sidewalk shall be segmented into 5-foot-long rectangular blocks with tooled joints. Concrete driveways shall be segmented into uniform rectangular blocks with tooled joints at a maximum spacing of 10 feet in each direction. The joint must extend at least one-fifth of the total thickness of concrete. The edges of the sidewalk along forms and joints shall be rounded with an edging tool of 1/4-inch radius. All joints shall be at right angles to the centerline of the sidewalk.
- B. Concrete driveways shall be jointed in approximately square sections. The depth of the joint and the finishing of the edges shall be the same as for concrete sidewalk.

### 3.11 EXPANSION JOINTS

- A. A 1/2-inch-thick asphaltic expansion joint filler shall be placed at sidewalk-driveway intersections, between sidewalks and buildings, between back of curb and sidewalk, at intersection between new or existing curb and gutter, around all castings, and at maximum 40-foot intervals in sidewalks.

### 3.12 SLOPE

- A. Sidewalk cross slope shall be 1.5 percent unless otherwise noted in the Drawings or requested by ENGINEER.

### 3.13 CURB RAMP

- A. Curb ramps shall have a maximum slope of 7 percent, with maximum grade changes of 11 percent at curb to ramp transitions, and be provided with a truncated dome patterned surface meeting ADA requirements and as shown on Drawing 01-975-85A.

### 3.14 INLET CASTING ADJUSTMENT

- A. Inlet casting shall be adjusted to grade as required for the installation of the new curb and gutter. Inlet casting backs shall be adjusted for a depressed flow line at all inlets in the low points (0.72 feet); all other inlet shall be adjusted for a normal flow line (0.50 feet).

### 3.15 CURING

- A. As soon after finishing operations as the free water has disappeared, the concrete surface shall be sealed by spraying on it a uniform coating of curing material in such a manner as to provide a continuous water impermeable film on the entire concrete surface.
- B. The material shall be applied to form a uniform coverage at the rate of not less than one-half gallon per 100 square feet of surface area.
- C. Within 30 minutes after the forms have been removed, the edges of the concrete shall be coated with the curing compound applied at the same rate as on the finished surface.

### 3.16 PROTECTION OF CONCRETE

- A. CONTRACTOR shall erect and maintain suitable barricades to protect the new concrete. Where it is necessary to provide for pedestrian traffic, CONTRACTOR shall, at their own cost, construct adequate crossings. Crossing construction shall be such that no load is transmitted to the new concrete.
- B. Any part of the work damaged or vandalized prior to final acceptance shall be repaired or replaced at the expense of CONTRACTOR in a manner satisfactory to ENGINEER.
- C. Pedestrian traffic shall not be permitted over new concrete prior to 72 hours after application of curing material. Vehicular traffic shall not be permitted over newly placed concrete until a minimum compressive strength of 3,000 psi has been achieved.

END OF SECTION

## SECTION 32 17 23.13

### PAVEMENT MARKINGS

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. This section describes furnishing and installing pavement markings conforming to the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, Latest Edition, Section 646 and as shown on the Drawings.

##### 1.02 MEASUREMENT AND PAYMENT

- A. The cost of this shall be included in the Lump Sum Bid.

##### 1.03 REFERENCES

- A. State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, Latest Edition, Section 646.

##### 1.04 SUBMITTALS

- A. Submittals shall be in accordance with provisions of Section 01 33 00–Submittals.

#### PART 2–PRODUCTS

##### 2.01 PAVEMENT MARKINGS

- A. Provide epoxy wet reflective/recoverable elements in accordance with Wisconsin Department of Transportation Approved Products List (APL).

#### PART 3–EXECUTION

##### 3.01 PAVEMENT MARKINGS

- A. Place markings in accordance with Section 646 of the Standard Specifications.
- B. Centerline marking shall be double 4-inch solid yellow line placed at the marked centerline.
- C. Traffic lane marking shall be single 4-inch broken white line placed 12 feet from median curb flange or as shown, or requested by ENGINEER. Turning-lane markings and crosswalk markings shall be 8 inches and 6 inches solid white, respectively. Stop bars shall be 18 inches solid white.
- D. Markings shall be placed at locations noted within 1-inch tolerance.

END OF SECTION

## SECTION 32 32 23

### SEGMENTAL RETAINING WALL

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included: Interlocking modular concrete retaining wall units and accessories.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 REFERENCES

- A. ASTM C140–Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- B. ASTM C1372–Standard Specification for Dry-Cast Segmental Retaining Wall Units.
- C. ASTM D2339–Standard Test Method for Strength Properties of Adhesives in Two-Ply Wood Construction in Shear by Tension Loading.
- D. ASTM D4475–Standard Test Method for Apparent Horizontal Shear Strength of Pultruded Reinforced Plastic Rods By the Short-Beam Method.
- E. ASTM D4595–Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- F. ASTM D5262–Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.
- G. GRI-GG1–Standard Test Method for Geogrid Rib Tensile Strength.
- H. GRI-GG2–Standard Test Method for Geogrid Junction Strength.
- I. GRI-GG4–Determination of Long Term Design Strength of Geogrids.
- J. GRI-GG5–Determination of Geogrid (Soil) Pullout.
- K. NCMA SRWU-1–Test Method for Determining Connection Strength of SRW.
- L. NCMA SRWU-2–Test Method for Determining Shear Strength of SRW.

##### 1.03 DELIVERY, STORAGE, AND HANDLING

- A. Masonry units, when delivered to the site, shall be thoroughly cured and shall be dry. When stored on the site, they shall not be in contact with the ground and shall be kept clean.

## 1.04 SUBMITTALS AND DESIGN REQUIREMENTS

- A. Submittals shall be in accordance with provisions of Section 01 33 00–Submittals.
- B. CONTRACTOR shall submit construction drawings and design calculations for the retaining wall system prepared and stamped by a Professional. The engineering designs, techniques, and material evaluations shall be in accordance with the manufacturer's requirements. The geotechnical parameters used for wall design shall be as provided on the Drawings or as required by the Project Soils Engineer. Construction drawings shall include all details necessary for construction of the retaining wall, including elevations and steps in top and bottom of wall, locations, sizes, types, and lengths of geogrid, and any other required information.
- C. Walls shall be designed for a surcharge between 50 psf (pedestrian traffic) to 250 psf (highway loading) and a railing load of 300 plf (highway loading guardrail) to 500 plf (precast traffic barrier) in addition to the loads imposed by the retained material. The engineered design for walls subject to highway loading behind wall shall be in accordance with the AASHTO Standard Specifications for Highway Bridges, Section 5.8.
- D. Submit gradation of base leveling pad material and unit fill material.
- E. Submit color samples for OWNER's selection.

## PART 2–PRODUCTS

### 2.01 MODULAR CONCRETE MASONRY UNITS

- A. Masonry units shall be Keystone, Rockwood, Allan Block, Mesa Block, or equal. Specification is written based on the Keystone System.
- B. Masonry units shall conform to ASTM C1372 and shall have a minimum 28-day compressive strength of 3,000 psi and a maximum moisture absorption of 8% as measured in accordance with ASTM C140.
- C. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 3.5 feet. For straight walls, cap units shall have nonangled straight sides.
- D. Standard units shall be 8 inches high by 18 inches wide with sculptured rock face texture. Top row of units shall have a smooth face.

### 2.02 STRUCTURAL GEOGRID

- A. Geogrid shall be a product with a regular grid structure of a select high density polyethylene or polypropylene resin, UX1500 MSE, as manufactured by Tensar Corporation, or equal.
- B. Minimum allowable junction strength of the geogrid, per G.R.I. GG2, shall be equal to or greater than 90% of the ultimate strength of the geogrid, as per G.R.I. GG1.

### 2.03 CONNECTING PINS

- A. Units shall be interlocked with noncorrosive fiberglass pins.

- B. Connecting pins shall be 1/2-inch diameter thermoset isophthalic polyester resin-pultruded fiberglass reinforcement rods.
- C. Pins shall have a minimum flexural strength of 128,000 psi and short beam shear of 6,400 pounds per ASTM D4475.
- D. Connecting pins are not required for masonry units with integral keys or lips that provide mechanical interlock between adjacent units.

#### 2.04 ADHESIVE

- A. Construction adhesive shall be Keystone Kapseal, or equal, and shall meet requirements of ASTM D2339.

#### 2.05 BASE LEVELING PAD

- A. Base leveling pad material shall be 6 inches of compacted crushed stone, 3/8 inch to 3/4 inch. Pea gravel shall not be allowed.

#### 2.06 UNIT FILL

- A. Unit fill shall be free-draining, well-graded crushed stone, 3/8 inch to 3/4 inch, with no more than 5% passing the No. 200 sieve. Masonry unit voids shall be capable of accepting a railing post diameter of up to 3 inches. Nonshrink grout shall be used in voids accepting railing posts.

#### 2.07 BACKFILL

- A. Backfill for use beyond drainage zone behind units shall be as specified in Section 31 23 00—Excavation, Fill, Backfill, and Grading.

### PART 3—EXECUTION

#### 3.01 EXCAVATION

- A. Foundation soil shall be excavated as required for leveling pad dimensions shown on the Drawings.
- B. Subgrade shall be observed by the Project Soils Engineer to confirm that the actual foundation soil conditions meet or exceed assumed design strength. Soils not meeting required strength shall be removed and replaced with acceptable material.

#### 3.02 BASE LEVELING PAD

- A. Leveling pad materials shall be placed as shown on the Drawings to a minimum thickness of 6 inches and shall extend laterally a minimum of 6 inches in front of and behind the modular wall.
- B. Materials shall be compacted so as to provide a level surface on which to place the first course of units. Compaction shall be to 95% of standard proctor for sand or gravel-type materials. For crushed rock, material shall be densely compacted.

- C. Leveling pad shall be prepared to provide complete contact of retaining wall unit with base.

### 3.03 INSTALLATION

- A. Units shall be installed to conform to elevations shown on the Drawings or as staked in the field to match existing grade.
- B. Place first course of concrete wall units on the base leveling pad. The units shall be checked for level and alignment. Units shall be in full contact with base. Bottom of wall shall be minimum 12 inches below finished grade and shall be lower if required by design.
- C. Units shall be placed side by side for full length of wall alignment. Alignment may be done by a string line or offset from base line.
- D. Units shall be interlocked with fiberglass pins or lips cast integrally with each masonry unit. Pins shall protrude into adjoining courses above a minimum of 1 inch. Two pins required per unit.
- E. Fill all voids inside and between units and drainage zone behind units with unit fill material. Tamp fill. Do not use automated compaction equipment directly over the units. Walk behind mechanical compaction equipment may be used to compact soils that are placed beyond the drainage zone behind the unit. Mobile mechanical compaction equipment shall not be used within 5 feet of the wall face.
- F. While placing material behind first course of units, replace the passive soil wedge at the front of these units.
- G. Sweep all excess material from top of units and install next course. Each course is to be completely unit filled, backfilled, and compacted prior to proceeding to next course.
- H. Geogrid reinforcement shall be placed at the elevation(s) and to the extent required by design. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignments.
- I. The geogrid soil reinforcement shall be laid horizontally on compacted backfill. Place the next course of modular concrete facing units over geogrid. The geogrid shall be pulled taut and anchored prior to backfill placement on the geogrid.
- J. Geogrid reinforcements shall be continuous throughout their embedment length(s). Spliced connections between shorter pieces of geogrid will not be allowed.
- K. Place next course, pull each unit forward away from the embankment against pins in the previous course, and backfill as the course is completed. Repeat procedure to the extent of wall height.
- L. Provide permanent mechanical connection of cap units to wall units with construction adhesive. Apply adhesive to top surface of unit below, and place cap unit into position. Place cap units over projecting pin from units below. Pull forward to setback position. Backfill and compact to finished grade.

- M. As appropriate where the wall changes elevation, units shall be stepped with grade or turned into the embankment with a convex return end. Minimum of three units shall be installed into the grade on compacted leveling pad in area of convex return end. Units shall be laid to create the minimum radius possible.

END OF SECTION

## SECTION 32 82 19.19

### NATIVE SEEDING

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Preparation of subsoil.
  - 2. Placing topsoil.
  - 3. Seeding, mulching, and fertilizing.
  - 4. Maintenance.
- B. Except for paved, riprapped, bioengineered or built-up areas, all areas of the site which are disturbed and areas noted on the Drawings shall be seeded.
- C. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- D. Payment: Seeding shall be paid for at the lump sum price bid for Native Seeding. The lump sum price shall include costs of furnishing and constructing all items in this section including top soil preparation or placement, seeding, polymer, additions (if specified), mulching, watering, and all other related items.

##### 1.02 REFERENCES

- A. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.
- B. USDA-NRCS Wisconsin Agronomy Technical Note 5 “Establishing and Maintaining Native Grasses, Forbs, and Legumes.”

##### 1.03 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, pure live seed (PLS) weight (as applicable), date of packaging, seed origin, and location of packaging.

##### 1.04 DELIVERY, STORAGE, AND PROTECTION

- A. Seed shall be delivered to the site in its original, unopened container, labeled as to genus and species for each component of the collective mix. Store any seed delivered prior to use in a manner safe from damage from heat, moisture, rodents, or other causes and according to standard specifications. Any seed damaged after the initial observation shall be replaced by CONTRACTOR at CONTRACTOR’s expense. Seed shall be 100% pure live seed (PLS) by weight (as applicable). Seed shall be from current year collections or previous year collected material. All seed shall be appropriately stored, sorted/graded, inoculated, stratified, and otherwise pretreated standard to the industry.

## 1.05 PLANTING SEASON

- A. Native Seeding Mix: March 15 to June 30 and September 1 to October 15 when ground is not frozen and as agreed upon by ENGINEER, OWNER, and CONTRACTOR.

Note: Dormant season planting between October 15 and March 15 is acceptable provided that seed is provided at two times the specified rate of Pure Live Seed (PLS). Surface seeding conditions shall be of such condition to retain and prevent erosion/loss of seed. Planting between June 30 and September 1 may be acceptable to ENGINEER. Additional care shall be taken for areas seeded between June 30 and September 1 to maintain a moist soil condition. Watering to maintain an equivalent of 1-inch of rain per week is mandatory unless approved in writing by ENGINEER.

## 1.06 GUARANTEE

- A. CONTRACTOR shall guarantee the germination of seed installed and ground cover sufficient to meet erosion control needs. Maintenance and monitoring for a period of one growing season shall be CONTRACTOR's responsibility.

## 1.07 JOB CONDITIONS

- A. CONTRACTOR shall protect all plants, lawns, and grass areas from damage at all times. Damaged plants, lawns, or grass areas shall be replaced or treated as required to conform with specifications herein for fresh seed, sod, or stock.
- B. Work areas shall be kept clean and orderly during the installation period. Under no conditions shall debris from planting activities result in a safety concern on-site or to adjacent off-site property.
- C. Damage to lawns or seeded areas incurred as a result of replacement operations shall be repaired by CONTRACTOR at no cost to OWNER.

## PART 2--PRODUCTS

### 2.01 SEED MIXTURE

- A. Native Seeding Mix: Approved seed mixes are specified below. The approved mix shall be applied at the rate specified below in areas shown on the Drawings as native seeding (a) upland or (b) wetland. With the exception of species, standards shall be per Section 630 of Standard Specifications. Seed test dates and results shall be provided by the manufacturer. Pending approval, each seed lot may be subject to sampling and testing by the state seed laboratory. CONTRACTOR to select appropriate mix for project site and notify ENGINEER in writing. Alternative mixes or custom mixes are acceptable provided the proposed mix contains a minimum of six native grasses and a minimum of ten forbs and seed mixes result in coverage of 100 to 130 seeds per square foot. Seeding reference and maintenance recommendation are Tables 11 to 19 and other applicable sections of USDA-NRCS Wisconsin Agronomy Technical Note 5 "Establishing and Maintaining Native Grasses, Forbs, and Legumes."

- B. Wetland Mix: Approved mixes for wetland sites or riparian/channel projects.
1. Detention Basin Native Mix @ 12 lbs/AC.  
Prairie Nursery, Westfield, WI.
  2. Wet-Mesic Site Mix @ 12 lbs/AC.  
Ion Exchange, Harpers Ferry, IA.
  3. Detention Basin Mix @ 12 lbs/AC.  
Prairie Moon Nursery, Winona, MN.
  4. Shoreline Wet Edge or Sedge Meadow TNG Mix @ 12 lbs/AC.  
Genesis Nursery, Tampico, IL.
  5. Wet Prairie Seed Mix or Swale and Basin Mix @ 12 lbs/AC.  
Taylor Creek Restoration Nurseries, Brodhead, WI.
  6. Economy Prairie (50%) and Stormwater (50%) Seed Mix @ 12 lbs/AC.  
Cardno Native Plant Nurseries, Madison, WI and Walkerton, IN.
  7. Stormwater Biofiltration Mix (#SWB) or Floodplain Mix (FLPL) @ 12 lbs/AC.  
Agrecol Corporation, Inc., Madison, WI.
  8. Tall/Wet Mix or Pollinator Mix for Mesic to Wet Soils @ 10 lbs/AC.  
Prairie Restorations, Inc., Princeton, MN.

\* WDNR maintains a list of restoration nurseries as contained in various publications and on-line web listings. Alternatives may be considered and/or rejected.

- C. Upland Mix: Approved mixes for upland sites.
1. Xerces Pollinator Mix for Medium Soils Mix @ 12 lbs/AC.  
Prairie Nursery, Westfield, WI.
  2. Prudent Prairie Seed Mix @ 12 lbs/AC.  
Ion Exchange, Harpers Ferry, IA.
  3. Tallgrass Exposed Clay Subsoil or PDQ Seed Mix @ 15 lbs/AC.  
Prairie Moon Nursery, Winona, MN.
  4. Broad Spectrum Prairie Mix @ 15 lbs/AC.  
Genesis Nursery, Tampico, IL.
  5. CP42 Pollinator Habitat @ 12 lbs/AC.  
Taylor Creek Nursery, Brodhead, WI.
  6. Basic Prairie Seed Mix @ 12 lbs/AC.  
Cardno Native Plant Nurseries, Madison, WI and Walkerton, IN.
  7. Savanna/Woodland Edge Mix (#SVWE) @ 12 lbs/AC.  
Agrecol Corporation, Inc., Madison, WI.

\* WDNR maintains a list of restoration nurseries as contained in various publications and on-line web listings. Alternatives may be considered and/or rejected.

- D. Cover Crop: Annual ryegrass and Canada Wild Rye (*Elymus Canadensis*) for uplands or Riverbank Rye (*Elymus virginicus*) for wetlands shall be planted at a rate of 5 + 20 and 20 lbs/acre, respectively, over the entire area disturbed by construction. Such seeding shall be required at the completion of construction (along with final seeding) or anytime when construction ceases for more than 2 weeks and final seeding is not complete. Such erosion control overseeding shall be incidental to the seeding specification. Native ryes shall not be required for interim seedings.

E. Plant Material Requirements and Vendors:

1. Materials:

- a. All seeds shall be guaranteed by the supplier to be true to name and species and to be 100% pure live seed, unless approved by ENGINEER. All seed shall be observed by ENGINEER for variety and purity immediately prior to seeding operations.
- b. Supplier shall perform the appropriate techniques to provide timely germination of seed, such as scarification or cold stratification, or inoculation prior to seeding.
- c. To increase genetic diversity and improve success rates of revegetation efforts, all stock used for revegetation shall be certified prior to installation as having a genetic point of origin within 200 linear statute miles of the site. Materials should be procured from sources as near to the site as possible.
- d. Substitutions of ecologically equivalent native species will be allowed only upon approval by the project engineer. Information documenting the above mentioned specifications and any to follow must be presented to ENGINEER five days prior to seeding activities.
- e. Note: The seed mix and planting recommendations are available from the individual vendors.

2. Partial list of suppliers or additional vendors:

Agrecol Corporation Ecological Agricultural Technologies 2918 Agriculture Drive Madison, WI 53718 (608) 226-2544	Cardno Native Plant Nursery 128 Sunset Dr. Walkerton, IN 46574 (574) 586-2412	Ernst Conservation Seeds 8884 Mercer Pike Meadville, PA 16335 (800) 873-3321
Genesis Nursery 23200 Hurd Road Tampico, IL 61283 (815) 438-2220	Ion Exchange 1878 Old Mission Dr. Harpers Ferry, IA 52146-7533 (800) 291-2143	La Crosse Seed 2901 Packers Avenue Madison, WI 53707 (608) 249-9291 (800) 356-7333
Marshland Transplant Aquatic Nursery P.O. Box 1 Berlin, WI 54923 (920) 361-4200	Prairie Moon Nursery Rt. 3, Box 163 Winona, MN 55987 (507) 452-1362	Prairie Nursery P.O. Box 306 Westfield, WI 53964 (800) 476-9453
Prairie Restorations, Inc. P.O. Box 327 Princeton, MN 55371 (612) 389-4342	Reinders, Inc. W227 N6225 Sussex Road Sussex, WI 53089-3969 (800) 785-3301	Taylor Creek Restoration Nursery 17921 Smith Road P.O. Box 256 Brodhead, WI 53520 (608) 897-8547

## 2.02 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds, roots and rocks; pH value of minimum 5.4 and maximum 7.0. Salvaged topsoil with roots, rhizomes, seed, and propagules is favored for wetland seeding areas.
- B. Topsoil from the site may be used if it meets the above requirements. Additional topsoil shall be provided as required by Drawings and Specifications. Non-frozen, friable topsoil shall be used for all restoration activities. Hauled-in topsoil meeting these requirements may be necessary, at CONTRACTOR's expense.

## 2.03 ACCESSORIES

- A. Mulching material shall be clean oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Water shall be clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

## PART 3-EXECUTION

### 3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

### 3.02 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil in accordance with local, state, and federal regulations. Salvaged wetland topsoil and associated seedbank, rhizomes, and plant materials shall be managed as a resource when stripping, regrading, and restoring natural vegetation areas.
- C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat deep (> 12 inches) subsoiling or cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.
- D. No seeding shall occur on frozen ground or at daytime temperatures lower than 32°F (0°C) unless approved in writing.

### 3.03 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 6 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. In nonwetland areas, remove vegetative matter and foreign nonorganic material from topsoil while spreading.

- D. In lawn-like areas grade topsoil to eliminate rough, low or soft areas, and to provide positive drainage. When working in wetland areas, an irregular surface topography ( $\pm 4$  inches) is acceptable, provided seeding operations can still be administered fully.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage. Final grade of soil shall not be above root collar of tree or shrubs.
- F. Leave stockpile area and site clean and raked, ready to receive landscaping.

#### 3.04 SEEDING

- A. Sow seed using either Method A or Method B as defined in Section 630.3.3 of Standard Specifications for Highway Construction.
- B. Apply Native Seed Mix at 12 pounds/acre or at vendor recommended rate if higher. Apply at least 100 to 130 seeds per square foot.
- C. Apply cover crop seed at a total rate of 25 pounds per acre (5 annual rye, 20 riverbank rye). Apply evenly in two intersecting directions. Rake in lightly or roll the seeded area after seeding.
- D. Do not seed areas in excess of that which can be mulched on same day.
- E. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- F. Immediately following seeding, apply mulch or erosion mat (if specified). Place and anchor mulch using methods outlined in Section 627.3 of the Standard Specifications.
- G. Apply water with a fine spray immediately after each area has been seeded or mulched and on a daily basis to keep straw in place.
- H. Seeding shall be maintained by CONTRACTOR until grass is well established. Grass is well-established when the cover crop covers the entire seeded areas to a height of 2 inches. If grass is well-established prior to the end of one growing season, CONTRACTOR shall maintain grass according to Section 32 92 19—Seeding and Sodding, Paragraph 3.09.
- I. Place erosion control mats per Section 31 25 00—Slope Protection and Erosion Control.
- J. Cleaning and Repair: Waste and excess material from the seeding operation shall be promptly removed. Adjacent paved areas are to be cleaned, and any damage to existing adjacent turf areas shall be repaired.
- K. Initial Acceptance: All seeding areas shall be evaluated for Initial Acceptance after the entire seeding area has been covered with the specified seed and the appropriate topsoil coverage (such as erosion mat or turf reinforcement mat, etc. as shown on the Drawings). Initial Acceptance shall be based on CONTRACTOR providing OWNER with the specified submittals and a visual observation by CONTRACTOR and OWNER of the seeding area to evaluate that the appropriate seed has been applied at the specified density.

### 3.05 MAINTENANCE

#### A. Maintenance—General:

1. Immediately reseed areas which do not show a developing stand of cover. Reseeding shall be the same as that originally specified for that particular area. As native mixtures are difficult to assess the first year of growth, satisfactory establishment of the cover crop and general erosion control in these mixes shall constitute baseline establishment. Development of understory/native seeds shall be assessed as noted below.
2. Correct damage resulting from erosion, gullies, rills, or other causes by filling with topsoil, tamping, and reseeding if damage occurs prior to end of guarantee period or final completion.

#### B. Maintenance—Mowing:

1. Herbaceous Seed Mixes: Mow to a height of 6 inches periodically during establishment period and apply spot herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides. Mowing shall be every 4 to 6 weeks during the growing season or when competing vegetation reaches 10 to 12 inches in height. These heights are to be maintained through repeat mowings as needed until the end of the guarantee period. Raking and removal of grass/weed clippings shall occur when and if greater than 50% of the seeded area is covered by dense layers of clippings. The mulching effect of clippings is beneficial to the establishment of the native seed mixes and up to 50% of the aerial coverage of the seeding may contain mowed/mulch materials at any one time between mowings. No areas shall remain mulched in this manner more than one mowing cycle.
2. Prior to Initial Acceptance and during the Warranty period beginning with the Initial Acceptance, CONTRACTOR shall:
  - a. Inspect the seeded areas at a sufficient frequency so that weeds do not re-seed themselves. Minimum inspection frequency shall include spring, summer, and fall inspections. CONTRACTOR shall notify ENGINEER of the inspection no less than 48 hours prior to an inspection.
  - b. Implement the appropriate weed control approach(es) within 7 calendar days of the inspection, as conditions allow. If weather and/or site conditions would cause unnecessary damage to the site, CONTRACTOR shall notify ENGINEER and provide a schedule for implementing the maintenance protocols.
  - c. Maintain the weed population at less than 25% for native mixes, and 10% for lawn mixes cumulative cover of the seeded area. Do not let seed heads of weeds mature. Weed control methods shall be acceptable to ENGINEER.
3. Other maintenance activities may be completed at CONTRACTOR's discretion to meet the Warranty performance criteria. CONTRACTOR shall notify ENGINEER of planned additional maintenance activities prior to implementation.

#### C. Seeded areas shall be watered to prevent grass and soil from drying out. For areas allowed to be seeded between June 30 and September 1, watering shall consist of applied or rainfall derived amounts of 1 inch per week. CONTRACTOR shall provide documentation showing adequate watering has been achieved.

#### D. Immediately reseed areas that fail to show adequate catch. Bare spots shall not exceed 5 square feet in area and not exceed 3% of the total seeded areas.

- E. Protect seeded areas with “Do Not Spray or Mow” warning signs during maintenance period.

END OF SECTION

## SECTION 32 92 19

### SEEDING AND SODDING

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Preparation of subsoil.
  - 2. Topsoil.
  - 3. Seeding, sodding, mulching or erosion mat, and fertilizing.
  - 4. Maintenance.
- B. Except for paved, riprapped, or built-up areas, all areas of the site which are disturbed and areas noted on the Drawings shall be seeded or sodded. Prior to seeding or sodding, disturbed areas shall be graded to subgrade for placement of topsoil. Surfaces on 3-to-1 slope or less may either be seeded or sodded, but surfaces on greater than 3-to-1 slope shall be sodded.
- C. CONTRACTOR shall proceed with restoration of property and cleanup of all disturbed areas concurrently with the installation of utilities and street construction.
- D. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 MEASUREMENT AND PAYMENT

- A. Payment: Payment for topsoil, seeding, fertilizer, mulching, erosion mat, and maintenance of restored areas shall be included in the Lump Sum Bid. One percent of the total Contract price shall be retained following project completion until a uniform 2-inch growth of vegetation is established over all restored areas.

##### 1.03 REFERENCES

- A. FS O-F-241–Fertilizers, Mixed, Commercial.
- B. Standard Specifications: Unless otherwise indicated, Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, including all issued supplemental specifications.

##### 1.04 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing when suspended vertically by holding the upper two corners. Submit sod certification for grass species and location of sod source.

## 1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration. Do not deliver more sod than can be laid within 24 hours.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## PART 2-PRODUCTS

### 2.01 SEED MIXTURE

- A. Seed materials shall conform to Section 630 of the Standard Specifications for No. 40 Seed.
- B. Weed content shall not exceed 0.5% in mixture.

### 2.02 SOD

- A. Sod materials shall conform to Section 631 of the Standards Specifications.
- B. Netting or fabric for sod reinforcement shall be in accordance with Section 631.2.2 of the Standard Specifications.
- C. Anchorage staples shall be in accordance with Section 631.12.3 of the Standard Specifications.

### 2.03 SOIL MATERIALS

- A. Topsoil shall consist of salvaged topsoil or hauled-in topsoil in accordance with Section 625 of the Standard Specifications.
- B. Engineered Soil: Bioretention Basins require overexcavation, decompaction, and reconstruction with 24 inches of engineered soil except where noted otherwise. Engineered soil shall be provided in conformance with the criteria specified in Conservation Practice Standard 1004-Bioretention for infiltration.

### 2.04 ACCESSORIES

- A. Erosion mat shall be in accordance with the WisDOT Erosion Control Product Acceptability List (PAL).
- B. Fertilizer shall be in accordance with Section 629 of the Standard Specifications for Type A fertilizer. Fertilizer shall be provided for seed and sod locations.
- C. Water shall be clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

- D. CONTRACTOR shall be responsible for watering in accordance with Section 630 and Section 631 of the Standard Specifications.

### PART 3-EXECUTION

#### 3.01 GENERAL

- A. CONTRACTOR shall proceed with restoration of property and cleanup of all disturbed areas concurrently with the installation of utilities and street construction.

#### 3.02 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

#### 3.03 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil in accordance with local, state, and federal regulations.
- C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat deep (> 12 inches) subsoiling or cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

#### 3.04 PLACING TOPSOIL

- A. Place topsoil in accordance with Section 625 of the Standard Specifications.
- B. Spread topsoil to a minimum depth of 6 inches over area to be seeded. Rake until smooth.
- C. Place topsoil during dry weather and on dry unfrozen subgrade.
- D. Remove vegetable matter and foreign nonorganic material from topsoil while spreading.
- E. Grade topsoil to eliminate rough, low or soft areas, and to provide positive drainage.
- F. Manually spread topsoil around trees, plants, and buildings to prevent damage.
- G. Leave stockpile area and site clean and raked, ready to receive landscaping.
- H. Engineered topsoil placement of 24 inches by CONTRACTOR is required within bioretention basin areas except as noted otherwise.

#### 3.05 FERTILIZING

- A. Apply fertilizer in accordance with Section 629 of the Standard Specifications.
- B. Apply fertilizer after smooth raking of topsoil and prior to installation of seed or sod, no more than 18 hours before seeding or 48 hours before sodding.

- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix fertilizer thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### 3.06 SEEDING

- A. Apply seed in accordance with Section 630 of the Standard Specifications. Apply evenly in two intersecting directions. Rake in lightly or roll the seeded area after seeding.
- B. Planting season shall be between April 15 and June 15, or between August 15 and October 15.
- C. Do not sow immediately following rain, when ground is too dry or during windy periods.
- D. Seeding shall be maintained by CONTRACTOR until grass is well established. Grass is well established when it covers the entire seeded areas to a height of 2 inches.
- E. Place erosion control mats per Section 31 25 00–Slope Protection and Erosion Control.

### 3.07 LAYING SOD

- A. Place sod in accordance with Section 631 of the Standard Specifications.
- B. Moisten prepared surface immediately prior to laying sod.
- C. Lay sod immediately after delivery to site to prevent deterioration.
- D. Lay sod tight with no open joints visible and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- E. Lay smooth. Align with adjoining grass areas.
- F. On slopes 4-to-1 and steeper, sod shall be secured with wooden pegs at a maximum of 24 inches on center.
- G. On slopes 2-to-1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
- H. All sod placed in ditches, flumes, or other appurtenances where a concentrated flow of water may be expected shall be staked regardless of the slope.
- I. Water sodded areas immediately after installation. Saturate sod to 4-inch depth of soil.
- J. All sodded areas shall be kept thoroughly moist until the sod is established. Sod that dies during correction period shall be replaced at no cost to OWNER.

### 3.08 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2 1/2 inches. Do not cut more than one-third of grass blade at any one mowing.

- B. Immediately remove clippings after mowing.
- C. Water to prevent grass and soil from drying out.
- D. Roll surface to remove minor depressions or irregularities.
- E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- F. Immediately reseed areas which fail to show adequate catch. Bare spots shall not exceed 5 square feet in area and not exceed 3% of the total seeded areas. Immediately replace sod in areas which show bare spots or deterioration.
- G. Protect seeded areas with warning signs during maintenance period.
- H. Immediately reseed areas which do not show a satisfactory stand of established grass, and resod areas that do not show satisfactory establishment.
- I. Correct damage resulting from erosion, gullies, rills, or other causes by filling with topsoil, tamping, refertilizing, and reseeding if damage occurs prior to acceptance of work.
- J. Maintain seeded lawns for not less than 60 days after substantial completion.
- K. If seeded in fall and not given full 60 days of maintenance, or if not considered acceptable at that time, continue maintenance the following spring until acceptable lawn is established.
- L. Maintain sodded lawns for not less than 30 days after substantial completion.
- M. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth acceptable lawn free of eroded or bare areas.

END OF SECTION

## SECTION 32 93 00

### RAINGARDEN, PRAIRIE, AND PERENNIAL PLANTINGS

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Perennial plants of type specified.
  - 2. Shredded hardwood mulch.
  - 3. Plant preparation and mulching.
  - 4. Maintenance.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with 3 years' experience. Plant materials shall be free of disease and hazardous insects.
- B. Installer Qualifications: A landscape or restoration company specializing in installing and planting the plants with 3 years' experience.
- C. Restoration Qualifications: Company specializing in restoration with on-site staff with proof of Arborist Certification, Erosion Control Certification, or Ecological Expertise.

