# CONSTRUCTION AND OPERATIONAL STANDARDS, SPECIFICATIONS AND PROCEDURES FOR FACILTIES FOR THE TOWN OF OSSIAN
# WELLS COUNTY, INDIANA

507 North Jefferson Street
Ossian, Indiana 46777

Incorporated into the Town's Code of Ordinances pursuant to Ordinance 18-11-1 adopted by the Ossian Town Council on November 12, 2018.

**STANDARD DETAILS**

**Bedding & Backfill**



**Sanitary Sewer**



**General Structures**



**Storm Sewer**

**Streets**



**Water**

PART 1 - GENERAL

1.1 **General Procedures**

A. The standards, provisions, restrictions, rules, and conditions set forth in the Construction and Operational Standards, Specifications and Procedures for Facilities for the Town of Ossian shall be used in accordance with the Wells County Zoning Ordinance and Wells County Subdivision Control Ordinance. If there are conflicts between the Standards and Specifications and the County ordinances, then the more stringent standards, provisions, restrictions, rules and conditions shall be controlling.

B. The Town of Ossian may authorize deviations from these standards and specifications upon written request from a Contractor / Property Owner / Developer.

C. The Developer or Contractor shall submit construction drawings for a plat or development plan to the Town for review and approval prior to any approval by the Wells County Area Plan Commission. Requests for variances shall be submitted in writing to the Town.

D. Details in the construction drawings prepared shall adhere to applicable standards, provisions, restrictions, rules, and conditions set for the in Ossian Standards & Specifications.

1.2 **Scope of the Work**

A. The Contractor shall furnish all labor, materials, necessary tools, equipment, all utility and transportation services and construct all mains and appurtenances complete and ready for continuous operation, including all pipe, manholes, cleanouts, valves, hydrants, fittings, curbs, curb and gutter, sidewalks, pump stations, pavement removal, pavement replacement, new pavement, site restoration, the protection of all existing structures and utilities, and all other items as required by the Contract Documents.

1.3 **Utilities for Construction Purposes**

A. The Contractor shall furnish all utilities for construction purposes. Construction water connections shall be temporary, to be broken when not in use and are to be made only with the permission of the Town. The Town will provide water for pressure testing except for water required due to a failed test. Contractor(s) shall provide means to convey water for hydrostatic testing into piping being tested. Contractor(s) shall provide water for other types of testing required.

1.4 **Inspection**

A. All materials furnished by the Contractor are subject, at the discretion of the Town, to inspection and approval at the plant of the manufacturer.

B. All pipe and appurtenances shall be laid, jointed and tested for defects and leakage in the manner specified and in the presence of and as approved by the Town / Engineer Representative. **All water and sewer services shall be inspected by the Town / Engineer Representative prior to covering the pipe. Forty-eight (48) business hours notice required.**

1.5 **Material Furnished by the Contractor**

A. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. Installed material discovered to be defective shall be removed and replaced with acceptable material at no additional cost to the Town. The Contractor shall be responsible for the safe storage of material furnished by him or to him, accepted by him, and intended for the work, until the material has been incorporated in the completed project. The interior of all pipe, fittings and accessories shall be kept free from dirt or foreign matter at all times.

B. Changes Caused by Material Purchased by the Contractor: The Contractor shall make any and all necessary changes in construction and piping to install materials approved for installation.

1.6 **Material Furnished by the Town**

A. The Contractor's responsibility for any material furnished by the Town shall begin at the point of delivery thereof to the Contractor. Material already on the site shall become the Contractor's responsibility. The Contractor shall examine all material furnished by the Town at the time and place of delivery to him and shall reject all defective material. Material furnished by the Town that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at no expense to the Town.

1.7 **Disposition of Defective Material**

A. All material found during the progress of the work to have cracks, flaws or other defects will be rejected by the Town. All defective materials shall be promptly removed from the site of the work by the Contractor.

1.8 **Existing Utilities**

A. The location of existing utilities as shown on the drawings are approximate and are to be verified by the Contractor, prior to initiation of construction. The Contractor is responsible to provide notice of work to utilities and request utility locates prior to construction, allowing sufficient time for respective utility companies to mark the underground utilities prior to construction. The telephone number for utility locates is 811 or 1-800-382-5544. Minor relocations of the mains will be possible with written permission of Town and Utility.

B. Various underground conduits, and other structures are shown on the drawings, as marked or taken from the records of the respective utilities, but other structures not shown on the drawings may be encountered. The Contractor is responsible to protect existing utilities. The

Contractor shall be held responsible for the repair of all facilities broken or otherwise damaged.

C. The Contractor shall notify the Town if a conflict exists and wait for instruction prior to construction or any rework will be at the Contractor's expense. Documentation of field verification shall be submitted to the Town prior to commencing Work.

1.9 **Permits for Construction**

A. All permits for construction shall be the complete responsibility of the Contractor, unless noted otherwise. The Contractor will be responsible for complying with all conditions of all permits including the payment of any and all special bonding or inspection charges emanating there from, unless noted otherwise.

1.10 **Protection of the Work**

A. The Contractor shall take all necessary precautionary measures as may be required to prevent damage to the work. Contractor is also responsible for storage of the material, waste containment bins and the furnishing and maintaining barricades, flares, and flagmen. Any damage caused by the lack of proper caution on the part of the Contractor shall be repaired or replaced to original or better condition at no cost to the Town.

1.11 **Material Verification**

A. The Town / Engineer Representative shall have access to material delivery tickets to allow for compliance verification with the specifications.

1.12 **Disposal of Waste and Water**

A. During and following the completion of all work, the Contractor shall dispose of all waste, water and debris in a legal manner satisfactory to the Town.

1.13 **Erosion Control**

A. Contractor shall provide and maintain methods, equipment, and temporary construction as required to control dust, erosion, and sediment at the Site and adjacent areas. Maintain controls until site is stabilized and controls no longer required by permit. Upon completion of Work, remove erosion and sediment controls and restore the Site to specified condition. If condition is not specified, restore Site to preconstruction condition. Comply with Indiana Department of Environmental Management Rule 5 regulations, with the requirements of the Wells County Soil & Water Conservation Service, and with any project applicable Stormwater Pollution Prevention Plan (SWPPP).

1.14 **Maintenance of Traffic**

A. The Contractor shall cooperate with the Ossian street department to maintain traffic and shall submit a Maintenance of Traffic plan to the Town for review and approval fifteen (15) days prior to construction. The Contractor shall notify and arrange with the municipal police, fire and EMS departments and the School Corporation before closing any street. Where it is necessary to maintain one-way traffic, the Contractor shall provide necessary watchmen, flagmen, and proper barricades to insure safety. The Contractor shall notify the Town of Ossian forty-eight (48) business hours in advance of any closures or restrictions on the Town of Ossian streets.

## PART 2 - EXCAVATION AND BACKFILL

### 2.1 Excavation

A. All earth excavation shall be open cut from the surface, except where otherwise shown on the drawings. Excavation shall be interpreted to mean clearing the site; pavement removal where required; excavation of the material encountered in the proposed grade of the conduit; furnishing and placing all sheeting, trenching, trimming and bracing; supporting of structures above and below ground; removal and disposal of water; repairing damage to structures, conduits, and utilities encountered; backfilling; compaction; temporary surfacing of roadways; disposal of surplus materials; providing barricades; temporary lighting; and restoration of the site. During the progress of excavation, care shall be exercised to reserve sufficient material for filling and backfilling.

### 2.2 Utility Trench Excavation

A. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures and utilities, both known and unknown, may be determined, and he shall be held responsible for the repair of such when broken or otherwise damaged. The trench shall be excavated to a point below the bottom of proposed pipe to allow placement of bedding per these Specifications.

B. Open trenches shall be properly protected and guarded by the Contractor in such a manner as to prevent accidents, casualties, or damage of any nature whatsoever to persons, vehicles and abutting property.

C. The trench shall be excavated so that the pipe can be laid to the alignment and grade required. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channels, storm drains or storm sewers.

D. The Contractor shall thoroughly familiarize himself with and implement OSHA Rules and Regulations relating to the Construction Industry, with specific attention being given to the sections devoted to trench construction.

### 2.3 Exploratory Excavation

A. Location of Existing Underground Facilities:
   1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.
   2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

B. The Contractor will be required to excavate and locate existing underground improvements in advance of proceeding with the excavation for the conduit or carry the excavation sufficiently in advance of pipe laying operations that changes in line and grade may be accommodated in order to avoid such existing underground facilities. The cost of all exploratory excavation shall be the responsibility of the Contractor.

C. On the basis of the information obtained from the exploratory excavation, the Town / Engineer may order certain changes in line or grade of the conduit. In any case, changes in the new conduit, or in existing improvements, shall be made only with approval of the Town / Engineer.

2.4 **Pipe Clearance in Rock**

A. Ledge rock, boulders and large stone shall be removed to provide a clearance of at least six (6) inches below and on each side of all pipe and appurtenances. Pipe bedding shall be utilized around the pipe within these clearance areas.

B. The specified minimum clearances are the minimum clearance distances which will be permitted between any part of the pipe and appurtenances being laid, and any part, projection or point of such rock, boulder or stone.

2.5 **Utility Trench Unstable Soil**

A. In areas where unstable soil is encountered below the bottom of the pipe, the Contractor shall notify the Town / Engineer Representative. The length and depth to which unstable soil is to be excavated shall be as determined by the Town / Engineer Representative and no such material shall be excavated unless and until so ordered by the Town / Engineer Representative. All unstable soil shall be completely removed from the site of the work.

B. In cases where over-excavation for the replacement of unacceptable soil materials is required, the excavation shall be backfilled to the required subgrade with special backfill material and thoroughly compacted as specified.

2.6 **Width of Trench**

A. The width of trench shall be the minimum which will permit the pipe to be laid safely and jointed properly and the backfill to be placed and compacted as specified and as recommended by the pipe manufacturer and the Town / Engineer.

2.7 **Sheeting, Bracing, and Shoring**

A. Where required to properly protect the construction work, adjacent property, work or workmen, sheeting, bracing and shoring shall be provided by the Contractor.

2.8 **Sheeting Left in Place**

A. Sheeting, bracing and shoring shall not be left in place after completion of the work except as required by written order of the Town. Where required to protect the work, adjacent structures or property, sheeting, bracing and shoring shall be left in place, but shall be cut or left not less than two feet below the established surface grade.

2.9 **Removal of Water**

A. The Contractor shall provide and maintain during construction, adequate equipment to properly remove and dispose of all water entering the trench or other part of the work where conduits are being placed. In water bearing strata, well points or under drain material may be required to effect a dry trench or pit. No pipe shall be laid in water or when, in the opinion of the Town / Engineer Representative trench conditions are unsuitable.

2.10 **Piling of Excavated Material**

A. In general, material excavated from trenches will not be allowed to be piled on adjacent walks and driveways. The amount of Public Street which may be occupied by the construction work at any time shall be subject to the requirements of the use of the street by the public and approval by the Town. Piling of material outside of right-of-way or easement lines will not be allowed.

2.11 **Disposal of Excavated Materials**

A. All suitable excavated material shall be used in backfilling over the pipe and appurtenances or distributed otherwise in lawn areas to the design grades. All excavated material in excess of the quantity required for backfilling, filling, or subsequent settlement and all unsuitable material shall be removed by the Contractor and disposed of in a timely, legal, and appropriate manner. The Contractor shall be responsible for securing disposal site(s), as well as all grading or reseeding required at same.

B. For all offsite stockpiles and disposal of excavated materials, Contractor is responsible for Indiana Rule 5 Erosion Control Permit as applicable and implementation of erosion control.

2.12 **Blasting**

A. Blasting and explosives will not be permitted.

2.13 **Backfilling**

A. All trenches and excavations shall be backfilled to at least the original surface of the ground or pavement subgrade with allowances made for subsequent settlement. Backfill material shall be deposited in the trench in lifts for its full width simultaneously. Care shall be exercised to work the embedment material completely around the pipe and backfill material completely around appurtenances, filling all voids. Compaction of the backfill shall be provided to the

extent that undue settlement of the backfill does not occur. For nonpavement areas, the backfill shall be placed in lifts to the original grade level. For pavement areas, special backfill shall be placed in lifts and compacted per these specifications.

2.14 **Backfilling in Freezing Weather**

A. Backfilling shall not be completed in freezing weather except by permission of the Town / Engineer Representative. No backfilling shall be made with frozen material, nor shall backfilling be made when the material in the trench is already frozen.

2.15 **Backfill and Fill; Suitable & Unsuitable Materials**

A. Materials acceptable for use as backfill against walls, foundations, underground ductbanks, and other structures shall be stockpiled native sandy clay or granular soils obtained from on-site excavations and which are uniformly mixed, contain no organic matter, nor contain rocks or fragments greater than 3 inches in size, nor have greater than 40 percent passing the 200 sieve.

B. Standard backfill and fill materials from off-site sources shall consist of silty or clayey sand soils that are uniformly mixed, contain no organic matter and which have a Plasticity Index less than ten. The maximum particle size of imported soils shall be 3-inches or less, if required to satisfy trenching, landscaping, or other requirements. The moisture content of the backfill and fill materials shall be within two percent (2%) of optimum per ASTM D1557.

C. All materials for use as backfill and fill material shall be tested by the laboratory services, as requested by the Town / Engineer. If on-site material is unsuitable, as determined by the Town / Engineer, Special Backfill or approved off-site fill shall be used.

2.16 **Embedment Material for Flexible Pipes**

A. All flexible pipes (PVC, HDPE, DIP, CMP) shall be bedded in crushed stone bedding. INDOT Classifications No. 5 and No. 8 are acceptable. The crushed stone shall be placed from a minimum depth beneath the pipe of the outer pipe diameter divided by eight (4 inch minimum) to the pipe's springline. Compacted granular bedding material is then placed on top of the crushed stone, level across the trench, to a point a minimum of 12 inches above the crown of the pipe. The compacted granular bedding material shall consist of angular, graded stone. INDOT Classification No. 5, No. 8, No. 9 are acceptable. Required backfill is then placed on top of the compacted angular bedding. If the requirements of the pipe manufacturer are more stringent, they shall apply.

2.17 **Embedment Material for Rigid Pipes**

A. All rigid pipes (RCP) shall be bedded in compacted Granular Bedding Material: The compacted granular bedding shall consist of angular 0.25 inch to 1.5 inch, graded stone. INDOT Classification No. 5, No. 8 and No. 9 are acceptable. Compacted granular bedding material is placed to a point a minimum of 12 inches above the crown of the pipe. Required backfill is

then placed on top of the compacted granular bedding. If the requirements of the pipe manufacturer are more stringent, they shall apply.

2.18 **Special Backfill**

A. Special Backfill for use beneath structures, concrete slabs and asphalt pavements (and where shown or specified below and around structures) shall be in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Section 904. The material shall be acceptable quality, free from large or frozen lumps, wood, or other extraneous matter. Backfill shall be in accordance with gradation for No. 53 or No. 73 coarse aggregate in accordance with the gradation requirements of INDOT Standard Specifications latest edition, Section 904.03(e). Coarse Aggregate No. 53 or 73 shall be crushed stone or air-cooled blast furnace slag (ACBF), Class D or higher.

2.19 **Compaction**

A. Compaction will be required of all embedment material. The Contractor shall maintain on the job site with each crew, a copy of the manufacturer's recommendations with respect to pipe embedment material and compaction.

B. With respect to special backfill material, the Contractor shall place the material in lifts and compact each lift per the following table.

C. Material shall be within plus or minus two percent (2%) of optimum moisture content. The Contractor shall submit to the Town written documentation of proof of compaction. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Town / Engineer. Jetting, flooding, puddling, or vibroflotation may not be used without written consent of the Town / Engineer. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated. Granular bedding for structures shall have each lift thoroughly compacted and seated with the subgrade. Compaction methods and procedures shall be subject to approval of the Town / Engineer. Unless otherwise indicated or approved by the Town / Engineer, place fills in the loose lift thicknesses indicated hereafter and compact to a dry density not less than the specified percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D1557, unless otherwise noted.

| Usage | Percent Compaction | Lift Thickness |
|---|---|---|
| Subgrade and Subbase Fill: | | |
| Below Pavements, Walkways | 95 | 8 |
| Below Footings or Structural Slabs | 98 | 6 |
| Lawn Areas | 90 | 8 |

| | | |
|---|---|---|
| Fill Adjacent to (Or Behind) Vertical Walls | 95 | 8 |
| Special Backfill (Pipes & Structures) | 95 | 6 |
| Trench Backfill Above Pipe (Lawn Areas) | 90 | 8 |
| Manhole / Drainage Structure Backfill (Lawn Areas) | 90 | 8 |
| Granular Pipe Embedment Material | 90 | 6 |

2.20 **Compaction Testing During Construction**

A. Quality Control Testing During Construction: Contractor's independent testing service shall inspect and approve subgrades and fill layers before construction Work is performed thereon. All associated costs for density testing as specified by the Town shall be at the expense of the Contractor.

B. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Tests of subgrades and fill layers shall be taken as follows:
   1. The frequency of Contractor confirmation tests shall be not less than as follows: Each test location for trenches shall include tests for each layer, type, or class of backfill from bedding to finish grade.
      a. Trenches for Underground Facilities:
         1) In open fields: Two locations every 1,000 linear feet.
         2) Along dirt or gravel roads or off traveled Right-of-Way: Two locations every 500 linear feet.
         3) Crossing paved roads: Two locations along each crossing.
         4) Under pavement cuts or within two feet of pavement edges: One location every 400 linear feet.
      b. For Structural Backfill: On 30-foot intervals on all sides of the structure for every compacted lift, but no less than one per lift on each side of the structure for structures less than 60 feet long on a side.
      c. In Embankment or Fill: One per 1,000 square feet on every compacted lift.
      d. Base Material: One per 1,000 square feet on every compacted lift.
      e. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least 1 test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Town / Engineer.

2. Copies of the test reports shall be submitted promptly to the Town / Engineer. Contractor tests shall be performed by a soils testing laboratory acceptable to the Town / Engineer.

## 2.21 Construction in Highway Rights of Way

A. All construction within the road right-of-way shall be carried out in complete accordance with the requirements of the respective highway authority: Town, County, or INDOT.

## 2.22 Special Highway and Railroad Crossings

A. **S**pecial construction procedures will be required at those locations as shown on the drawings. When required, special construction procedures shall consist of boring a casing pipe for installation of a carrier pipe. The casing pipe lengths, size, thickness and location shall be as shown on the drawings and on the permits.

## 2.23 Directional Drilling

A. The Contractor will be permitted to utilize directional drilling to install new water main and sewers only when approved in writing by the Town, except as required by special permit conditions. The pipe material shall be per these Specifications.

B. The directional drilling operation shall be a minimum of a two-stage process. The first stage shall consist of drilling a pilot hole formed by the use of a drill bit. During this drilling process, bentonite or equal drilling fluid shall be pumped down the center of the drilling rods with a separate pipe used to remove the soil cuttings that have become mixed with the drilling fluid liquid. The second stage of the directional drilling operation shall consist of reaming out the pilot hole to accommodate the pipeline. All reaming devices shall be attached to a pipe that removes the soil cuttings and conveys them to the surface.

C. The pilot hole and reamed hole shall be drilled so as to provide straight sections and uniform transitions from straight to long radius curve sections. The pipeline profile shall contain no high points except as noted on the drawings. The drill path shall be monitored by using a pothole machine and electronic package. The minimum required cover on water mains and sewage force mains shall be five (5) feet. At no time shall any bore contain voids. All directional drilling shall be stopped immediately if any surface deformation is detected in the road right-of-way.

D. No additional payment will be made for failed drilling attempts.

E. All utilities along bore path shall be vacuum excavated to determine exact location and elevation prior to construction.

## PART 3 - PAVEMENT, LAWNS, & SURFACE RESTORATION

### 3.1 Temporary Surfacing

A. The Contractor shall provide all temporary roadway surfacing and maintenance of the temporary surfacing until the backfill has been properly compacted and prepared, to permit pavement replacement. Temporary roadway surfacing over the entire area of surface where the pavement has been removed shall consist of not less than a twelve inch (12") depth of compacted #53 or #73 coarse aggregate in accordance with the gradation requirements of INDOT Standard Specifications, latest edition, Section 904.03(e), or a two inch (2”) layer of cold mix asphalt as may be approved by the Town. The Contractor shall provide an emergency contact telephone number in case of settlement or failure.

### 3.2 Site Restoration

A. The Contractor shall restore all sidewalks, property monumentation, curbing, gutters, drives, fences, poles, top soil, grass, trees, landscaping, or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, unless noted otherwise.

### 3.3 Roadway Pavement

A. No permanent roadway pavement shall be replaced until the condition of the backfill is such as to properly support the pavement. Types of pavement on existing streets as indicated on the drawings refer to the wearing surface only except as may be otherwise indicated.

B. In the preparation of the subgrade for pavement replacement, the temporary surfacing shall be removed to the subgrade of the pavement replacement and any loose or cracked pavement adjacent shall be cut and removed. The subgrade shall be accurately graded and compacted. Where the subgrade under the undisturbed pavement has fallen away, the Contractor shall provide properly compacted material under the pavement or remove such pavement as may be necessary to provide a firm supporting pavement subgrade foundation.

C. In no case shall the pavement replacement material be less than the minimum specified for new pavement construction.

### 3.4 Subgrade for Base

A. The Contractor shall prepare the subgrade for the new pavement base material by fine grading, rolling and compacting to the lines and grades as set out in the Contract Drawings. All sub-grades shall be compacted per the Excavation & Backfill portion of these specifications.

B. Prior to placement of aggregate base for roadways, subgrade shall be proof-rolled with a tri-axle dump truck loaded with twenty (20) tons and approved by the Town / Engineer. There

shall be one or two complete coverages as directed by the Town / Engineer. Tire tracks, irregularities, or failures shall be corrected at the Contractor's expense. Proof-roll shall be within twenty-four (24) hours of base placement / paving operations.

3.5 **Pavement Thicknesses**

A. All pavement thickness as specified shall be finished thickness.

3.6 **Stone Base**

A. When stone base is specified, it shall be constructed to the line, grade, cross section and depth as indicated on the Drawings.

B. Stone Base shall consist of aggregate, placed and compacted in layers not less than three inches (3") in depth and not exceeding six inches (6") in depth, to the full depth specified.

C. Place and compact as shown on plans and details.

D. The aggregate material shall be placed in a manner to prevent segregation of the material.

E. The material shall be well compacted by approved mechanical means. Jumping jacks, plate compactors, and backhoe compactors may be used in small areas as determined by the Town. Rollers shall be used in larger areas.

F. Stone base shall be proof-rolled with a tri-axle dump truck loaded with 20 tons and approved by the Town / Engineer. There shall be one or two complete coverages as directed by the Town / Engineer. Tire tracks, irregularities, or failures shall be corrected.

3.7 **Hot Mix Asphalt (HMA) Paving**

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Section 402.

B. Quality Assurance
   1. Manufacturer Qualifications: Manufacturer shall be an INDOT certified hot mix asphalt producer and shall be listed on the most recent version of the INDOT list of certified hot mix asphalt producers, unless otherwise approved by the Town.
   2. Laboratory Qualifications: Testing laboratory shall be an INDOT certified hot mix asphalt laboratory and shall be listed on the most recent version of the INDOT list of certified hot mix asphalt laboratories, unless otherwise approved by the Town.
   3. Regulatory Requirements: Comply with INDOT Standard Specifications latest edition, Section 402 and provisions thereto for asphalt paving work.

C. Environmental Limitations

1. Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
    a. Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
    b. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
    c. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
2. Pavement Marking Paint: Apply on a clean, dry surface, only when the following conditions are met:
    a. Do not place pavement markings unless the surface temperature is between 50 deg F and 95 deg F.

D. Products
1. Aggregates
    a. General: All aggregates used in asphalt mixture shall be in accordance with INDOT Standard Specifications latest edition, Section 904. Use materials and gradations that have performed satisfactorily in previous installations.
    b. Coarse Aggregate: ASTM D 692, hard, strong; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
    c. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
        1) For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
    d. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.
2. Asphalt Materials
    a. All Hot Mix Asphalt (HMA) material shall conform to applicable requirements of the INDOT Standard Specification latest edition, Sections 402 and 406. All bituminous mixtures shall be as follows:
        1) HMA Surface, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B).
        2) HMA Intermediate, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B).
        3) HMA Base, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B).
    b. Tack Coat: Rapid-curve liquid asphalt conforming to INDOT Standard Specification latest edition, Section 406.
    c. Water: Potable.
    d. Recycled materials (RAP): Per INDOT Standard Specifications latest edition, Section 402.08 for Recycled Materials, not to exceed 25% by weight (mass) of the total mixture.
3. Auxiliary Materials
    a. Fine Aggregates: Per INDOT Standard Specifications latest edition, Section 904.

b. Pavement-Marking Paint: All pavement marking materials shall be in accordance with INDOT Standard Specifications latest edition, Section 808. Color: White and Yellow

4. Mixes
   a. Hot-Mix Asphalt (HMA): Provide dense, hot-laid, hot-mix asphalt plant mixes with the following requirements.
      1) Provide mixes with a history of satisfactory performance in geographical area where Project is located.
      2) Surface Course: 110#/in/syd HMA Surface, Type B
      3) Base Course: 110#/in/syd HMA Intermediate, Type B
      4) Subbase: INDOT #53/#73 Compacted Aggregate over INDOT #2 Compacted Aggregate, layer thickness as shown in the Drawings.

E. Line and Grade
   1. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
   2. Where indicated on Drawings, finish surface grades to match existing. Contractor responsible to implement adequate grade control.
   3. Shoulders: Construct to line, grade, and cross-section shown.

F. Subbase
   1. The construction of the subbase shall conform to the details shown on the plans.

G. Preparation
   1. Prepare subgrade as specified in INDOT Standard Specifications latest edition, Sec. 402.11.
   2. Existing Roadway:
      a. Modify profile by grinding, milling, or overlay methods as approved, to provide transition to existing adjacent pavement and surfaces and to produce smooth riding connection to existing facility. Where pavement overlay is proposed or required, all butt joints shall be milled to the depth of the proposed overlay and shall include a minimum 20 foot long milled transition area.
      b. Sawcut existing roadway to create clean edge.
      c. Paint edges of existing adjacent pavement with tack coat prior to placing new pavement. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.
      d. Preparation of Surfacing: The Contractor shall adjust all manholes, valves, catch basins, inlets, etc. to finish grade. Contractor may make such adjustments by using an approved adjustment ring.

H. Examination
   1. Verify that subgrade is dry and in suitable condition to support paving & imposed loads.
   2. Prior to placement of the pavement, proof-rolling of the sub-base shall be required as evidence that the sub-base is in a firm and unyielding condition and completed with a

uniform density. Complete proof-rolling operations per the requirements of these Specifications. All soft and yielding material that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. Paving material shall not be placed on a soft, spongy, frozen or otherwise unsuitable subgrade, sub-base or base. Proof-roll shall be within twenty-four (24) hours of base placement / paving operations.

3. Proceed with paving only after unsatisfactory conditions have been corrected.

I. Surface Preparation

1. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
   a. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
2. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.00251 Ton/Syd (0.06 gal/Syd) per INDOT Design Manual latest edition, Chapter 17 – Quantity Estimating.
   a. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   b. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
3. Equipment: The tack coat material shall be applied with a pressure distributor similar to that required by the Indiana Department of Transportation Specifications, latest edition, and shall be equipped with hose and nozzle for hand spray operation.

J. Patching

1. Hot-Mix Asphalt (HMA) Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
2. Portland Cement Concrete (PCCP) Pavement: Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
3. Tack Coat: Apply per Surface Preparation requirements of this Specification.
4. Patching HMA: Partially fill excavated pavements with HMA base mix and, while still hot, compact to line and grade appropriate for placement of surface. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

K. Hauling: Hot asphaltic concrete shall be laid hot. When hauling, hot asphaltic concrete trucks shall be required to cover the materials with tarps at all times and take other precautions to assure the proper temperature of the mix. Any material which falls below the temperature requirements of the mix, as set out in the Indiana Department of Transportation Specifications shall not be used in the work.

L. Placement
   1. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
      a. Place hot-mix asphalt surface course in single lift.
      b. Spread mix at minimum temperature of 250 deg F (121 deg C).
      c. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
      d. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
   2. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
      a. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
   3. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

M. Joints
   1. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
      a. Clean contact surfaces and apply tack coat to joints.
      b. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
      c. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
      d. Construct transverse joints as described in INDOT Standard Specifications latest edition, Section 402.14.
      e. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
      f. Compact asphalt at joints to a density within 2 percent of specified course density.

N. Compaction
   1. General: Compaction shall conform to INDOT Standard Specifications latest edition, Section 402.15 for the minimum number of rollers and coverage. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
      a. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
   2. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

3. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted.
4. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still at the highest temperature where the mixture does not exhibit any possibility for distortions.
5. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
6. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
7. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
8. Erect barricades to protect paving from traffic until mixture has cooled sufficiently to prevent distortions.

O. Installation Tolerances
1. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   a. Base Course: Plus or minus 1/2 inch (13 mm).
   b. Surface Course: Plus 1/4 inch (6 mm), no minus.
2. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
   a. Base Course: 1/4 inch (6 mm).
   b. Surface Course: 1/8 inch (3 mm)
   c. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

P. Pavement Overlay
1. Preparation:
   a. Remove fatty asphalt, grease drippings, dust, and other deleterious matter.
   b. Surface Depressions: Fill with asphalt concrete mix, and thoroughly compact.
   c. Damaged Areas: Remove broken or deteriorated asphalt concrete and patch as specified.
   d. Portland Cement Concrete Joints: Remove joint filler to minimum ½ inch (12 millimeters) below surface
2. Application:
   a. Tack Coat: As specified in this section.
   b. Place and compact asphalt concrete as specified.
   c. Place first layer to include widening of pavement and leveling of irregularities in surface of existing pavement.
   d. When leveling irregular surfaces and raising low areas, the actual compacted thickness of any one lift shall not exceed 2 inches (50 millimeters).

e. Final wearing layer shall be of uniform thickness, and meet grade and cross-section as shown.

Q. Field Quality Control
1. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
a. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to INDOT Standard Specifications latest edition, Sections 402.13 and 402.15.
4. Testing Requirements and Frequency
a. Quality Control Tests:
1) Asphalt Content, Aggregate Gradation: Once per every 500 Tons (400 mg) of mix or once every 4 hours, whichever is greater.
2) Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 1,000 Tons (900 mg) or once every 8 hours, whichever is greater.
5. Density Tests: Once every 500 Tons (450 mg) of mix or once every 4 hours, whichever is greater.
6. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
7. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

R. Disposal
1. Except for material indicated to be recycled, remove excavated materials from project site and legally dispose of them in an EPA-approved landfill.
a. Do not allow excavated materials to accumulate on-site.

## 3.8 **Portland Cement Concrete Pavement (PCCP)**

A. The Work shall consist of the construction of plain non-reinforced rigid concrete pavement on a prepared base in accordance with these Specifications and in close conformance with the lines, grades, thickness and typical cross sections shown on the plans or established by the Town / Engineer.

B. Quality Assurance
1. Comply with all applicable provisions of the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Sections 502, 610, and other applicable articles called for herein.
2. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work in this Section.

3. Contractor shall engage an independent materials testing firm to perform field testing. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
4. Testing shall include three concrete cylinder compressive-strength tests per ASTM C31 for each 10 cys of concrete placed or each day of concrete placement if less than 10 cys of concrete is placed in a day. Reports of compressive-strength tests shall include: concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
5. One slump test per ASTM C143 shall be taken for each set of cylinders cast.
6. Three test beams shall be taken and tested at intervals recommended by the independent testing agency to determine when a modulus of rupture of 550 psi per AASHTO T97 is obtained.
7. Additional Tests: Testing agency shall make additional tests of the concrete, at Contractor's expense, when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Town / Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Additional tests may include:
    a. Air test per ASTM C321
    b. Yield test per ASTM C138
8. The finished paving will not be accepted or considered complete until all improvements pass the testing requirements of these specifications and the permitting authority.

C. Materials
1. The materials used in concrete shall conform to the applicable INDOT Standard Specifications latest edition, Section 502 – Portland Cement Concrete Pavement and shall meet the requirements of the following subsections of INDOT Standard Specifications latest edition, Section 901.

| | | |
|---|---|---|
| a. | Admixtures | 912.03 |
| b. | Coarse Aggregate, Class AP, Size 8 | 904 |
| c. | Fine Aggregate, Size No. 23 | 904 |
| d. | Fly Ash | 901.02 |
| e. | Ground Granulated Blast Furnace Slag | 901.03 |
| f. | Portland Cement | 901.01(b) |
| g. | Rapid Set Patching Materials | 901.07 |
| h. | Water | 913.01 |
| i. | Joint Materials | 906 |
| j. | Reinforcing Steel (If Specified) | 910.01 |
| k. | Concrete Curing Materials | 912.01 & 912.02 or As Noted |

D. Mix Design:
1. Portland Cement Concrete
    a. The mix design shall conform to INDOT Standard Specifications latest edition, Sections 502.04 and 502.05.

| | | |
|---|---|---|
| b. | Portland cement content | 564 lbs/yd3 |
| c. | Maximum water/cementitious ratio | 0.487 |
| d. | Maximum cement reduction for GGBFS replacement | 30% |
| e. | 70 Fly Ash/portland cement substitution ratio | 1.25 by weight |
| f. | Maximum cement reduction for fly ash replacement | 20% |
| g. | GGBFS/portland cement substitution ratio | 1.00 by weight |
| h. | Slump, formed | 2 in. to 4 in. |
| i. | Slump, slipformed | 1.25 in. to 3 in. |
| j. | Air | 5.0% to 8.0% |
| k. | Minimum flexural strength, third point loading, with fly ash | 550 psi at 28 days |
| l. | Relative yield | 0.98 to 1.02 |

2. High-Early Strength Concrete
    a. The mix design shall conform to INDOT Standard Specifications latest edition, Sections 502.04 and 502.05.

E. Preparation
1. The construction of the subgrade shall conform to the lines, grades and cross sections as shown on the plans and INDOT Standard Specifications latest edition, Section 502.07 and provisions thereto for subgrade preparation.
2. During subgrade preparation and after its completion, adequate drainage shall be provided at all times to prevent water from standing on the sub-grade.
3. Prior to placement of the pavement, proof-rolling of the sub-base shall be required as evidence that the sub-base is in a firm and unyielding condition and completed with a uniform density. Complete proof-rolling operations per the requirements of these Specifications. All soft and yielding material that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. Paving material shall not be placed on a soft, spongy, frozen or otherwise unsuitable subgrade, sub-base or base.
4. A leveling course is not required as long as the finished sub-grade / sub-base conforms to the lines, grades and cross sections as shown on the plans. However, should a leveling course be used, it shall be the material as specified for the subbase.

F. Subbase
1. The construction of the subbase shall conform to the details shown on the plans and to INDOT Standard Specifications Section 502.08.
2. Prior to placement of concrete, the subgrade or subbase shall be thoroughly moistened, but the method of moistening shall not be such as to form mud or pools of water.

G. Forms
1. The subgrade beneath the forms shall be cut to grade and compacted so that the forms, when set, will be firmly in contact for their whole length and at the required elevation. The forms must be set and secured so as to resist springing, settlement or other movement resulting from the placement of concrete against them or from the weight or vibration of any equipment they support.

H. Curing Materials

1. Curing shall conform to INDOT Standard Specifications latest edition, Section 504 and provisions thereto providing for curing.
2. Concrete shall be cured by protecting it against loss of moisture, rapid temperature change or mechanical injury for at least ninety six (96) hours after placement.
3. Approved materials for use in curing include double burlap cloth, waterproof paper blankets, white burlap polyethylene sheets and liquid membrane forming compounds.
4. Other methods may be approved; however, the Town / Engineer's prior approval is required.

I. Joints

1. Joints shall be in accordance with INDOT Standard Specifications latest edition, Section 503 and provisions thereto providing for joints. Longitudinal and transverse joints are required for all concrete pavements.
2. Construction Joints:
    a. Place transverse construction joints at the end of concrete pouring operations if more than 30 minutes has elapsed.
    b. Transverse construction joints and reinforcing shall be in accordance with INDOT Standard Specifications Section 503.03(c) and associated INDOT standard drawings.
    c. Longitudinal construction joints and reinforcing shall be in accordance with INDOT Standard Specifications Section 503.03(d) and associated INDOT standard drawings.
3. Expansion Joints:
    a. Expansion joints shall be in accordance with INDOT Specification Section 503.03(f) and associated INDOT standard drawings.
    b. Place joints at the beginning and end of all curb returns and at the interface between new concrete pavement and existing concrete pavement, concrete curbs, site structures, and building foundations. The maximum interval between expansion joints shall be as shown by the Town / Engineer, except the maximum interval shall be 50 feet if not specified otherwise.
    c. A one (1) day preformed expansion joint shall be placed at the end of each day's work and a one half (1/2) inch preformed expansion joint shall be made around all box outs for manholes and/or inlets and other structures.
4. Contraction Joints And Longitudinal Joints:
    a. Transverse contraction joints, reinforcing dowels, and sealant shall be in accordance with the requirements for INDOT Type D-1 Contraction Joint in INDOT Standard Specifications Section 503.03(a) and associated standard drawings.
    b. Longitudinal joints, reinforcing, and sealants shall be in accordance with INDOT Standard Specifications Section 503.03(b) and associated standard drawings.
    c. Provide joints at the locations identified on the site drawings. If joints are not shown the length between transverse contraction joints (Type D-1 contraction joint) shall not exceed eighteen (18) feet and in no case shall a transverse construction joint be placed less than ten (10) feet apart.

d. Transverse contraction joints shall be placed at every inlet, manhole or other structure in line of the pavement. The location of these structures shall determine the exact location of the joints. All joints shall be extended throughout the pavement section and curbs to the full width.
e. Transverse joints shall match existing adjacent joint patterns.
f. Whenever the width between forms of pavement under construction is greater than sixteen (16) feet, longitudinal joints shall be constructed so as to divide the pavement into strips.

J. Construction Requirements
1. Concrete construction shall comply with INDOT Specification Sections 502, 503, and 504.
2. Placement of concrete shall be in accordance with INDOT Specification Section 502.09 and 502.12.D.
3. Finishing of concrete shall be in accordance with INDOT Specification Section 502.14 and 504.
4. Comply with requirements and with recommendations in INDOT Specification Section 502.10 and ACI 304R for measuring, mixing, transporting, and placing concrete.
5. Unless noted otherwise, do not add water to concrete during delivery, at project site, or during placement.
6. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in INDOT Specification Section 502.12 and ACI 309R.
7. Tolerance: Gap below 10-foot long, unleveled straightedge not to exceed 1/8 inch. Comply with tolerances of ACI 117 and as follows: Thickness: Plus 3/8 inch, minus 1/4 inch. Elevation: 1/4 inch.
8. Normal Crown
   a. The pavement crown for all streets shall be computed at a minimum rate of one quarter (1/4) inch per foot, except as otherwise noted on the plans.
9. Cold-Weather Placement:
   a. No concrete shall be placed during the period November 15 to April 15 without prior authorization.
   b. PCCP operations shall not begin until the ambient temperature is thirty five (35) degrees Fahrenheit and rising. PCCP operations shall be discontinued when the ambient temperature is descending and is forty (40) degrees Fahrenheit or below. PCCP may occur outside these temperatures when authorized in writing by the Town. Regardless of placement temperature, sufficient means shall be taken to prevent the PCCP from freezing prior to attaining opening to traffic strengths in accordance with INDOT Standard Specifications latest edition, Section 502.11 and 502.18. Any PCCP damaged by freezing shall be removed and replaced.
   c. No concrete shall be deposited on a frozen subgrade or subbase.
10. Hot-Weather Placement:
   a. Hot weather conditions will produce a rapid rate of evaporation of moisture from the surface of the concrete and accelerated setting time. Adjustment will need to be made to the PCCP mix to ensure proper handling, placing, finishing, and curing as the weather becomes just slightly warmer and climatic factors of high winds,

low relative humidity, solar radiation are present at the project site and as temperatures rise above seventy five (75) degrees Fahrenheit.

b. In the case of hot weather conditions, effective precautions shall be implemented and conform to the American Concrete Institute (ACI) 305R Standard Specifications latest edition, Hot Weather Concreting and following procedures:.
   1) Modify PCCP mix design as appropriate. Retarders, moderate heat of hydration cement, pozzolanic materials, slag, or other proven local solutions may be used. The cement content of the mixture may be reduced while ensuring the concrete strength will be attained, with approval from the Town.
   2) Have adequate manpower to quickly place, finish, and cure the concrete.
   3) Limit the addition of water at the job site and add water only on arrival at the job site to adjust the slump. Water addition shall not exceed about two (2) to two and half (2 ½) gallons per cubic yard (10 to 12 L/m3). Adding water to concrete that is more than one and half (1 ½) hours old should be avoided.
   4) On dry and/or hot days, when conditions are conducive for plastic shrinkage cracking, dampen the subgrade, forms and reinforcement prior to placing concrete, but do not allow excessive water to pond.
   5) Begin final finishing operations as soon as the water sheen has left the surface; start curing as soon as finishing is completed. Continue curing for at least 3 days; cover the concrete with wet burlap and plastic sheeting to prevent evaporation or use a liquid membrane curing compound described in ACI 306, or cure slabs with water. Retention of moisture will optimize the cement hydration process and allow the concrete to develop its full strength potential. Failure to keep exposed surfaces from drying excessively fast may result in cracking and shrinking, and jeopardizes the PCCP integrity.
   6) Do not use accelerators unless it is common practice to avoid plastic shrinkage cracking and expedite finishing operations. Obtain written approval of Town.

c. Pavement shall be closed to traffic for fourteen (14) days after it is placed. Unless test beams are taken and tested to indicate a modulus of rupture of at least 550 psi. The beams shall be tested as simple beams with third point loading in accordance with ASTM C78 except:
   1) The beam size shall be measured to the nearest one sixteenth (1/16) inch instead of one tenth (1/10) inch.
   2) The test results shall be discarded when the break occurs outside the middle one third (1/3) of the beam.

## 3.9 **Concrete Driveways, Sidewalks, Curb Ramps, Curbs, & Gutters**

A. Contractor shall provide all labor, materials, equipment, and incidentals, permanent and temporary as shown, specified, or required to furnish and install concrete driveways, curbs

and gutters, concrete sidewalks, and concrete ramps in accordance with these Specifications and in conformance with the lines and grades shown on the plans or established by the Town.

B. All areas, elements, and facilities for pedestrian access, circulation, and use that are constructed, installed, or altered in the public right-of-of way shall comply with the Public Rights-of-Way Accessibility Guidelines (PROWAG), latest edition.

C. Quality Assurance
   1. Comply with all applicable provisions of the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Sections 502, 604, 605, 610, 702, and other applicable articles called for herein.
   2. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.
   3. Installer: Shall have a minimum of two years' experience installing PCCP curbs and gutters, concrete sidewalks, concrete ramps, and PCCP driveways.
   4. Contractor shall engage an independent materials testing firm to perform field testing. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
   5. Testing shall include three concrete cylinder compressive-strength tests for each 10 cys of concrete placed or each day of concrete placement if less than 10 cys of concrete is placed in a day. Reports of compressive-strength tests shall include: concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   6. One slump test shall be taken for each set of cylinders cast.
   7. Additional Tests: Testing agency shall make additional tests of the concrete, at the Contractor's expense, when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
   8. The finished paving will not be accepted or considered complete until all improvements pass the testing requirements of these specifications and the permitting authority.

D. Materials
   1. Concrete for sidewalks and ramps shall be in accordance with INDOT Standard Specifications latest edition, Section 702 for Concrete, Class A.
   2. Concrete for curbing shall be in accordance with INDOT Standard Specifications latest edition, Section 605.
   3. Unless otherwise specified on the Drawings the work shall be unreinforced concrete. Reinforcing may be required at the Town's discretion. Reinforcing steel, if specified in the Drawings, shall be in accordance with INDOT Standard Specifications latest edition, Section 910.
   4. Proportioning & Design of Class "A" Concrete Mix for Driveways, Sidewalks, Curbs, Gutters & Ramps:

a. Minimum compressive strength at 28 days: 4,000 psi.
b. Maximum water-cement ratio by weight: 0.49.
c. Minimum cement content: 564 pounds per cubic yard.

E. General Execution
1. Unless otherwise noted on the plans, all sidewalks shall be a minimum of four (4) inches thick, except at driveways sidewalks shall be a minimum of six (6) inches thick.
2. PCCP residential driveway approaches shall be 6 inches thick on top of 4 inches compacted aggregate No. 53. PCCP commercial driveway approaches shall be a minimum 8 inches thick on top of 6 inches compacted aggregate No. 53.

F. Excavation
1. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface conforming to the Section shown on the plans.
2. All soft and unsuitable material shall be removed and replaced with compacted special backfill or as specified on the plans.

G. Forms
1. Forms shall be of wood, metal or other approved material and shall extend for the full depth of the concrete. Forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

H. Placing Cement Concrete
1. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete.
2. The proportioning, mixing and placing of the concrete shall be in accordance with the requirements of INDOT Standard Specifications, latest edition, Sections 502 for PCCP, Section 605 for curbs, and Section 604.03(d) for sidewalks and ramps.

I. Finishing
1. Concrete shall be proportioned, mixed and placed in accordance with the requirements for the class of concrete specified. After the concrete for the curb is placed, it shall be tamped and spaded or vibrated until mortar entirely covers the surface. The top shall be floated smooth and the outer upper corner rounded to a 1/4 inch radius.
2. The face and the top of the curb shall be checked with a 10 foot straight-edge. Portions showing irregularities of 1/4 inch or more shall be removed and replaced at the expense of the Contractor.
3. Compaction of concrete placed in the forms shall be by vibration or other acceptable methods. Forms shall be left in place for 24 hours or until the concrete has set sufficiently so that they can be removed without injury to the curbing. Upon removal of the forms, the exposed curbing face shall be rubbed immediately to a uniform surface. Rubbing shall be accomplished by the use of water and a carborundum brick. For the

purpose of matching adjacent concrete finishes or for other reasons, the Town / Engineer may permit other methods of finishing. Plastering will not be permitted.

4. Comply with INDOT Standard Specifications latest edition, Section 605.04 for finishing of curbs, Section 502 for finishing of PCCP, Section 604.03(e) for finishing of sidewalks and ramps, and Section 610 for finishing of driveways, except no transverse corrugations are required on curb ramps.
5. The surface shall be finished with a float. No plastering of the surface will be permitted. All outside edges of the slab and all joints shall be edged with a 1/4 inch radius edging tool.

J. Joints

1. The type and location of joints and the size of preformed joint filler shall be as shown on the plans or described herein, whichever is more restrictive.
2. Joints for PCCP driveways and approaches shall be in accordance with INDOT Specification 502 and 503.
3. For curb and gutter installation, where the adjacent pavement contains joints, such joints shall be continued through the integral curb. Pavement contraction joints shall be carried through integral curb with preformed joint material 1/4 inch thick, shall conform to the cross section of the curb, and shall be set perpendicular to the face and top of the curb. Preformed expansion joints shall be placed at the beginning and end of all curb returns and also at all castings.
4. Curbing that is not constructed integral with adjacent pavement shall be constructed with intermediate planes of weakness, 1/3 depth, sawed at 10 foot intervals. The width shall not be less than 1/8 inch or more than 1/4 inch, and they shall be placed at the beginning and end of all curb returns and also at all castings.
5. Expansion joints shall be carried through the walk, with preformed joint filler. Expansion joints shall be a minimum of one half (1/2) inch wide, full depth and spaced at a distance not to exceed forty eight (48) feet. Dummy transverse joints shall be evenly spaced between expansion joints and/or drives and steps with a maximum spacing of five (5) feet. Remolded expansion joint filler one half (1/2) inch thick shall be provided between new and old walk drives and abutting existing buildings or steps.
6. Construction joints shall be formed around all appurtenances such as manholes, utility poles, etc., extending into and through the sidewalks. Premolded expansion joint filler one half (1/2) inch thick shall be installed in these joints. This expansion joint material shall extend for the full depth of the walk.
7. Unless otherwise noted, no joint sealants will be required for concrete sidewalks. At the Town's discretion, for expansion and construction joints provide joint filler strips according to ASTM D 1751 or ASTM D 1752 and type SL Silicone Sealant complying with ASTM D 5893 for Type SL. Install per the manufacturer's recommendations and according to ASTM C 1193.
8. Where a replacement walk or curb abuts an existing walk or curb, the Contractor shall provide dowel reinforcing into the existing curb, walk or driveway as directed by Town.

K. Curing

1. PCCP driveways and approaches shall be cured per INDOT Specification Section 502.

2. Concrete for curbs, curb & gutters, sidewalks, and curb ramps shall be cured for at least seventy-two (72) hours. Curing shall be by means of moist burlap or mats or by approved curing compounds. The method and details of curing shall be subject to Town / Engineer's approval. During the curing period all traffic, both pedestrian and vehicular, shall be excluded.

L. Reconstructed Concrete Curbs, Gutters, Sidewalks, or PCCP Driveways

1. This work consists of the satisfactory removal, disposal of removed material and replacement of existing driveways, concrete curb, or gutter or the placing of new curb or gutter at the locations indicated on the plans or as directed.
2. Where an existing concrete sidewalk or PCCP driveway is to be reconstructed, all disintegrated concrete, stone, or other material shall be completely removed and replaced with new concrete sidewalk or driveway in accordance with this specification.
3. The proposed concrete sidewalk shall be constructed the same width as the existing walk or to another width as directed in writing by the Town / Engineer.
4. The removal of concrete driveways, curbing or gutter shall be to uniform lines as directed. The Contractor may be required to cut the driveway or curb to be removed in a straight line with an approved power driven concrete saw if an existing joint is not available. The sawing shall be such that the portion of driveway or curb or gutter to remain in place will not be damaged in any way. Any portion of the sidewalk, driveway, curb, or gutter, which is damaged or removed back of the established line, shall be replaced at the Contractors expense.
5. Unless otherwise directed, sidewalk which must be removed shall be removed between tool marks or joints. At locations where the sidewalk and curb are adjacent and the curb is deteriorated, the curb shall also be replaced as directed.
6. The new sidewalk shall have a joint pattern similar to the surrounding sidewalk.

M. Backfilling

1. After the concrete has set sufficiently, the spaces in adjacent to the concrete shall be refilled with suitable material to the required elevation in layers of not more than six (6) inches and be thoroughly tamped.

N. Curb Machine

1. Curb machines may be used to construct curb provided the curb can be constructed to the requirement of these Specifications.

O. Integral Curb Work

1. If integral curb Work is specified or required it shall be constructed as shown on the Drawings using Concrete, Class A.

P. Driveway Closure & Restoration

1. Property owners shall be notified of work at driveway a week prior to driveway closure.
2. Replace and repair driveways back to original condition and as specified.

3.10 **Stone and Gravel Drive Replacement**

A. Stone and gravel replacement shall consist of eight inches of compacted #73 crushed limestone upon a compacted subbase.

3.11 **Grading and Seeding**

A. The Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install all lawns and grasses.

B. Review installation procedures under other sections and coordinate the installation of items that must be installed with, or before, lawns and grasses. If applicable, notify other contractors in advance of the planting of lawns and grasses to provide them with sufficient time for the installation of items that must be installed with, or before, lawns and grasses

C. The project site disturbed by construction shall be rough graded to a uniform and level grade prior to fine grading and seeding. All surplus or borrowed material necessary for completion of the fine grading shall be placed by the Contractor. All areas to receive seeding shall be shaped, trimmed, raked uniform smooth, free from clods, rocks and other deleterious matter.

D. Quality Assurance
   1. Source Quality Control:
      a. Provide topsoil that is of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, rocks, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial wood seeds, and shall not contain objectionable plant material.
      b. Provide sod procured from areas having growing conditions similar to location of Site.
      c. Machine-cut sod into rectangular sections, exercising care to retain the native soil on the roots of the sod, during stripping, transportation and planting.
      d. Cut and move sod only when soil moisture conditions are such that favorable results can be expected.
      e. Rectangular sections of sod may vary in length but shall be equal in width and of a size that permits the sod to be lifted and rolled without breaking.
      f. Seed that has been stored at temperatures, or under conditions not recommended by the seed Supplier, or has become wet, moldy, or otherwise damaged, shall not be acceptable.

E. Project Conditions
   1. Environmental Requirements:
      a. Proceed with and complete lawn and grass planting as rapidly as portions of the Site become available, working within the seasonal limitations for each type of lawn and grass planting required.

b. Proceed with planting only when current and forecasted weather conditions are favorable to successful planting and establishment of lawns and grasses.
    1) Do not spread seed when wind velocity exceeds five miles per hour.
    2) Do not plant when drought, or excessive moisture, or other unsatisfactory conditions prevail.
c. Begin maintenance immediately after each area is planted and continue until acceptable growth is established.
d. Herbicides, chemicals and insecticides shall not be used on areas bordering wetlands.

2. Scheduling:
    a. Plant during one of the following periods:
        1) Spring Planting: April 1 to June 15.
        2) Fall Planting: September 1 to October 30.
        3) During other periods, the time of planting shall be determined by the Town / Engineer.
3. Water & irrigate lawn and grass plantings as required to obtain adequate establishment of lawns and grasses.

F. Topsoil:
1. Seeding / Sodding: INDOT Section 914.01
2. All soil accepted as topsoil, whether obtained from on-site or off-site sources, shall comply with specified topsoil requirements.
3. Provide fertile, friable, natural topsoil, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than 1-inch in diameter, or other extraneous material harmful to plant growth, in compliance with ASTM D 5268.
4. Topsoil Source: Reuse surface soil stockpiled on-site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. If not suitable amend topsoil to meet requirements approved by the Town / Engineer. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    a. Supplement acceptable on-site soil with manufactured topsoil from off-site sources, when quantities available on-site are insufficient to complete the Work.

G. Lawn Grass Seed:
1. Lawn Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by INDOT 621. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, specified.
2. Seed Species:
    a. Apply “Lawn Grass Seed” at proportion by weight as follows:
        1) 60 percent Perennial Ryegrass
        2) 28 percent Kentucky Bluegrass
        3) 12 percent Creeping Red Fescue
        4) 1 percent maximum weed content
        5) Or as approved otherwise.

b. Apply “General Purpose Mixture” at proportion by weight as follows:
    1) The general purpose mixture shall be “Seed Mixture R” in accordance with INDOT 621.06, or approved equal.
c. The Town may revise seed mix requirements on a project-specific basis.

H. Turf Grass Sod:
1. Comply with INDOT Standard Specifications, latest edition, Section 914.07.
2. Sod shall be a variety or blend of Kentucky Bluegrass or fescue cut to a height of 2 to 3 inches, and shall be free from all primary and noxious weeds.
3. Provide strongly rooted machine-cut sod, not less than 2 years old of uniform density, color and texture from a similar climate region. Provide only sod capable of vigorous growth and development when planted (viable, not dormant) and in strips no less than 16 inches wide and shall be no less than 2 feet in length. Edges of sod shall be cut to a uniform thickness of no less than 3/4-inch (excluding top growth and thatch).

I. Fertilizers:
1. Provide commercial grade complete fertilizer of neutral character, consisting of fast- and slow release nitrogen with an analysis of 12-12-12, in accordance with Indiana Department of Transportation Standard Specification Subsection 914.03.

J. Mulches:
1. Provide air-dry, clean, mildew- and certified seed and weed free, mulch. Mulch may consist of straw, excelsior mulch, wood cellulose fiber mulch, excelsior blanket, paper mat or straw mat, in accordance with Indiana Department of Transportation Standard Specification Subsection 914.05.

K. Water:
1. Provide water acceptable for lawn and meadow application and containing no material harmful to plant growth and establishment and in accordance with Indiana Department of Transportation Standard Specification Subsection 914.09 (a).

L. Examination
1. Contractor shall examine the areas and conditions under which lawn and grass Work is to be performed, and notify Town / Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Town / Engineer.

M. Preparation
1. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
2. Provide erosion-control measures to prevent erosion or displacement of seeded soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3. Confirm that subgrade is at proper elevations and that no further earthwork is required to bring the subgrade to proper elevations. Provide subgrade elevations that slope parallel to finished grade and towards subsurface drains shown.
4. Remove all construction debris, trash, rubble, and all extraneous materials from subgrade. In the event that fuels, oils, concrete washout, or other material harmful to plant growth or germination have been spilled into the subgrade, excavate the subgrade sufficiently to remove all such harmful materials and fill with approved fill, compacted to the required subgrade compaction level. Removed materials to be disposed of in a legal manner.

N. Fine Grading
1. Reset and realign curb boxes and meter boxes to ensure proper alignment and plumbness upon fine grading.
2. Immediately prior to dumping and spreading topsoil, clean subgrade of all stones greater than 1 inch and all other extraneous matter. Remove all such material from Site.
3. Notify Town / Engineer that subgrade has been cleaned, and obtain approval prior to spreading topsoil.
4. Do not attempt to spread excessively wet, muddy or frozen topsoil. Do not spread topsoil more than five days before seeding or planting.
5. Spread topsoil to a minimum depth of three (3) inches but not less than required to meet finish grades after light rolling and natural settlement.
6. The area to be seeded shall be made smooth and uniform and shall conform to the finished grade and cross section shown on the Drawings or as directed by the Town / Engineer.
7. Incorporate fertilizers, after spreading Topsoil, as specified, and at a rate of:
   a. Fertilizer: 18 pounds per 1,000 square feet.

O. Conventional Seeding
1. General: Maintain grade stakes until removal is mutually agreed upon by all parties concerned.
2. Rake or harrow all seedbeds immediately prior to seeding to produce a rough, grooved surface, no deeper than 1 inch. Seed only when seedbed is in a friable condition and not muddy or hard.
3. Sow seed using a spreader or seeding machine.
4. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.
5. Sow lawn grass seed mixture at the rate of not less than 5 pounds for every 1,000 square feet.
6. All seeded areas shall be thoroughly mulched by a method approved by the Town / Engineer. Mulching material shall be applied uniformly in a continuous blanket at a rate of 92 pounds per 1,000 square feet. Mulch shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally with a mulch tiller. Care shall be exercised to obtain a reasonably even distribution of mulch incorporated into the soil.

7. Using a uniform fine spray, irrigate lawn and grass plantings as required to obtain adequate establishment of lawns and grasses.
8. Reseed areas that remain without mulch for longer than 3 days.
9. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
10. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched areas. Reseed areas damaged as a result of such activity.

P. Sodding Lawns

1. Prepare, lay, and water sod per the requirements of INDOT Standard Specifications, latest edition, Section 621.
2. Do not lay sod on ground that is frozen, dust dry or that has not been uniformly prepared, as specified. Do not lay dormant sod.
   a. Lay sod within 24 hours of harvesting.
3. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod.
4. Place sod strips in straight lines parallel to one another.
5. Lay sod across angle of slopes exceeding one on three.
6. Anchor sod on slopes exceeding one on three and steeper, and in ditches with grade steeper than one percent. Space anchors as recommended by sod Supplier, but not less than two anchors for each sod strip to prevent slippage. Use the following anchor dimensions:
7. Wood Peg Anchors: 1/2 inch x 3/4 inch x 12 inch minimum.
8. T-shaped Wire Pins: Machine bent from 8 gauge low carbon steel with a minimum if an 8 inch leg, a 4 inch head, and a 1 inch secondary drive.
9. Immediately upon completion of a section of sodding, tamp, roll lightly and water to ensure contact with subgrade and elimination of air pockets.
10. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
11. Immediately after planting, water sod thoroughly with a fine spray. Water sufficiently to ensure penetration of moisture to bottom of prepared topsoil layer; not just to bottom of sod blanket.