##### 1.03 WARRANTY

- A. Plant material shall have 100 percent survival warranty for a period of 60 days from the date of final completion. At the end of the correction period, as defined in the Supplementary Conditions, a minimum survival rate of 70 percent will be considered acceptable. Unaccepted material shall be removed and replaced by CONTRACTOR at no cost to OWNER during the next suitable growing season.
- B. Replacement plants shall be the same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

#### PART 2–PRODUCTS

##### 2.01 PLANT MATERIALS-RHIZOMES, PLUGS, PLANTS

- A. All plant materials shall conform to American Standard for Nursery Stock (current edition), and be delivered standard to the restoration industry. Plants shall be true to species and variety specified and nursery grown in accordance with good horticultural practices.
- B. Plant Materials: Species and size identifiable in this specification, referenced specification, or plant schedule, grown in climatic conditions similar to those in locality of the project.

- C. Rhizome plugs, plants, and stock shall be of the type noted and handled, installed and maintained in similar manner for bare root and containerized stock as specified in the Standard Specifications.
- D. Types and Mixtures: Types and mixtures of perennial plants and bulbs shall be as follows:
1. Bulbs: Bulbs shall be of the color and variety specified.
  2. Ornamental Herbaceous Plants: Ornamental herbaceous plants shall be of the color and variety specified. Ornamental herbaceous plants and all other stock other than bulbs shall be either 4-inch by 4-inch by 4-inch potted plants. Also acceptable are bare root plants or containerized stock of minimum size of 2 inches by 3 inches or No. SP3 container class with volume of 14 to 30 cubic inches. Bare root plants may be used if installed in the spring prior to the normal budding time of the plant. Potted plants shall be used when specified on the Drawings.
  3. Prairie Type Plants: A random mixture consisting of no more than 20% of any one of the species shall be planted. Install bare root plants or containerized stock of minimum size of 2 inches by 3 inches or No. SP3 container class with volume of 14 to 30 cubic inches over project area shown on Drawings at 24-inch spacings.
    - a. Aster laevis–Smooth Aster.
    - b. Baptisia leucantha–White Wild Indigo.
    - c. Echinacea pallida–Pale Purple Coneflower.
    - d. Eryngium yuccifolium–Rattlesnake Master.
    - e. Liatris pycnostachya–Gayfeather.
    - f. Monarda fistulosa–Wild Bergamont.
    - g. Ratibida pinnata–Yellow Coneflower.
    - h. Rudbeckia subtomentosa–Sweet Black-eyed Susan.
    - i. Silphium terebinthinaceum–Prairie Dock.
    - j. Tradescantia ohiensis–Spiderwort.
    - k. Schizachyrium scoparium–Little Bluestem.
    - l. Sporobolus heterolepis–Prairie Dropseed.
  4. Wetland Type Plants: Install the following species of plants/plugs over the entire raingarden(s) and the basins of the proposed stormwater storage areas at select 36-inch centers and/or patches. Install as bare root plants or containerized stock of minimum size of 2 inches by 3 inches or No. SP3 container class with volume of 14 to 30 cubic inches. An equal number of each of the following species shall be planted based on site-specific conditions. Not all moisture requirement types may be needed. Confirm planting needs with ENGINEER.
    - a. Wet-Mesic slopes above Ordinary Water:
      - (1) Aster novae-angelica–NE Aster.
      - (2) Carex typhina–Common Cattail/Sedge.
      - (3) Carex frankii–Franks Sedge.
      - (4) Heliopsis helianthoides–Early ox-eye Sunflower.
      - (5) Liatris spicata–Marsh Blazing Star.
      - (6) Solidago riddellii–Riddell’s Goldenrod.
    - b. 0- to 6-inch Water Depth Plants:
      - (1) Acorus calamus–Sweet Flag.
      - (2) Iris virginica shrevei–Blue Flag Iris.
      - (3) Eupatorium maculatum or perfoliatum–Joe Pye Weed.
      - (4) Sagittaria latifolia–Arrowhead.
      - (5) Sparganium eurycarpum–Large Fruited Burreed.
    - c. 6 to 12-inch Water Depth Plants:
      - (1) Nuphar advena–Yellow Spatterdock Water-lily
      - (2) Pontederia cordata–Pickerelweed.

- (3) *Sagittarium rigida*–Sessile-fruited Arrowhead.
  - (4) *Scirpus fluviatilis*–River Bulrush.
  - (5) *Schoenoplectus pungens*-Three-Square Bulrush.
5. Sedge Meadow Type: Install the following species of plants/plugs over the entire raingarden(s) and the slopes of special management areas at 18-inch centers and within patches. Install as bare root plants or containerized stock of minimum size of 2 inches by 3 inches or No. SP3 container class with volume of 14 to 30 cubic inches. A random mixture consisting of no more than 20% of any one of the species shall be planted.
- a. *Asclepias incarnata*–Rose Milkweed.
  - b. *Calamagrostis canadensis*–Blue Joint Grass.
  - c. *Carex lacustris*–Lake Bank Sedge.
  - d. *Carex hystricina*–Bottle Brush Sedge.
  - e. *Carex stricta*–Tussock Sedge.
  - f. *Iris Versicolor*-Blue Flag Iris.
  - g. *Scirpus fluviatilis*–River Bulrush.
  - h. *Spartina pectinata*–Prairie Cord Grass.
  - i. *Rudbeckia subtomentosa*–Sweet Black-eyed Susan.
6. Woodland Type Plants: A random mixture consisting of no more than 15% of any one of the species shall be planted as bare root, 4-inch by 4-inch by 4-inch potted plants, or SP3 stock over project area shown on Drawings at 24-inch spacings. Up to four species may be eliminated and up to two species may be replaced with site-specific ecological substitutes. Use only if referenced on the project drawings:
- a. *Aquilegia Canadensis* or *alpina*–Columbine.
  - b. *Arisaema triphyllum*–Jack-In-The-Pulpit.
  - c. *Carex rosea*–Wood Sedge.
  - d. *Delphinium tricorne*–Wild Larkspur.
  - e. *Dicentra cucullaria*–Dutchman’s Breeches.
  - f. *Dodecatheon meadia*–Shooting Stars.
  - g. *Elymus hystrix*–Bottlebrush Grass.
  - h. *Eupatorium purpureum*–Sweet Joe Pye Weed.
  - i. *Geranium maculatum*–Wild Geranium.
  - j. *Hydrophyllum virginianum*–Virginia Waterleaf.
  - k. *Mertensia virginica*–Bluebells.
  - l. *Phlox divaricata*–Blue Phlox.
  - m. *Polemonium reptans*–Jacob’s Ladder.
  - n. *Pycnanthemum verticillatum* var. *pilosum*–Hairy Mountain Mint.
  - o. *Rudbeckia laciniata*–Wild Golden Glow.
  - p. *Sanguinaria canadensis*–Bloodroot.
  - q. *Smilacina racemosa*–False Solomon’s Seal.
  - r. *Solidago ulmifolia*–Elm Leaved Goldenrod.
  - s. *Tradescantia ohiensis*–Spiderwort.
  - t. *Uvularia grandiflora*–Yellow Bellwort.
- E. Planting Notes: When low areas are saturated or visible aesthetics and appearance is of emphasis, CONTRACTOR shall plant patches of 10 square feet or 10 feet diameter to compliment site conditions and promote survival and aesthetics. CONTRACTOR shall not plant nonemergent plants in standing water.

2.02 PLANT MATERIALS-SEED

- A. Native Seeding Mix contained in Section 32 92 19–Seeding and Sodding or Section 32 92 19.19–Native Seeding.

<p>Agrecol Corporation Ecological Agricultural Technologies 2918 Agriculture Drive Madison, WI 53718 (608) 226-2544</p>	<p>Cardno Native Plant Nursery 128 Sunset Dr. Walkerton, IN 46574 (574) 586-2412</p>	<p>Ernst Conservation Seeds 8884 Mercer Pike Meadville, PA 16335 (800) 873-3321</p>
<p>Genesis Nursery 23200 Hurd Road Tampico, IL 61283 (815) 438-2220</p>	<p>Ion Exchange 1878 Old Mission Dr. Harpers Ferry, IA 52146-7533 (800) 291-2143</p>	<p>La Crosse Seed 2901 Packers Avenue Madison, WI 53707 (608) 249-9291 (800) 356-7333</p>
<p>Marshland Transplant Aquatic Nursery P.O. Box 1 Berlin, WI 54923 (920) 361-4200</p>	<p>Prairie Moon Nursery Rt. 3, Box 163 Winona, MN 55987 (507) 452-1362</p>	<p>Prairie Nursery P.O. Box 306 Westfield, WI 53964 (800) 476-9453</p>
<p>Prairie Restorations, Inc. P.O. Box 327 Princeton, MN 55371 (612) 389-4342</p>	<p>Reinders, Inc. W227 N6225 Sussex Road Sussex, WI 53089-3969 (800) 785-3301</p>	<p>Taylor Creek Restoration Nursery 17921 Smith Road P.O. Box 256 Brodhead, WI 53520 (608) 897-8547</p>

2.03 MULCH MATERIALS

- A. Mulching Material: Weed-free, shredded, aged, fine-grade, organic hardwood mulch, free of growth or germination-inhibiting ingredients. Chipped or otherwise floatable mulch is not acceptable.

2.04 ENGINEERED SOIL

- A. Raingardens and bioretention plantings require overexcavation, decompaction, and reconstruction with 18 to 24 inches of engineered soil that meets the standards of Section 32 92 19–Seeding and Sodding, Part 2 (where applicable and if basins contained on Drawings).
- B. Engineered Soil: Bioretention Basins require overexcavation, decompaction, and reconstruction with 24 inches of engineered soil except where noted otherwise. Engineered soil shall be provided in conformance with the criteria specified in Conservation Practice Standard 1004-Bioretention for infiltration.

2.05 ACCESSORIES

- A. Stakes: 3.5-foot length, minimum 0.25-inch by 1.5-inch, sturdy, softwood lumber, pointed end or mild steel angle, galvanized, pointed end.

## PART 3-EXECUTION

### 3.01 TRANSPORTING AND STORING PLANTS

- A. After 1-week notice of delivery, ENGINEER may observe the plants and bulbs at the work site at the beginning of each planting day and reject any material that is not properly packaged (including clear labeling by species) or that is not in a firm, moist, or viable condition. Any plants remaining at the end of the day shall be removed from the work site and properly stored by CONTRACTOR.
- B. Before planting, sufficient water shall be added to stock and potted plants so that the soil around the roots is not dry and crumbly when the plants are removed from the pots.

### 3.02 LAYOUT OF PLANTING

- A. When plants are specified to be planted in prepared soil planting beds, the planting bed shall be subject to review of ENGINEER prior to planting. If no prepared soil planting bed is specified, the plants shall be planted in areas that have existing cover or have been wood mulched, seeded and mulched, or sodded. Where perennial plants, except bulbs, shall be planted, the planting beds shall be delineated with selective mowing stakes. Selective mowing stakes shall be according to Article 250.08.
- B. When possible, prepare the aquatic raingarden or stormwater planting areas by flooding the planting site making sure the soil is saturated. To plant, push the plugs or plants into planting holes and pack around it by hand. Make sure all roots are covered with soil, without void spaces, and firmly in contact with the soil.

### 3.03 PLANTING TIME

- A. Planting times for the various types of perennial plants shall be as follows:
  - 1. Bulbs: Bulbs shall be planted between October 15 and November 15.
  - 2. Ornamental Herbaceous Plants, Prairie Type Plants, Wetland Emergent Type Plants, and Sedge Meadow Type Plants shall be planted between April 1 and June 15, or between August 15 and September 15.
  - 3. Wetland plug plantings beyond September 15 shall be subject to written approval of ENGINEER.
  - 4. Woodland type plants shall be planted between April 1 and May 15 or September 1 to September 15.

### 3.04 PLANTING

- A. Plant pits shall be excavated with vertical sides. These holes shall be no deeper than the depth of the plant, container, or root system when the plant is at its proper grade. Set plants vertical, firmly pressing surrounding soils with hand or foot to provide full soil-to-root contact.
- B. Place topsoil in holes around roots or balls, mixed with fertilizer and peat moss or compost. Topsoil around roots shall be pressed and watered.
- C. Place plants where indicated on the Drawings. Position plants for appearance.

- D. Planting Procedures:
1. The spacing of the plants shall be as shown on the Drawings to uniformly fill the planting beds. General guidance on wetland planting beds is noted in other sections. Individual plants within the beds shall be planted as follows:
    - a. Bulbs: Bulbs shall be planted to a depth of 6 inches (150 mm) in turf areas or prepared beds.
    - b. Ornamental Herbaceous Plants, Prairie Type Plants, Sedge Meadow Type Plants, and Woodland Type Plants. When planted in prepared soil planting beds, these plants shall be planted by a hand method standard of the restoration industry.
      - (1) When planted in existing turf, the planting area shall be mowed to a maximum height of 2 inches (50 mm).
      - (2) In existing cover, shredded wood mulch, or seeded and mulched or sodded planting areas, a 12-inch-diameter planting area for individual plants shall be prepared. The existing cover, or seed and mulch shall be cut and removed from the 12-inch-diameter planting area and the soil within the planting area loosened to a depth of 6 inches. The plants shall be planted within the planting area and immediately watered with at least 1 gallon (5 L) of water per plant.
  2. Install rhizomes/potted plants following the installation of any necessary erosion control, weed barrier, or mulching. The plantings shall be installed in accordance with the supplier's instructions, planting details, and Standard Specifications.
- E. Period of Establishment: Period of establishment for the various types of perennial plants shall be as follows:
1. No period of establishment will be required for bulbs.
  2. Perennial plants must undergo a 60-day period of establishment. Additional waterings shall be performed at least once within every 7 days for 4 weeks following installation. Water shall be applied at the rate of 2 gallons per square yard (9 L/sq m). Should excess moisture prevail, ENGINEER may delete any or all of the additional watering cycles. In severe weather, ENGINEER may request additional waterings.
    - a. Watering of plants in beds shall be applied in such a manner that all plant holes are uniformly saturated without allowing the water to flow beyond the periphery of the bed.
    - b. At the midway point or end of the period of establishment, CONTRACTOR will be permitted to replace any unacceptable plants and shall thoroughly weed all the beds.
- F. Method of Measurement:
1. This work will be measured in units of each of the type specified. Measurement for this work will be performed at the end of the 60-day establishment period for the replacement planting. Only plants that are in place and alive at the time of measurement will be measured and accepted, except that if fewer than 25% of the plants are acceptable, a quantity equal to 25% of the number of units of plants originally planted will be considered measured.
  2. Selective mowing stakes are incidental and shall delimit plantings.
  3. Payment shall be by Lump Sum for total engineering project unless otherwise contracted.

### 3.05 INSTALLATION OF ACCESSORIES

- A. Place selective mowing/layout stakes or edging around planting areas where shown on the Drawings. Install edging using anchors or stakes at approximately 4 feet on center.
- B. Place mulch over landscaping fabric or membrane where indicated on Drawings.

- C. Install pin flags to designate planted areas, patches, or groupings of plantings.

### 3.06 PLANT PRUNING

- A. Each plant, rhizome, tuber, or plug shall be root on top-pruned in accordance with good horticulture practice to enhance establishment to facilitate growth, and provide plant with best chance for survival and appearance.

### 3.07 MULCH

- A. Within 24 hours the plants shall be mulched with 2 inches of shredded, fine-grade organic hardwood mulch free from deleterious materials, weeds, stones, and sticks. Cumulative depth of mulch may be a maximum of 3 inches in raingarden beds. For raingarden and naturalized plantings, mulch shall be placed to a depth of 2 to 3 inches in areas planted with individual plants. Mulch shall not be applied for raingardens and naturalized plantings where seed is also applied. Care shall be taken to place the mulch in a way that does not smother plants.

### 3.08 MAINTENANCE

- A. Maintain plant life for 60 days after date of final completion.
- B. Neatly trim plants where necessary.
- C. Immediately remove clippings after trimming.
- D. Water to prevent plants and soil from drying out, per previous sections.
- E. Control growth of weeds. Apply herbicides or pesticides in accordance with manufacturer's instructions.
- F. CONTRACTOR shall be responsible for, and shall repair damage resulting from, erosion until final completion plus 60 growing season days, unless agreed upon otherwise in writing.
- G. Plants and seed materials and placement shall conform to Standard Specifications unless noted herein.
- H. Maintenance Mowing Prairie and Sedge Meadow Areas: To reduce weed establishment of native mixes, mow two to three times (4 to 6 weeks apart) during the first year with the mower deck about 6 inches off the ground. OWNER is also directed to the management recommendations of the USDA-NRCS document titled NRCS Wisconsin Agronomy Technical Note 5 "Establishing and Maintaining Native Grasses and Legumes." Mowing shall be required of CONTRACTOR if the growing season time periods are reached prior to final completion. OWNER is to mow one time during the second year before weeds set their seeds. OWNER to mow or otherwise maintain once every 3 to 5 years following the initial 2 years of maintenance to remove dead plant material and stimulate new seed.

### 3.09 LAYOUT

- A. See project drawings for additional information.

END OF SECTION

## SECTION 32 94 00

### TREES, PLANTS, STONE MULCH, AND EDGING

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. Trees and plants.
  - 2. Hardwood mulch.
  - 3. Stone mulch.
  - 4. Plastic and aluminum edging.
  - 5. Maintenance.
  - 6. Tree pruning.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with 3 years' experience. Plant materials shall be free of disease and hazardous insects.
- B. Installer Qualifications: Company specializing in installing and planting the plants with 3 years' experience.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

##### 1.03 WARRANTY

- A. All plant material is to be fully guaranteed throughout the correction period. Only those plants that are alive and normally healthy for the first year will be accepted. Unaccepted material shall be removed and replaced by CONTRACTOR at no cost to OWNER during the next suitable growing season.
- B. Replacement plants shall be the same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

#### PART 2–PRODUCTS

##### 2.01 PLANT MATERIALS

- A. Plant names shall conform to those given in Standardized Plant Names, 1942 Edition, American Joint Committee on Horticultural Nomenclature. All plants shall be true to name and legibly tagged as to name and size. Federal or other governmental certificates of inspection shall accompany all shipments as required.
- B. Plant materials, methods, etc. shall conform to the latest edition of ANSI Z60.1.

- C. CONTRACTOR shall have investigated the sources of supply and shall be satisfied that CONTRACTOR can supply the listed plants in the size, variety and quality specified before submitting a Bid. Failure to do so will not relieve CONTRACTOR of the responsibility for furnishing and installing all plant materials in strict accordance with the Contract Documents.
- D. All material shall be the highest quality. Plants shall have typical growth habit for their species. Plants shall be sound, healthy, vigorous, and free from insect pests, plant diseases, and injury. One sided plants and plants taken from tightly planted nursery rows will be rejected.
- E. All plants shall equal or exceed measurements specified, measured before pruning with branches in normal position. Height and spread refers to main body of plant and not from tip to tip of branches and roots. Trees shall have a well-defined central leader.
- F. Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged, cut, or crooked leader, included bark, abrasion of bark, sunscald, disfiguring knots, insect damage, mold, or prematurely opened buds are cause for rejection.

## 2.02 FERTILIZER

- A. Fertilizer shall be equal to Milorganite (6-2-0), Louisville Green (5-3-0), or equal uniform in composition and free-flowing. Fertilizer that becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted. Rate of application shall be as recommended by nursery.

## 2.03 MULCH MATERIALS

- A. Hardwood Mulch: Organic hardwood mulch, free from deleterious materials, weeds, stones, sticks and growth or germination-inhibiting ingredients.
- B. Stone Mulch: Stone mulch shall be 1 1/2-inch decorative landscape stone.

## 2.04 ACCESSORIES

- A. Edging: Black Diamond by Valley View Industries; commercial edging by COL-MET, or equal. Metal edging shall be commercial grade 1/8 inch by 4 inches. Plastic edging shall have a minimum 4-inch side wall and 1-inch-diameter head and shall have a V-lip configuration for added stiffness and anchor-holding power.
- B. Membrane: 20-mil-thick, water-permeable polyolefin fabric.
- C. Wrapping Materials: Burlap or other commercial-grade tree wrap.
- D. Stakes: Softwood lumber, pointed end or mild steel angle, galvanized, pointed end.
- E. Cable, Wire, Eye Bolts: Noncorrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- F. Tree Protectors: Rubber sleeves over cable to protect tree stems, trunks, and branches.

## PART 3-EXECUTION

### 3.01 PLANTING

- A. Plants should be planted on the day of delivery. If this is not possible, protect the stock not planted. Plant material shall be kept in the shade, well protected with soil, wet moss or other acceptable material, and shall be well watered. Plants shall not be bound with wire or rope at any time to avoid damaging the bark or breaking branches.
- B. Plants shall be lifted and handled from the bottom of the ball only. Plants moved with a ball will not be accepted if the ball is cracked, loose, or broken before or during the planting operations.
- C. Fertilizer shall be delivered to site in original, unopened containers, each bearing manufacturer's guaranteed analysis. Packaged materials shall be stored off ground and protected from moisture.
- D. CONTRACTOR shall coordinate planting Work with installation of sod and the construction of other site features.
- E. CONTRACTOR shall take precautions to provide that equipment and vehicles do not disturb or damage existing site grading, walks, drives, utilities, plants, etc., and shall replace and/or return to original condition any damage caused by CONTRACTOR's negligence at no cost to OWNER.
- F. CONTRACTOR shall maintain plantings immediately upon installation of plants and continue until acceptance, including watering, weeding, removal of dead material, resetting of plants to proper grade and plumb position, and other necessary operations.
- G. Plants shall be alive and in good, healthy, and flourishing condition of growth at the end of the correction period.
- H. Any plant installed under this Contract that is dead or not in a vigorous, thriving condition shall be removed from the site and replaced at CONTRACTOR's cost as soon as conditions permit during the normal planting season. In case of any questions regarding the condition of a rejected plant, CONTRACTOR may elect to allow such plant to remain through another complete growing season. If at that time, the rejected plant is found to be dead or in an unhealthy or badly impaired condition, it shall be replaced. One replacement after acceptance shall constitute fulfillment of CONTRACTOR's guarantee for the particular plant replaced. All replacements shall be plants of the same kind and size as specified originally. CONTRACTOR shall make all necessary repairs required because of plant replacements. Such repairs shall be done at no extra cost to OWNER. Plants shall be replaced, mulched, wrapped, fertilized, pruned, and restored to original condition at no extra cost to OWNER.
- I. Plant pits shall be excavated with vertical sides. These holes shall be no deeper than the depth of the ball, container, or root system when the plant is at its proper grade. Set plants vertical.
- J. Place topsoil in holes around roots or balls, mixed with fertilizer and peat moss or compost. Topsoil around roots shall be compacted and watered. After plant pit is backfilled, shallow basin shall be formed with ridge of soil to facilitate watering.

- K. Place plants where indicated on the Drawings. Position plants for appearance.
- L. Remove nonbiodegradable root containers and twine.
- M. Soil excavated from plant pits that is similar in nature to topsoil and is determined to be suitable for planting soil shall be thoroughly mixed with one part of peat to five parts of existing soil. Very poor soils of clay, gumbo, gravel, hard-pan, or other soils injurious to plants shall not be used.
- N. If quantity of soil excavated from planting pits is not adequate for planting, CONTRACTOR shall furnish imported planting soil consisting of partially decomposed vegetable matter of natural occurrence. Such soil shall be black, clean, low in content of mineral or woody material, mildly acidic, fertile and friable. This soil shall be mixed with one part of peat to five parts of soil. Peat shall be a domestic product consisting of partially decomposed vegetable matter of natural occurrence; black, clean, granulated, or shredded.
- O. Deciduous trees and shrubs shall be planted from September 15 to December 1 and from April 1 to June 1. All trees and shrubs shall be planted to provide the maximum growing time allowable under the Contract Times. At the option and on full responsibility of CONTRACTOR, planting operations may be conducted under unseasonable conditions without additional compensation or change to warranty.
- P. CONTRACTOR shall stake out on the ground the location of all plants before excavation is begun, and review layout with OWNER. Plants installed at incorrect locations shall be relocated by CONTRACTOR at no expense to OWNER.
- Q. CONTRACTOR shall excavate the plant pit, centered at the location stake, cylindrical in shape with vertical sides and flat or saucer-shaped bottom. Planting soil for backfilling shall be kept separate from excavated subsoil. Pit shall be large enough to provide at least 12 inches of planting soil backfill around and beneath the root system. Where surface or subsurface conditions prevent digging a plant pit to specified dimensions, obtain approval from landscape architect to modify location or pit dimensions.
- R. The root ball shall be centered in the plant pit resting on 12 inches of planting soil well-tamped. The plant hole shall be backfilled with planting soil placed in layers around the root ball. Each layer shall be hand-tamped in place in a manner to avoid injury to roots and ball. When approximately two thirds of the plant hole has been backfilled, the hole shall be filled with water to allow the soil to settle around the roots. Top of root ball shall be 1 inch above surrounding grade. The cord or wire securing burlap at base of tree shall be cut, with the burlap folded back.
- S. Just prior to observation for acceptance, CONTRACTOR shall prune all plantings. The amount of pruning will be limited to the minimum necessary to remove dead or injured twigs and branches to compensate for loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or shape of the plant.
- T. CONTRACTOR shall promptly remove any soil, peat, or similar material that has been brought onto paved areas by planting operations, keeping those areas clean at all times, and shall remove all debris resulting from planting operations from the site.
- U. Replacement plantings shall match existing plant type, with minimum 4-year nursery growth.

### 3.02 TREE REMOVAL AND REPLACEMENT

- A. Trees marked for removal within street and road rights-of-way and in easements shall be removed by CONTRACTOR and properly disposed. Trees within street and road rights-of-way marked for removal need not be replaced unless specifically noted otherwise on drawing. CONTRACTOR shall replace all other removed and damaged trees and shrubs with new stock at its expense. New trees shall be located as requested by OWNER or ENGINEER.
- B. Trees shall be replaced as follows. Diameters shall be measured 4 feet above the ground.

Deciduous Trees

Up to 1 1/2 inches

Like size and type

Greater than 1 1/2 inches

Min. 1 1/2 inches of like type

Coniferous Trees

Up to 6 feet tall

Like size and type

Greater than 6 feet tall

Min. 6-foot tree of like type

- C. All bushes and shrubs removed during construction shall also be restored to their original position and condition. If the bush or shrub is damaged or dies after restoring, CONTRACTOR shall replace it with one of same kind and size up to a height of 4 feet. Bushes and shrubs beyond this height shall be replaced by one that is 4 feet.
- D. It is intended that as many trees as possible be saved during construction. No trees, except those so designated, shall be removed without prior approval of OWNER. CONTRACTOR shall conduct the work to protect all trees to remain. CONTRACTOR shall provide suitable fencing installed at the tree drip line for all trees within the construction area to protect trees from damage and soil compaction by its equipment.
- E. Trees that are damaged during construction shall be repaired. CONTRACTOR shall retain the services of a professional nurseryman who is a member of the National Arborist Association to direct CONTRACTOR on the proper repair of damaged trees. Damaged limbs and roots shall be pruned or dressed according to recommendations of the nurseryman. Backfill shall be replaced as soon as possible to reduce exposure of roots to air. Scarfed areas on trees shall be suitably dressed. Compaction of root areas under the drip line of the tree is to be avoided whenever possible.
- F. When removing trees, special care shall be taken to not damage surrounding private property. Costs for tree removal or replacement and construction around trees shall be included in the price bid for the work.
- G. CONTRACTOR shall relocate or bore and jack under or by such trees as desired to minimize construction damage. Cost for such construction shall be included in the price bid for the work.

### 3.03 INSTALLATION OF ACCESSORIES

- A. Place edging around hardwood mulch, stone mulch, and planting areas where shown on the Drawings. Install edging using stakes at approximately 4 feet on center.

- B. Place membrane (weed barrier) in all areas to receive stone or hardwood mulch.
- C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.04 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 to 2 inches	2 stakes with two ties
2 to 4 inches	3 guy wires
Over 4 inches	4 guy wires

3.05 TREE PRUNING

- A. Each tree and shrub shall be pruned in accordance with good horticulture practice to preserve natural character of plant and to facilitate growth.

3.06 MULCH

- A. Place stone mulch to 3-inch depth over membrane in all areas indicated on the Drawings.
- B. Place organic hardwood mulch to a depth of 3 to 4 inches over membrane for all trees and plants unless mulched with other materials as indicated on the Drawings.

3.07 MAINTENANCE

- A. Maintain plant life for 3 months after date of substantial completion.
- B. Neatly trim plants where necessary.
- C. Immediately remove clippings after trimming.
- D. Water to prevent soil from drying out.
- E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- F. Apply pesticides in accordance with manufacturer's instructions.

3.08 SCHEDULE-PLANT LIST

- A. See Drawings for schedule.

END OF SECTION

## SECTION 33 00 10

### BURIED PIPING AND APPURTENANCES

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included:
  - 1. All underground piping, valves, and appurtenances of every description.
  - 2. Excavation, dewatering, and backfilling for all work under this section unless otherwise noted.
  - 3. Concrete foundations and anchor bolts for all equipment furnished under this section.
  - 4. Underground piping connections to all equipment, whether furnished under this section or not.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 REFERENCED SPECIFICATIONS

- A. WisDOT Specifications in the Standard Specifications shall refer to the State of Wisconsin Department of Transportation, Division of Highways, Standard Specifications for Highway and Structure Construction, Latest Edition, including the Effective ASP 6.
- B. Conservation Practice Standards in the Standard Specifications shall refer to the Wisconsin Department of Natural Resources Conservation Practice Standards-Construction Site and Sediment Control.

##### 1.03 SUBMITTALS

- A. Shop Drawings: General arrangement drawings of 3 inches or larger exterior (belowground) ductile iron, stainless steel and welded steel piping shall be submitted to ENGINEER for approval. Drawings shall include proposed materials, length, location, and elevation of pipe, fittings, pipe restraint, valves, and appurtenances.

#### PART 2–PRODUCTS

##### 2.01 MATERIALS OF CONSTRUCTION

- A. All materials used in the manufacture, assembly, and painting of piping and valves in contact with water shall be compatible with potable water supplies and in contact with chemical feed systems shall be compatible with the chemicals being used. All glues, solvents, solders, etc., shall likewise be compatible. For instance, no lead-base solders shall be used. All materials in contact with water to be used for potable water supplies shall be National Sanitation Foundation (NSF)-approved.
- B. Size and Type:
  - 1. All materials shall conform to the size and type shown on the Drawings or called for in the specifications.

2. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event standard fittings are not available, the method of joining shall be standard selected by CONTRACTOR and submitted for review by ENGINEER.
- C. Materials provided shall be suitable for the conditions in which they are being installed and used. CONTRACTOR shall review installation requirements of the Contract with material suppliers and incorporate any additional installation requirements necessary to meet the required use within the price bid for the Work.
- D. All pipe and materials used in performance of the Work shall be clearly marked as to strength, class, or grade. Pipe and materials not so marked shall be subject to rejection.
- E. When requested by ENGINEER, material suppliers shall furnish certificates of compliance indicating that all tests required by various Standards have been conducted and that the test results comply with the Standards.
- F. Piping appurtenances shall be made of the materials specified. All appurtenances not designated as to type shall be selected by CONTRACTOR and submitted for review by ENGINEER.

## 2.02 MANHOLES AND UNDERGROUND UTILITY STRUCTURES

- A. General: All provisions of Drawing 01-975-41A, 01-975-42A, or 01-975-43A, enclosed in these specifications, except those contrary to provisions delineated herein or on the Drawings shall apply to manholes.
- B. Unless otherwise specified or shown on the Drawings for special manholes, all manholes shall be reinforced concrete precast manholes. Reinforced concrete manhole base sections, riser sections, cones, and flat slabs shall conform to the requirements of ASTM C478. Solid precast manhole bottoms shall be provided except where shown on the Drawings. Manholes shall be provided with minimum diameters as shown on Drawings 01-975-41A, 01-975-42A, or 01-975-43A.
- C. Manhole top sections shall be precast reinforced eccentric cones unless precast reinforced flat slabs are specifically required or shown on the Drawings or are necessary because of shallow depth. Flat slabs shall have opening offset unless otherwise required or shown. Flat slabs shall be designed for HS20 loadings.
- D. Unless otherwise specified or shown on the Drawings, all underground utility structures shall be precast, reinforced concrete. Reinforced concrete base sections, riser sections, and flat slabs shall conform to the requirements of ASTM C858. Flat slabs shall be designed for HS20 loadings. Solid precast bottoms shall be provided unless otherwise shown on the Drawings.
- E. Manhole Chimney Adjusting Rings:
  1. Manhole adjusting rings shall be injection molded-recycled HDPE as manufactured by Ladtech, Inc., or expanded polypropylene as manufactured by Cretex Specialty Products.
  2. CONTRACTOR shall supply ring materials, adhesive, labor, and equipment to install the rings in strict accordance to manufacturer's recommendations. CONTRACTOR shall permanently install rings with adhesive so that all manhole casting rims are set level with the Drawings. Ring inside diameter shall be 24-inch nominal, or larger to match frame.

3. CONTRACTOR shall have all ring sizes available when rebuilding tops of manholes, including tapered sections to allow for seamless adjusting of frame elevations on flat and sloped surfaces.
4. Concrete adjusting rings shall not be used for manhole adjustments. Substitute HDPE adjusting rings for concrete rings shown in Standard Detail Drawing 01-975-43A.

F. Manhole Chimney Seals:

1. Internal/external manhole chimney seals shall be provided for all new manholes. Chimney seal shall be Adaptor internal/external adaptor seal, or equal.
2. Existing manholes exposed during the construction period shall have the adjustment rings replaced and a new chimney seal installed. Existing castings shall be reused.
3. Manhole frame-chimney seals shall be designed to prevent the leakage of water into the manhole at the area of the joint between the manhole frame and chimney continuously throughout a 20-year design life. The seal shall remain flexible, allowing repeated vertical movements of the frame because of frost lift, ground movement, or other causes of up to 2 inches and/or repeated horizontal movements of the frame because of thermal movement of the pavement or other causes of up to 1/2 inch, both rates of movement occurring at rates not less than 0.10 inch per minute. The seal and its appurtenances shall not extend far enough into the manhole opening to restrict entry or exit from the manhole.
4. The seal shall be made of only materials that have been successfully used in sanitary sewer construction for at least 10 years and have proven to be resistant to sanitary sewage; corrosion or rotting under wet or dry conditions; the gaseous environment in sanitary sewers and at road surfaces including common levels of ozone, carbon monoxide and other trace gases at the sites of installations; the biological environment in soils and sanitary sewers; chemical attacks by road salts, road oil and common street spillages or solvents used in street construction or maintenance; the temperature ranges, variations and gradients in and between manhole frames and chimneys in the climate of the location of construction; variations in moisture conditions and humidity; fatigue failure caused by a minimum of 30 freeze thaw cycles per year; or vibrations because of traffic loadings; fatigue failure because of repeated variations of tensile, compressive and shear stresses and repeated elongation and compression; and any combination of the foregoing. The materials used shall be compatible with each other and the manhole materials.

G. Valve Boxes:

1. A valve box shall be provided for fire hydrant auxiliary valves and for valves in the main. The valve box shall be centered and plumb over the wrench nut of the valve with the box cover flush with the finished ground elevation. Solid 4-inch concrete blocks shall be placed under the base of valve boxes so that the bottom of the base is about 2 inches away from contact with the valve bonnet. A Gate Valve Adaptor by Adaptor Inc., or equal, shall be provided. The valve box shall not transmit shock or stress to the valve.
2. Valve boxes shall be made of cast iron conforming to ASTM A48. The castings shall be free from blowholes, porosity, hard spots, shrinkage defects or cracks, or other injurious defects and shall have a normal smooth casting finish. The castings shall be thoroughly coated with a 1 mil minimum thickness bituminous coating. Valve boxes shall be 5 1/4 inches in diameter. Valve boxes shall have a maximum length of 7 feet when extended without extension sections. Extensions shall be provided for deeper mains.
3. Valve boxes shall consist of a base section, tubular mid and top sections, both with cast threads by which one can be telescoped on the other, extension sections if required, and a circular drop cover unless indicated otherwise.

4. Valve boxes shall be installed in accordance with Drawing 01-975-64A.
  5. Valve boxes shall be Clow three-piece ductile iron valve box, or approved equal. All valve boxes shall be American made. Valve stem extensions shall be provided for valves deeper than 8 feet. Lids shall be marked for appropriate use. CONTRACTOR shall verify that all valve boxes are large enough to accommodate all operating nuts and wrenches. Provide one "Tee" valve key operator for each valve manhole and one for each tank with tank or channel drain.
- H. Area drains as shown on the Drawings shall be constructed using a section of 24-inch-diameter RCP bell and spigot joint pipe. Castings for area drains shall be Neenah R-4360D grate with frames. The pipe bell i.d. shall be greater than the casting o.d. so that the casting will fit within the bell without becoming wedged against the side of the pipe.
- I. Precast Reinforced Concrete Manholes:
1. Lengths of manhole riser (barrel) shall be furnished in such combinations as to conveniently make up the depth of the manhole. A maximum of two handling holes per length of riser will be permitted.
  2. Drop entrances to sanitary sewer manholes shall be installed where indicated on the Drawings and as shown on Drawing 01-975-43A. Drop entrances shall be of the same diameter as the sewer main from sizes 8 inches through 18 inches. For larger diameters, the drop shall be 18 inches unless otherwise shown on the Drawings. Drop entrances for storm sewer manholes are not required.
  3. The interior bottom of sanitary sewer and storm sewer manholes shall be constructed of concrete benches which shall be precast or poured in place in the field. Benches shall extend to the top of each pipe to a maximum height of 42 inches. Flow lines shall be made smooth with uniform curves to promote flow through the manhole.
  4. All joints between manhole pipe sections and top shall be tongue and groove conforming to ASTM C443. Manhole joints shall be sealed with circular O ring or preformed flexible joint sealant that shall be Ram-nek, Kent-Seal, Mas-stik, or equal.
  5. Manhole connections for sanitary sewer mains shall be made using flexible, watertight connections, PSX Press Seal, Kor N Seal, or equal, for sewers up through 18-inch diameter. All other sanitary sewer manhole connections shall be made with A Lok, PSX Press Seal, Kor N Seal, or equal. The joint shall provide a flexible, watertight connection between pipe and manhole. Manhole connections for storm sewer mains and leads may be made with cast-in-place concrete during completion of manhole interior in lieu of above.
  6. Manhole bottoms for sanitary sewer shall be monolithically precast with the bottom section for manholes up through 6-foot diameter. Bottoms for larger diameter manholes shall be precast but need not be monolithically cast with the bottom section. All other manhole bottoms shall be either poured in place or precast concrete.
  7. Manhole bottoms for air release manholes, force main cleanout manholes and water system valve manholes shall have an 18-inch diameter sump hole. Sump hole shall have a solid concrete bottom where groundwater is above the bottom of the manhole.
  8. Manholes shall be furnished of minimum diameters as shown on Drawing 01-975-43A. Manholes shall be furnished large enough to provide a minimum distance, between adjacent pipe, measured tangentially along the inside face of the manhole, equal to one half the outside diameter of the intersecting sewer pipe. In any event, manholes shall be furnished in the diameter necessary to accommodate intersecting sewer pipe and the pipe to manhole connection as proposed for use.
  9. Steps shall be installed in all manholes by the manufacturer as shown on Drawings 01-975-41A, 01-975-42A, and 01-975-43A and shall be cast iron conforming

to ASTM A48 or steel reinforced plastic conforming to ASTM A615, Grade 60 and ASTM D4101 with molded copolymer polypropylene covering conforming to ASTM D4101, Type PP200B33450Z02, or equal. Manhole steps shall be spaced 16 inches on center with an allowable tolerance of (plus or minus) 1 inch. Steps shall be inserted in manhole riser, cone, and flat slab sections prior to the initial set of the concrete in accordance with ASTM C478 and shall have maximum embedment and pullout resistance in accordance with ASTM C497. The top step shall be located 10 inches or less from the top of the manhole cone section or uppermost structure section. Manhole steps shall be Neenah Type R-1981-N, M.A Industries, Inc. PS1-PF, or equal.

10. Precast reinforced concrete manhole risers and tops shall be tested in accordance with ASTM C497. Precast reinforced concrete manhole risers and tops meeting the strength requirements will be considered acceptable and shall be stamped with an appropriate monogram. When requested, copies of test reports shall be submitted to ENGINEER before the manhole sections are installed in the Project. Final acceptance will be made after field inspection upon delivery to the jobsite.
  11. Precast reinforced concrete manhole sections shall be subject to rejection for failure to conform to any of the requirements of the Standard Specifications. In addition, individual sections of manhole risers and tops may be rejected because of any of the following reasons:
    - a. Fracture or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
    - b. Defects that indicate imperfect proportioning, mixing, and molding.
    - c. Surface defects indicating honey combed or open texture.
    - d. Damaged ends, where such damage would prevent making a satisfactory joint.
    - e. Manhole steps out of line, or not properly spaced.
    - f. Noticeable infiltration into manhole.
    - g. Variation in diameter of the manhole section of more than 1% from the nominal diameter.
    - h. Any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more regardless of position in the section wall.
- J. Each precast reinforced concrete manhole riser and top section shall be clearly marked with the name or trademark of the manufacturer and the date of manufacture. This marking shall be indented into the manhole section or shall be painted thereon with waterproof paint.
- K. Storm Sewer Inlets: All inlets shall meet the requirements of ASTM C913. Construction shall conform to Drawing 01-975-41A. Inlets, in general, shall be rectangular in shape and shall be constructed of precast or poured-in-place concrete.
- L. Masonry:
1. Concrete block shall meet the requirements of ASTM C139.
  2. The face size of stretcher units shall be 7 5/8 inches by 15 5/8 inches. Variations in the face size shall be within the limits permitted by the above standards. Special shapes and sizes shall be furnished and installed as necessary.
  3. Sewer brick shall conform to ASTM C32. All sewer brick shall be Grade SS and manhole brick shall be Grade MS. Sewer brick shall be installed as shown on the Drawings furnished by ENGINEER and as required in the construction of sewer appurtenances.

- M. Manhole and Inlet Castings:
1. All manhole and inlet castings shall be gray iron and meet the requirements of ASTM A48. Unless otherwise shown on the Drawings, standard manhole castings shall be Neenah R1550 with machined frame, Type B solid lid, concealed pick holes and self-sealing gaskets, East Jordan Iron Works, or equal. Floodproof castings shall be Neenah R1916 C with machined frame, type B solid lid, concealed pick holes and self-sealing gaskets, East Jordan Iron Works, or equal.
  2. Inlet castings for locations with curb and gutter shall be Neenah R3067 with type L grates on slopes and type R grates at low points, East Jordan Iron Works, or equal. For driveway areas, inlet castings shall be Neenah R3290 with Type C grates, East Jordan Iron Works, or equal.
  3. Frames for valve manholes shall be Neenah R-6065 with Type B lid, R-5900-F with Type C lid with two concealed pickholes equipped with self-sealing gaskets, or equal. Catch basin grates shall be Neenah R-1550 with machined frame and Type D open grate, or equal. Interior mud basin castings shall be Neenah R-6118, or equal, with grey iron Class 35 frame and grating for heavy-duty use.
- N. Mortar: Mortar shall meet the requirements of ASTM C270. Mortar shall be one part Portland cement and 2 1/4 parts washed mortar sand.
- O. Preformed Flexible Joint Sealant: Preformed flexible joint sealant shall be EZ Stik, Kent Seal, Ram Nek, or equal, meeting the requirements of ASTM C990.
- P. O-Rings: O-rings shall meet the requirements of ASTM C443.

2.03 BURIED PIPING

- A. The following pipe materials shall be used for Town of Brookfield Projects:

Pipe Application	Material
Sanitary Sewer	Solid Wall PVC SDR 35
Sanitary Sewer Laterals (Types 1, 2, 4, and 5)	Solid Wall PVC SDR 35
Water Main ≤ 12 inches	C 900 PVC Pipe DR 18
Water Main ≥ 12 inches	C 905 PVC Pipe DR 18
Water Services	High Density Polyethylene (HDPE) SDR 9
Force Main ≤ 12 inches	C 900 PVC Pipe DR 18
Force Main ≥ 12 inches	C 905 PVC Pipe DR 18
Grinder Pump Sewers and Laterals	PVC Schedule 40 Pipe or PVC SDR 21 Pipe < 4 inches
Fittings for PVC Used in Water Main or Force Main	Ductile or cast iron
Fittings for Grinder Pump Sewers	Schedule 40 or 80 Fittings
Directional Drilling	HDPE SDR 9

- B. Ductile Iron Fittings:
1. Each fitting shall have the weight, class or nominal thickness, country where cast, casting period, manufacturer's mark, the year in which the pipe was produced, and the letters DI or DUCTILE cast or stamped thereon. Improper or incomplete marking will be cause for rejection of the pipe or fitting.

2. CONTRACTOR shall furnish certification data representing each fitting furnished. The certification report shall clearly state that all fittings furnished meet the appropriate AWWA specification.
3. Restrained joints shall be provided in accordance with Part 3–Execution. Mechanical joints shall be restrained with MEGALUG® Series 1100 or 1100 SD, by EBAA Iron Sales, Inc., UNIFLANGE Series 1400 by Ford Meter Box Co., Inc., or equal, restraint. Push-on joints for ductile iron piping shall be restrained with MEGALUG® Series 1700 or 1100 HD, by EBAA Iron Sales, Inc., UNIFLANGE Series 1450 by Ford Meter Box Co., Inc., Flex-Ring or Lok-Ring by American Cast Iron Pipe Company, TR Flex by U.S. Pipe Company, TR Flex by McWane, or equal.
  - a. Pipe restraint fittings shall be provided as follows:
    - (1) For PVC pipe with ductile iron mechanical joint fittings–MEGALUG® Series 2000 PV, 1100SV, or 2000SV by EBAA Iron Sales, Inc.; Series D SLCE or PVM by Sigma; Series 1000C or 4000 by Star Pipe Products; or equal.
    - (2) For PVC pipe with PVC push on joints (not solvent welded)–MEGALUG® Series 1100HV, 1900, or 2800 by EBAA Iron Sales, Inc.; Series SLCEH, PWP (greater than 12-inch only), or D PWP (12 inches or less) by Sigma; Series 4100P by Star Pipe Products; or equal.
  - b. Gland body, wedges, and wedge actuating components shall be ductile iron conforming to ASTM A536 Grade 65 45 12. Bolts and tie rods shall be high strength low alloy steel conforming to AWWA C111.
  - c. Gaskets that include metal locking segments vulcanized into the gasket to grip the pipe to provide joint restraint are not acceptable.
4. Joint restraint is not required for gravity sewers, drains, and those pipes designated in Paragraph 3.02.G.1. Infiltration/Exfiltration Tests. Joint restraint shall be provided for any pipe requiring pressure testing.
5. Underground pipe shall have mechanical joint or push-on joint ductile iron fittings conforming to AWWA C110 and C111 or AWWA C153 compact fittings with a minimum rated working pressure of 150 psi. Gaskets for fittings shall be as specified for underground piping.
6. All ductile iron fittings shall be American Cast Iron Pipe, Tyler Union, U.S. Pipe, McWane Ductile, Griffin, or equal.
7. Unless otherwise specified, all exterior ductile iron fittings shall be cement-mortar lined and asphaltic-coated inside. Cement-mortar lining shall be in accordance with AWWA C104. Unless otherwise specified, fittings shall be shop primed or asphaltic-coated outside. Asphaltic coating shall conform to applicable standards herein for the pipe and fittings.
8. All ductile iron fittings designated A (Air) shall be unlined and shall receive exterior coating as specified above. All ductile fittings designated HW (Hot Water) shall be cement-mortar lined, but not asphaltic-coated inside, and shall receive exterior coating as specified above.
9. All buried ductile iron appurtenances shall be polyethylene encased in accordance with AWWA C105. Polyethylene encasement shall be Class C (carbon black) and shall be minimum 8 mil thickness. Tape for securing the film shall be a thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, asphaltic coating, and polyethylene. Tape shall have a minimum thickness of 8 mils and a minimum width of 1 inch. The polyethylene film envelope shall be as free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw materials. There shall be no other visible defect, such as holes, tears, blisters, or thinning out at folds.

10. Tapping and Bonding:
  - a. In cases where corporation stops are to be tapped into mains, pipe wall thickness shall be furnished as specified in AWWA C151 to provide four threads or pipe saddles shall be furnished as approved by manufacturer. All PVC pipe must have tapping saddles.
  - b. Cable bond conductor or electrobond conductivity straps shall be installed on all ductile iron piping to maintain electrical continuity across joints. Continuity across valves and fittings shall be made with multiple conductivity straps connected in series. Lead-tipped gaskets or bronze wedges will not be allowed.
11. Cutting in and Repair Tees and Sleeves and Tapping Tees: Cutting-in and repair tees and sleeves and tapping tees shall be of ductile or cast iron with the same rated working pressure of the pipe in which they are installed but no less than 150 psi.
12. Exterior Joints, Fittings, and Gaskets: Joints, fittings, and gaskets shall have the same rated working pressure of the pipe in which they are installed but no less than a minimum rated working pressure of 150 psi.

C. Reinforced Concrete Pipe:

1. Reinforced concrete pipe for sanitary sewer and storm sewer shall meet the requirements of ASTM C76, or ASTM C361 Low Head Pressure Pipe for circular pipe, ASTM C507 for elliptical pipe, ASTM C655 for D-load pipe, or ASTM C1433 for box culvert pipe. All pipes shall have a smooth interior wall. (Sanitary sewer pipe shall be provided with either a smooth exterior wall (i.e., no bell) or with an R-4 big bell joint and shall be Class IV minimum. Sanitary sewer pipe shall be D-load reinforced concrete pipe meeting ASTM C655. Manufacturer shall provide pipe design calculations for proposed installation loading as part of shop drawing submittals.) Strength and class of the pipe shall conform to the Drawings and as specified herein. All reinforced concrete pipe used in the work shall be of adequate strength to support the trench loads applied. Unless otherwise shown or specified, all reinforced concrete pipe shall be Class 3 minimum and shall have a minimum "B" wall construction. All reinforcing cages shall be circular for circular pipe. All reinforcing cages shall be elliptical for elliptical pipe. Reinforcing cage shall extend to the full width into the bell end of the pipe and to within 1 inch of the spigot end of the pipe.
2. Standard and special fittings shall be of approved manufacturer and shall conform to requirements of the trade and these specifications. All fittings shall be of a strength at least equal to that of the sewer main and shall be jointed with the same type of joint as used in the sewer main.
3. Not more than one lift hole per length of pipe shall be used in storm sewer. Lift holes will not be permitted in sanitary sewers.
4. Reinforced concrete pipe and fittings shall be provided with joints and gaskets that meet ASTM C1628 for sanitary sewer pipe and ASTM C443 or ASTM C361 for storm sewer pipe. Joints for sanitary sewer shall be sealed with rubber gaskets of either continuous O-ring or profile cross section. Joints for circular and elliptical storm sewer shall be sealed with rubber gaskets having a continuous O-ring cross section, Tylox Superseal, or equal. All pipe shall be specifically built to fit the gasket used. Provide precast concrete endwalls on all storm sewers.
5. All reinforced concrete pipe used for sanitary sewer shall be vacuum tested from end to end at the factory in accordance with ASTM C1214. Test results, date, pipe class, date of manufacture, and individualized pipe i.d. shall be clearly marked on each pipe. Written vacuum test results for each pipe i.d. shall be kept and submitted to ENGINEER. ENGINEER shall be provided an opportunity to observe all tests.
6. Nonstandard pipe lengths may be used at manholes and structures as necessary to allow them to be located at the locations identified on the Drawings. Reinforced

concrete bends, tees, and reducers shall be manufactured to provide for the required transitions as shown on the Drawings. Sufficient additional reinforcement shall be added at the spring lines and top and bottom of the pipe to prevent shearing after installation. Repairs to complete fabricated pipe fittings shall be such that the completed unit shall have the same strength as that of the remainder of the pipe barrel and the concrete used to complete the section shall not spall or separate.

7. Concrete apron endwalls for concrete pipe sewers shall be manufactured with reinforcement and concrete conforming to the pertinent requirements for minimum Class II, Wall B, reinforced concrete pipe as specified in ASTM C76. Concrete apron endwalls for concrete elliptical pipe sewers shall be manufactured with reinforcement and concrete conforming to the pertinent requirements for Class HE-III reinforced concrete elliptical pipe as specified in ASTM C507. Joint ties shall be installed at the last two downstream joints on any pipe run ending in an apron endwall that is constructed with reinforced concrete pipe of any type or size, as shown on Drawing 01-975-31A. Pipe gates shall be installed on reinforced concrete apron endwalls as shown on Drawing 01-975-30A.
8. Acceptance of reinforced concrete pipe shall be on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections.
9. Cement used in the manufacture of reinforced concrete pipe shall meet the requirements of ASTM C150, Standard Specification for Portland Cement for Type II cement.
10. A three-edge bearing test shall be conducted by the manufacturer according to ASTM C497 as proof of design by determining the ultimate load capacity of the pipe. One segment of pipe from each pipe class must pass the three-edge bearing test such that the load required to produce the ultimate load exceeds the load rating of the pipe. The test results shall be maintained in a log and provided to OWNER. Manufacturer shall also maintain concrete cylinder testing data and quality control records to verify that pipe meets the required ASTM standards.
11. An alkalinity test shall be conducted on the concrete mixture used for each type and class of reinforced concrete pipe used in the Project. The alkalinity test shall be conducted according to ASTM C497 and the alkalinity of all concrete mixtures shall be equal to or greater than 0.2 grams of CaCO<sub>3</sub> equivalent reactivity per gram of concrete. The manufacturer shall complete the alkalinity tests.
12. The costs of the tests shall be incidental to the pipe cost. CONTRACTOR shall include all such costs in the price bid for the Work. CONTRACTOR shall submit a signed, dated, and certified copy of the test data to OWNER (in a format acceptable to OWNER) for review prior to delivering any pipe to the Project site. No additional compensation will be made to CONTRACTOR for the required testing.
13. The pipe leakage shall not exceed 150 gallons/day/inch inside diameter/mile of pipe. The manufacturer shall provide a written and signed statement indicating the pipe meets this criterion.
14. CONTRACTOR shall provide written certification that pipe meets the standards herein.

D. Perforated Piping:

1. Perforated pipe and fittings shall be heavy-duty corrugated polyethylene conforming to ASTM F405 and ASTM F667. Pipe and fittings shall be provided as shown on the Drawings and in accordance with ASTM F449.
2. Adapters with band seals shall be provided when joining with pipe of different materials.
3. Pipe shall be as manufactured by Advance Drainage Systems, Inc., Hancor, Inc., or equal.

4. See detail on Drawings for laying conditions.
  5. Fabric shall be provided in accordance with manufacturer's instructions. Minimum lap shall be 18 inches. All laps shall be tacked or pinned to prevent separation during installation.
- E. Copper Water Tubing:
1. Copper tubing installed within trenches shall be Type K soft annealed seamless copper tubing and shall conform to the Specifications of ASTM B88. All other copper shall be Type K hard copper conforming to ASTM B88.
  2. Fittings shall be of the flared or compression type. Unions shall be extra heavy three-part unions only. Joints shall not be used under floor slabs.
  3. The name or trademark of the manufacturer and a mark indicating the type shall be permanently and plainly marked on tubing.
  4. Fittings for copper tubing shall be copper alloy meeting the requirements of AWWA C800-14. The maximum lead content shall be 0.25%. They shall have uniformity in wall thickness and strength and shall be free from any defect that may affect their serviceability.
  5. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer.
  6. Shutoff valves shall be placed on each branch for all underground piping.
- F. PVC Piping—Chemical Feed and Chemical Solution Piping:
1. PVC Pipe (Schedule Pipe)—Less Than 4 Inches: PVC Schedule pipe less than 4 inches in diameter shall conform to the requirements of ASTM D1785 for Schedules 40, 80, or 120. Pipe shall be solvent weld type conforming to ASTM D2855 with bell conforming to ASTM D2672. Pressure rating for pipe supplied shall be minimum 150 psi. PVC pipe diameter shall conform to galvanized iron or steel pipe sizes (IPS).
  2. Provide tracer wire as specified.
- G. Solid Wall PVC:
1. Polyvinyl chloride (PVC) pipe shall meet the requirements of ASTM D3034 for pipe sizes 4 inches through 15 inches and ASTM F679 for pipe sizes 18 inches through 60 inches.
  2. PVC material for ASTM D3034 pipe shall have cell classification 12454 or 12364 as defined in ASTM D1784 with minimum modulus of elasticity of 400,000 psi. Pipe stiffness shall be minimum 46 psi when tested in accordance with ASTM D2412. Pipe shall have a maximum standard dimension ratio (SDR) of 35.
  3. PVC material for ASTM F679 pipe shall have cell classification 12454 or 12364 as defined in ASTM D1784 with a minimum modulus of elasticity of 500,000 psi. Pipe stiffness shall be a minimum 115 psi when tested in accordance with ASTM D2412.
  4. Pipe and fittings shall be the product of one manufacturer, and the manufacturer shall have experience records substantiating acceptable performance of the pipe and fittings to be furnished. The minimum wall thickness of fittings shall be the same as the pipe to which it connects.
  5. Acceptance of piping and fittings shall be subject to tests conducted in accordance with ASTM D3034 and/or ASTM F679.
  6. Fittings such as saddles, elbows, tees, wyes, and others shall be of material and construction corresponding to and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.
  7. Joints shall be of the elastomeric type for pipes 4 inches or larger and elastomeric or solvent cement for pipes less than 4 inches.

8. Elastomeric joints shall be a bell and spigot joint conforming to ASTM D3212 sealed by a rubber gasket conforming to ASTM F477 so that the assembly will remain watertight under all conditions of service, including the movements resulting from the expansion, contraction, settlement, and deformation of the pipe. Bells shall be formed integrally with the pipe and shall contain a factory-installed positively restrained gasket.
  9. Solvent cement joints shall be assembled using solvent cement obtained from the pipe manufacturer, which conforms to the requirements of ASTM D2564.
  10. The assembled joint shall pass the performance tests as required in ASTM D3212.
- H. Grinder Pump Pressure Sewer Pipe and Fittings (Less Than 4 Inches):
1. Grinder pump pressure sewer pipe and laterals shall be constructed of PVC conforming to ASTM D1785 for Schedules 40, 80, or 120 or to ASTM D2241, Class 250, SDR 17 with solvent weld joints.
  2. All fittings shall be solvent weld, 1120 PVC, Schedule 40 conforming to ASTM D2466 or Schedule 80 in accordance with ASTM D2467. Threaded fittings shall be Schedule 80 minimum conforming to ASTM D2464.
  3. All fittings and joints shall have a working pressure rating at least equal to the pipe to which they are attached. Fittings shall be compatible with the above specified SDR PR or Schedule Pipe. All PVC fittings outside of manholes shall have socket or bell ends. Transitions to curb stops shall be socket type on the PVC side and threaded on the curb stop side. Fittings inside manholes shall be as shown on the Drawings. All PVC pipe and fittings shall be approved by the National Sanitation Foundation and shall bear their mark of approval.
  4. Provide tracer wire as specified.
- I. Open Profile Wall PVC (18 Inches and Larger Pipe Only):
1. Open profile PVC pipe and fittings shall meet the requirements of ASTM F794. Fittings shall also conform to ASTM D3034 SDR 35. Pipe shall have smooth interior with a ribbed exterior. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of gaskets without additional cutting or matching. Pipe shall have solid wall cross section; no voids between inner and outer surfaces of pipe wall.
  2. PVC materials shall have cell classification 12454 as defined in ASTM D1784 with minimum modulus of elasticity of 400,000 psi. Pipe stiffness shall be minimum 46 psi when tested in accordance with ASTM D2412. Impact strength shall equal or exceed values given in ASTM D3034 or F679.
  3. Pipe and fittings shall be the product of one manufacturer and the manufacturer shall have an experience record substantiating acceptable performance of the pipe to be furnished. Fittings shall be injection molded.
  4. All joints shall be of the flexible elastomeric type with bells and spigots conforming to ASTM D3212. Gaskets shall conform to ASTM F477. All bells shall be formed integrally with the pipe. Elastomeric gasket shall be positively restrained in ribs on spigot of pipe.
  5. Acceptance of piping shall be subject to tests conducted by an approved testing agency in accordance with ASTM F794.
  6. Fittings such as saddles, elbows, tees, wyes, and others shall be of material and construction corresponding to, and have a joint design compatible with, the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe. Fittings shall be molded.
  7. Joints shall be sealed with elastomeric gaskets meeting the requirements of ASTM F477. Solvent cement shall not be used to join pipe lengths or fittings to pipe

lengths. The assembled joint shall pass the performance tests as required in ASTM D3212.

8. The pipe wall will be homogeneous and contain no seams. Minimum pipe stiffness per ASTM D2412 shall be 60 psi for 18 inches and 46 psi for 21 inches and larger pipe sizes. Pipe shall withstand impact of 220 foot pounds. Standard lengths shall be 13 foot or 20 foot lengths. Pipe shall withstand flattening up to 60% without cracking, splitting, or breaking and pass acetone immersion in accordance with ASTM D2152.

J. Gravity Sanitary Sewer Service Branches and Laterals:

1. Branches (tees and wyes) shall be of the same material as the main except for reinforced concrete pipe used for sanitary sewer. For reinforced concrete pipe, special branches shall be furnished and installed to accept the lateral. Such special branches are subject to review by ENGINEER.
2. If a different thermoplastic material is specified for laterals than for the main line, appropriate solvent welds, fittings, transition couplings, and other appurtenances shall be provided to effect a water tight seal.
3. Fittings for laterals shall be of the same material as the lateral pipe unless special fittings are needed for transition between material types or sizes or standard fittings are not manufactured.
4. Where the wye or tee branches and laterals are of dissimilar materials, CONTRACTOR shall provide a transition coupling for the connection.
5. All fittings used, including type of jointing, are subject to review by ENGINEER.

K. Steel or Aluminum Corrugated Pipe:

1. Corrugated pipe composed of corrosion protected steel or of aluminum shall meet the requirements of AASHTO M36 and of structural steel plate shall meet the requirements of M167. Pipe provided shall be new and free of defects and scale. Pipe and fittings that are dented, deformed, or have damaged coatings shall be removed from the site at CONTRACTOR's expense.
2. The average inside diameter of circular pipe shall not vary more than 1/2 inch or 1%, whichever is greater, from the nominal diameter.
3. The span and rise dimensions shall not vary more than 1 inch or 2% of the equivalent circular diameter, whichever is greater.
4. Coupling bands shall conform to AASHTO M36 and shall be made of the same base metal as the pipe. The bands shall not be less than 7 inches wide for diameters of 8 inches to 30 inches, inclusive; not less than 12 inches wide for pipe with diameters 36 inches to 60 inches, inclusive; and not less than 24 inches wide for pipe with diameters greater than 60 inches. Such bands shall be so constructed as to lap on an equal portion of each of the pipe sections to be connected and preferably shall be connected at the ends by galvanized angles having minimum dimensions of 2 inches by 2 inches by 3/16 inch.
5. All connections shall be shop fabricated where possible.
6. All cuts in corrugated pipe and pipe arch shall be saw cut. Connections cut in the field shall be saw cut with a saddle connection of 16-gauge material bolted on the corrugated pipe with 1/2-inch-diameter galvanized bolts.

L. Force Main:

1. Force main pipe shall be PVC piping, pressure class 235 psi, DR 18, meeting the requirements of AWWA C900 or AWWA C905.
2. Markings on the pipe shall include the following: Nominal pipe size, type of plastic pipe material, DR number, AWWA designation with which the pipe complies, and manufacturer's name.

3. Fittings on PVC pipe shall be ductile iron mechanical joint conforming to requirements specified for ductile iron fittings with appropriate transition fittings and gaskets.
4. Push-on joints for PVC piping shall be restrained with MEGALUG® Series 1500 (AWWA C900) by EBAA Iron Sales, Inc., Uni-Flange® Series 1350 by Ford Meter Box Co., Inc., or equal. PVC piping with ductile iron mechanical joint fittings shall be restrained with MEGALUG® Series 2000 PV by EBBA Iron Sales Inc., Uni-Flange® Series 1500 by Ford Meter Box Co., Inc., or equal.

M. PVC Pipe (AWWA) and PVC Pressure Pipe Fittings (4 Inches and Larger):

1. PVC water main shall be AWWA PVC pressure-rated pipe and shall conform to the requirements of AWWA C900 for pipe from 4 inches to 60 inches. Pipe shall be furnished with integral elastomeric bell and spigot joints.
2. PVC pipe diameter shall conform to ductile iron pipe sizes (DIPS). The type of PVC material, nominal pipe size, standard dimension ratio, and pressure class shall be not less than pressure class 235 and not greater than pipe dimension ratio 18.
3. Markings on pipe shall include the following: Nominal pipe size, type of plastic pipe material, DR number, AWWA Designation with which the pipe complies, manufacturer's name, and the seal or mark of the laboratory making the evaluation of the suitability of the pipe for transport of potable water.
4. All fittings for PVC pressure pipe shall be iron pipe fittings as specified herein.
5. Provide tracer wire for underground PVC piping as specified herein, unless otherwise noted.

N. HDPE Water Piping:

1. Buried HDPE piping may be used instead of buried copper piping for PW, NPW, DEW piping 2-inch diameter or less.
2. HDPE piping shall be copper tube size (CTS) and meet NSF Standard 61.
3. Resin Compounds: Polyethylene materials used shall be of HDPE, meeting 1600 Design Stress @ 23°C or 1000 Design Stress @ 60°C, applicable requirements for PE4710 pipe and tubing as defined by ASTM D-3350, Cell Classification 445576E. All HDPE services shall meet the requirements of AWWA C901 with a pressure class not less than 160 and shall not have a dimension ratio greater than 9. HDPE pipe shall be manufactured according to ASTM 3035 and with material conforming to PE code PE3408. HDPE shall be installed using one continuous coil of pipe. No unions or joint of any type will be acceptable during the installation of the pipe.
4. Piping shall be permanently indented every two feet along the pipe barrel, identifying the pipe with manufacturer's name or logo, pressure rating, nominal size, NSF logo, and QC control codes.
5. HDPE pipe fittings shall be compatible with and from the same manufacturer as HDPE piping, shall be equal in material and construction to that of HDPE piping, and shall be fusion butt-welded to piping.
6. Fusion welding of HDPE piping shall be in accordance with applicable standards, codes, and specifications. Welders shall be trained and certified for this practice. CONTRACTOR shall provide certification similar to that specified under Section 33 00 10, Paragraph 1.03 for welders if requested and all welds are subject to testing as specified.
7. Shut off valves shall be placed on each branch of underground piping as specified or as shown on Drawings.
8. Brass quick joint couplings (Ford Meter Box Company, or equal) made specifically for HDPE piping may be used on a limited basis and subject to approval by ENGINEER.

Couplings shall conform to AWWA Standard C800. Couplings shall meet NSF 61. No couplings shall be installed under floor slabs.