Q. Reconditioning Existing Lawns and Grass Areas

1. Recondition existing lawn damaged by Contractor's operations, including areas used for storage of materials or equipment and areas damaged by movement of vehicles. Recondition existing lawn and grass areas where minor regrading is required.
2. Provide fertilizer, seed or sod and soil amendments, as specified for new lawns and grass areas, and as required to provide satisfactorily reconditioned lawns and grass areas. Provide new topsoil as required to fill low spots and meet new finish grades.
3. Till stripped, bare, and compacted areas thoroughly to a depth of 12 inches.
4. Remove diseased or unsatisfactory lawn and grass areas; do not bury into soil. Remove topsoil containing extraneous materials resulting from Contractor's operations including oil drippings, stone, gravel and other construction materials.

5. In areas approved by Town / Engineer, where substantial lawns and grass areas remain (but are thin), mow, dethatch, core aerate and rake. Fill low spots, remove humps, cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers, as required. Apply seedbed mulch, if required, to maintain moist condition.
6. Water newly planted areas and keep moist until new lawns are established, as specified.

R. Acceptance Criteria for Lawns and Grass Areas
1. Lawn and grass Work will be considered acceptable when:
   a. Areas Seeded with "Lawn Grass Seed" Mixture: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 square feet and bare spots not exceeding 5 inches by 5 inches.
   b. Areas Seeded with "General Purpose" Mixture: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 20 square feet and bare spots not exceeding 12 inches by 12 inches.
   c. Areas Sodded with "Turf Grass Sod": When a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

S. Cleanup and Protection
1. Promptly remove soil and debris, created by lawn and grass Work, from paved areas. Clean wheels of vehicles before leaving Site to avoid tracking soil and topsoil onto roads, walks, or other paved areas.
2. Erect barricades and warning signs as required protecting newly planted areas from traffic. Maintain barricades throughout extended service period and remove when service period ends. Treat, repair or replace damaged lawns and meadows.

T. Inspection & Acceptance
1. The Contractor shall replace or repair any areas damaged by erosion or which fail to grow or take root within one (1) year of the date of final acceptance of the work.
2. Where lawns and grass areas do not comply with specified acceptance criteria, reestablish lawns and grasses and continue extended service period until lawns and grasses comply with criteria for acceptance.

## PART 4 - PIPE AND FITTINGS

### 4.1 General Requirements

A. The Contractor shall furnish and install, complete and ready for continuous operation, all new water, sanitary sewer, storm sewer pipe and appurtenances as shown on the drawings and/or herein specified. The Contractor shall furnish and follow the manufacturer's recommendations and requirements for the installation and use of the selected pipe, fittings and special appurtenances.

B. A complete installation shall include materials, labor, all special features, appurtenances, supports, transitions between different types of pipe and structural modifications for the type of pipe furnished.

C. Contractor shall be responsible for verification of pipe loading during construction. Pipe design is based on final installation depth and required cover.

D. Marking for Identification
   1. Marking:
      a. Each standard and random length of pipe in compliance with this specification shall be clearly marked with the following information that will remain legible during normal handling and storage.
         1) ASTM or AWWA Standard Designation.
         2) Pipe Size.
         3) Pressure/Thickness Class/Profile Number/Standard Dimension Ratio (SDR).
         4) All HDPE for water line piping shall have a blue stripe installed by the manufacturer during the pipe forming process. All HDPE for force main piping shall have a green stripe installed by the manufacturer during the pipe forming process. The pipe in either case shall have multiple stripes so as to be viewed from any angle along the pipe.

E. Quality Assurance
   1. Qualifications
      a. Manufacturer shall have a minimum of five (5) years of experience producing pipe and fittings of the materials specified, and shall be able to submit documentation of at least five (5) installations in satisfactory operation for at least five (5) years.
   2. Component Supply and Compatibility:
      a. All pipe of each material type shall be furnished by the same manufacturer.
      b. Pipe Supplier shall prepare and review all Shop Drawings and other submittals for all materials furnished under this section.
      c. Materials shall be suitable for specified conditions of service and shall be integrated into overall assembly by Pipe Supplier.
   3. Quality of materials, process of manufacture and finished pipe shall be subject to inspection by Town / Engineer.

## 4.2 Replacement of Existing Pipes and Appurtenances

A. Unless shown or noted otherwise on the drawings, all existing sewer lines, water lines, drainage tile, culverts, or other pipe conduits or appurtenances that are disturbed by construction shall be repaired or replaced with the same type and size as encountered. The cost of all such repair or replacement shall be the Contractor's responsibility.

B. The location of all repaired lines shall be furnished to the Town / Engineer Representative as part of the As-Built Record Drawings. The information provided shall indicate the size, depth and material of the line as well as the size and material utilized in making the repair.

## 4.3 Conditions of Service

A. General:
   1. Pipe materials shall be suitable for services intended.
   2. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
   3. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated in the Contract Documents.
   4. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the municipal utility.
   5. Clean rework or recycled material generated by the manufacturer's own production may be used as long as the pipe or fittings produced meet all the requirements of this Section.

## 4.4 Polyvinyl Chloride (PVC) Piping (Gravity, Non-Pressure, Storm & Sanitary)

A. Buried PVC Gravity Sewer Pipe (Diameter < 18 inch).
   1. Material (SDR 35):
      a. Pipe shall comply with ASTM D3034.
      b. Wall Thickness and Pipe Stiffness: Pipe stiffness shall be determined in accordance with test methods in ASTM D3034.
         1) Main Line & Service Laterals: SDR 35, with minimum ring stiffness of 46 psi.
         2) Service Laterals: SDR 35, with minimum ring stiffness of 46 psi.
   2. Fittings:
      a. Gasketed fittings shall comply with ASTM D3034.
      b. Unless otherwise shown or indicated, saddle wyes are unacceptable.
   3. Joints:
      a. Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
      b. Jointing lubricant shall be as recommended by pipe manufacturer.
      c. Provide elastomeric gaskets complying with ASTM F477 and ASTM D3212.

B. Sanitary Sewer Laterals

1. All gravity sewer service laterals connecting to a main line gravity sanitary sewer line shall be six inch (6") diameter (or match existing lateral size if greater) SDR-35 PVC pipe conforming to the same specifications as the main line gravity sewer. Written approval from the Town is required for less than six inch (6") diameter. A four inch (4") diameter lateral will be permitted only upon demonstration by the applicant that slopes can be provided adequate for cleansing velocities and that the lateral is appropriately sized for the flows generated.
2. Connection to the main line gravity sewer shall be by means of a wye or tee installed with the main line sewer. In the event that a tap is made into an existing sewer, same shall be accomplished utilizing a manufactured wye or tee with rubber hub adapters or, only if approved in writing, a saddle on the pipe.
3. All gravity sanitary lateral stubs shall be installed to the right of way line.
4. Buried Piping Identification Tracing for Service Laterals.
    a. Install tracing wire for service connections in accordance with the Contract Drawings and these Specifications. Tracing wire shall be installed from the mainline sewer to the building cleanout, where it is brought up to grade.

4.5 **Ductile Iron Pipe, Joints, and Fittings (Pressure & Non-Pressure, Water & Storm):**

A. Flanged pipe shall only be used inside buildings or structures. It shall not be used in a direct bury application unless noted otherwise.

B. Flanged Pipe: Fabricate in accordance with AWWA C115.

1. Pressure Rating: As specified in on Contract Drawings. If not otherwise specified, 3 inch to 12 inch diameter pipe shall be a minimum Pressure Class 350 in accordance with AWWA C150. Water main pipe with a diameter larger than 12 inch shall be a minimum Pressure Class 250 in accordance with AWWA C150.

C. Non-Flanged Pipe: Conform to AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.

1. Pressure Class:
    a. 3 inch diameter through 12 inch diameter shall be a minimum Pressure Class 350 in accordance with AWWA C150.
    b. Larger than 12 inch diameter shall be a minimum Pressure Class 250 in accordance with AWWA C150.
2. Special Thickness Class: As specified on the Drawings / Piping Schedules.

D. Pipe Joints:

1. Flanged Joints: Conform to AWWA C110 and AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure noted on Contract Drawings.
    a. Gaskets: Unless otherwise specified, gaskets shall be at least 1/8 inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for

the service conditions specified, specifically designed for use with ductile iron pipe and fittings.

b. Bolts: Comply with ANSI B18.2.1.
   1) Exposed: ASTM A307, Grade B.
   2) Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.

c. Nuts: Comply with ANSI B18.2.2.
   1) Exposed: ASTM A563, Grade A, Heavy hex.
   2) Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.

2. Mechanical Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure rating or special thickness class, and test pressure specified.
   a. Glands: Ductile iron.
   b. Gaskets: Plain tip.
   c. Bolts and Nuts: High strength, low alloy steel in accordance with AWWA C111. Cor-Blue or approved equal.

3. Push-On Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure class or special thickness class, and test pressure specified.
   a. Gaskets: Vulcanized SBR, unless otherwise specified.
   b. Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.
   c. Products and Manufacturers: Provide one of the following:
      1) Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, Canada Pipe Company, Ltd., McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.
      2) Fastite Joint by American Cast Iron Pipe Company.
      3) Tyton Joint by U.S. Pipe and Foundry Company.
      4) Or equal.

4. Restrained Joints: Restrained joints shall comply with AWWA C110 or AWWA C153. Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of Town / Engineer.
   a. Products and Manufacturers: Provide restrained joints for mechanical joint piping by one of the following:
      1) Megalug, Series 1100, by EBBA Iron Sales, Inc.
      2) RomaGrip, by Romac
      3) One-Lok, by Sigma
      4) Star Grip 3000 Series, by Star Pipe
      5) Or approved equal.
   b. Products and Manufacturers: Provide restrained joints for push-on joint piping by one of the following:
      1) Super-Lock Joint Pipe, by Clow Water Systems, a division of McWane, Inc.
      2) Lok-Ring Joint, or Flex-Ring Joint, by American Cast-Iron Pipe Company.
      3) TR Flex Joint, by U.S. Pipe and Foundry Company.
      4) Snap-Lok, by Griffin Pipe Products Company.
      5) Or equal.

5. Flanged and Push-On Joint Fittings: Comply with AWWA C110/AWWA C153 and AWWA C111.
    a. Material: Ductile iron.
    b. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.
6. Mechanical Joint Fittings: Comply with AWWA C110/AWWA C153 and AWWA C111.
    a. Material: Ductile iron.
    b. Glands: Ductile iron.
    c. Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.

E. Cement-mortar Lining:
1. Unless noted otherwise in the Contract Documents, pipe and fittings shall be lined with bituminous seal coated cement-mortar lining in accordance with AWWA C104.

F. Specials:
1. Transition Pieces:
    a. Provide suitable transition pieces (adapters) for connecting to existing piping. Submit for approval prior to construction.
    b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.

G. Exterior Surface Preparation and Coatings
1. Buried Pipe and Fittings:
    a. Asphaltic Coating: Coat pipe and fittings with an asphaltic coating approximately 1 mil thick, in accordance with AWWA C151, AWWA C115, AWWA C110, and AWWA C153, as applicable.
2. Fusion Bonded Epoxy Coating for Fittings
    a. When specified, fittings shall be factory coated with 100 percent solids, thermosetting, dry powder epoxy, in conformance with AWWA C116.

## 4.6 **Polyethylene Encasement**

A. When specified, provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.

B. Supply polyethylene in tubes or sheets.

C. Polyethylene encasement materials shall be in accordance with AWWA C105.

D. In addition, polyethylene encasement for use with ductile iron pipe and fitting systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.

E. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

F. Lumps of clay, mud, cinders etc. on the pipe surface shall be removed prior to installation of the polyethylene encasement.

G. Polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement with the minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as, bell-spigot interfaces, bolted joints or fittings and to prevent damage to the polyethylene caused by backfilling operations.

H. Overlaps and ends shall be secured with adhesive tape or plastic tie straps.

I. Installations below the water table tube-form polyethylene should be used with both ends thoroughly sealed with adhesive tape or plastic tie straps at the joint overlaps.

J. Circumferential wraps of tape shall be placed at 2 foot internals along the barrel of the pipe.

K. Provide polyethylene wrap for fire hydrant leads and valves if specified in Contract Documents.

## 4.7 HDPE Pressure Pipe for Water Main or Sanitary Force Main

A. HDPE piping may be utilized only with the Town's written permission.

B. Quality Assurance
   1. Manufacturer's Qualifications:
      a. HDPE pipe and fittings manufacturers and distributors shall be listed as current members of the Plastics Pipe Institute (PPI).
      b. Contractor shall have a minimum of five (5) years of recent experience installing HDPE pressure pipe and fittings for at least the specified pipe and fittings sizes and lengths and shall be able to submit documentation of at least five (5) installations in satisfactory operation for at least five (5) years.
      c. Fusion operators shall have received current training & certification per PPI TN-42.

C. Conditions of Service
   1. General:
      a. Pipe shall be capable of withstanding a minimum recurring surge pressure (water hammer) flow velocity of 4 ft/sec, 55 cycles/day, and 100-year estimated fatigue life, or higher if shown in the Drawings. Occasional and fire flow velocity of 10 fps per NFPA 24.

D. HDPE Mainline Pipe
   1. Dimensions:

1) Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with AWWA C901 and/or AWWA C906 and/or ASTM F714.
2) Wall thickness DR 11.
3) HDPE pipe shall be DIPS.

2. The pipe shall meet the requirements of the applicable AWWA C901 and/or AWWA C906 and/or ASTM F714.
3. Pipe shall be pressure rated to meet the service pressure requirements specified by Town / Engineer.
4. Pipe material used for the manufacture of HDPE shall be high density polyethylene (HDPE) having a material designation code of PE 4710 or higher, meeting the requirements of ASTM D3350 with a minimum cell classification of PE 445574C. Pipe material shall be listed in PPI TR-4 and NSF-61 (for potable water only) and have an allowable stress (HDS) of 1000 psi at 73°F.
5. Only smooth wall HDPE will be permitted.
6. Approved manufacturers are: See list on plasticpipe.org.
7. Physical Properties
   a. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

| Property | Unit | Test Procedure | Value |
|---|---|---|---|
| 1. Material Designation | - | PPI/ASTM | - |
| 2. PPI Material Listing | - | PPI TR-4 | PE 4710 |
| 3. Material Classification | - | ASTM D 1248 | III C 5 P34 |
| 4. Cell Classification | - | ASTM D 3350 | 345434C or 355434C |
| 5. Density | g/cm3 | ASTM D 1505 | >0.941 |
| 6. Melt Index (E) | g/10 min | ASTM D 1238 | <0.15 |
| 7. Flexural Modulus | psi | ASTM D 790 | >110,000 |
| 8. Tensile Strength | psi | ASTM D 638 | <160,000 |
| 9. ESCR (C) | hours | ASTM D 1693 | 3,000 to 3,500 |
| 10. HDB | psi | ASTM D 2837 | 1,600 @ 23°C |
| 11. UV Stabilizer (C) | %carbon black | ASTM D 1603 | 2 to 3 |
| 12. Elastic Modulus | psi | ASTM D 638 | 110,000 |
| 13. Brittleness | Temp F | ASTM D 746 | <-180 |
| 14. Vicat Softening | Temp F | ASTM D 1525 | 255 |
| 15. Thermal Expansion | in/in/ F | ASTM D 696 | 8 x 10E-5 |
| 16. Hardness | Shore D | ASTM D 2240 | 64 |
| 17. Molecular Weight Category | - | - | Extra-High |

   b. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90 percent of the nominal.

E. HDPE Joints
   1. General:

a. Joints shall be as specified in the Contract Documents. If not specified, pipe to pipe joints shall be butt heat fusion joints. Provide ductile iron flanged joints for exposed pipe fittings and ductile iron mechanical joints for buried pipe fittings.

2. Butt Heat Fusion Joints:
   a. Shall be allowed for joining lengths of pipe in a straight run only.
   b. Shall conform to ASTM F2620 and PPI TR-33.
   c. Joint strength shall be equal to or greater than the strength of the pipe, as demonstrated by testing requirements.
3. Special Transition Pieces:
   a. Provide suitable transition pieces (adapters) for connecting to existing piping or MJ valves.
   b. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.
   c. All transitions shall be DIPS DR 11 fused MJ adapters by ISCO or approved equal. Follow all manufacturer recommendations.
   d. All connection to existing pipe shall use a thrust collar.
4. Electro-fusion Couplings
   a. When utilized, electro-fusion couplings shall contain heating coils located at the sealing surface. Use ISCO products or approved equal. Follow all manufacturer recommendations.
5. Thrust Collars
   a. Contractor shall account for impacts of temperature expansion and contraction when installing and connecting HDPE pipe to existing systems. All connections to existing pipe shall use a thrust collar to counteract the Poisson effect. Concrete thrust collar shall be attached to the HDPE pipe by the use of electro-fusion flex restraint devices by ISCO or approved equal. Thrust collar detail shall be submitted to and approved by Town / Engineer prior to construction.

F. Fittings
1. Provide ductile iron fittings; refer to ductile iron fitting specifications.

G. Pipe Stiffeners
1. Provide support using pipe stiffeners.
2. Use stiffeners constructed of stainless steel, per ASTM A240 Type 304.
3. The outside diameter of the stiffener must match the inside diameter of the pipe.

H. Electrofusion Saddles
1. When required by the plans in lieu of tapping saddles, provide electrofusion saddles manufactured in accordance with ASTM F-1055 and conform with the following material requirements:
   a. Pre-Blended resin 4710 which complies with ASTM D3350.
   b. Resin must be acceptable for use with potable water and comply with NSF Standard 61.

I. Joint Restraint: Provide restrained joints where shown or indicated.

1. Proposed restraint system shall be submitted to the Town for review and approval.
2. Restraint system shall be per the recommendations of the pipe manufacturer and appropriate for the fitting to pipe connection.
    a. Mechanical Joint Fitting Restraint:
        1) EBAA Megalug Series 2000PV
        2) Or approved equal.
    b. Push On Fitting Restraint
        1) EBAA Series 15PF00
        2) Or approved equal.
    c. Flange Adapter & Restraint
        1) EBAA Megaflange Series 2100
        2) Or approved equal.

## 4.8 **Water Service Piping & Fittings**

A. HDPE Water Service Pipe and Fittings

1. Polyethylene compounds shall be per PE-3408 with minimum cell classification 345444C.
2. HDPE tubing shall be copper tubing size, CTS, outside diameter controlled, minimum 1" diameter.
3. SDR 9, 200 psi working pressure rated @ 73.4 degrees F with ability to maintain 300 psi for 1000 hours @ 73.4 degrees F.
4. Meet requirements of ASTM D-2737, ASTM D-3350, NSF-14, NSF-61, AWWA C-901.
5. Color: Shall be solid blue exterior tubing or black tubing with blue striping.
6. Tubing shall be labeled at minimum with manufacturer, diameter, outside diameter control, working pressure rating, ASTM specifications and NSF approval.
7. All HDPE shall be continuous from the water main to the curb stop and from the curb stop to the water meter.
8. Stainless steel sleeves should be inserted in all pipe ends connecting to a meter or fitting. Inserts shall be:
    a. 304 stainless steel material, seamless (not split)
    b. Properly sized diameter for CTS, SDR 9 200 psi HDPE tubing and length that does not extend beyond the end of the compression fitting
    c. One end flared to ensure proper seating into end of HDPE tubing
    d. Designed for use with compression style connections.
9. All connections and joints shall utilize brass mechanical compression fittings that are designed and specified for use with HDPE tubing.
    a. Gripping band type restraint shall be used (i.e. Mueller C110 Compression Connection, Ford Quick Joint).

B. Copper Water Service Pipe and Fittings

1. Copper service line piping shall be Type K soft temper copper (ASTM B88) of the flarable type. The minimum size copper line shall be ¾". Joints shall be drawn up firmly and shall be tested before backfilling and any leakage stopped.

2. All joints and fittings on copper service lines shall be brass of the compression type design.

C. No other water service piping material permitted for services two inch diameter and smaller without the written permission of the Town. Larger services shall utilize water main materials.

## 4.9 HDPE Gravity Pipe for Storm Sewers

A. General
1. HDPE piping system shall be specifically designed, constructed, and installed for the service intended.

B. HDPE Non-Perforated Pipe Dual Walled
1. Pipe shall be flexible, non-perforated dual wall HDPE piping with smooth interior walls unless otherwise noted on the plans.
2. Pipe shall have a smooth interior and annular exterior corrugations.
3. Pipe
   a. 10" & Smaller: AASHTO M252, Type S or SP, High Density Polyethylene (HDPE)
   b. 12" & Larger: AASHTO M294, Type S or SP, High Density Polyethylene (HDPE)
   c. Pipe shall meet ASTM F2306 (Virgin HDPE Resin) or ASTM F2648 (Allows Recycled HDPE Material).
   d. Join pipe with gaskets according to ASTM F 477 elastomeric seals.
4. Fittings
   a. Pipe fittings shall be standardized for the type of pipe and joint specified.
   b. In general, all fittings shall be constructed of the same pipe material and material class as the sewer pipe.
   c. Fittings shall meet the requirements of ASTM F2306, ASTM F2648, AASHTO M252, or AASHTO M294.

## 4.10 HDPE Underdrain Pipe & Geotextiles

A. Underdrain pipe shall be perforated plastic pipe in accordance with INDOT Standard Specifications, latest edition, Section 718.02.

B. Fine sediment protection shall be non-woven geotextile material be in accordance with INDOT Standard Specifications, latest edition, Section 718.

## 4.11 PVC Pressure Pipe for Water Main or Sanitary Force Main

A. Polyvinyl Chloride (PVC) Piping
1. Buried PVC Pressure Pipe (Diameter ≤ 12 inch):
   a. Material:
      1) Pipe shall comply with one of the following, as specified on the Plans:
         a) AWWA C900; Material per ASTM D1784, Class 12454; (water or force mains) or

b) ASTM D2241; Material per ASTM D1784, Class 12454 (force mains only)

2) Wall Thickness: DR 18 for AWWA C900 PVC or SDR 21 for ASTM D2241.

3) Fabricate AWWA C900 pipe with ductile iron pipe equivalent outside diameter.

b. Fittings:

1) Provide ductile iron fittings; see ductile iron pipe specifications.

c. Joints:

1) Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.

2) Jointing lubricant shall be as recommended by pipe manufacturer.

3) Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.

2. Buried PVC Pressure Pipe (Diameter 12 inch to 24 inch):

a. Material:

1) Pipe shall comply with AWWA C905.

2) Material shall comply with ASTM D1784, Class 12454-B.

3) Wall Thickness: SDR 18.

4) Fabricate pipe with ductile iron pipe equivalent outside diameter.

b. Fittings:

1) Provide ductile iron fittings; see ductile iron pipe specifications.

c. Joints:

1) Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.

2) Jointing lubricant shall be as recommended by pipe manufacturer.

3) Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.

3. Restrained Joints: Provide restrained joints where shown or indicated.

a. PVC push-on joint piping:

1) Ford Uni-flange Block Buster 1350

2) EBAA Megalug Series 1600

3) Or approved equal.

b. PVC Pipe to Mechanical Joint

1) EBAA Megalug Series 2000PV

2) Or approved equal.

## 4.12 **Concrete Pipe (Gravity, Non-Pressure, Storm Sewer)**

A. Qualifications:

1. Concrete pipe and, where specified, associated fittings shall be from a source listed in the INDOT List of Certified Precast Concrete Producers, in accordance with ITM 813.

B. General

1. Pipe and fittings shall conform to requirements of ASTM C76 or ASTM C655. Pipe shall be free of fractures and surface roughness. Planes of pipe ends shall be perpendicular

to longitudinal axis. Joints shall be designed so that, when sections are laid together, they make a continuous line of pipe with smooth interior free of irregularities in flow line. Fittings, where specified, shall be constructed of the same pipe material and material class as the storm sewer pipe.

2. Pipe Materials:
    a. Cement for concrete Work shall be in accordance with ASTM C150 or ASTM C595.
    b. Aggregates shall conform to ASTM C33.
    c. Steel bar reinforcement shall be in accordance with ASTM A82 or ASTM A496.
    d. Steel wire fabric reinforcement shall be in accordance with ASTM A185.
3. Concrete pipe shall be of the strength classification as shown on the Drawings. A minimum of Class III pipe should be used on all Town projects.
4. The use of concrete pipe shall be limited to 12" diameter and larger.
5. Joints:
    a. Joints shall have a groove on the spigot for placement of a flexible, rubber gasket in conformance with ASTM C443.
    b. Gasket shall be a continuous ring that fits snugly to form a flexible soil-tight seal.
    c. For round pipes with a diameter greater than 24 inch, petroleum based mastic material may be used in lieu of rubber gaskets.

## 4.13 **Pipe Tracing Wire**

A. Tracer wire shall be required on all water mains, water services, force mains, and sanitary sewer laterals.

B. All wire utilized for tracing wire shall be designed for and approved by the manufacturer for use in buried low voltage applications and approved by the Town / Engineer.

C. Provide - No. 10 or stronger high strength copper clad steel reinforced with HDPE insulation tracing wire rated for a minimum tensile strength of 600lbs. The following materials are acceptable:
    1. Soloshot Copperhead Industries, LLC
    2. BoreTough, Agave Wire, LTD
    3. Or approved equal

D. Splice tracing wire together with the following material:
    1. DRYCONN Direct Bury Lug Aqua
    2. Agave Direct Bury lug DWTWC-003
    3. Or approved equal

E. Installation
    1. Tracing wire shall be laid directly over the pipe and attached to the pipe at regular intervals not to exceed ten (10) feet.
    2. Attach the tracer wire to the pipe using plastic “zip” strapping or metal wire.
    3. The following technique shall be used to splice wires together:
        a. Use direct bury lug and strip the wire to 5/8”.
        b. Place one stripped conductor into the lug.

c. Tighten the set screw till it comes in contact with the solid conductor.
d. Note the location of screwdriver and continue tightening the set screw ¾ turn for # 10 solid copper wire.
e. Repeat the steps for the adjacent side.
f. Remove sealant cover and discard. Close housing, aligning conductors until housing lid is fully latched.

4. For valves, the wire shall be brought up the outside of the valve or curb box riser or cleanout. Construct an opening in the lip of the valve box or curb box to allow the top of the tracer wire to be stored inside the box. Ensure that the opening is sized adequate so the cover will fit snug onto the box, once the tracer wire is installed. The wire should be installed with an excess length of 4-6 inches that is to be folded down in the valve box.
5. For cleanouts, the wire shall be brought up the outside of the cleanout. Wrap a minimum of 12" of wire around the outside of the cleanout within four inches of grade. No tracing wire should be drawn up inside or terminated inside a cleanout.
6. For hydrants, install tracing wire in the hydrant shut off valve box in accordance with the installation requirements for values listed above.
7. Successful completion of conductivity test to be completed by the Contractor and in the presence of the Town / Engineer. Successful completion of the test will be required prior to acceptance of water main.

## PART 5 - PIPE INSTALLATION

### 5.1 General

A. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.

B. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from Town / Engineer before proceeding.

C. Town / Engineer will observe excavations and bedding prior to laying pipe by Contractor. Notify Town / Engineer in advance of excavating, bedding, pipe laying, and backfilling operations.

D. Minimum cover over buried piping shall be as follows:
   1. Water mains and water services equal to or greater than 2 inch diameter: 5 feet
   2. Water services smaller than 2 inch diameter: 4.5 feet
   3. Gravity sanitary sewer mains: 4 feet
   4. Gravity sanitary laterals: 3 feet
   5. Sanitary force mains: 5 feet
   6. Storm sewers: 3 feet
   7. Unless otherwise shown or approved by Town / Engineer on a project specific basis.

E. Comply with NFPA 24 for "Outside Protection", where applicable to water piping systems used for fire protection.

### 5.2 Quality Assurance

A. Regulatory Requirements:
   1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including.
      a. Indiana Title 327 Water Pollution Control Division
      b. Indiana Department of Environmental Management

### 5.3 Cleaning Pipe and Fittings

A. All lumps, blisters, and excess coatings shall be removed from the bell and spigot end of each pipe.

### 5.4 Separation of Sewers and Potable Water Piping or Potable Water Structures

A. Horizontal Separation:
   1. Existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten feet.
   2. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undistributed earth shelf on

one side of sewer and with bottom of potable water main at least 18 inches above top of sewer.

3. No water main should be located within 8 feet of a sanitary or storm sewer manhole as measured from the outside edge of the water main to the outside edge of the structure.
4. Exception:
    a. Where it is not possible to provide minimum horizontal separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

B. Vertical Separation:
1. Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses potable water main.
2. Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.
3. Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.
4. Exceptions:
    a. Where it is not possible to provide minimum vertical separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe. Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.
    b. Encase either potable water main or sewer in watertight carrier pipe extending ten feet on each side of crossing, measured perpendicular to potable water main.

C. Separation of Sewer Mains and Potable Water Structures:
1. Maintain a 100 feet minimum distance from water supply wells or other water supply sources and structures.

## 5.5 **Plugs (Bulkheads)**

A. Temporarily plug installed pipe as directed by Town at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

B. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.

C. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.

D. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to Town / Engineer.

5.6 **Bedding Pipe**

A. Bed pipe as specified and in accordance with the Contract Documents and the requirements in the Excavation & Backfill section of these Specifications.

B. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.

C. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.

D. Bedding to be shaped to provide continuous bearing support to pipe for full length. Bedding to be shaped to receive bell and maintain bearing support on remainder of pipe.

E. Do not lay pipe until Town / Engineer approves bedding condition.

F. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

5.7 **Alignment**

A. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by Town / Engineer.

B. Slope piping uniformly as shown on the Drawings.

C. Maintain reference line and grade with laser equipment daily for adjustment and accuracy. Correct deficiencies in equipment, reference line and reference grade. Take precautions to prevent deflections in reference line and grade.

D. Contractor shall install sewer pipe in compliance with slope requirements shown on the Drawings.

E. Contractor shall test every section of installed sewer pipe for compliance with design slope.

5.8 **Laying Pipe**

A. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:
   1. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.
   2. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55, ASTM F645.
   3. Sanitary and Storm Sewers: ASCE 37.

B. Each piece shall be opposite or near the place where it is to be laid in the trench. Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench, piece by piece, by means of a crane, rope or other suitable tools or equipment, in such

a manner so as to prevent damage to main materials and to protective coatings and lining. Under no circumstances shall main materials be dropped or dumped into the trench.

C. Slope piping uniformly between elevations shown.

D. No pipe lengths shorter than 6 ft are permitted without written approval of the Town / Engineer.

E. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.

F. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by Town / Engineer.

G. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by Town / Engineer.

H. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.

I. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly cleaned and dried immediately before pipe is laid.

J. Field cut pipe, where required, with machine approved by manufacturer for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe. Breaking of the pipe with any type of hammer will not be permitted.

K. Do not place blocking under pipe, unless specifically approved by Town / Engineer for special conditions.

L. Touch up protective coatings in manner satisfactory to Town / Engineer prior to backfilling.

M. Notify Town / Engineer in advance of backfilling operations.

N. On steep slopes, take measures acceptable to Town / Engineer to prevent movement of pipe during installation.

O. Thrust Restraint: Where required by specifications or shown on Contract Documents, provide thrust restraint.

P. Exercise care to avoid flotation when installing pipe in cast-in-place concrete, and in locations with high groundwater. The Contractor shall take all precautions necessary to prevent

flotation of the pipe due to water coming into the trench. Any damage from flotation or water entering the trench shall be corrected by removing that section which becomes damaged and repairing or replacing it.

5.9 **Joining Pipe**

A. All pipe joints shall be made up in strict accordance with the pipe manufacturer's recommendations. Joints not tight shall be disassembled, thoroughly cleaned, and remade. Under no conditions shall bolted joints be made tight by overstressing the bolts, or tightening the bolts beyond the manufacturer's recommended range of torque. The Contractor shall provide and have available for the use of the Town / Engineer Representative on the job at all times, properly calibrated indicating torque wrenches to fit all joint bolts being used. Joints found to have bolts tightened above the manufacturer's recommended maximum torque shall be disassembled, cleaned, and properly remade as directed by the Town.

B. Slip joints and other rubber gaskets type pipe joints shall be installed in strict accordance with the manufacturer's recommendations. Lubricants other than those recommended by the pipe manufacturer shall not be used. Joints found to be not tight or with the plain end not sufficiently inserted into the socket shall be disassembled, thoroughly cleaned and properly installed. The plain end shall not be inserted beyond the manufacturer recommendations into the receiving end.

5.10 **Backfilling**

A. Conform to applicable requirements of the Excavation & Backfill Specifications.

B. Place backfill as Work progresses.

5.11 **Installation of Underdrains**

A. Underdrain shall be installed in accordance with INDOT Standard Specifications, latest edition, Section 718, except video inspection not required.

B. Underdrain pipes shall be capped (at structures) until completion of Site. Underdrains connected directly to a storm drainage structure shall be non-perforated for a distance of at least 3 feet from the structure interface to avoid possible piping problems. The free end of the underdrains shall be permanently capped or, if specified, provided with cleanouts. Use appropriate caps and fittings compatible with the pipe material.

C. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the Engineer. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with pipe materials.

D. Line the pipe trench of all perforated underdrain pipes with non-woven geotextile to provide fine sediment protection to the pipe underdrain.

E. No. 8 stone shall be used for bedding and trench backfill around underdrain piping.

F. Care shall be exercised to prevent natural or fill soils from intermixing with the stone aggregate surrounding perforated pipe. All contaminated stone aggregate shall be removed and replaced with uncontaminated stone aggregate.

## 5.12 Connections to Meter Assemblies, Backflow Prevention Assemblies, Valves, and Hydrants

A. Install meters, backflow prevention, valves and hydrants as shown and indicated in the Contract Documents.

B. Provide suitable adapters when meter assemblies, backflow prevention assemblies, valves or hydrants and piping have different joint types.

C. Provide thrust restraint at all meter assemblies, backflow prevention assemblies, hydrants, and at valves.

## 5.13 Transitions from One Type of Pipe to Another

A. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

## 5.14 Setting Valves and Fittings

A. Valves, fittings, plugs and caps shall be set and jointed to the pipe in the manner specified for cleaning, laying and joining pipe.

B. Cast iron valve boxes shall be firmly supported, and maintained centered and plumb over the operating nut of the valve, with box cover flush with the surface of the finished pavement or finished grade of the surrounding area or any such other level as may be directed.

## 5.15 Thrust Restraint

A. Provide thrust restraint on piping systems where shown or indicated in the Contract Documents.

B. Thrust restraint may be accomplished by using restrained pipe joints. Harnessing buried pipe permitted only if approved by Town / Engineer in writing. Thrust restraints shall be designed for axial thrust exerted by test pressure specified on Contract Drawings, or 150 psi for water mains or 100 psi for force mains if not listed on Drawings.

C. Restrained Pipe Joints:
   1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
      a. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system; or other suitable joint restraint system, subject to the approval of Town / Engineer.

b. Thermoplastic and HDPE Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide proprietary restrained joint system; or other suitable joint restraint system, subject to the approval of Town / Engineer.

D. Provide joint restraint for the minimum lengths noted below:
1. Project Engineer shall submit for approval a joint restraint length schedule for each diameter and material of piping utilized on the project and requiring restraint. Restraint lengths shall be based on approved calculation methodology by DIPRA, EBAA Iron's Restraint Length Calculator, or approved equal, using the following parameters:
a. a minimum safety factor of 1.5,
b. the test pressure specified on the drawings,
c. a Type 3 trench,
d. and the appropriate soil classification.

## 5.16 **Work Affecting Existing Piping**

A. Operation of existing valves shall be by Town only.

B. Taking Existing Pipelines and Underground Facilities Out of Service:
1. Do not take pipelines or Underground Facilities out of service unless specifically listed in the Contract Documents or approved by Town / Engineer.
2. Notify Town / Engineer in writing prior to taking pipeline or Underground Facilities out of service.
3. Shutdown notification shall be provided twenty-four (24) hours in advance of the shutdown in accordance with the General Conditions and Contract Documents. Notice to affected occupants, Fire Department, Owner, and Town / Engineer is required.
4. Shutdown not to exceed four (4) hours. Stand-by service to be provided as required.

C. Work on Existing Pipelines or Underground Facilities:
1. Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.
2. Prevent contamination of existing facilities. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.

D. Salvage all hydrants, valve boxes, & curb boxes removed and deliver to Town unless noted otherwise by the Town. Remove with caution to avoid damage to hydrant or box.

## 5.17 **Records**

A. Record Documentation:
1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.

2. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
3. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.
4. The Contractor shall keep accurate and complete records of the actual location of all fittings, existing pipes, repair of existing utilities or tiles, tap locations into the main and the depths of the service laterals at the point of termination of the laterals.
5. Said records shall be turned over to the Town at the completion of the project. Each sewer and water fitting, structure, tap location, or valve box shall be referenced to three permanent monuments. All water service tap lines shall be measured from the building corners on the property served.
6. As-built drawings shall be submitted on a hard paper format and in an electronic format compatible with AutoCAD.
7. All as-built wye and connection locations shall be as shown on a set of as-built drawings by the Contractor and also typewritten on a separate page with the Owner's name and address.

## 5.18 Special Installation Instructions

A. In recognition of the fact that there are currently many different pipe materials available from many different manufacturers, the Contractor will be required to obtain from the pipe manufacturer his published recommendations for installation of his pipe, and nothing in these specifications shall preclude compliance by the Contractor with the manufacturer's recommendations. Contractor responsible to notify Engineer of conflict between manufacturer's recommendations and applicable ASTM / AWWA standards.

## 5.19 Grade and Alignment

A. All gravity sanitary sewer pipe shall be installed using a laser and target system through the pipe. A ground surface laser and target system will be permitted for use when installing force main pipe that requires alignment and grade. The use of a laser system does not preclude the use of differential leveling instruments for determining the exact elevation of the installed pipe.

## PART 6 - SEWER & WATER MAIN APPURTENANCES

### 6.1 Quality Assurance

A. Manufacturer's Qualifications:
   1. Manufacturer shall be able to provide documentation of at least five installations of substantially similar products to that specified, in satisfactory service for at least five years.

B. Component Supply and Compatibility:
   1. Specified appurtenances of each type shall be furnished by a single manufacturer.

C. Regulatory Requirements:
   1. Drinking Water Requirements: Valves that will be in contact with potable water or water that will be treated to become potable shall comply with ANSI/NSF 61 and the Safe Drinking Water Act.

### 6.2 Conditions of Service

A. General
   1. All sewer and water main appurtenances shall be constructed of the material as shown on the Drawings and as may be specified hereafter. Water appurtenance items shall be suited for services intended.
   2. Water appurtenances that will be in contact with potable water shall be listed in ANSI/NSF 61 as being suitable for contact with potable water.
   3. Sewer appurtenance items shall be suited for services intended.

### 6.3 Valves

A. Valves used in water distribution systems shall be resilient seat gate valves.

B. Resilient-Seated gate valve, ductile-iron body, bonnet and gate; resilient seats, bronze stem and stem nut. Resilient seated gate valves are to be manufactured in accordance with AWWA C509 or AWWA C515. Valves shall be ductile iron bronze mounted. Resilient seats shall be applied in accordance with AWWA C509 or AWWA C515.

C. Buried valves shall have mechanical joints. Valves shall open left (counterclockwise) and shall be equipped with O-ring packing and a two inch (2") operating nut and non-rising stem. Contractor shall verify direction of opening with Town / Engineer prior to ordering.

D. Provide fusion bonded epoxy interior coating according to AWWA C550 and fusion bonded epoxy exterior coating.

E. Valves shall be designed for a working pressure of 250 psi.

F. Install valve nut extension if valve is installed deeper than 60" cover.

G. Provide with posi-cap alignment device.

H. The following resilient seated gate valves are acceptable for use in connection with water main installation, listed by manufacturer and model number:
   1. American Flow Control, 2500 series
   2. Clow, 2639/2640 or 2638
   3. Kennedy, KS-FW or KS-RW
   4. Mueller, 2360 or 2361
   5. Or approved equal

6.4 **Hydrant Assembly**

A. Fire hydrants shall conform to AWWA C502 and shall be complete with all necessary fittings and accessories. Hydrants shall conform to the Water Utility Owner standards and specifications. Hydrants shall be 5 ¼" size with 6" inlet connection. They shall have one 4 ½ inch pump connection and two 2 ½ inch hose connections.

B. The hydrant shall open left (counterclockwise) and be of sufficient length to accommodate depth of burial of water main and for pumper nozzle height 18" minimum above grade. **Contractor shall verify direction of opening with Town & Engineer prior to ordering.**

C. All hydrants shall be properly painted before shipment and after installation in accordance with AWWA C502. **Contractor shall verify color with Town prior to ordering.**

D. Provide anchorage with restrained joints, and support in upright position.

E. Hydrants shall have an auxiliary valve as detailed on fire hydrant assembly standards and according to AWWA M17.

F. Hydrants shall be for 250 psi working pressure. The hydrant shall be such that the valve will remain closed if the upper portion of the fire hydrant is removed or broken off. The operating nut shall be pentagonal.

G. The hose caps shall be secured to the hydrant with a chain during shipment. The chains may only be removed after the hydrant is placed into service.

H. A drainage pit shall be provided below each hydrant, consisting of at least ½ cubic yard of compacted pervious material.

I. The following fire hydrants are acceptable for use in connection with water main installation, listed by manufacturer and model number:
   1. Waterous Pacer WB-67-250 (American Flow Control)
   2. No "Or-Equal" items or substitutions permitted.

## 6.5 Blow Off Assembly

A. Minimum working pressure of 200 psig. Include separate curb valve and restrained joints in supply piping.

## 6.6 Restrained Joints for Sewer & Water Appurtenances

A. Provide restrained joints for water appurtenances by one of the following:
   1. EBAA Iron Mega-Lugs
   2. Field Lok Gaskets
   3. Romac MJ Grip Rings
   4. Or approved equal

## 6.7 Services

A. Service taps on a water main shall include the brass corporation stop in the main, saddle on plastic mains, service line, curb stop and box, and reconnection to existing service if applicable. The curb stop shall include a cast iron curb box with lid marked water.

B. Service piping and fittings shall be per the Pipe & Fittings and Pipe Installation specifications.

## 6.8 Curb Stops

A. Curb stops shall be ball type valves of extra heavy, all brass construction. The curb stops shall have a heavy or thick tee-head operator and a 90 degree rotation of the ball. Each stop shall be equipped with a curb box. Ball valves shall have Teflon coated balls and hard or synthetic rubber seat-rings.

B. The following corporation stops are acceptable for use in connection with water main installations, listed by manufacturer and model number:
   1. Mueller, B-25204N or B-25209N
   2. Ford, B22-NL or B44-NL
   3. McDonald, 76100 or 76100-22
   4. Or Approved Equal.

## 6.9 Corporation Stops

A. Corporation stops shall be ball type valves of extra heavy, all brass construction. The corporation stops shall have a flat, thick, operating head with a 360 degree rotation. The corporation stop inlet threads shall be machined with standard AWWA tapered threads.

B. The following corporation stops are acceptable for use in connection with water main installations, listed by manufacturer and model number:
   1. Mueller, B-25000N or B-25008N
   2. Ford, FB-600NL or FB-1000NL
   3. McDonald, 74701B or 74701B-22

4. Or Approved Equal.

## 6.10 Valve Boxes & Curb Boxes

A. Valve boxes shall cast iron, two (2) or three (3) piece, Buffalo-style, screw type boxes. The boxes shall be five and one-quarter inch (5¼") shaft size with a round base. The word "water" or "sewer" shall be cast on the box lid as appropriate. Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length as required for depth of burial of valve, and bottom section with base of size to fit over valve. Install valve box extension if valve is installed deeper than 60" cover. Place geotextile around valve bonnet and connections of three pieces.

B. Curb boxes shall be cast iron two (2) piece, Buffalo-style, screw type boxes. The box shall be three inches (3") in diameter with a round base. The word "water" or "sewer" shall be cast on the lid as appropriate. The lid shall be held in place with a standard brass pentagon head screw.

## 6.11 Tapping Saddles

A. Tapping saddles shall be used for service taps of plastic piping. The tapping saddles and hardware shall be ductile iron with epoxy coating, stainless steel or bronze material with AWWA tapered threads. The tapping saddle design shall be hinged or bolted, both with a minimum strap width of two inches (2"). Three (3) piece tapping saddle design is not allowed.

B. Tapping saddles for HDPE shall be submitted for approval by Town / Engineer.

C. The saddles for PVC shall be Ford style FC202, FRS202, FS303, or equal.

D. Tapping saddles must be used for the installation of a corporation stop in a tapped pipe. The tap saddle is made to a specific inner diameter to match the outer diameter of the pipe. It fully supports the pipe and is sized so that the parts when bolted together cannot be over tightened on the pipe; Manufacturer's installation instructions must be followed.

## 6.12 Tapping Sleeve & Valve

A. The tapping sleeve and valve shall be suitable for wet installation without interrupting water service. The tapping sleeve shall be suitable for the pipe material and size of the line being tapped.

B. Tapping sleeves shall be manufactured of ductile iron or stainless steel. Stainless steel sleeves shall be Type 304 steel. Sleeve shall be flanged faced and drilled per ANSI B 16.1, with standard tapping flange counterbore per MSS SP-60. Tapping sleeves shall meet minimum working pressure requirements of 200 psi for twelve inch and smaller sleeves. All tapping sleeves shall include a test plug.

C. Gasket for tapping sleeve shall completely surround pipe.

D. Nuts and bolts shall be Type 304 stainless steel.

E. Acceptable tapping sleeves:
   1. Ford FAST
   2. Romac SST III
   3. Mueller H-304
   4. Or approved equal

F. The tapping valve shall be mechanical joint x tapping flange. The flanged end shall have a raised face to match counterbore in tapping sleeve outlet per MSS SP-60. Tapping valves shall also conform to the specifications as outlined for gate valves in this Specification.

## 6.13 Water Meter Boxes

A. Where utilizing meter pit per Town direction, meter pit, lid, and meter setter to be provided by the Town and installed plumb and level by the Contractor. Meter setter to include shutoff valve and backflow prevention. Shutoff valve in meter setter does not replace separate curb stop and curb box.

## 6.14 Backflow Prevention Devices

A. All backflow prevention devices must be approved and listed by the Foundation for Cross Connection Control and Hydraulic Research as published by the University of Southern California. This listing is available from USC or IDEM's Drinking Water Branch.

## 6.15 Cleanouts

A. Install piping so cleanouts open in direction of flow in sewer pipe. Set cleanout frames and covers as shown on the site drawings.

## 6.16 Tap Connections

A. Connect to existing sewer main according to the conditions of the sewer tapping permit.

## 6.17 Combination Air Valve

A. Valve shall be capable of venting sufficient quantities of air as determined by the manufacturer's approved sizing methods, while pipelines are being filled and allowing air to re-enter while pipelines are being drained.

B. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.

C. Combination Air Valves shall be automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated

air from a piping system while the system is in operation and under pressure. The valve shall perform the function of both Air Release and Air/Vacuum Valves and be furnished as a single body or dual body type as indicated on the plans.

1. Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.
2. Valve shall be Val-Matic single body 801 or 803 Series, ARI D-020 Series, or approved equal.
3. Valves shall be supplied with flushing attachments to allow periodic flushing of sediment, grease, and solids. Attachments consist of an inlet isolating valve, bronze blow off and flushing valves, and a minimum of five feet of rubber hose with quick disconnects to allow connection to a clean water source.
4. Valves shall be coated with fusion bonded epoxy per AWWA C550.
5. Valves shall be installed in a manhole structure as shown on plans.
6. Valves vaults must be equipped with an exhaust pipe extending to a downward facing elbow with the opening at an elevation of eighteen (18) inches above ground, unless noted otherwise on plans.

## 6.18 Painting of Buried Valves and Appurtenances

A. Exterior steel, cast-iron, and ductile iron surfaces, except machined or bearing surfaces of buried valves and appurtenances and except those surfaces coated with fusion bonded epoxy, shall be painted in manufacturer's shop with two coats of asphalt varnish conforming to FS TT-C 494.

## 6.19 Installation

A. General:
   1. Install water and sewer appurtenances as shown, specified, and as recommended by the manufacture.
   2. In the event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from Engineer before proceeding.
   3. Location of service connections and insertion valves indicated are approximate. Final location will be established during construction by the Town.
   4. Do not install water service connections until new mains have been successfully tested, disinfected, and placed in service.
   5. Prior to ordering tapping sleeve assembly, expose existing main and verify circumference of existing pipe.
   6. Prior to ordering insertion valve and sleeve assembly, expose existing main at point of installation and verify circumference, actual caliper diameter and roundness of existing pipe. In addition, identify the exterior condition of the pipe with respect to pitting, scaling, electrolysis, or other defects which would affect manufacturing dimensions or exact location of the insertion.

B. Fire Hydrants
   1. Install hydrants as shown and indicated in the Contract Documents.
   2. Provide suitable adapters when hydrants and piping have different joint types.

3. Provide thrust restraint at all hydrants located at pipeline terminations.
4. Set hydrants plumb and to grade of curb, street, alley, highway, or right-of-way with pumper nozzle toward middle line of street, highway, or right-of-way.
5. Set hydrant on crushed stone or well tamped gravel; provide loose stone or gravel fill up to drainage port.
6. Where fire hydrant must be located in a paved area provide a minimum of 5-foot by 5-foot concrete block-out, with expansion joints on all sides.
7. When Town / Engineer deems it necessary to set a fire hydrant at a greater depth of bury as a result of changing hydrant location from that shown, adjust elevation by furnishing and installing the fire hydrant manufacturer's standard barrel and stem extensions.

C. Valves
1. Install valves, valve boxes, and curb boxes as shown and indicated in the Contract Documents.
2. Provide suitable adapters when valves and piping have different joint types.
3. Provide thrust restraint at all valves located at pipeline terminations.
4. Set valves plumb and on solid bearing.
5. Place valves within park strip areas (grass area between sidewalk and curb), or as directed by the Town / Engineer.
6. Install insertion valves and sleeves using personnel skilled and experienced in the use of the valve insertion machinery and accessory equipment of the type, design and size corresponding to each valve size installed. Remove section of severed water main and present to Town as proof of satisfactory execution of the operation. Town may retain coupon for further analysis or testing to evaluate the condition of existing water main.

D. Tapping Sleeve & Valve
1. Contractor shall perform the tapping of the existing main according to the manufacturer’s specifications.
2. The Contractor shall excavate an area of sufficient size and depth, conforming to OSHA requirements, to accommodate the operations of tapping the existing line and setting the valve.
3. Assemble, align, and fit tapping sleeve and tapping valve to main using personnel skilled and experienced in making of pressure taps. In the event of mismatch of purchased materials, make necessary arrangements with manufacturer for factory refit. Any field refit will require written manufacturer and Town approval. Remove section of severed water main through tapping valve and present to Town as proof of satisfactory execution of the operation. Town may retain coupon for further analysis or testing to evaluate the condition of existing water main.
4. The Contractor shall furnish and install a valve box with the necessary extensions, backfill and compact the excavated area.
5. The Contractor shall perform a 150 psi hydrostatic pressure test, or a different pressure as required by the Town / Engineer, on the tapping sleeve and valve prior to tapping the existing water main. *Lower test pressures for air testing will be permitted only when*

*approved in writing by the Town / Engineer.* This pressure test will be performed using the test plug provided with the tapping sleeve.

E. Valve Boxes & Curb Boxes
   1. Center and plumb valve and curb box over valve; set box cover flush with finished grade.

F. Small Service Connections ( ¾-Inch Thru 2-Inch)
   1. Trenchless Service Connections
      a. Install pipe under street and highway pavements by pushing or boring, in accordance with the Directional Drilling requirements of these Specifications.
   2. Ensure service connection has a minimum cover of 4 feet 6 inches (4'-6").
   3. Buried Piping Identification Tracing for Service Connections.
      a. Install tracing wire for service connections in accordance with the Contract Drawings.
      b. Ensure connectivity is maintained between the mainline tracer wire and the service connection tracer wire.
      c. All tracing wire splices and connections shall be made using a direct bury waterproof connection device, intended for use with low voltage tracing wire.
      d. When connecting tracing wire from the mainline to a copper service line secure the connection with 2 plastic hose clamps and wrap the connection in waterproof tape.
   4. For existing service connections, intercept or extend as shown or noted to connect to new water mains.
   5. For existing service connection pipe to be abandoned, close the exposed end by crimping.
   6. For existing service connections to be abandoned on existing water mains to remain in service, dig up (expose) and turn off the existing corporation stop at the connection to the existing main.
   7. All service lines installed on mains for future use shall be installed to curb stop located within two feet of the right of way. Do not place curb box / meter box in driveway or sidewalk.
   8. All service lines shall be installed with tracer wire to the water meter.

G. Large Service Connections (3 Inch and Larger)
   1. Minimum cover for services shall be per the pipe installation specifications.
   2. Service Connections on New Mainline
      a. Install tee compatible with the mainline material.
      b. Install a standard gate valve and valve box.
   3. Service Connections on Mainlines In Service
      a. Install tapping sleeve compatible with the mainline material.
      b. Install a tapping valve and standard valve box.
   4. All service lines installed on mains for future use shall be installed to curb stop / valve located within two feet of the right of way. Do not place curb box / valve box / meter box in driveway or sidewalk.

H. Connections and Insertions into Existing Mains

1. Existing mains into which valves are to be inserted cannot be shut down or taken out of service. The entire operation of installing the valves shall be accomplished below 100 psig at the point of installation.
2. Connect new mains to existing mains using proper fittings and in a manner acceptable to Town / Engineer.
3. Expose existing mains at connection points prior to making connections with reasonable time available to determine elevation, verify type of pipe, confirm outside diameter of pipe, identify type of existing restraints, and order correct materials for connection.
4. No cut-ins or connections to existing mains shall be made unless written approval is obtained from the Town / Engineer.
5. Plan all connecting work to reduce number of shutoffs.
6. Two days prior to shutting valves on existing lines, notify all affected property Owners, local official in charge of the water works system, and Town / Engineer of such shutoff.
7. Keep shutoff time to a minimum and do at off-peak hours.
8. A representative of Town shall operate existing valves. Contractor shall not operate existing valves.
9. Town and Engineer assume no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.
10. Take extreme care in making connections to prevent contamination of existing mains.
11. Before making cut-ins or connections to existing mains, wash all fittings, valves, and pipe with clean water, and then disinfect by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.
12. Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of Town.
13. Contractor responsible for all bypass pumping required for connection.

I. Water Meter Boxes

1. Install assemblies as shown or noted and with meter pit cover at grade level; comply with component manufacturer's instructions.
2. Install meter setters level and plump.
3. Do not install meter pits in street, parking lots, driveways, or any area where vehicular traffic may occur.

J. Backflow Prevention Devices

1. Install backflow valves in accordance with manufacturer's recommendations.

## PART 7 - MANHOLES & STRUCTURES

### 7.1 General

A. Manholes and structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as directed by Town / Engineer.

B. Cast-iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified.

C. Concrete for cast-in-place manholes and structures and for inverts in precast and masonry manholes and structures shall be Class "A" and shall conform to the requirements specified hereinafter.

D. All manholes and structures shall be precast construction, unless otherwise shown.

E. Inverts shall be as shown and shall conform accurately to the size and elevation of the adjoining pipes.

### 7.2 Existing Conditions

A. Avoid damage to the existing system. Existing manholes, catch basins, and sewers damaged by the Contractor shall be repaired to the satisfaction of the Town at no additional cost.

### 7.3 Precast Concrete Manholes & Structures

A. Precast manholes and structures shall conform to the details shown. Provide cast-in-place concrete bases where shown.

B. Except where otherwise specified precast manhole components shall consist of reinforced concrete pipe sections especially designed for manhole construction and manufactured in accordance with ASTM C 478, except as modified herein.

C. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured by wet cast methods only, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.

D. Sanitary Sewer Manholes
   1. Provide manhole with tongue and groove joints. Seal joints with all of the following methods:
      a. Rubber Gasket in accordance with ASTM C443
         1) Manufacturers: Provide rubber gasket from the following:
            a) O-Ring Gasket, by Press-Seal Gasket Corporation.
            b) Or equal.
      b. Preformed Flexible Joint Sealant in accord with ASTM C990 & AASHTO- M198.

1) Manufacturers: Provide joint sealant from the following:
   a) EZ Stik, by Press-Seal Gasket Corporation.
   b) Kent Seal #2, by Hamilton-Kent.
   c) RU 106 RUB'RNEK LTM, by Henry Co.
   d) or equal.

c. Butyl Rubber Backplaster-exterior
   1) Manufacturers: Provide joint sealant from the following:
      a) Trowelable EZ Stik #3, by Press-Seal Gasket Corporation
      b) or equal.

d. Polyethylene Plastic Sheeting Film
   1) Manufacturers: Provide joint sealant as required to protect the joint from backfill operations:
      a) 6 mm polyethylene plastic sheeting film by Visqueen.
      b) or equal.

E. Storm Sewer Manholes
   1. Provide manhole with tongue and groove joints. Seal joints with the following method:
   2. Preformed Flexible Joint Sealant in accordance with ASTM C990 and AASHTO- M198.
      a. Manufacturers: Provide joint sealant from the following:
         1) EZ Stik, by Press-Seal Gasket Corporation.
         2) Kent Seal #2, by Hamilton-Kent.
         3) RU 106 RUB'RNEK LTM, by Henry Co.
         4) or equal.

F. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 130 pounds per cubic foot, an H-20 wheel loading, and an allowance of 30 percent impact.

G. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

H. The barrel of the manhole shall be constructed of various lengths of riser sections to provide the correct height with the fewest joints.

I. Except as approved by the Town, openings in the barrel of the manholes for pipe connections will not be permitted closer than one foot from the nearest joint. Special manhole base or riser sections shall be furnished as necessary to meet this requirement.

J. A precast or cast-in-place slab or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover.

## 7.4 **Drop Connections**

A. Drop connections for sanitary sewer manholes and structures shall be constructed where shown or directed by the Town / Engineer and shall conform to the design and details shown.

B. Concrete for pipe encasement shall be Class "A". Concrete shall be bonded to manhole in the manner shown or otherwise approved by Town / Engineer. Drop connection pipe encasement shall begin six (6) inches above the drop connection and continue to the bottom of the manhole.

## 7.5 Riser Rings

A. Riser rings shall be used for all precast and masonry manholes and structures, where required. Stacks of riser rings shall be as specified, and shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished grade.

B. Riser rings shall be precast concrete and shall have a minimum thickness of 2 inches and a maximum thickness of 6 inches. No more than two (2) riser rings shall be stacked together to reach the finished grade without the written approval of the Town / Engineer.

C. Riser ring joints shall be sealed with the following method:
   1. Preformed Flexible Joint Sealant in accordance with ASTM C990 and AASHTO- M198.
      a. Manufacturers: Provide joint sealant from the following:
         1) RU 106 RUB'RNEK LTM, by Henry Co.
         2) EZ Stik, by Press-Seal Gasket Corporation.
         3) Kent Seal No 2, by Hamilton Kent.
         4) Or Approved Equal.

## 7.6 Sanitary Manhole Chimney Seal

A. In addition to the required riser ring joint seal, provide both of the following:
   1. Butyl Rubber Backplaster-exterior
      a. Manufacturers: Provide joint sealant from the following:
         1) Trowelable EZ Stik #3, by Press-Seal Gasket Corporation
         2) or equal.
   2. Supplemental Exterior Seal: Provide one of the following:
      a. External Chimney Seal, manufactured by Cretex Specialty Products.
      b. Wrapidseal, manufactured by CANUSA-CPS.
      c. Or Approved Equal.

## 7.7 Castings

A. Materials
   1. 24" Sanitary Casting:
      a. Material: ASTM A48/A48M, Class 35B.
      b. Products and Manufacturers: Provide one of the following:
         1) R-1772, manufactured by Neenah Foundry Company, with "Sanitary" lettered solid lid.
         2) 1022Z1, manufactured by East Jordan Iron Works, Inc, with 1020AHDGS "Sanitary Sewer" lettered solid lid.
         3) Or equal.