9. Provide tracer wire as specified with buried HDPE piping.
- O. HDPE Corrugated Pipe:
1. Corrugated pipe composed of high density polyethylene shall meet the requirements of AASHTO M252 and M294. Pipe and fittings shall be made from virgin polyethylene compounds conforming to ASTM D3350.
  2. Pipe shall have interior smooth inner wall of full circular cross section with an integrally formed outer corrugated wall AASHTO Type S designation.
  3. Fittings may be molded or fabricated and shall not impair the integrity or function of the pipe. Only fittings supplied or recommended by pipe manufacturer shall be used. Where elastomeric gaskets are required, they shall conform to ASTM F477.
- P. HDPE Pipe and Fittings:
1. HDPE pressure rated pipe shall conform to the requirements of AWWA C906 for pipe from 4 inches through 65 inches. HDPE pipe shall be manufactured from material conforming to PE Code PE4710.
  2. HDPE pipe outside diameter shall conform to ductile iron pipe sizes (DIPS). The type of HDPE material, nominal pipe size, standard dimension ratio, and pressure rating shall be not less than pressure class 250 and not greater than a dimension ratio (DR) 9.
  3. Markings on the pipe shall include the following: Nominal pipe size, type of plastic pipe material, DR number, pressure class rating, manufacturer's name, and the seal or mark of the laboratory making the evaluation of the suitability of the pipe for the transport of potable water.
  4. Fittings for HDPE pipe shall conform to AWWA C906 and shall have the same pressure rating as the pipe in which they are installed.
- Q. Surface Water Crossings: Unless indicated otherwise on the Drawings, pipe for water crossings shall be ductile iron, Flex-Ring, or Lok-Ring by American Cast Iron Pipe Company, TR Flex by U.S. Pipe Company, or equal. Type of joint is subject to the review of ENGINEER and approval of OWNER. Mechanical joints with retainer glands will not be allowed.
- R. Transition Couplings for Gravity Sewer Service: Transition couplings shall be provided to join dissimilar pipe materials or to connect pipe where a standard pipe joint cannot be provided. Couplings shall be designed to join the pipe materials matching flow line elevations. Transition couplings for gravity sewer service shall be Fernco 5000 RC Strongback, Mission Flex Seal ARC Shielded, or equal. Shear rings shall be provided to minimize differential settlement. All bands, clamps, shear rings and other metal components shall be stainless steel. Bushings or transitions shall be provided to accommodate pipe size differences.
- S. Miscellaneous Pipe:
1. Piping needed for repair or reconstruction of existing utilities and appurtenances shall be of the same type and strength as the existing. The type of jointing used in repair and reconstruction shall be reviewed by ENGINEER. Special fittings shall be furnished and installed as necessary for repair, reconstruction, or connection of existing facilities.

2. All special fittings on or for connection to utilities shall be specifically built for the type of gasket used. Special fittings shall have joints of the same type as the utility to which the connection is being made.
3. When sanitary sewer construction is within 50 feet of a potable well, 200 feet of a municipal well, or as requested by ENGINEER, a water main equivalent pipe shall be used. To transition from water main equivalent pipe to pipe normally supplied, a transition pipe with suitable joints to mate the two different pipes shall be supplied. No field constructed transitions will be allowed unless reviewed by ENGINEER and approved by OWNER. Construction shall not proceed until proper transition pipe is supplied.

T. Tracer Wire:

1. Provide minimum 10-gauge solid insulated copper tracer wire with buried thermoplastic pressurized pipe. Wire shall be continuous, terminate, and be accessible at manholes, fire hydrants, or at test stations as specified below. Tracer wire shall be located 12 inches above the top of the pipe. Any splices in copper wire shall be made with a 3M™ DBR/Y-6 splice kit, or equal.
2. Tracer wire test stations shall be SnakePit magnetized tracer boxes by Copperhead Industries, or equal. Tracer box shall be corrosion-resistant brass wire lugs and wax pad to cover wire connection. Cover shall be color-coded according to APWA standards for fluid conveyed. Provide SnakePit Lite Duty Box in unpaved areas and Roadway Box in paved areas. Provide Rhino Triview Marker Posts, or equal, at all test stations. Provide custom decals to identify fluid in piping. The tracer wire shall be accessible at a minimum of every 500 feet along the pipeline and at horizontal bends in piping. The tracer wire shall run into and up the sides of all manholes and be secured near the casting. Test stations shall be placed as required between manholes to comply with the minimum 500-foot tracer wire accessibility requirement.
3. CONTRACTOR shall perform continuity testing of all tracer wire in the presence of OWNER and ENGINEER.

2.04 VALVES

A. The following valves shall be used on the Project:

Valve Applications	Type
Water Main ≤12 Inches	Resilient Wedge Gate Valves
Water Main >12 Inches	Butterfly Valves
Force Main	Plug Valves

B. Gate Valves:

1. Shutoff valves in potable and non-potable water lines 4-inch diameter and larger shall be AWWA C515, ductile iron AWWA C509, cast iron, resilient seat, nonrising stem, OS&Y (rising stem) for wastewater applications, mechanically jointed, and open counterclockwise. All gate valves shall be M&H valve company 4067-01, American Flow Control Series 2500, Kennedy 4571, Clow F-6100 or an approved equal.
2. Where shown or specified, gate valves in lines 4 inches in diameter or larger shall be AWWA C500 iron body, bronze-mounted, nonrising stem, double-disc, parallel seat, Class 150, O-ring stem seals.

C. Corporation Stop and Curb Stop Valves:

1. Performance Requirements: Lead Free Requirements: All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe,

fittings and fixtures in potable water systems that have a weighted average lead content  $\leq 0.25\%$  per the Federal Safe Drinking Water Act as amended January 4th, 2011 Section 1417. All products used in potable water systems shall be UL classified in accordance with ANSI/NSF 61 for potable water service and shall meet the low lead requirements of NSF 372.

2. Corporation Stop Valves 2 Inches and Smaller: Bronze body ground key valve, bronze plug, AWWA taper thread inlet and copper flare outlet nut connections or compression type, AWWA C800.
3. Curb Stop Valves: Boxes 2 Inches and Smaller: Bronze body plug valve, bronze plug, quarter turn check, O ring seals, copper flare nut connections or compression type, AWWA C800. Provide Minneapolis pattern, Mueller H-10300, Ford EM 2-65-56, A.Y. McDonald 5614 or an approved equal curb box complete with lid and stationary rod.
4. Valve boxes shall be Clow three-piece ductile iron valve box, or approved equal. All valve boxes shall be american made. Valve stem extensions shall be provided for valves deeper than 8 feet.
5. Corporation stops used for HDPE shall be compressing fittings, Mueller B25008, Ford F1001, A.Y. McDonald 4701-22 or an approved equal with stainless steel stiffeners. If copper services are requested, corporation stops shall be Mueller H15154, Ford B22-M, A.Y. McDonald 6104, or an approved equal.
6. Tapping saddles for service lines shall be Romac 202N, or Smith Blair 317.

## 2.05 FIRE HYDRANTS

- A. Fire hydrants provided under these Standard Specifications shall conform to AWWA C502 for Dry Barrel Fire Hydrants. Hydrants shall have the following features:

Bury Length	Approximately 7 1/2 feet to traffic flange.
Nozzle Size	One 4 1/2-inch- and two 2 1/2-inch-diameter openings.
Nozzle Threads	National standard fire hose coupling screw threads.
Drain Port:	Drain port at base of hydrant barrel. Plug drain port when hydrant installed in area where groundwater level may rise above drain port.
Size of Main Valve Opening	5 1/4-inch-diameter minimum. The hydrant lead connection shall be minimum 6-inch-diameter mechanical joint.
Torque Requirements	Hydrant shall comply with AWWA C502 even if greater than 5-foot bury.
Lubrication	Nontoxic and providing proper lubrication for a temperature range of -30°F to +120°F.

- B. Hydrants shall have permanent markings identifying the manufacturer by name, initials, insignia, or abbreviations in common usage, and designating the size of the main valve opening and the year of manufacture. Markings shall be so placed as to be readily discernible and legible after hydrants have been installed.
- C. CONTRACTOR shall furnish certification to ENGINEER that the hydrant and all material used in its construction conform to the applicable requirements of AWWA C502 and the supplementary requirements thereto.
- D. All joints on fire hydrant leads shall be made using pipe restraint specified herein. Approximately 1/2 cubic yard of bedding stone shall be placed from the bottom of the trench around the hydrant elbow and up the hydrant barrel. Bedding stone shall be wrapped completely in filter fabric to prevent the in migration of fine materials.

- E. CONTRACTOR shall furnish all necessary fittings in the fire hydrant lead to install the fire hydrant in a plumb condition at locations shown on the Drawings and at the specified depth of bury. The pumper nozzle of all fire hydrants shall be installed with the nozzle pointing toward the street. ENGINEER reserves the right to alter the location of fire hydrants from that shown on the Drawings.
- F. Hydrants shall be installed as shown on Drawing 01-975-65A.
- G. Fire Hydrant:
  - 1. Fire hydrant shall be Waterous W-67 Pacer, or equal with a minimum 7-foot bury depth.
  - 2. Hydrant to be painted red.
  - 3. Provide restrained joint system from auxiliary valve in road box back to tee.
  - 4. Connect hydrant to auxiliary valve with 2-foot length of pipe.
  - 5. Provide drain port at base of hydrant barrel. Plug drain port when hydrant installed in area where groundwater level may rise above drain port.
  - 6. All hydrants shall be marked with a 5-foot tall stainless spring and mounting bracket, fiberglass rod covered with red and white reflective tape. CONTRACTOR shall use Vait Senior Hydrant Marker LRS8500W-R&W-30501, or equal.

## 2.06 CONCRETE

- A. All concrete poured under this Contract, unless shown or specified otherwise, shall conform to the requirements of Division 03.

## 2.07 AGGREGATE SLURRY (FLOWABLE) BACKFILL

- A. Aggregate slurry (flowable) backfill shall consist of fine and coarse aggregate conforming to ASTM C33. Coarse aggregate shall be size number 67 and fine aggregate shall be size number 4. The material shall be mixed with water to provide an approximate 3-inch slump. The mix shall be deposited in the trench from ready-mix concrete transit mix trucks and shall be consolidated using concrete vibrators or vibratory plate compactors.

## PART 3-EXECUTION

### 3.01 INSTALLATION

- A. Underground Piping:
  - 1. Utility lines shall be laid and installed to the lines and grades specified with valves, fittings, manholes, and other appurtenances at the specified locations; spigots centered in bells; and all manholes and riser pipes plumb. All water main, sewer main, water services and sanitary laterals shall have a minimum of 6.5 feet of cover but shall be deep enough to provide service to buildings. Water main, force main, and other pressure mains shall be installed to within (plus or minus) 0.1 feet of designed grades. Sanitary and storm sewer and laterals shall be installed to within (plus or minus) 0.03 feet of designed grades. Service lines shown on the Drawings are approximate. Staking shall be completed in conformance with Division 01 of the Standard Specifications.
  - 2. Deviations Occasioned by Underground Facilities: Wherever significant obstructions not shown on the Drawings are encountered during the progress of the Work, CONTRACTOR shall proceed in accordance with the general contract documents to

notify owners and protect the facilities. Existing items unnecessarily damaged during the performance of the Work shall be repaired and replaced at the expense of CONTRACTOR.

3. Prior to commencing pipe laying, CONTRACTOR shall notify ENGINEER of the intended date for starting Work. ENGINEER may request at CONTRACTOR's expense the removal and relaying of pipe which was installed prior to notification of ENGINEER.
  - a. Proper implements, tools, and facilities shall be provided and used by CONTRACTOR for the safe and convenient prosecution of the Work. All pipe, fittings, and appurtenances shall be carefully lowered into the trench piece by piece with a crane, rope, or other suitable tools or equipment, in such manner as to prevent damage to materials. Under no circumstance shall pipe be dropped or rolled into the trench.
  - b. Materials shall be as shown on the Drawings or as specified herein.
4. Material Inspection: CONTRACTOR shall inspect the pipe, fittings, and appurtenances for defects when delivered to the jobsite and prior to lowering into the trench. Defective material shall be removed from the jobsite. All material shall be clean and free of deleterious substances prior to use in the Work.
5. Except where noted or specified, all ductile iron underground piping shall be laid in accordance with AWWA C600 or AWWA C605 with the conditions that (a) blocking shall not be used to support pipe and (b) all bends and fittings shall be restrained as specified below, and pipe joints shall be restrained in all directions from all bends and fittings to the length as specified below.
6. For restrained pipe joints, all underground ductile iron pipe joints (except for the branch of tees and dead ends) shall be restrained to the length listed below in all directions from all bends and fittings. The branch of tees shall be restrained to two times the length listed below. Dead ends shall be restrained to 2.5 times the length listed below. All joints on yard and fire hydrant leads shall be restrained. Where wall penetrations occur at less than the length indicated below, the wall fittings shall also be restrained. Additional restraint shall be provided inside of structures as required.

MINIMUM LENGTH (IN FEET)  
 RESTRAINED PIPE FROM BENDS OR FROM BENDS OR FITTINGS  
 (POLYWRAPPED AND MINIMUM 6 FEET BURY DEPTH)

Pipe Size, Inches	Test Pressure, psi				
	10	25	50	100	150
3 to 12	5	18	18	36	36
14 to 18	5	18	18	36	54
20 to 24	5	18	36	54	72
30	10	18	36	72	90
36	10	18	36	72	
42	10	36	54	90	
48	10	36	54	90	

7. Force main and water main shall be installed in accordance with AWWA C605 for PVC pipe, and AWWA M55 for HDPE pipe. All plugs, caps, tees, hydrants, bends, and other fittings for water mains and force mains shall be provided with restrained joints.

8. PVC sewer and plant drain piping shall be installed in accordance with ASTM D2321. Except where noted or specified, PVC or other thermoplastic pressure piping shall be installed in accordance with ASTM D2774.
9. Except where noted or specified, reinforced concrete pipe shall be installed in accordance with ASTM C12.
10. Plumbing system shall be installed and tested in accordance with local and state plumbing code requirements. Where requirements conflict, the stricter standard shall apply.
11. CONTRACTOR shall lay all gravity pipe to the line and grade shown on the Drawings with bell ends uphill wherever possible. If not possible, CONTRACTOR shall lay pipe to the line and grade shown on the Drawings with bell ends in the direction of laying. Water piping and shall have a minimum of 6 1/2 feet of cover. Unless shown otherwise, drainage piping shall clear floor slabs or footings by a minimum of 6 inches.
12. Any pipe or fittings cracked in cutting or handling or otherwise not free from defects shall not be used. Pipe must be kept clean of mortar, cement, clay, sand, or other material. When PVC piping is installed during hot weather, it shall be laid in the trench with slack or permitted to cool to ground temperature before it is cut to length for making final connections. PVC expansion joints shall be provided where needed.
13. At times when pipe laying is not in progress, the open ends of pipe shall be closed with plugs to prevent the entry of foreign material. Acceptable plugs include Foreman Nite Caps by APS, mechanical joint cap or plug, bladder plug, or test plug. All foreign material shall be removed from the pipe prior to acceptance.
14. The locations and elevations of existing piping and manholes are approximate. Where necessary, existing piping shall be exposed by CONTRACTOR to confirm location and elevation before installing new piping. Any changes in pipe location or elevation shall be approved by OWNER.
15. General Excavation:
  - a. Pipe Laying:
    - (1) All pipe shall be laid accurately to the line and grade as designated. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be joined or of the factory made jointing material shall be clean and dry. Lubricants, primers, adhesives, and other joint material shall be used and installed as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a workmanlike manner as to obtain the degree of watertightness specified. Pertinent specifications from the joint and pipe manufacturer which outline procedures to be followed in making the joint shall be furnished to ENGINEER.
    - (2) Wyes, tees, and special fittings shall be installed as called for on the Drawings, or as requested by ENGINEER. Wyes, tees, and special fittings, shall, in general, be jointed with the same type of joint as used in the pipe.
    - (3) In joining two dissimilar types of pipe, manufactured adapters and fittings shall be used. Adapters and fittings shall be configured to maintain invert elevations at same level.
    - (4) Joint deflections shall not exceed the limits established by the pipe manufacturer for the pipe and joint being used.
    - (5) Joints that are damaged because of carelessness, improper handling, or failure to prevent imperfections in manufacture shall be subject to rejection and gaskets shall be subject to rejection whenever they show surface cracking, tears, or splice separation.

- (6) At times when pipe laying is not in progress, the open ends of pipe shall be closed with plugs to prevent the entry of foreign material. All foreign material shall be removed from the pipe prior to acceptance.
  - (7) After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with specified backfill material tamped around it except at the bells.
  - (8) Pipe shall be brought home by using a cross member and levers or jacks. It will not be permissible to push pipe home with motor powered excavation equipment.
  - (9) Force main and water main shall be installed in accordance with AWWA C600 for iron pipe, AWWA C605 for PVC pipe, and AWWA M55 for HDPE pipe. All plugs, caps, tees, hydrants, bends, and other fittings for water mains and force mains shall be provided with restrained joints.
- b. Sewer Service Branch and Lateral Installation:
- (1) CONTRACTOR shall furnish and install sanitary sewer and storm sewer branches, laterals, and leads as shown on the Drawings or requested by ENGINEER. Under normal circumstances, service laterals will be installed within the right of way or easement to serve all existing buildings and all platted lots. Any utility main installed, that will be maintained by the Town of Brookfield Sanitary District No. 4 shall be within a utility easement. The easement description and an easement figure shall be provided to the Sanitary District prior to construction. In certain cases, only wye or tee branches will be installed to vacant lots. Service laterals shall consist of a branch fitting at the main and extension of the specified lateral pipe to the end of lateral as called for and requested. All necessary fittings shall be furnished and installed to complete the installation as shown on Drawing 01-975-75A. All necessary fittings shall be furnished and installed to complete installation of storm sewer leads as shown on Drawing 01-975-41A.
  - (2) Wye or tee branches: Wherever shown on the Drawings or requested by ENGINEER, wye or tee branches shall be provided for use in making sanitary sewer service and storm sewer inlet connections. Unless specified otherwise on the Drawings, wye or tee branches for sanitary sewer service lateral connections to single family residences shall be 4-inch diameter. All other sanitary sewer service lateral connections shall be 6 inches. Wye or tee branches for storm sewer inlet connections shall be of the size called for on the Drawings, 12 inches minimum.
  - (3) Sanitary sewer service branches shall be turned so that the branch is at an angle of 30 degrees or 45 degrees from the horizontal.
  - (4) Sanitary Sewer Service Laterals: Under normal conditions and unless otherwise shown on the Drawings or requested by ENGINEER, all service laterals shall be Standard Laterals, Type 1, as shown on Drawing 01-975-75A. Service laterals of Types 2 through 6 may be requested by ENGINEER to meet field conditions. Laterals shall be sized to provide each structure with sanitary service. All laterals shall be installed with a minimum 2% slope, and enter the sewer main at a wye fitting not through a manhole.
  - (5) It is the general intent to install Modified Laterals, Type 2, 4, or 5 for service to homes that presently have shallow or no basements or where the depth to groundwater at the end of lateral is shallow. Types 3 and 6 risers are only to be provided where shown on the Drawings.

- (6) Installation and Testing Requirements: Except for those branches that are to be used on storm sewers or for extending sanitary sewer service laterals, wye and tee branches shall be closed with airtight stoppers blocked to withstand air test pressures.
  - (7) The ends of all laterals shall be plugged and blocked to resist air test pressures. All plugs shall be manufactured to fit the pipe used and shall be watertight. The ends of all laterals shall be marked as shown on Drawing 01-975-75A using flagging tape and 2 by 4 markers.
  - (8) Unless otherwise provided for in the Drawings, each service lateral shall have a tracer wire installed from the main to the property line or the location of the connection to the existing service, whichever is greater or applicable, and as shown on Drawing 01-975-76A. The tracer wire shall be 10-gauge solid copper with no splices. The wire shall be secured to the pipe with duct tape at a minimum of 3-foot intervals. The ends of the tracer wire shall be brought to the ground surface and stored in an access terminal box, DWS-Tracer Wire Access Box, or equal, at a location selected by OWNER. Eighteen inches of additional wire length shall be coiled at the location of the terminal box. CONTRACTOR shall confirm the method of installation is compatible with OWNER's means of detecting the location of the service lateral. Each tracer wire shall be tested by CONTRACTOR to confirm it accurately provides the location and depth of the sewer lateral.
  - (9) A complete and accurate tabulation of length, depth, and location of all branches, risers, and laterals shall be kept by CONTRACTOR on cards available from ENGINEER. Measurements shall be made from the nearest downstream manhole. Lateral installation to meet these Standard Specifications and field conditions are the responsibility of CONTRACTOR. Problems occurring because of failure to provide proper installation or proper records shall be corrected by CONTRACTOR at its expense.
  - (10) No installed lateral shall be backfilled until ENGINEER has been notified that the lateral is complete and reasonable time is allowed for observation of the Work.
- c. Water Service Lateral Installation:
- (1) Water service laterals requiring reconstruction and new service laterals shall be installed in accordance with AWWA C600, and as shown on Drawing 01-975-66. CONTRACTOR shall perform all excavation, backfill, and other Work necessary for a complete installation. The service tubing shall be continuous and shall be placed at a minimum depth of 6.5 feet. Each service shall include a corporation stop at the main, copper service tubing, curb stop, curb box, couplings, and all other appurtenances necessary for a complete installation. Where existing services in the street are being reconstructed, the new service shall be connected to the existing service at the property line unless otherwise shown or specified. Taps in the main shall be at an angle of 45 degrees above the horizontal.
  - (2) OWNER reserves the right to make taps and connections to the new mains prior to backfilling by CONTRACTOR. CONTRACTOR shall delay backfilling until OWNER has completed its Work.
  - (3) All curb boxes on new services shall be marked by placing a 4-foot long 2 by 4 adjacent to it. The 2 by 4 shall project 1 foot above existing ground and shall be painted blue. All services shall be extended to the street property line, unless otherwise shown or specified.

- d. Manholes:
  - (1) Manholes shall be installed in accordance with Drawing 01-975-41A for storm sewer, Drawing 01-975-42A for water main, and Drawing 01-975-43A for sanitary sewer. Manholes shall be plumb with any steps aligned and openings located over steps. For sanitary sewers, openings shall be located over the bench and not the sewer flow line itself.
  - (2) All manholes shall be made watertight and shall show no visible signs of leakage at the time of final review and within the correction period. Any leakage shall be sealed from the exterior of the manhole.
- e. Storm Sewer Inlets:
  - (1) Storm sewer inlets shall be installed in accordance with Drawing 01-975-41A. Inlets shall be set to the line and grade as furnished by ENGINEER. The outside end of the lift hole shall be covered with filter fabric to prevent the entrance of fines into the inlet.
  - (2) Inlets shall be connected to the storm sewer main either at manholes, at wye branches in the main, or to other inlets, all as shown on the Drawings. Minimum size of inlet lead pipe shall be 12 inches.
  - (3) Storm inlets shall be backfilled to undisturbed soil and at least 2 feet along connecting piping with bedding material.
- f. Masonry:
  - (1) No masonry shall be laid when the temperature of the outside air is below 40°F unless all masonry materials are heated and protected against freezing.
  - (2) Only enough mortar shall be mixed that can be conveniently used before it reaches initial set. Retempering of mortar will not be permitted.
- g. Abandoning Utilities: Utilities to be abandoned shall, unless otherwise noted on the Drawings, be abandoned in place. Open ends of pipes shall be plugged with 12 inches of concrete. Manhole barrels, valve boxes and other such structures shall be removed to a point 3 feet below existing or final ground surface, whichever is lower, and shall then be filled with backfill material compacted to that of the trench backfill. An approximate 9-inch-diameter opening shall be made in the bottom of the structure to allow for groundwater movement. Prior to abandonment of water services the Town Sanitary District #4 will remove the water meter and shut-off the service at the curb box. Abandon water services by exposing the corporation stop at the main, turning stop off, disconnecting the service line from the corporation stop, inserting a plug or cap on the exposed end of the corporation stop, and backfill excavation to existing grade. Abandonment shall include all required compacted backfill and restoration of grounds, sidewalk, pavement or other features to match surrounding conditions.
- h. Connections to and Modifications of Structures and Mains:
  - (1) Unless otherwise noted on the Drawings, openings in existing structures to allow for connection of mains shall be core drilled, and the mains themselves shall be connected by use of watertight connections as specified in the Standard Specifications. Flow channels in the bottoms of existing structures shall be modified as necessary to provide smooth transition for incoming flow and/or orientation of mains. These modifications may include breaking out and reforming flow channels.
  - (2) Where mains, new and existing, are to intersect, dog house manholes shall be provided to facilitate connection and to gain access to the intersecting mains. Manholes shall be provided at the manufacturing plant with arched openings in lower barrel section to span each of the intersecting mains. Reinforcing shall be cut and bent back. In the field, manhole shall be set on

concrete blocks, with reinforcing provided according to Drawings 01-975-41A, 01-975-42A, or 01-975-43A for the bottom slab. Concrete shall be poured under and around the manhole to seal all openings, cover and adhere to the slab and bent reinforcement, and provide for benches or fillets in the manhole. Sanitary and storm sewer mains shall be kept intact until the bench or fillet is poured. Then the top of pipe to springline shall be removed to provide access.

16. Valve Boxes: The valve box shall be centered and plumb over the wrench nut of the valve with the box cover flush with the finished ground elevation. Solid 4-inch concrete blocks shall be placed under the base of valve boxes so that the bottom of the base is about 2 inches away from contact with the valve bonnet. The valve box shall not transmit shock or stress to the valve.
17. Yard Hydrants: Yard hydrants shall be set on a slab of concrete at least 1 cubic foot in size and against a 3-cubic-foot minimum concrete brace laying against undisturbed earth. Backfill at base of hydrant shall be 1 cubic yard of coarse gravel. It shall be the responsibility of CONTRACTOR to set the hydrants at to the proper grade. Extensions or fittings shall be provided as required.
18. Trench drains, channel, and grates shall be installed according to manufacturer's requirements. Place minimum 4 inches of concrete beneath and on each side of channels.

### 3.02 FIELD QUALITY CONTROL

- A. CONTRACTOR shall include the cost of all televising, testing, cleaning, and disinfection in the price bid.
- B. Work shall be tested as specified in this section. Unless indicated in writing before testing begins, tests shall be witnessed by ENGINEER and others as necessary. Test results shall be recorded, and reports or appropriate certificates shall be submitted to ENGINEER in triplicate.
- C. New piping shall be tested. Prior to conducting the pressure and leakage test, CONTRACTOR shall backfill the trench for its full depth. All bends and special connections to the main shall be adequately blocked and tied prior to the test. Any damage caused to the main or its appurtenances during performance of these tests shall be corrected by CONTRACTOR at its expense. Should underground piping fail test, CONTRACTOR shall be responsible for removal and replacement of backfill, and relay new pipe if necessary, to repair the defective pipe. Under no circumstances shall defects be sealed from the interior of the pipe, and only where specifically allowed by ENGINEER, shall defects be sealed from the exterior of the pipe. Piping, interior or exposed, shall be subject to test before being covered with insulation or paint. Piping and appurtenances shall be watertight or airtight and free from visible leaks. Manholes and precast reinforced concrete wet wells and appurtenances shall be free of any visible leaks. Any leakage shall be sealed by methods acceptable to OWNER, from the exterior of the manhole or structure. Precast reinforced concrete manhole risers and tops shall be tested in accordance with ASTM C497.
- D. Piping shall be flushed or blown out after installation prior to testing. CONTRACTOR shall provide all necessary piping connections, water, air, test pumping equipment, water meter, bulkheads, valves, pressure gauge and other equipment, materials, and facilities necessary to complete the specified tests. CONTRACTOR shall provide all temporary sectionalizing devices and vents for testing.

E. Pressure Tests:

1. Pressure tests shall be performed as required by AWWA C600 and AWWA C605, unless otherwise noted herein.
2. When test medium for piping is water, all air shall be removed from piping by flushing, opening vents, loosening flanges, utilizing equipment vents and/or installation of corporations at high points in system. Test pumping equipment used shall be centrifugal pumps or other pumping equipment that will not place shock pressures on the main. Power plunger pumps will not be permitted for use on closed pipe systems. Pumps shall be disconnected during test periods. Presence or absence of air will be determined during pressurization of the piping system.
3. The test pressure in all lines shall be held for one hour during which time the leakage allowance shall not exceed that specified. In case repairs are required, the pressure test shall be repeated until the pipeline installation conforms to the specified requirements. Pumps, air compressors, instrumentation, and similar equipment shall not be subjected to the pressure tests. All piping conveying a combination of fluids, such as SCM/WAS, shall be tested at the higher test pressure.
4. During performance of the hydrostatic pressure test, water main shall be subjected to a minimum pressure of at least 50% above normal working pressure with a minimum pressure 125 psi. Force main shall be tested to 200% of normal operating pressure in the main, but to no more than the pressure rating of the pipe.
5. CONTRACTOR shall keep a record of all tests performed. These records shall show the individual lengths of main tested and test results.
6. Where connections are made to existing mains, it shall be the responsibility of CONTRACTOR to provide the necessary hydrostatic tests on all new mains installed. This may necessitate, but is not limited to, the installation of temporary valves and restraint to isolate the new system from the existing system. All materials, Work, and equipment necessary for this Work shall be furnished by CONTRACTOR at its expense.
7. All testing of pipelines shall proceed concurrently with installation. CONTRACTOR is encouraged to conduct daily preliminary testing of its Work.
8. Water from disinfection testing shall not be discharged to a stream, creek, river, storm sewer tributary thereto, or to a navigable water without first neutralizing the chlorine residual in the water and complying with local, state, and federal laws thereto.
9. Gauges used for testing shall have increments as follows:
  - a. Tests requiring a pressure of 10 psi or less shall use a testing gauge having increments of 0.10 psi or less.
  - b. Tests requiring a pressure of greater than 10 psi by less than or equal to 100 psi shall use a testing gauge having increments of 1 psi or less.
  - c. Tests requiring a pressure of greater than 100 psi shall use a testing gauge having increments of 2 psi or less.

F. Prior to making final connection between new and existing piping, new piping shall be tested as specified above.

G. Infiltration/Exfiltration Tests:

1. Leakage Testing:
  - a. All sanitary sewer gravity mains and drains shall be tested for leakage after installation of laterals and placement of backfill. Leakage testing of thermoplastic and iron sanitary sewer gravity mains shall be conducted in accordance with ASTM F1417. Testing of clay sanitary sewer mains shall be in accordance with ASTM C828. Testing for concrete sanitary sewer mains shall be in accordance

- with ASTM C1214. CONTRACTOR shall keep a record of all tests performed. These records shall show the individual lengths of main tested and test results.
- b. Sewers 18 inches and larger may be tested for leakage by infiltration or exfiltration in lieu of vacuum testing. Concrete pipe shall be tested per ASTM C969 except as modified herein. If groundwater is 2 feet or more above the sewer, measurements will be taken to determine the rate of infiltration into the sewer. If groundwater is below 2 feet above the sewer, the stretch of sewer shall be plugged at its downstream end and water shall be placed inside the sewer to provide a minimum of 4 feet of head above the upstream end.
  - c. Measurements will then be taken to determine the rate of leakage out of the sewer. CONTRACTOR shall furnish all labor and materials necessary for making the tests. The allowable leakage shall be as indicated below for final acceptance.
  - d. At the conclusion of construction and before final acceptance of the Work, the downstream end of all sanitary sewer will be measured for infiltration. Allowable infiltration shall not exceed 100 gallons/inch of pipe diameter/mile/day for that portion of the Work under groundwater. If infiltration is exceeded, the leak or leaks shall be located and repaired.
  - e. CONTRACTOR shall prepare all pipeline for testing and shall furnish all equipment, materials, tools, and labor necessary for performance of the tests. Equipment for the low pressure air test of gravity mains shall be equal in all operational aspects to that as furnished by Cherne Industries, Inc., United Survey, or equal.
  - f. Test apparatus and gauges shall be located such that ENGINEER or OWNER do not have to enter a confined space to verify readings.
  - g. Air and leakage testing of storm sewers will not be required.
2. Deflection Testing:
- a. All PVC pipe used for sanitary sewer shall be tested for vertical deflection. Maximum deflection after completion of backfilling shall be 5% of the inside pipe diameter. Testing shall not be started until trench backfill has been in place for 30 days. CONTRACTOR shall keep a record of all tests performed. These records shall show the individual lengths of main tested and test results. Deflection shall be measured by pulling a mandrel with a vertical diameter equal to 95% of the pipe inside diameter through the line, after thoroughly flushing the lines to be tested. The testing device shall be controlled using cables at both the upstream and downstream manholes. The testing device must pass freely through the sewer without the use of unreasonable force on the control cables. Any line that will not pass the test cylinder will not be accepted until the faulty sections have been removed and replaced and the line retested.
  - b. Deflection testing of thermoplastic storm sewer shall be provided in accordance with the above requirements.
- H. Manhole Testing:
1. Sanitary sewer and process piping manholes shall be vacuum tested in accordance with ASTM C1244. Pipes entering the manhole shall be plugged and the seal inflated in accordance with manufacturer's recommendations. CONTRACTOR shall provide all required test apparatus, including vacuum pump and gauges.
  2. Vacuum testing of storm sewer and other manholes will not be required.
- I. Televised Inspection: A color televised survey of installed sanitary sewer and storm sewer shall be provided after testing to confirm branch locations, verify cleanliness of sewer, and confirm presence or absence of sags or deviations in sewer alignment. Sewers shall be

cleaned immediately prior to the survey. The survey shall conform to NASCO PACP standards.

- J. Continuity Testing: CONTRACTOR shall provide all equipment, labor, and materials necessary to perform continuity testing of all ductile iron water mains installed. Tests shall be performed using an ohmmeter to demonstrate that electrical continuity exists across all joints. CONTRACTOR shall make all necessary repairs to establish continuity across joints.

### 3.03 CLEANING AND DISINFECTION

- A. All equipment and materials shall be clean before installation. CONTRACTOR shall disinfect and flush the potable water system before it is put online. Water main shall be disinfected according to AWWA C651.
- B. In accordance with the requirements of AWWA C651, at least one set of samples shall be collected from every 1,200 feet of new water main, plus one set from the end of the line and at least one set from each branch.
- C. CONTRACTOR shall obtain two water samples and arrange for analysis of water in potable systems for bacteria in accordance with Option A of Section 5.1 of AWWA C651. Copies of test results shall be submitted to OWNER and ENGINEER.
- D. CONTRACTOR shall furnish all water and other materials, equipment, and labor necessary to disinfect all new water mains and all existing water mains disturbed by construction. CONTRACTOR shall notify the Health Department to observe disinfection test and shall coordinate and bear cost for necessary laboratory testing and shall provide safe bacteriological sample results to OWNER prior to placing the water main in service. Sampling and testing shall be scheduled to complete the Work within the Contract Times. Items of material for testing shall be furnished in the size and quantity necessary to properly complete the test. Interruption or delay of CONTRACTOR's Work progress caused by testing and sampling shall not be cause for extra payment under the Contract nor shall they be cause for extension of Contract Time.
- E. Broken concrete, rubble fill, and other excess material shall be removed from the site and wasted.
- F. All waste disposal areas and all areas used for the storage of materials or the temporary deposit of excavated earth shall be leveled off, cleaned up, and returned to condition that existed prior to construction.
- G. All surplus material, tools, and equipment shall be removed, and the premises shall be left free of everything of the kind.

### 3.04 CLEANUP

- A. Upon completion of the work, all improvements disturbed by CONTRACTOR's operations shall be repaired or replaced. Broken concrete, rubble fill, and other excess material shall be removed from the site and wasted.

- B. All areas used for the storage of materials or the temporary deposit of excavated earth shall be leveled off and cleaned up. All surplus material, tools, and equipment shall be removed, and the premises shall be left free of everything of the kind.
- C. All pipes and manholes shall be flushed until clean, and all debris and mud shall be removed.

### 3.05 DEMOLITION

- A. All exterior piping removals, including manholes and appurtenances and abandonment, shall be by CONTRACTOR. The locations and elevations of existing piping are approximate. Where necessary, existing piping shall be exposed before installing new piping. Any changes in pipe location or elevation shall be reviewed by ENGINEER.
- B. CONTRACTOR shall remove or abandon all existing piping and appurtenances as noted. Unless otherwise shown or specified, piping and appurtenances to be removed shall become the property of CONTRACTOR and shall be removed from the site for salvage or disposal. Unless otherwise shown or specified, piping shown or specified to be abandoned shall have each end plugged with concrete or nonshrink grout. Nonshrink grout shall be as specified in Division 03. Wherever excavations cross piping to be abandoned, piping shall be removed to the limits of the excavation and the ends shall be filled as specified above.
- C. Valve boxes and exposed valves and operators on piping to be abandoned shall be removed. All concrete surfaces to remain shall be patched as required to provide a smooth surface. Repiping and connections to new piping shall be as specified for new piping.
- D. It is the responsibility of CONTRACTOR to remove the items listed below, including piping and appurtenances, as specified, and patch all holes resulting therefrom unless specified or shown otherwise. The intent of these specifications is to require that the removal of materials, patching of all existing holes, and repiping be done in a workmanlike manner. All costs shall be included in the Lump Sum Bid.

END OF SECTION

## SECTION 33 01 30

### SUMMARY OF WORK–UTILITIES

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. The Work consists of providing all the labor, material and equipment necessary to complete the following:
  - 1. Sewer Cleaning.
  - 2. Sewer Root Foaming.
  - 3. Sewer Televising.
  - 4. Sewer Bypass Pumping.
  - 5. Sewer Obstruction Removal.
  - 6. Sewer Chemical Sealing.
  - 7. Sewer Lining.
  - 8. Sewer Special Structural Liner.
  - 9. Sewer Lateral Inserts.
  - 10. Excavation Rehabilitation.
  - 11. Manhole Chemical Sealing.
  - 12. Manhole Casting and Cover Rehabilitation.
  - 13. Manhole Resurfacing and Coating.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern Work in this section.

##### 1.02 SEQUENCING

- A. Applicable provisions of Section 01 11 00–Summary of Work govern construction sequencing.

##### 1.03 EXISTING SYSTEM

- A. Applicable provisions of Section 01 11 00–Summary of Work describe the existing system.

##### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Applicable provisions of Section 01 60 00–Materials and Equipment govern the handling, storage, and protection of materials and equipment.

##### 1.05 DEFINITIONS

- A. The following definitions or abbreviations apply to the Work in this Division:
  - 1. CCTV–closed-circuit color television
  - 2. NASSCO–National Association of Sewer Service Companies
  - 3. Mobilization–The initial process of assembling, making ready, and transporting to the Project site, the necessary materials and equipment to complete the package of Work designated by OWNER. The timetable for mobilization shall be as needed to allow for completion of the Work within the time frame required by OWNER.
  - 4. Emergency Mobilization–Mobilization within the time period indicated in the Bid to meet emergency conditions as determined by OWNER.

## 1.06 SUBMITTALS

- A. Any proposed method of sewage bypass pumping shall be submitted in accordance with Section 33 01 31–Sewer Bypass Pumping.

## 1.07 MATERIALS AND SUPPLIES

- A. CONTRACTOR shall provide materials and supplies to satisfactorily complete the Work to the satisfaction of OWNER. Materials and supplies shall be suitable for the environment in which they are to be used or installed and shall be compatible with each other.
- B. Suppliers shall be deemed to impliedly warrant that their products and all component materials incorporated into them are suitable and fit for the intended use of such products and shall be free from defect in material, workmanship or design, such warranty to run to the benefit of OWNER and ENGINEER. The foregoing applies whether the products or their component parts are specified in the Contract Documents or are of supplier's design.

## 1.08 WATER

- A. Water required for the Project shall be provided by CONTRACTOR. CONTRACTOR is responsible for making all arrangements to obtain water and for its use in the Work. See Section 01 50 00–Temporary Facilities.

## 1.09 WASTE DISPOSAL

- A. CONTRACTOR is responsible for proper and safe disposal of all material removed from the sewers.

## 1.10 PAYMENT

- A. Payment for changes in quantities, as shown in the Bid, shall be made in accordance with the prices bid for the Work for the various items indicated. No change of quantities shall annul or impair the Contract made and entered into relative to said Work. Payment shall be made for the quantities of each Bid item as actually installed.
- B. If a price is not provided in the Bid for an item of Work, the Work shall be considered incidental and included in adjacent or associated items of Work.
- C. Cost for providing the following shall be considered incidental to the Work unless otherwise indicated in the Bid.
  - 1. Providing water for use in the Work.
  - 2. Removing, transporting, and disposing of material from the sewers.

## PART 2–PRODUCTS

NOT APPLICABLE

## PART 3-EXECUTION

### 3.01 SITE CONDITIONS

- A. CONTRACTOR is expected to examine carefully the site of the proposed Work and fully acquaint itself with the conditions as they exist to fully understand any restraints, difficulties or other extenuating circumstances that may be present during the performance of the Work.
- B. See the Supplementary Conditions for listing of any reports and drawings related to the Work.

### 3.02 PROTECTION

- A. The sewers in the Project are operated and maintained by OWNER. CONTRACTOR shall perform the Work in such a manner that the operation of the existing sewers and pumping stations are not interrupted, impaired or damaged. Existing sewers and pumping stations must be maintained in operation at all times or adequate provisions provided to convey both dry and wet weather flow. No CONTRACTOR operation shall impede the functions of the pumping station or sewer system including increasing surcharging in the system and basement backups. Any Work impacting the operation of OWNER's system shall be coordinated with OWNER.
- B. CONTRACTOR shall assume full responsibility for any damage to adjacent lands and buildings and to the owners or occupants thereof. CONTRACTOR shall examine adjacent lands and buildings and shall account for protection of the lands and buildings during the Work. Any damage caused shall be repaired at the expense of CONTRACTOR.
- C. CONTRACTOR shall be aware of the attractive nuisance of the Work and make provisions for mitigating any problems. See Division 01.
- D. CONTRACTOR shall take into account the impact precipitation events may have on the Work and shall schedule the Work accordingly. CONTRACTOR shall protect Work from damage caused by such events whether locally or regionally as they may impact the Work.

### 3.03 SEWER SERVICE

- A. It shall be CONTRACTOR's responsibility to maintain sewer service throughout the duration of the Work. When the Work is being conducted, CONTRACTOR shall maintain sewer service by use of bypass pumping as necessary. Sewer service shall be maintained to each home or business that is connected to the sewer or manhole where the Work is being conducted. All sewers shall be kept in service when work is not being performed.
- B. Sewage or jetting water shall not be allowed to back up into basements. CONTRACTOR shall be responsible for preventing any sewage backups into basements or cleaning impacts of such backups should they occur.

### 3.04 USE OF PREMISES

- A. CONTRACTOR shall confine its operations, equipment and storage areas to the existing rights-of-way and easements as shown on the Drawings in which the existing sewer system is located unless CONTRACTOR enters into written agreements with property owners for use of lands during construction. Such agreements shall be provided to OWNER.

END OF SECTION

## SECTION 33 01 31

### SEWER BYPASS PUMPING

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work Included: Providing all materials, labor, equipment, power, and maintenance necessary to perform bypass pumping while the Work is being completed.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.
- C. Coordinate the Work of this section with Section 33 01 30–Summary of Work–Utilities.
- D. Payment:
  - 1. No separate payment item is included for Sewer Bypass Pumping. All costs for bypass pumping required to complete the Work shall be considered incidental to the Work and included in the cost of adjacent or related Work.
  - 2. The cost of retrieving equipment under all circumstances, including when it becomes lodged, shall be incidental to the Work.

##### 1.02 SUBMITTALS

- A. Submittals shall be in accordance with provisions of Section 01 33 00–Submittals.
  - 1. CONTRACTOR shall submit to OWNER detailed plans and descriptions outlining all provisions and precautions to be taken by CONTRACTOR regarding the handling of existing sewage flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required to provide proper protection of the facilities, including protection of the access and bypass pumping locations from damage because of the discharge flows and compliance with the requirements specified in these Contract Documents. No rehabilitation or construction shall begin until all provisions and requirements have been reviewed by OWNER.
  - 2. The Bypass Pumping plan shall include but not be limited to details of the following:
    - a. Staging areas for pumps.
    - b. Sewer plugging method and types of plugs.
    - c. Number, size, material, location, and method of installation of suction piping.
    - d. Number, size, material, method of installation, and location of installation of discharge piping.
    - e. Bypass pump sizes, capacity, number of each size to be on-site, and power requirements.
    - f. Standby power generator size and location.
    - g. Downstream discharge plan.
    - h. Method of protecting discharge manholes or structures from erosion and damage.
    - i. Method of noise control for each pump and/or generator.
    - j. Any temporary pipe supports and anchoring required.
    - k. Design plans for access to bypass pumping locations.
    - l. Schedule for installation and maintenance of bypass pumping lines.
    - m. Plan indicating location of bypass pumping lines.

- B. Any proposed method of other flow controls shall be submitted for review by OWNER.

## PART 2-PRODUCTS

NOT APPLICABLE

## PART 3-EXECUTION

### 3.01 SEWER BYPASS PUMPING

- A. Where required by sewage flows or inability to prevent debris from falling into the flow stream, CONTRACTOR shall bypass the sewage around the sewer sections or manholes as required to complete the Work.
- B. Precautions shall be taken when bypass pumping is required to prevent the flooding of nearby property.
- C. Under no circumstances will the diversion or dumping of raw sewage be allowed onto the streets, trenches, or into storm sewers. The bypass shall be made by plugging an existing upstream manhole and pumping the sewage into a downstream manhole or adjacent sanitary sewer system if acceptable to OWNER. Bypass pumping shall mean the use of pumps, tanks, hoses, and other necessary equipment to cause uninterrupted flow of sewage around the section or reach in which the Work is being accomplished.
- D. All bypass pumping operations must be attended by personnel to prevent flooding in case of pump failure. Under no conditions shall a bypass pumping operation be left unattended. All personnel for setup, operation, and supervision of the bypass pumping equipment shall be provided as necessary.
- E. All hoses and pumps shall be sized by CONTRACTOR to be of sufficient capacity to handle the existing sewage flow, plus additional flow that may occur during wet weather periods and during periods of high runoff. All equipment used in bypass pumping shall be operated and maintained in proper running condition at all times.
- F. All hose connections shall be watertight and no leakage shall be allowed to the surface. Pumping system hoses and appurtenances shall be tested prior to use in the sewer system to provide watertightness.
- G. CONTRACTOR shall provide a pump capable of conveying all flow that passes through the sewers within the bypassed area. A backup pump capable of conveying all flow that passes through the existing sewer pipes within the bypass area shall be present on site during bypass pumping operations. A backup generator capable of powering the bypass pump, if not integral to the backup pump, shall be provided on site during bypass pumping operations.
- H. No bypass pumping shall occur during non-working hours or on Saturday or Sunday without prior approval by OWNER. OWNER shall have the authority to prevent bypass pumping operations from occurring on a specific day or days if OWNER decides that bypass pumping operations could occur during periods of forecasted rain events. CONTRACTOR shall adjust bypass pumping schedule based on comments and restrictions from OWNER at no cost to OWNER.

- I. At the end of each working day, the reach or section being bypassed shall be placed in service and the bypass plug removed.
- J. The pumps shall be specifically designed for sewage, capable of passing 3-inch solids.
- K. CONTRACTOR shall satisfactorily demonstrate to OWNER that the bypass system works for at least the diurnal flow pattern before beginning any Work.

END OF SECTION

## SECTION 33 05 07

### TRENCHLESS CONSTRUCTION

#### PART 1-GENERAL

##### 1.01 SUMMARY

- A. Work Included: Provide all utilities required through the use of trenchless construction techniques as shown on the drawings or as specified.
- B. Unit Prices: The unit price for horizontal directional drilling, tunneling, boring, jacking, and pipe bursting shall include all labor, materials, and equipment to complete the Work.
- C. Measurement and Payment:
  - 1. Payment for horizontal directional drilling, tunneling, boring, jacking, and pipe bursting shall be for work successfully performed.
  - 2. Measurement for horizontal directional drilling, tunneling, boring, jacking, and pipe bursting will be based on the linear footage of pipe installed.

#### PART 2-PRODUCTS

##### 2.01 PIPE AND APPURTENANCES

- A. Ductile Iron Pipe:
  - 1. See Section 33 00 10–Buried Piping and Appurtenances for ductile iron pipe specifications.
  - 2. All joints for carrier pipes shall be restrained within steel casing pipe. Restrained joints shall meet the applicable requirements of ANSI A21.11 (AWWA C111).
  - 3. The words, “Ductile Iron” and the weight and class of pipe shall be plainly marked on each piece of exterior pipe.
- B. Polyvinyl Chloride (PVC):
  - 1. See Section 33 00 10–Buried Piping and Appurtenances for PVC pipe specifications.
  - 2. All PVC pipe shall be restrained at each joint within steel casing pipe.
- C. High Density Polyethylene Pressure Pipe (HDPE): See Section 33 00 10–Buried Piping and Appurtenances for HDPE pipe specifications.
- D. Steel Casing Pipe:
  - 1. The welded steel casing pipe used shall be leak proof and of adequate diameter and thickness to support all jacking, earth, live, and other loads imposed and to permit installation of the carrier pipe to plan line and grade. The steel casing pipe shall be installed to within plus or minus 0.1 feet of designed grades. Type and minimum size of casing pipe shall be as called for below. Steel casing pipe shall conform to ASTM A139 Grade B. The minimum yield strength shall be 35,000 psi. The steel casing pipe shall be designed for E-80 loading. Coated steel casing pipe shall be coated with asphaltic coating applied at place of manufacturer. Asphaltic coating shall be minimum 1 mil thick.

Nominal Diameter (Inches)	Minimum Thickness for Coated (Inch)	Noncoated (Inch)
12 and Under	0.188	0.188
14 and 16	0.219	0.282
18	0.250	0.313
20	0.281	0.344
22	0.312	0.375
24	0.344	0.407
26	0.375	0.438
28	0.406	0.469
30	0.406	0.469
32	0.438	0.501
34 and 36	0.469	0.532
38, 40 and 42	0.500	0.563
44 and 46	0.531	0.594
48	0.563	0.625
50	0.594	0.656
52	0.625	0.688
54	0.656	0.719
56 and 58	0.688	0.750
60	0.719	0.781
62	0.750	0.813
64	0.718	0.844
66 and 68	0.813	0.875
70	0.844	0.906
72	0.875	0.938

- (1) Thicker walls shall be provided to meet jacking pressures, soil loading, or to conform to permit requirements for the Work.
  - (2) Ring deflection shall not exceed 2% of the nominal diameter.
  - (3) Sections of pipe shall be field welded with a continuous circumferential, full depth single "V" groove (butt joint) weld. Welds shall have strength equal to pipe walls.
2. Casing pipe shall be installed using equipment and material that cases the hole as earth is removed to eliminate cavities at the lead end of the casing pipe. Grouting between casing pipe and soil opening shall be performed when needed to secure casing pipe, to prevent soil collapse, and to fill voids between the casing pipe and native soil. The front of the casing pipe shall be provided with a mechanical arrangement or device that positively prevents the auger from leading the pipe so that no unsupported excavation is ahead of the pipe. The auguring process shall be set such that it permits a balance between jacking pressures and the ratio of carrier pipe advancement to the quantity of soil excavated to eliminate voids in the soil. This is especially critical in the event granular, loose, or unstable soils are encountered at the face of the casing pipe. CONTRACTOR shall maintain a record of soil removed against carrier pipe volume as a check against formation of voids.
  3. The carrier pipe shall be placed inside the casing pipe using stainless steel casing spacers. Casing spacers shall be designed to guide and support the carrier pipe in the casing. Standard casing spacers shall consist of a 14-gauge AISI type 304 stainless steel risers. Each riser shall be equipped with a removable

ultra-high-molecular weight polymer- or glass-reinforced plastic runner. Attachment hardware shall be AISI Type 304 stainless steel. Spacers shall have a minimum width of 8 inches. Standard casing spacers shall be Cascade Waterworks Manufacturing Model CCS, Advance products and Systems, Inc., or Pipeline Seal and Insulator, Inc., Model S8G. At least three spacers shall be provided for each length of carrier pipe, but the number of spacers used shall be not less than the minimum requirements of the manufacturer. They shall be attached to the barrel of the carrier pipe so they are parallel to the longitudinal centerline. The annular space between the casing pipe and carrier pipe shall be left empty.

4. All carrier pipe within the limits of jacking pits shall be installed at CONTRACTOR's expense to resist all loads imposed including, if necessary, the use of special pipe.
- E. Tracer Wire: Tracer wire shall be installed on all trenchless piping. CONTRACTOR shall attach a continuous 7 by 19 strand core, 1/4-inch-diameter vinyl-coated galvanized aircraft cable pulled with the horizontal directional drilling operation as tracer wire. Aircraft cable shall be attached to the pipe at 20-foot intervals. If the HDD is through rock, CONTRACTOR shall provide a minimum of two aircraft cables attached to the pipe. Tracer wire shall be successfully tested before acceptance.
- F. Sacrificial Anode Bags:
1. Anode bags shall be 17-pound and/or 32-pound high-potential magnesium anode bags furnished with 10 linear feet of type TW No. 12 solid copper wire lead.
  2. Copper sleeve is required to Cadweld wire lead of bag to the pipe being protected.
  3. A 747 aerosol primer shall be used, primer adhesive shall be used to install handy cap. Bituminous coating shall be used when installing anode bag leads to ductile iron pipe to protect Cadweld.

## PART 3-EXECUTION

### 3.01 HORIZONTAL DIRECTIONAL DRILLING

- A. Where shown on the Drawings, horizontal directional drilling shall be provided using HDPE pipe.
- B. A certificate of "Compliance with Specification" shall be furnished for all materials to be supplied. Test reports prepared by an independent testing laboratory shall be provided certifying that polyethylene pipe conforms to the requirements of ASTM D3350.
- C. Subject to compliance with the complete requirements of these Standard Specifications, manufacturers offering HDPE pipe products that may be incorporated into the Work include Performance Pipe, Poly Pipe, or equal.
- D. Fusion Welding: Polyethylene pipe shall be joined using the butt fusion welding process. Provide a fused flanged adapter with ductile iron follower flange and a ductile iron flanged pipe for interconnections with ductile iron and/or PVC piping.
- E. CONTRACTOR may use a drilling fluid which is completely biodegradable. Clay based drilling fluids will also be allowed. Drilling fluid shall be subject to the review of OWNER. CONTRACTOR shall provide their own clean water for drilling fluid. At no time shall the drilling fluid be discharged to a surface water. This includes drilling fluid that may surface along the directionally drilled pipe route. CONTRACTOR shall provide other drilling fluids

or procedures as needed to prevent a discharge of drilling fluids to surface waters at no additional cost to OWNER.

- F. The boring unit shall have a tracking device that is capable of providing depth and location at all points of the boring path. Record Drawings showing horizontal and vertical locations of the conduit shall be created by CONTRACTOR based on the tracker information and submitted to OWNER.
1. Finished Pipe:
    - a. CONTRACTOR shall submit detailed information to OWNER of the procedure and the steps to be followed for the installation of the directional drilling method selected, even if the process is named in the Standard Specifications. All such instructions and procedures submitted shall be carefully followed during installation. Any proposed changes in installation procedures shall require submittal of revised procedures.
    - b. The installed pipe shall be continuous over the entire directionally drilled length and shall be free from visual defects, such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness, and other deformities. Pipe with gashes, nicks, abrasions, or any such physical damage that may have occurred during storage and/or handling, which are deeper than 10% of the wall thickness, shall not be used and shall be removed from the construction site.
  2. Pipe Jointing:
    - a. Sections of polyethylene pipe shall be assembled and joined on the jobsite above ground. Pipe ends to be joined shall be cut square, then joined, by the heating and butt fusion method in strict conformance with the manufacturer's printed instructions.
    - b. The butt fusion method for pipe jointing shall be carried out in the field by operators with prior experience in fusing polyethylene pipe with similar equipment using proper jigs and tools per standard procedures outlined by the pipe manufacturer. These joints shall have a smooth, uniform, double rolled back bead made while applying the proper melt, pressure, and alignment. It shall be the sole responsibility of CONTRACTOR to provide an acceptable butt fusion joint. The replacement pipe shall be joined on the site in appropriate working lengths near the insertion pit.
  3. Insertion or Access Pits:
    - a. The location and number of insertion or access pits shall be planned by CONTRACTOR and submitted in writing prior to excavation. The pits shall be located such that their total number shall be minimized and the length of replacement pipe installed in a single pull shall be maximized. The maximum length of continuous liner shall not exceed the pipe bursting system manufacturer's recommendations.
    - b. Upon completion of the directional drilling operation by CONTRACTOR, CONTRACTOR shall backfill the excavation, perform clean up and all site restoration, as indicated on the Drawings. All surfaces shall be restored in kind with thicknesses matching those removed.
  4. Process Limitations:
    - a. Though the installation process may be licensed or proprietary in nature, CONTRACTOR shall not change any material, thickness, design values, or procedures stated or approved in the submittals. CONTRACTOR shall submit, in writing, full details about component materials, their properties and installation procedures, and abide by them fully during the entire course of the Project.
    - b. All allowable directional drilling methods are considered to be structurally equal processes as far as end product required. The minimum required performance

criteria, and/or standards, physical/structural properties, chemical resistance tests, and the replacement pipe thicknesses as given in this Standard Specification shall be strictly complied with.

- G. It is CONTRACTOR's responsibility to examine the proposed line segment and notify if conditions exist that could cause problems with the directional drilling method. Such conditions could include nearby services that could be damaged by the operations, existing slabs that could be damaged, or less than acceptable depth of cover.

### 3.02 TUNNELING, BORING, JACKING, OR BORING AND JACKING

- A. Where shown on the Drawings or specified, the sewer, water main, or force main (carrier pipe) shall be placed inside a casing pipe that is installed by tunneling, jacking, boring, or jacking and boring or other acceptable methods not using open cut construction techniques. Installation shall be accomplished in accordance with Federal and State Laws and municipal ordinances. Installation shall also conform to any permit requirements obtained by OWNER or CONTRACTOR from railroads; local, county, state or federal agencies; or any other such entity requiring a permit to allow the Work to proceed. Should there be a conflict between permit requirements and those herein, the stricter requirement shall control.
- B. CONTRACTOR's means and methods of construction shall be capable of controlling water and soil infiltration at the excavated face, along the alignment and at shaft excavations to properly conduct the Work, to maintain a stable excavation, and to prevent collapse of the ground. CONTRACTOR shall obtain any dewatering permits required. If CONTRACTOR's means and methods are not effective in controlling such infiltration, CONTRACTOR shall select other means and methods and demonstrate to OWNER that water and soil infiltration can be excluded, all at no additional cost to OWNER. Shafts and open cut excavations shall be excavated by methods determined by CONTRACTOR to be capable of and suitable for coping with the surface and subsurface conditions. CONTRACTOR shall have a representative on site at all times who is experienced in the tunneling technique being used.
- C. Installation of casing and carrier pipe shall proceed in such a manner as to minimize disruption of traffic and to avoid damage to adjacent roadways, railroad tracks, and other structures. No equipment shall operate off the pavement or tracks or the shoulder of the roadway or tracks being crossed during the course of construction. Signs, barricades, flag men, and lighting shall be provided or may be modified by any permit requirements and as needed to complete the Work—the more stringent requirement controlling.
- D. CONTRACTOR shall submit manufacturer's data for the casing pipe, spacers, and carrier pipe. Information shall include the name of the pipe manufacturer, the dimensions of the pipe, and details on the material and method of pipe manufacturer or fabrication.
- E. CONTRACTOR shall submit a jacking plan for each installation. The plan shall identify the method and equipment to be used, the location and size of the jacking pits, and the limits of the proposed jacking.
- F. The carrier pipe shall be the same material as specified for open cut installation in the adjacent pipe.

- G. All casing pipe shall be on-site before any jacking is to start. Once jacking operation is started, it shall be continued without interruption until completion. The position for spacers shall adequately support the carrier pipe throughout the casing. A casing spacer shall be installed within 1 foot of each end of the casing, on each side of each pipe joint, and at a maximum spacing of 10 feet for ductile iron carrier pipe. The carrier pipe shall be adjusted so that the end extends past the end of the casing 18 inches. After the carrier pipe is installed, the casing end seals shall be neoprene with stainless steel bands. The casing end seals shall be Cascade, or equal.

### 3.03 PIPE BURSTING

- A. Sewer Bypass Pumping:
  - 1. Bypass pumping shall be required while repairs are being made. CONTRACTOR shall provide bypass pumping for the duration of pipe bursting operations. CONTRACTOR shall coordinate construction activities with OWNER to schedule bypass pumping a minimum of three days prior to pipe bursting operations.
  - 2. See Section 33 01 31–Sewer Bypass Pumping.
- B. Line Obstructions: Notify ENGINEER if preinstallation video (TV) inspection reveals a situation in the existing sewer that will prevent successful pipe bursting operation. Should pipe bursting be unsuccessful or should situations be present that prevent pipe bursting, CONTRACTOR shall install the pipe by other methods at no additional cost to OWNER.
- C. CONTRACTOR shall submit information, in detail, of the procedure and the steps to be followed for the installation of the pipe bursting method selected, even if the process is named in the specification. All such instructions and procedures submitted shall be carefully followed during installation. Any proposed changes in installation procedures shall require submittal of revised procedures and acceptance by OWNER.
- D. Insertion or Access Pits:
  - 1. The location and number of insertion or access pits shall be planned by CONTRACTOR and submitted prior to excavation. The pits shall be located such that their total number shall be minimized and the length of replacement pipe installed in a single pull shall be maximized; provided that single runs shall not exceed 750 linear feet.
  - 2. CONTRACTOR shall excavate access/insertion pits and shall provide necessary sheeting, shoring, and dewatering prior to beginning the pipe bursting operation.
  - 3. Upon completing the pipe bursting operation, CONTRACTOR shall backfill and restore the excavation.
- E. Process Limitations:
  - 1. Though the installation process may be licensed or proprietary in nature, CONTRACTOR shall not change any material, thickness, design values, or procedures matters stated or approved in the submittals. CONTRACTOR shall submit, in writing, full details about component materials, their properties and installation procedures, and abide by them fully during the entire course of the project.
  - 2. All allowable pipe bursting methods are being considered to be structurally equal processes as far as “end product” required. The minimum required performance criteria, and/or standards, physical/structural properties, chemical resistance tests, and the replacement pipe thicknesses as given in this specification shall be strictly complied with. It shall be the responsibility of CONTRACTOR to comply with the specifications in full without any request for changes after the award of the Contract.

3. It is CONTRACTOR's responsibility to examine the proposed line segment and notify ENGINEER if conditions exist that could cause problems with the pipe bursting method. Such conditions could include nearby services that could be damaged by the operations, existing slabs that could be damaged, or less than acceptable depth of cover. CONTRACTOR shall repair all damages that occur by the pipe bursting at no additional cost to OWNER.

### 3.04 SACRIFICIAL ANODE BAG INSTALLATION

#### A. Sacrificial Anode Bags:

1. Strip off approximately 1 inch to 1 1/2 inches of coating from end of wire on anode bag. Slide copper sleeve onto wire and crimp with a wire crimping tool to secure it to the wire. Copper wire sleeve and copper wire must be bright, clean and dry. Remove scale and bituminous coating on outside of iron pipe in preparation for cad weld. Iron pipe should be bright, clean and dry. Surface must be free from large pits and flaws. Under some conditions of temperature and humidity the surface to be welded will sweat causing porous welds. This can be eliminated by warming the surface with a hand torch prior to welding. Use No. 25 charge with powder-marked steel. Check mold tag for material to be welded and proper cartridge size. Make sure all surfaces and conductors are clean and dry. Prepare Cad weld furnace. Inspect furnace for damage or overuse. If the combustion chamber shows signs of corrosion or loss of wall thickness, it may not properly contain the weld, causing a blowout to weld material. Replace the furnace when such deterioration is found. Open the door on top of furnace. Insert metal disk into bottom of furnace. Open Cad weld cartridge and dump into furnace on top of metal disk. The cartridge may have to be tapped to remove hardened powder from cartridge bottom. Close the door. Place furnace on top of pipe with slot opening, located at the bottom of the furnace, facing the anode wire. Slide end of wire into slot of furnace. Use an igniting tool or a small torch to ignite the Cad weld cartridge. Follow all safety rules for personal protection. Hold furnace on pipe until weld has solidified. The appearance of weld should match the mold of the furnace closely. Tap weld with a hammer to remove any slag and to check for a sound weld. Clean weld with a wire brush, prime and install handy cap to protect mold.
2. Bell and spigot joint or fitting: If a pipe joint or fitting is uncovered, a jumper wire will be installed across the joint with No. 12 AWG copper wire Cad welded onto the pipe on each side of the pipe joint or fitting. The copper wire lead of the anode bag will be installed on this jumpered wire with a No. 8 AWG brass split-bolt connector. Wire connector will be sealed with 3M Scotch Vinyl Mastic Pad and two layers of polyethylene wrap.
3. All ductile iron fittings and hydrant leads being part of a PVC main shall receive 17-pound high-potential magnesium anode bags. Anodes should be attached to each ductile iron fitting and on all fire hydrant leads. If ductile iron fittings are within 20 feet of each other, one anode unit shall be used for both fittings. No additional cost for additional wiring shall be paid for by OWNER for this.
4. All new ductile iron mains should be installed with 32-pound high-potential magnesium anode bags. CONTRACTOR shall be responsible to install anode bag units according to the following table.

Ductile Iron Main Anode Spacing	
Pipe Size (DIA)	Distance Between Anode Bags
20-IN	30
16-IN	35
12-IN	50

Ductile Iron Main Anode Spacing	
Pipe Size (DIA)	Distance Between Anode Bags
10-IN	60
8-IN/6-IN	75
Hydrant Leads	Each

5. Sacrificial anode bags shall be installed at each end of the casing pipe.

### 3.05 FINISHED PIPE

- A. The installed pipe shall be continuous over the entire length and shall be free from visual defects, such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness, and other deformities. Pipe with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, which are deeper than 10% of the wall thickness shall not be used and shall be removed from the construction site.

### 3.06 TESTING

- A. Testing of pipes installed with trenchless techniques shall be in accordance with Section 33 00 10–Buried Piping and Appurtenances.
- B. CONTRACTOR shall perform a continuity test on all tracer wire in the presence of ENGINEER or OWNER. Continuity testing shall be performed prior to asphalt or concrete pavement placement. If the tracer wire is found to be not continuous after testing, CONTRACTOR shall repair or replace the failed segment of wire at CONTRACTOR's expense. All repairs or replacement shall be completed prior to asphalt or concrete placement.

END OF SECTION

## SECTION 33 07 19

### BURIED PIPING INSULATION

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. Work includes insulation for all underground exterior piping except piping extending from a building perimeter out to 5 feet.
- B. Related Sections and Divisions: Applicable provisions of Division 01 shall govern work in this section.

##### 1.02 REFERENCES

- A. All material, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:
  - 1. ASTM C168–Standard Terminology Relating to Thermal Insulation.
  - 2. ASTM C272–Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.
  - 3. ASTM C518–Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 4. ASTM C552-17–Standard Specification for Cellular Glass Thermal Insulation.
  - 5. ASTM E96–Standard Test Methods for Water Vapor Transmission of Materials.

##### 1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00–Submittals.
- B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, and fitting materials, along with safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

##### 1.04 QUALITY ASSURANCE

- A. All insulation or components of this specification section shall meet or exceed the requirements and quality of the items herein specified, or as denoted on the Drawings.
- B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.
- C. Insulation systems shall be applied by experienced contractors. Within the past five years, CONTRACTOR shall be able to document the successful completion of a minimum of three projects of at least 50% of the size and similar scope of the work specified in this section.

##### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials in accordance with Section 01 60 00–Materials and Equipment.