2. Watertight Sanitary Casting:
    a. Material: ASTM A48/A48M, Class 35B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-1772, manufactured by Neenah Foundry Company, with “Sanitary Sewer” lettered, solid, bolted lid.
        2) 1022Z1PT, manufactured by East Jordan Iron Works, Inc, with “Sanitary Sewer” lettered, solid, bolted lid.
        3) Or equal.
3. 12” Cleanout Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-1976, manufactured by Neenah Foundry Company.
        2) 1578, manufactured by East Jordan Iron Works, Inc.
        3) Or equal.
4. 24” Solid Storm Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-1772, manufactured by Neenah Foundry Company, with environmental lettering/symbols.
        2) 1022Z1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
        3) Or equal.
5. 24” Storm Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-2502, manufactured by Neenah Foundry Company, with Type D grate and environmental lettering/symbols.
        2) 1022Z1M1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
        3) Or equal.
6. 24” Beehive Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-1772, manufactured by Neenah Foundry Company, with R-4351-D beehive grate and environmental lettering/symbols.
        2) 1022Z1, manufactured by East Jordan Iron Works, Inc, with 6509-O beehive grate and environmental lettering/symbols.
        3) Or equal.
7. 30” x 30” Beehive Grate:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-4215-C, manufactured by Neenah Foundry Company, with environmental lettering/symbols.
        2) 6610-O, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.

3) Or equal.

8. 2’ x 2’ Alley Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:
      1) R-3036-B, manufactured by Neenah Foundry Company, with type S grate and environmental lettering/symbols.
      2) 5100ZM1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
      3) Or equal.
9. 2’ x 2’ Curb and Gutter Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:
      1) R-3010, manufactured by Neenah Foundry Company, with grate Type A and environmental lettering/symbols.
      2) 7010ZM1T1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
      3) Or equal.
10. 2’ x 2’ Curb and Gutter Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:
      1) R-3010, manufactured by Neenah Foundry Company, with grate Type R and environmental lettering/symbols.
      2) 7010ZM5T1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
      3) Or equal.
11. 2’ x 2’Curb and Gutter Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:
      1) R-3010, manufactured by Neenah Foundry Company, with grate Type S and environmental lettering/symbols.
      2) 7010ZM3T1, manufactured by East Jordan Iron Works, Inc, with environmental lettering/symbols.
      3) Or equal.
12. 2’ x 3’ Curb and Gutter Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:
      1) R-3067, manufactured by Neenah Foundry Company, with grate Type C and environmental lettering/symbols.
      2) 7030Z1, manufactured by East Jordan Iron Works, Inc, with grate Type M2 and environmental lettering/symbols.
      3) Or equal.
13. 2’ x 3’ Curb and Gutter Casting:
   a. Material: ASTM A48/A48M, Class 35 B.
   b. Products and Manufacturers: Provide one of the following:

1) R-3067, manufactured by Neenah Foundry Company, with grate Type R and environmental lettering/symbols.
2) 7030Z1, manufactured by East Jordan Iron Works, Inc, with grate Type M3 and environmental lettering/symbols.
3) Or equal.

14. 2' x 3' Curb and Gutter Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) 7030Z1, manufactured by East Jordan Iron Works, Inc, with grate Type M5 and environmental lettering/symbols.
        2) Or equal.
15. 33" Round Curb & Gutter Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) 7020Z, manufactured by East Jordan Iron Works, Inc, with grate Type M1 and environmental lettering/symbols.
        2) Or equal.
16. 33" Round Curb & Gutter Casting:
    a. Material: ASTM A48/A48M, Class 35 B.
    b. Products and Manufacturers: Provide one of the following:
        1) R-3159-A, manufactured by Neenah Foundry Company, with grate Type S and environmental lettering/symbols.
        2) 7020Z, manufactured by East Jordan Iron Works, Inc, with grate Type M2 and environmental lettering/symbols.
        3) Or equal.

B. Fabrication, General:
    1. The Contractor shall furnish all cast-iron manhole frames and covers conforming to the details shown on the Drawings, or as hereinbefore specified.
    2. Castings shall be of uniform quality, free of sand holes, gas holes, shrinkage cracks, and other surface defects.
    3. Castings shall be ground smooth and well-cleaned by shot blasting in the shop.
    4. Design and fabricate frames and covers to prevent rocking and rattling under traffic loads that will be imposed in actual use.
    5. Fabricate castings true to pattern so that component parts fit together.
    6. The surface of drainage inlets shall have a casted marker that displays that it drains to waterways, as shown on Drawings.
    7. Each casting shall be identifiable and, depending on its size, shall indicate the following: name of producing foundry, ASTM material designation, individual part number, and cast or heat date. Castings shall include all lettering shown or indicated on the Drawings.
    8. Castings other than open grate castings are required to have a concealed pickhole.

## 7.8 Concrete Mix

A. Proportioning and Design of Class “A” Concrete Mix:
   1. Minimum compressive strength at 28 days: 4,000 psi.
   2. Maximum water-cement ratio by weight: 0.50.
   3. Minimum cement content: 564 pounds per cubic yard.

B. Proportioning and Design of Class “B” Concrete Mix:
   1. Minimum compressive strength at 28 days: 3,000 psi.
   2. Maximum water-cement ratio by weight: 0.50.
   3. Minimum cement content: 517 pounds per cubic yard.

## 7.9 Poured-in-Place Manhole Bases

A. Poured-in-place bases are shall be utilized only with written permission of the Town.

B. Poured-in-place bases shall be placed on suitable foundations, as shown in details, after the pipes are laid.

C. They shall be cast using class “A” concrete.

D. They shall be cast monolithically to an elevation at least 7 inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed.

E. Base, walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected.

## 7.10 Manhole Base Installation

A. Precast bases shall be set on a 6” min. crushed stone or crushed gravel foundation as shown and detailed. Precast bases shall be set at the proper grade and carefully leveled and aligned.

## 7.11 Precast Manhole Sections Installation

A. Install sections, joints and gaskets in accordance with these specifications and the manufacturer’s recommendations.

B. Lifting holes, if used in manhole components, shall be repaired using a conical precast concrete plug, properly sealed into place using non-shrink cement or epoxy grout. The repair shall be clean and neat to ensure water tightness.

## 7.12 Manhole Channels

A. Flow Channel
   1. All invert channels through manholes and structures shall be constructed of Class “A” concrete. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown or as ordered.

2. For all sanitary sewer manholes with equal diameter influent and effluent pipes in a straight through alignment, a minimum 0.10 foot drop between the inverts of the influent and effluent pipes shall be maintained.
3. Flow channels through a manhole shall be made to conform in shape, and slope to that of the connecting sewers. The channel walls shall be shaped or formed to the full height of the springline of the outlet sewer so that maintenance, inspection, and flow in the manhole are not obstructed.

B. Bench
1. Benches shall be provided on each side of the manhole channel when the pipe diameter(s) are less than the manhole diameters.
2. Benches shall be built up to the heights shown, and shall be sloped no less than 1/2-inch per foot (4 percent), or as directed by the Town / Engineer and given a uniform wood float finish.
3. Care shall be taken to slope all benches for proper drainage to the invert channel.

## 7.13 Manhole Steps

A. Manhole steps shall be provided at 12" to 16" spacing. Manhole steps shall be ½" steel reinforced with polypropylene plastic coating and meet the requirements of ASTM C-478.

## 7.14 Stubs for Future Connections

A. When installing pipe stubs for future pipeline, installation of all stubs shall be properly restrained to prevent any movement. Where pipe stubs, sleeves or couplings for future connections are shown or directed by the Town / Engineer, Contractor shall provide all materials and labor in order to complete the Work.

## 7.15 Grading at Manholes & Structures

A. Backfill shall be carried up evenly on all sides of the structures to prevent overturning forces.

B. All sanitary sewer manholes and structures in unpaved areas shall be built, as shown or directed by the Town / Engineer, to an elevation higher than the original ground, with the ground surface graded to drain away from the manhole. All storm sewer manholes and structures in unpaved areas shall be built, as shown or directed by the Town / Engineer, with the ground surface graded to drain towards the manhole or casting. Fill shall be placed around manholes to the level of the upper rim of the manhole frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground, unless otherwise shown or directed by the Town / Engineer. The slope shall be covered with minimum 3-inches of topsoil, seeded and maintained until a satisfactory growth of grass is obtained.

C. Manholes and structures in paved areas shall be constructed to meet the final surface grade. In paved areas on state highways, all manholes and structures shall be 1/2-inch below final wearing surfaces. Manholes and structures shall not project above finished roadway pavements to prevent damage from snowplows.

D. Contractor shall be solely responsible for the proper height of all manholes and structures necessary to reach the final grade at all locations. Contractor is cautioned that Engineer's review of Shop Drawings for manhole components will be general in nature and Contractor shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole to meet field conditions for final grading.

7.16 **Manhole Watertightness**

A. All manholes and structures shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to Town / Engineer approval. Note that sanitary sewer manholes shall be vacuum tested per these Specifications.

7.17 **Flexible Pipe Joint at Manhole Base for Sanitary Manholes**

A. An approved flexible joint shall be provided between each pipe entering and exiting the manhole. Pipe to structure connections shall conform to the details shown. The joint into the manhole base shall be completely watertight.

B. Provide products manufactured to meet the requirements of ASTM C923.

7.18 **Manhole and Pipe Connection for Storm Manholes**

A. A grout collar shall be provided between the annular space of each pipe entering and exiting the manhole.

B. Pipe collar shall be placed on the inside and outside of the manhole. Collar shall be Class “A” or Class “B” concrete or non-shrink grout.

C. Pipe to manhole connections shall be soil tight and conform to the details shown on Drawings.

D. An approved rubber gasket boot may be used in lieu of a grout collar.
   1. Provide products manufactured as listed below and meeting requirements of ASTM C923.

7.19 **Casting Installation**

A. Comply with casting manufacturer's printed instructions and the Contract Documents. Install casting in accordance with requirements of manufacturer of product on which casting will be installed.

B. Set castings accurately to required location, alignment, and elevation, plumb, level, true and free of rack, measured from established lines and levels. Where applicable, brace temporarily or anchor temporarily in formwork.

C. In Paved and Unpaved Streets and Alleys:
   1. Where work is in paved streets or areas which have been brought to grade, not less than six inches (6”) and not more than twelve inches (12”) of riser rings shall be

provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished street grade. The top of the manhole casting shall be flush with the finished grade, unless otherwise directed by the Town / Engineer.

D. Within Cultivated and Non-Cultivated Areas:
   1. Where work is in cultivated areas, the top of the manhole casting shall be exposed one foot (1') and in non-cultivated areas the casting shall be flush with the finished grade, unless otherwise directed by the Town / Engineer.

7.20 **Connections to Existing Manholes & Sewers**

A. Connections at existing manholes shall be made in a manner to prevent damaging the structure and shall be made watertight where the connection is made. Openings shall be core drilled and rubber boots shall be installed.

B. In-lieu of rubber boots for storm structures, Contractor may install, by hand, non-shrink dry-pack grout mortar, 5000 psi compressive strength minimum.

7.21 **Cleaning**

A. All new manholes shall be thoroughly cleaned of all silt, debris, and foreign matter of any kind, prior to final inspection.

## PART 8 - TESTING & STERILIZATION

### 8.1 General

A. General Testing Requirements
   1. All testing shall be in accordance with IDEM, INDOT or other recognized standards and regulations.
   2. Notify Town / Engineer and authorities having jurisdiction in writing at least 48 hours in advance of testing.
   3. Conduct all tests and disinfections in presence of Town / Engineer Representative.
   4. Remove or protect pipeline-mounted devices that could be damaged by testing.
   5. Provide all apparatus and services required for testing, including:
      a. Test risers and associated connections to the main, test pumps, compressors, hoses, calibrated gauges, meters, test containers, valves, fittings, and temporary pumping systems required to maintain Town's operations.
      b. Temporary bulkheads, bracing, blocking, and thrust restraints.
   6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
   7. Demonstrate that all valves in the test section are opened as appropriate for the test.
   8. Unless otherwise specified, Town will provide water required for hydrostatic testing and disinfection except for water required due to a failed test. Contractor shall provide means to convey water for hydrostatic testing into piping being tested. Contractor shall provide water for other types of testing required.
   9. All leaks, broken or cracked pipe, valves, etc. which are identified by testing shall be repaired. Any sections of main which do not meet test acceptance criteria shall be repaired or replaced. Retest after repair at no additional cost.
   10. Where necessary due to absence of valves or structures, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve or structure. Piping not installed by Contractor and that fails the test shall be repaired upon authorization of Town. Unless otherwise included in the Work, repair of existing piping or underground facilities will be paid as extra Work.
   11. Test to confirm connectivity of tracer wire.
   12. Copies of all test reports are required, or test shall be considered to have failed.

### 8.2 Test Schedule

A. Provide hydrostatic testing for all force main piping at a test pressure of 100 psi and for all water main piping at a test pressure of 150 psi, unless noted otherwise. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.

B. Do not place potable water into the newly installed pipe until the Town is on the project site and gives the Contractor approval. Any valve opening to place potable water into the newly installed pipe shall be done by the Town.

C. Pressure tests shall conform to the applicable AWWA and ASTM standard.

D. Provide vacuum test of all sanitary manholes.

E. Provide deflection and leakage testing of all gravity sanitary sewer mains.

8.3 **Gravity Pipe Testing**

A. Deflection Test:
   1. A deflection test shall be performed on each flexible pipe following the elapse of thirty (30) days after the placement of the final backfill.
   2. No pipe shall exceed a deflection of five percent (5%) or greater.
   3. The diameter of the rigid ball or mandrel used for a deflection test shall be no less than ninety-five percent (95%) of the base inside diameter of the pipe to be tested dependent on what is specified in the corresponding ASTM standard. The test shall not be performed with the aid of a mechanical pulling device.

B. Leakage Test: All gravity sanitary sewers shall be tested per one of the following tests:
   1. A hydrostatic test shall be performed with a minimum of two (2) feet of positive head. The rate of exfiltration or infiltration shall not exceed two hundered (200) gallons per inch of pipe diameter per linear mile per day.
   2. Air test plastic pipe according to ASTM F1417-92: “Standard Test Method for Installation Acceptance of plastic gravity sewer lines using Low-Pressure Air”.

C. Any piping that is damaged shall be removed and re-installed before approval.

D. An infiltration test is required only when specified by the Contract Documents.
   1. The Contractor shall furnish all weirs, bulkheads, catchments, and other appurtenances as required for performing the test.
   2. Procedure for Infiltration Testing: After the new main line pipe has been installed and the new house service laterals connected in a reach of conduit between two manholes, this reach of sanitary sewer may be tested for infiltration. This testing shall be performed through the use of a bulkhead in the upstream manhole and a calibrated sharp-edged weir installed at the downstream manhole. The infiltration flow from the reach undergoing testing shall be measured over a sufficiently long period of time to establish the rate of infiltration but in no case shall the test duration be less than two (2) hours. Where the reach being tested was installed through ground that required dewatering, the infiltration test shall not be performed until a sufficient period of time has elapsed after the dewatering equipment has been removed to permit the ground water table to return to its natural level, as agreed by the Town.
   3. Allowable Infiltration: The total quality of infiltration into the system from ground water during wet weather or from water from creeks, rivers, springs or other sources shall not exceed two hundred gallons per inch diameter of sewer, per mile, per twenty-four (24) hours (0.00263 gallon per inch diameter, per 100 feet, per minute).

## 8.4 **Vacuum Testing**

A. Manholes

1. Perform vacuum test on all manholes according to ASTM C1244 prior to backfill.
2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
3. Following set-up of test apparatus per manufacturer's recommendations, draw vacuum of ten inches of mercury on manhole being tested. The time shall be measured for the vacuum to drop to nine inches mercury.
4. Start test upon reaching specified test vacuum. Test duration shall be in accordance with ASTM C1244.
    a. Minimum test times for various manhole diameters shall conform to the following table per ASTM C1244 or be 1 minute; whichever is longer:

| Depth (ft) | Diameter, in. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 |
| **Time, in seconds** | | | | | | | | | | | | | |
| <4 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | 63 | 67 | 71 |
| 12 | | | | | | | | 62 | 67 | 71 | 76 | 81 | 85 |
| 14 | | | | | | 62 | 67 | 72 | 78 | 83 | 89 | 94 | 100 |
| 16 | | | | | 69 | 70 | 76 | 83 | 89 | 95 | 101 | 108 | 114 |
| 18 | | | | 65 | 73 | 79 | 86 | 93 | 100 | 107 | 114 | 121 | 128 |
| 20 | | | 65 | 72 | 81 | 88 | 95 | 103 | 111 | 119 | 126 | 135 | 142 |
| 22 | | 64 | 72 | 79 | 89 | 97 | 105 | 114 | 122 | 131 | 139 | 148 | 156 |
| 24 | | 64 | 78 | 87 | 97 | 106 | 114 | 124 | 133 | 143 | 152 | 161 | 170 |
| 26 | 64 | 75 | 85 | 94 | 105 | 114 | 124 | 134 | 144 | 155 | 164 | 175 | 185 |
| 28 | 69 | 81 | 91 | 101 | 113 | 123 | 133 | 145 | 155 | 167 | 177 | 188 | 199 |
| 30 | 74 | 87 | 98 | 108 | 121 | 132 | 143 | 155 | 166 | 178 | 189 | 202 | 213 |

5. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, manhole fails the test and shall be repaired and retested. If vacuum drop is less than 1 inch of mercury, manhole passes the test.

## 8.5 **Hydrostatic Testing**

A. General:

1. All newly installed water and sanitary force mains must be pressure and leak tested prior to final acceptance.

B. Preparation

1. Pipeline shall be laid and backfilled.
2. Valves shall be properly located, operable, and plumb and at correct elevation.
3. Lines shall be properly vented to eliminate entrapped air.
4. Prior to testing, ensure adequate thrust protection is in place and joints are properly installed.

5. Prior to testing ensure that the line is clean and free of dirt and debris.
6. For PVC and thermoplastic pipe, follow preparation and procedures described in Section 7 of ANSI/AWWA Standard C605. Test pressure & duration shall be 150 psi for 2 hours for water mains & 100 psi for 2 hours for force mains, unless noted otherwise.
7. For ductile iron piping, follow preparation & procedures described in AWWA C600. Test pressure shall be as specified and duration shall be for 2 hours.
8. For HDPE pipe, follow preparation and procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize shall not exceed 8 hours. If re-testing of a test section or pipeline is required, at least 8 hours shall elapse between tests. HDPE pipe test pressure and duration shall be 150 psi for 4-hour expansion period and 140 psi for the 1-hour test.

C. Test Procedure:
1. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
2. Expel air from pipe as required by venting through air release valves, blow-offs, or special taps at high points in line. Obtain approval of Town / Engineer prior to tapping pipe for expelling air.
3. During the test, examine all exposed pipe, fittings, valves and appurtenances for leakage. Make repairs to eliminate visible leakage.
4. For DIP and PVC Pressure Pipe
    a. Add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
    b. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
    c. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure.
    d. Pump from test container to maintain test pressure. Measure volume of water pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.
5. For HDPE Pressure Pipe
    a. After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for four hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
    b. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
    c. Timed Test Period: After four hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for three hours, indicating no leakage.
    d. If no visible leakage is observed and pressure remains within 5% of the original test pressure for one hour, a passing test is indicated.

D. Makeup Water Allowances:

1. The allowable makeup water allowance is the maximum amount of water that is added into a pipeline undergoing hydrostatic pressure testing. The allowable leakage rates for the various pipe materials and joints are listed below.
2. No Makeup Water: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.
3. Makeup Water shall be less than the allowable amounts specified in AWWA C600 for ductile iron pipe or AWWA C605 for PVC pipe, and less than that determined by the following formula:

$$L = \frac{S*D*(\text{Square Root of } P)}{148{,}000}$$

L = allowable leakage, gallons per hour
S = length of pipe tested, feet
D = nominal diameter of pipe, inches
P = average test pressure during leakage test, psi

4. Observed leaks shall be repaired regardless of leakage measurements.
5. Any damaged or defective pipes, fittings, valves, or joints should be repaired and the pressure test repeated until satisfactory results are obtained, at no additional cost to the Town.

## 8.6 Cleaning and Disinfection for Potable Water Piping

A. Cleaning, General: Clean pipe systems as follows:

1. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.
2. Thoroughly clean all piping, including flushing with water, in manner approved by Town / Engineer, prior to placing in service. Flushing may occur prior to or after pressure testing, but prior to disinfection. Following disinfection, flush chlorine solution and sodium hypochlorite out of piping with water.
3. Flushing operation shall maintain a minimum velocity of 2.5 ft/sec in main. Taps and openings shall be provided by the Contractor as necessary to achieve minimum velocity.
4. The Contractor shall submit a method and schedule for flushing to the Town / Engineer.

B. Disinfection:

1. Disinfect all potable and finished water piping.
2. Disinfect following pressure tests and prior to connection to existing water main.
3. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by Town / Engineer.
   a. Prior to disinfection, clean piping as specified and flush thoroughly per AWWA C651.

b. For disinfection, conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting, unless alternative method is acceptable to Town / Engineer. Chlorine tabs are not permitted unless approved by the Town / Engineer in writing.

4. Chlorine, testing, disinfection, work and all necessary equipment shall be provided by Contractor. Chlorine gas is not permitted on the jobsite.
5. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of at least 25 mg/L shall remain in the pipe after 24 hours.
6. Disinfect piping and all related components. Repeat as necessary to complete disinfection.
7. Operate all valves during disinfection.
8. Bacteriologic tests shall be performed by Contractor. Certified test laboratory report must be provided to the Town.
    a. Two consecutive safe bacteriological samples shall be taken 24 hours apart before placing the water line into service. Samples shall be collected for every 1,200 feet of new main, plus samples from each branch and the end of the line. If excessive quantities of debris, or trench water, has entered the main, samples shall then be taken at approximately 200-foot intervals. Samples should never be collected from hoses or fire hydrants. A suggested sampling tap is a corporation stop with copper goose neck assembly. The goose neck assembly shall be removed after use as directed by the Town.
    b. Disinfection record:
        1) Type and form of disinfectant used.
        2) Date and time of disinfectant injection; start and time of completion.
        3) Test locations.
        4) Date and time of flushing start and completion.
    c. Bacteriological report record:
        1) Date issued, project name, and testing lab information.
        2) Time and date of water sample collection.
        3) Name of person collecting samples.
        4) Test locations.
        5) Coliform bacteria test results for each outlet tested.
        6) Certification that water confirms, or fails to conform, to bacterial standards.
        7) Bacteriologist's signature and authority.
9. After required retention period,
    a. If water has been properly dechlorinated, flushing to the Storm Sewer is acceptable. Properly dispose of chlorinated water in accordance with Laws and Regulations.
    b. Only flush chlorinated water to the Sanitary Sewer after obtaining approval from Town.
    c. Do not discharge chlorinated water to storm sewers, ditches, or overland.
    d. No flushing during a rain event.

10. If first bacteriologic sample fails, one more is allowed at Contractor's expense. If the second sample fails, another flush must take place. If the second sample fails, the disinfection process shall be repeated. Contractor must remain on site for the entire disinfection process until the pipe passes.

## PART 9 - PUMP STATIONS AND APPURTENANCES

### 9.1 General

A. The Contractor shall furnish and install one pumping station complete with all equipment installed in a structure as shown on the Contract Drawings. Pump stations shall be as shown on the drawings and shall be complete with all concrete, mechanical, electrical, site and miscellaneous items of work shown, specified, or required for a complete and functional installation.

B. The principal items of equipment shall include two submersible, non-clog pumps; valves; piping; control panel with circuit breakers, and automatic pumping level controls, providing all wiring and conduit, and telemetry if specified (to include re-establishing any existing telemetry). General details of construction are shown on the drawings along with pump capacities, speed, minimum motor horsepower, power characteristics, etc. Miscellaneous items necessary for a complete and functional installation are the responsibility of the Contractor.

C. Pump station specifics vary greatly on a project-specific basis. The Town reserves the right to allow deviations from this specification upon review of the Town Manager and Wastewater Operator.

D. The Town may require installation of a flow meter on a project-specific basis. Likewise, the Town may require installation of a telemetry system compatible with Town needs on a project-specific basis.

E. Capacity
   1. Pump stations shall be designed to adequately handle the estimated flow from the proposed development without overflow with one pump in service. In addition, the structure, internal piping and valves, electrical service and wet well shall be of sufficient size to permit enlargement of the station, by only exchanging the pumps and motors, to the capacity required to handle contributory flows from areas adjacent to, but outside, the project location. The Town zoning map and the Ossian and Wells County Comprehensive Plans shall be used in conjunction with the Town / Engineer in determining the design capacity.
   2. Pump design shall be based on average daily flow with a peaking factor of four times that average flow. Pump starts shall not exceed 5 per hour or as recommended by the manufacturer.

F. All equipment supplied and installed under this item of the specifications shall meet the requirements of the Occupational Safety & Health Act of 1970.

9.2 **Quality Assurance**

A. The pumps shall be heavy duty, electric submersible, centrifugal non-clog units designed for handling raw, unscreened sewage and wastewater. The pumps shall be capable of operating in a liquid temperature up to 104 degrees F.

B. Pump manufacturer and impeller type to be coordinated with Town. Town to evaluate on case by case basis.

C. Motors shall be VFD compatible.

D. The pump, mechanical seals and motor units provided shall be from the same manufacturer.

E. The pumping unit manufacturer shall test each pump for mechanical and electrical correctness.

F. All control panels shall be designed and constructed to UL 508A standards. All control panels shall be UL 508A listed. Control panels shall be made available to the Town / Engineer during factory testing.

9.3 **Submittals**

A. Standard submittal data for pump approval must consist of:
   1. Manufacturer's Certificate of compliance certifying compliance with the referenced specifications and standards.
   2. Shop drawings with performance data and physical characteristics.
      a. Certified performance total dynamic head, capacity, brake horse power, efficiency, and required net positive suction head curves for each pump supplied.
   3. Manufacturer's installation instructions.
   4. Manufacturer's operation and maintenance material and manuals.
   5. Certified copies of test reports.
   6. Pump outline drawing.
   7. Station drawing for accessories.
   8. Warranty Information.
   9. Electrical:
      a. Submit all electrical requirements for each piece of equipment including voltage, phase, and load data.
      b. Submit a drawing showing the electrical enclosure placement within the pump station. Placement must be approved by the Town / Engineer prior to installation.
      c. Provide interior and exterior layouts of control panels where applicable. Layouts shall be to scale and a bill of material shall be included.
      d. Submit information on all pilot and control components. This includes but is not limited to: pilot lights, relays, push buttons, and timers.

e. Provide wiring and interconnection diagrams for each piece of equipment. For example, submitting one diagram for all screening equipment is not acceptable. Differentiate between panel and field wiring.
f. "Typical" diagrams are not acceptable. Manufacturer's standard diagrams may be submitted if they are made specific for this project by:
    1) Showing all included options, special items, etcetera.
    2) Unused options or features shall be crossed out or deleted.
    3) Identify the drawing with project name, equipment name, and tag number.

10. Standard submittal data for plug and check valve approval must consist of:
    a. Shop Drawings
    b. Product Data
11. Operation and Maintenance Manuals
    a. The Contractor shall submit operation and maintenance manuals for the pump equipment furnished hereunder.
    b. The Contractor shall submit operation and maintenance manuals for the plug and check valves furnished hereunder.
12. Local Representative and Service Provider.

9.4 **Submersible Sewage Pumps**

A. Pump manufacturer shall be subject to review and approval of Town. The motors shall be of a voltage, phase, and speed as approved by the Town. Impeller configuration shall be subject to review and approval of Town. Motors 5 H.P. and larger shall be equipped with VFDs if directed by Town.

B. Pumps: Pumps shall be of the submersible type for handling raw unscreened sewage. Pump volute, motor, and seal housing shall be high quality gray cast iron. Impeller shall be either cast iron or cast bronze of a non-clog design capable of handling minimum three (3) inch sphere solids, fibrous material, heavy sludge, and other matter found in normal sewage applications. Impeller shall have pump out vanes on the back shroud of the impeller to keep pumped material away from the seal area and increase operating life. Impeller shall be either slip fit or taper fit with key to securely lock the impeller to the driving shaft. The pump volute shall be fit with a replaceable bronze wear ring to minimize wear on the impeller and help achieve longer balance operating life. All fasteners shall be of stainless steel. Alternative impeller arrangements are permitted only with written approval from the Engineer.

C. Mating Surfaces: All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Sealing shall be accomplished when metal-to-metal contact is made, resulting in controlled compression of the rubber O-rings without requirement of a specific torque limit.

D. Seal System: The pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall consist of one (1) stationary seat and one (1) rotating ring held in place by its own spring. The lower seal shall be removable without disassembling the seal chamber. The upper seal between the motor and the seal chamber shall be of the

same design with its own separate spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The shaft sealing system shall be capable of operating submerged to pressures equivalent to two hundred (200) feet. No seal damage shall result from operating the pump unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication. The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor shall be connected to an alarm in the control panel to indicate lower seal failure.

E. Housing: The stator winding, rotor and bearings shall be mounted in sealed submersible type housing. Insulation utilized in the stator windings shall be Class H with maximum temperature capability of 180° C. Motor housing shall be filled with a high dielectric oil to give superior heat transfer and allow the bearing to run in a clean, well lubricated environment; or the housing shall be air filled with grease lubricated bearings. The pump and motor are to be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Stator shall be securely held in place with a removable end ring and threaded fasteners so that it may be easily removed in the field without use of heat or press. Shaft shall be stainless steel and supported by ball bearings. Motor shall be provided with heat sensing units attached to the motor windings which shall be connected to the control panel to shut down pump if overheating occurs.

F. Cables: Pump motor cable and heat sensor/seal failure sensor cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Cable of the proper length shall be provided to eliminate need for splices or junction boxes between pump and "control center." The cable shall enter the motor through a cord cap assembly which is double sealed allowing disassembly and disconnect of the wires and the motor and still not damage the sealed characteristics of the motor housing. Each individual conductor shall be color coded in accordance with generally accepted industry standards. The color coding shall designate the application of the conductor.

G. Mounting Base: The pump mounting base shall include adjustable guide rail supports and a discharge connection with a one hundred twenty-five (125) pound standard flange. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal.

H. Guide Rails: A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame. All mounting equipment shall be stainless steel.

I. Rail Guide & Lifting Chain: The pumps shall be equipped with sliding brackets or rail guides. A stainless steel lifting chain of adequate length for the basin depth shall be provided for each

pump. Each pump shall be equipped with a permanent, stationary lifting handle with a minimum clearance of twelve (12) inches between the top of the pump and bottom of the handle.

J. The rails and the rail guide shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable.

## 9.5 Concrete Pump Station Structure and Details

A. Provide the precast pump station structures of the type and size as shown on the drawings.

B. Provide the following items of accessories and equipment, subject to approval by the Town.
1. Stainless steel lifting yokes and stainless steel chain or cable and clamps for each pump.
2. Stainless steel pump guide rails.
3. Positive type quick release discharge flange to allow pump removal without entering the station.
4. Gravity vent.
5. Entrance hatch.
6. Piping, valves and valve vault.
7. Electrical and control equipment.

C. Each station shall include an electrical disconnect, pressure transducer with backup float control, alarm horn with a silencer, HOA on the control panel, flashing alarm light with a red dome (120 VAC), spare check valve, set of spare seals for each pump, pressure gauge, running hour meters for each pump, tool kit, cable hoist/puller and 4 inch or 6 inch emergency pump connection. Other than piping and valving, all materials shall be of 304/316 Stainless Steel or non-metallic, with Town approval. Galvanized components are not allowed.

## 9.6 Submersible Pump Station Controls

A. Pump operation shall be completely automated. Per the Town's direction, provide either multi-point float control or a submersible continuous level sensor (transducer) for primary control with backup multi-point float control. Provide mounting bracket, cable, intrinsic safety barrier, and other items as required.
1. Start and stop one pump on rise or fall of water level.
2. Start both pumps in the event the water continues to rise with one pump running.
3. Automatically alternate the pumps in the lead position or each 24 hours, whichever occurs first.
4. Automatically start the second pump if the lead pump should fail for any reason.
5. Light alarm light (flashing) in case of high water level in the wet well.
6. Light alarm light (solid) in case of a pump seal failure signal.

## 9.7 Pump Station Control Panels

A. The control panel shall be a complete package with circuit breakers, starters, etc. for each pump, automatic control system, separate alternating relay with manual control, alarm system components, hand-off-auto selector switches, indicating lights, three running time meters, (one to record the time both pumps are operating) and all other miscellaneous accessories as may be shown on the drawings and/or required for a complete installation.

B. Control panel shall be enclosed in NEMA 4X stainless steel enclosure with hinged front cover equipped with a lock.

C. Pump indicting lights shall consist of a green light for pump running, red light for pump off and a light for pump seal failure. All pilot lights shall be of the transformer type with low voltage lamps for extended life service. Mount pump indicating lights in a convenient exterior position so as to be visible without opening the panel front cover. Mount the alarm light on top of the panel and the horn on the side of the panel.

D. Provide a transformer to obtain power for the alarm system, automatic control system, and duplex convenience receptacle. Provide a heater strip with thermostat control. The control circuit shall be connected through the heat sensing switches in the pump and shall disconnect the control circuit in case of a high temperature condition on the pump motor. A HP rated contactor shall be provided for each pump.

E. The Control Panel shall be mounted on a stainless steel or aluminum dual pedestal system at eye level. Details of the proposed mounting arrangement shall be submitted for review with the pump station shop drawings.

F. If VFDs provided, pump speed shall be controlled by wet well level in Auto mode. In Hand mode, pump speed shall be controlled by rheostat mounted in Control Panel.

## 9.8 Submersible Pump Station Piping and Valves

A. Furnish complete station piping, valve pit, check valves and plug valves.

B. The discharge pipe and fittings shall be ductile iron Class 350. Inside pipe and fittings shall be flanged. Bell end pipes or fittings with mechanical joints shall be provided at or near the outside face of the station well. Piping shall be supported independent of the sewage flanges.

C. All plug valves shall be eccentric and lever operated. One lever shall be provided for each plug valve. Valves shall be rated for 175 psi working pressure minimum. All plug valves shall be of the size specified on the plans with nut actuator. Valves shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-close position and vice-versa. Valves shall be coated with fusion bonded epoxy coating on interior and exterior, 6 mils min. Valves shall be manufactured by Val-Matic, GA Industries, or approved equal.

D. All check valves shall be iron body, bronze mounted, with outside lever and weight, to operate without excessive loss of head. Valves shall be rated for 150 psi differential pressure. Covers shall be bolted and ends flanged. Check valves shall be of the size specified on the plans, shall be swing type check valves as manufactured by Clow, M & H, or approved equal. The valve shall permit flow in only one direction, close tightly when the discharge pressure exceeds the inlet pressure, and shall close without a slam or hammering action. All internal parts, including the disc seat, shall be easily replaced in the field without removing the valve from the pipeline. Valves shall be coated with fusion bonded epoxy coating on interior and exterior, 10 mils min.

E. Guide rails and all interior miscellaneous metals, including bolts, shall be stainless steel.

9.9 **Installation**

A. All equipment shall be installed in accordance with these specifications, construction drawings and the manufacturer's printed instructions.

B. Inspect all equipment and appurtenances prior to installation of the Work. Promptly remove damaged or unsuitable products from the job site. Replace damaged or unsuitable products with new, undamaged and suitable products.

C. All electrical work shall be done by a qualified licensed electrician and shall conform to the National Electric Code.

9.10 **Testing**

A. Each pump shall be fully tested in accordance with manufacturer's written instructions. Certified copies of the test results shall be furnished with each pumping unit. Record the test voltage and amperage measurements.

9.11 **Manufacturer's Supervision**

A. The Contractor shall include in his bid price the services of a factory trained representative, of the pump manufacturing company, for two separate days at the lift station to perform initial start-up of the pumping station and demonstrate satisfactory performance of each piece of equipment and instruct operating personnel in the operation and maintenance of the equipment.

9.12 **Electrical Service**

A. The Contractor shall be responsible for all construction and operational costs imposed by the electric utility to provide electric service to the pump station, from the initiation of construction until substantial completion (acceptance) by the Town of Ossian. Electrical service size to be submitted to and approved by Town of Ossian.

## 9.13 Standby Electrical Generator Connection

A. The Contractor shall furnish and install at the pump station a standby electrical generator connection as specified by the Town on a project-specific basis. The Town reserves the right to require installation of a local generator as specified by the Town on a project-specific basis.

## 9.14 Transfer Switches

A. The Contractor shall furnish and install a transfer switch as specified by the Town on a project-specific basis.

## 9.15 Warranty

A. Unless approved otherwise by the Town in writing, the pump manufacturer shall warrant the pumps being supplied to the Town against defects in workmanship and materials for a period of five years under normal use, operation, and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear or a progressive schedule of cost for a period of five years; parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all units. Warranty costs shall include all shipping costs.

## PART 10 - ELECTRICAL

10.1 **Scope**

A. The electrical work to be executed for this project shall include all material, transportation, labor, tools, and equipment to complete and leave ready for operation a complete electrical system as called for in these specifications and/or on the accompanying drawing.

10.2 **General Requirements**

A. Perform all work in accordance with the latest edition of the National Electric Code. Nothing contained in these specifications should be interpreted as conflicting with the Code.

B. All materials and equipment installed shall be new and undeteriorated and of a quality not less than the minimum specified. Materials for which examination service is provided shall bear the Underwriters label.

C. All workmanship shall be in accordance with the best practices of the trade. Electrical work shall be installed by journeymen electricians under the direct supervision of a competent foreman. At no time shall electrical work be installed by apprentice electricians or laborers without the immediate on-the-job supervision of a journeyman electrician.

D. Wiring layouts when shown on Drawings are schematic and the exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be changed. It refers only to the exact locations of conduits and equipment to fit into the work and the coordination of conduits and other equipment with piping and equipment included under other divisions of the specifications.

E. Furnish and install all necessary hangers, supports, straps, pull boxes and fittings not indicated on the drawings but which are required for a complete and properly installed system.

F. Consult all contract drawings which may affect the location of any equipment, conduit or wiring and make minor adjustments in location to secure coordination.

G. Other than minor adjustments all modifications shall be submitted to the Town / Engineer for approval before proceeding with the work.

H. The Contractor shall at all times be fully informed of the progress of the general construction, and shall install all work that is concealed and built into the work in place in sufficient time to insure proper location without delays to the work of the other trades. Properly attend the electrical work during the progress of construction to prevent misalignments of and damages to the electrical work.

10.3 **Grounding**

A. Grounding shall be in strict accordance with the requirements of the National Electric Code.

B. Only approved grounding clamps shall be used for attachment of grounding conductors.

C. Grounding conductors exposed to mechanical injury shall be installed in conduit.

D. Provide code size grounding conductors in all runs of PVC conduit.

10.4 **Shop Drawings**

A. Prior to the commencement of work the Contractor shall submit to the Town, for approval, drawings relating to the arrangement of work and shop drawings of all equipment and apparatus.

B. The drawings as submitted shall bear the stamp of approval of the Contractor as evidence that the drawings have been checked and considered satisfactory to the Contractor. Drawings submitted which include variations from the requirements of the contract specifications, or plans shall include specific mention of such variations in order that, if acceptable, action may be taken for adjustment.

C. The Town's review and approval of the Contractor's drawings or equipment details do not relieve the Contractor of responsibility for errors, omissions, deviation from specified requirements and incidental work required for proper operation, equipment failure and space requirements.

10.5 **Inspection, Tests, Permits and Fees**

A. After completion of the work, furnish to the Town a certificate of inspection and approval from the inspecting agency having jurisdiction for all electrical work.

B. Immediately correct all work which is found unacceptable by the Town. Work shall be considered unacceptable when it is contrary to the plans and/or specifications and/or the National Electric Code and/or accepted standards of good workmanship.

C. Demonstrate by tests, at the request of the Town, the compliance of the installation with these specifications, the drawings, the National Electric Code and the accepted standards of good workmanship. These tests shall include operation of equipment, continuity of the conduit system and grounding resistance. All labor and testing equipment for the performance of these tests shall be furnished by the Contractor.

10.6 **Electrical Service**

A. The general details of the electrical services are shown on the drawings. The Contractor shall arrange for modifications or changes to the required electrical service with the electric company serving the station.

10.7 **Underground Electrical Line Identification Tape**

A. During trench backfilling for exterior underground power, signal and communications lines, install permanent, bright colored continuous printed underground plastic tape compound, 6 inches wide by 4 mils thick, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches, install a single line marker. Printed legend shall be indicative of the general type of underground line below.

10.8 **Service-Entrance Equipment**

A. Provide service-entrance equipment and accessories, which are UL listed and labeled and marked 'Suitable For Use As Service Entrance Equipment' of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation, and as herein specified. Contractor is to verify with the Electric Utility, the necessary service entrance equipment, installation procedures, each entity's responsibility.

10.9 **Wiring Methods**

A. All wiring shall be installed in conduit or raceway. All conduit installed exposed to (10) feet elevation above grade shall be aluminum (ARC) conduit. Galvanized conduit is not permitted. All conduit installed underground shall be polyvinyl chloride heavy wall conduit approved for direct burial with all joints cemented together using couplings and fittings as recommended by the manufacturer. All conduit installed underground shall be installed with top of conduit at a minimum of thirty inches below final grade.

## PART 11 - CLEANUP AND GUARANTEE

### 11.1 Cleanup

A. The Contractor shall maintain the site of work, in a neat and clean condition at all times and shall not allow surplus construction materials, tools, rubbish, excess soil and other foreign matter to accumulate in a nuisance fashion and/or hazardous or unsightly manner. The timely disposition or disposal from the site of any such item shall be the complete responsibility of the Contractor. The Contractor shall follow the requirements of IDEM Rule 5 at all times.

B. Final acceptance will not be made until after all cleanup, site work including restoration of all fences, lawns, landscaping, mailboxes, curbs, drives, poles, signs, sidewalks, property monument replacement, pavement replacement, repair work and all other miscellaneous items disturbed during construction have been completed to a condition equal to that before construction began, and to the satisfaction of the Town and/or any other public body that may have jurisdiction.

### 11.2 Guarantee

A. In general all materials, labor, equipment, miscellaneous accessories and their installation shall be guaranteed to be free from all defects for a period of one year from the date of start-up and continuous use by the Town. Any defects found during this one year period shall be repaired or replaced at no cost to the Town and any such defect that has been repaired or replaced shall thenceforth be guaranteed for an additional twelve months from the date of such repair or replacement.

B. The Contractor shall assume complete responsibility for the guarantee of all facets of construction and is hereby cautioned that individual manufacturer’s guarantees of equipment or other appurtenances will not be recognized unless they exceed the requirements of the previous paragraph.

C. The required lubrication, start-up and adjustment of equipment and other appurtenances shall be performed at the appropriate time by or under the direct supervision of the Contractor and the manufacturer's representative with all equipment and appurtenances left in proper working order for use by the Town.

D. The Contractor shall be responsible for assembling from each manufacturer of equipment supplied on the project, shop drawings, specifications, and operations and maintenance (O&M) instructions into one or more manuals and furnish the Town with three (3) hard copies plus one (1) PDF copy of each manual.

PART 12 - STORMWATER DESIGN STANDARDS

## 12.1 INTRODUCTION AND GENERAL REQUIREMENTS

A. This document contains the technical standards to administer the requirements of the Town of Ossian Code of Ordinances, Article 34.03, and Wells County Subdivision Control Ordinance, Article 7, within the Town of Ossian, Indiana. The Code is the regulatory authority of stormwater management and this document contains the technical requirements to achieve compliance with the Code. The Code shall prevail in the event of conflict between the information contained in this document and the Code.

B. In addition to this document, the Town of Ossian may have adopted, or may adopt in the future, separate stormwater management technical standards that may not be incorporated in this document. The most restrictive case shall prevail in the event of conflict between the requirements contained in this document and the adopted standards.

C. The Town of Ossian Department of Storm Water Management may issue administrative variances from these standards upon written request. The Department of Storm Water Management may deviate from the standards if public safety is affected.

D. Record drawings shall be provided for detention facilities, storm sewers, swales, and open channels.
   1. Maintain accurate and up-to-date record documents showing actual location, depths, and dimensions of all piping, detention facilities, swales, open channels, and building pads noted in the permitting design drawings.
   2. Show piping with elevations referenced to project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
   3. The Contractor shall keep accurate and complete records of the actual location of all fittings, existing pipes, repair of existing utilities or tiles, tap locations into the main and the depths of the service laterals at the point of termination of the laterals.
   4. Said records shall be turned over to the Town at the completion of the project.
   5. As-built drawings shall be submitted on a hard paper format and in an electronic PDF format.

## 12.2 RUNOFF RATE DETERMINATION

A. Runoff rates shall be computed for the parcel area under development plus the watershed area flowing into the parcel under development. The runoff rate for a given rainfall intensity is calculated as follows.
   1. Development sites less than or equal to 20 acres in size, with a contributing off-site drainage area less than or equal to 50 acres and no depressional storage.
      a. The Rational Method may be used. The methodology and calculations are determined in the Indiana Local Technical Assistance Program (LTAP) Stormwater Drainage Manual, current version.

1) Tables B-1 and B-2 contain rainfall intensity and depth data for the return frequency.
2) Tables B-3 and B-4 show values for the runoff coefficient "C".
3) Table B-5 provides runoff coefficients and inlet times by land use classification.

b. A computer model that can generate hydrographs based on Natural Resources Conservation Service (NRCS) TR-20 or TR-55 methodologies, times of concentration, and curve numbers may be used along with a 24-hour duration NRCS Type 2 Rainfall Distribution. TR-55 shall be used for time of concentration calculations. See Tables B-2, B-6, and B-7.

2. Development sites greater than 20 acres in size, or contributing off-site drainage area greater than 50 acres, or with significant depressional storage.
   a. A computer model that can generate hydrographs based on Natural Resources Conservation Service (NRCS) TR-20 or TR-55 methodologies, times of concentration, and curve numbers may be used along with a 24-hour duration NRCS Type 2 Rainfall Distribution. TR-55 shall be used for time of concentration calculations. See Tables B-2, B-6, and B-7.
3. Development sites with drainage areas greater than or equal to one square mile.
   a. For the design of any Major Drainage System, carrying runoff from an area of one or more square miles, the discharge must be obtained from, or be accepted by, the Indiana Department of Natural Resources (IDNR). Other portions of the site must use the discharge methodology in the applicable section of this chapter.
4. Huff rainfall distributions (Bulletin 71, Rainfall Frequency Atlas of the Midwest, 1992) may be considered on a case by case basis with the approval of the Town of Ossian Department of Storm Water Management.
5. In the case of existing upstream detention, an allowance equivalent to the reduction in flow rate provided may be made for upstream detention only when:
   a. such detention and release rate have been accepted by the Wells County Surveyor's Office, and
   b. evidence of its construction and maintenance can be shown.
6. Receiving waters
   a. Design engineer shall evaluate receiving waters and verify sufficient capacity for the runoff from the proposed development. See Wells County Subdivision Control Ordinance, Article 7, Storm Water Standards, for further requirements.

## 12.3 DETENTION STORAGE VOLUME DETERMINATION

A. Policies for stormwater quantity management, allowable release rates, and exemptions from detention requirements are provided in the Wells County Subdivision Control Ordinance, Article 7.

B. Detention storage volume determination methods shall comply with one of the following.
   1. Development sites less than or equal to 5 acres in size, with a contributing drainage area less than or equal to 50 acres and no depressional storage.
      a. The required stormwater storage volume may be calculated using the Rational Method and based on runoff from the design return frequency storm. The

methodology and calculations are determined in the Indiana Local Technical Assistance Program (LTAP) Stormwater Drainage Manual, current version.

b. A computer model that can generate hydrographs based on Natural Resources Conservation Service (NRCS) TR-20 or TR-55 methodologies, times of concentration, and curve numbers may be used along with a 24-hour duration NRCS Type 2 Rainfall Distribution from the design return storm. TR-55 shall be used for time of concentration calculations.

2. Development sites greater than 5 acres in size or contributing drainage area greater than 50 acres or with significant depressional storage.
   a. A computer model that can generate hydrographs based on Natural Resources Conservation Service (NRCS) TR-20 or TR-55 methodologies, times of concentration, and curve numbers may be used along with a 24-hour duration NRCS Type 2 Rainfall Distribution from the design return storm. TR-55 shall be used for time of concentration calculations.
3. Huff rainfall distributions (Bulletin 71, Rainfall Frequency Atlas of the Midwest, 1992) may be considered on a case by case basis with the approval of the Town of Ossian Department of Storm Water Management.

## 12.4 STORM SEWER DESIGN STANDARDS AND SPECIFICATIONS

A. All private or public storm sewers shall conform to the design standards and other requirements contained herein. For Rational Method analysis, the duration shall be equal to the time of concentration for the drainage area. In computer based analysis, the duration is as noted in the applicable methodology associated with the computer program.

B. General
   1. Storm sewer and culvert velocities shall be between 2.5 ft/s and 10.0 ft/s based on full flow, gravity conditions.
   2. The end of all storm sewers into wet or dry basins, channels or swales, or streams shall have concrete footing supports or anchored end sections to constrain movement and shall be equipped with riprap or other approved means of erosion control.
   3. The engineer shall use sound engineering judgement to determine a starting tailwater elevation. In no case shall the downstream starting water surface elevation be assumed to be lower than the top of the pipe or the maximum 10-year flood basin/receiving water body elevation, whichever is higher.
   4. Facilities functioning as a Major Drainage System, carrying runoff from an area of one or more square miles, must also meet IDNR design standards in addition to the Ossian and Wells County standards. In case of discrepancy, the most restrictive shall apply.

C. Storm Sewer Design
   1. All storm sewers shall accommodate peak runoff from the 10-year return frequency storm with the hydraulic grade line (HGL) contained within the crown of pipe. The HGL shall not exceed any storm structure rim elevation for the 100-year return frequency storm without the express written consent of the Town of Ossian Department of Storm Water Management and provisions for an overland flow path protecting public safety. Supporting hydraulic calculations shall be provided.

2. Storm sewers hydraulic capacity sized by the Rational Method analysis must be done using Manning's Equation. The methodology and calculation are determined in the Indiana Local Technical Assistance Program (LTAP) Stormwater Drainage Manual, current version.
3. Allowable Manning's "n" roughness coefficient values for storm sewer materials are listed in Table B-8.
4. The minimum diameter of all public storm sewer, and detention basin outlet pipe (not including subdrains) shall be 12 inches with supporting hydraulic calculations. Smaller diameters will be only allowed on a case by case basis with formal approval of the Town of Ossian Department of Storm Water Management.
5. When the minimum 12 inch diameter pipe will not limit the release rate to the required detention storage volume, the release rate for detention storage shall be controlled by an orifice plate or other device, subject to acceptance of the Wells County Surveyor's Office.
6. Public storm sewers shall be straight between manholes and/or inlets unless approved otherwise in writing by the Department of Storm Water Management.
7. Backwater Method for pipe system analysis (submerged pipe)
    a. A more sophisticated design/analysis methodology than Manning's equation will be required for existing or proposed storm drain hydraulic analyses which possess submerged outfalls. The backwater analysis method provides a more accurate estimate of pipe flow by calculating individual head losses in pipe systems that are surcharged and/or have submerged outlets. These head losses are added to a known downstream water surface elevation to give a design water surface elevation for a given flow at the desired upstream location. Total head losses may be determined as follows:
        1) Total head loss = frictional loss + manhole loss + velocity head loss + junction loss
    b. Any submerged pipe will only be reviewed as a variance to the standards of this manual and on a case by case basis.

D. Culvert Design
1. When crossing under a public road, alley, or street which provides the only access for a commercial or residential development or which is classified as a freeway, arterial, parkway, and/or collector by the Town of Ossian, Wells County, or the Northeastern Indiana Regional Coordinating Council (NIRCC):
    a. Culverts shall accommodate peak runoff from the 50-year frequency storm with maximum surcharge of three feet above the crown of pipe and no road surcharging or overtopping.
    b. The 100-year return frequency storm hydraulic grade line (HGL) must be calculated.
        1) Design calculations must show the existing offsite hydraulic profile will not be impacted and must establish what upstream areas are subject to inundation in the 100-year frequency storm.
        2) A drainage easement shall be recorded for upstream areas subject to inundation in the 100-year frequency storm.
2. When crossing under a driveway:
    a. Culverts shall accommodate peak runoff from the 10-year frequency storm at a minimum, with hydraulic grade line within the crown of pipe. Driveway

overtopping will be permitted in larger storms provided it does not encroach the public road. Variations from this policy require the written consent of the Town of Ossian Department of Storm Water Management.

E. Pipe Cover, Grade, and Separation from Water Mains
   1. A minimum 2.0 feet of cover is required between the pavement subgrade and the top of the pipe unless approved otherwise in writing by the Department of Storm Water Management. The pipe cover shall also meet the pipe manufacturer's recommendations.
   2. Storm sewer separation from water mains shall follow 327 IAC 8-3.2-9 (Indiana Administrative Code).

F. Connections to Storm Sewer System
   1. Specific language shall be provided in the protective covenants, on the record plat, or with the parcel deed of record, noting the ability of the system to accommodate any permitted connections listed below.
      a. Roof downspouts, roof drains, footing drains, foundation drains, sump pumps, and perimeter drains may be connected to manholes, inlets, or designated storm sewers. Discharge into designated storm drainage channels/swales is also permitted.
         1) No downspouts or roof drains shall be connected to the sanitary sewers.
         2) Roof downspout and roof drains shall be shown in the drainage calculations for the storm sewer system.
         3) Floor drain flow or other sanitary sewage shall be connected to sanitary sewers.
      b. A storm sewer lateral shall be provided to each parcel in a subdivision. The storm sewer shall be designed to accommodate sump pump drainage from each home. Backflow prevention shall be provided as needed to protect lower building levels. Minimum size shall be 6 inch diameter at 1% minimum slope. Lateral shall be provided with fabricated cap and marked. Material shall match mainline storm sewer unless approved otherwise by Town of Ossian Department of Stormwater Management.
   2. Blind taps are permitted with the use of an Inserta-Tee, or approved equal, provided:
      a. The lateral tap is from a residential downspout, roof drain, or sump pump.
      b. The main line is 12" nominal pipe size or larger.
      c. The protrusion into the main line does not exceed 1".
   3. Swimming pool drains shall not be connected to the storm sewers unless dechlorination is provided.
   4. None of the above-mentioned devices shall be connected to any street underdrains, unless specifically authorized by the Town of Ossian Department of Storm Water Management.

G. Pipe Installation
   1. Pipe installation shall be per "Part 5 – Pipe Installation" of the Ossian "Standards and Specifications".
   2. Dips/sags on newly installed storm systems will not be allowed.
   3. Variations from these standards must be justified and receive written acceptance from the Town of Ossian Department of Storm Water Management.

H. Pipe Materials

1. Pipe and fitting materials used in storm sewer construction shall be per "Part 4 – Pipe and Fittings" of the Ossian "Standards and Specifications".
2. Corrugated metal Pipe (CMP) will only be permitted for road culverts and only when approved in writing by the Town of Ossian Department of Storm Water Management. Driveway culverts must be smooth-walled.

I. Manholes/Inlets

1. Manholes and inlets used in storm sewer construction shall be per "Part 5 – Manholes and Structures" of the Ossian "Standards and Specifications".
2. Manholes or inlets shall be provided at the following locations:
    a. Where two or more storm sewers converge.
    b. Where pipe size or pipe material changes.
    c. Where a deflection in horizontal alignment occurs.
    d. Where a change in pipe slope occurs.
3. The maximum distance between storm sewer manholes shall be as follows:
    a. Pipe Diameter <= 42 in → Maximum distance between manholes 400 ft.
    b. Pipe Diameter >= 48 in → Maximum distance between manholes 600 ft.
4. Where a swale or channel runs over a pipe, manholes or inlets with domed open-grate lids are required every 100' linear feet minimum, with a location within twenty feet of the high side of every driveway crossing.
5. Manhole/inlet minimum size shall be as follows:
    a. Structure Depth <= 5 feet → Minimum diameter 30 inches or 30x30 square.
    b. Structure Depth > 5 feet → Minimum diameter 48 inches or 48x48 square.

J. Street Stormwater Design

1. The allowable spread of water during the 10-year return frequency storm shall be limited as follows:
    a. Arterial Streets are limited to maintain a minimum of two clear (free of standing or flowing water) 10-foot traffic lanes.
    b. Collector Streets are limited to maintain a minimum one clear (free of standing or flowing water) 10-foot traffic lane.
    c. Local Roads are limited to no curb overtopping.
2. The maximum depth of water during the 100-year return frequency storm shall be limited as follows:
    a. The maximum depth of water shall not exceed 12-inches above the gutter flowline or edge of pavement flowline if there is no gutter.
    b. Additionally, the maximum depth of water for any public road, alley, or street which provides the only access for a commercial or residential development or which is classified as a freeway, arterial, parkway, and/or collector by the Town of Ossian, Wells County, or the Northeastern Indiana Regional Coordinating Council (NIRCC) shall not exceed the crown of the road (to allow for emergency vehicles).
3. Inlet Sizing and Spacing
    a. The inlet grate shall be adequate to pass the design 10-year frequency storm flow with 50% of the sag inlet areas clogged.
    b. Inlet design and spacing may be done using the hydraulic equations per manufacturer recommendations or orifice/weir equations.

c. Gutter spread on continuous grades may be determined using the Manning's equation. Further guidance regarding gutter spread calculation may be found in the Indiana Local Technical Assistance Program (LTAP) Stormwater Drainage Manual, current version.

K. Curb outlets to allow surface drainage onto the roadway are prohibited. No curb cuts shall be made to allow pipe discharge onto roadway or gutter.

L. Special hydraulic structures required to control the flow in storm runoff drainage systems include: junction chambers, drop manholes, stilling basins, and other special structures. These structures shall be limited to those locations justified by prudent planning and by careful and thorough hydraulic engineering analysis. Certification of special structures by a certified Indiana Structural Engineer may also be required.

M. Storm Sewer Easements

1. Minimum easement widths for storm drains when measured at right angles to the pipe shall be twenty feet (20'). More stringent requirements for stormwater easement size and additional covenants may be made by the Town of Ossian Department of Storm Water Management based upon individual site conditions.
2. An easement shall be provided to any upstream, offsite, and adjacent parcel to allow a future storm sewer connection to an existing storm sewer system.
3. If connecting to an existing public storm sewer on an adjacent parcel, a private easement must be obtained from that adjacent land owner for any segments of storm sewer installed outside existing easements. Alternatively, a public storm sewer easement may be obtained and a public storm sewer extended across the adjacent parcel.

N. Drainage System Overflow Design

1. Overflow path/ponding areas (paths leading to the detention/retention basin) resulting from a 100-year frequency storm shall be calculated throughout the development. The calculation shall be based on all on-site and off-site contributing drainage areas for the proposed land use. The storm pipe system shall be assumed completely plugged.
2. The 100-year overflow path centerline shall be clearly shown as a distinctive line symbol on the plans.
3. Easement Width
   a. Except for residential side lot overflow paths, a minimum 20 feet width permanent drainage easement shall be provided for drainage system overflow paths / ponding areas, unless special circumstances require a larger easement at the discretion of the Town of Ossian.
   b. If the overflow path is between two adjacent lots in a subdivision, then the area shall be designated as a Common Area and be a minimum 20 feet width.
   c. Swale and channel easements and common areas shall be wide enough to accommodate maintenance equipment.
4. No structures, sheds, or fences can be constructed within the easement or common areas that may impede free stormwater flow. These areas are to be maintained by the property owners or be designated as common areas maintained by the homeowner's association. All landscaping that impedes free stormwater flow is shall be removed.

5. The Lowest Entry Elevation and Lowest Adjacent Grade for all residential, commercial, or industrial buildings shall be a minimum 1 foot above the noted overflow path/ponding elevation.
6. The overflow path/ponding may be modeled as successive series of natural ponds and open channel segments. Calculations for determining the 100-year overflow path/ponding elevations may be based on hand calculation methods utilizing normal depth calculations and storage routing techniques or performed by Acceptable Computer Modeling Programs.