- B. Deliver materials to the site in such a manner as to protect the materials from shipping and handling damage.
- C. Materials that could be damaged by the elements should be packaged in such a manner that they could withstand short-term exposure to the elements during transportation.
- D. Store materials in a clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.
- E. Use all means necessary to protect insulation before, during, and after installation.
- F. All scratched, dented, and otherwise damaged insulation shall be repaired or replaced as requested by OWNER without additional cost to OWNER.

#### 1.06 GENERAL REQUIREMENTS

- A. All insulation and associated materials shall be free of asbestos.

### PART 2-PRODUCTS

#### 2.01 EXTRUDED POLYSTYRENE BOARD INSULATION

- A. Acceptable manufacturers are Dow Stryofoam Highload 100, Owens Corning Foamular 250, or equal.
- B. Insulation shall be extruded polystyrene board conforming to ASTM C518.
- C. Minimum nominal density shall be 1.6 lbs/ft<sup>3</sup>.
- D. R-value shall meet or exceed 5.0 (hr-ft<sup>2</sup>-°F)/(btu-in) at 75°F mean.
- E. Insulation shall be rated for service from -290°F to 165°F.

#### 2.02 CLOSED CELL CELLULAR GLASS INSULATION.

- A. Acceptable manufacturers are Owens Corning FOAMGLAS, or equal.
- B. Insulation shall be cellular glass thermal insulation conforming to ASTM C552.
- C. Minimum nominal density shall be 7.18 lb/ft<sup>3</sup>.
- D. Thermal conductivity shall not exceed 0.29 btu-in/°F-hr-ft<sup>2</sup> at 75°F.
- E. Insulation shall be rated for service from -450°F to 900°F

#### 2.03 JACKETING

- A. Underground Direct-Buried Jacketing:
  - 1. Acceptable manufacturers are Polyguard Products Insulrap No-Torch 125, Pittsburgh Corning Pittwrap SS, or equal.

2. Minimum 70-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

#### 2.04 ACCESSORIES

- A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
- B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

### PART 3-EXECUTION

#### 3.01 GENERAL

- A. All insulation damaged during construction shall be replaced in accordance with these specifications.
- B. All insulation shall be applied in accordance with the manufacturer's written recommendations. Destructive methods such as sheet metal screws are not acceptable. All pipe insulation shall be installed with joints butted firmly together.
- C. All valves and fittings shall be insulated with mitered sections of insulation equal in density and thickness to adjoining insulation.
- D. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.
- E. All un-insulated penetrations through the insulation system shall be insulated along their length to a minimum distance of four times the insulation thickness. To prevent moisture migration behind the insulation, these penetrations shall be sealed with a sealant as recommended by the manufacturer and flashed to shed water.

#### 3.02 FORMED POLYISOCYANURATE INSULATION INSTALLATION

- A. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9 inches to 12 inches on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of flexible closed cell joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before applying protective covering. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6 inches from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

- B. Install per manufacturer's recommendations.
- C. Installation shall include considerations for expansion and contraction of piping.
- D. Field taper all changes in insulation thickness to provide a smooth transition for jacketing and provide coatings and sealants as recommended by the manufacturer at transition pieces.

3.03 PROTECTIVE JACKET INSTALLATION

- A. Install per manufacturer's recommendations.
- B. All adhesives and sealants shall be applied within temperature ranges established by the manufacturer.

3.04 BELOW GRADE BOARD INSULATION

- A. Where depth of top of piping lies above the frost line, provide buried extruded polystyrene board with 2-inch thickness.
- B. Horizontal width of required insulation is indicated on schedule below. Insulation shall be at least 18 inches below grade and 6 inches above top of piping, centered above the centerline of the pipe. If insulation is to be installed more than 6 inches above top of piping, the number of inches exceeding 6 inches shall be added to the width of insulation determined from the table below.
- C. Minimum width of insulation board shall be at least 3 times pipe diameter.

Minimum Width of Extruded Polystyrene Board Insulation (ft)						
Predicted Frost Depth (ft)	Depth of Top of Piping (ft)					
	2.0	2.5	3.0	3.5	4.0	4.5
2.5	2	Not Required				
3.0	3	2	Not Required			
3.5	4	3	2	Not Required		
4.0	5	4	3	2	Not Required	
4.5	6	5	4	3	2	N.R.
5.0	7	6	5	4	3	2
5.5	8	7	6	5	4	3
6.0	9	8	7	6	5	4
6.5	10	9	8	7	6	5

- D. Extruded polystyrene board insulation shall be installed as recommended by the manufacturer and according to Drawing 01-975-163A bound at the end of these specifications.

END OF SECTION

## SECTION 33 11 13.19

### CONDUCTIVE TRACE WIRE FOR NONMETALLIC PIPE INSTALLATION

#### PART 1–GENERAL

##### 1.01 SUMMARY

- A. This section covers the requirements for installation of a conductive trace wire with non-metallic pipe underground.

##### 1.02 MEASUREMENT AND PAYMENT

- A. Work performed under this section shall be included in the unit price for pipe installation, as applicable, unless otherwise indicated in the Bid Form.

##### 1.03 SYSTEM DESCRIPTION

- A. Install electrically continuous trace wire with access points as described herein to be used for locating nonmetallic pipe with an electronic pipe locator after installation.

##### 1.04 SUBMITTALS

- A. Submit copies of shop drawings showing materials being offered and catalog data verifying the products meet the requirements of this section. CONTRACTOR shall submit four copies of each submittal, which will be retained by ENGINEER, plus the number of copies that are to be returned to CONTRACTOR by ENGINEER after review is completed.

#### PART 2–PRODUCTS

##### 2.01 PRODUCTS

- A. Trace wire shall be 10 gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Wire connectors shall be 3M DBR, or approved equal, and shall be watertight and provide electrical continuity.

#### PART 3–EXECUTION

##### 3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

- A. Trace wire shall be installed in the same trench and inside bored holes and casing with nonmetallic pipe during pipe installation. It shall be secured to the pipe as required so that the wire remains adjacent to the pipe. The trace wire shall be securely bonded together at all wire joints with an approved watertight connector to provide electrical continuity, and it shall be accessible at all new water valve boxes, water meter boxes, fire hydrants, sewer manholes, sewer cleanouts, gas valves and gas meter risers, as applicable to the utility line being installed. At manholes, the wire shall be installed from the exterior of the manhole to the interior by installing a 24-inch loop in the wire underneath the manhole frame. A single branch wire shall be terminated at each access location (new water valve boxes, water meter

boxes, etc. as previously listed), and the wires shall be spliced underground using the specified connector. For lines with more than 5 feet of cover, the wire shall be installed directly over the pipe at a depth of 5 feet. If the spacing of valves and meters is greater than one mile, install an intermediate trace wire access assembly as detailed on the Drawings. Where access points for trace wire on gas lines exceeds 500 feet, install test lead boxes such that maximum access point spacing is 500 feet.

- B. For termination of trace wire at locations other than a manhole, a valve box, or a water meter, provide a standard plastic water meter box and terminate the wire inside the meter box.

### 3.02 TESTING

- A. CONTRACTOR shall provide line location (tracing) equipment (sending unit and receiver) and shall demonstrate in the presence of ENGINEER that the trace wire functions properly throughout all of the work.

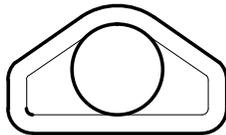
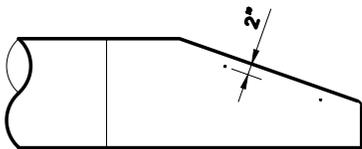
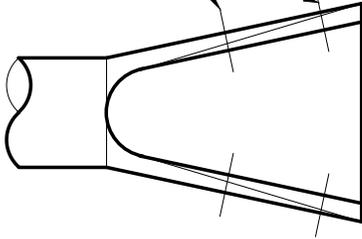
### 3.03 REPAIR/RESTORATION

- A. CONTRACTOR shall replace all trace wire that does not function properly or shall make repairs to make the trace wire function properly.

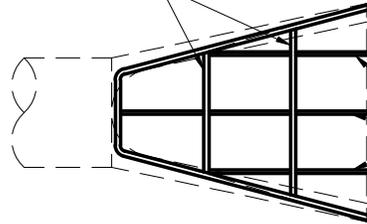
END OF SECTION

**STANDARD DETAIL DRAWINGS**

SHOP DRILL FOUR 7/16" HOLES AS SHOWN

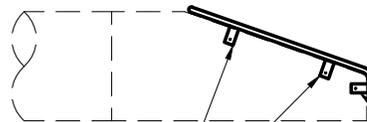


1" DIA. STD. PIPE AT 8" O.C., WELDED TO FRAME



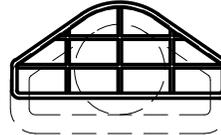
3/4" DIA. ROD AT 12" O.C. MAX., WELDED AT EACH PIPE

1" DIA. STD. STEEL PIPE FRAME



4"x4"x3/16" ANGLE TABS WELDED TO FRAME (4 REQ'D), PROVIDE 7/16" HOLE IN EACH ANGLE TAB

TWO ADDITIONAL CONNECTORS SHALL BE PROVIDED WHEN PIPE DIA. OR EQUAL DIA. IS 36" OR GREATER



**NOTES:**

1. CONTRACTOR SHALL BOLT THE PIPE GATE TO THE CONCRETE ENDWALL WITH FOUR 3/8"x6" MACHINE BOLTS, WITH NUTS ON INSIDE WALL
2. THE PIPE GATE SHALL RECEIVE THE FOLLOWING PREPARATION AND PAINTING
  - A. BARE SURFACES- AFTER THOROUGH SCRAPING, WIRE BRUSHING AND CLEANING, APPLY THE THREE COAT SYSTEM LISTED
  - C. PAINT EACH COAT AS AN OVERALL COAT
  - D. ALLOW 24 TO 48 HOURS DRYING TIME BETWEEN COATS
    - FIRST COAT: RUST-OLEUM X-60 RED BARE METAL PRIMER OR EQUAL
    - SECOND COAT: RUST-OLEUM 960 ZINC CHROMATE PRIMER OR EQUAL
    - THIRD COAT: RUST-OLEUM 1282 HIGH GLOSS AND METALLIC FINISH OR EQUAL
3. PRECAST REINFORCED CONCRETE APRON ENDWALL SHALL BE MANUFACTURED TO MEET REQUIREMENTS FOR CLASS II, "B" WALL REINFORCED CONCRETE PIPE, ASTM C-78 AND AASHTO M170 SPECIFICATION

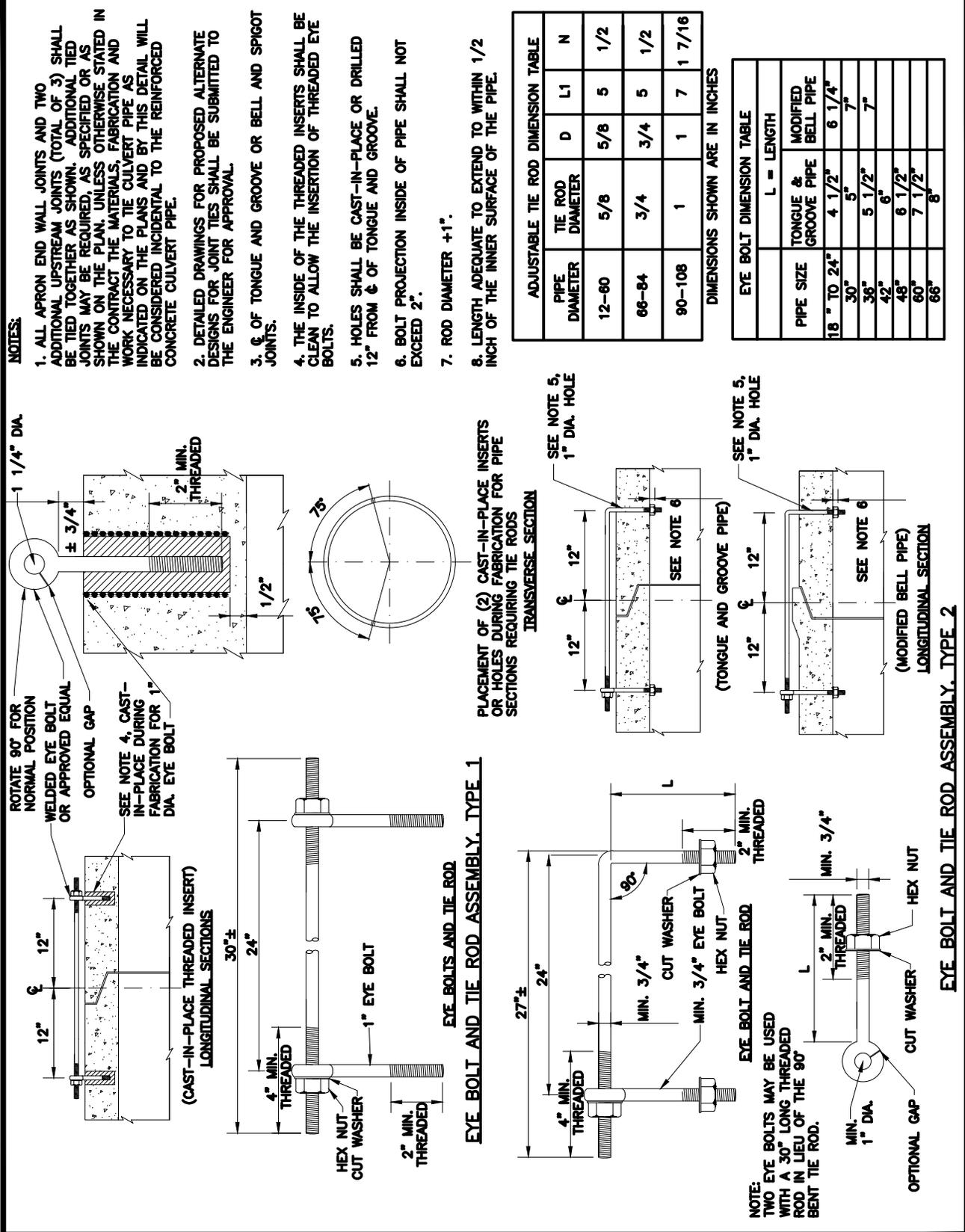
**PIPE GATE  
SHEET TITLE 2**

**STANDARD DETAIL**



01-975-30A

OCTOBER 2011



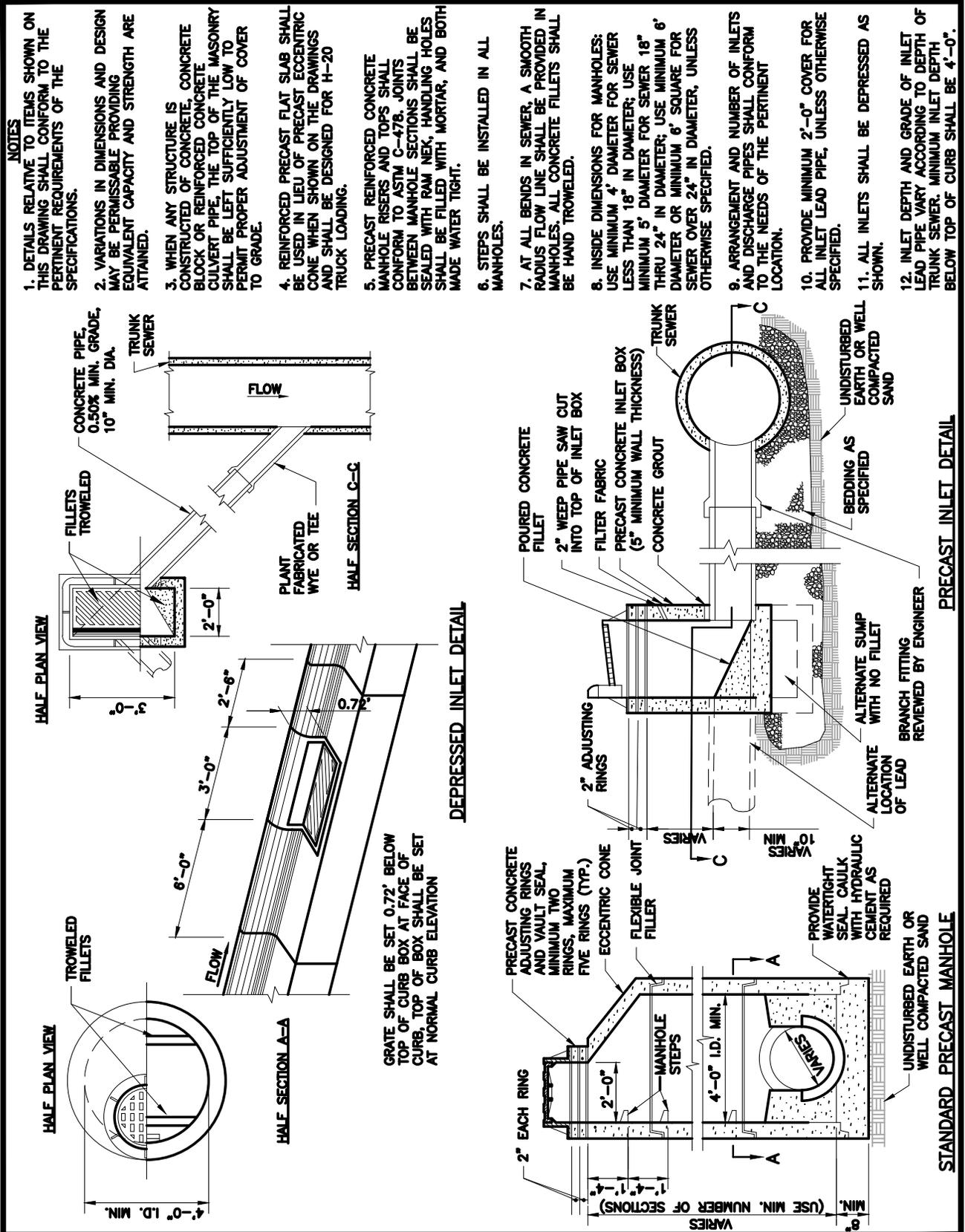
**JOINT TIES FOR CONCRETE PIPE**

**STANDARD DETAIL**



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OCTOBER 2011



**STORM SEWER  
MANHOLES AND INLETS**

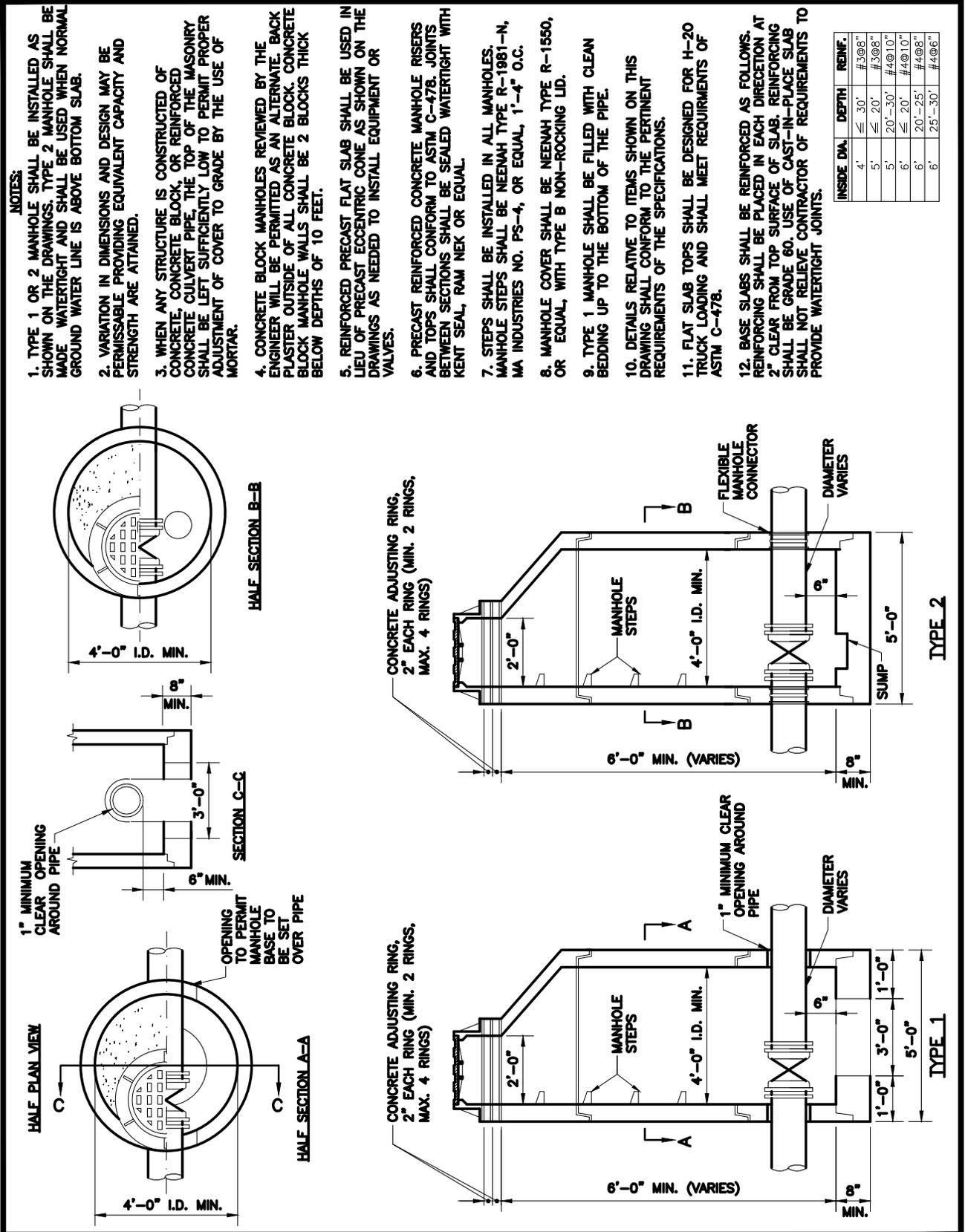
**STANDARD DETAIL**



**STRAND ASSOCIATES**  
01-975-41A  
OCTOBER 2011

**NOTES**

1. DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS.
2. VARIATIONS IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.
3. WHEN ANY STRUCTURE IS CONSTRUCTED OF CONCRETE, CONCRETE BLOCK OR REINFORCED CONCRETE CULVERT PIPE, THE TOP OF THE MASONRY SHALL BE LEFT SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE.
4. REINFORCED PRECAST FLAT SLAB SHALL BE USED IN LIEU OF PRECAST ECCENTRIC CONE WHEN SHOWN ON THE DRAWINGS AND SHALL BE DESIGNED FOR H-20 TRUCK LOADING.
5. PRECAST REINFORCED CONCRETE MANHOLE RISERS AND TOPS SHALL CONFORM TO ASTM C-478. JOINTS BETWEEN MANHOLE SECTIONS SHALL BE SEALED WITH RAM NEX, HANDLING HOLES SHALL BE FILLED WITH MORTAR, AND BOTH MADE WATER TIGHT.
6. STEPS SHALL BE INSTALLED IN ALL MANHOLES.
7. AT ALL BENDS IN SEWER, A SMOOTH RADIUS FLOW LINE SHALL BE PROVIDED IN MANHOLES. ALL CONCRETE FILLETS SHALL BE HAND TROWELED.
8. INSIDE DIMENSIONS FOR MANHOLES: USE MINIMUM 4' DIAMETER FOR SEWER LESS THAN 18" IN DIAMETER; USE MINIMUM 5' DIAMETER FOR SEWER 18" THRU 24" IN DIAMETER; USE MINIMUM 6' DIAMETER OR MINIMUM 6' SQUARE FOR SEWER OVER 24" IN DIAMETER, UNLESS OTHERWISE SPECIFIED.
9. ARRANGEMENT AND NUMBER OF INLETS AND DISCHARGE PIPES SHALL CONFORM TO THE NEEDS OF THE PERTINENT LOCATION.
10. PROVIDE MINIMUM 2'-0" COVER FOR ALL INLET LEAD PIPE, UNLESS OTHERWISE SPECIFIED.
11. ALL INLETS SHALL BE DEPRESSED AS SHOWN.
12. INLET DEPTH AND GRADE OF INLET LEAD PIPE VARY ACCORDING TO DEPTH OF TRUNK SEWER. MINIMUM INLET DEPTH BELOW TOP OF CURB SHALL BE 4'-0".



**WATER MAIN  
VALVE MANHOLES**

**STANDARD DETAIL**



**STRAND  
ASSOCIATES**

01-975-42A

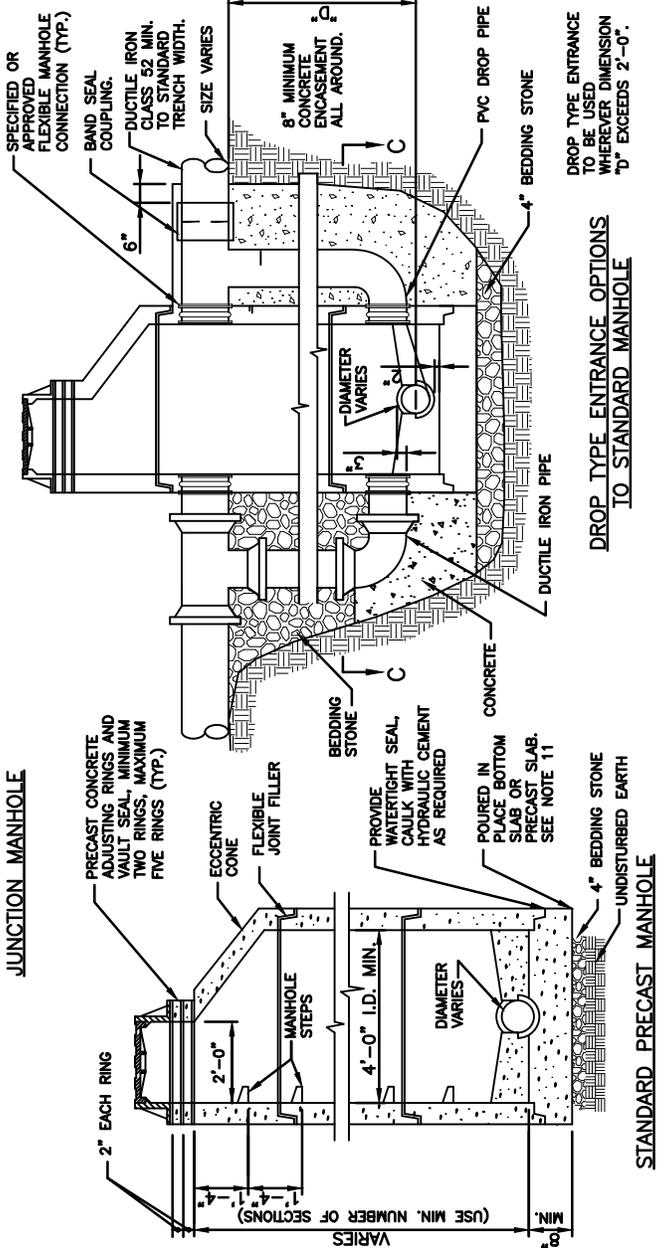
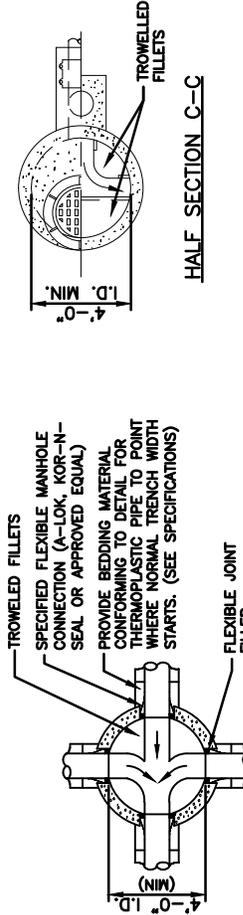
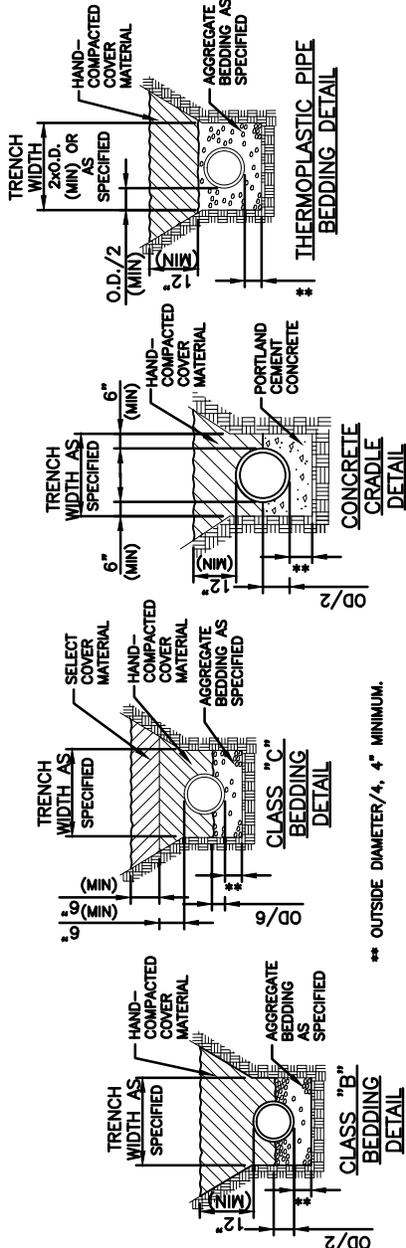
OCTOBER 2011

- NOTES:**
- TYPE 1 OR 2 MANHOLE SHALL BE INSTALLED AS SHOWN ON THE DRAWINGS. TYPE 2 MANHOLE SHALL BE MADE WATERTIGHT AND SHALL BE USED WHEN NORMAL GROUND WATER LINE IS ABOVE BOTTOM SLAB.
  - VARIATION IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.
  - WHEN ANY STRUCTURE IS CONSTRUCTED OF CONCRETE, CONCRETE BLOCK, OR REINFORCED CONCRETE CULVERT PIPE, THE TOP OF THE MASONRY SHALL BE LEFT SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE BY THE USE OF MORTAR.
  - CONCRETE BLOCK MANHOLES REVIEWED BY THE ENGINEER WILL BE PERMITTED AS AN ALTERNATE. BACK PLASTER OUTSIDE OF ALL CONCRETE BLOCK. CONCRETE BLOCK MANHOLE WALLS SHALL BE 2 BLOCKS THICK BELOW DEPTHS OF 10 FEET.
  - REINFORCED PRECAST FLAT SLAB SHALL BE USED IN LIEU OF PRECAST ECCENTRIC CONE AS SHOWN ON THE DRAWINGS AS NEEDED TO INSTALL EQUIPMENT OR VALVES.
  - PRECAST REINFORCED CONCRETE MANHOLE RISERS AND TOPS SHALL CONFORM TO ASTM C-478. JOINTS BETWEEN SECTIONS SHALL BE SEALED WATERTIGHT WITH KENT SEAL, RAM NEX OR EQUAL.
  - STEPS SHALL BE INSTALLED IN ALL MANHOLES. MANHOLE STEPS SHALL BE NEEVAH TYPE R-1981-N, MA INDUSTRIES NO. PS-4, OR EQUAL, 1'-4" O.C.
  - MANHOLE COVER SHALL BE NEEVAH TYPE R-1550, OR EQUAL, WITH TYPE B NON-ROCKING LID.
  - TYPE 1 MANHOLE SHALL BE FILLED WITH CLEAN BEDDING UP TO THE BOTTOM OF THE PIPE.
  - DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS.
  - FLAT SLAB TOPS SHALL BE DESIGNED FOR H-20 TRUCK LOADING AND SHALL MEET REQUIREMENTS OF ASTM C-478.
  - BASE SLABS SHALL BE REINFORCED AS FOLLOWS. REINFORCING SHALL BE PLACED IN EACH DIRECTION AT 2" CLEAR FROM TOP SURFACE OF SLAB. REINFORCING SHALL BE GRADE 60. USE OF CAST-IN-PLACE SLAB SHALL NOT RELIEVE CONTRACTOR OF REQUIREMENTS TO PROVIDE WATERTIGHT JOINTS.

INSIDE DIA.	DEPTH	REINF.
4'	≤ 30'	#3@8"
5'	≤ 20'	#3@8"
5'	20'-30'	#4@10"
6'	≤ 20'	#4@10"
6'	20'-25'	#4@8"
6'	25'-30'	#4@6"

**NOTES**

1. DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
2. VARIATIONS IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE, PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.
3. ALL CONCRETE FILLETS SHALL BE HAND TROWELED WITH A 1/4" FT. SLOPE.
4. INSIDE DIMENSIONS FOR MANHOLES: USE MINIMUM 4' DIAMETER FOR SEWER LESS THAN 18" IN DIAMETER; USE MINIMUM 5' DIAMETER FOR SEWER 18" THRU 24" IN DIAMETER; USE MINIMUM 6' DIAMETER OR MINIMUM 6' SQUARE FOR SEWER OVER 24" IN DIAMETER.
5. BEDDING CLASSES "B" AND "C" SHALL MEET OR EXCEED ASTM C12 REQUIREMENTS.
6. DROP TYPE ENTRANCE TO STANDARD MANHOLE WILL BE PAID FOR SEPARATELY IF SO LISTED IN THE BID.
7. SEE DRAWINGS FOR DROP TYPE ENTRANCES FOR SANITARY SEWERS LARGER THAN 15".
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF REGULATORY BODIES OF THE STATE AND APPLICABLE MUNICIPAL ORDINANCES.
9. ALL NEW CONSTRUCTION SHALL BE PLACED ON UNDISTURBED EARTH OR STONE BEDDING.
10. FLAT SLAB TOPS SHALL BE DESIGNED FOR H-20 TRUCK LOADING AND SHALL MEET REQUIREMENTS OF ASTM C-478.
11. BASE SLABS SHALL BE REINFORCED AS FOLLOWS: REINFORCING SHALL BE PLACED IN EACH DIRECTION AT 2" CLEAR FROM TOP SURFACE OF SLAB. REINFORCING SHALL BE GRADE 60. USE OF CAST-IN-PLACE SLAB SHALL NOT RELIEVE CONTRACTOR OF REQUIREMENTS TO PROVIDE WATERTIGHT JOINTS.
12. FLAT SLABS SHALL BE PROVIDED IN SHALLOW DEPTH SITUATIONS IN LIEU OF ECCENTRIC CONES.