## 12.5 OPEN CHANNEL AND SWALE DESIGN STANDARDS AND SPECIFICATIONS

A. All private or public channels and swales shall conform to the design standards and other design requirements contained herein.

B. General
   1. Channel-designed to convey the peak runoff for the 100-year return frequency storm from any upstream drainage area.
   2. Swale-designed to convey the peak runoff for the 100-year return frequency storm from any upstream drainage area.
      a. Maximum flow shall be limited to 4 cubic feet per second (cfs).
      b. Maximum length shall be limited to 400’.
      c. Shall be used in residential rear and side yards unless approval obtained from Town of Ossian Department of Storm Water Management.
   3. See Table B-9 for design parameters.
   4. Materials shall be based on design velocities and flow depth.
   5. Watercourses, including rear and side yard drainage swales, designated within a development plan must be shown on the plat.
   6. Facilities functioning as a Major Drainage System, carrying runoff from an area of one or more square miles, must also meet IDNR design standards in addition to the Wells County standards. In case of discrepancy, the most restrictive requirements shall apply.

C. Hydraulic Design
   1. The flow depth and flow width shall be determined using Manning's Equation.
   2. The performance of all drainage system parts shall be checked to ensure all buildings are properly located outside the 100-year flood boundary and flow paths are confined to the designated easement.
   3. Channel or swale flow into a closed system requires runoff rate and head loss computations to demonstrate the pipe is capable of conveying the 100-year channel flow for developed conditions. This must be accomplished either entirely or in combination with a defined overflow channel with no reduction in flow velocity, flow rate, or increase in backwater conditions.
   4. Backwater Method for Drainage System Analysis
      a. The 100-year water surface elevation along channels and swales shall be based on accepted methodologies provided in the LTAP Stormwater Drainage Manual, current edition, or Acceptable Computer Modeling Programs listed in Article 12.2.

D. Geometry

1. Minimum swale and channel slopes are as shown in Table B-10.
    a. Swale or channel slopes less than the minimum may be allowed by the Town of Ossian on a case by case basis in commercial and industrial areas or provided the flow path is paved with a minimum of 4" concrete.
2. The required channel cross-section and grade are determined by design capacity, material in which the channel is to be constructed, and requirements for maintenance.
3. The channel grade shall be such that the velocity in the channel is high enough to prevent siltation but low enough to prevent erosion. In no case should channel velocities exceed the limits shown in Table B-10 without authorization from the Town of Ossian Department of Storm Water Management. The channel design should incorporate increased runoff due to the proposed development in addition to existing runoff.
4. Channels shall have freeboard adequate to cope with the effect of hydraulic jumps where design flow depth is slightly below critical depth. Minimum freeboard shall be twelve inches.
5. Channel and Drainage Swale Setbacks
    a. The applicant shall take into account public safety when designing open channel flow when the design discharge produces a depth greater than three (3) feet in the channel. No channels with greater than three (3) feet of flow depth shall be permitted within fifty (50) feet of the public right of way.
    b. Adequately-designed guard rails, berms, or other structural measures are encouraged and may be allowed by the Town on a case by case basis in lieu of the above-noted setbacks to minimize the chances of vehicles entering the basin.
    c. Danger signs should be mounted at appropriate locations to warn of deep water, possible flood conditions during storm periods, and other dangers that exist. Recommendations contained within this document do not relieve the applicant and owner/developer from the responsibility of taking all necessary steps to ensure public safety with regards to such facilities.
6. Depth shall be established sufficient to accommodate adequate outlets for subsurface drains, tributary ditches, or streams.
7. The ditch bottom shall also be low enough to install adequately-sized driveway culverts with minimum cover as required by these Standards and the manufacturer. Driveway culvert inverts shall be designed to adequately consider upstream and downstream culvert elevations.

E. Easements
1. Swales and channels serving more than one lot, with the exception of side lot swales serving only two lots, shall be located in an easement with maintenance access rights noted on the plat.
2. Easement Widths
    a. Easement widths shall be determined based on the overland flow width for the calculated water surface elevation.
    b. Swale and channel easements shall be wide enough to accommodate maintenance equipment.
    c. The minimum easement width shall be twenty feet (20') unless special circumstances require otherwise at the discretion of the Town of Ossian.

3. In the case of a subdivision, channels and swales containing an overland flow path or detention basin outfall shall be contained within an easement and maintenance responsibilities noted in the Covenants.
4. No structures, sheds, or fences can be constructed within the easement or common areas that may impede free stormwater flow. These areas are to be maintained by the property owners or be designated as common areas maintained by the homeowner's association. All landscaping that impedes free stormwater flow shall be removed.

F. Spoil Placement
1. Spoil material resulting from excavation shall be placed in a manner that will:
   a. Minimize overbank wash.
   b. Provide free flow of water between the channel and all areas naturally draining to the channel. This includes any existing floodplain boundary unless the valley routing and water surface profiles are based on continuous dikes being installed.
   c. Not hinder the development of access routes necessary for maintenance.
   d. Leave the right-of-way in the best condition feasible, consistent with the project purposes, for productive use by the owner.
   e. Be accepted by the IDNR, Indiana Department of Environmental Management (IDEM), or US Army Corps of Engineers (COE), if applicable.

## 12.6 STORMWATER DETENTION DESIGN STANDARDS

A. The following shall govern any stormwater detention improvement design. A basin shall be constructed to temporarily detain stormwater runoff exceeding the maximum peak release rate authorized by the Ordinance.
1. Allowable Release Rates – Allowable release rates are defined in Article 7, Storm Water Standards, of the Wells County Subdivision Control Ordinance.
2. Acceptable Detention Facilities - The increased stormwater runoff resulting from a proposed development should be detained on-site by the provisions of appropriate wet bottom or dry bottom detention facilities, underground detention storage, or other acceptable techniques. Measures that slow the overland flow rate and velocity in runoff channels shall also be used to partially control runoff rates.
   a. Outlet control structures and overflow facilities shall be designed to operate solely by gravitational acceleration, automatic operation, not require manual attention, and require little or no maintenance for proper operation.
3. Downstream Restrictions – Policies for addressing downstream restrictions are defined in Article 7, Storm Water Standards, of the Wells County Subdivision Control Ordinance.
4. Management of Off-site Runoff – Policies for managing upstream tributary areas are defined in Article 7, Storm Water Standards, of the Wells County Subdivision Control Ordinance.
5. Emergency Overflow Structures:
   a. The overflow structure length is determined using the weir equation and a discharge rate equal to the peak 100-year inflow based on developed conditions. The basin is assumed full to the overflow control elevation.
   b. The separate emergency overflow structure elevation shall be set at the 100-year basin elevation. The top of bank elevation must include a minimum freeboard one

(1) foot above the flow over the spillway, unless approved otherwise by the Town on a case by case basis.

c. Emergency overflow structures shall be designed to handle the peak inflow discharge and peak flow velocity resulting from the 100-year return frequency storm runoff from the entire contributing watershed draining to the detention/retention facility. This shall assume post-development condition on-site and existing condition off-site.

d. An emergency overflow structure for a detention/retention facility connected in series shall accommodate the largest peak inflow to all basins in series upstream of the structure.

e. Maximum flow depth over the emergency overflow structure shall be 1'. A larger flow depth may be accepted by the Town of Ossian Department of Storm Water Management in special circumstances.

f. Examples of emergency overflow structures include a weir, spillway, or manhole with discharge pipe. The structures must be constructed of concrete.

g. The emergency overflow routing from the emergency overflow structure to an adequate receiving system must be positive (by gravity), shown on the construction plans, and on the plat. It must be sized to accommodate the emergency overflow structure design flow.

h. The emergency overflow structure shall not be used as outlet control for the basin, including bypassing offsite flows.

6. Acceptable Outlet and Adjoining Property Impact Policies

a. The proposed flow path from the development outfall(s) to a regulated drain, natural watercourse (blue line stream on USGS quadrangle map), or an acceptable municipal storm sewer shall be provided on an exhibit that includes topographic information.

b. Any existing field tile encountered during the construction shall be incorporated into the proposed stormwater drainage system or tied to an acceptable outlet. The upstream portions of the tile encountered shall be located and confirmed to be outside future building sites or shall be reconstructed to the property line to avoid future building sites. An easement shall be recorded over the top of the tile.

c. No development activities conducted shall be allowed to obstruct free storm water flow from an upstream property.

1) No approval shall be granted for a drainage system where the outfall from the stormwater drainage system of any development flows through real estate owned by others prior to reaching a regulated drain or watercourse until all real estate owners crossed by the outfall consent in writing to the use of their real estate through a recorded easement. Easement shall be shown on the recorded plat in the case of subdivisions.

2) Off-site drainage improvements may be required if an adequate outlet is not located on site. Those improvements may include, but are not limited to; extending storm sewers, clearing, dredging, obstruction removal to open drains or natural water courses, and the removal or replacement of undersized culvert pipes as required by the Town of Ossian.

7. For small areas of unpaved land that will not be part of the storm sewer and detention basin system, the maximum release rate shall not be greater than existing. The applicant

will be responsible for determining the capacity of the receiving water. These areas will only be reviewed on a case by case basis with the Town of Ossian.

B. General Detention Basin Design Requirements

1. The design shall ensure a minimum 80% of the original detention capacity is restored within 48 hours from the start of the design 100-year return frequency storm.
2. The 100-year storage elevation of stormwater detention facilities shall be separated by not less than 25 feet from any building or structure to be occupied.
3. The Lowest Entry Elevation (including walkout basement floor elevation and any other above ground entry elevations) for all residential, commercial, or industrial buildings shall be:
    a. set a minimum 2 feet above the calculated 100-year storm water surface elevation or 2 feet above the emergency overflow structure elevation, whichever is higher.
    b. set a minimum 1 foot above the flood elevation along the emergency overflow route, calculated on the emergency overflow weir design discharge.
4. Due to public and emergency rescue personnel safety considerations, no detention facility or other water storage area, permanent or temporary, shall be constructed under or within twenty (20) feet of any utility line or utility pole. Likewise, utility poles or utility lines shall not be placed within twenty (20) feet of any detention facility or other water storage area. Variation from this policy shall require written approval from the affected utility and a variance request and approval of the same by the Town of Ossian.
5. Detention Basin Setbacks
    a. All stormwater detention facilities shall be separated from any road right-of-way by no less than 50 feet measured from the top of bank or the 100-year pool if no defined top of bank is present. This distance shall use the most restrictive right-of-way possible.
    b. The minimum distance from the basin's toe of slope in fill, and top of bank in cut, shall be 10' to the adjacent property line.
    c. Adequately-designed guard rails, berms, or other structural measures are encouraged and may be allowed by the Town on a case by case basis in lieu of the above-noted setbacks to minimize the chances of vehicles entering the basin.
6. Basin side slopes shall be as shown on Figures B-11 or B-12.
7. At the discretion of the Town of Ossian Department of Storm Water Management, safety screens with openings that prevent the passage of a four (4) inch diameter sphere shall be provided for all above-surface and accessible (outside of an enclosed and lidded structure) pipe or open end sections 12 inch in diameter or larger. This is a requirement to prevent children or large animals from crawling into the structures. The openings shall not be too close and cause repeated obstructions and maintenance issues.
8. Danger signs should be mounted at appropriate locations to warn of deep water, possible flood conditions during storm periods, and other dangers that exist.
9. The decision to use fencing and signs around a detention basin is left to the owner or the developer. Recommendations contained within this document do not relieve the applicant and owner/developer from the responsibility of taking all necessary steps to ensure public safety with regards to such facilities.
10. The outlet from the basin shall be a minimum 0.5 foot above the normal water level of the receiving water body for maintenance purposes.

11. An outlet control orifice shall be no less than 4 inches in diameter, even if the 4 inch diameter orifice results in a discharge that exceeds the predetermined maximum authorized peak flow release rates. However, the basin size shall be based on the more restrictive maximum allowable release rate.
12. If pollution risk is present and containment ability needed, the detention basin outlet pipe may have a manual gate valve for spill protection. The valve must remain open.
13. Grass or other suitable cover/erosion protection measure shall be provided along the detention storage basin banks. Vegetative cover around detention facilities should be maintained as appropriate.
14. Debris and trash removal and other necessary maintenance shall be performed by the property owner or association on a regular basis to assure continued operation in conformance to design.
15. No residential lots or any part thereof shall be used for any part of a detention basin. This assumes the basin is full to the elevation of peak flow over the emergency overflow structure elevation.
16. Within subdivisions, basins shall be placed within a common area either platted or legally described and recorded as a perpetual stormwater easement while assumed full to the 100-year water surface elevation or the emergency overflow weir elevation, whichever is higher. A minimum of fifteen (15) feet horizontally from the top of bank of the facility, or the 100-year pool elevation if no defined top of bank is present, shall be dedicated as permanent stormwater easement if the above-noted boundary of the common area does not extend that far.
17. Earthen levee compaction levels shall reach 95 percent Modified Proctor Density, utilizing suitable soil materials, at appropriate moisture levels. Levees shall be provided with a core trench (cut-off trench) of compacted soil, to prevent water piping either beneath the levee, or around the levee ends.
18. The principal spillway outlet pipe structure shall be provided with anti-seep devices for leveed detention/retention facilities which generate 3 feet or more of head pressure. The construction material for these devices shall be of like material as the pipe structure, i.e. poured in place concrete or polyethylene sheet with sewn rubber boot. As a general guide, anti-seep collars shall possess a minimum dimension of 5'x 5' and be spaced a maximum of 25' apart.
19. The anti-seep collars shall be clearly shown on the construction plan details. The material used for bedding and backfill of pipe structures through an earthen dam or levee shall be the same soil material used in surrounding embankment construction.
20. Basins shall be accessible by a maintenance access easement, or common area, shown on the plat or development plan to include a route for maintenance and emergency vehicles. Minimum width shall be 14’ and free of obstructions.

C. Additional Requirements for Dry-Bottom Facility Design

1. In addition to general design requirements, detention facilities that will not contain a permanent pool of water shall comply with the following requirements:
    a. Provisions shall be incorporated into facilities for complete interior drainage of dry bottom basins, including providing a 1% minimum positive basin bottom slope to outlet structures, 1% minimum positive longitudinal and transverse grades to perimeter drainage facilities, paved gutters, or the installation of subsurface drains.

b. The maximum planned depth of stormwater stored shall not exceed six (feet), with the majority of the basin having a maximum of four (4) feet in depth for residential developments. Deeper storage shall be permitted only with the written approval of the Town of Ossian.

c. Side slopes of 3:1 or flatter shall be provided for stability in excavated detention facilities. In the case of valley storage, natural slopes may be considered to be stable.

D. Additional Requirements for Wet-Bottom Facility Design

1. All improvements for detention facilities with a permanent water surface shall meet both the dry basin requirements above the permanent water surface and the following additional requirements:
   a. A controlled positive outlet will be required to maintain the design water level in the wet bottom facility and provide required detention storage above the design water level.
   b. Basin geometry shall comply with Figure B-11 or B-12, including provisions for a safety ledge.
   c. If permeable material is discovered within the footprint of a designed wet basin, the material shall be undercut an additional 18" and filled with clay material or other impermeable material.

E. Parking Lot Storage

1. Paved parking lots may be designed to temporarily surcharge stormwater on all or a portion of their surfaces. Maximum surcharge depth shall be limited to six (6) inches so as to prevent damage to parked vehicles and so access to parked vehicles is not impaired.
2. Ponding should be confined to those positions of the parking lots farthest from the area served.
3. The 100-year inundation boundary must be determined and clearly shown on the construction plans.

F. Two-Stage Ditches

1. Two-stage ditches may not be utilized in lieu of stormwater detention without the written consent of the Town of Ossian Department of Storm Water Management.

G. Detention Facility in Floodplain

1. County ordinances specify when detention is permitted and prohibited in floodplain. When detention in the floodplain is prohibited, newly created floodplain storage volume shall be provided in lieu of detention volume at a ratio of 1.5 floodplain storage units to 1.0 detention volume units. Refer to County ordinances.
2. Detention basin placement within the 100-year floodplain requires additional design considerations in order to be effective and to comply with local Flood Control Ordinances. In rare cases when the Wells County Floodplain Administrator and/or the Wells County Surveyor's Office may allow a detention storage within a 100-year floodplain, only the net increase in storage volume above that which naturally existed on the floodplain shall be credited to the development.
3. All work in the floodplain must comply with the Wells County Ordinance for Flood Hazard Areas.

4. The detention basin top of embankment should be at or above the 100-year floodplain elevation, including any open spillways. Any pipe outlets must be equipped with a backflow prevention device unless the detention basin storage is provided entirely above the 100-year flood elevation.
5. A detention basin constructed within the 100-year floodplain and utilizing a backflow prevention device will eliminate the floodplain storage that existed on the detention basin site, and will require compensatory floodplain storage.
6. The analysis for a detention basin in the floodplain must consider appropriate tailwater impacts and any backflow prevention device effect.
7. Compensatory storage volume cannot also be used as detention volume.

H. Joint Development of Control Systems
1. Stormwater control systems may be planned and constructed jointly by two or more developers as long as compliance with the Ordinance and these standards are maintained.

I. Diffused Outlets
1. When the allowable runoff is released in an area susceptible to flooding or erosion, the developer may be required to construct appropriate storm drains through such area to avert increased flood hazard caused by the allowable runoff concentration at one point instead of the natural overland distribution.
2. Diffused outlets are not generally permitted. In rare circumstances where a diffused outlet is considered appropriate, specific requirements for such a release will be determined on a case by case basis at the discretion of the Town of Ossian and the Wells County Surveyor's Office.

J. IDNR Requirements
1. All designs for basins to be constructed in a floodway with a drainage area of one square mile or more must also satisfy IDNR permit requirements.

K. Grading and Building Pad Elevations
1. Maximum yard slopes shall be 3:1 where soil has been disturbed during construction processes.
2. It shall be the property owners' responsibility to maintain the natural features on their lots and to take preventive measures against any and all erosion and/or deterioration of natural or manmade features on their lots.

## 12.7 DEFINITIONS

**Acceptable Computer Modeling Programs.** TR-55 (NRCS), TR-20 (NRCS), HEC-HMS (US Army Corps of Engineers (COE)), and HEC-1 (COE), HEC-RAS, and HEC-2. The use of other computer models must be accepted in advance by the Wells County Surveyor's Office.

**Backwater.** The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water shall flow. (DNR Indiana Drainage Handbook)

**Base Flood Elevation.** The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year. (FEMA NFIP)

**Base Flow.** The portion of streamflow that is not due to storm runoff but is the result of ground water discharge or discharge from lakes or similar permanent impoundments of water.(IDEM ISWQM)

**Channel.** A natural stream or excavated ditch that conveys water. (IDEM ISWQM)

**Closed Conduit.** A pipe, tube, or tile used for transmitting water.

**Compensatory Storage.** An artificial volume of storage within a floodplain used to balance the loss of natural flood storage capacity when artificial fill or substructures are placed within the floodplain.

**Construction activity.** Land disturbing activities associated with the construction of infrastructure and structures. This term does not include routine ditch or road maintenance or minor landscaping projects. (327 IAC 15-5-4)

**Construction plan.** A representation of a project site and all activities associated with the project. The plan includes the location of the project site, buildings and other infrastructure, grading activities, schedules for implementation and other pertinent information related to the project site. A storm water pollution prevention plan is a part of the construction plan. (327 IAC 15-5-4)

**Control Structure.** A structure designed to control the rate of flow that passes through the structure, given a specific upstream and downstream water surface elevation.

**Conveyance.** 1. A measure of the ability of a stream, channel, or conduit to convey water. 2. A comparative measure of the water-carrying capacity of a channel; that portion of the Manning discharge formula that accounts for the physical elements of the channel. 3. A measure of the water-transporting capacity of a channel, floodplain, drainage facility, storm drain, or other natural or artificial watercourse feature traversed by flow such as runoff or irrigation water. For the design storm(s), conveyance can include that associated with overtopping flow and flood plain relief at a cross-drainage structure. (INDOT)

**Crown of Pipe.** The elevation of the top of pipe. (DNR Indiana Drainage Handbook)

**Culvert.** A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal or other impediment. (DNR Indiana Drainage Handbook)

**Datum.** Any level surface to which elevations are referred, usually Mean Sea Level. (DNR Indiana Drainage Handbook)

**Depressional Storage Areas.** Non-riverine depressions in the earth where stormwater collects. The volumes are often referred to in units of acre-feet.

**Design Storm.** A selected storm event, described in terms of the probability of occurring once within a given number of years, for which drainage or flood control improvements are designed and built. (DNR Indiana Drainage Handbook)

**Detention.** Managing stormwater runoff by temporary holding and controlled release. (IDEM ISWQM)

**Detention Basin.** Constructed basins that collect, temporarily hold, and gradually release excess storm water from storm events. Detention is achieved through the use of an outlet control structure that regulates the rate of storm water outflow. (IDEM ISWQM)

**Detention Facility.** A facility designed to detain a specified amount of stormwater runoff assuming a specified release rate.

**Detention Storage.** The temporary detaining of stormwater in storage facilities, on rooftops, in streets, parking lots, school yards, parks, open spaces or other areas under predetermined and controlled conditions, with the rate of release regulated by appropriately installed devices (DNR Indiana Drainage Handbook).

**Detention Time.** The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge). (IDEM ISWQM)

**Developer.** Any person financially responsible for construction activity, or an owner of property who sells or leases, or offers for sale or lease, any lots in a subdivision. (327 IAC 15-5-4)

**Development.** For purposes of flood control regulations, any change or improvement to land brought about by human activity, including but not limited to:

(1) Construction, reconstruction, or placement of a building or any addition to a building:

(2) Installation of a manufactured home on a site, preparing a site for a manufactured home, or installing a recreational vehicle on a site for more than one-hundred-eighty (180) days, where permitted;

(3) Installation of utilities, erection of walls and fences, construction of roads, or similar projects;

(4) Construction of flood control structures such as levees, dikes, channel improvements, etc.;

(5) Mining, dredging, filling, grading, excavation, or drilling operations;

(6) Construction and/or reconstruction of bridges or culverts;

(7) Storage of materials; or

(8) Any other activity that might change the direction, height, velocity of flood, or surface waters.

"Development" does not include any authorized activity with respect to a regulated drain as defined in IC 36-9-27-2, as may be amended from time to time. Neither does this definition include activities such as maintenance of existing structures and facilities such as painting, re-roofing, resurfacing roads, or gardening, plowing, and similar agricultural practices that do not involve filling, grading, excavating, or constructing permanent structures.

**Discharge.** Usually the rate of water flow. A volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day. (IDEM ISWQM)

**Drainage Area.** The area draining into a stream at a given point. It may be of different sizes for surface runoff, subsurface flow and base flow, but generally the surface runoff area is considered as the drainage area. (IDEM ISWQM)

**Drainage Facility.** Infrastructure constructed or installed for conveyance and/or storage of stormwater or floodwater.

**Dry Detention Basin.** Storm water basin designed to capture, temporarily hold, and gradually release a volume of storm water runoff to attenuate and delay storm water runoff peaks. Dry detention basins provide water quantity control (peak flow control and stream channel protection) as opposed to water quality control. Also known as "dryponds" or "detention basins." (IDEM ISWQM)

**Earth Embankment.** A man-made deposit of soil, rock, or other material often used to form an impoundment. (IDEM ISWQM)

**Emergency Overflow Structure (Spillway).** Usually a vegetated earth channel used to safely convey flood discharges around an impoundment structure. (IDEM ISWQM)

**Energy Dissipater.** A device to reduce the energy of flowing water to prevent erosion. (IDEM ISWQM)

**Erosion.** The wearing away of the land surface by water, wind, ice, gravity, or other geological agents. The following terms are used to describe different types of water erosion:

Accelerated erosion-Erosion much more rapid than normal or geologic erosion, primarily as a result of the activities of man.

Channel erosion-An erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.

Gully erosion-An erosion process whereby runoff water accumulates in narrow channels and, over relatively short periods, removes the soil to considerable depths, ranging from 1-2 ft. to as much as 75-100 ft.

Rill erosion-An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.

Splash erosion-The spattering of small soil particles caused by the impact of raindrops on wet soils; the loosened and spattered particles may or may not be subsequently removed by surface runoff.

Sheet erosion-The gradual removal of a fairly uniform layer of soil from the land surface by runoff water. (IDEM ISWQM)

**Erosion and sediment control measure.** A measure placed, constructed on, or applied to the landscape that prevents or curbs the detachment of soil, its movement and/or deposition. (IDEM ISWQM)

**Farm or Field Tile.** A small diameter pipe installed in an agricultural area to allow drainage of farmland. (DNR Indiana Drainage Handbook)

**Fill Material.** Any material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody.(USACOE 33 CFR 323)

**Flood (or Flood Waters).** A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow, the unusual and rapid accumulation, or the runoff of surface waters from any source. (DNR Indiana Drainage Handbook)

**Flood Elevation.** Height of flood waters above an elevation datum plane. (FEMA)

**Flood Hazard Area.** Those flood plains or parts of flood plains that have not been adequately protected from flood water by means of dikes, levees, reservoirs, or other works approved by the natural resources commission. (IC 14-8-2-98) Any floodplain, floodway, floodway fringe, or any combination thereof which is subject to inundation by the regulatory flood; or any flood plain as delineated by Zone X on a Flood Hazard Boundary Map.

**Floodplain Management.** Program of corrective and preventive measures for reducing flood damage, including flood control projects, floodplain land use regulations, floodproofing or retrofitting of buildings, and emergency preparedness plans. (FEMA)

**Floodplain.** The lowland that borders a stream and is subject to flooding when the stream overflows its banks. Areas consisting of drainage channels and adjoining dry land areas that are susceptible to being inundated by water from any natural source. (IDEM ISWQM)

**Floodway.** A channel (either natural, excavated, or bounded by dikes and levees) used to carry flood flows. (IDEM ISWQM)

**Freeboard.** A vertical distance between the elevation of the design high-water and the top of a dam, diversion ridge, or other water control device. (IDEM ISWQM)

**Grade.** (1) The slope of a road, a channel, or natural ground. (2) The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction, such as paving or the laying of a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment, or bottom of excavation, or other land area to a smooth, even condition. (IDEM ISWQM)

**Grading.** The cutting/or filling of the land surface to a desired slope or elevation. (IDEM ISWQM)

**Groundwater.** 1. Subsurface water occupying the saturation zone, from which wells and springs are fed. 2. A source of base flow in a stream. The term applies only to water below the water table. (INDOT)

**Groundwater Recharge.** The process by which water seeps into the ground, eventually replenishing ground water aquifers and surface waters such as lakes, streams, and oceans. This process helps maintain water flow in streams and wetlands and preserves water table levels that support drinking water supplies. (IDEM ISWQM).

**Hard Surface.** See “Impervious Surface.”

**High Water.** Maximum designed permitted, or regulated water level for an impoundment.

**Hydraulic Grade Line (HGL).** 1. In a closed conduit, a line joining the elevation to which water can stand in risers. In an open conduit, the hydraulic grade line is the water surface. 2. In open-channel flow, it is the water surface. (INDOT)

**Hydrograph.** A graph showing for a given point on a stream the discharge, stage (depth), velocity, or other property of water with respect to time. (IDEM ISWQM).

**Hydrology.** The science of the behavior of water in the atmosphere, on the surface of the earth, and underground. (IDEM ISWQM).

**Impervious surfaces.** Surfaces that cannot infiltrate rainfall, including rooftops, pavement, sidewalks, and driveways. (IDEM ISWQM).

**Individual building lot.** A single parcel of land within a multi-parcel development. (327 IAC 15-5-4)

**Individual lot operator.** A contractor or subcontractor working on an individual lot. (327 IAC 15-5-4)

**Individual lot owner.** A person who has financial control of construction activities for an individual lot. (327 IAC 15-5-4)

**Inlet.** 1. A surface connection to a closed drain. 2. A structure at the diversion end of a conduit. 3. The upstream end of a structure through which water can flow. 4. An inlet structure for capturing concentrated surface flow. (INDOT)

**Invert.** The inside bottom of a culvert or other conduit. (IDEM ISWQM)

**Land Surveyor.** A person licensed under the laws of the State of Indiana to practice land surveying. (DNR Indiana Drainage Handbook)

**Lowest Entry Elevation.** The elevation in a structure where overbank flooding can enter the structure.

**Lowest Adjacent Grade.** Elevation of the lowest ground surface that touches any of the exterior walls of a building.(FEMA)

**Manhole.** A structure through which one can access a drainage system. (INDOT)

**National Flood Insurance Program (NFIP)** The program of flood insurance coverage and floodplain management administered under the Act and applicable federal regulations promulgated in Title 44 of the Code of Federal Regulations, Subchapter B.(FEMA NFIP)

**Natural Drainage.** The flow patterns of stormwater run-off over the land in its pre-development state. (IDEM ISWQM)

**Normal Depth.** Depth of flow in an open conduit during uniform flow for the given conditions. (IDEM ISWQM)

**Off-site.** Everything not located at or within a particular site.

**On-Site.** Located within the controlled or urbanized area where runoff originates.

**Open Drain.** A natural watercourse or constructed open channel that conveys drainage water. (IDEM ISWQM)

**Open Space.** Any land area devoid of any disturbed or impervious surfaces created by industrial, commercial, residential, agricultural, or other manmade activities.

**Orifice.** A device which controls the rate of flow from a detention basin.

**Outfall.** The point, location, or structure where wastewater or drainage discharges from a sewer to a receiving body of water. (IDEM ISWQM)

**Outlet.** The point of water disposal from a stream, river, lake, tidewater, or artificial drain. (IDEM ISWQM)

**Overland Flow.** Consists of sheet flow, shallow concentrated flow and channel flow. (DNR Indiana Drainage Handbook)

**Peak Discharge (or Peak Flow).** The maximum instantaneous flow from a given storm condition at a specific location. (IDEM ISWQM)

**Perennial Stream.** A stream that maintains water in its channel throughout the year. (IDEM ISWQM)

**Permeability (soil).** The quality of a soil that enables water or air to move through it. Usually expressed in inches per hour or inches per day. (IDEM ISWQM)

**Pervious.** Allowing movement of water. (IDEM ISWQM)

**Piping.** The formation of "pipes" by underground erosion. Water in the soil carries the fine soil particles away, and a series of eroded tubes or tunnels develop. These openings will grow progressively larger and can cause a dam failure. (IDEM ISWQM)

**Plat.** The drawing on which a plan of subdivision is presented to the Plan Commission (or an approved committee of the Commission) for approval, showing the length, width, and size of each lot, and public ways or places. A plat must be properly approved and recorded to be of effect.

**Porous Pavement (Pervious).** Porous pavement is similar to conventional asphalt or concrete but is formulated to have more void space for greater water passage through the material. (IDEM ISWQM)

**Primary Outlet.** The structure that controls the discharge rate of stormwater from a detention facility associated with on-site flow or smaller storm events.

**Professional Engineer.** A person licensed under the laws of the State of Indiana to practice professional engineering. (DNR Indiana Drainage Handbook)

**Project site.** The entire area on which construction activity is to be performed. (327 IAC 15-5-4)

**Rainfall Intensity.** The rate at which rain is falling at any given instant, usually expressed in inches per hour. (IDEM ISWQM)

**Reach.** The smallest subdivision of the drainage system, consisting of a uniform length of open channel. Also, a discrete portion of river, stream or creek. For modeling purposes, a reach is somewhat homogeneous in its physical characteristics. (IDEM ISWQM)

**Receiving Stream, Receiving Channel, or Receiving Water.** The body of water into which runoff or effluent is discharged. (IDEM ISWQM)

**Recharge.** Replenishment of groundwater reservoirs by infiltration and transmission from the outcrop of an aquifer or from permeable soils. (IDEM ISWQM)

**Regulated Drain.** An open drain, a tiled drain, or a combination of the two. A drain subject to the provisions of the Indiana Drainage Code, I.C.-36-9-27.

**Regulatory (or 100-Year) Flood.** The discharge or elevation associated with the 100-year flood as calculated by a method and procedure which is acceptable to and approved by the Indiana Department of Natural Resources and the Federal Emergency Management Agency. The "regulatory flood" is also known as the "base flood". (DNR Indiana Drainage Handbook)

**Regulatory Floodway.** See Floodway.

**Release Rate** The amount of storm water release from a storm water control facility per unit of time.

**Reservoir.** A natural or artificially created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary. The term is also used in the hydrologic modeling of storage facilities. (DNR Indiana Drainage Handbook)

**Retention.** The storage of stormwater to prevent it from leaving the development site. May be temporary or permanent. (IDEM ISWQM)

**Retention basin.** A natural or artificial basin that functions similar to a detention structure except that it maintains a permanent water supply. (IDEM ISWQM)

**Retention Facility.** A facility designed to completely retain a specified amount of stormwater runoff without release except by means of evaporation, infiltration or pumping. The volumes are often referred to in units of acre-feet. (DNR Indiana Drainage Handbook)

**Riverine.** Relating to, formed by, or resembling a stream (including creeks and rivers). (DNR Indiana Drainage Handbook)

**Runoff.** That portion of precipitation that flows from a drainage area on the land surface, in open channels, or in stormwater conveyance systems. (IDEM ISWQM)

**Runoff Coefficient.** A decimal fraction relating the amount of rain which appears as runoff and reaches the storm drain system to the total amount of rain falling. A coefficient of 0.5 implies that 50 percent of the rain falling on a given surface appears as storm water runoff.

**Sediment.** Solid material (both mineral and organic) that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface. (IDEM ISWQM)

**Sedimentation.** The settling and accumulation of unconsolidated sediment carried by runoff.(IDEM ISWQM)

**Seepage.** The passage of water or other fluid through a porous medium, such as the passage of water through an earth embankment. (DNR Indiana Drainage Handbook)

**Site.** The entire area included in the legal description of the land on which land disturbing activity is to be performed.

**Slope.** Degree of deviation of a surface from the horizontal measured as a numerical ratio or percent. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise) (e.g., 2:1). Slope can also be expressed as the rise over the run (e.g., a 2:1 slope is a 50% slope) (IDEM ISWQM)

**Soil.** The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (IDEM ISWQM)

**Special Flood Hazard Area.** An area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V.(FEMA NFIP)

**Spill.** The unexpected, unintended, abnormal, or unapproved dumping, leakage, drainage, seepage, discharge, or other loss of petroleum, hazardous substances, extremely hazardous substances, or objectionable substances. The term does not include releases to impervious surfaces when the substance does not migrate off the surface or penetrate the surface and enter the soil.

**Spillway.** (1) A passage, such as a paved apron or channel, for surplus water to flow over, around, or through a dam or similar structure. (2) An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water. (IDEM ISWQM)

**Stilling Basin.** A device or structure placed at or near the outlet of a structure for the purpose of inducing energy dissipation where flow velocity is expected to cause unacceptable channel-bed scour and bank erosion. (INDOT)

**Storm Duration.** The length of time that water may be stored in any stormwater control facility, computed from the time water first begins to be stored.

**Storm Event.** An estimate of the expected amount of precipitation within a given period of time. For example, a 10-yr. frequency, 24-hr. duration storm event is a storm that has a 10% probability of occurring in any one year. Precipitation is measured over a 24-hr. period. (IDEM ISWQM)

**Storm Frequency.** The time interval between major storms of predetermined intensity and volumes of runoff--e.g., a 5-yr., 10-yr. or 20-yr. storm. (IDEM ISWQM)

**Storm Sewer.** A sewer that carries storm water, surface drainage, street wash, and other wash waters but excludes sewage and industrial wastes. Also called a storm drain. (IDEM ISWQM) For the purpose of this document, an underdrain, agricultural tile drain, or on-site residential conduits installed to convey sump drains, downspouts, etc. are not considered a storm sewer.

**Stormwater.** Water resulting from rain, melting or melted snow, hail, or sleet.

**Stormwater Drainage System.** All means, natural or man-made, used for conducting storm water to, through or from a drainage area to any of the following: conduits and appurtenant features, canals, channels, ditches, storage facilities, swales, streams, culverts, streets and pumping stations.

**Stormwater Pollution Prevention Plan (SWPPP).** Identifies potential sources of pollution and outlines specific management activities designed to minimize the introduction of pollutants into storm water. (IDEM ISWQM) A plan developed to minimize the impact of storm water pollutants resulting from construction activities.

**Stormwater Quality Measure.** A practice or a combination of practices to control or minimize pollutants associated with storm water runoff. (327 IAC 15-5-4)

**Stormwater runoff.** The volume of water generated by a storm that does not infiltrate into the ground or is not retained in storage as surface water. (IDEM ISWQM)

**Stream.** See Perennial Stream, Receiving Stream. (IDEM ISWQM)

**Streambanks.** The usual boundaries (not the flood boundaries) of a stream channel. Right and left banks are named facing downstream. (IDEM ISWQM)

**Subarea/Subbasin.** Portion of a watershed divided into homogenous drainage units which can be modeled for purposes of determining runoff rates. The subareas/subbasins have distinct boundaries, as defined by the topography of the area. (DNR Indiana Drainage Handbook)

**Subdivision.** Any land that is divided or proposed to be divided into lots, whether contiguous or subject to zoning requirements, for the purpose of sale or lease as part of a larger common plan of development or sale. (327 IAC 15-5-4)

**Subsurface Drain.** A pervious backfield trench, usually containing stone and perforated pipe, for intercepting groundwater or seepage. (IDEM ISWQM)

**Sump Pump.** Device used to remove water from seepage or rainfall that collects in areas protected by a levee, floodwall, or dry floodproofing. In addition, a sump pump is often part of a standard house drainage system that removes water that collects below a basement slab floor. (FEMA)

**Surcharge.** Backup of water in a sanitary or storm sewer system in excess of the design capacity of the system.

**Surface Runoff.** Precipitation that flows onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface but collects and runs off. (IDEM ISWQM)

**Swale.** An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct stormwater into primary drainage channels and may provide some groundwater recharge.(IDEM ISWQM)

**Tailwater.** The water surface elevation at the downstream side of a hydraulic structure (i.e. culvert, bridge, weir, dam, etc.). (DNR Indiana Drainage Handbook)

**Tile Drain.** Pipe made of perforated plastic, burned clay, concrete, or similar material, laid to a designed grade and depth, to collect and carry excess water from the soil. (IDEM ISWQM)

**Time of Concentration (Tc).** The time required for water to flow from the most distant point to the downstream outlet of a site. Runoff flow paths, ground surface slope and roughness, and channel characteristics affect the time of concentration. (IDEM ISWQM)

**Topography.** A general term to include characteristics of the ground surface, such as plains, hills, mountains, relief, slopes, and other physiographic features. (IDEM ISWQM)

**Tributary.** Based on the size of the contributing drainage area, a smaller watercourse which flows into a larger watercourse. (DNR Indiana Drainage Handbook)

**Underdrain.** A small diameter perforated pipe that allows the bottom of a detention basin, channel or swale to drain. (DNR Indiana Drainage Handbook)

**Uniform Flow.** A state of steady flow when the mean velocity and cross-sectional area remain constant in all sections of a reach. (IDEM ISWQM)

**Water Quality.** A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. (IDEM ISWQM)

**Water Resources.** The supply of groundwater and surface water in a given area. (IDEM ISWQM)

**Water Table.** (1) The free surface of the groundwater. (2) That surface subject to atmospheric pressure under the ground, generally rising and failing with the season or from other conditions such as water withdrawal. (IDEM ISWQM)

**Waterbody.** Any accumulation of water, surface, or underground, natural or artificial, excluding water features designed as water pollution control facilities.

**Watercourse.** A definite channel with bed and banks within which concentrated water flows, either continuously or intermittently. (IDEM ISWQM) It includes rear and side yard drainage swales designated within a development plan and must be shown on the plat.

**Watershed.** The region drained by or contributing water to a stream, lake, or other body of water. (IDEM ISWQM)

**Watershed Area.** All land and water within the confines of a drainage divide. (IDEM ISWQM)

**Waterway.** A naturally existing or manmade open conduit or channel utilized for the conveyance of water.

**Weir.** Device for measuring or regulating the flow of water. (IDEM ISWQM)

**Wet-Bottom Detention Basin (Retention Basin).** A basin designed to retain a permanent pool of water after having provided its planned detention of runoff during a storm event.

**Wetlands.** Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and/or those wetland areas that are under the COE jurisdiction. (DNR Indiana Drainage Handbook)

## 12.8 Tables and Figures

**Table B-1 Intensity-Duration-Frequency**

| Duration | | Return Frequency - Rainfall Intensity (in/hr) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Hours | Minutes | 1 yr | 2 yr | 5 yr | 10 yr | 25 yr | 50 yr | 100 yr |
| 0.08 | 5 | 4.20 | 5.04 | 6.12 | 6.84 | 7.92 | 8.64 | 9.48 |
| 0.17 | 10 | 3.30 | 3.96 | 4.74 | 5.28 | 6.06 | 6.60 | 7.08 |
| 0.25 | 15 | 2.68 | 3.20 | 3.84 | 4.36 | 4.96 | 5.44 | 5.88 |
| 0.50 | 30 | 1.78 | 2.14 | 2.64 | 3.02 | 3.50 | 3.88 | 4.24 |
| 1 | 60 | 1.08 | 1.32 | 1.66 | 1.92 | 2.27 | 2.55 | 2.84 |
| 2 | 120 | 0.64 | 0.78 | 0.99 | 1.15 | 1.38 | 1.56 | 1.75 |
| 3 | 180 | 0.46 | 0.56 | 0.70 | 0.82 | 0.98 | 1.11 | 1.25 |
| 6 | 360 | 0.27 | 0.33 | 0.41 | 0.48 | 0.58 | 0.66 | 0.75 |
| 12 | 720 | 0.16 | 0.19 | 0.24 | 0.28 | 0.33 | 0.38 | 0.43 |
| 24 | 1440 | 0.09 | 0.11 | 0.14 | 0.16 | 0.19 | 0.21 | 0.24 |
| Minimum time of concentration ($T_c$) = 5 minutes<br>Source: NOAA Atlas 14, Volume 2, Version 3, 2004 | | | | | | | | |

**Table B-2 Depth-Duration-Frequency**

| Duration | | Return Frequency - Rainfall Depth (in) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Hours | Minutes | 1 yr | 2 yr | 5 yr | 10 yr | 25 yr | 50 yr | 100 yr |
| 0.08 | 5 | 0.35 | 0.42 | 0.51 | 0.57 | 0.66 | 0.72 | 0.79 |
| 0.17 | 10 | 0.55 | 0.66 | 0.79 | 0.88 | 1.01 | 1.10 | 1.18 |
| 0.25 | 15 | 0.67 | 0.80 | 0.96 | 1.09 | 1.24 | 1.36 | 1.47 |
| 0.50 | 30 | 0.89 | 1.07 | 1.32 | 1.51 | 1.75 | 1.94 | 2.12 |
| 1 | 60 | 1.08 | 1.32 | 1.66 | 1.92 | 2.27 | 2.55 | 2.84 |
| 2 | 120 | 1.28 | 1.56 | 1.98 | 2.30 | 2.75 | 3.11 | 3.49 |
| 3 | 180 | 1.37 | 1.67 | 2.10 | 2.46 | 2.94 | 3.34 | 3.75 |
| 6 | 360 | 1.63 | 1.98 | 2.48 | 2.90 | 3.49 | 3.98 | 4.50 |
| 12 | 720 | 1.89 | 2.27 | 2.84 | 3.32 | 3.99 | 4.54 | 5.14 |
| 24 | 1440 | 2.17 | 2.61 | 3.25 | 3.77 | 4.50 | 5.10 | 5.72 |
| Minimum time of concentration ($T_c$) = 5 minutes<br>Source: NOAA Atlas 14 Point Precipitation Frequency Estimates (Station Fort Wayne WSO AP) | | | | | | | | |

**Table B-3 Urban Runoff Coefficients**

| Type of Surface | Runoff Coefficient "C" |
|---|---|
| Hard Surfaces | |
| Asphalt | 0.90-0.95 |
| Concrete | 0.90-0.95 |
| Roof | 0.90-0.95 |
| Gravel | 0.65-0.80 |
| Lawns (Sandy) | |
| Flat (0-2% Slope) | 0.07 |
| Rolling (2-7% Slope) | 0.12 |
| Steep (Greater than 7% Slope) | 0.17 |
| Lawns (Clay) | |
| Flat (0-2% Slope) | 0.16 |
| Rolling (2-7% Slope) | 0.21 |
| Steep (Greater than 7% Slope) | 0.30 |
| Source: Adapted from LTAP Stormwater Drainage Manual, December 2015. Alternative "C" values with justification may be proposed by Engineer for consideration by reviewing agency. | |

**Table B-4 Rural Runoff Coefficients**

| | Soil Texture | | |
|---|---|---|---|
| | Open Sandy Loam | Clay & Silt Loam | Tight Clay |
| Type of Surface | Runoff Coefficient "C" | | |
| Woodland | | | |
| Flat (0-5% Slope) | 0.10 | 0.30 | 0.40 |
| Rolling (5-10% Slope) | 0.25 | 0.35 | 0.50 |
| Steep (Greater than 10% Slope) | 0.30 | 0.50 | 0.60 |
| Pasture | | | |
| Flat (0-5% Slope) | 0.10 | 0.30 | 0.40 |
| Rolling (5-10% Slope) | 0.16 | 0.36 | 0.55 |
| Steep (Greater than 10% Slope) | 0.22 | 0.42 | 0.60 |
| Cultivated | | | |
| Flat (0-5% Slope) | 0.30 | 0.50 | 0.60 |
| Rolling (5-10% Slope) | 0.40 | 0.60 | 0.70 |
| Steep (Greater than 10% Slope) | 0.52 | 0.72 | 0.82 |
| Source: LTAP Stormwater Drainage Manual, December 2015 | | | |

**Table B-5 Runoff Coefficients**
**by Land Use and Typical Inlet Times**

| Land Use | Runoff Coefficient "C" | | | Inlet Time (minutes) |
|---|---|---|---|---|
| | Flat (0-2% Slope) | Rolling (2-7% Slope) | Steep (Greater than 7% Slope) | |
| Commercial (Downtown) | 0.75 | 0.83 | 0.91 | 5 |
| Commercial (Neighborhood) | 0.54 | 0.60 | 0.66 | 5-10 |
| Industrial | 0.63 | 0.70 | 0.77 | |
| Garden Apartments | 0.54 | 0.60 | 0.66 | |
| Churches | 0.54 | 0.60 | 0.66 | |
| Schools | 0.31 | 0.35 | 0.39 | 10-15 |
| Semi Detached Residential | 0.45 | 0.50 | 0.55 | |
| Detached Residential | 0.40 | 0.45 | 0.50 | |
| Quarter Acre Lots | 0.36 | 0.40 | 0.44 | |
| Half Acre Lots | 0.31 | 0.35 | 0.39 | |
| Parkland | 0.18 | 0.20 | 0.22 | To be Computed |

Source: HERPICC Stormwater Drainage Manual, July 1995.

Note: Interpolation, extrapolation, and adjustment for local conditions shall be based on engineering experience and judgment. If the inlet times to be used exceed 15 minutes, the runoff coefficient "C" shall be determined, based on "The Three River Coordinating Council Master Plan for Storm Drainage, April 1972", according to the following relationship:

| Estimated Impervious Surface (%) | Runoff Coefficient "C" |
|---|---|
| 0 to 5 | 0.25 & less |
| 5 to 10 | 0.25 to 0.30 |
| 10 to 15 | 0.30 to 0.35 |
| 15 to 23 | 0.35 to 0.40 |
| 23 to 30 | 0.40 to 0.45 |
| 30 to 45 | 0.45 to 0.55 |
| 45 to 60 | 0.55 to 0.65 |
| 60 to 80 | 0.65 to 0.80 |
| 80 to 100 | 0.80 to 1.00 |

This table shall only be used for existing development or master planning. For any proposed development on a parcel, the coefficient must be calculated per parcel using Tables B-3 or B-4.

## Table B-6 Runoff Curve Numbers

| Cover Type and Hydrologic Condition | Average Percent Impervious Area | Curve Numbers for Hydrologic Soil Group | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Open space (lawns, parks, golf courses, cemeteries, etc) | | | | | |
| Poor (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good (grass cover >75%) | | 39 | 61 | 74 | 80 |
| Impervious areas | | | | | |
| Paved parking lots, roofs, driveways, etc. (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads | | | | | |
| Paved-curbs (excluding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved-open ditches (including right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (including right-of-way) | | 76 | 85 | 89 | 91 |
| Urban districts (only to be used for master planning) | | | | | |
| Commercial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| Residential district by average lot size (only to be used for master planning) | | | | | |
| 1/8 acre or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 acre | 38 | 61 | 75 | 83 | 87 |
| 1/3 acre | 30 | 57 | 72 | 81 | 86 |
| 1/2 acre | 25 | 54 | 70 | 80 | 85 |
| 1 acre | 20 | 51 | 68 | 79 | 84 |
| 2 acres | | 46 | 65 | 77 | 82 |
| Pasture, grassland, or range - continuous forage for grazing | | | | | |
| Poor | | 68 | 79 | 86 | 89 |
| Fair | | 49 | 69 | 79 | 84 |
| Good | | 39 | 61 | 74 | 80 |
| Meadow-continuous grass, protected from grazing and generally mowed for hay | | 30 | 58 | 71 | 78 |
| Brush-brush/weed/grass mixture with brush the major element | | | | | |
| Poor | | 48 | 67 | 77 | 83 |
| Fair | | 35 | 56 | 70 | 77 |
| Good | | 30 | 48 | 65 | 73 |
| Woods-grass combination (orchard or tree farm) | | | | | |
| Poor | | 57 | 73 | 82 | 86 |
| Fair | | 43 | 65 | 76 | 82 |
| Good | | 32 | 58 | 72 | 79 |
| Woods | | | | | |
| Poor | | 45 | 66 | 77 | 83 |
| Fair | | 36 | 60 | 73 | 79 |
| Good | | 30 | 55 | 70 | 77 |
| Farmsteads-buildings, lanes, driveways, and surrounding lots | | 59 | 74 | 82 | 86 |
| Source: Adapted from Runoff Curve Numbers for Urban Areas and Agricultural Lands (USDA, 1986) | | | | | |

**Table B-7 NRCS Type II Rainfall Distribution Ordinates**

| Cumulative Storm Time (hr) | Cumulative Percent of Storm Depth | Cumulative Storm Time (hr) | Cumulative Percent of Storm Depth | Cumulative Storm Time (hr) | Cumulative Percent of Storm Depth |
|---|---|---|---|---|---|
| 0.00 | 0.00 | 8.25 | 12.60 | 16.50 | 89.30 |
| 0.25 | 0.20 | 8.50 | 13.30 | 16.75 | 89.80 |
| 0.50 | 0.50 | 8.75 | 14.00 | 17.00 | 90.30 |
| 0.75 | 0.80 | 9.00 | 14.70 | 17.25 | 90.80 |
| 1.00 | 1.10 | 9.25 | 15.50 | 17.50 | 91.30 |
| 1.25 | 1.40 | 9.50 | 16.30 | 17.75 | 91.80 |
| 1.50 | 1.70 | 9.75 | 17.20 | 18.00 | 92.20 |
| 1.75 | 2.00 | 10.00 | 18.10 | 18.25 | 92.60 |
| 2.00 | 2.30 | 10.25 | 19.10 | 18.50 | 93.00 |
| 2.25 | 2.60 | 10.50 | 20.30 | 18.75 | 93.40 |
| 2.50 | 2.90 | 10.75 | 21.80 | 19.00 | 93.80 |
| 2.75 | 3.20 | 11.00 | 23.60 | 19.25 | 94.20 |
| 3.00 | 3.50 | 11.25 | 25.70 | 19.50 | 94.60 |
| 3.25 | 3.80 | 11.50 | 28.30 | 19.75 | 95.00 |
| 3.50 | 4.10 | 11.75 | 38.70 | 20.00 | 95.30 |
| 3.75 | 4.40 | 12.00 | 66.30 | 20.25 | 95.60 |
| 4.00 | 4.80 | 12.25 | 70.70 | 20.50 | 95.90 |
| 4.25 | 5.20 | 12.50 | 73.50 | 20.75 | 96.20 |
| 4.50 | 5.60 | 12.75 | 75.80 | 21.00 | 96.50 |
| 4.75 | 6.00 | 13.00 | 77.60 | 21.25 | 96.80 |
| 5.00 | 6.40 | 13.25 | 79.10 | 21.50 | 97.10 |
| 5.25 | 6.80 | 13.50 | 80.40 | 21.75 | 97.40 |
| 5.50 | 7.20 | 13.75 | 81.50 | 22.00 | 97.70 |
| 5.75 | 7.60 | 14.00 | 82.50 | 22.25 | 98.00 |
| 6.00 | 8.00 | 14.25 | 83.40 | 22.50 | 98.30 |
| 6.25 | 8.50 | 14.50 | 84.20 | 22.75 | 98.60 |
| 6.50 | 9.00 | 14.75 | 84.90 | 23.00 | 98.90 |
| 6.75 | 9.50 | 15.00 | 85.60 | 23.25 | 99.20 |
| 7.00 | 10.00 | 15.25 | 86.30 | 23.50 | 99.50 |
| 7.25 | 10.50 | 15.50 | 86.90 | 23.75 | 99.80 |
| 7.50 | 11.00 | 15.75 | 87.50 | 24.00 | 100.00 |
| 7.75 | 11.50 | 16.00 | 88.10 | | |
| 8.00 | 12.00 | 16.25 | 88.70 | | |
| Source: Natural Resources Conservation Service (NRCS), "TR-20 Computer Program for Project Formulation Hydrology", page F9, May 1982. | | | | | |
| Note: For use when not already built in the computer program. | | | | | |

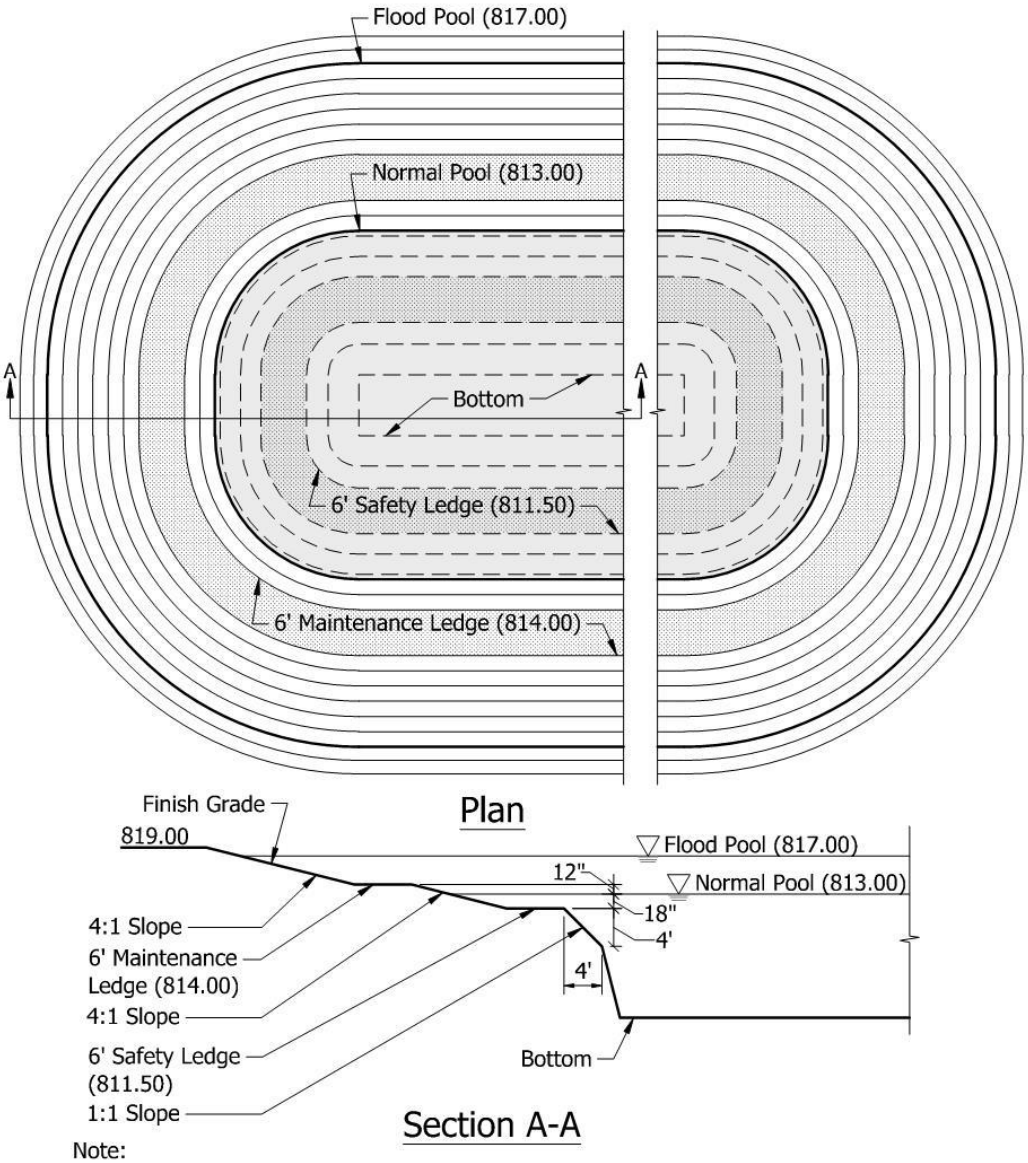
**Table B-8 Manning's "n" coefficient**

| Material | Coefficient "n" |
|---|---|
| Closed Conduits | |
| Concrete | 0.013 |
| HDPE | 0.013 |
| PVC | 0.013 |
| Ductile Iron | 0.013 |
| Circular CMP, Annular Corrugations, 2 2/3 x ½ inch | |
| Unpaved | 0.024 |
| 25% Paved | 0.021 |
| 50% Paved | 0.018 |
| 100% Paved | 0.013 |
| Circular CMP, Annular Corrugations, 6 x 2 inch, Field Bolted | |
| Unpaved | 0.030 |
| Source: Adapted from LTAP Stormwater Drainage Manual, December 2015. Alternative "n" values with justification may be proposed by Engineer for consideration by reviewing agency.<br><br>See LTAP Stormwater Drainage Manual, December 2015, for Open Channels (Lined), Open Channels (Excavated), Highway Channels and Swales with Maintained Vegetation, Streets and Expressway Gutters, and Natural Stream Channels | |

**Table B-9 Open Channel and Swale Design**

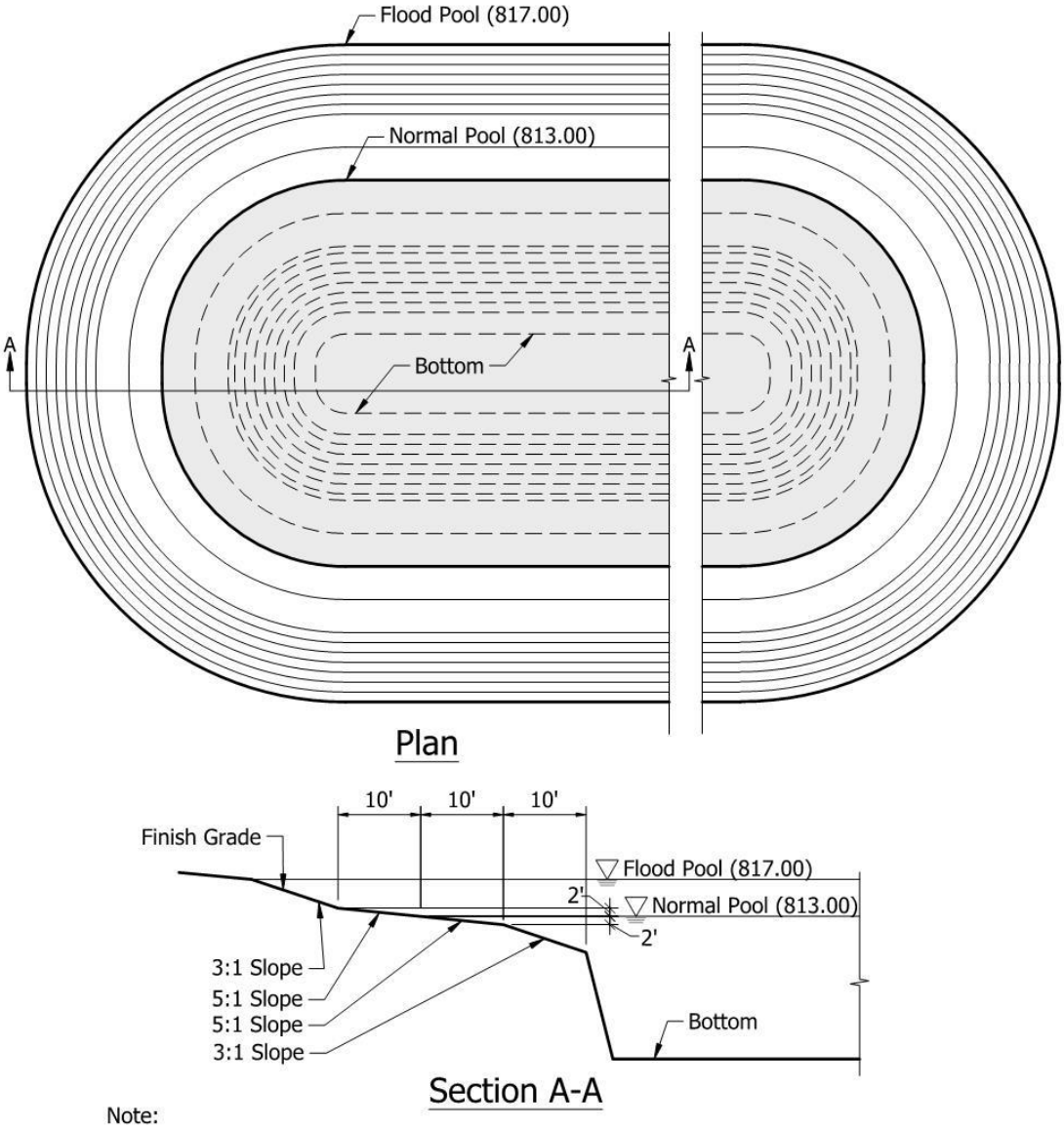
| Type | Maximum Side Slope (H:V) | Minimum Longitudinal Slope (%) | Maximum Velocity (ft/s) |
|---|---|---|---|
| Channel | | | |
| Grass Lined | 3:1 | 1.00 | 4 |
| Rip Rap, Concrete, or other acceptable method | 2:1 | 0.50 | 10 |
| Structural Retaining Wall[1] | > 2:1 | 1.00 | 10 |
| Swale | 3:1 | 1.00 | 4 |
| 1. Taking into account all pertinent structural provisions<br>2. Lower minimum longitudinal slopes may be permitted by the Town on a case by case basis when an underdrain is provided. | | | |

**Figure B-11 Wet-Bottom Detention Facility with Normal Pool (Type I)**




Note:
Indicated slopes represent steepest allowable slope.
Flatter slopes are permitted.