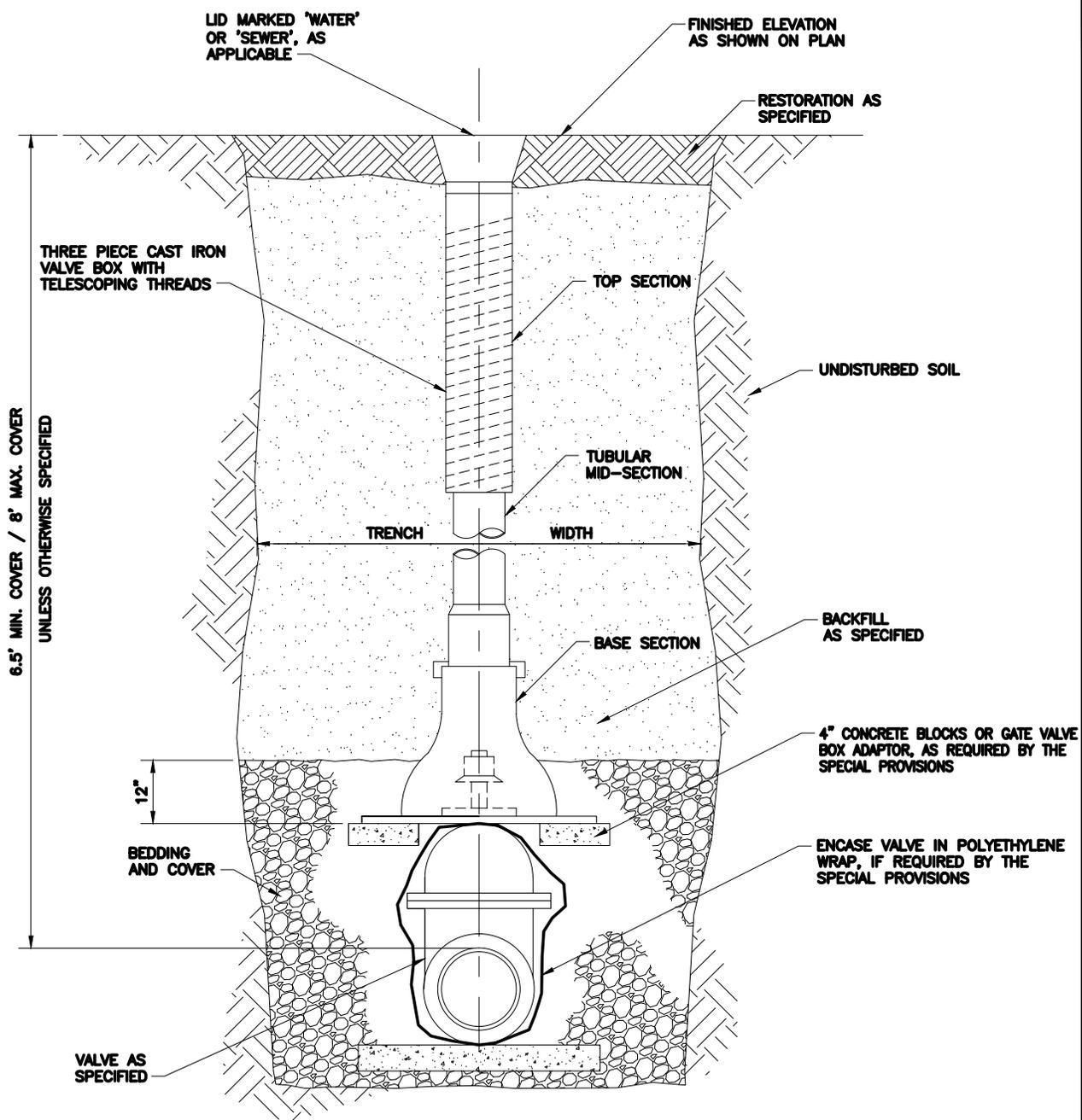


INSIDE DIA.	DEPTH	REINF.
4'	≤ 30"	#3@8"
5'	≤ 20"	#3@8"
5'	20'-30"	#4@10"
6'	≤ 20"	#4@10"
6'	20'-25"	#4@8"
6'	25'-30"	#4@6"

**SANITARY SEWER APPURTENANCES**  
**STANDARD DETAIL**

**STRAND ASSOCIATES**  
81-975-43A  
OCTOBER 2011

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### STANDARD BURIED GATE VALVE BOX SETTING

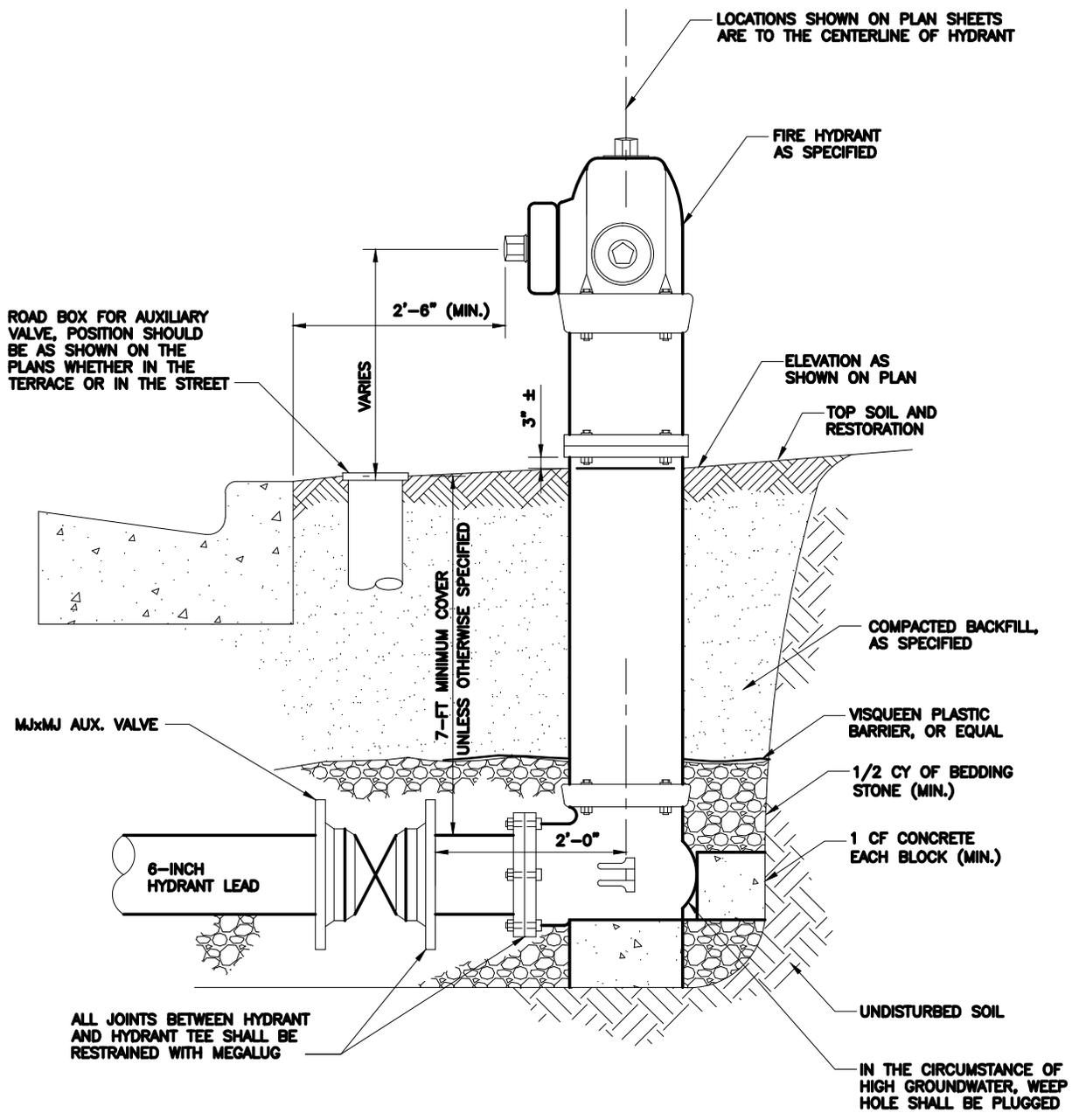
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OCTOBER 2011

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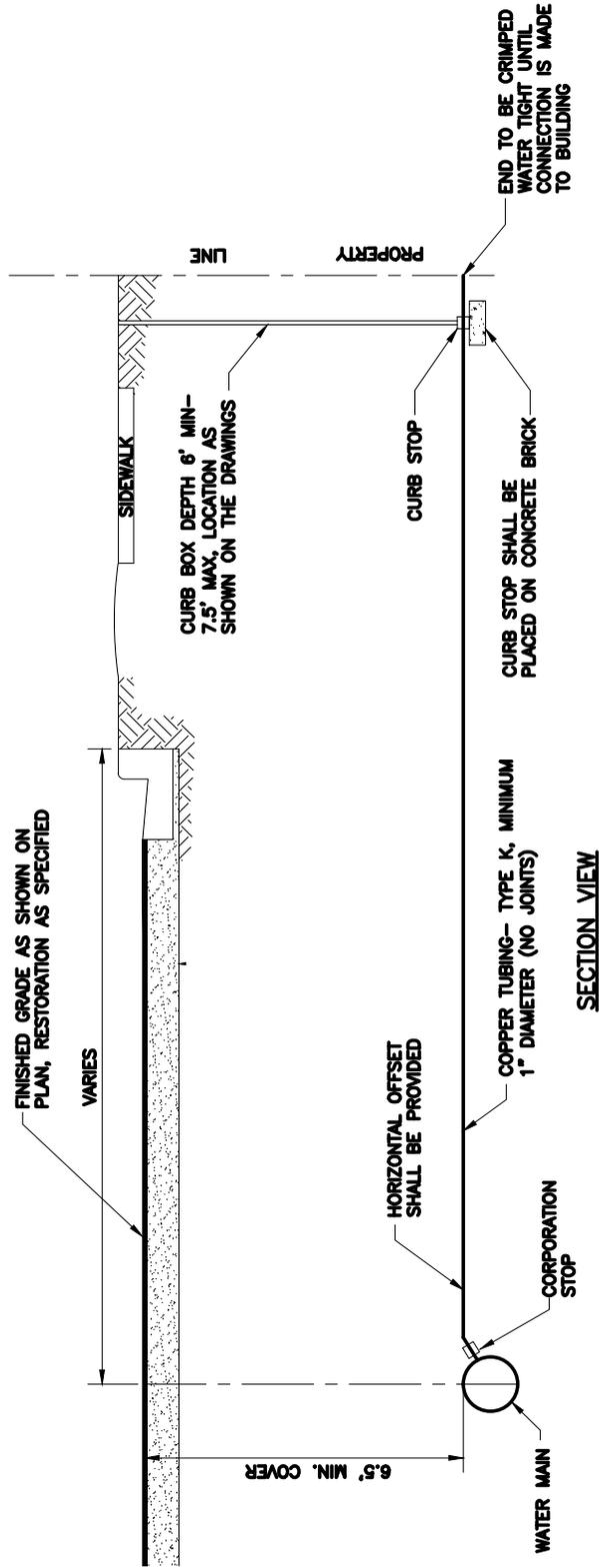
### HYDRANT INSTALLATION

#### STANDARD DETAIL

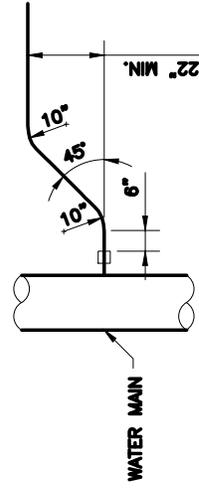
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01-975-65A

OCTOBER 2011



**SECTION VIEW**



**HORIZONTAL OFFSET PLAN VIEW**

- NOTES**
1. ALL FITTINGS SHALL BE FLARED OR COMPRESSION JOINT TYPE, AND CONFORM TO AWWA REQUIREMENTS
  2. CORPORATION STOP TO BE TAPPED INTO DUCTILE IRON WATER MAIN, UNLESS OTHERWISE SPECIFIED, AND ATTACHED TO PVC WATER MAIN WITH A SADDLE
  3. ALL TAPS TO BE MADE UNDER PRESSURE WHEN APPLICABLE.
  4. NO TAPS TO BE CLOSER THAN 18" APART ALONG MAIN
  5. ALL COPPER TUBE BENDS TO BE SMOOTH RADIUS, 10" MIN
  6. WATER SERVICE LATERAL TO BE TESTED ALONG WITH WATER MAIN, UNLESS IT IS AN EXISTING SERVICE BEING RECONNECTED

**RESIDENTIAL WATER SERVICE LATERAL**

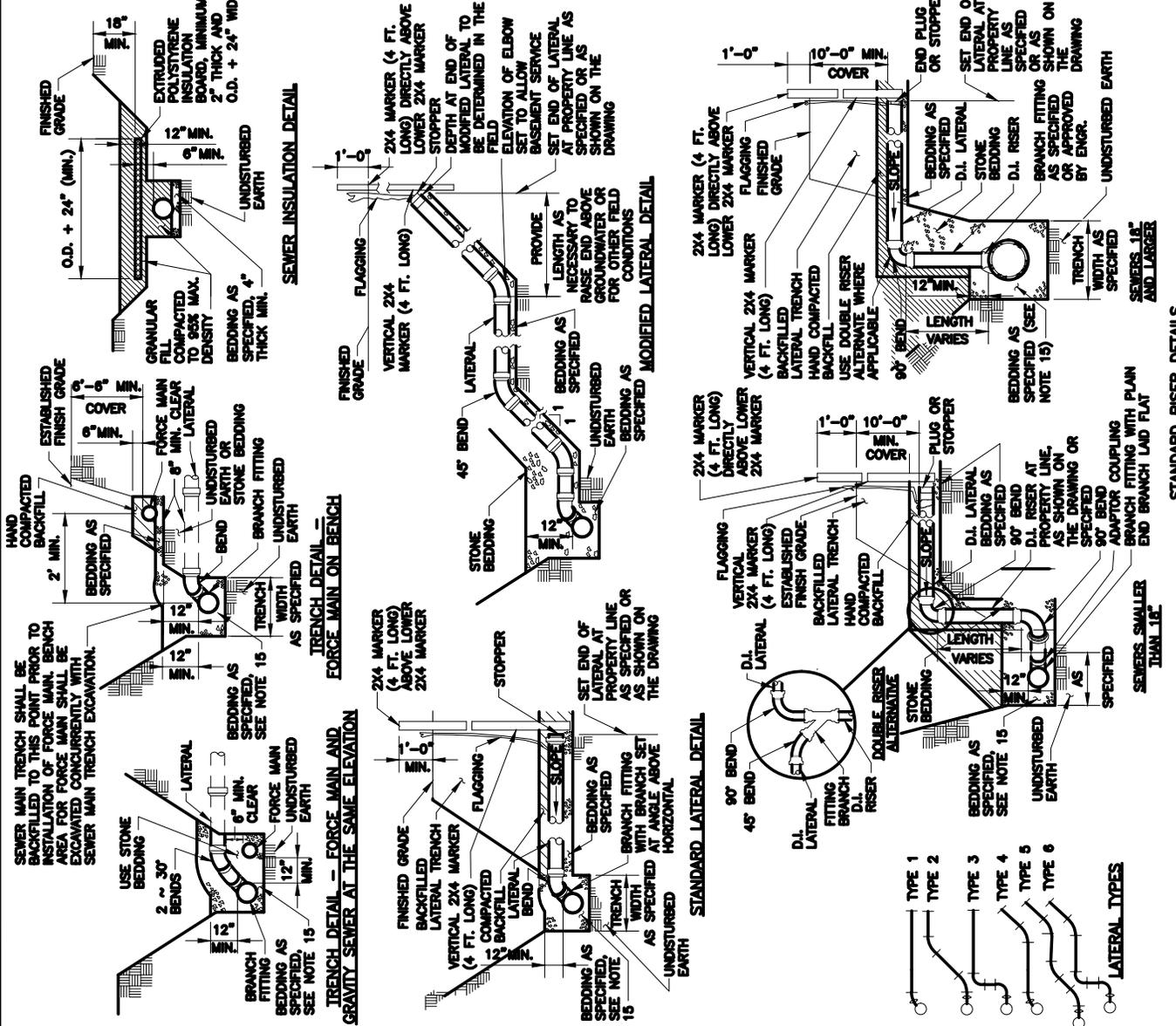
**STANDARD DETAIL**



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**NOTES:**  
 1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF REGULATORY BODIES OF THE STATE AND APPLICABLE MUNICIPAL ORDINANCES.  
 2. DETAILS RELATIVE TO ITEMS SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.  
 3. VARIATIONS IN DIMENSIONS AND DESIGN MAY BE PERMISSIBLE, PROVIDING EQUIVALENT CAPACITY AND STRENGTH ARE ATTAINED.  
 4. ALL NEW CONSTRUCTION SHALL BE PLACED ON UNDISTURBED EARTH OR STONE BEDDING.  
 5. BEDDING CLASSES "B" AND "C" SHALL MEET OR EXCEED ASTM C12 REQUIREMENTS.  
 6. ALL LATERALS SHALL BE LAID AT A STANDARD SLOPE OF 1/4-INCH PER FOOT UNLESS OTHERWISE NOTED ON THE DRAWINGS, OR SPECIFIED IN NO CASE SHALL LATERAL SLOPE BE LESS THAN 1/8-INCH PER FOOT. MAXIMUM LATERAL SLOPE SHALL BE 1 TO 1.  
 7. END PLUGS OR STOPPERS FOR THE ENDS OF LATERALS AND BRANCH FITTINGS SHALL BE PROVIDED.  
 8. 2x4'S SHALL BE PLACED AT ALL LATERALS ENDS SO THAT ONE PROTRUDES 12 INCHES ABOVE FINISHED GRADE AND ONE IS LOCATED IN THE GROUND AT THE END OF THE LATERAL. 2x4'S SHALL BE PAINTED FLOURESCENT ORANGE. 2x4'S SHALL EACH BE AT LEAST 4 FT. LONG.  
 9. BAR STEEL REINFORCEMENT SHALL BE IMBEDDED 1 1/2-INCH CLEAR MINIMUM.  
 10. THE TOP OF ANY MANHOLE STRUCTURE SHALL BE LEFT SUFFICIENTLY LOW TO PERMIT PROPER ADJUSTMENT OF COVER TO GRADE.  
 11. INSTALL DOUBLE RISERS WHERE SHOWN ON THE DRAWINGS OR SPECIFIED.  
 12. STANDARD LATERALS AND MODIFIED LATERALS SHALL BE CONSTRUCTED OF MATERIAL AS SPECIFIED.  
 13. RISERS AND LATERALS FROM RISERS SHALL BE CONSTRUCTED OF DUCTILE IRON. FITTINGS FOR RISERS AND LATERALS FROM RISERS SHALL BE GRAY IRON OR DUCTILE IRON.  
 14. FLAGGING SHALL BE 4-INCH WIDE STANDARD ORANGE VINYL TAPE. THE FLAGGING AROUND END OF ALL LATERALS AND EXTEND UNBROKEN TO FINISHED GRADE DIRECTLY ABOVE ENDS OF LATERALS.  
 15. STONE BEDDING SHALL BE USED AROUND AND TO ONE FT. ABOVE TOP OF ALL SEWER MAINS AT LATERAL CONNECTIONS. PROVIDE BEDDING AS SPECIFIED ELSEWHERE.



# SANITARY SEWER LATERALS

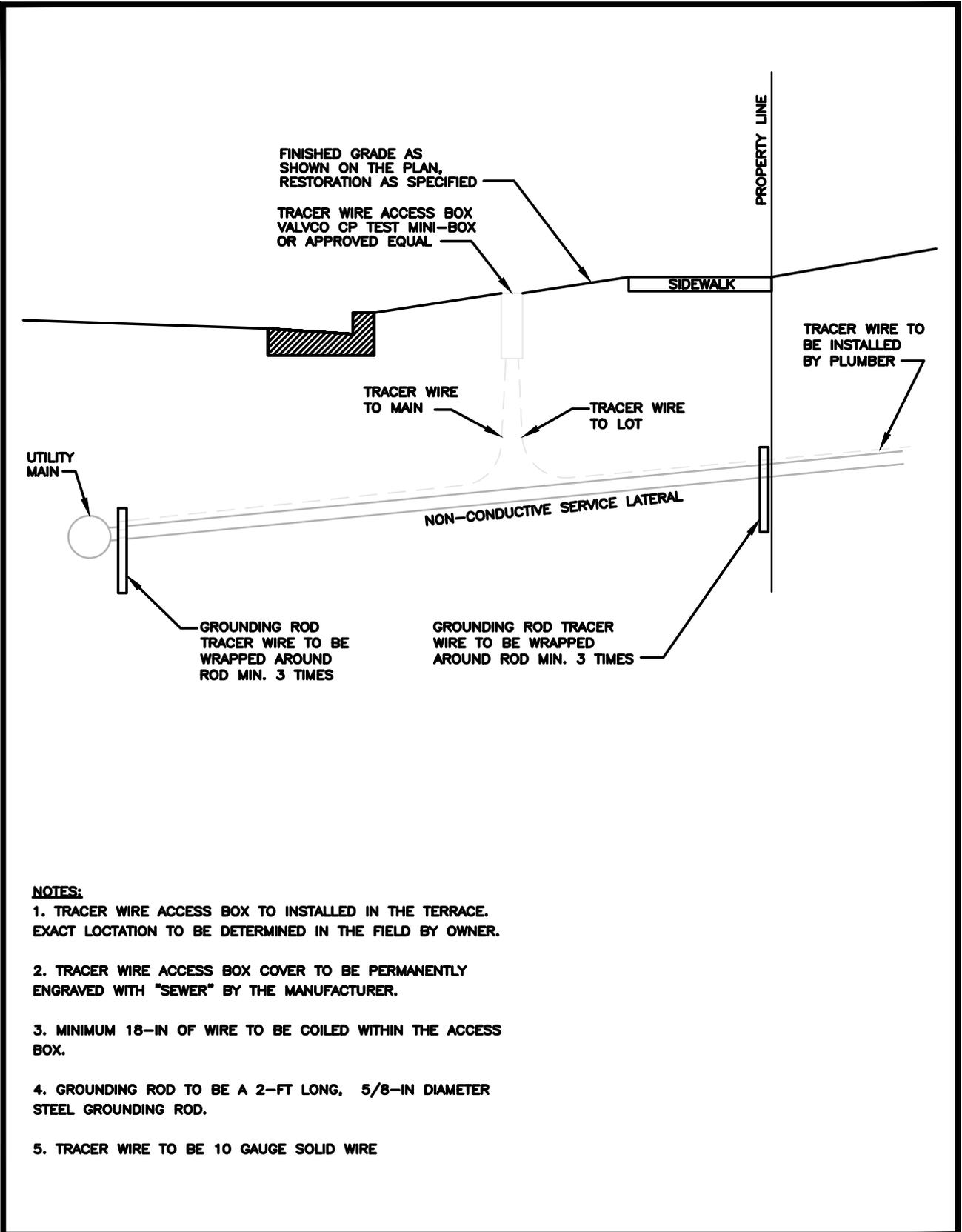
## STANDARD DETAIL



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**NOTES:**

1. TRACER WIRE ACCESS BOX TO INSTALLED IN THE TERRACE. EXACT LOCTATION TO BE DETERMINED IN THE FIELD BY OWNER.
2. TRACER WIRE ACCESS BOX COVER TO BE PERMANENTLY ENGRAVED WITH "SEWER" BY THE MANUFACTURER.
3. MINIMUM 18-IN OF WIRE TO BE COILED WITHIN THE ACCESS BOX.
4. GROUNDING ROD TO BE A 2-FT LONG, 5/8-IN DIAMETER STEEL GROUNDING ROD.
5. TRACER WIRE TO BE 10 GAUGE SOLID WIRE

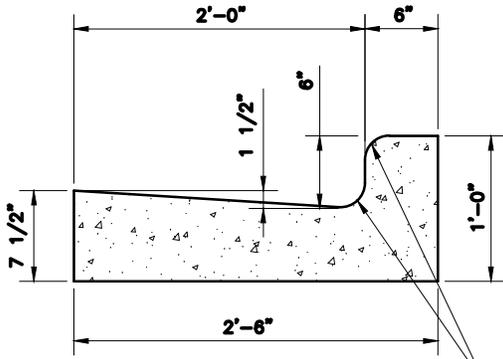
**TRACER WIRE INSTALLATION  
FOR NON-CONDUCTIVE SERVICE LATERALS**

**STANDARD DETAIL**

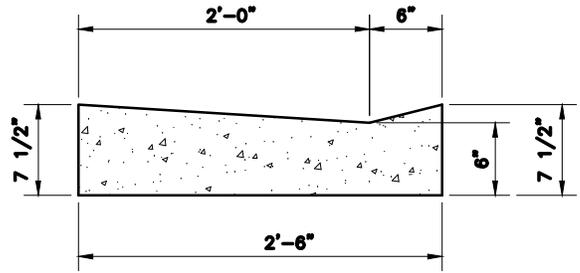


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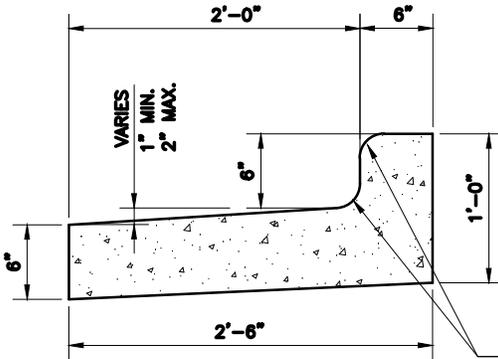
OCTOBER 2011



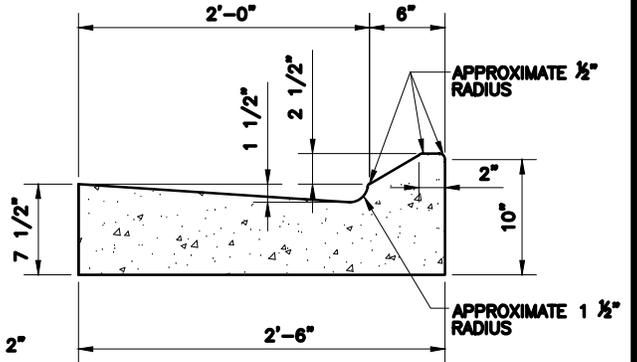
**STANDARD SECTION**



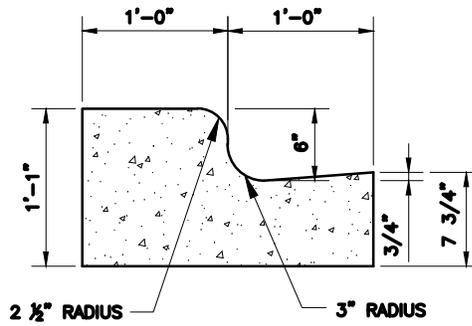
**DRIVEWAY SECTION**



**REJECT SECTION**



**MOUNTABLE SECTION**



**TYPE 'E' SECTION**

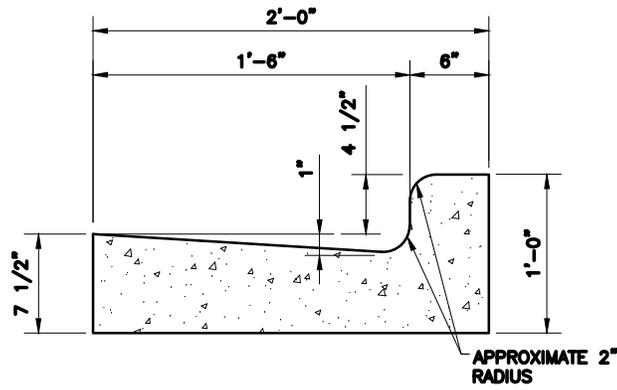
**30-INCH CONCRETE CURB AND GUTTER**

**STANDARD DETAIL**

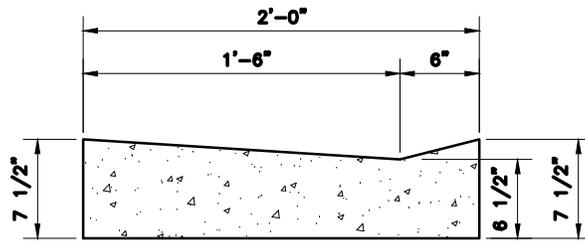


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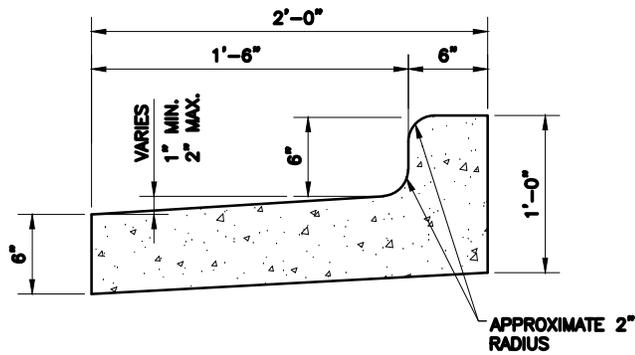
OCTOBER 2011



**STANDARD SECTION**



**DRIVEWAY SECTION**



**REJECT SECTION**

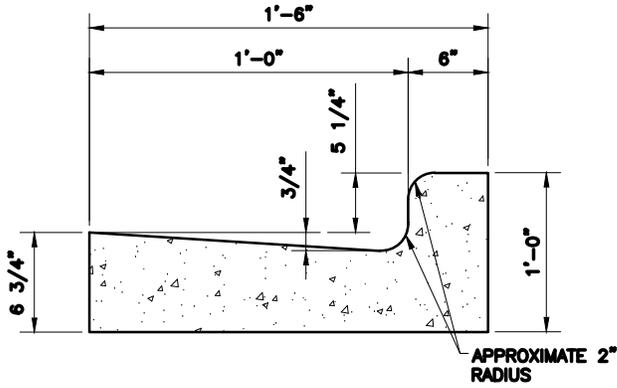
**24-INCH CONCRETE  
CURB AND GUTTER**

**STANDARD DETAIL**

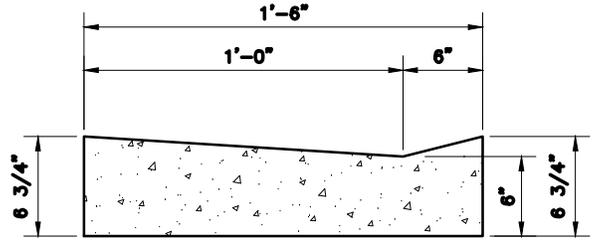


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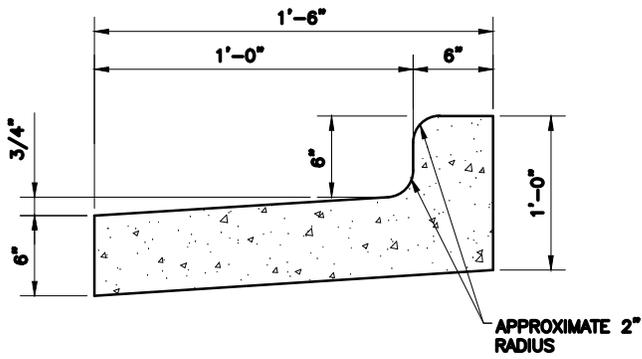
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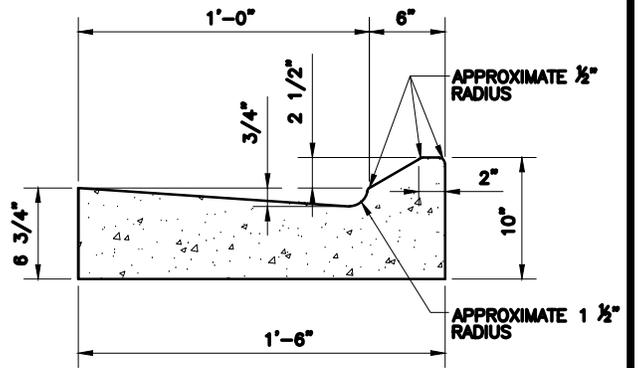
**STANDARD SECTION**



**DRIVEWAY SECTION**



**REJECT SECTION**



**MOUNTABLE SECTION**

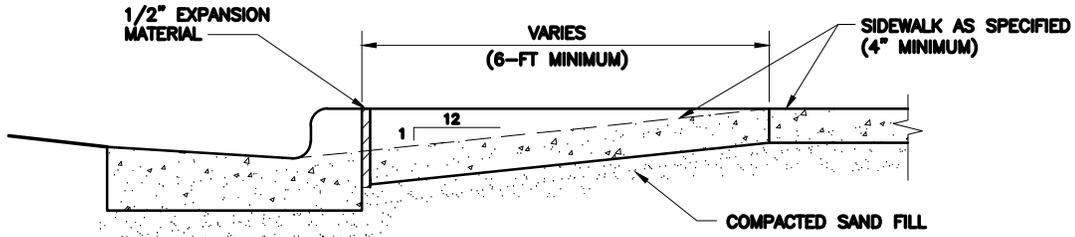
**18-INCH CONCRETE  
CURB AND GUTTER**

**STANDARD DETAIL**

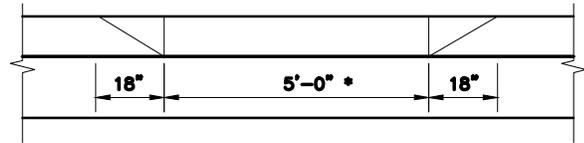
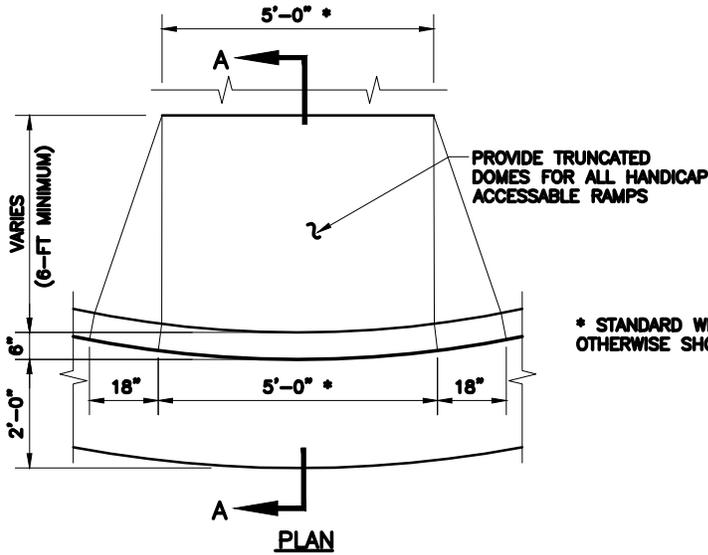