**Figure B-12 Wet-Bottom Detention Facility with Normal Pool (Type II)**




Note:
Indicated slopes represent steepest allowable slope.
Flatter slopes are permitted.

# Dedications & Agreements

**DEDICATION OF WATER DISTRIBUTION MAINS**

The undersigned _____ (hereinafter referred to as "Developer"), being the developer of a tract of real estate commonly known as _____ and specifically described as follows: _____

A survey of which was prepared by _____ is attached hereto, marked Exhibit "A" and made part hereof.

The undersigned does hereby grant, dedicate and convey unto the Town of Ossian, Wells County, Indiana, its successors and assigns, the water distribution main system identified on said real estate including rights to utilize easements thereon for the purpose of repairing, replacing or otherwise addressing matters relating to the water distribution mains.

In dedicating this water distribution main system and easements related thereto, and to induce the Town of Ossian to accept this system as part of the water distribution mains serviced by the Town, the undersigned make the following warranties and representations:

1. The water distribution mains dedicated herein was constructed by a fully licensed and insured Contractor and that the construction of said water distribution mains was performed in a workmanlike manner, utilizing workers and materials which comply with all applicable plans, specifications, laws, ordinances and similar requirements.

2. The water distribution mains dedicated herein has been warranted for a period of at least one (1) year from the date of this Dedication by the contractor who constructed the system and said warranty is fully assignable to the Town of Ossian by the Developer. By executing this Dedication, the Developer does hereby transfer and assign to the Town of Ossian all rights, title and interest in and to the above referenced warranty.

3. All bills and expenses relating to the construction of the water distribution mains, including labor, materials, supplies, subcontractors, and all other matters have been fully paid for by the Developer or the Contractor and the Developer does hereby indemnify and hold the Town of Ossian harmless from any and all claims relating to the construction of the water distribution mains for the warranty period.

4. In the event that any damage of defect is disclosed during the warranty period, the Developer will utilize its best efforts in assisting the Town in asserting any warranty claim which is required and in repairing the defect.

5. The Developer further agrees to comply with the Indiana State Board of Accounts requirement to provide the Town of Ossian with an itemized breakdown of the construction costs and as-built drawings of the water distribution mains being dedicated.

The provisions of this Dedication of Water Distribution Mains shall be deemed to be part of every contract or transaction for the sale of any portion or the entirety of the real estate described above, and the provisions herein contained shall be binding upon and inure to the owner or owners of the real

estate provided, however, that the warranty requirements will remain the exclusive responsibility of the Developer or its heirs and assigns.

This Dedication is subject to the approval of the Town of Ossian, Indiana

Dated this _____ day of _____ 20__

_____"DEVELOPER"

By

STATE OF INDIANA )
) SS:
COUNTY OF _____ )

Before me, the undersigned, a Notary Public, in and for said County and State, personally appeared _____ , this _____ day of _____ , 20___. In witness whereof I have subscribed my name and affixed my official seal.

Notary Public

My Commission Expires:_____ My County of Residence:

**APPROVAL BY THE TOWN OF OSSIAN, INDIANA**

The Town of Ossian hereby certifies that the foregoing Dedication of Water Distribution Mains has been reviewed and further certifies that the same is in conformity with all requirements of the Town of Ossian and the approval of the Town is now given to such dedication.

Dated this ____ day of _____ , 20__ .

TOWN COUNCIL
TOWN OF OSSIAN, IN

_____

_____

_____

_____

_____

The State Board of Accounts requests the Town have on file the following:

a. The cost of construction of the water distribution mains including a unit price breakdown and the lineal feet of water distribution mains included in this dedication.

ATTEST:

_____
CLERK TREASURER

**DEDICATION OF STORM SEWER INFRASTRUCTURE SYSTEM**

The undersigned _____ (hereinafter referred to as "Developer"), being the developer of a tract of real estate commonly known as _____ and specifically described as follows: _____

A survey of which was prepared by _____ is attached hereto, marked Exhibit "A" and made part hereof.

The undersigned does hereby grant, dedicate and convey unto the Town of Ossian, Wells County, Indiana, its successors and assigns, the storm sewer infrastructure system identified on said real estate including rights to utilize easements thereon for the purpose of repairing, replacing or otherwise addressing matters relating to the storm sewer infrastructure system.

In dedicating this storm sewer infrastructure system and all easements related thereto, and to induce the Town of Ossian, IN to accept this storm sewer system as part of the infrastructure system serviced by the Town of Ossian, IN, the undersigned make the following warranties and representations:

1. The storm sewer infrastructure system as dedicated herein was constructed by an insured Contractor and that the construction of said storm sewer infrastructure system was performed in a professional and workmanlike manner, utilizing workers, equipment and materials which comply with all applicable plans, specifications, laws, ordinances, construction permits and other similar requirements.

2. The storm sewer infrastructure system as dedicated herein is warranted for a period of one (1) year from the date of this Dedication by the Developer who had the storm sewer infrastructure system constructed and said warranty is fully assignable to the Town of Ossian, IN. By executing this Dedication, the Developer does hereby transfer and assign to the Town of Ossian, IN all rights, title and interest in and to the above referenced warranty.

3. The Developer further warrants that bills and expenses relating to the construction of the storm sewer infrastructure systems, including labor, materials, supplies, subcontractors, and all other matters have been fully paid for by the Developer and the contractor and the Developer does hereby indemnify and hold harmless the Town of Ossian, IN from any and all claims relating to the construction of the storm sewer infrastructure system for the warranty period.

4. In the event that any damage or defect is disclosed during the warranty period, the Developer will utilize its best efforts to assist the Town of Ossian, IN in asserting any warranty claim which is required and in repairing the defect.

5. The Developer further agrees to comply with the Indiana State Board of Accounts requirement to provide the Town of Ossian with an itemized breakdown of the construction costs and as-built drawings of the storm sewer infrastructure system being dedicated.

The provisions of this Dedication of this Storm Sewer Infrastructure System shall be deemed to be part of every contract or transaction for the sale of any portion or the entirety of the real estate described

above, and the provisions herein contained shall be binding upon and inure to the owner or owners of the real estate provided, however, that the warranty requirements will remain the exclusive responsibility of the Developer or its heirs and assigns.

This Dedication is subject to the approval of the Town Council of the Town of Ossian, Indiana.

Dated this _____ day of _____ 20___

_____"DEVELOPER"

By

STATE OF INDIANA )
) SS:
COUNTY OF _____ )

Before me, the undersigned, a Notary Public, in and for said County and State, personally appeared _____ , this _____ day of _____ , 20____. In witness whereof I have subscribed my name and affixed my official seal.

Notary Public

My Commission Expires:_____ My County of Residence:

**APPROVAL BY THE TOWN OF OSSIAN, INDIANA**

The Town of Ossian acting through the Town Council hereby certifies that the foregoing Dedication of Storm Sewer Infrastructure System has been reviewed and further certifies that same is in conformity with all requirements of the Town of Ossian and that approval is hereby given by the Town Council for such dedication.

Dated this ____ day of _____ , 20 __ .

TOWN COUNCIL
TOWN OF OSSIAN, IN

_____

_____

_____

_____

_____

The State Board of Accounts requests the Town have on file the following:

a. The cost of construction of the storm sewer infrastructure including a unit price breakdown and the lineal feet of storm sewer infrastructure included in this dedication.

ATTEST:

_____
CLERK TREASURER

**DEDICATION OF WASTEWATER COLLECTION SYSTEM**

The undersigned _____ (hereinafter referred to as "Developer"), being the developer of a tract of real estate commonly known as _____ and specifically described as follows: _____

A survey of which was prepared by _____ is attached hereto, marked Exhibit "A" and made part hereof.

The undersigned does hereby grant, dedicate and convey unto the Town of Ossian, Wells County, Indiana, its successors and assigns, the wastewater collection system identified on said real estate including rights to utilize easements thereon for the purpose of repairing, replacing of otherwise addressing matters relating to the wastewater collection system.

In dedicating this wastewater collection system and easements related thereto, and to induce the Town of Ossian to accept this system as part of the wastewater collection system serviced by the Town, the undersigned make the following warranties and representations:

1. The wastewater system dedicated herein was constructed by a fully licensed and insured Contractor and that the construction of said wastewater collection system was performed in a workmanlike manner, utilizing workers and materials which comply with all applicable plans, specifications, laws, ordinances and similar requirements.

2. The wastewater collection system dedicated herein has been warranted for a period of at least one (1) year from the date of this Dedication by the contractor who constructed the system and said warranty is fully assignable to the Town of Ossian by the Developer. By executing this Dedication, the Developer does hereby transfer and assign to the Town of Ossian all rights, title and interest in and to the above referenced warranty.

3. All bills and expenses relating to the construction of the wastewater collection system, including labor, materials, supplies, subcontractors, and all other matters have been fully paid for by the Developer or the contractor and the Developer does hereby indemnify and hold the Town of Ossian harmless from any and all claims relating to the construction of the wastewater collection system for the warranty period.

4. In the event that any damage or defect is disclosed during the warranty period, the Developer will utilize its best efforts in assisting the Town in asserting any warranty claim which is required and in repairing the defect.

5. The Developer further agrees to comply with the Indiana State Board of Accounts requirement to provide the Town of Ossian with an itemized breakdown of the construction costs and as-built drawings of the wastewater collection system being dedicated.

The provisions of this Dedication of a Wastewater Collection System shall be deemed to be part of every contract or transaction for the sale of any portion or the entirety of the real estate described above, and the provisions herein contained shall be binding upon and inure to the owner or owners of the real estate provided, however, that the warranty requirements will remain the exclusive responsibility of the Developer or its heirs and assigns.

This Dedication is subject to the approval of the Town of Ossian, Indiana

Dated this _____ day of _____ 20___

_____"DEVELOPER"

By

STATE OF INDIANA )
) SS:
COUNTY OF _____ )

Before me, the undersigned, a Notary Public, in and for said County and State, personally appeared _____ , this _____ day of _____ , 20___. In witness whereof I have subscribed my name and affixed my official seal.

Notary Public

My Commission Expires:_____ My County of Residence:

**APPROVAL BY THE TOWN OF OSSIAN, INDIANA**

The Town of Ossian hereby certifies that the foregoing Dedication of Wastewater Collection System has been reviewed and further certified that the same is in conformity with all requirements of the Town of Ossian and the approval of the Town is now given to such dedication.

Dated this ____ day of _____ , 20__ .

TOWN COUNCIL
TOWN OF OSSIAN, IN

_____

_____

_____

_____

_____

The State Board of Accounts requests the Town have on file the following:

a. The cost of construction of the wastewater collection lines including a unit price breakdown and the lineal feet of wastewater collection lines included in this dedication.

ATTEST:

_____

CLERK TREASURER

**DEDICATION OF STREET PAVEMENT AND SIDEWALK INFRASTRUCTURE SYSTEM**

The undersigned _____ (hereinafter referred to as "Developer"), being the developer of a tract of real estate commonly known as _____ and specifically described as follows: _____

A survey of which was prepared by _____ is attached hereto, marked Exhibit "A" and made part hereof.

The undersigned does hereby grant, dedicate and convey unto the Town of Ossian, Wells County, Indiana, its successors and assigns, the street pavement and sidewalk system identified on said real estate including rights to utilize easements thereon for the purpose of repairing, replacing or otherwise addressing matters relating to the street pavement and sidewalk system.

In dedicating this street pavement and sidewalk system and all easements related thereto, and to induce the Town of Ossian, IN to accept this street pavement and sidewalk system as part of the infrastructure system serviced by the Town of Ossian, IN, the undersigned make the following warranties and representations:

1. The street pavement and sidewalk systems as dedicated herein were constructed by an insured Contractor and that the construction of said street pavement and sidewalk infrastructure system was performed in a professional and workmanlike manner, utilizing workers, equipment and materials which comply with all applicable plans, specifications, laws, ordinances, construction permits and other similar requirements.

2. The street pavement and sidewalk infrastructure systems as dedicated herein is warranted for a period of one (1) year from the date of this Dedication by the developer who had the street pavement and sidewalk systems constructed and said warranty is fully assignable to the Town of Ossian, IN. By executing this Dedication, the Developer does hereby transfer and assign to the Town of Ossian, IN all rights, title and interest in and to the above referenced warranty.

3. The Developer further warrants that all bills and expenses relating to the construction of the street pavement and sidewalk systems, including labor, materials, supplies, subcontractors, and all other matters have been fully paid for by the Developer and the contractor and the Developer does hereby indemnify and hold harmless the Town of Ossian, IN, from any and all claims relating to the construction of the street pavement and sidewalk system for the warranty period.

4. In the event that any damage or defect is disclosed during the warranty period, the Developer will utilize its best efforts to assist the Town of Ossian, IN, in asserting any warranty claim which is required and in repairing the defect.

5. The Developer further agrees to comply with the Indiana State Board of Accounts requirement to provide the Town of Ossian with an itemized breakdown of the construction costs and as-built drawings of the street pavement and sidewalk system being dedicated.

The provisions of this Dedication of this Street Pavement and Sidewalk System shall be deemed to be part of every contract or transaction for the sale of any portion or the entirety of the real estate described above, and the provisions herein contained shall be binding upon and inure to the owner or owners of the real estate provided, however, that the warranty requirements will remain the exclusive responsibility of the Developer or its heirs and assigns.

This Dedication is subject to the approval of the Town Council of the Town of Ossian, Indiana.

Dated this _____ day of _____ 20___

_____"DEVELOPER"

By

STATE OF INDIANA )
) SS:
COUNTY OF _____ )

Before me, the undersigned, a Notary Public, in and for said County and State, personally appeared _____ , this _____ day of _____ , 20____. In witness whereof I have subscribed my name and affixed my official seal.

Notary Public

My Commission Expires:_____ My County of Residence:

**APPROVAL BY THE TOWN OF OSSIAN, INDIANA**

The Town of Ossian acting through the Town Council hereby certifies that the foregoing Dedication of Street Pavement and Sidewalk Infrastructure System has been reviewed and further certified that same is in conformity with all requirements of the Town of Ossian and that approval is hereby given by the Town Council for such dedication.

Dated this ____ day of _____ , 20____ .

TOWN COUNCIL
TOWN OF OSSIAN, IN

_____

_____

_____

_____

_____

ATTEST:

_____
CLERK TREASURER

**STREET MAINTENANCE AND BONDING AGREEMENT**

This Agreement, entered into this_____day of_____, 20__, by and between_____ ("Developer") and the Town of Ossian ("Town").

WITNESSETH:

WHEREAS, the Town wishes to include in its inventory of streets for certification to the Indiana Department of Transportation of streets accepted by the Town for maintenance, various streets which have not been dedicated and accepted by the Town pending paving of the final top coat and delivery of a maintenance bond by the Developer; and

WHEREAS, the Town wishes to expedite the process to enable it to recover revenues under the Local Road and Street Fund, but does not wish to forego Developer's completion of the paving and bonding as a condition of final dedication and acceptance by the Town of the streets within this jurisdiction that have not been so completed.

NOW THEREFORE, for valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Developer hereby agrees that:

1. Developer will, notwithstanding acceptance by the Town in its annual certification of jurisdiction miles to the Indiana Department of Transportation, complete all street improvements as originally specified for approval of the subdivision, including, but not limited to, completion of the final asphalt top coat and the provision requiring a street maintenance bond for each street dedicated and accepted by the Town for maintenance prior to the acceptance of all required street improvements.

IN WITNESS WHEREOF, the Developer and Town have executed this instrument in duplicate this_____day of_____, 20___.

_____

By_____

Its_____

"DEVELOPER"

_____

Council President

STATE OF INDIANA
COUNTY OF _____, SS:

Before me, a Notary Public in and for said County and State, on this_____day of _____, 20___, personally appeared_____, "Developer", who acknowledged the execution of the above and foregoing Street Maintenance and Bonding Agreement to be its voluntary act and deed.

WITNESS my hand and Notarial Seal.

_____

_____, A Notary Public residing in_____County, IN

My Commission Expires:

_____

STATE OF INDIANA
COUNTY OF _____, SS:

Before me, a Notary Public in and for said County and State, on this_____day of _____, 200__, personally appeared _____, "Council President of the Town of Ossian", who acknowledged the execution of the above and foregoing Street Maintenance and Bonding Agreement to be his voluntary act and deed.

WITNESS my hand and Notarial Seal.

_____

_____, A Notary Public residing in_____County, IN

My Commission Expires:

_____

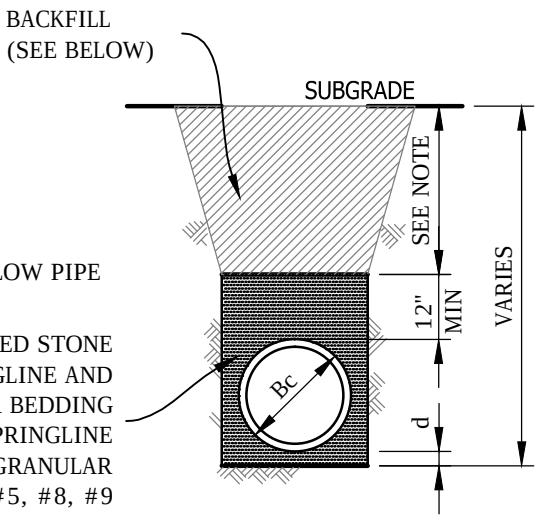
# Bedding & Backfill Standard Details

# BEDDING SPECIFICATIONS

1. FOR ROCK OR OTHER NON-COMPRESSIBLE MATERIAL, THE TRENCH SHALL BE OVER EXCAVATED TO PROVIDE A MINIMUM OF 6" MINIMUM CLEARANCE TO THE PIPE AND REFILLED WITH BEDDING MATERIAL.

2.

| DEPTH OF BEDDING MATERIAL BELOW PIPE | |
|---|---|
| D | d(Min.) |
| LESS THAN 36" | 4" |
| 36" & LARGER | Bc / 8 |




LEGEND

Bc = OUTSIDE DIA. OF PIPE
D = INSIDE DIA. OF PIPE
d = BEDDING MATERIAL BELOW PIPE BELL

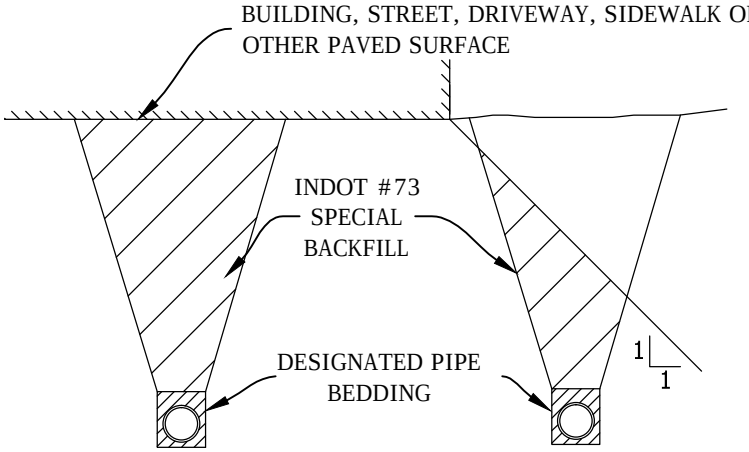
FLEXIBLE PIPE: COMPACTED CRUSHED STONE INDOT #5, #8 BELOW SPRINGLINE AND COMPACTED GRANULAR BEDDING INDOT #5, #8, #9 ABOVE SPRINGLINE

RIGID PIPE: COMPACTED GRANULAR MATERIAL INDOT #5, #8, #9

# BACKFILL SPECIFICATIONS

1. BACKFILL UNDER PAVED AREAS SHALL BE INDOT #73. INFLUENCE ZONE SHALL EXTEND AT A 1:1 SLOPE FROM ABOVE ITEM. COMPACTION SHALL MEET OR EXCEED 95% OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557.

2. BACKFILL WITHIN LAWN AREAS AND OUT OF THE INFLUENCE OF: BUILDING STRUCTURES, AND PAVED AREAS, SHALL BE STANDARD BACKFILL. STANDARD BACKFILL SHALL BE FREE OF: ROCK AND GRAVEL LARGER THAN 3" IN ANY DIMENSION, DEBRIS, WASTE, FROZEN MATERIALS, VEGETATION, AND OTHER DELETERIOUS MATERIAL ACCORDING TO ASTM D 2487. COMPACTION SHALL MEET OR EXCEED 90% OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557.



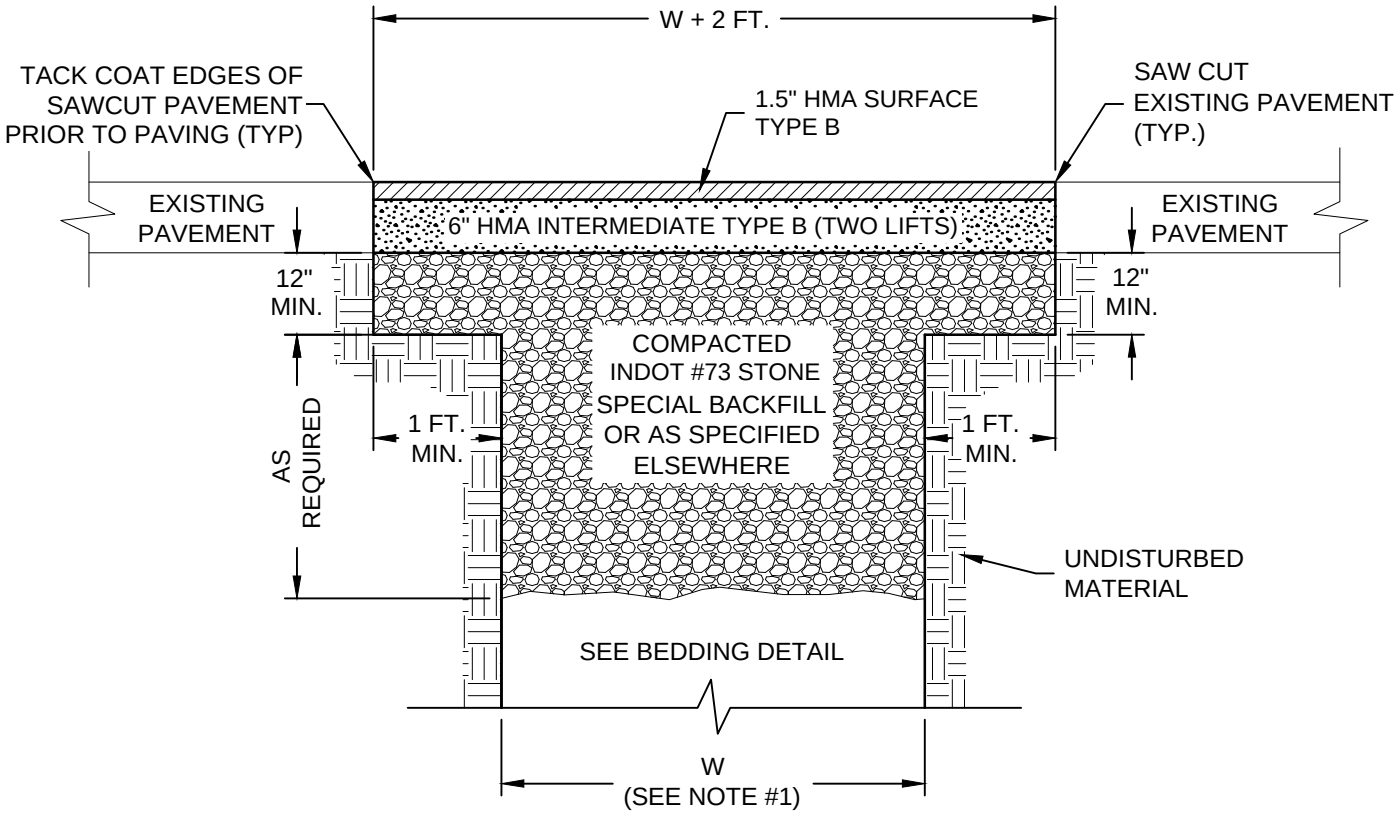

INFLUENCE LINE

SCALE : N.T.S.

NOTES:

1. MINIMUM COVER - STORMWATER 3', GRAVITY SANITARY MAINS 4', SANITARY LATERALS 3', WATER & FORCE MAINS 5'.
2. FLEXIBLE PIPE - PVC, HDPE, DIP, & CMP ARE CONSIDERED FLEXIBLE PIPES.
3. RIGID PIPE - RCP IS CONSIDERED RIGID PIPE.

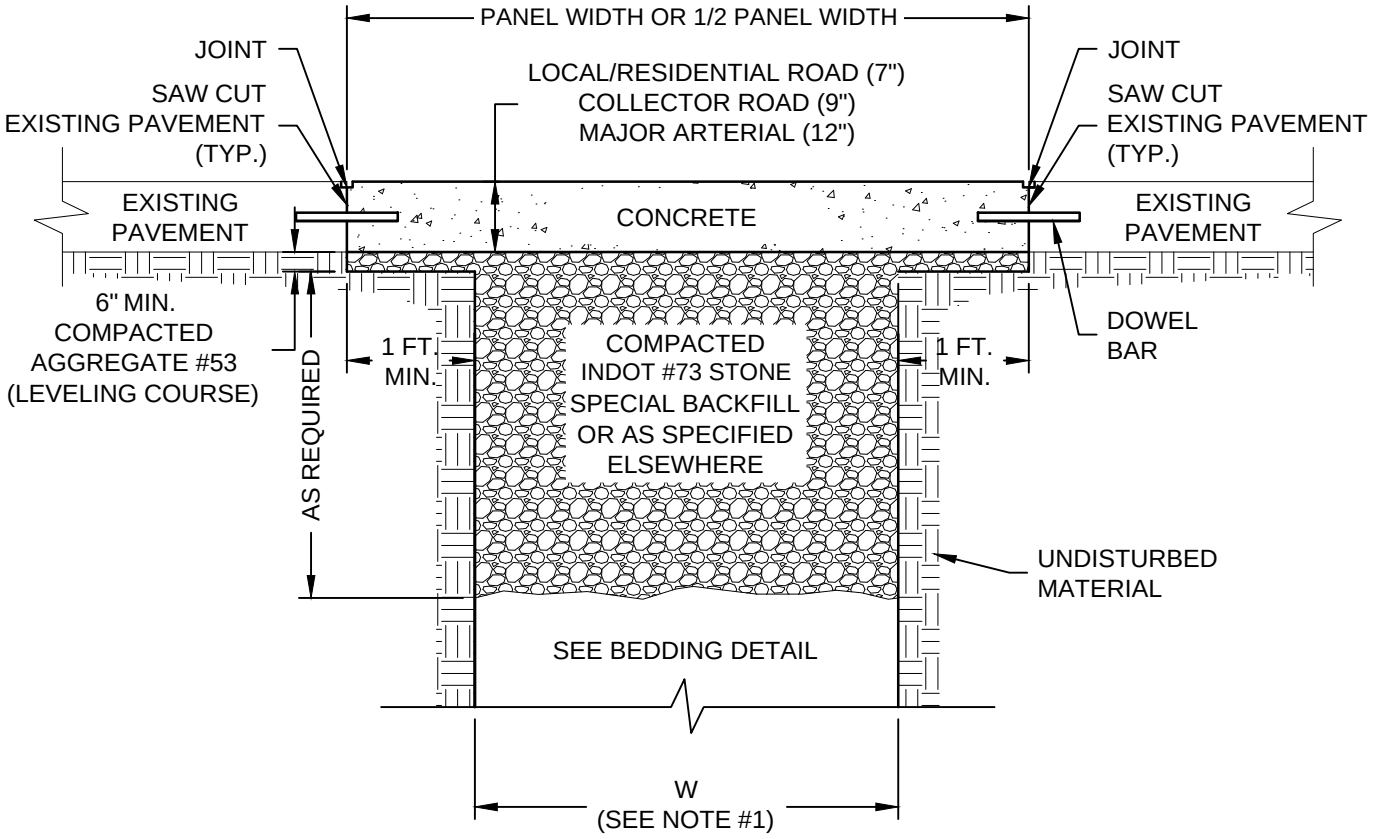
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | BF-01 | PIPE TRENCH DETAIL | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




NOTES:

1. MAXIMUM PAID WIDTH OF TRENCH (W) SHALL BE PER SPECIFICATIONS.
2. NEW SURFACE SHALL BE SLOPED TO MATCH EXISTING PAVEMENT.
3. FINAL ASPHALT CROSS SECTION SUBJECT TO REVIEW & MODIFICATION BY TOWN.

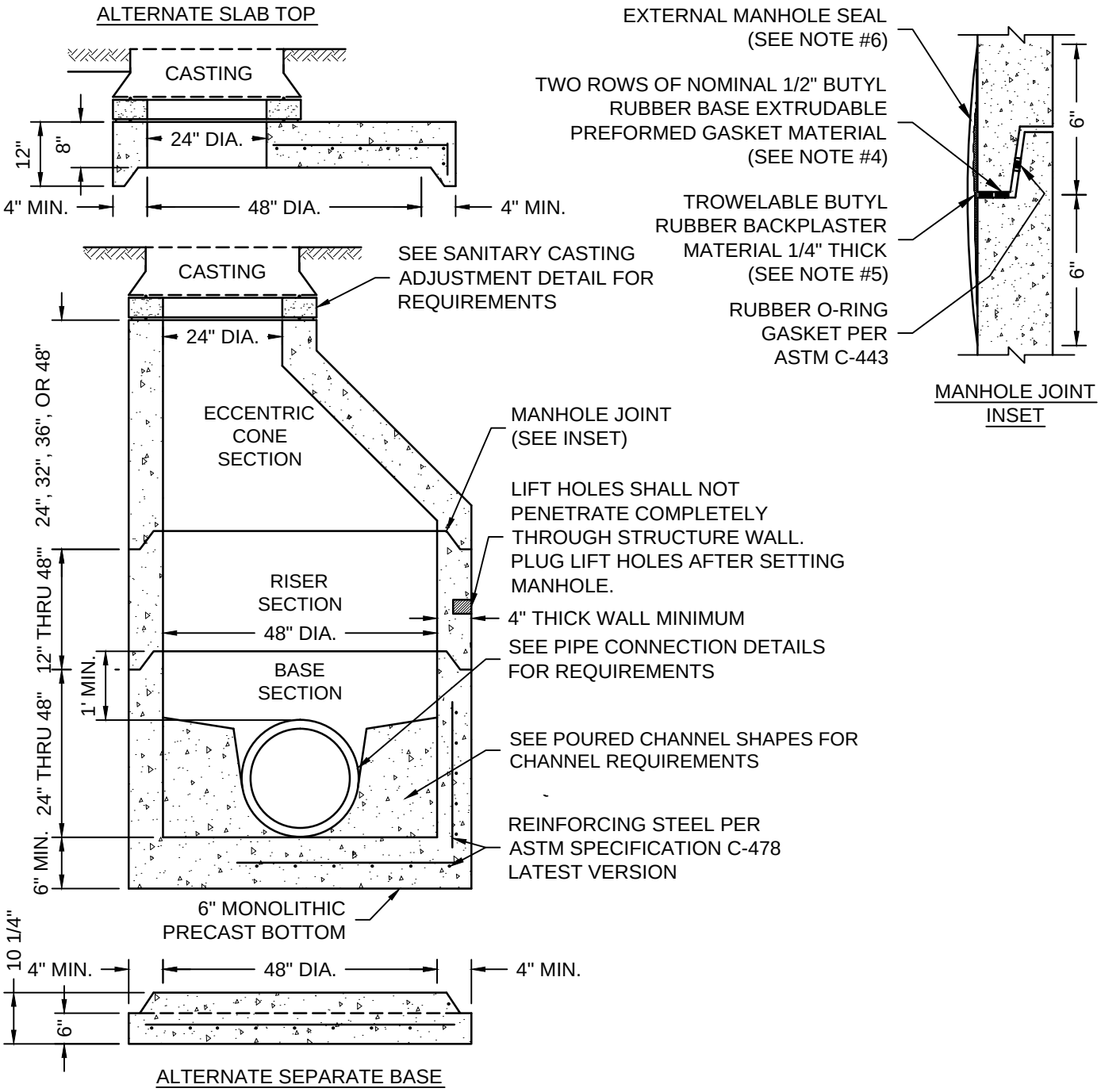
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | BF-02 | ASPHALT PATCH OVER UTILITY TRENCH | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:
1. MAXIMUM PAID WIDTH OF TRENCH (W) SHALL BE PER SPECIFICATIONS.
2. NEW SURFACE SHALL BE SLOPED TO MATCH EXISTING PAVEMENT.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | BF-03 | CONCRETE PATCH<br>OVER UTILITY TRENCH | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

# Sanitary Sewer Standard Details

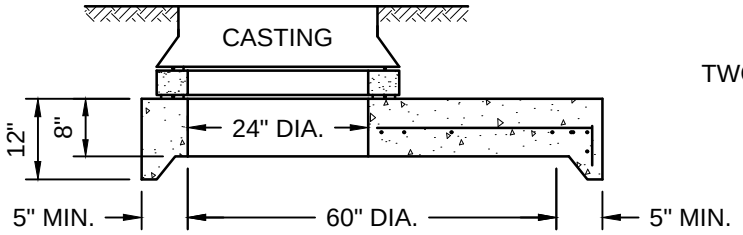


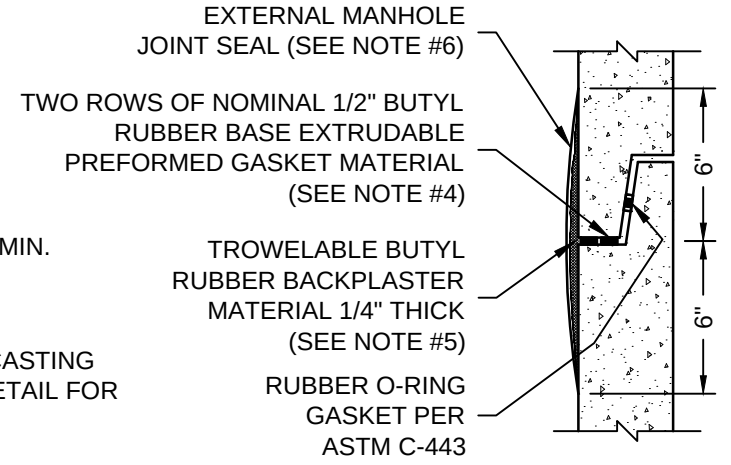

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED FRACTURED FACE STONE, 6" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. APPLY TROWELABLE BUTYL RUBBER BACK PLASTER MATERIAL 1/4" THICK (WHEN DRY) FROM 6" ABOVE TO 6" BELOW JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACUTRED BY PRESS-SEAL GASKET CORP.
6. EXTERNAL MANHOLE JOINT SEAL SHALL CONSIST OF A SHEET OF PLASTIC VISQUEEN.

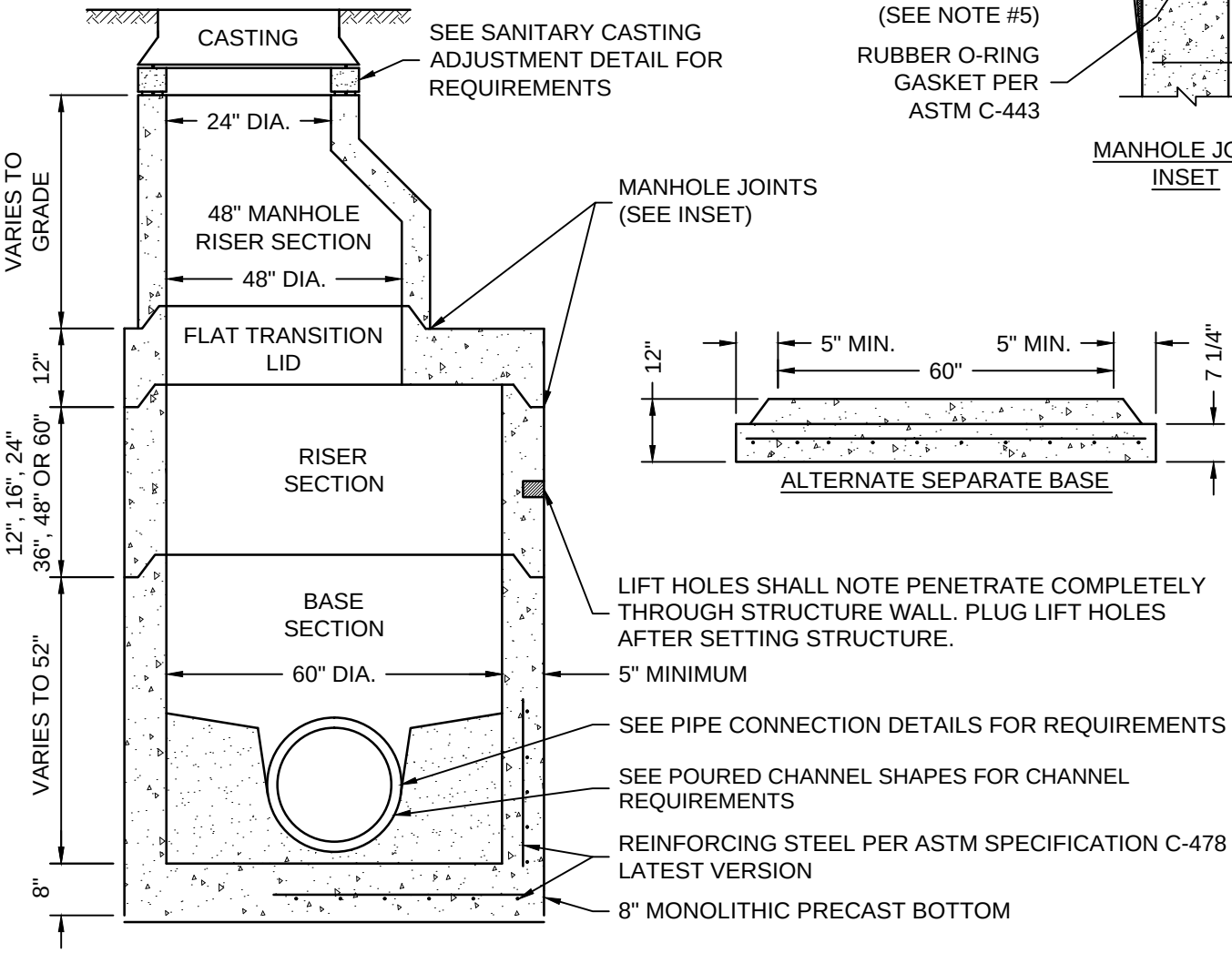
| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-01 | 48" SANITARY MANHOLE |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: |
| | | | SCALE: NONE |

ALTERNATE SLAB TOP




MANHOLE JOINT INSET





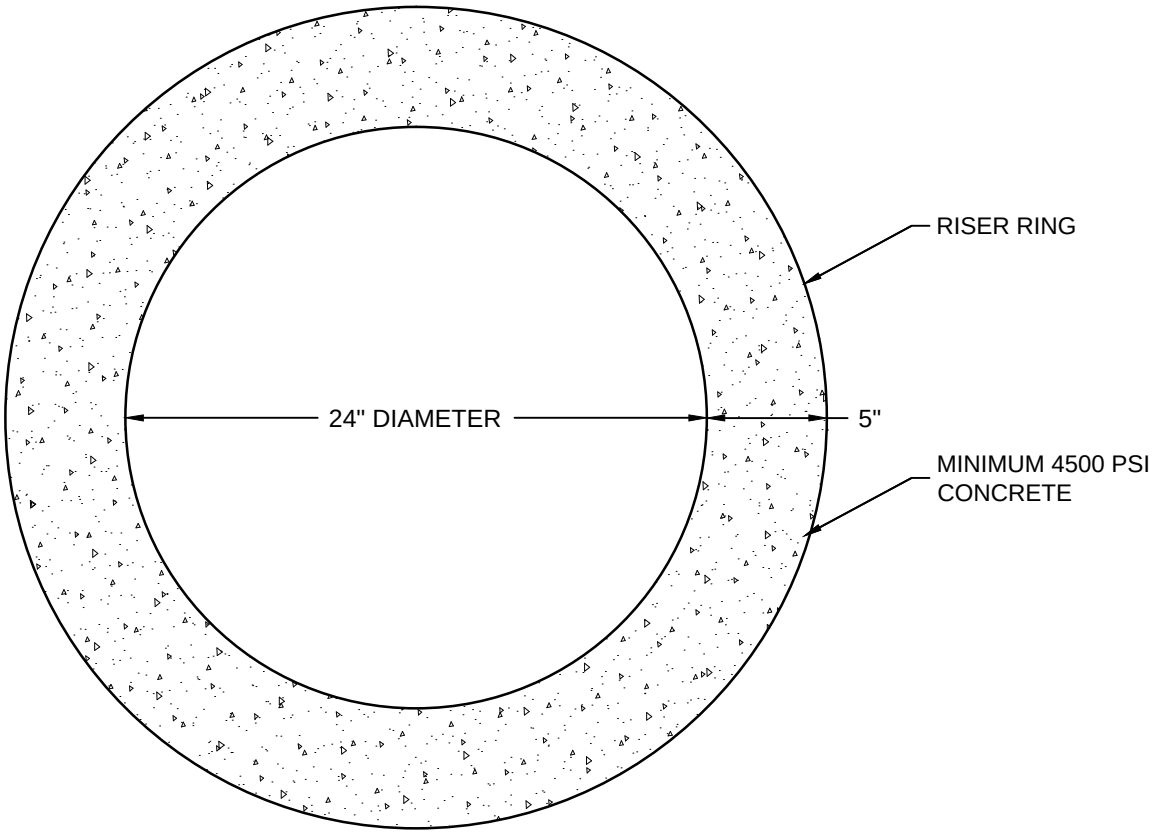


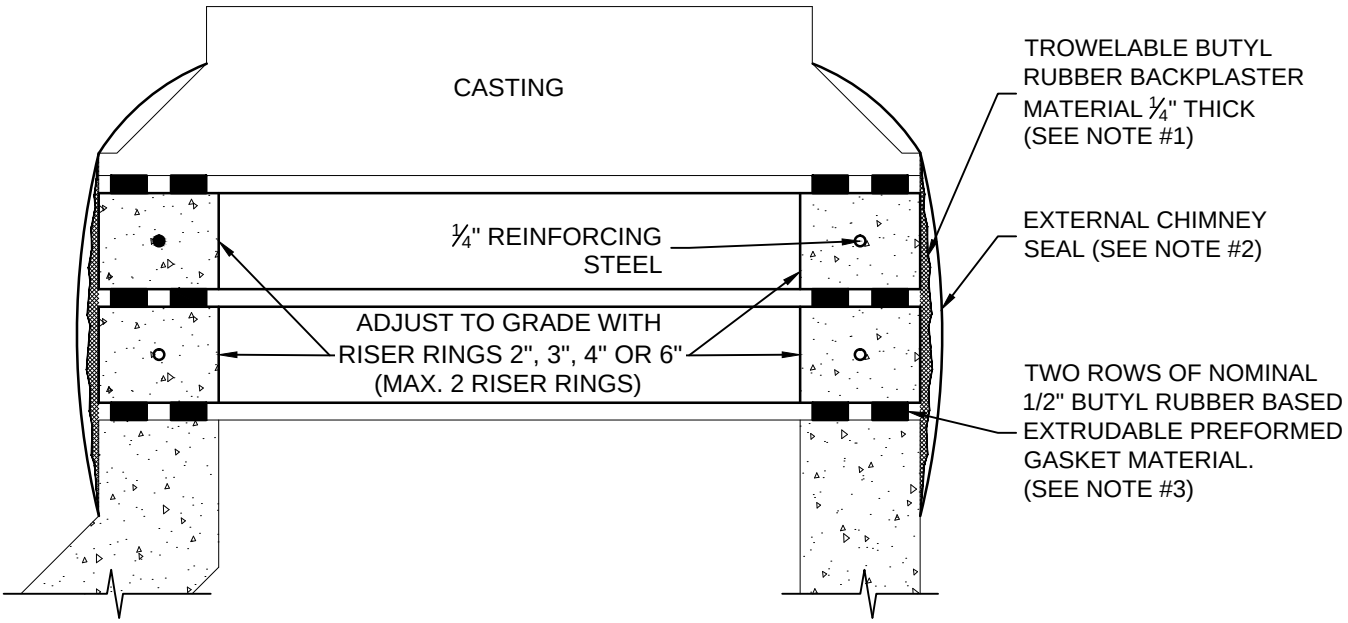
ALTERNATE SEPARATE BASE

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED FRACTURED FACE STONE, 6" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. APPLY TROWELABLE BUTYL RUBBER BACK PLASTER MATERIAL 1/4" THICK (WHEN DRY) FROM 6" ABOVE TO 6" BELOW JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACUTRED BY PRESS-SEAL GASKET CORP.
6. EXTERNAL MANHOLE JOINT SEAL SHALL CONSIST OF A SHEET OF PLASTIC VISQUEEN.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-02 | 60" SANITARY MANHOLE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

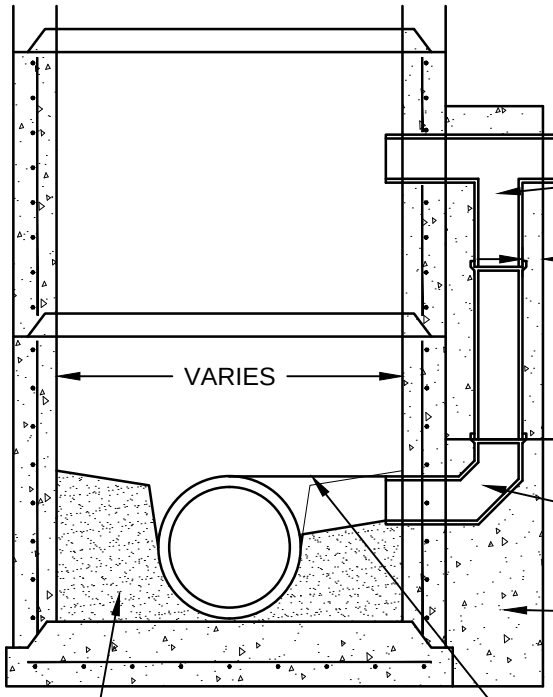



NOTES:

1. APPLY TROWELABLE BUTYL RUBBER BACKPLASTER MATERIAL 1/4" THICK (WHEN DRY) OVER RISER RINGS FROM 6" ABOVE TO 6" BELOW RISER RING JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACTURED BY PRESS-SEAL GASKET CORP.
2. EXTERNAL CHIMNEY SEAL SHALL CONSIST OF A HEAT- SHRINKING WRAP- AROUND SLEEVE (WRAPIDSEAL AS MANUFACTURERD BY CANUSA) OR EXTERNAL CHIMNEY SEAL (AS MANUFACTURED BY CRETEX).
3. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.

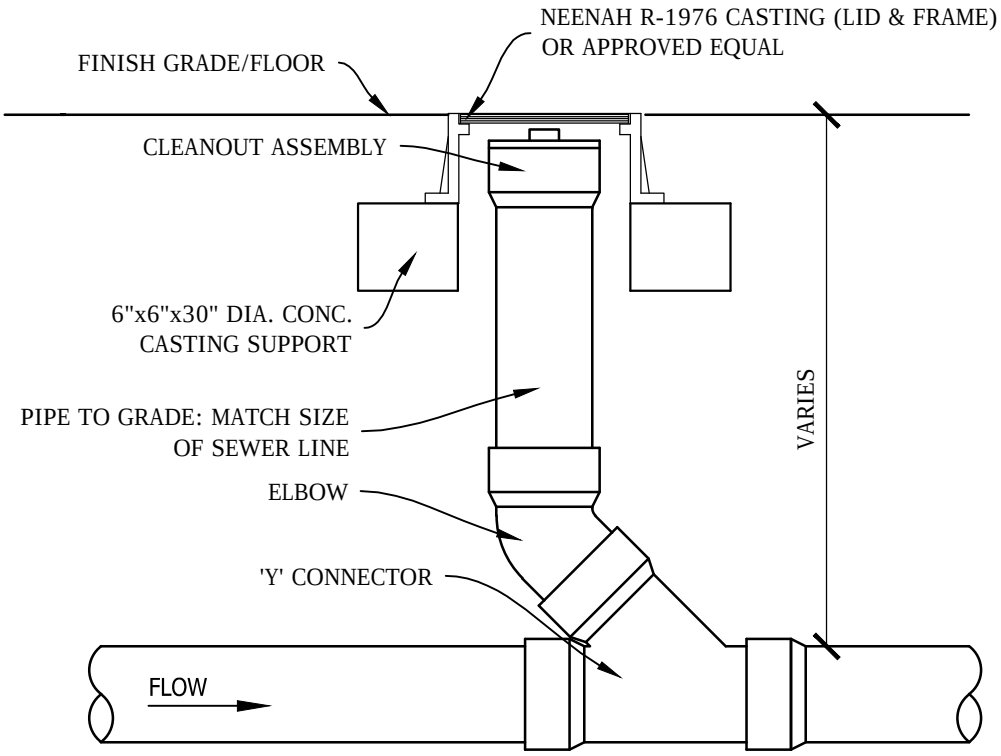
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-03 | SANITARY CASTING ADJUSTMENT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |



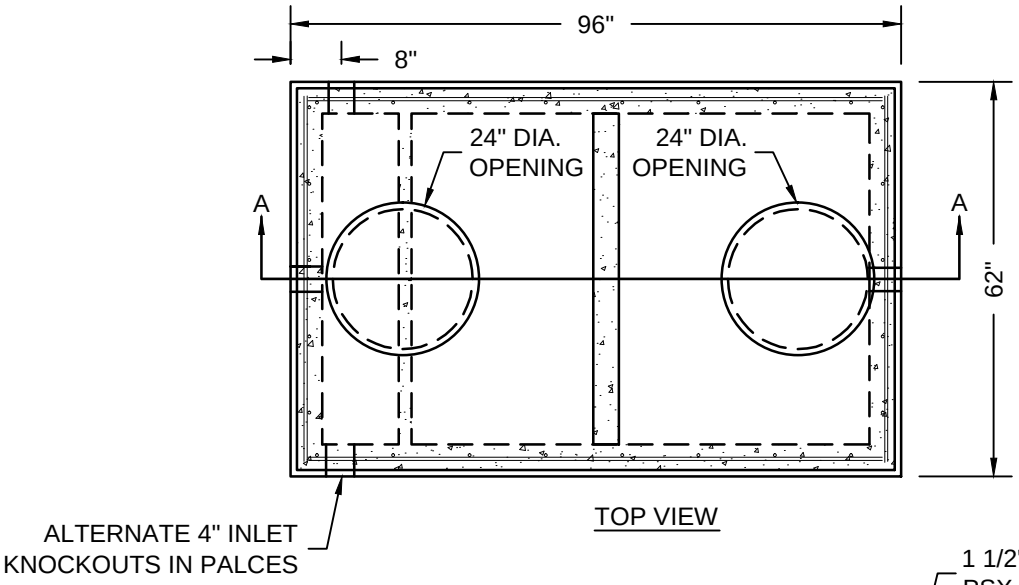

NOTES:

1. DROP PIPE SHALL BE A MINIMUM OF 8" FOR 8" TO 12" DIAMETER MAINLINE PIPE AND 12" DROP PIPE FOR ALL LARGER MAINLINE PIPES UNLESS OTHERWISE SPECIFIED.
2. GENERAL CONSTRUCTION REQUIREMENTS SAME AS STANDARD 48" MANHOLE.