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**CROSS SECTION A-A**



**PROFILE**

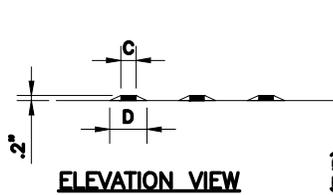
\* STANDARD WIDTH UNLESS OTHERWISE SHOWN ON PLANS

**NOTE:** LOCATE CURB RAMP AT THE CENTER OF INTERSECTION RADIUS, UNLESS SHOWN OTHERWISE IN THE PLANS OR NOTED IN FIELD

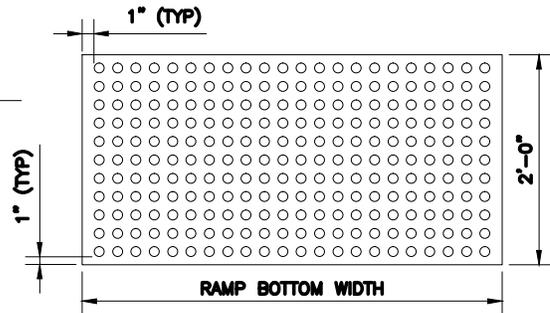
**CURB RAMPS**

	MIN.	MAX.
A	1.6"	2.4"
B	0.65"	1.5"
C	*	*
D	0.9"	1.4"

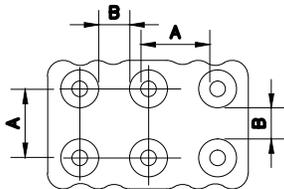
\* THE C DIMENSION IS 50% TO 65% OF THE D DIMENSION



**ELEVATION VIEW**



**PLAN VIEW**  
DETECTABLE WARNING FIELD (TYP)



**PLAN VIEW DETAIL**

**TRUNCATED DOMES**

DETECTABLE WARNING PATTERN  
DETAIL FOR ALL HANDICAP RAMPS

**NOTE:** MATERIALS AND METHOD OF CONSTRUCTION FOR TRUNCATED DOMES SHALL BE SPECIFIED IN SPECIAL PROVISIONS OR AS REQUIRED BY THE CITY

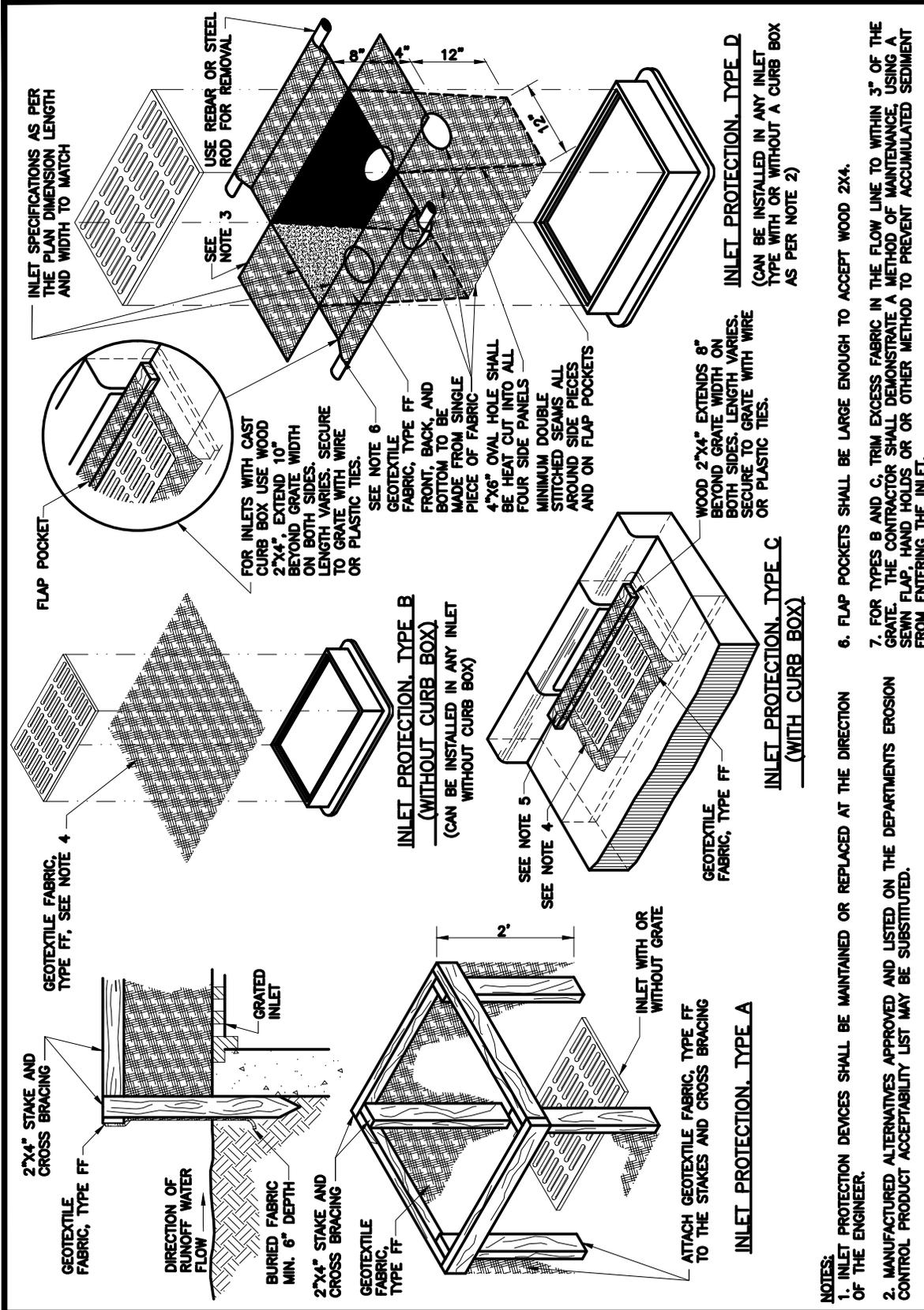
**CURB RAMP AND TRUNCATED DOMES**

**STANDARD DETAIL**



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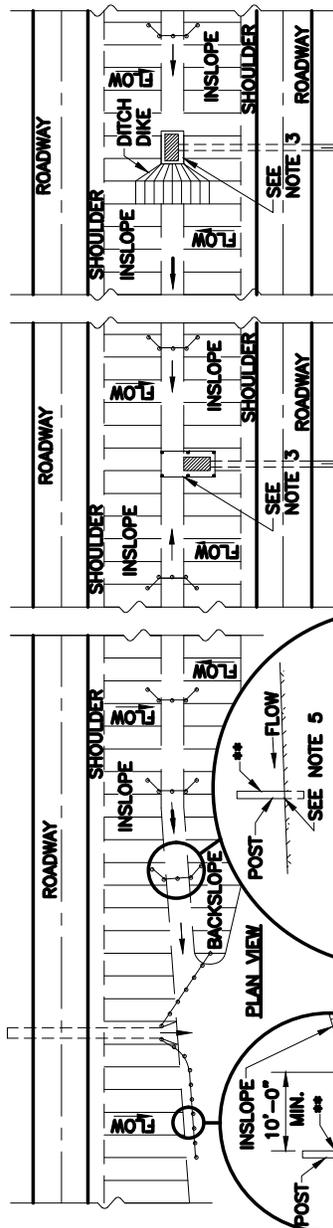
**INLET PROTECTION  
 TYPE A, B, C, AND D**

**STANDARD DETAIL**



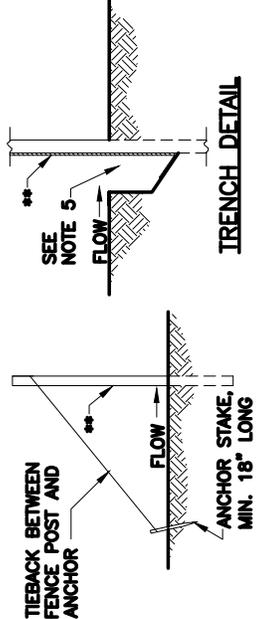
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SITUATION 1 PLAN VIEW  
SITUATION 2 PLAN VIEW  
**SILT FENCE AT MEDIAN SURFACE DRAINS**

\* 20' FOR NORMAL 10' DITCH  
\*\* GEOTEXTILE FABRIC SIDE

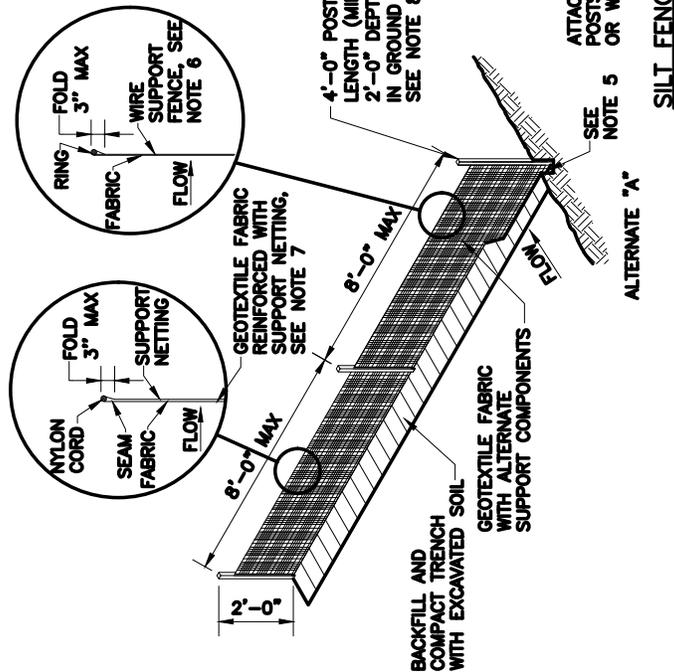


**TRENCH DETAIL**

**SILT FENCE TIE BACK**

NOTE: ADDITIONAL POST DEPTH OR TIE BACKS MAY BE REQUIRED IN UNSTABLE SOILS

**TYPICAL APPLICATIONS OF SILT FENCE**



**SILT FENCE**

- NOTES:**
1. DETAILS OF CONSTRUCTION NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND APPLICABLE SPECIAL PROVISIONS.
  2. WHEN POSSIBLE THE SILT FENCE SHOULD BE CONSTRUCTED IN AN ARC OR HORSESHOE SHAPE, WITH THE ENDS POINTING UPSLOPE TO MAXIMIZE BOTH STRENGTH AND EFFECTIVENESS.
  3. CROSS BRACE WITH 2"x4" WOODEN FRAME OR EQUIVALENT AT TOP OF POSTS.
  4. MINIMUM 14 GAGE WIRE REQUIRED, FOLD FABRIC 3" OVER THE WIRE AND STAPLE OR PLACE WIRE RINGS ON 12" C-C.
  5. EXCAVATE TRENCH A MINIMUM OF 4" WIDE AND 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL AND COMPACT TRENCH WITH EXCAVATED SOIL.
  6. WIRE SUPPORT FENCE SHALL BE 14 GAGE MINIMUM WOVEN WIRE WITH A MAXIMUM MESH SPACING OF 6". SECURE TOP OF GEOTEXTILE FABRIC TO TOP OF FENCE WITH STAPLES OR WIRE RINGS AT 12" C-C.
  7. GEOTEXTILE FABRIC SHALL BE REINFORCED WITH AN INDUSTRIAL POLYPROPYLENE NETTING WITH A MAXIMUM MESH SPACING OF 1/4" OR EQUAL, A HEAVY DUTY NYLON TOP SUPPORT CORD OR EQUIVALENT IS REQUIRED.
  8. STEEL POSTS SHALL BE STUDDED "TEE" OR "U" TYPE WITH A MINIMUM WEIGHT OF 1.2 LBS/LINEAR FOOT WITHOUT ANCHORS, OR ANCHORS SUFFICIENT TO RESIST POST MOVEMENT ARE REQUIRED. WOOD POSTS SHALL BE A MINIMUM SIZE OF 4" DIAMETER, OR 2 1/2" X 3 1/2", EXCEPT WOOD POSTS FOR GEOTEXTILE FABRIC REINFORCED WITH NETTING SHALL BE A MINIMUM SIZE OF 1 1/8" X 1 1/8" OAK OR HICKORY.
  9. ALTERNATES A AND B ARE EQUAL AND EITHER MAY BE USED.

**SILT FENCE**

**STANDARD DETAIL**

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**NOTES:**  
 1. DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.

2. VARIATIONS IN THE DIMENSIONS OR MATERIALS SHOWN HEREON SHALL BE PERMITTED IF THEY PROVIDE EQUIVALENT PROTECTION AND MATERIAL STRENGTH.

3. LAP JOINTS SHALL NOT BE PLACED IN THE BOTTOM OF V-SHAPED DITCHES.

4. JUNCTION SLOTS ON ADJACENT STRIPS OF MATTING SHALL BE STAGGERED A MINIMUM OF 4 FEET APART.

5. EDGES OF THE EROSION MAT SHALL BE IMPRESSED IN THE SOIL.

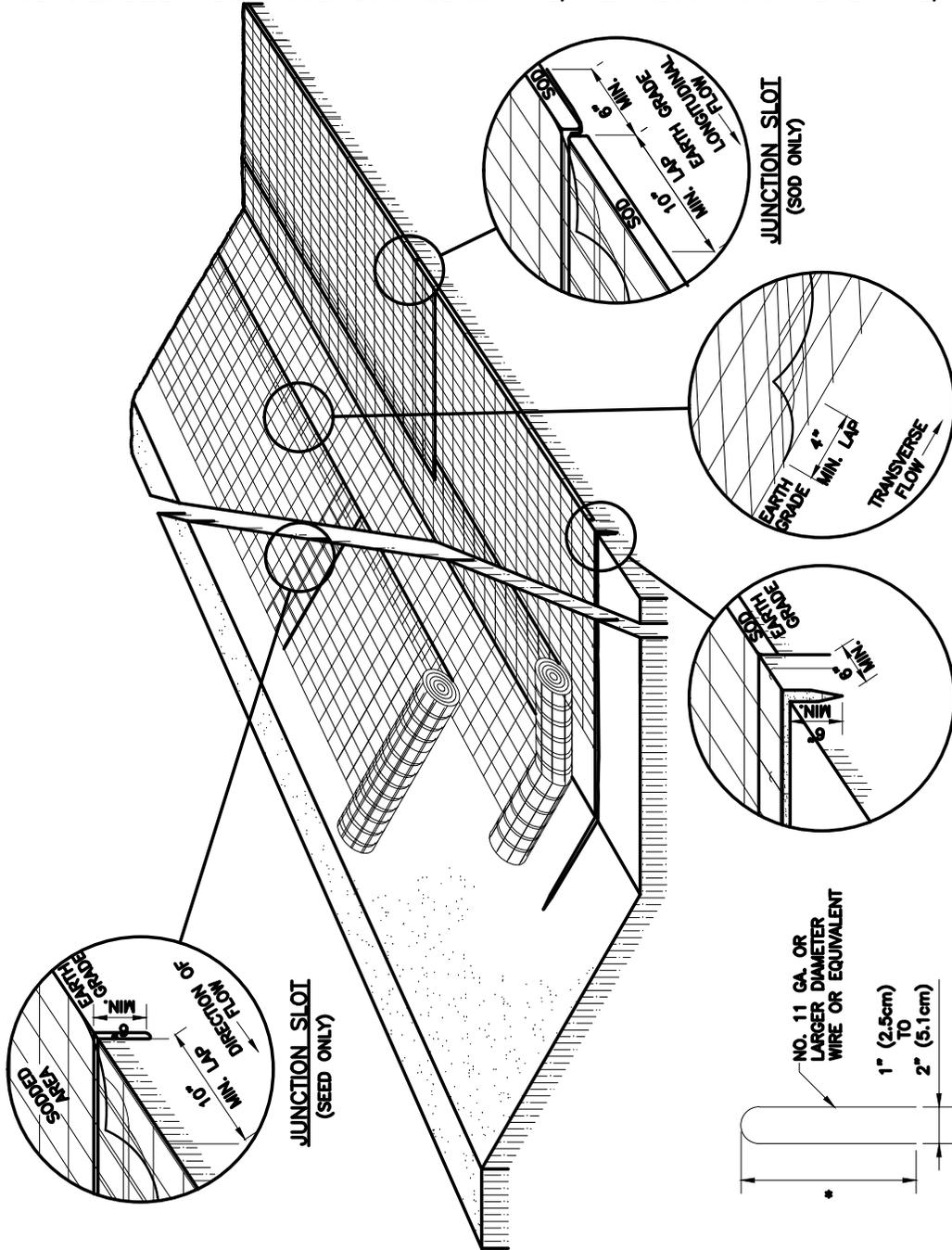
6. EROSION MAT SHALL BE MEASURED AND PAID FOR IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

**EROSION\_MAT\_OVER\_SOD**

- ONLY JUTE FABRIC WILL BE PERMITTED OVER SOD.
- FLOOD STAKES FOR SOD MAY BE OMITTED IF THE EXISTING SLOPE AND SOIL CONDITIONS SO PERMIT.
- THE WIDTH OF EROSION MAT SHALL ALWAYS EQUAL THE SOD WIDTH.
- SOD STRIPS MAY BE PLACED EITHER LONGITUDINALLY OR TRANSVERSELY TO THE FLOW LINE OF THE DITCH.

**EROSION\_MAT\_OVER\_SEEDING**

- JUNCTION OR ANCHOR SLOTS SHALL BE AT MINIMUM INTERVALS OF 100 FEET ON GRADES UP TO AND INCLUDING 3 PERCENT, AND 50 FEET ON GRADES EXCEEDING 3 PERCENT.



**EROSION CONTROL MAT INSTALLATION**

**STANDARD DETAIL**

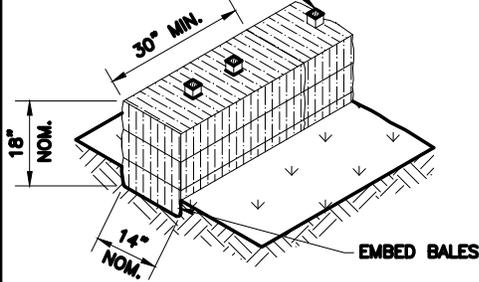


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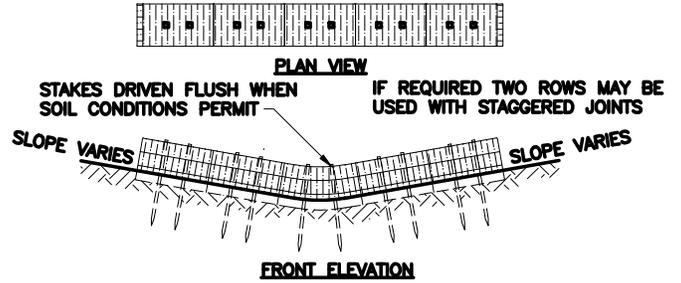
WOOD STAKES (2 PER BALE)  
 NOMINAL 2"x2"x30" MIN.  
 LENGTH OR EQUIVALENT.



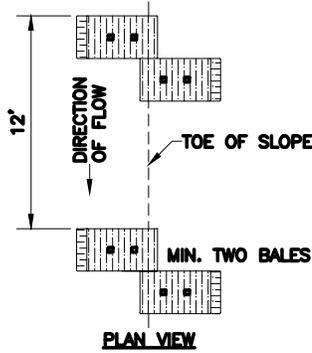
**DETAIL OF EROSION BALE INSTALLATION**

**NOTES:**

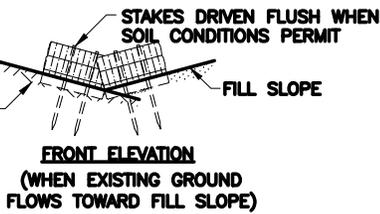
1. DETAILS OF CONSTRUCTION, MATERIALS AND WORKMANSHIP NOT SHOWN ON THIS DRAWING SHALL CONFORM TO THE PERTINENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS AND THE APPLICABLE SPECIAL PROVISIONS.
2. BALES SHALL BE PLACED END TO END OR OVERLAPPING AT RIGHT ANGLES TO THE DIRECTION OF FLOW AND FAR ENOUGH UP THE SIDES OF THE DITCH TO PREVENT ERODING AROUND ENDS.
3. BALES SHALL BE PLACED WITH TWINE OR TIE WIRES PARALLEL TO THE GROUND.
4. STAKES TO BE BATTERED IN OPPOSITE DIRECTIONS



**EROSION BALES ACROSS DITCH BOTTOM**

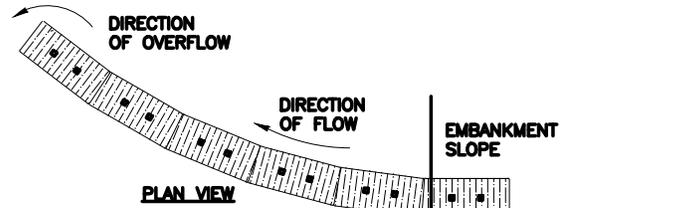


**NOTE:**  
 ALL DIMENSIONS  
 ARE APPROXIMATE

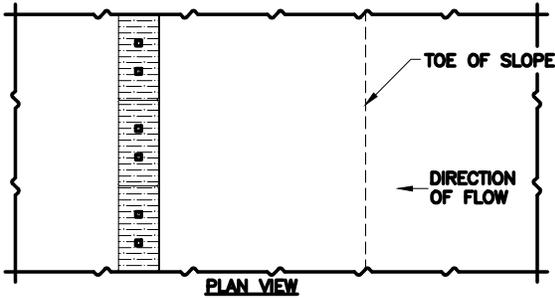
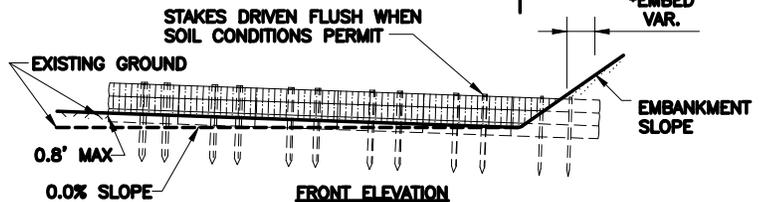


EXISTING GROUND

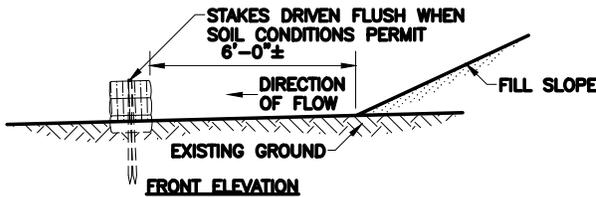
**FRONT ELEVATION  
 (WHEN EXISTING GROUND  
 FLOWS TOWARD FILL SLOPE)**



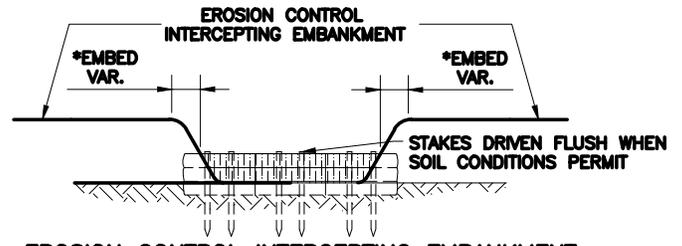
**EROSION BALES AT TOE OF SLOPE**



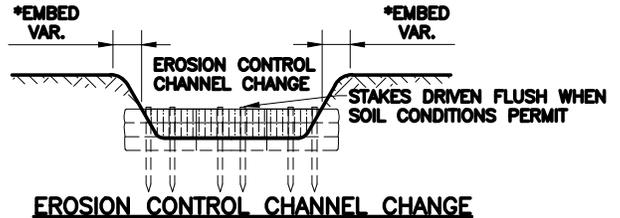
**PLAN VIEW**



**FRONT ELEVATION  
 (WHEN EXISTING GROUND  
 FLOWS AWAY FROM FILL SLOPE)**



**EROSION CONTROL INTERCEPTING EMBANKMENT**



**EROSION CONTROL CHANNEL CHANGE**

**EROSION CONTROL BALE INSTALLATIONS**

**STANDARD DETAIL**

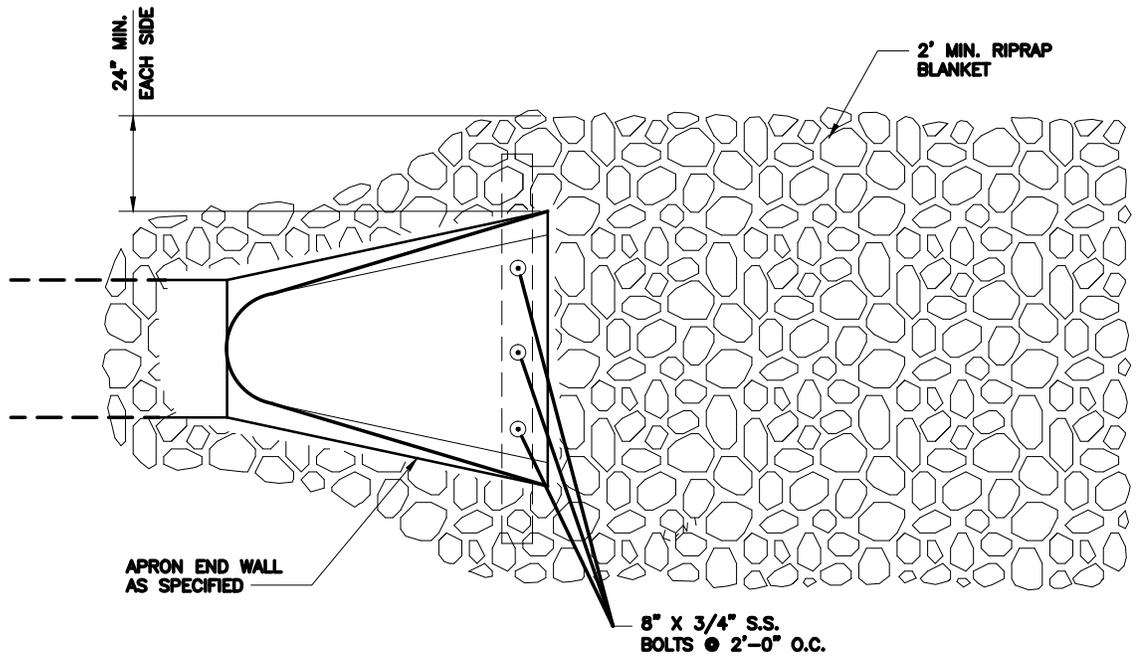
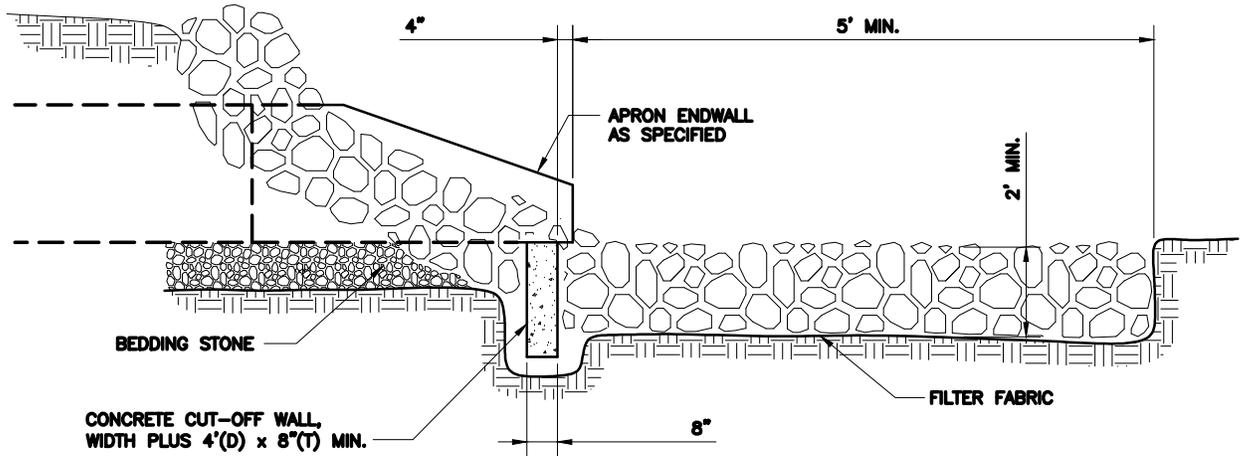


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### STORM SEWER OUTFALL

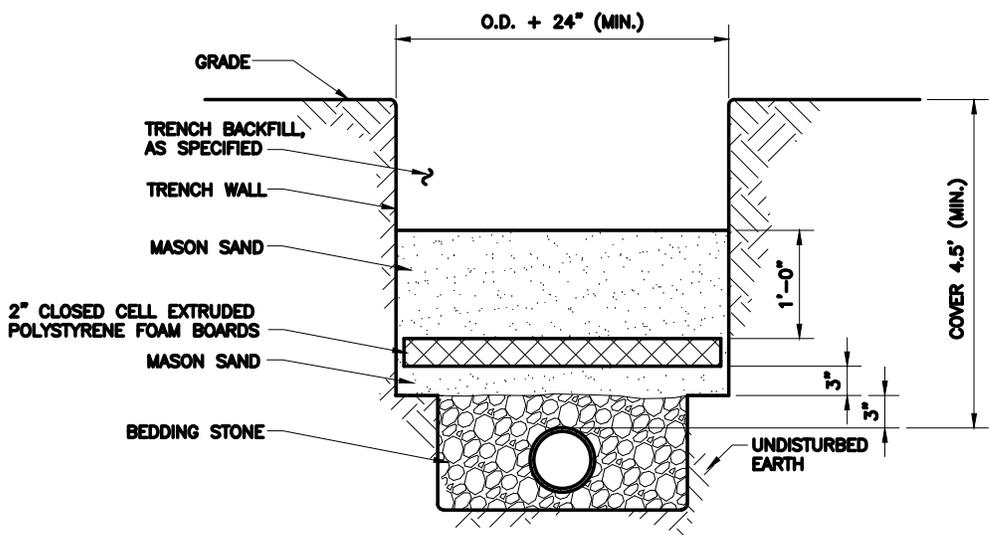
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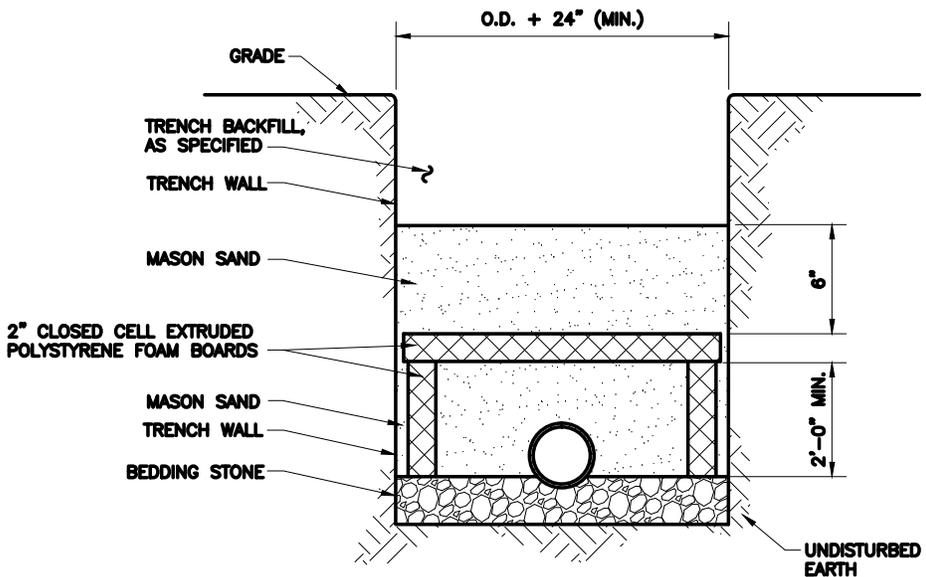
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**FULL WIDTH INSULATION**



**INVERTED U INSULATION**

**NOTE: INSULATION REQUIRED ON ALL PIPES HAVING LESS THAN 8-FT OF COVER, AND NO PIPES SHALL BE INSTALLED WITH LESS THAN 5-FT OF COVER**

**PIPE INSULATION**

**STANDARD DETAIL**



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OCTOBER 2011

For more location information  
please visit [www.strand.com](http://www.strand.com)

## Office Locations

Ames, Iowa | 515.233.0000

Brenham, Texas | 979.836.7937

Cincinnati, Ohio | 513.861.5600

Columbus, Indiana | 812.372.9911

Columbus, Ohio | 614.835.0460

Joliet, Illinois | 815.744.4200

Lexington, Kentucky | 859.225.8500

Louisville, Kentucky | 502.583.7020

Madison, Wisconsin\* | 608.251.4843

Milwaukee, Wisconsin | 414.271.0771

Nashville, Tennessee | 615.800.5888

Phoenix, Arizona | 602.437.3733

\*Corporate Headquarters