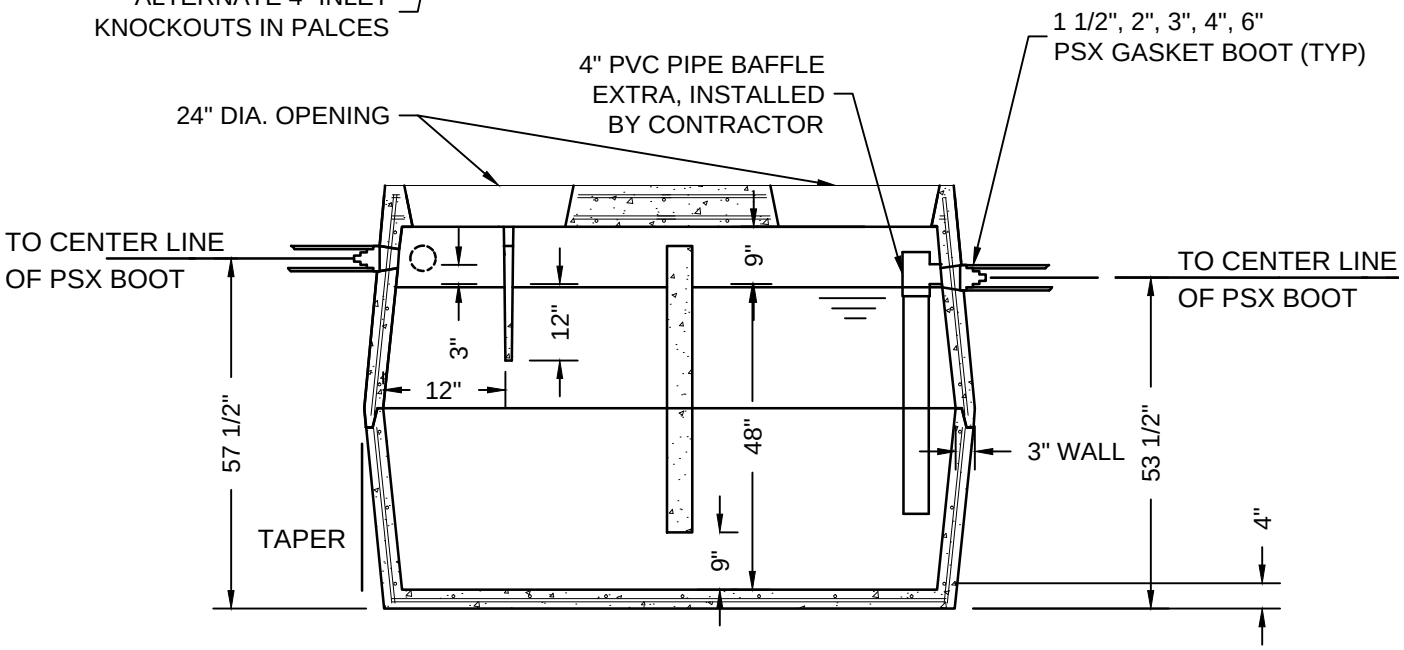
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-04 | OUTSIDE DROP CONNECTION FOR MANHOLES | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-05 | GRAVITY<br>SEWER CLEANOUT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




TOP VIEW

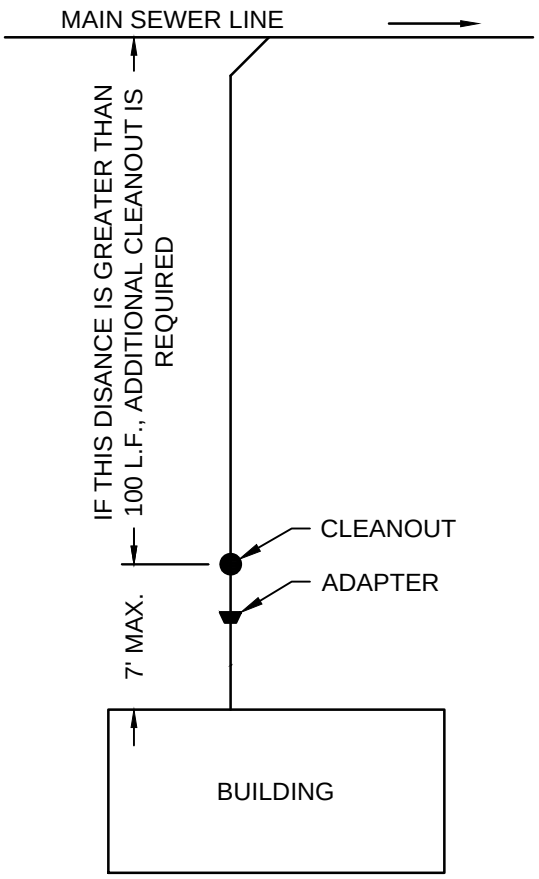



SECTION A-A

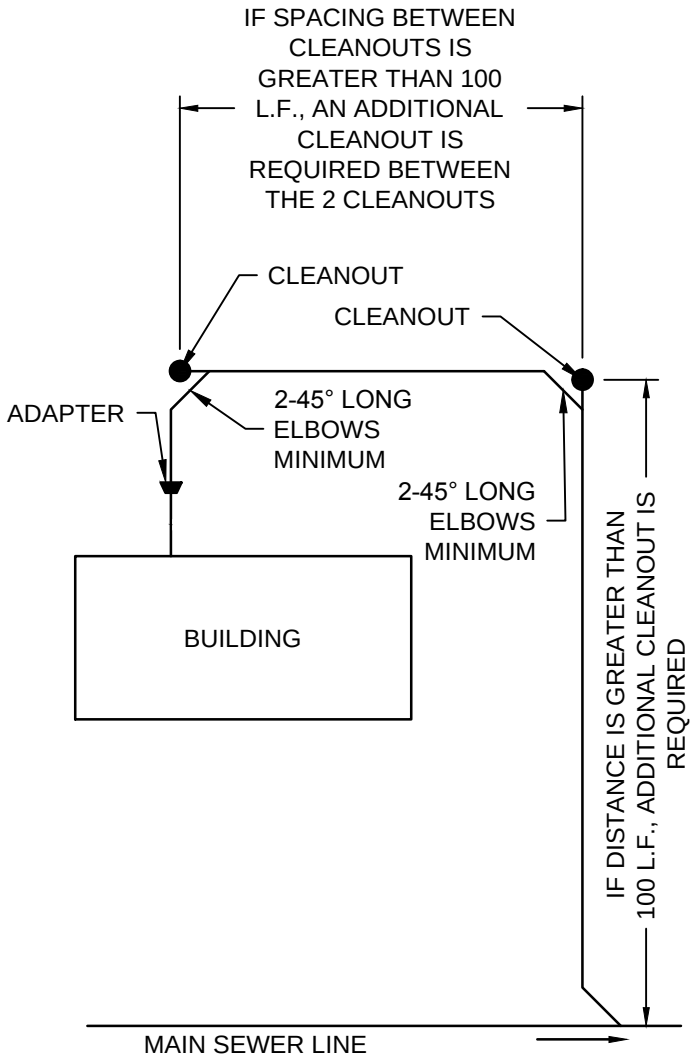
NOTES:

1. OPTIONAL TANK RISERS SHOULD BE ORDERED TO GRADE.
2. MINIMUM 4500 PSI AT 28 DAYS CONCRETE.
3. REINFORCING BARS SHALL CONFORM TO ASTM A-615 GRADE 60 STEEL.
4. ALL REINFORCING BARS SHALL BE CUT AND FORMED TO THE DIMENSIONAL TOLERANCES SPECIFIED IN ACI-315 OR ACI-318 EXCEPT WHERE NOTED ON DRAWINGS.
5. ALL BARS SHALL BE BENT COLD. BARS WITH KINKS AND BENDS NOT INDICATED SHALL NOT BE USED. HEATING AND REBENDING OF BARS IS NOT PERMITTED.
6. REINFORCING STEEL SHALL BE #4 REBAR AT 12" O.C. BOTH WAYS TIED TO 6X6 10/10 WELDED WIRE MESH. TOP OF GREASE TRAP TO HAVE DOUBLE LAYER OF STEEL.
7. EARTH COVER: 2'-0" MINIMUM UP TO 5'-0" MAXIMUM. SIZE PAD ACCORDING TO AMOUNT OF EARTH COVER.
8. DESIGN FOR TRAFFIC LOADING.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-06 | 1000 GALLON<br>GREASE INTERCEPTOR | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




STRAIGHT CONNECTION



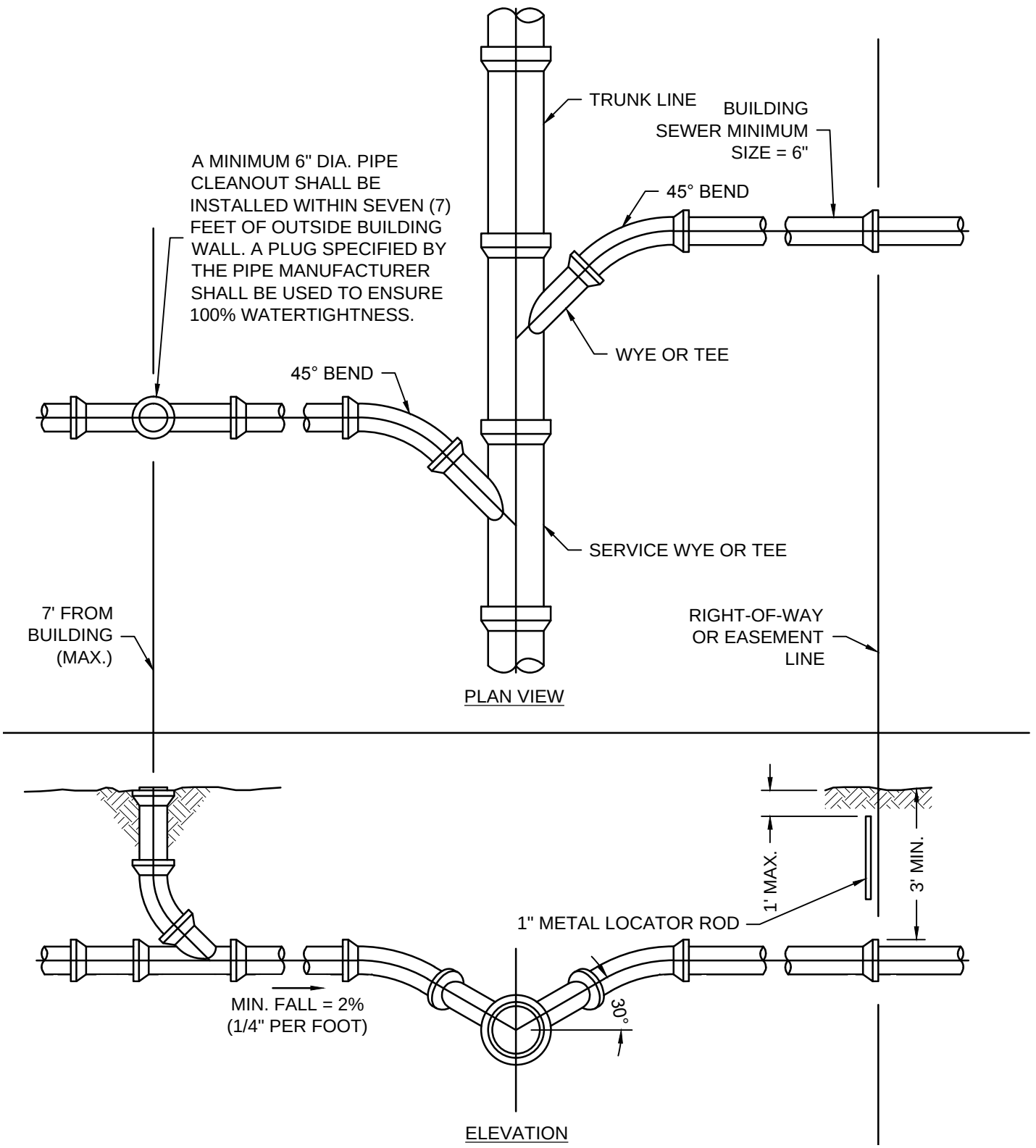

AROUND THE BUILDING CONNECTION

NOTES:

1. MAXIMUM DISTANCE BETWEEN THE EXTERIOR WALL AND THE CLEANOUT WYE SHALL BE 7'.
2. NO 90° ELBOW IS PERMITTED IN BUILDING SEWER. TWO 45° LONG ELBOWS MUST BE USED.
3. MINIMUM SLOPE OF BUILDING SEWER SHALL BE 2% (1/4" PER FOOT).
4. MINIMUM SIZE FOR BUILDING SEWER SHALL BE 6" IN DIAMETER.
5. BUILDING SEWER LINE SHALL BE INSPECTED AND APPROVED BEFORE EXCAVATION IS BACKFILLED.
6. NO CLEANOUT CAN BE INSTALLED IN A ROAD OR ALLEY RIGHT-OF-WAY OR IN A DEDICATED EASEMENT UNLESS OTHERWISE APPROVED BY THE GOVERNING AGENCY OR DEPARTMENT.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-07 | SANITARY SEWER LATERAL PLAN VIEW | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

LESS THAN 15' DEEP

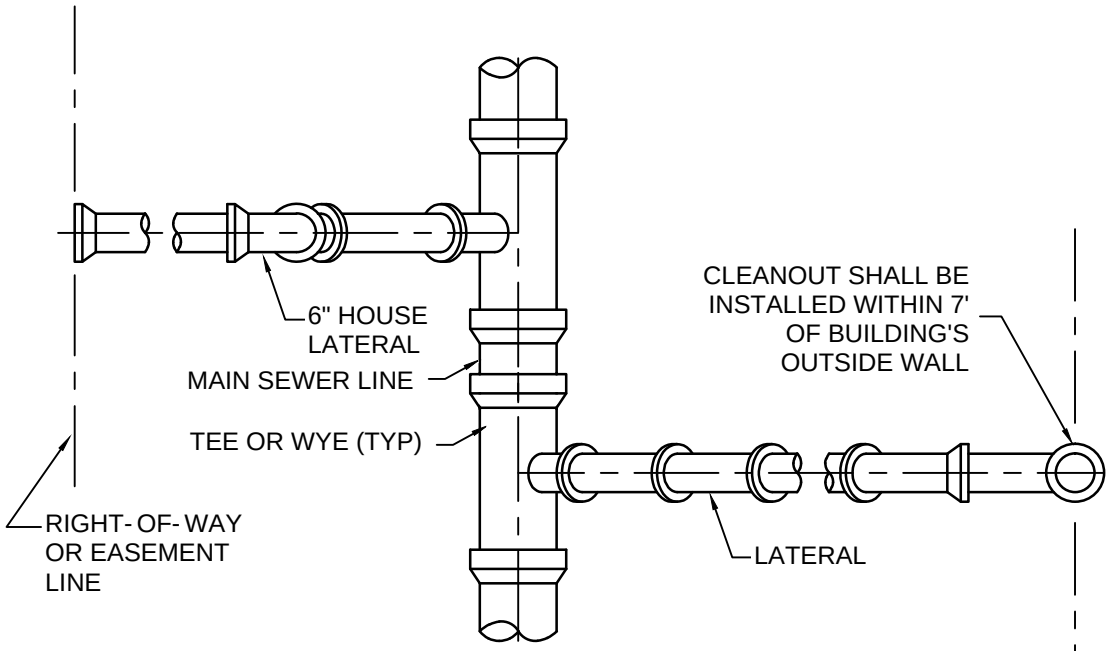



NOTES:

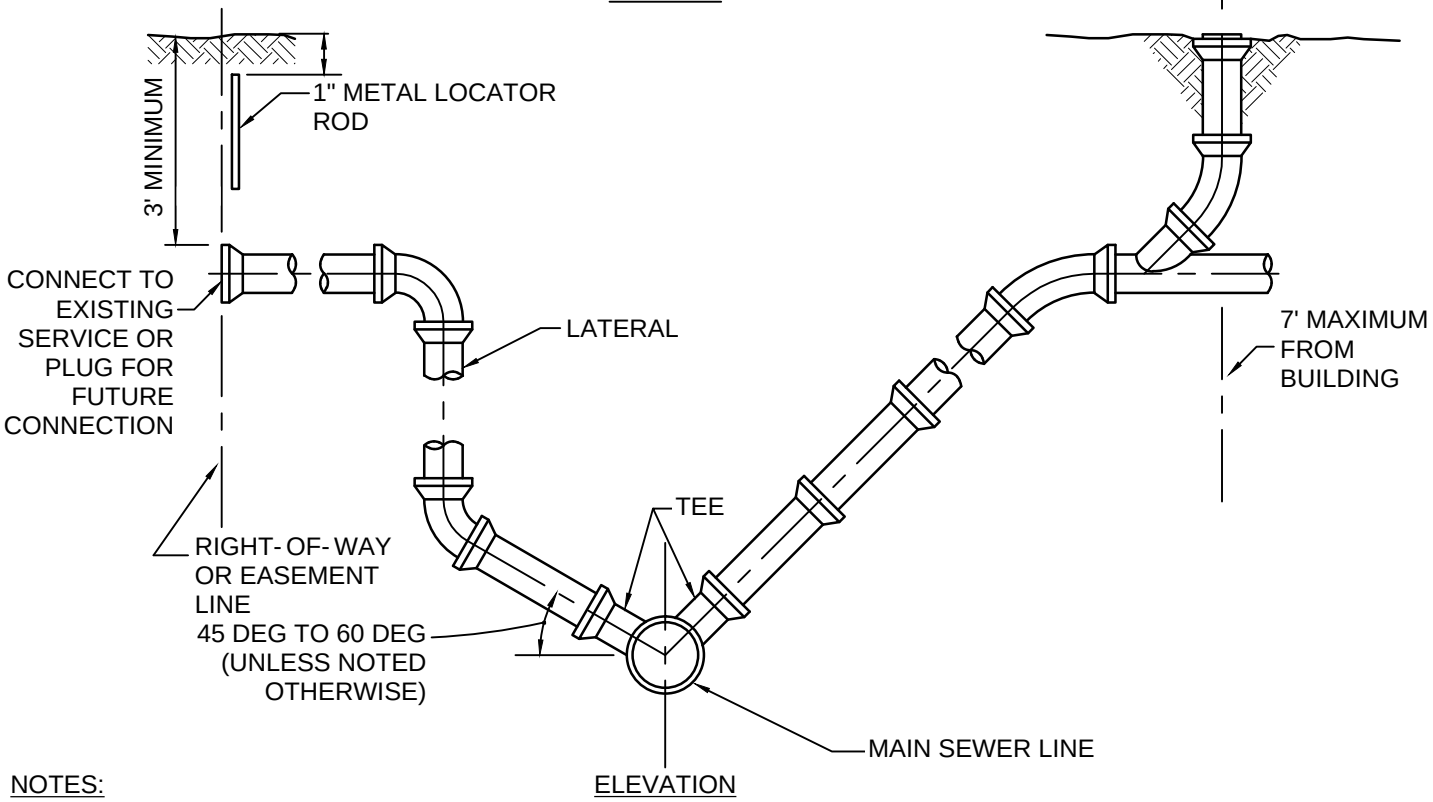
1. COMPACTION OF GRANULAR BACKFILL IS CRITICAL UNDER WYE AND BEND.
2. PROVIDE TRACER WIRE ON LATERALS PER SPECIFICATIONS.
3. PROVIDE WOOD STAKE EXTENDING 18" ABOVE GRADE AT SAME LOCATION AS METAL LOCATOR ROD.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-08 | SANITARY LATERAL<br>SHALLOW SERVICE CONNECTION | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

15' DEEP AND OVER




Plan View

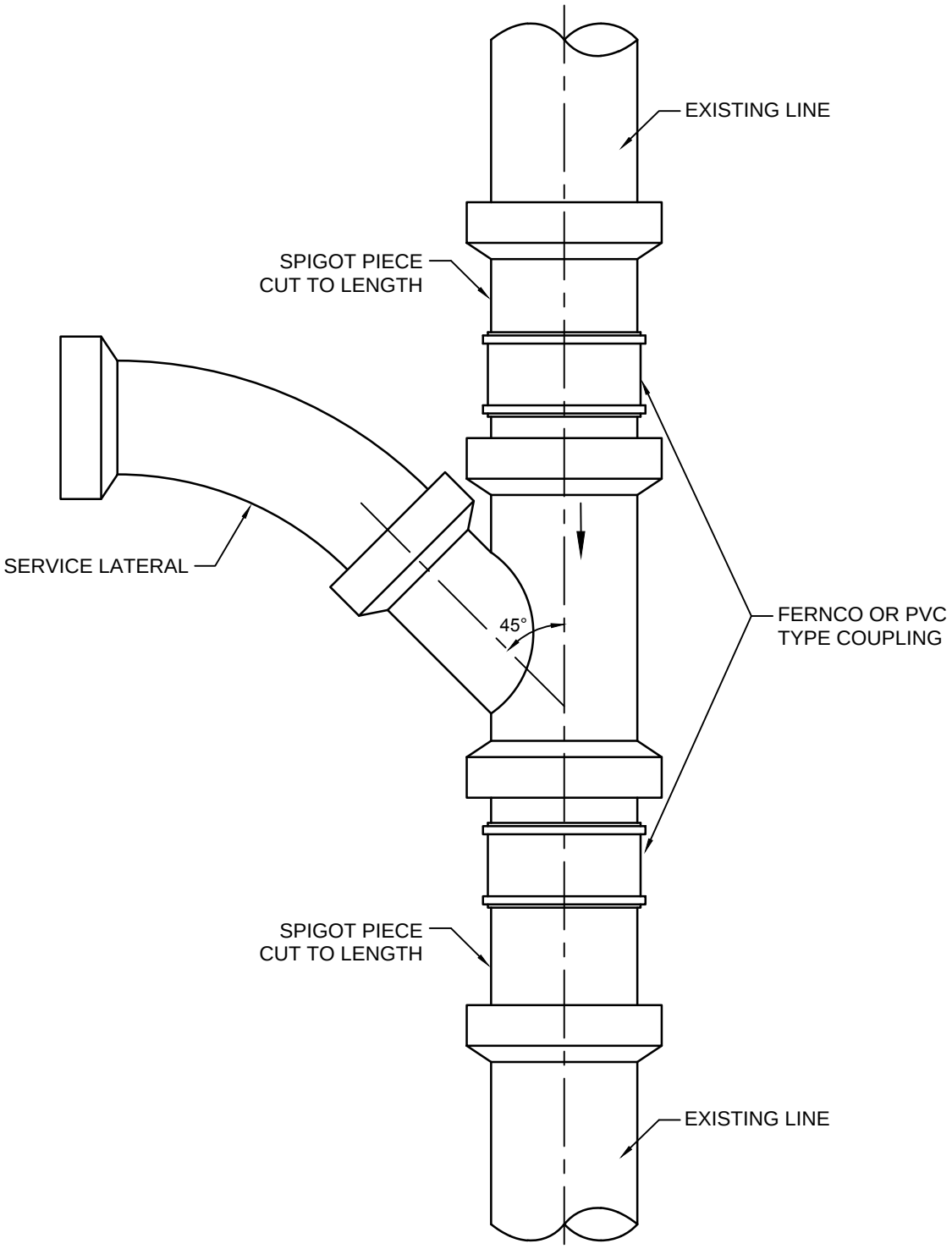



ELEVATION

NOTES:
1. MINIMUM LATERAL SLOPE: 1/4" PER FOOT.
2. PROVIDE TRACER WIRE ON LATERAL PER SPECIFICATIONS.
3. PROVIDE WOOD STAKE EXTENDING 18" ABOVE GRADE AT SAME LOCATION AS METAL LOCATOR ROD.

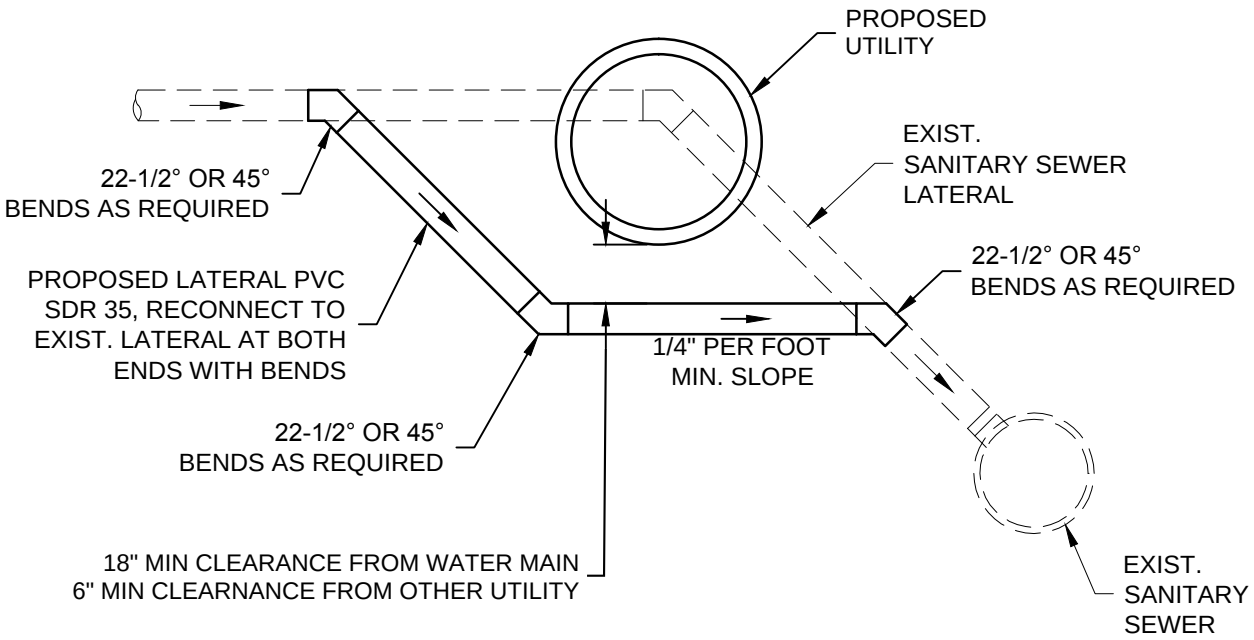
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-09 | SANITARY LATERAL<br>DEEP SERVICE CONNECTION | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

PIPES LESS THAN 15"




NOTES:
1. MANUFACTURED WYES OR TEES SHALL BE USED FOR ALL MAINLINE PIPE LESS THAN 15" IN DIAMETER.
2. BYPASS PUMPING BY CONTRACTOR AS REQUIRED WITH TOWN APPROVAL.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-10 | CUT-IN LATERAL CONNECTION | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. PROVIDE TRACER WIRE ON LATERAL PER SPECIFICATIONS.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-11 | SANITARY LATERAL LOWERING | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

Town of OSSIAN

STANDARD DRAWINGS

TOWN OF OSSIAN
507 N. JEFFERSON ST.
OSSIAN, IN 46777

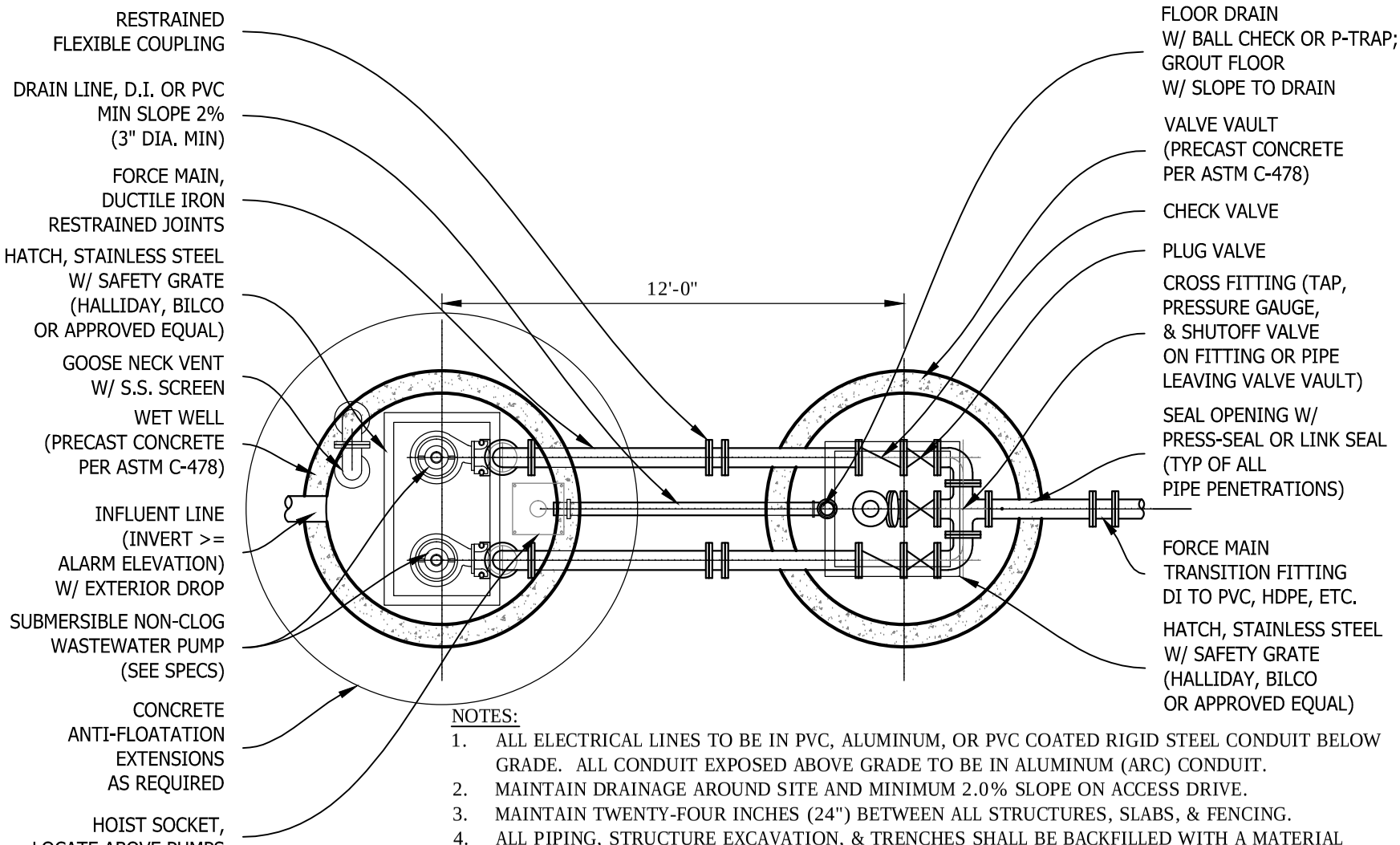
APPROVED: 06/13/16

SAN-12

REVISED:

LIFT STATION PLAN

SCALE: AS NOTED

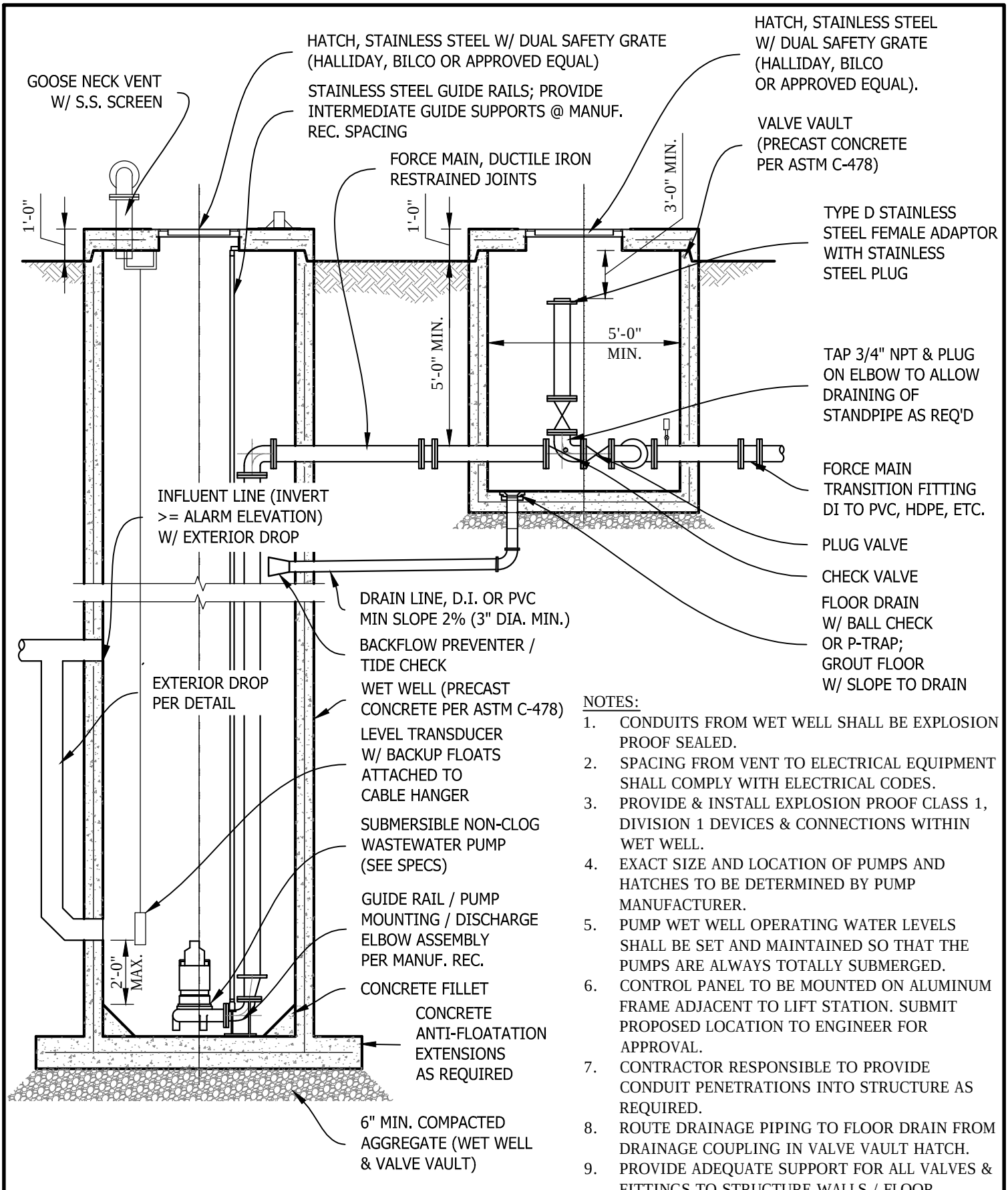



OPTIONAL ITEMS WHICH TOWN MAY REQUIRE:

1. FENCING & GATES
2. METERING PIT & PIPING
3. ON SITE GENERATOR & PAD
4. CHEMICAL TANK
5. TELEMETRY

NOTES:

1. ALL ELECTRICAL LINES TO BE IN PVC, ALUMINUM, OR PVC COATED RIGID STEEL CONDUIT BELOW GRADE. ALL CONDUIT EXPOSED ABOVE GRADE TO BE IN ALUMINUM (ARC) CONDUIT.
2. MAINTAIN DRAINAGE AROUND SITE AND MINIMUM 2.0% SLOPE ON ACCESS DRIVE.
3. MAINTAIN TWENTY-FOUR INCHES (24") BETWEEN ALL STRUCTURES, SLABS, & FENCING.
4. ALL PIPING, STRUCTURE EXCAVATION, & TRENCHES SHALL BE BACKFILLED WITH A MATERIAL APPROVED BY THE TOWN AND COMPACTED PER TOWN SPECIFICATIONS.
5. INSTALL LIFT OUT RAIL SYSTEMS, VALVES, CONTROLS, ACCESS COVER(S) AND ALL OTHER APPURTENANCES TO MAKE A COMPLETE SYSTEM. LIFT OUT RAIL SYSTEM COMPONENTS AND UPPER GUIDE BRACKETS TO BE STAINLESS STEEL.
6. INSTALL CHECK VALVES AND ISOLATION VALVES.
7. DUCTILE IRON SHALL BE PRESSURE CLASS 350 AND CONFORM TO AWWA C151.
8. INSTALL ALL TRANSDUCERS/FLOATS, POWER CONNECTIONS, AND MISCELLANEOUS FITTINGS WITHIN THE PUMP CHAMBER. FLOAT SWITCHES TO BE NON-MERCURY TYPE.
9. PROVIDE STAINLESS STEEL LIFTING CHAINS & GUIDE RAILS FOR EACH PUMP.
10. CONTROL PANEL TO INCLUDE: SEAL FAILURE DETECTION, PHASE DETECTION, VISUAL ALARM, AUDIO ALARM, ALTERNATE PUMPS & TIME CLOCK. INSTALL ON METER MOUNTING PEDESTAL OR PROVIDE SEPARATE MOUNTING PANEL. PROVIDE GENERATOR HOOKUP AND TRANSFER SWITCH PER MUNICIPAL REQUIREMENTS. THE PANEL MUST INCLUDE HEATER WITH THERMOSTAT CONTROL.
11. CONTRACTOR TO SUBMIT WIRING DIAGRAM FOR APPROVAL PRIOR TO CONSTRUCTION.

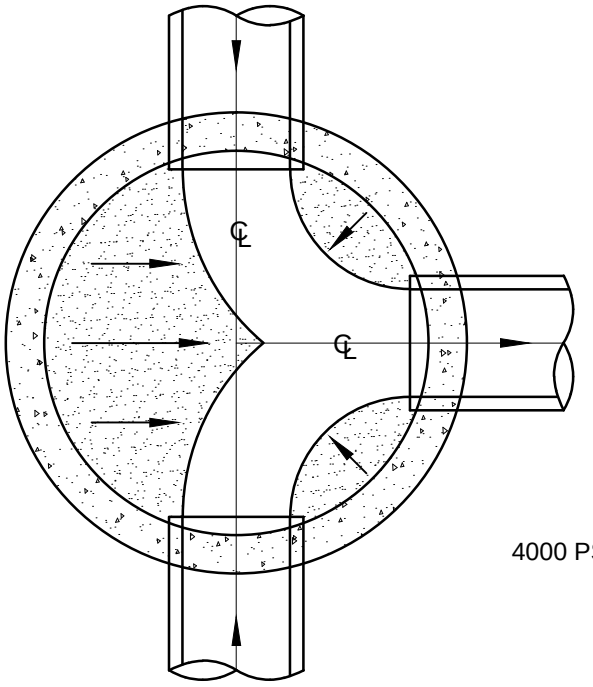


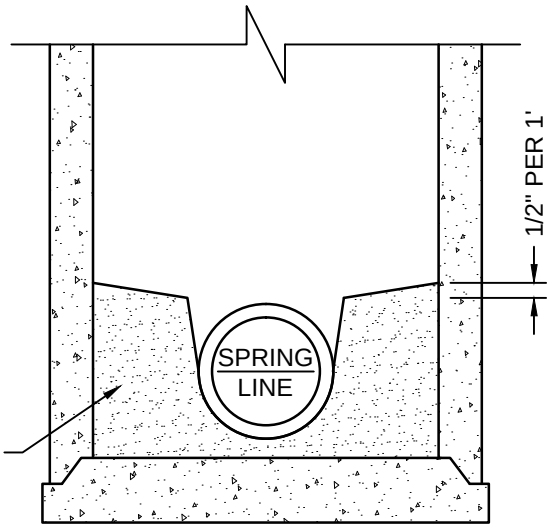

NOTES:

1. CONDUITS FROM WET WELL SHALL BE EXPLOSION PROOF SEALED.
2. SPACING FROM VENT TO ELECTRICAL EQUIPMENT SHALL COMPLY WITH ELECTRICAL CODES.
3. PROVIDE & INSTALL EXPLOSION PROOF CLASS 1, DIVISION 1 DEVICES & CONNECTIONS WITHIN WET WELL.
4. EXACT SIZE AND LOCATION OF PUMPS AND HATCHES TO BE DETERMINED BY PUMP MANUFACTURER.
5. PUMP WET WELL OPERATING WATER LEVELS SHALL BE SET AND MAINTAINED SO THAT THE PUMPS ARE ALWAYS TOTALLY SUBMERGED.
6. CONTROL PANEL TO BE MOUNTED ON ALUMINUM FRAME ADJACENT TO LIFT STATION. SUBMIT PROPOSED LOCATION TO ENGINEER FOR APPROVAL.
7. CONTRACTOR RESPONSIBLE TO PROVIDE CONDUIT PENETRATIONS INTO STRUCTURE AS REQUIRED.
8. ROUTE DRAINAGE PIPING TO FLOOR DRAIN FROM DRAINAGE COUPLING IN VALVE VAULT HATCH.
9. PROVIDE ADEQUATE SUPPORT FOR ALL VALVES & FITTINGS TO STRUCTURE WALLS / FLOOR.

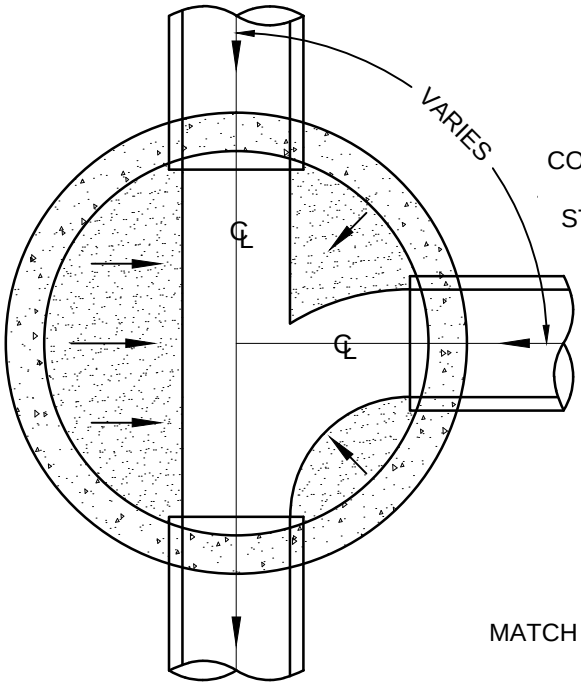
| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | SAN-13 | LIFT STATION SECTION |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |

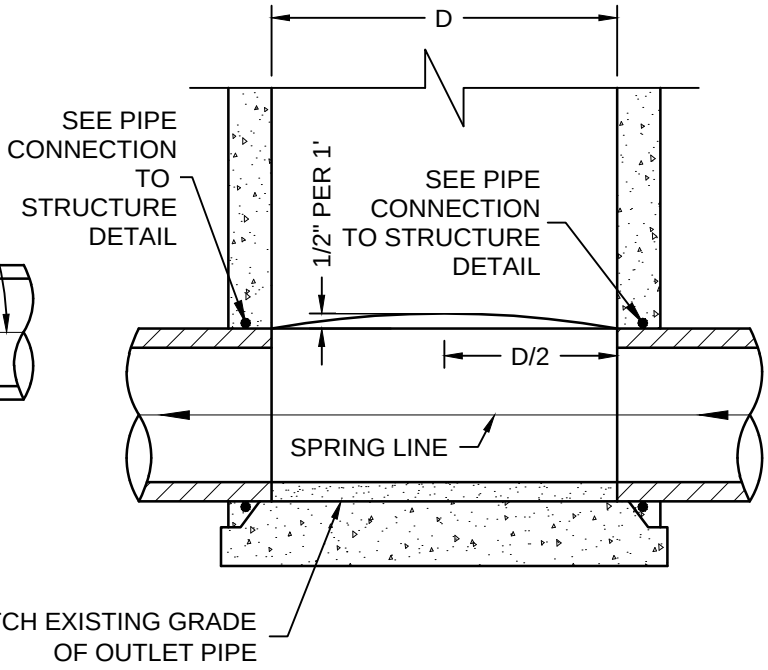
# General Structures Standard Details



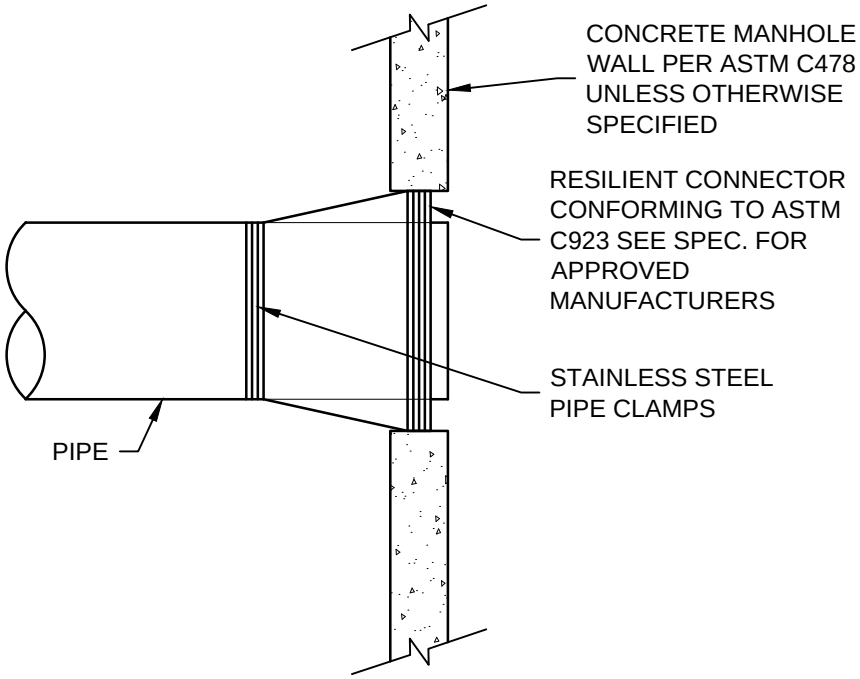




DROP, END, OR STEP-UP MANHOLE




| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-01 | POURED CHANNEL SHAPES | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

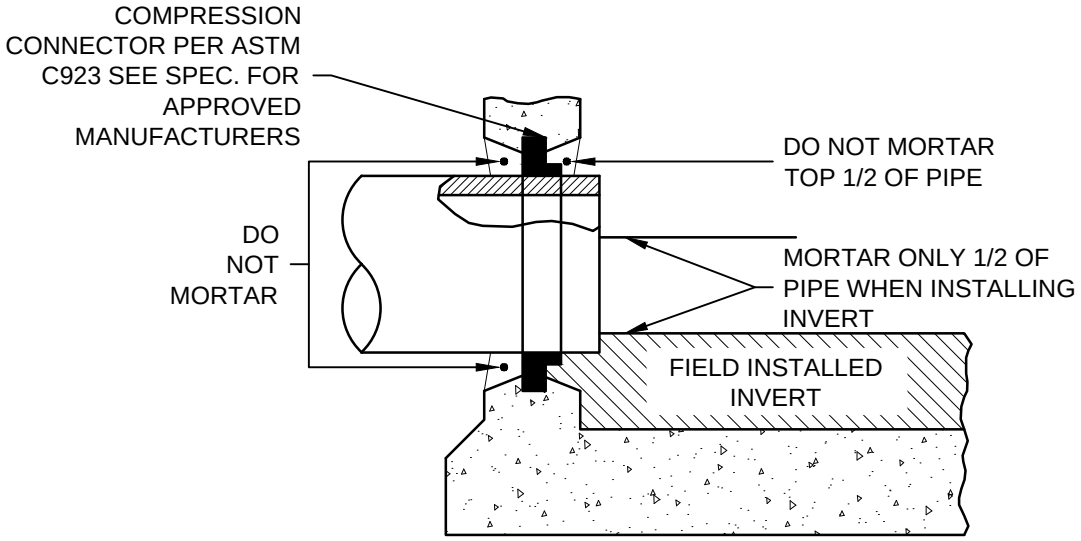



BOOT TYPE

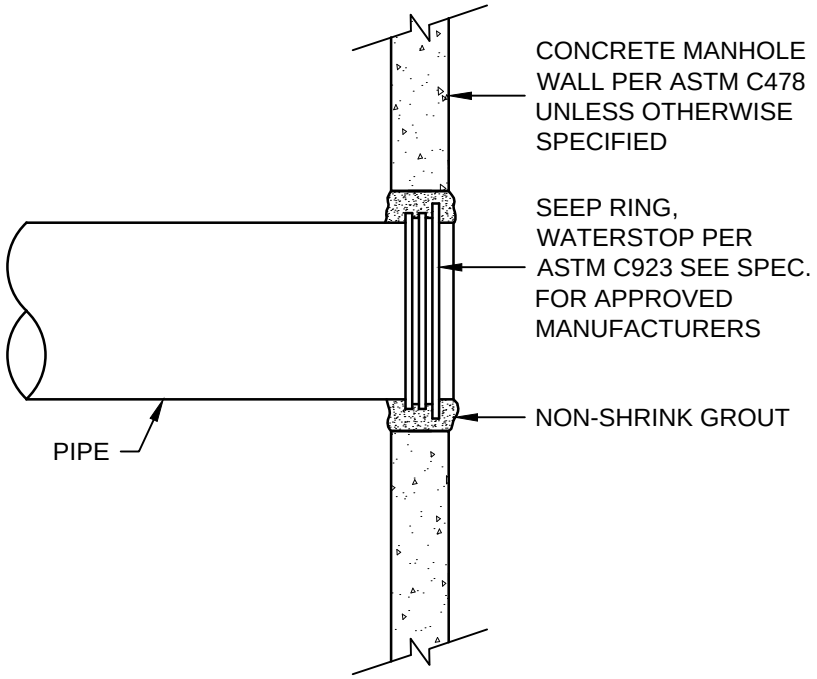
CAUTION:

1. WHEN INSTALLING PIPE STUBS FOR FUTURE PIPELINE, INSTALLATION OF ALL STUBS SHOULD BE PROPERLY RESTRAINED TO PREVENT ANY MOVEMENT.
2. TYPICAL APPLICATION IS FOR PIPES 36" IN DIAMETER OR SMALLER.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-02 | BOOTED PIPE CONNECTION TO STRUCTURE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




COMPRESSION TYPE CAST IN PLACE

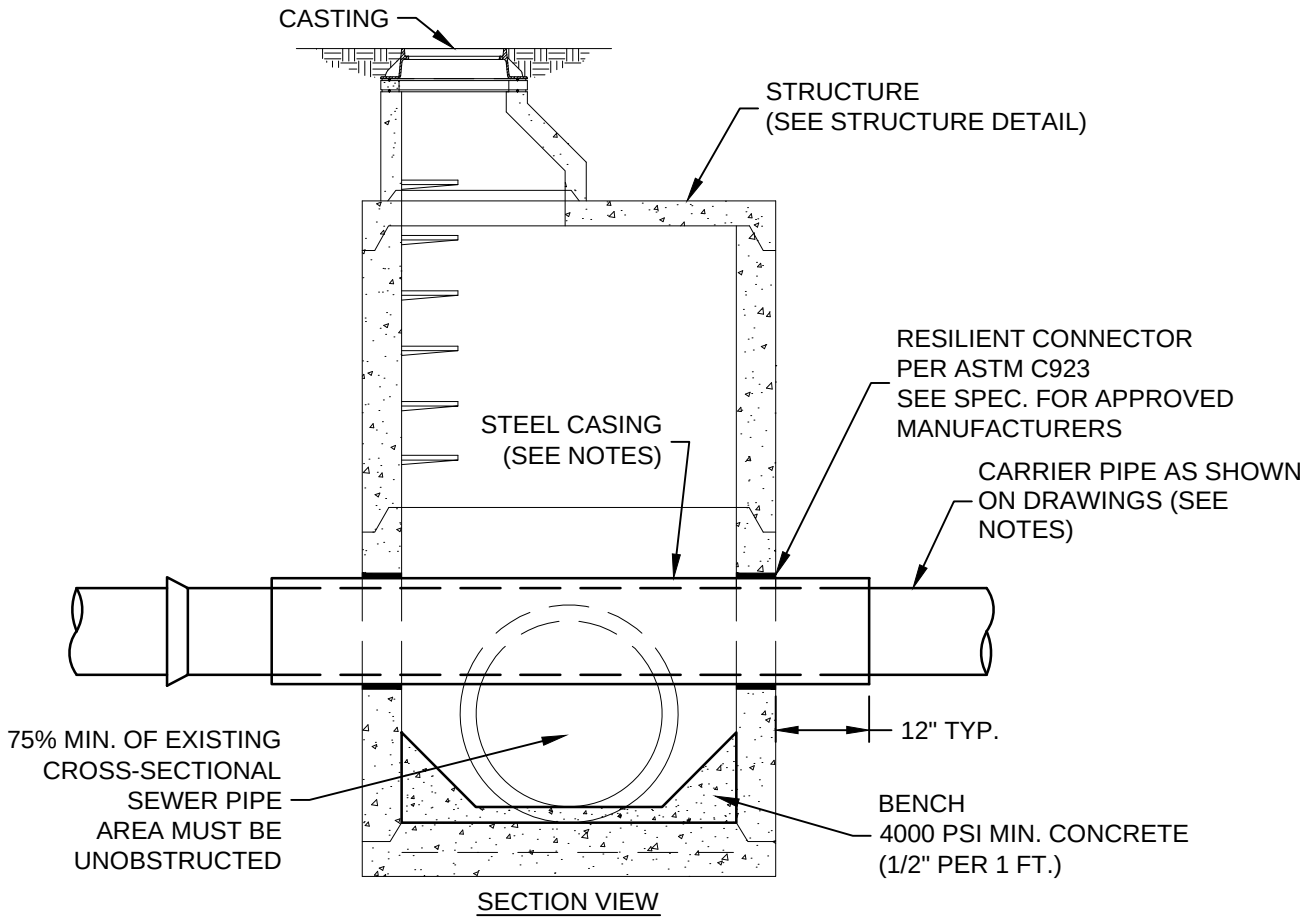



COMPRESSION TYPE GROUT IN PLACE

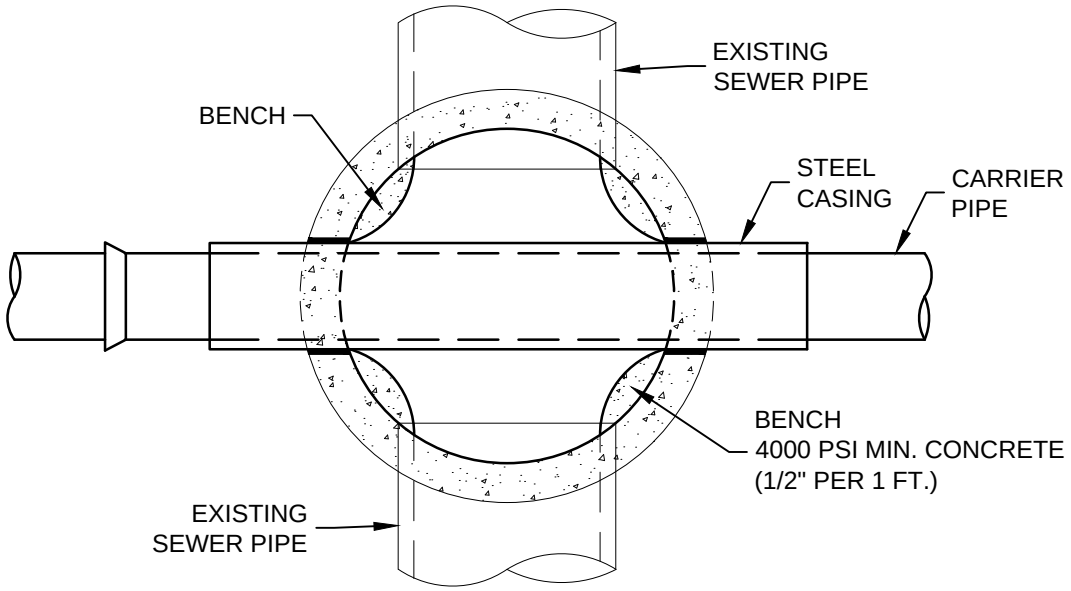
NOTES:

1. WHEN INSTALLING PIPE STUBS FOR FUTURE PIPELINE, INSTALLATION OF ALL STUBS SHOULD BE PROPERLY RETRAINED TO PREVENT ANY MOVEMENT.
2. TYPICAL APPLICATION IS FOR PIPES LARGER THAN 36".

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-03 | COMPRESSION PIPE CONNECTION TO STRUCTURE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




SECTION VIEW

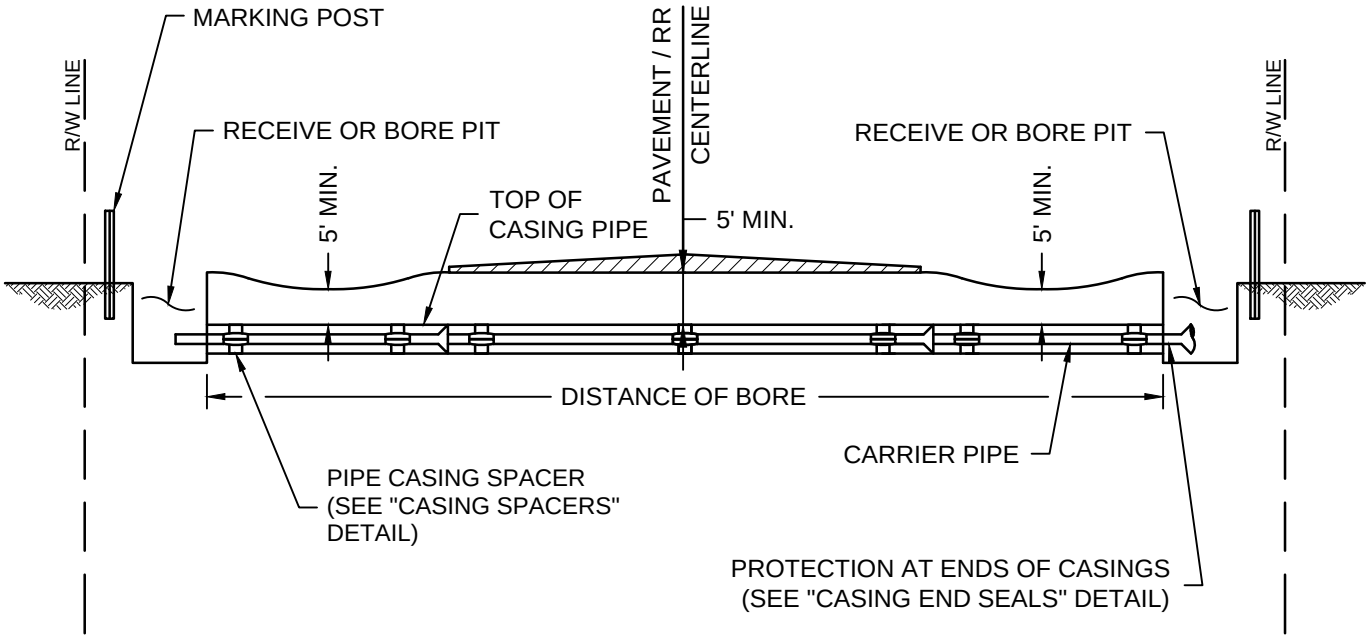



PLAN VIEW

NOTES:

1. STEEL CASING REQUIRED ON A CASE BY CASE BASIS PER OWNER / ENGINEER.
2. DUCTILE IRON PIPE SHALL BE USED FOR CROSSING PIPE IF CASING IS NOT USED.
3. CASING SPACERS SHALL BE USED WITH STEEL CASING. REFER TO CASING SPACERS DETAIL.
4. IT IS PREFERRED TO HAVE THE SANITARY SEWER PIPE RUN THROUGH THE MANHOLE (AS CARRIER PIPE) WHEN POSSIBLE.

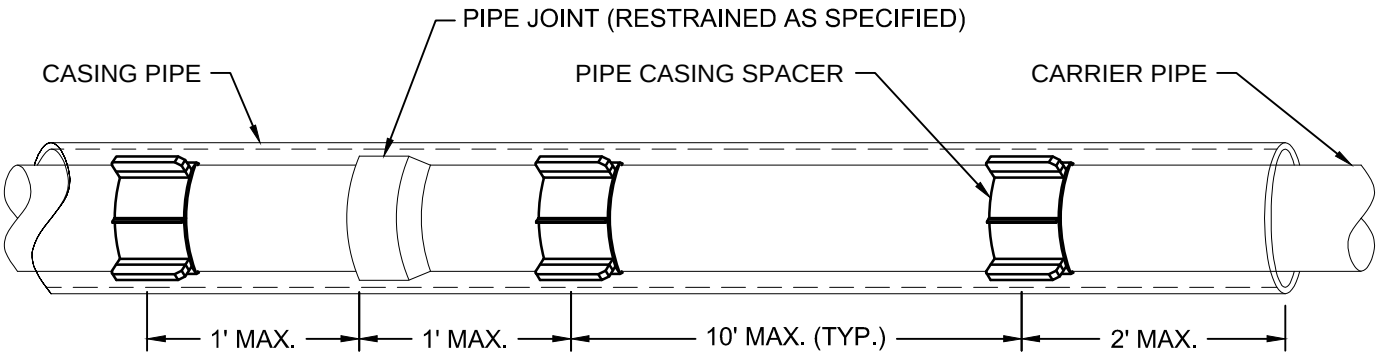
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-04 | CONFLICT STRUCTURE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. JOINTS MAY REQUIRE RESTRAINT WITHIN CASING IF SPECIFIED.
2. TRACING WIRE TO BE INSTALLED THROUGH ALL CASED BORINGS.
3. STEEL PIPE CASING SHALL CONFORM TO THE REQUIREMENTS OF ASTM A283, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED INTERIOR JOINTS SHALL BE GROUND TO A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C206, "AWWA STANDARD FOR FIELD WELDING OF STEEL WATER PIPE." COATING FOR STEEL CASING NOT REQUIRED.
4. STEEL PIPE CASING SHALL BE INSTALLED SYMMETRICAL ABOUT PIPE CENTERLINE (TYP). PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
5. CASING ONLY TO BE FILLED WITH SAND OR GROUT WITH APPROVAL BY OWNER / ENGINEER.

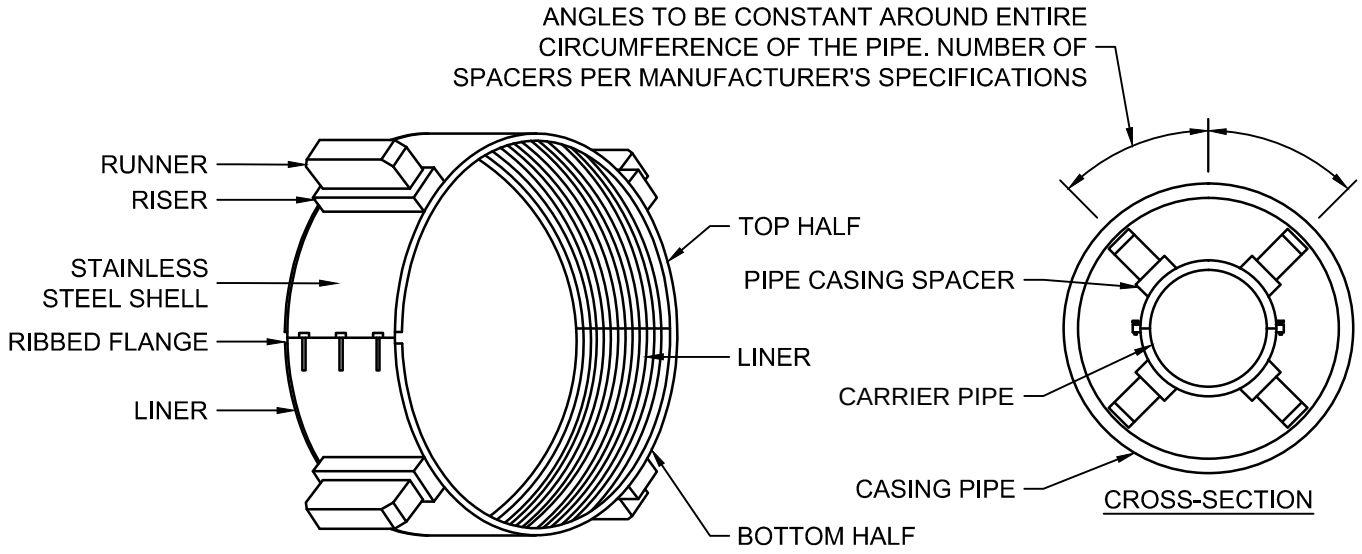
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-05 | TYPICAL JACKED & BORED CASING PIPE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




| CARRIER PIPE | | |
|---|---|---|
| PIPE SIZE | CASING O.D.* | THICKNESS ** |
| 6" | 16" | 1/4" |
| 8" | 18" | 1/4" |
| 10" | 20" | 5/16" |
| 12" | 24" | 3/8" |
| 16" | 30" | 1/2" |
| 18" | 30" | 1/2" |
| 20" | 36" | 1/2" |
| 24" | 42" | 1/2" |

* PROJECT ENGINEER RESPONSIBLE TO CONFIRM APPROPRIATE CLEARANCES FOR FLANGES / BELLS; SUBJECT TO TOWN REVIEW.

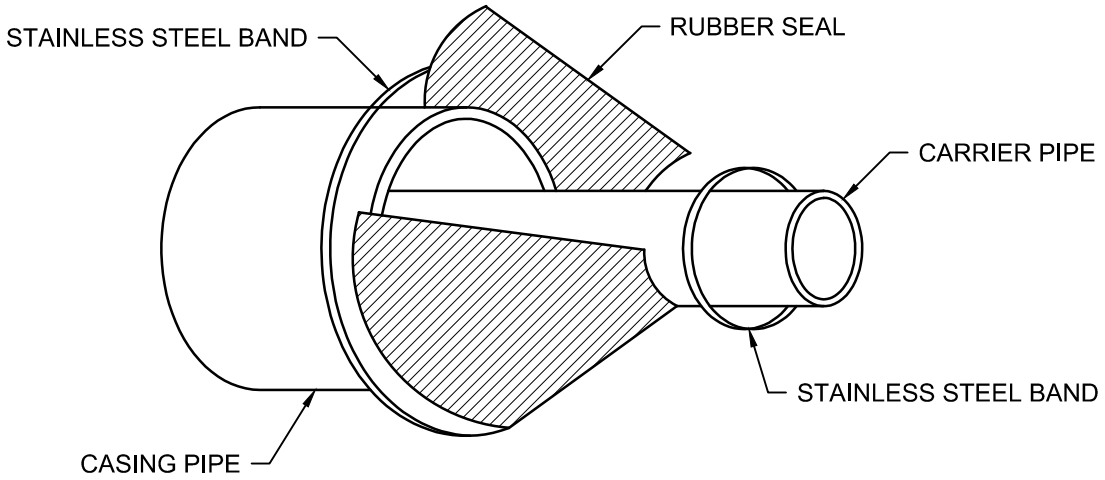
** PROJECT ENGINEER RESPONSIBLE TO COORDINATE WITH INDOT / RAILROAD / AUTHORITY HAVING JURISDICTION; SUBJECT TO TOWN REVIEW.



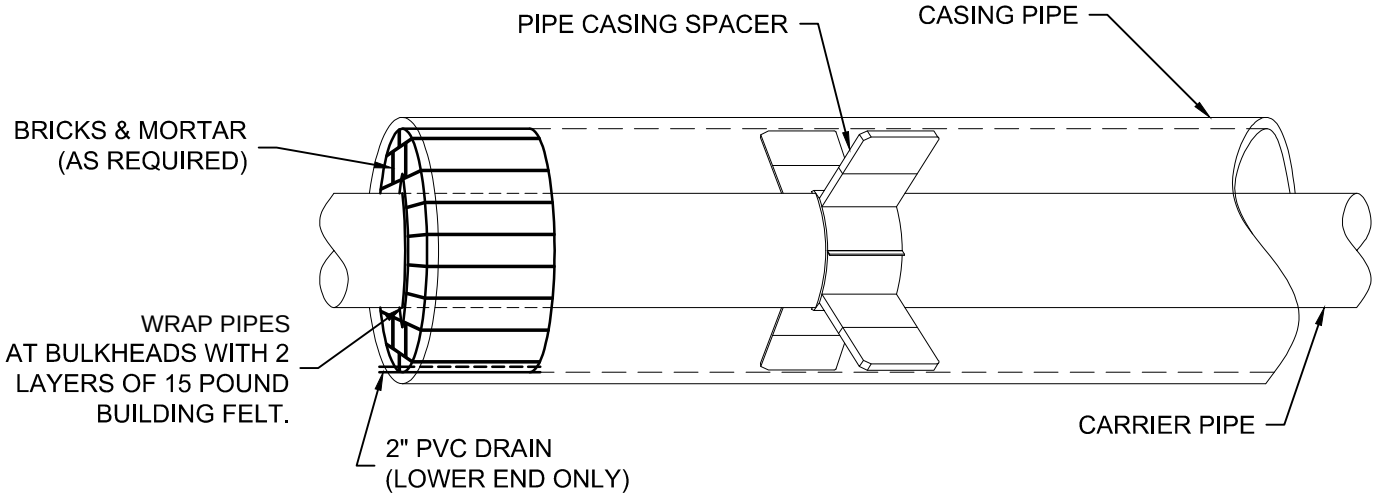

NOTES:

1. CASING SPACERS SHALL BE CCS SERIES BY CASCADE WATERWORKS MFG. ALTERNATE CASING SPACERS MAY BE USED WITH PRIOR APPROVAL FROM OWNER / ENGINEER.
2. TOWN APPROVED CASING SPACERS AND END SEALS SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS. USE A "CENTERED" CONFIGURATION AND PROVIDE THE MANUFACTURER WITH THE FOLLOWING INFORMATION: CARRIER PIPE O.D., CASING PIPE I.D., AND CASING LENGTH.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-06 | CASING SPACERS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |



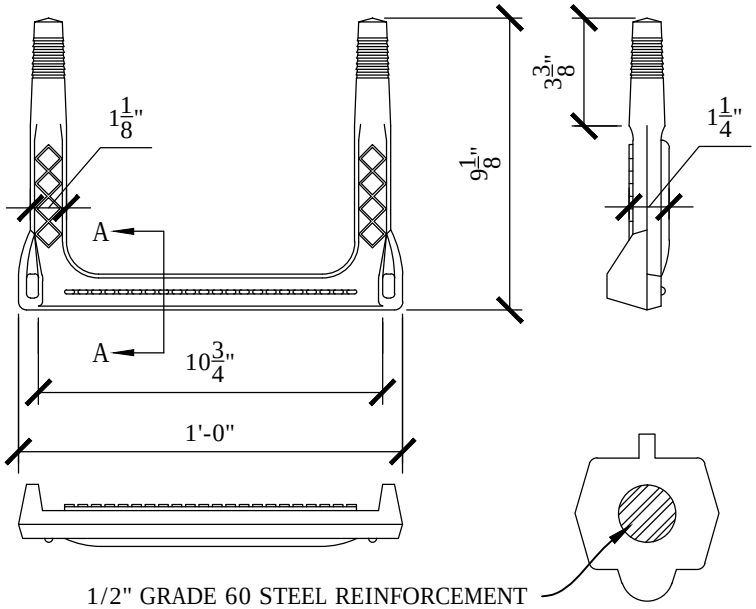

RUBBER END SEAL (3" DIAMETER AND SMALLER CARRIER PIPE)



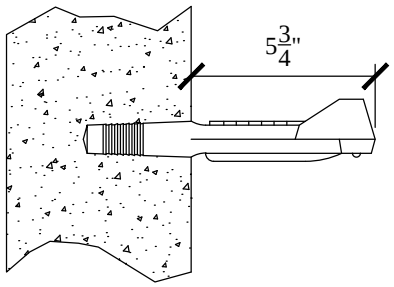

BRICK AND MORTAR END SEAL (4" DIAMETER AND LARGER CARRIER PIPE)

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-07 | CASING END SEALS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

REINFORCED PLASTIC




SECTION A-A



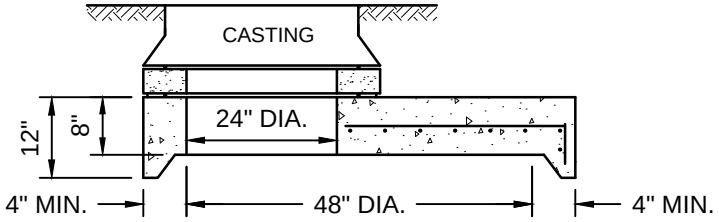

NOTES:

1. STEPS SHALL BE IN ACCORDANCE WITH ASTM C-478 LATEST EDITION.
2. ALTERNATIVE STEPS MAY BE SUBMITTED FOR APPROVAL AT DISCRETION OF TOWN.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STC-08 | STANDARD MANHOLE STEPS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |

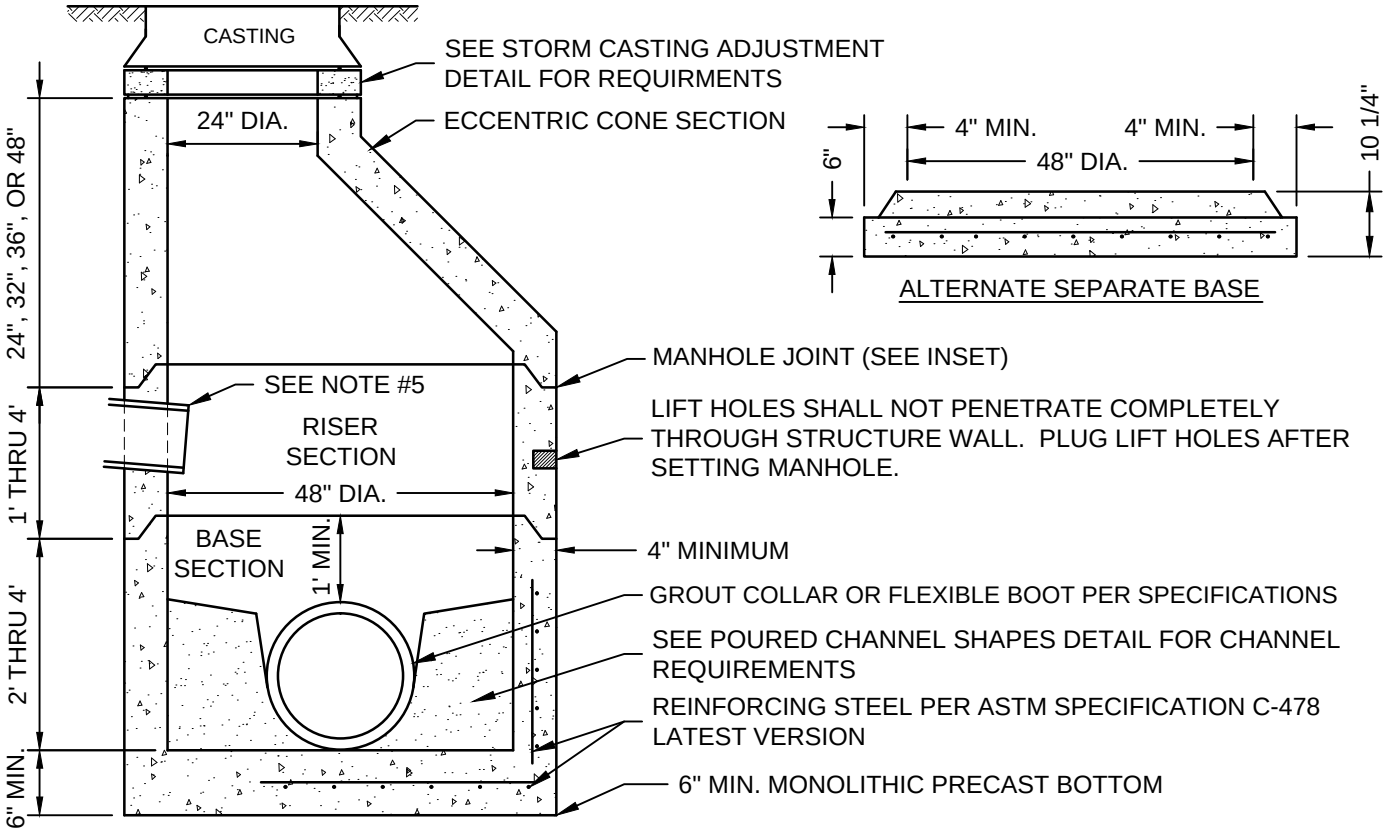
# Storm Sewer Standard Details

ALTERNATE SLAB TOP





MANHOLE JOINT INSET





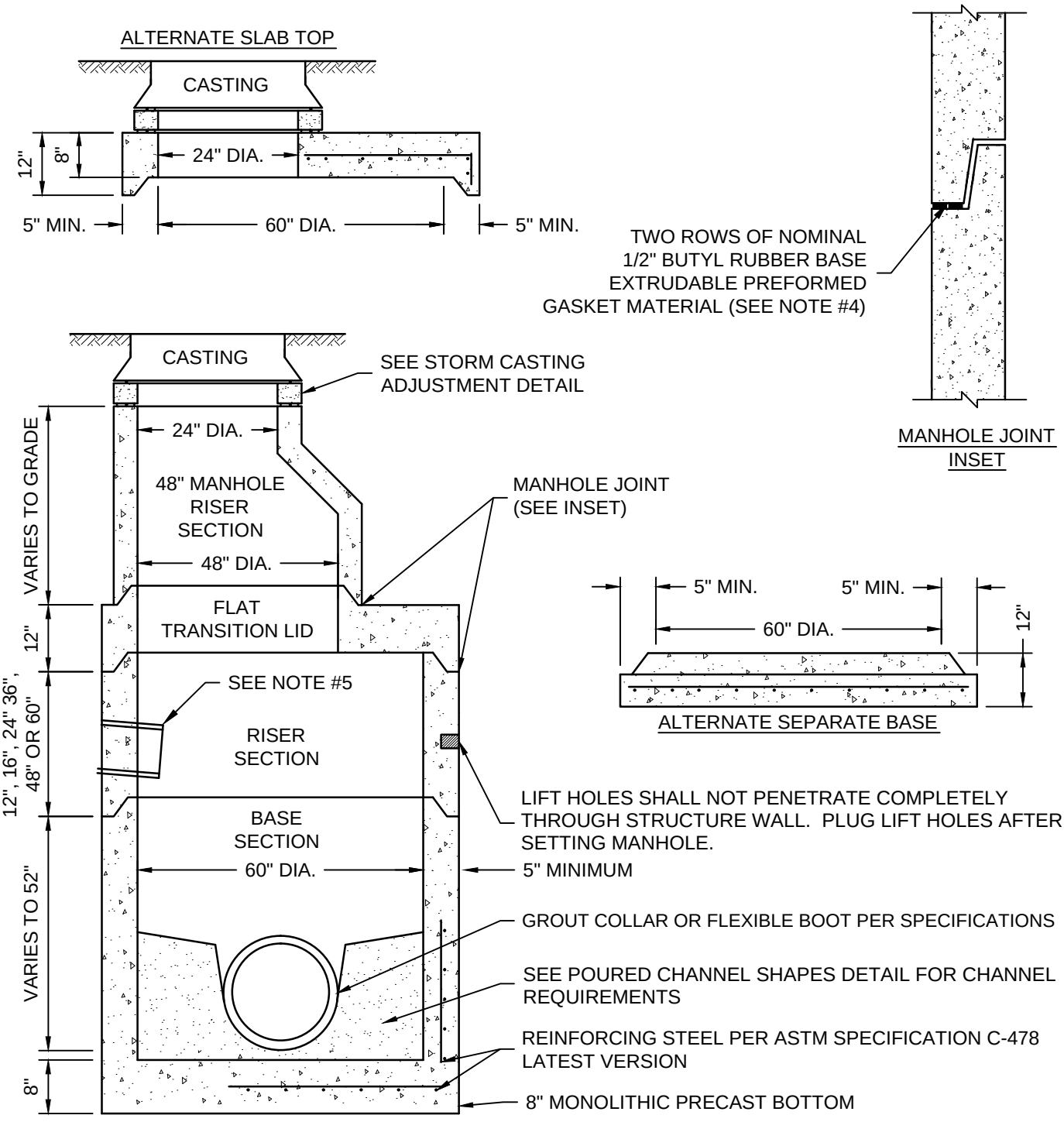


ALTERNATE SEPARATE BASE

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED CRUSHED STONE, 4" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. UNDERDRAIN CONNECTION SHALL BE ABOVE BENCH. SEE PIPE CONNECTION DETAILS FOR REQUIREMENTS.

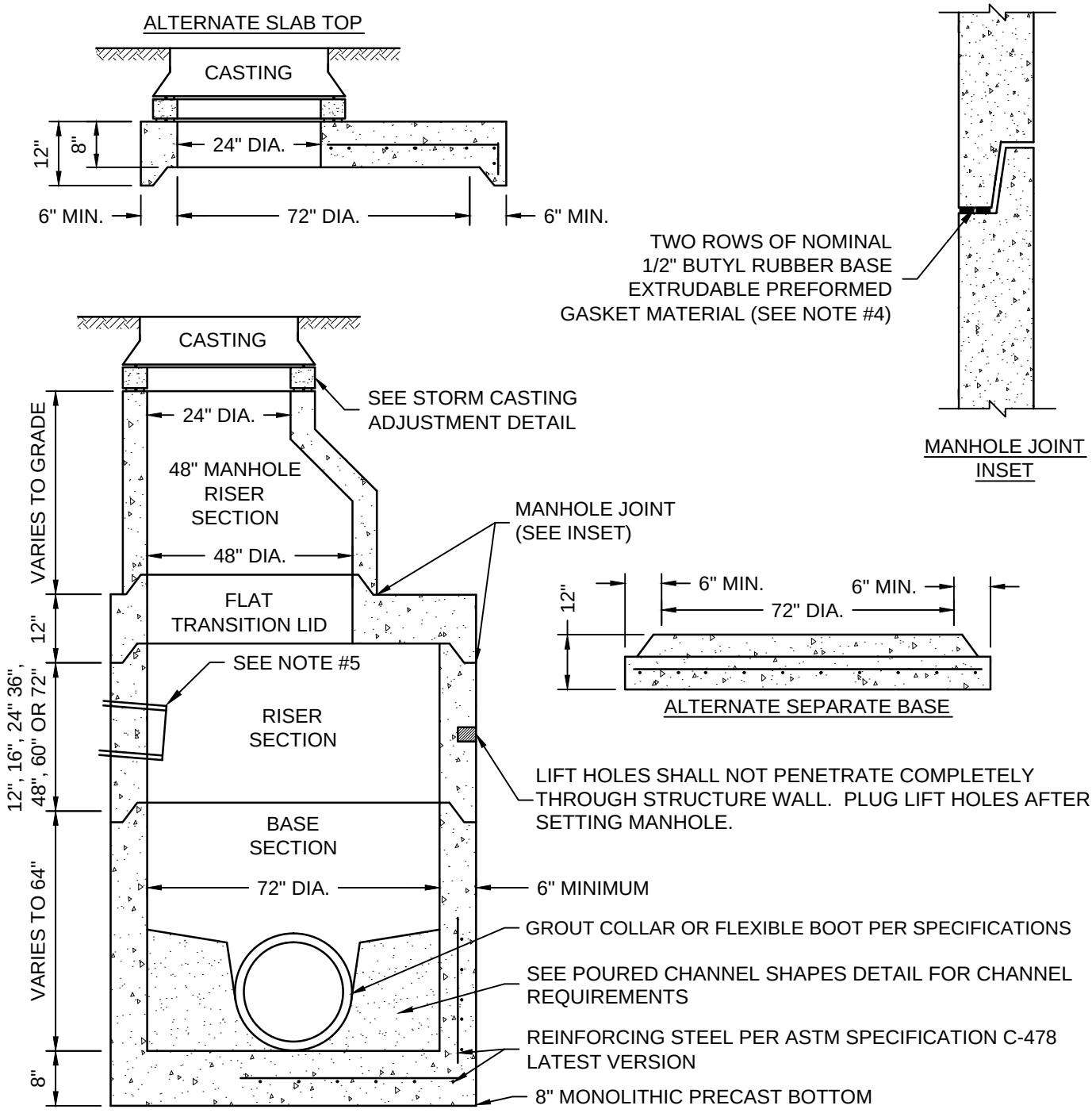
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-01 | 48" STORM MANHOLE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED CRUSHED STONE, 4" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. UNDERDRAIN CONNECTIONS SHALL BE ABOVE BENCH. SEE PIPE CONNECTION DETAILS FOR REQUIREMENTS.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-02 | 60" STORM MANHOLE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

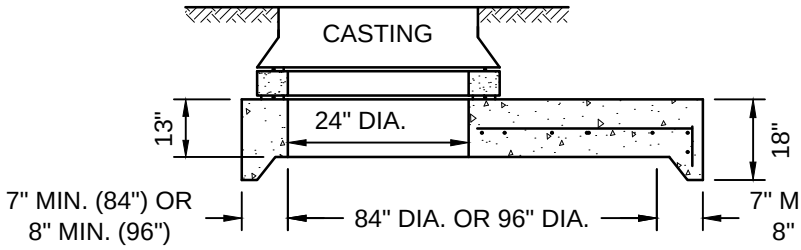


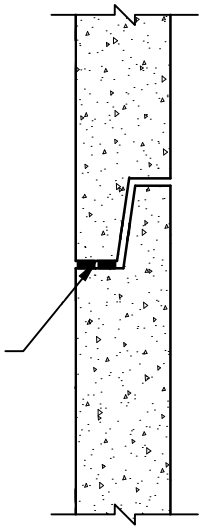

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED CRUSHED STONE, 4" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. UNDERDRAIN CONNECTIONS SHALL BE ABOVE BENCH. SEE PIPE CONNECTION DETAILS FOR REQUIREMENTS.

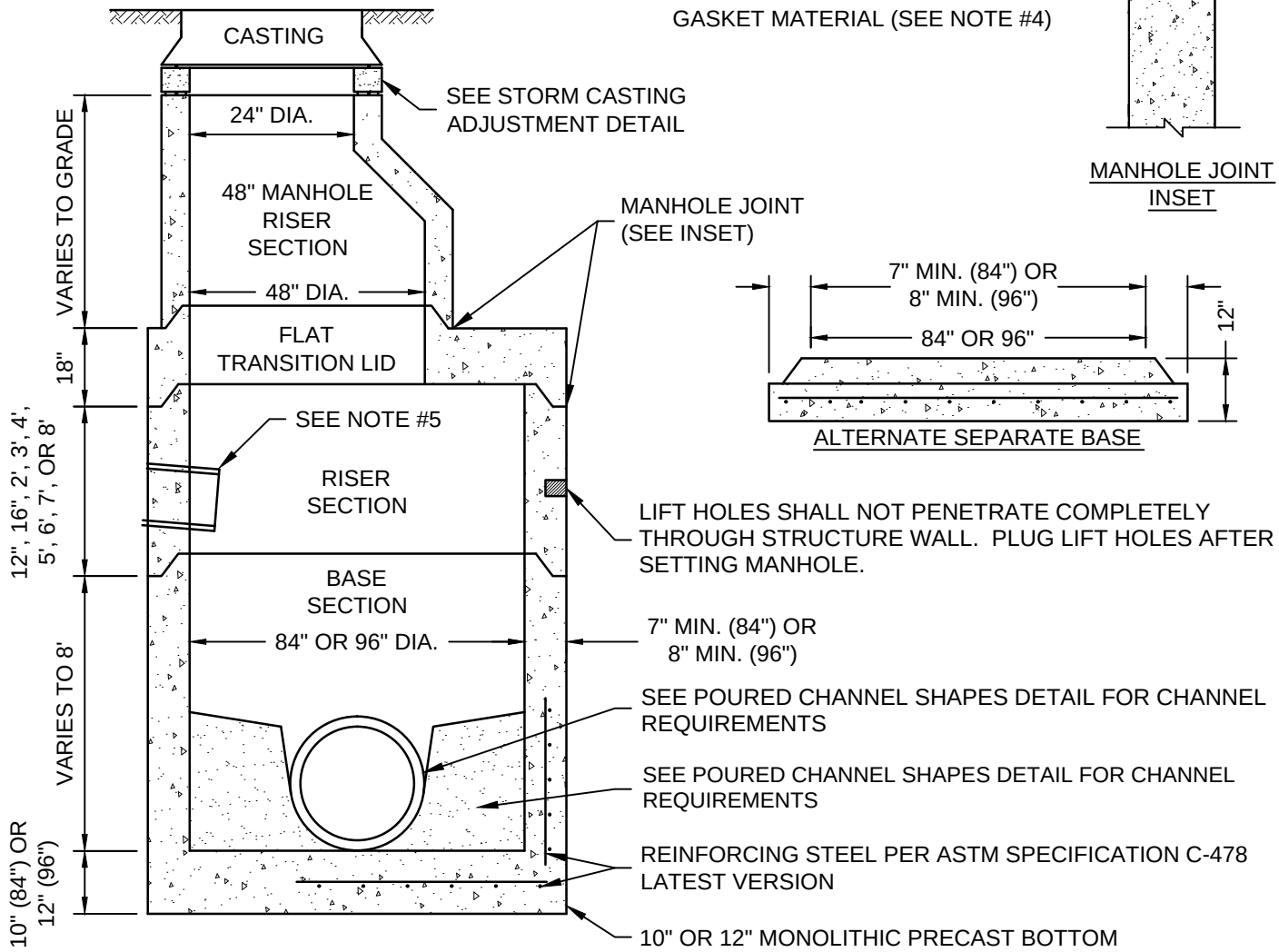
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-03 | 72" STORM MANHOLE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

ALTERNATE SLAB TOP




MANHOLE JOINT
INSET





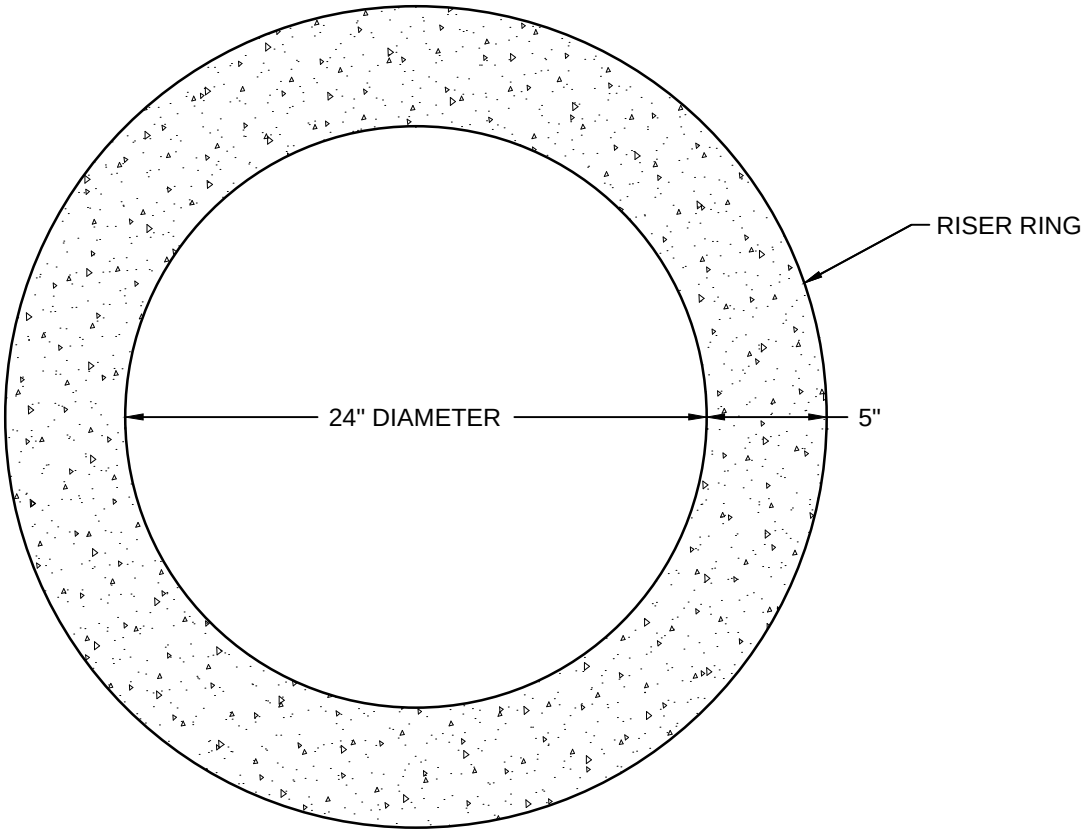


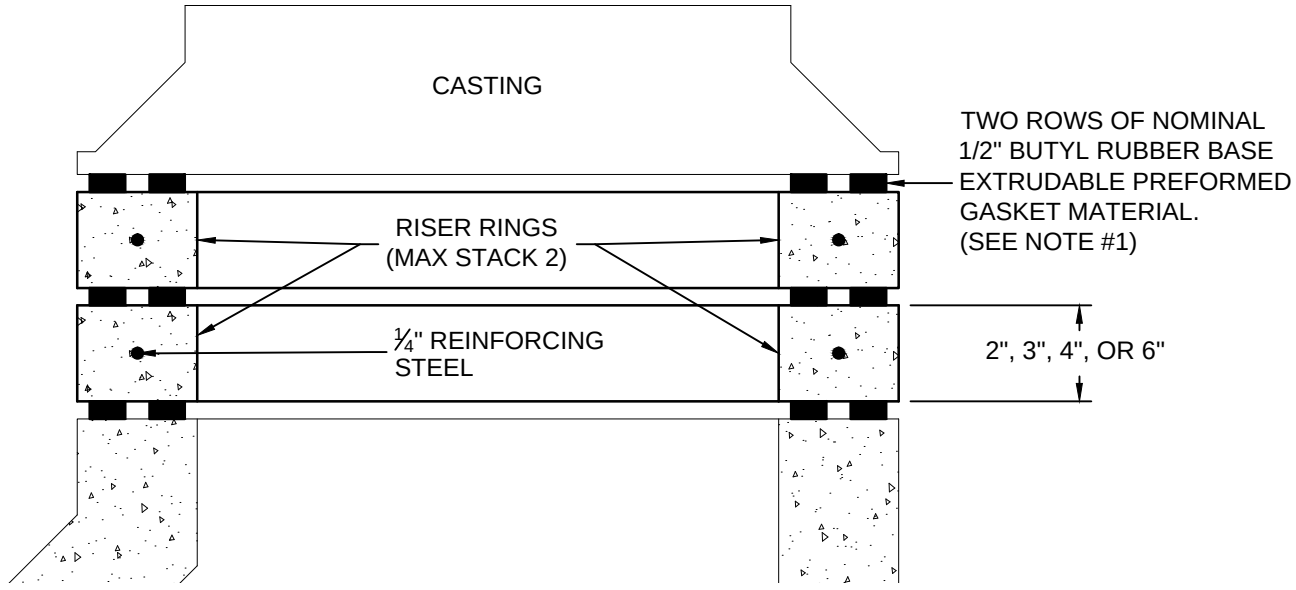
ALTERNATE SEPARATE BASE

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED CRUSHED STONE, 4" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. UNDERDRAIN CONNECTIONS SHALL BE ABOVE BENCH. SEE PIPE CONNECTION DETAILS FOR REQUIREMENTS.

| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-04 | 84"-96" STORM MANHOLE |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

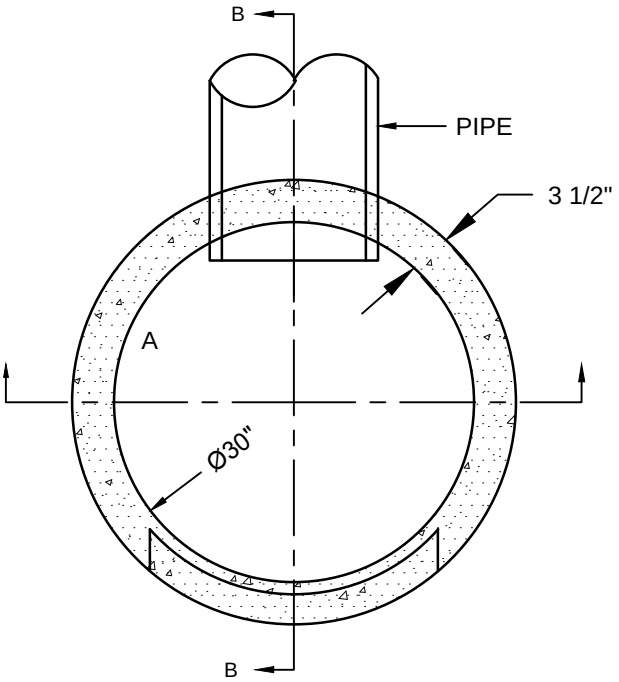


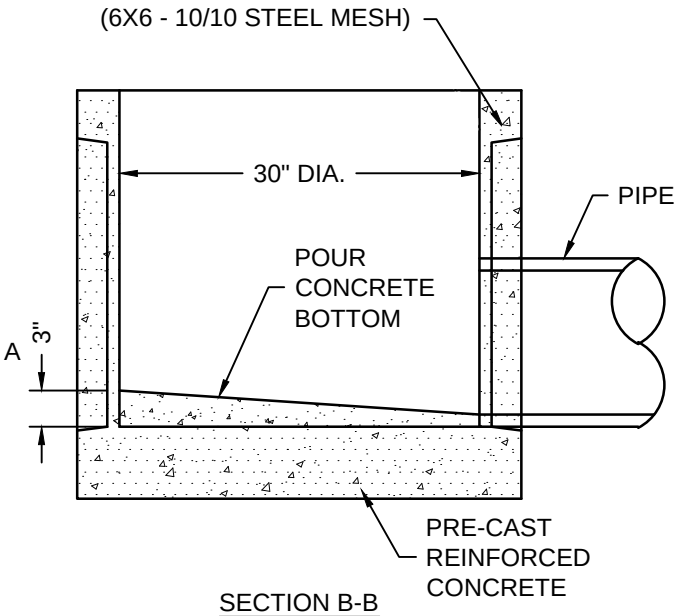

NOTES:

1. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
2. MINIMUM 4,500 PSI CONCRETE SHALL BE USED FOR RISER RINGS, ALTERNATE PRODUCTS MAY BE USED WITH PRIOR APPROVAL FROM THE OWNER.
3. PROVIDE NON- WOVEN GEOTEXTILE WRAP AROUND EXTERIOR OF MANHOLE CHIMNEY PER SPECIFICATIONS.

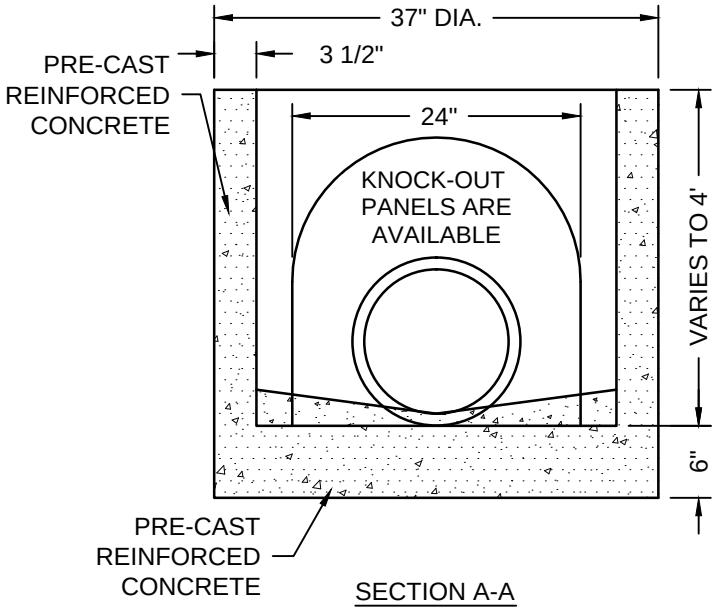
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-05 | STORM CASTING ADJUSTMENT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




PLAN VIEW




SECTION B-B

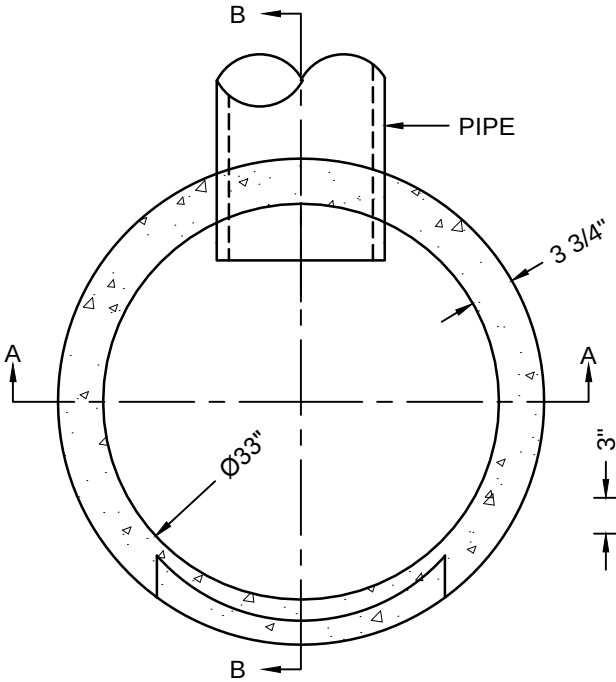



SECTION A-A

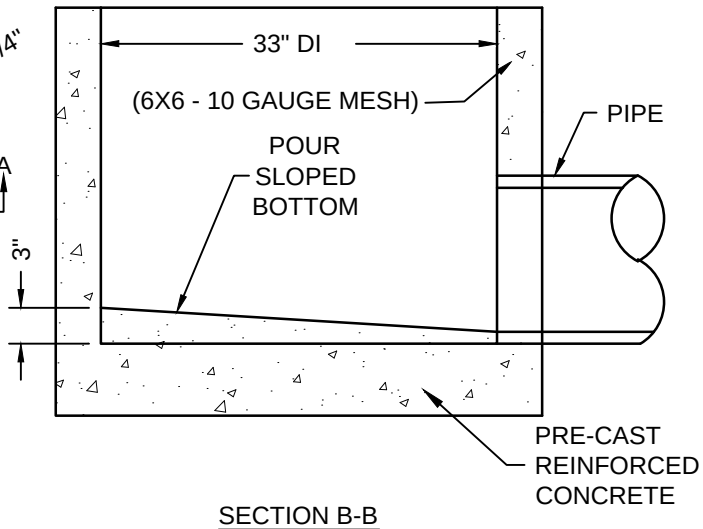
NOTES:

1. ALL CONCRETE TO BE A MINIMUM OF 4500 PSI @ 28 DAYS.
2. MANUFACTURED IN ACCORDANCE WITH ASTM C-478 AND INDOT SPEC. 907.04.
3. MANHOLE JOINTS TO BE TONGUE AND GROOVE WITH BUTYL RUBBER SEALANT OR O-RING PER ASTM C-443.
4. LIFTING HOLES REQUIRE PLUGGING.
5. PIPE CONNECTIONS SHALL BE PER PROJECT SPECIFICATIONS.
6. CONTRACTOR SHALL POUR SLOPED CONCRETE BOTTOM TO ALLOW ADEQUATE DRAINAGE IN INLET.
7. ALL REINFORCING STEEL SHALL MEET OR EXCEED ASTM C-478.
8. SEPARATE BASE AND FLAT TOP ARE PERMITTED UPON WRITTEN APPROVAL OF TOWN.

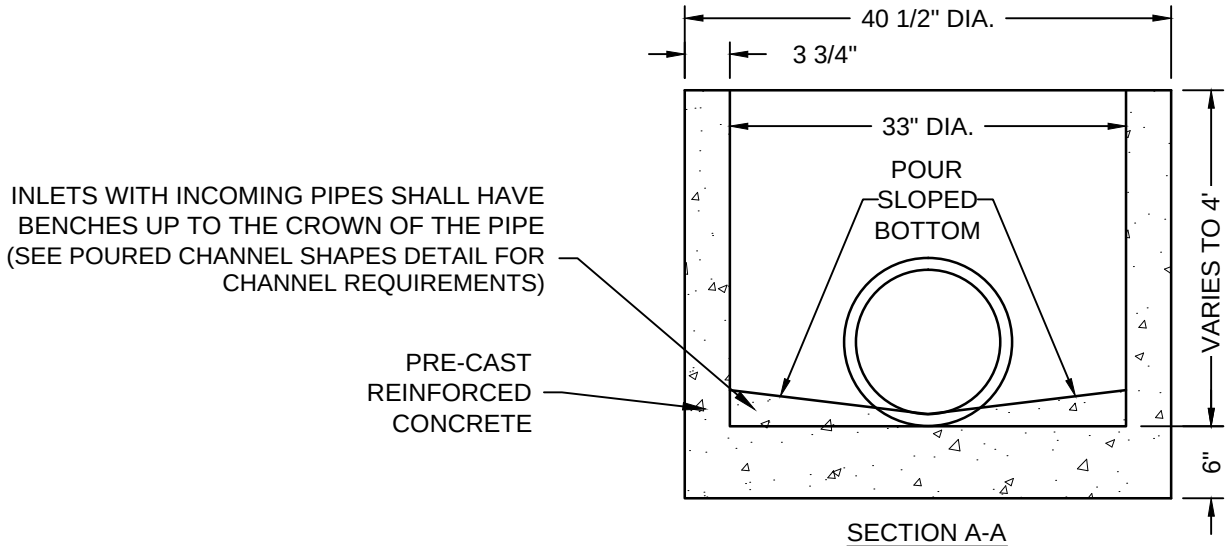
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-06 | 30" STORM INLET | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




PLAN VIEW




SECTION B-B



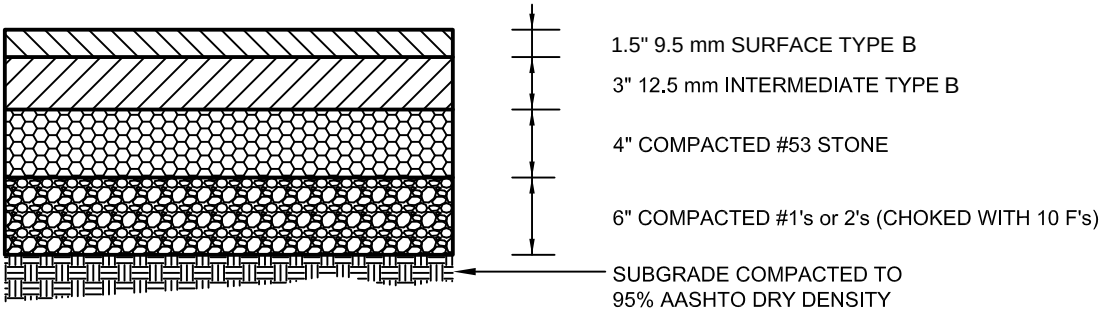

SECTION A-A

NOTES:

1. ALL CONCRETE TO BE A MINIMUM OF 4500 PSI @ 28 DAYS.
2. MANUFACTURED IN ACCORDANCE WITH ASTM C-478 AND INDOT SPEC. 907.04.
3. MANHOLE JOINTS TO BE TONGUE AND GROOVE WITH BUTYL RUBBER SEALANT OR O-RING PER ASTM C-443.
4. LIFTING HOLES REQUIRE PLUGGING.
5. PIPE CONNECTIONS SHALL BE PER PROJECT SPECIFICATIONS.
6. CONTRACTOR SHALL POUR SLOPED CONCRETE BOTTOM TO ALLOW ADEQUATE DRAINAGE IN INLET.
7. ALL REINFORCING STEEL SHALL MEET OR EXCEED ASTM C-478.
8. SEPARATE BASE AND FLAT TOP ARE PERMITTED UPON WRITTEN APPROVAL OF TOWN.

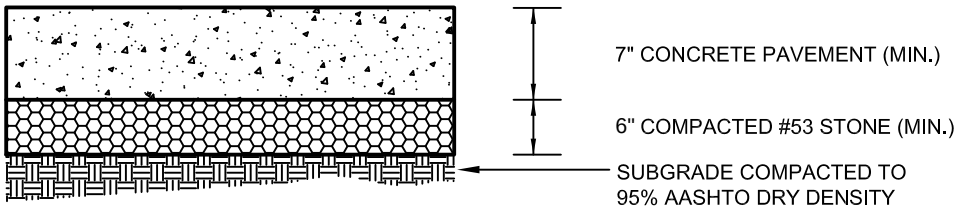
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STM-07 | 33" STORM INLET | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

# Streets Standard Details




## ASPHALT / STONE SECTION

NOT TO SCALE



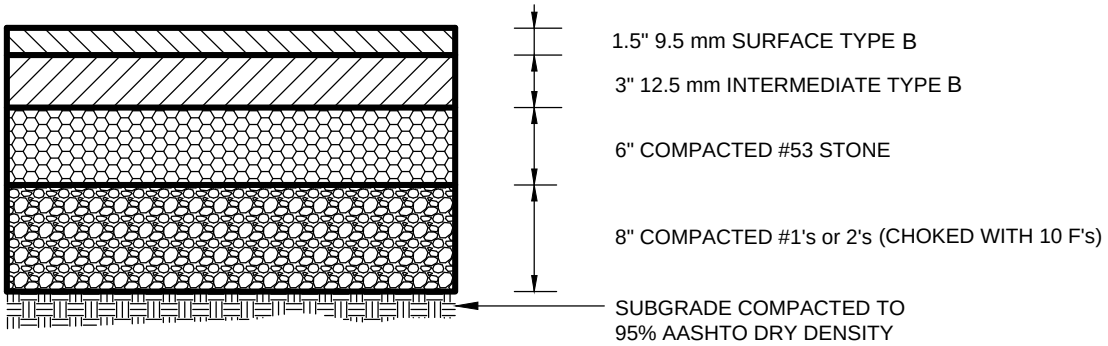

## CONCRETE PAVEMENT SECTION

NOT TO SCALE

NOTES:

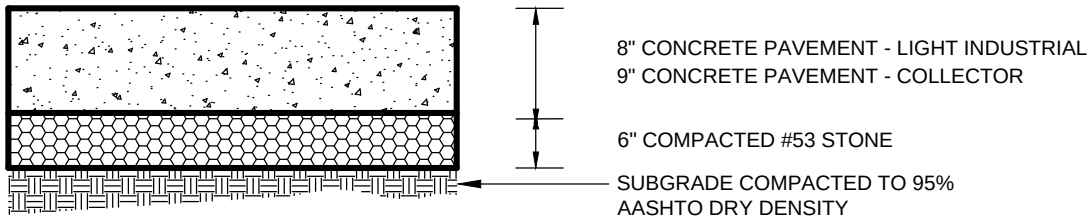
1. THE TOWN MAY AUTHORIZE ALTERNATE PAVEMENT CROSS SECTIONS UPON PROJECT-SPECIFIC REVIEW. CROSS SECTIONS SHOWN ARE INTENDED FOR NEW CONSTRUCTION.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-01 | RESIDENTIAL / LOCAL PAVEMENT<br>PAVEMENT SECTIONS | |
| | STANDARD DRAWINGS | APPROVED: XX/XX/XX | REVISED: XX/XX/XX | SCALE: NONE |




## ASPHALT / STONE SECTION

NOT TO SCALE



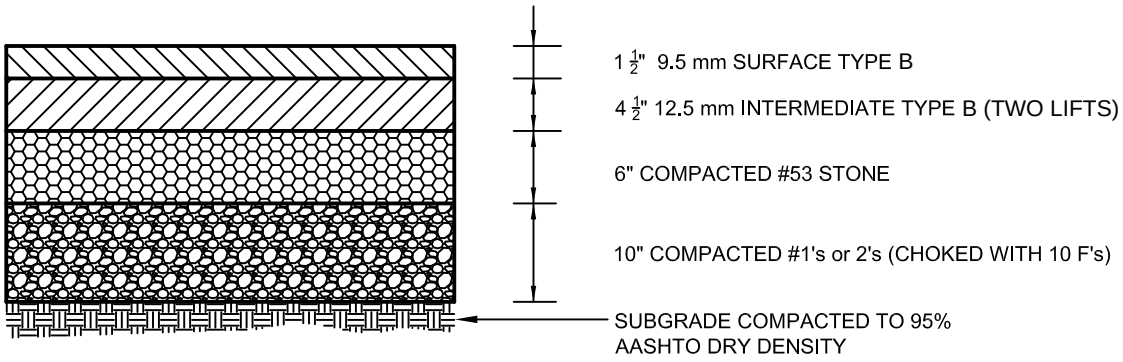

## CONCRETE PAVEMENT SECTION

NOT TO SCALE

NOTES:

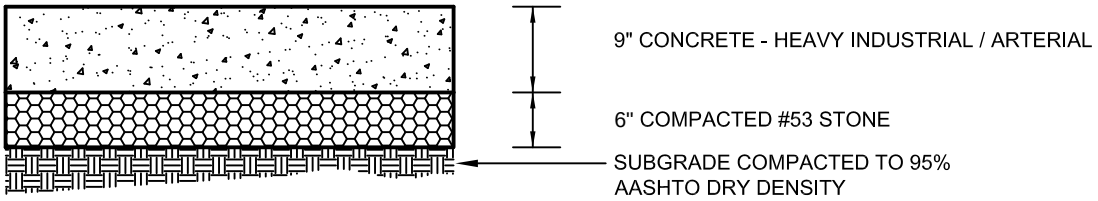
1. THE TOWN MAY AUTHORIZE ALTERNATE PAVEMENT CROSS SECTIONS UPON PROJECT- SPECIFIC REVIEW. CROSS SECTIONS SHOWN ARE INTENDED FOR NEW CONSTRUCTION.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-02 | COLLECTOR / LIGHT INDUSTRIAL PAVEMENT SECTIONS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




## ASPHALT / STONE SECTION

NOT TO SCALE



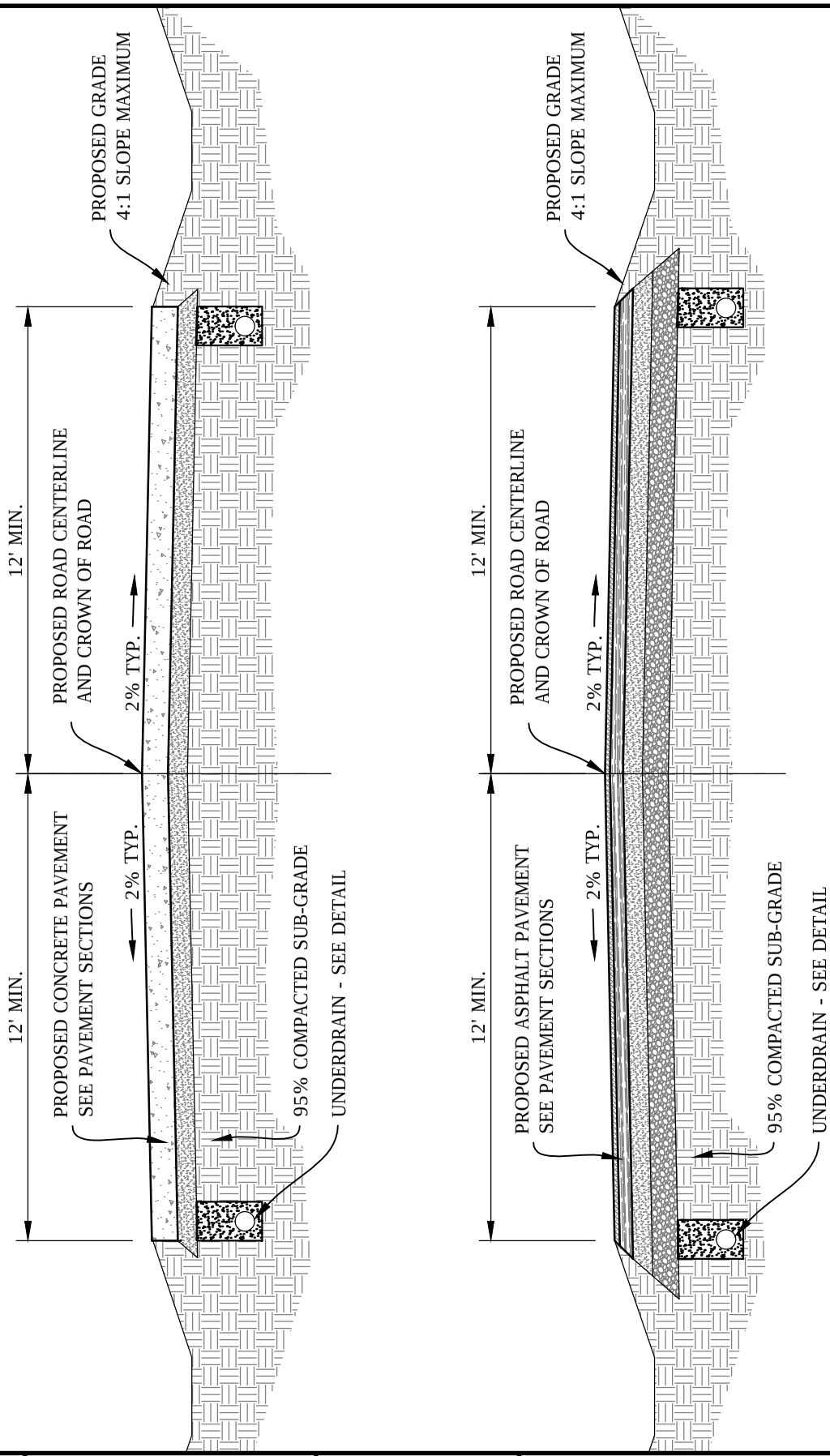

## CONCRETE PAVEMENT SECTION

NOT TO SCALE

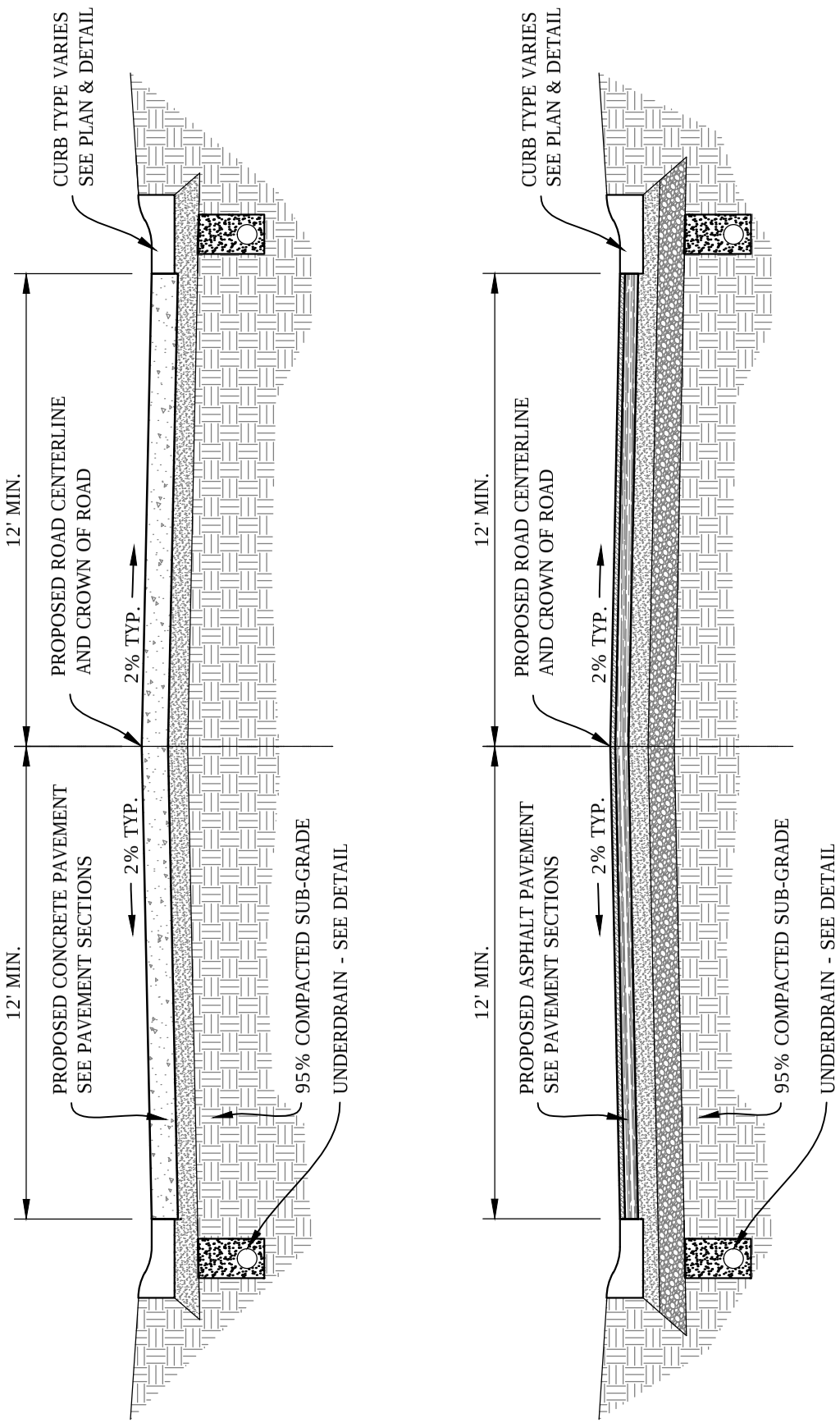
NOTES:

1. THE TOWN MAY AUTHORIZE ALTERNATE PAVEMENT CROSS SECTIONS UPON PROJECT-SPECIFIC REVIEW. CROSS SECTIONS SHOWN ARE INTENDED FOR NEW CONSTRUCTION.

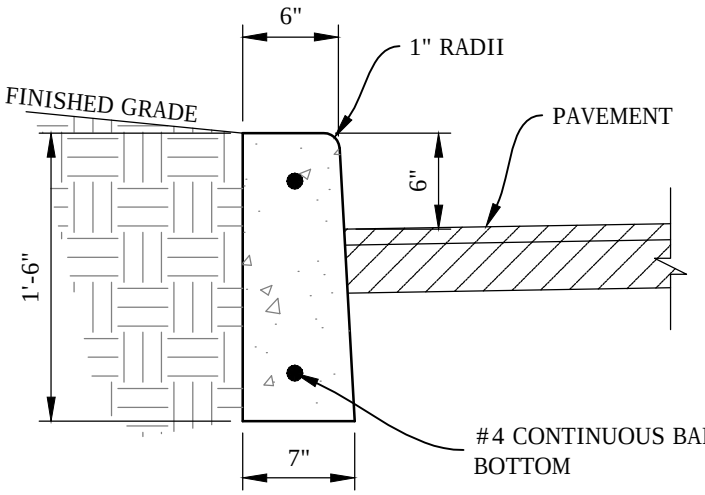
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-03 | ARTERIAL / HEAVY INDUSTRIAL PAVEMENT SECTIONS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-04 | ROADWAY CROSS SECTION<br>WITHOUT CURB AND GUTTER |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: / SCALE: AS NOTED |

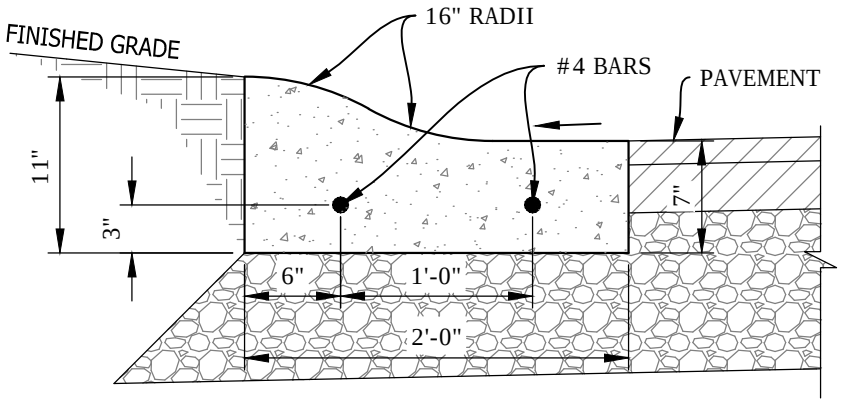



| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-05 | ROADWAY CROSS SECTION<br>WITH CURB & GUTTER |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |



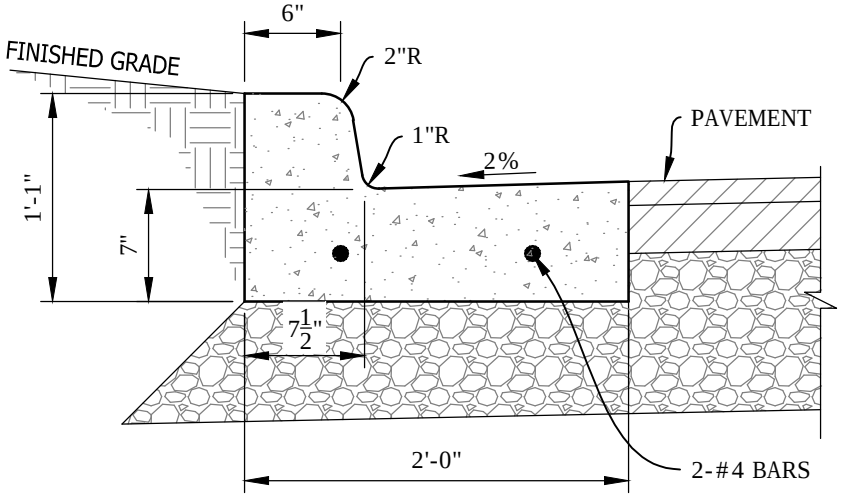

JOINTS:
PROVIDE WEAKNESS JOINTS & CONTROL JOINTS PER SPECIFICATIONS

## 6" VERTICAL CURB




JOINTS:
PROVIDE WEAKNESS JOINTS & CONTROL JOINTS PER SPECIFICATIONS

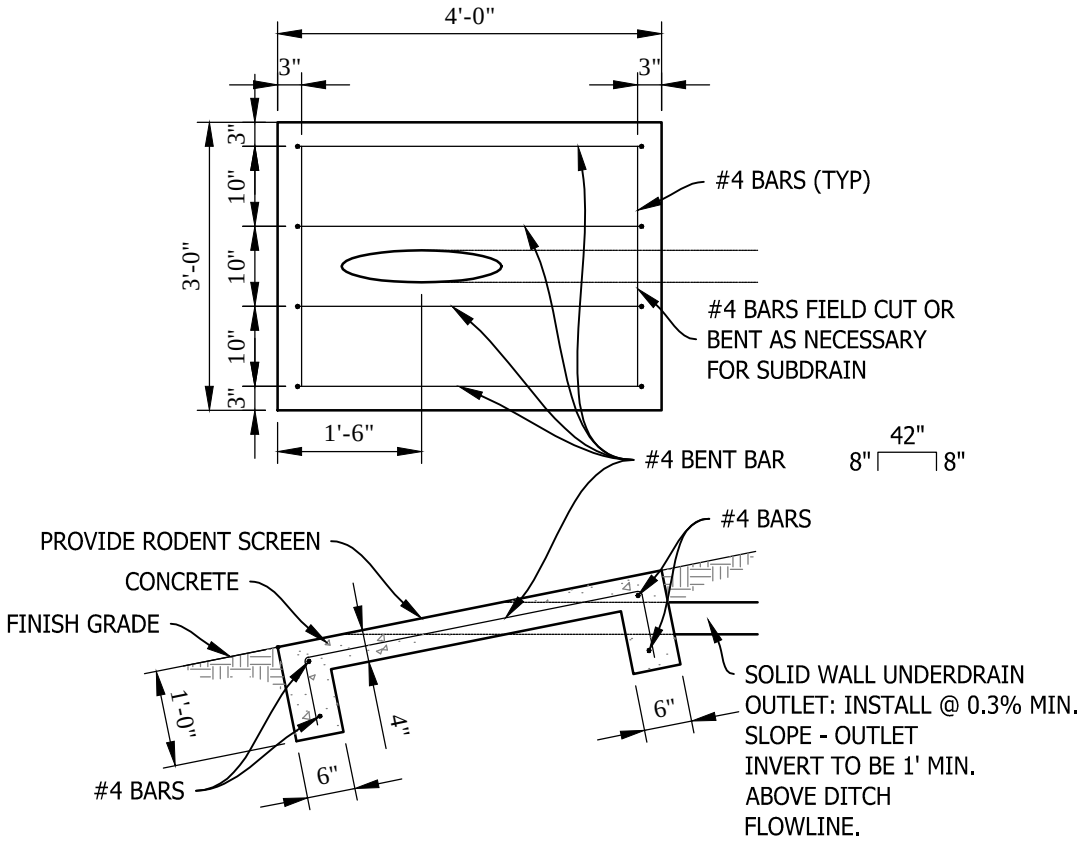
## ROLLED CURB & GUTTER TYPE C



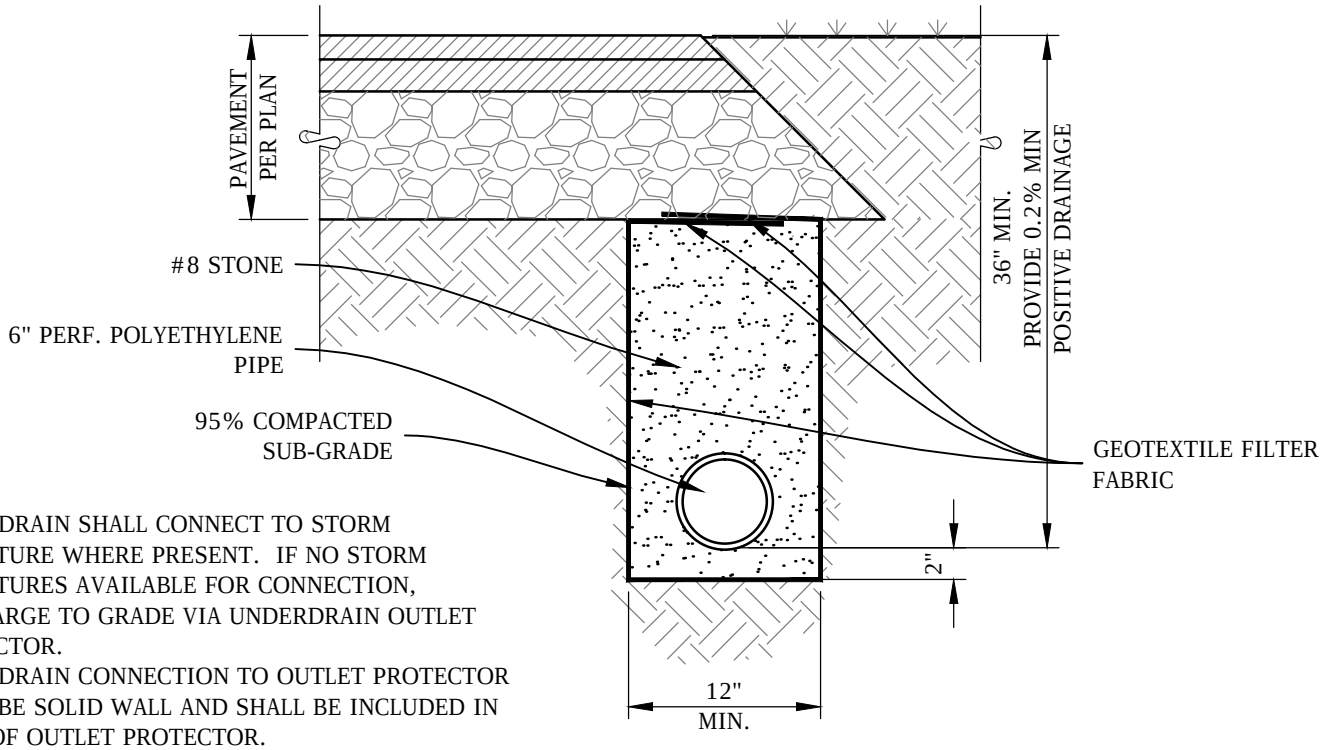

JOINTS:
PROVIDE WEAKNESS JOINTS & CONTROL JOINTS PER SPECIFICATIONS

## CURB & GUTTER TYPE A

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-06 | CONCRETE CURB & GUTTER | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




# UNDERDRAIN OUTLET PROTECTOR

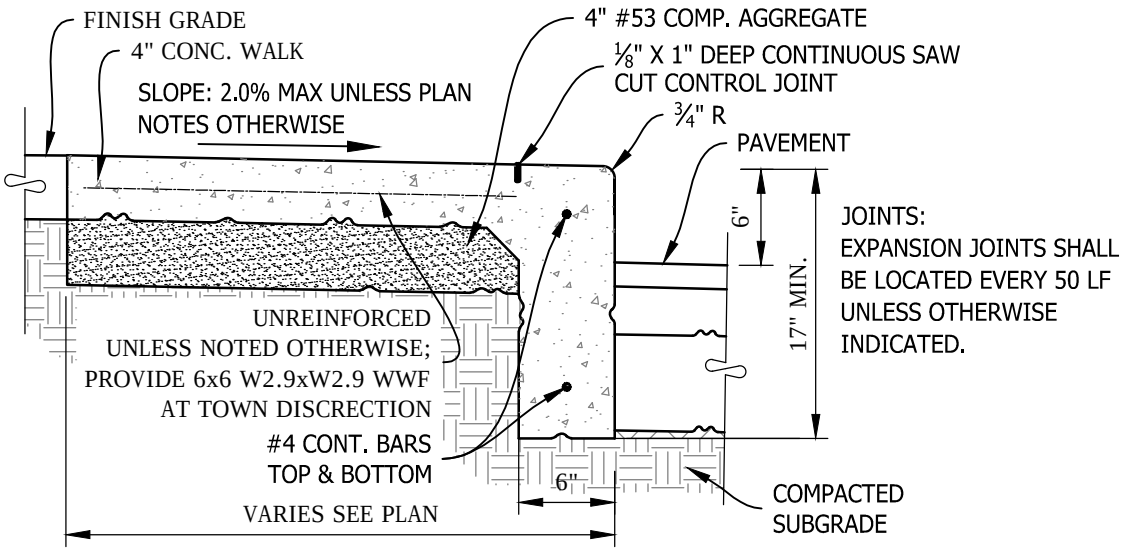



NOTES:

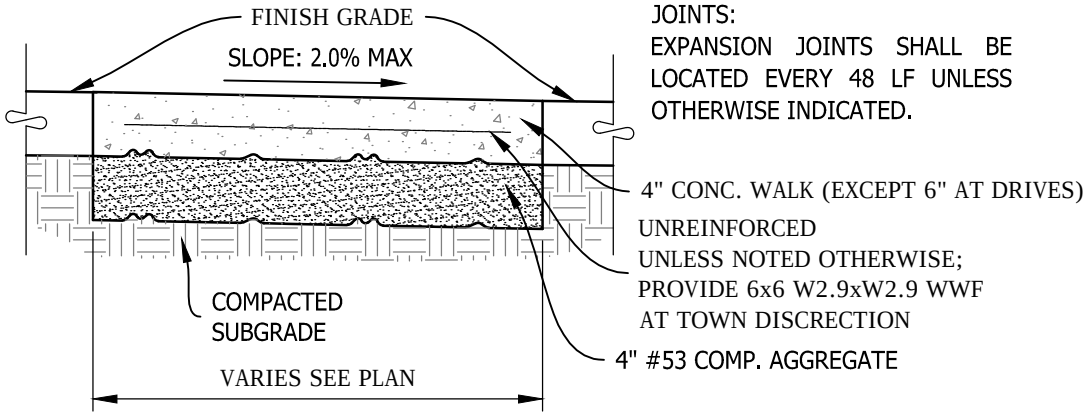
1. UNDERDRAIN SHALL CONNECT TO STORM STRUCTURE WHERE PRESENT. IF NO STORM STRUCTURES AVAILABLE FOR CONNECTION, DISCHARGE TO GRADE VIA UNDERDRAIN OUTLET PROTECTOR.
2. UNDERDRAIN CONNECTION TO OUTLET PROTECTOR SHALL BE SOLID WALL AND SHALL BE INCLUDED IN COST OF OUTLET PROTECTOR.

# UNDERDRAIN

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-07 | UNDERDRAIN DETAILS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




# CURB FACE WALK

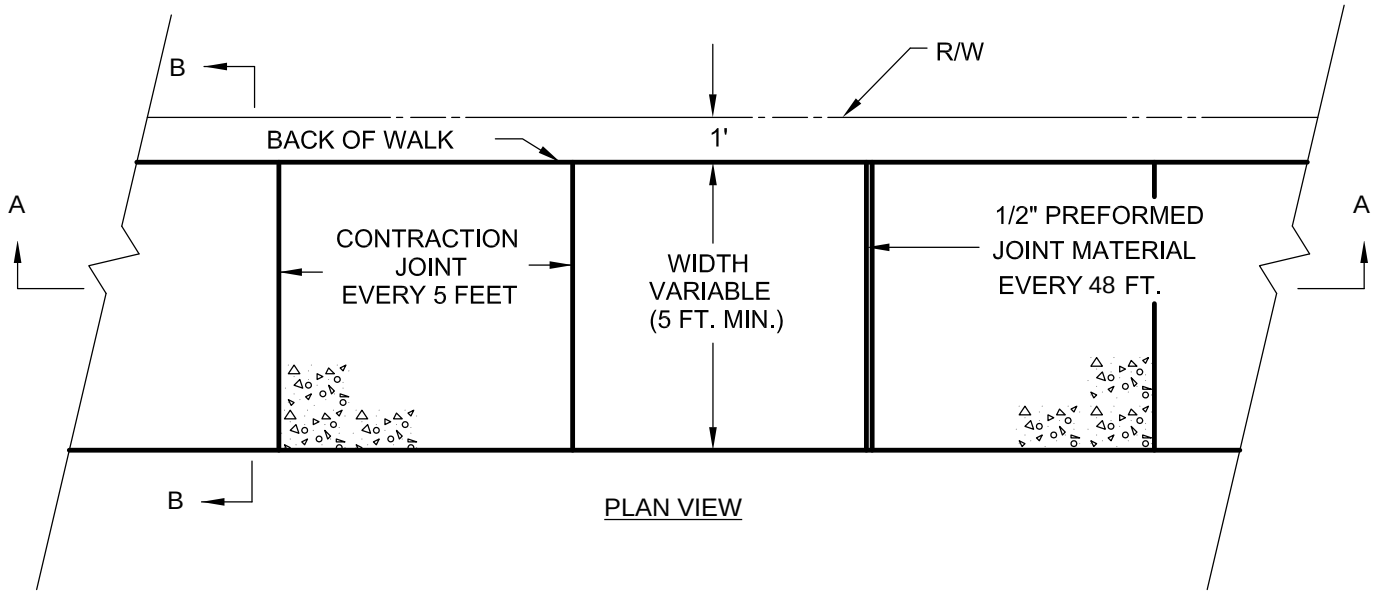



# STANDARD SIDEWALK

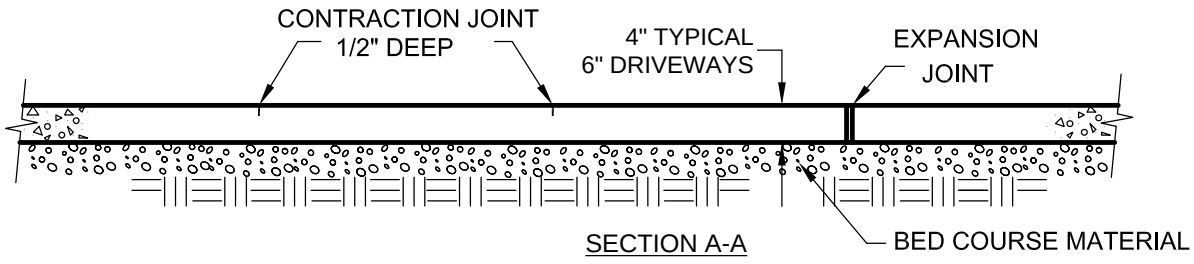
NOTES:

1. CEMENT TYPE: CLASS A CONCRETE, 4000PSI AT 28 DAYS.
2. DEPTH OF CONCRETE: 4" TYPICAL, 6" AT DRIVEWAY CROSSINGS.
3. EXPANSION JOINTS: 1/2" THICK PRE-FORMED EXPANSION JOINT MATERIAL SHALL BE INSTALLED IN THE FOLLOWING LOCATIONS:
   A. WHERE NEW SIDEWALK ABUTS AN EXISTING SIDEWALK, DRIVEWAY, OR CURB.
   B. EVERY 48' IN SIDEWALKS.
4. SCORED CONSTRUCTION JOINTS: ¾" TO 1 ¼" DEEP AT 5' INTERVALS.
5. CROSS SLOPE: NOT TO EXCEED 2.0%, WITH THE LOWEST PART OF THE SIDEWALK ABOVE THE ADJACENT CURB.
6. SURFACE FINISH: LIGHT BROOM FINISH APPLIED FROM SIDE-TO-SIDE OF THE SIDEWALK.
7. ADA COMPLIANCE: ALL CONSTRUCTION SHALL BE IN COMPLIANCE WITH THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT.
8. CONCRETE SIDEWALK SHALL BE FORMED WITH FORMS, FULL DEPTH, AND NOT EARTH FORMED.
9. CURB FACE WALK MAY BE UTILIZED WITH PERMISSION OF TOWN. SUBMIT DETAIL FOR APPROVAL.
10. CURB RAMPS SHALL MEET ALL REQUIREMENTS OF THE PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES. SUBMIT DETAILS FOR APPROVAL.

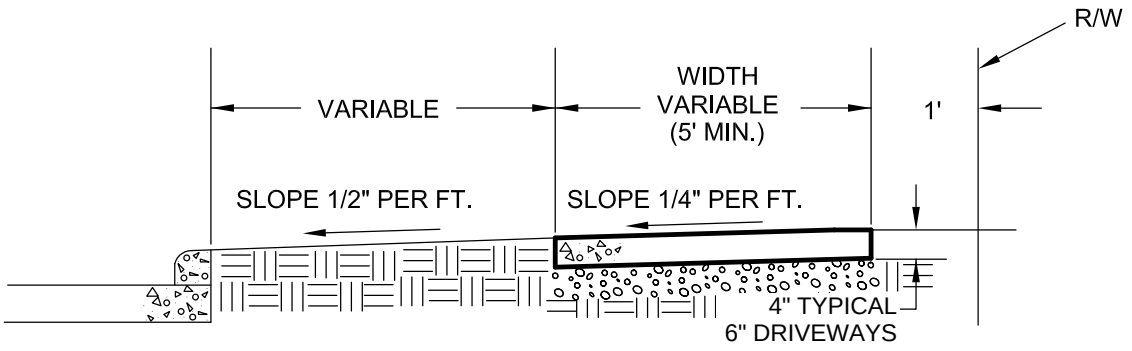
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-08 | SIDEWALK CROSS SECTIONS & REQUIREMENTS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




PLAN VIEW



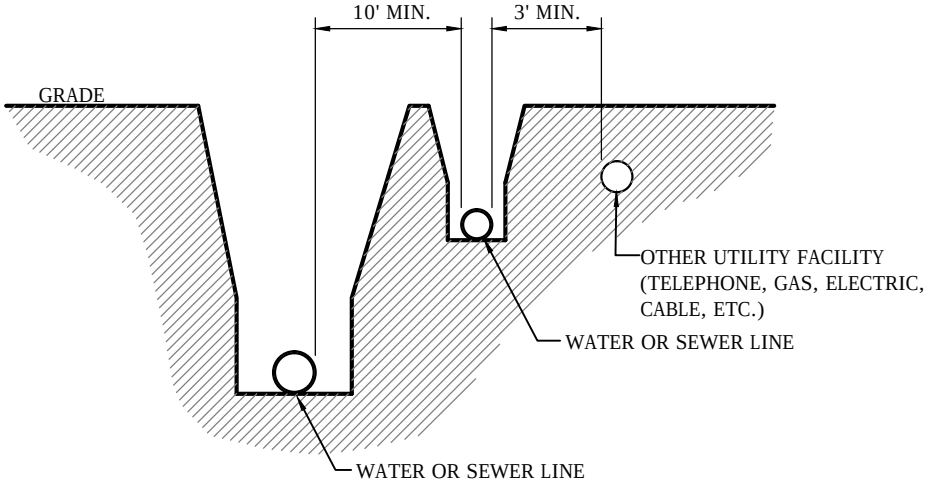

SECTION A-A



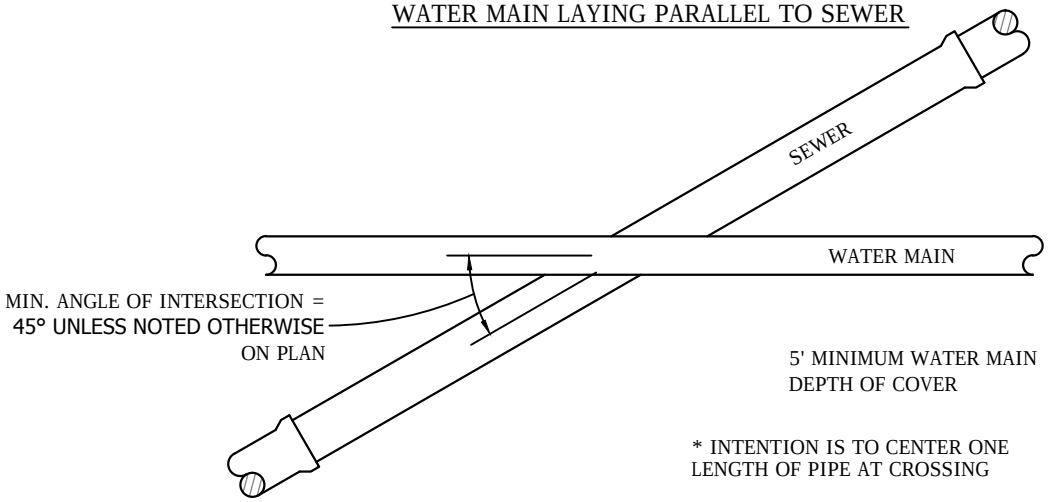

SECTION B-B

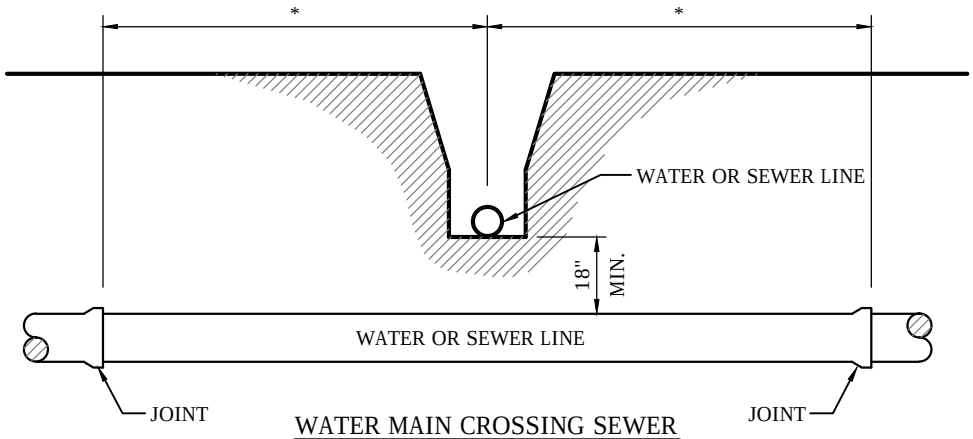
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | STR-09 | TYPICAL CONCRETE SIDEWALK | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

# Water Standard Details




WATER MAIN LAYING PARALLEL TO SEWER



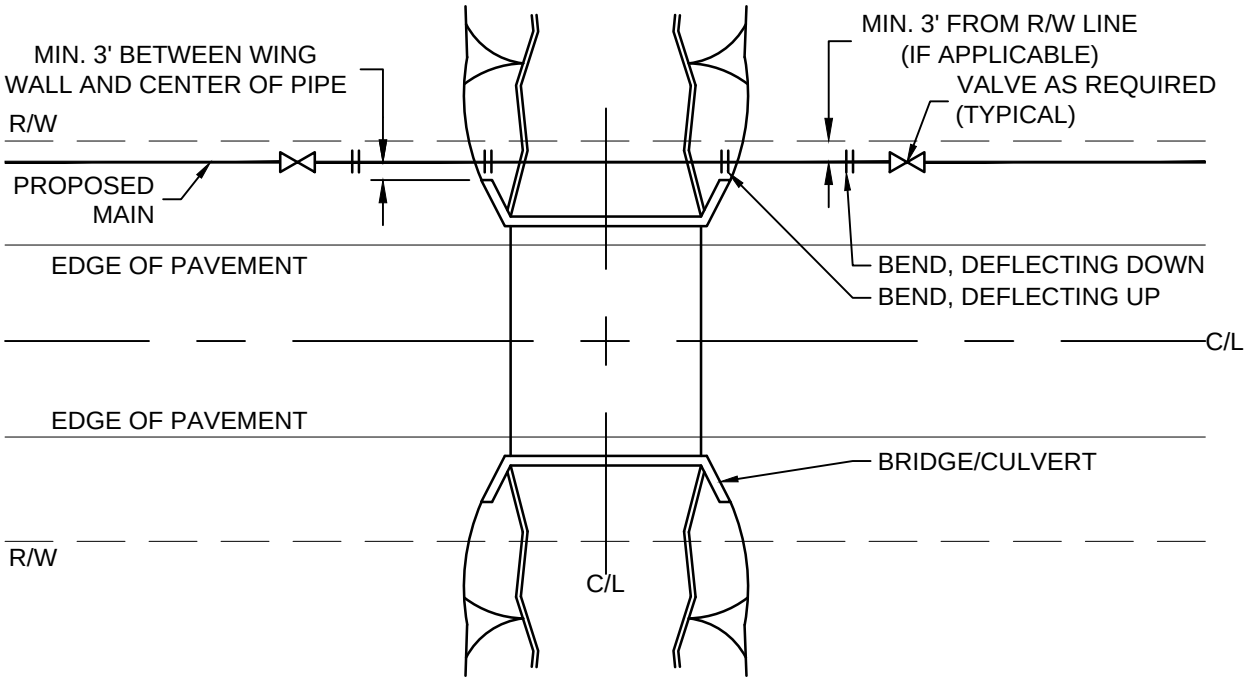



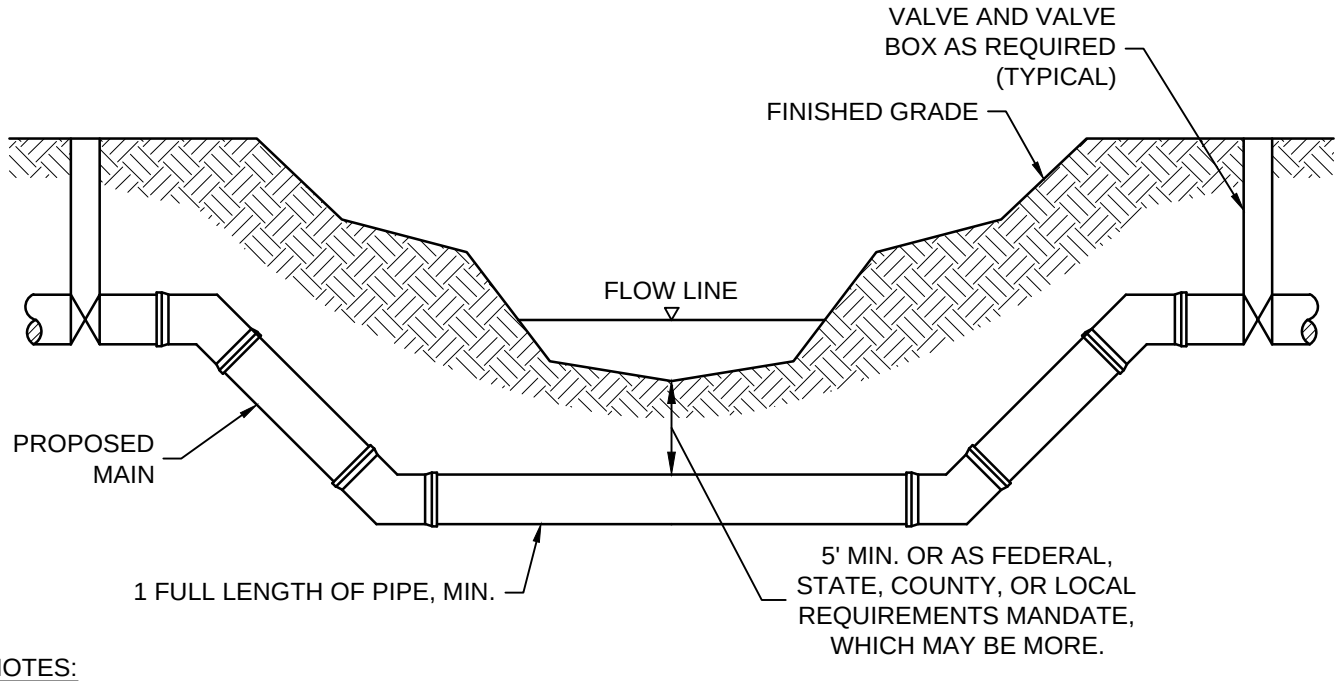

WATER MAIN CROSSING SEWER

NOTES:

1. WATER MAIN SHALL NOT BE LOCATED IN THE SAME TRENCH AS SANITARY SEWERS.
2. SEPARATION OF 3FT. HORIZONTAL WITH ANY UTILITY REQUIRED.
3. 5' MINIMUM DEPTH OF COVER ON WATER MAIN.
4. PREFERENCE IS FOR THE WATER MAIN TO BE LOCATED ABOVE ALL SEWERS.

| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-01 | SEWER & WATER<br>MAIN SEPARATION |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |

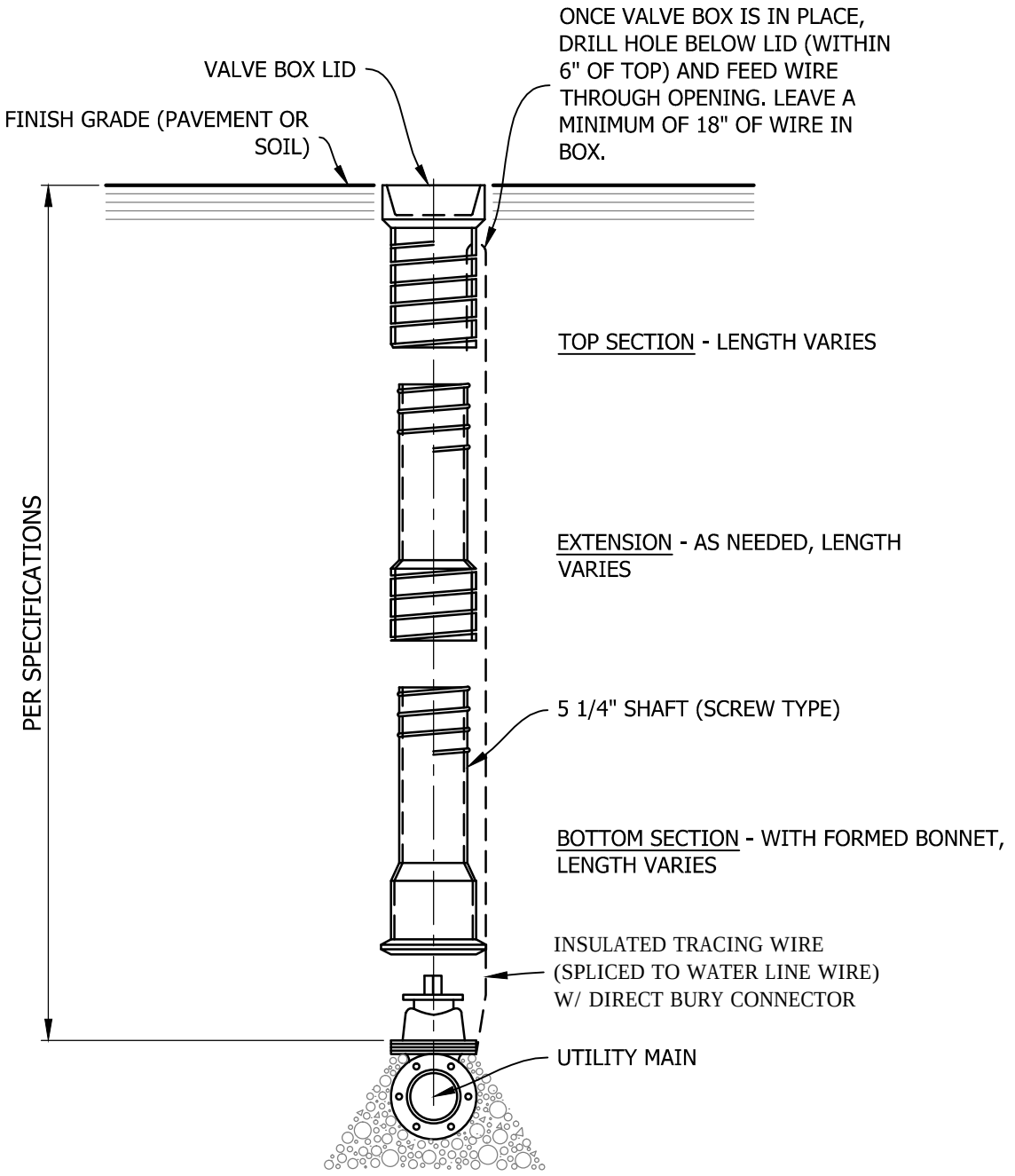



NOTES:

1. EXCAVATION WITHIN STREAM BED TO BE BACKFILLED WITH APPROVED MATERIAL AND COMPACTED. RESTRAIN PER PROJECT PLANS.
2. FOR WATER MAINS 12" AND LARGER, 22 1/2° BENDS SHALL BE USED.
3. RIPRAP ENTIRE WIDTH OF TRENCH + 12" EACH SIDE FROM TOP OF BANK TO TOP OF BANK. PROVIDE 18" REVETMENT RIPRAP, 24" CLASS I RIPRAP, OR 30" CLASS II RIPRAP OVER GEOTEXTILES AS REQUIRED BY PERMITTING AGENCY.

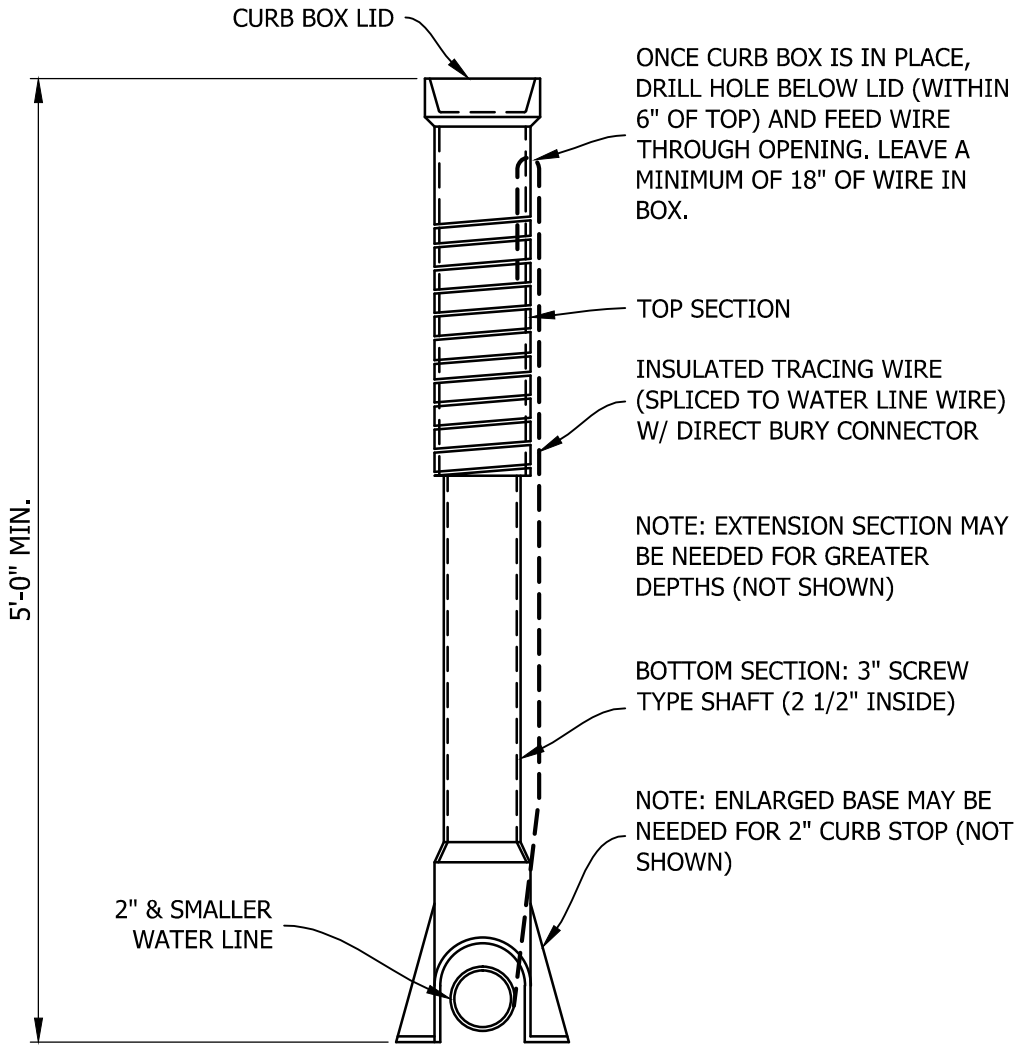
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-02 | TYPICAL CHANNEL CROSSING | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. ALL VALVE BOXES SHALL BE CAST IRON, BUFFALO SCREW STYLE WITH THE WORD "WATER" OR "SEWER" CAST IN THE LID AS APPROPRIATE.
2. VALVE BOX SHALL BE TWO OR THREE PIECE TYPE WITH A ROUND BASE AND 5 1/4" SHAFT SIZE.
3. PROVIDE POSI-CAP ALIGNMENT DEVICE PER SPECIFICATIONS.

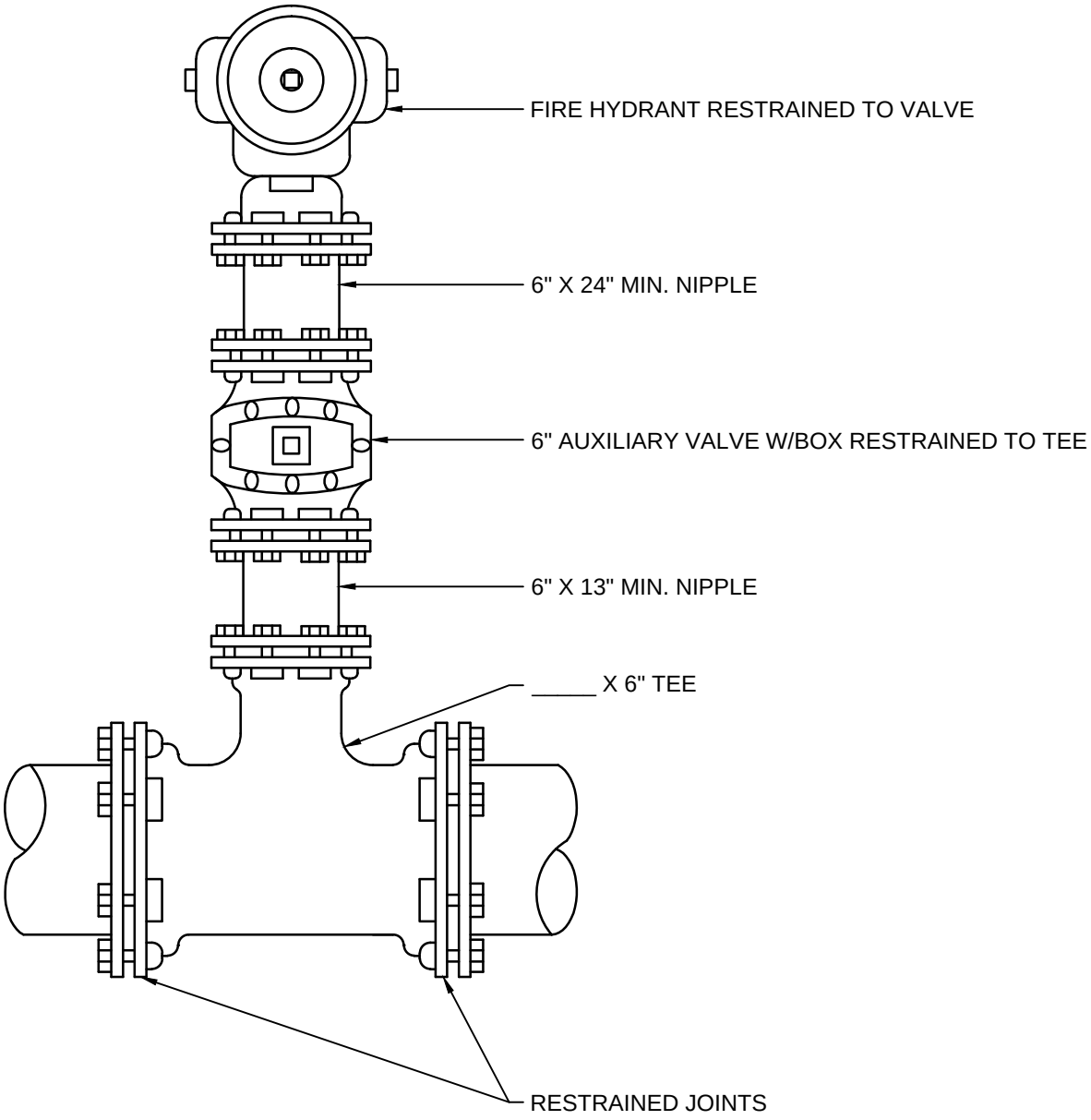
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-03 | VALVE BOX | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




NOTES:

1. ALL CURB BOXES SHALL BE CAST IRON, BUFFALO SCREW STYLE WITH THE WORD "WATER" OR "SEWER" CAST IN THE LID AS APPROPRIATE.
2. CURB BOX SHALL BE TWO PIECE TYPE WITH A 3" SHAFT SIZE (2 1/2" INSIDE).
3. THE LID SHALL BE HELD IN PLACE BY A STANDARD BRASS PENTAGON HEAD SCREW.

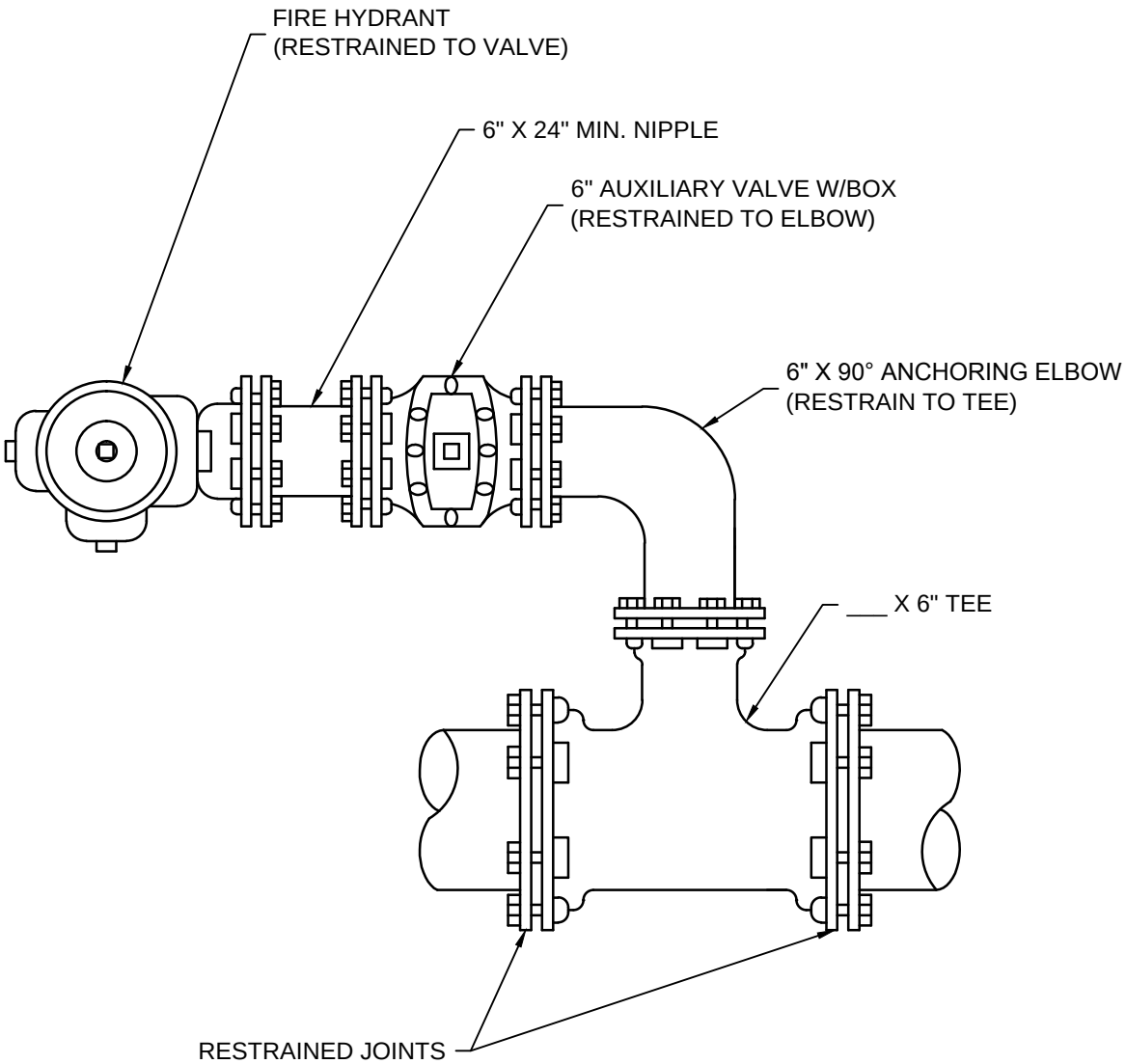
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-04 | CURB BOX | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




NOTES:

1. THIS ARRANGEMENT CAN BE USED ON ALL SIZES OF MAINS.
2. FIRE HYDRANTS SHALL BE INSTALLED PER "STANDARD FIRE HYDRANT SETTING" DETAIL.
3. ALL PIPING FROM TEE TO HYDRANT SHALL BE RESTRAINED.

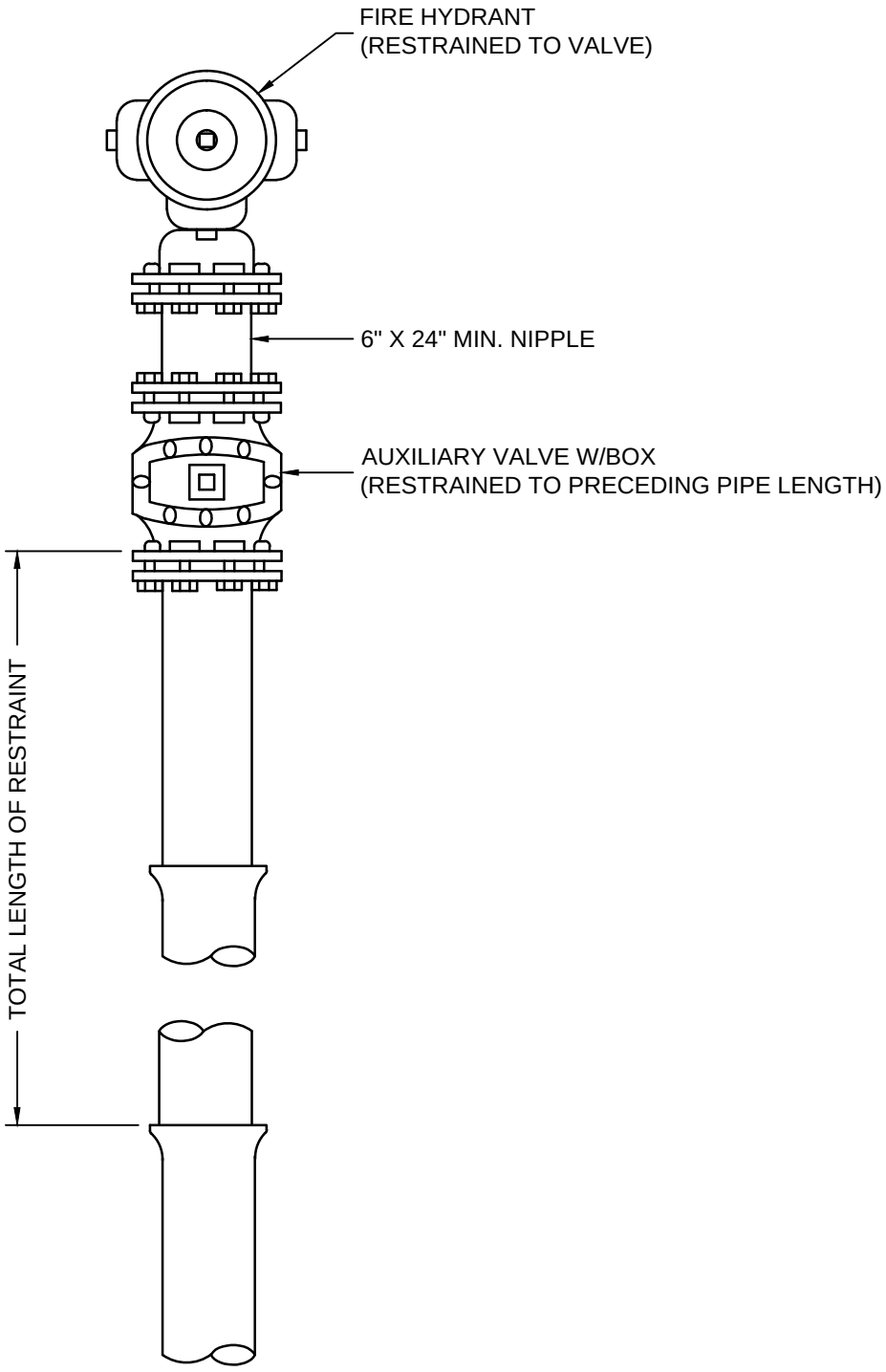
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-05 | HYDRANT ASSEMBLY<br>TYPE I | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. THIS ARRANGEMENT CAN BE USED ON ALL SIZES OF MAINS.
2. FIRE HYDRANTS SHALL BE INSTALLED PER "STANDARD FIRE HYDRANT SETTING" DETAIL.
3. ALL PIPING FROM TEE TO HYDRANT SHALL BE RESTRAINED.

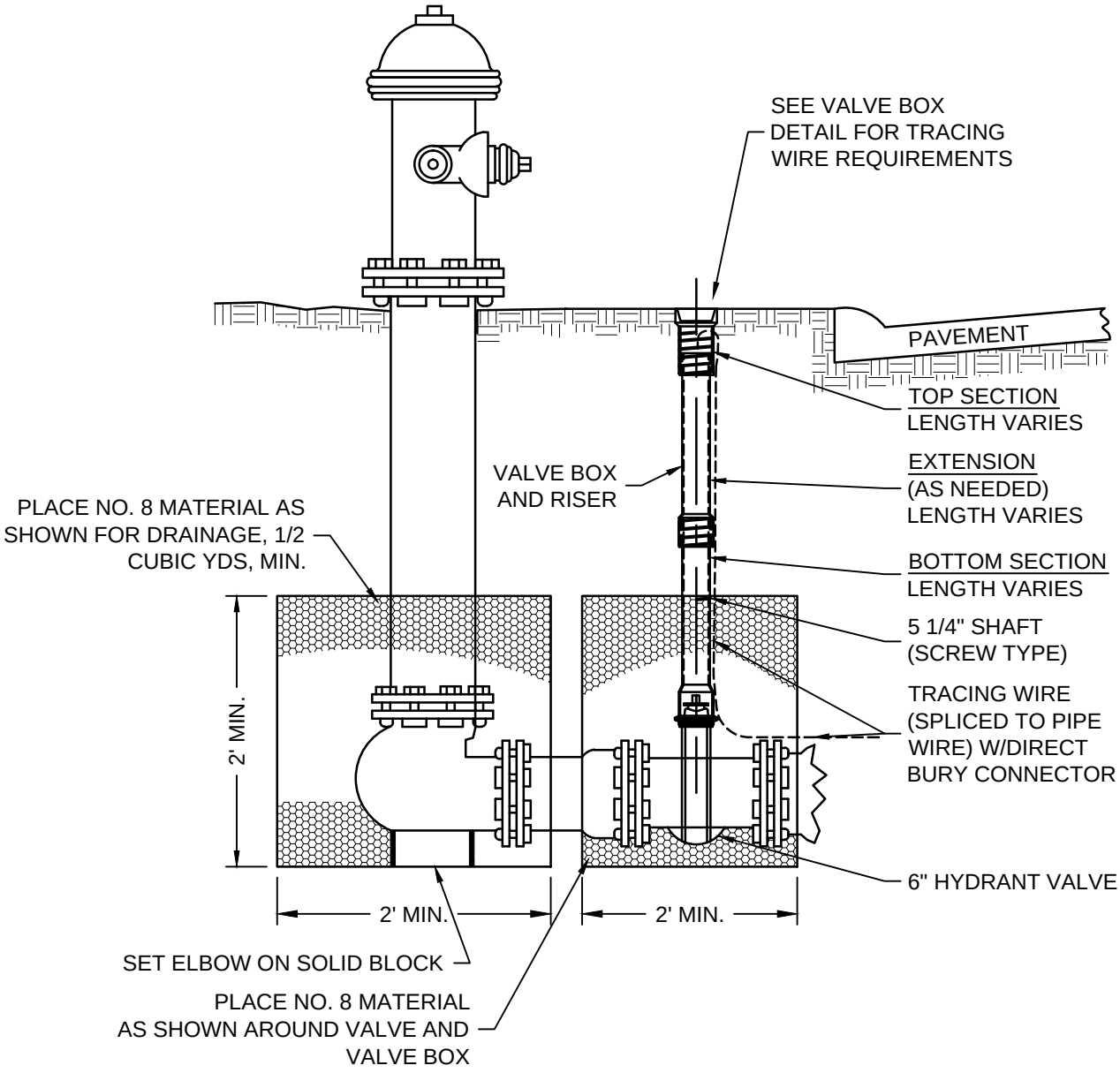
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-06 | HYDRANT ASSEMBLY<br>TYPE III | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. ASSUME CONDITION TO BE A DEAD END FOR DETERMINING THE LENGTH OF RESTRAINED JOINTS.
2. FIRE HYDRANTS SHALL BE INSTALLED PER "STANDARD FIRE HYDRANT SETTING" DETAIL.
3. ALL PIPING FROM VALVE TO HYDRANT SHALL BE RESTRAINED.

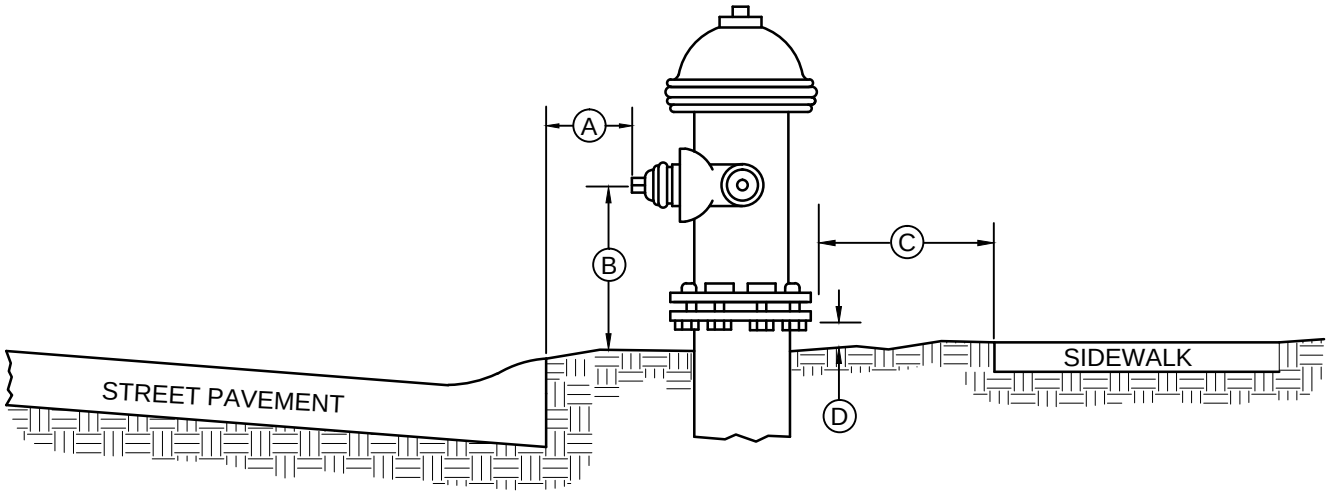
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-07 | HYDRANT ASSEMBLY<br>TYPE V | |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE | |




NOTES:

1. ALL HYDRANTS MUST BE RESTRAINED TO THE HYDRANT TEE.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-08 | STANDARD<br>FIRE HYDRANT SETTING | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




Ⓐ PUMPER NOZZLE MIN. 12", MAX 42" FROM BACK OF CURB & POINTED TOWARDS CURB.

Ⓑ PUMPER NOZZLE MIN. 18" ABOVE GROUND LINE.

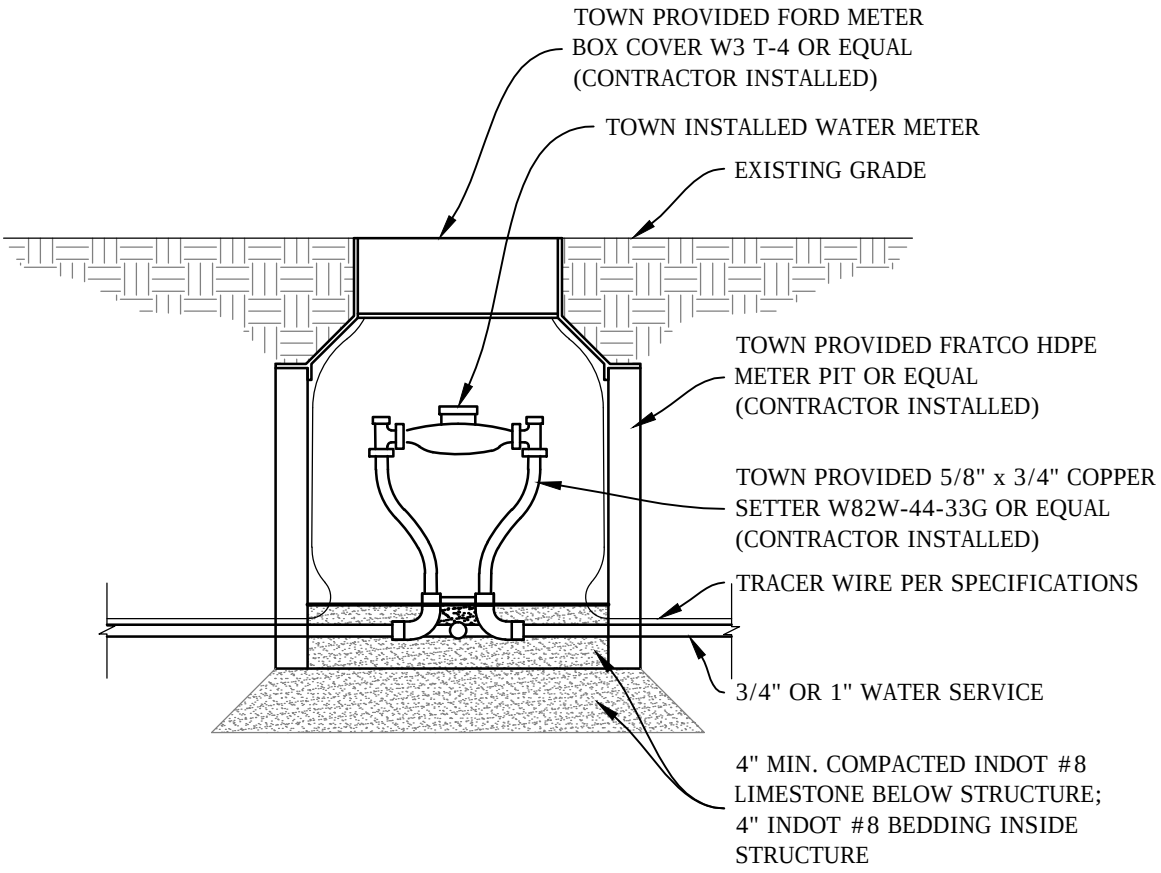
Ⓒ NO PART OF HYDRANT LESS THAN 6" FROM SIDEWALK.

Ⓓ MIN. 2", MAX. 8" ABOVE GRADE TO FLANGE OR GROUND LINE MARK ON HYDRANT.

NOTES:

1. WHERE FIRE HYDRANTS MUST BE LOCATED IN A PAVED AREA, A MINIMUM OF 5' X 5' CONCRETE BLOCK-OUT WITH EXPANSION JOINTS ON ALL SIDES SHALL BE PROVIDED.
2. PUMPER NOZZLE SHALL FACE THE STREET.
3. FIRE HYDRANTS SHALL BE INSTALLED PER "STANDARD FIRE HYDRANT SETTING" DETAIL.

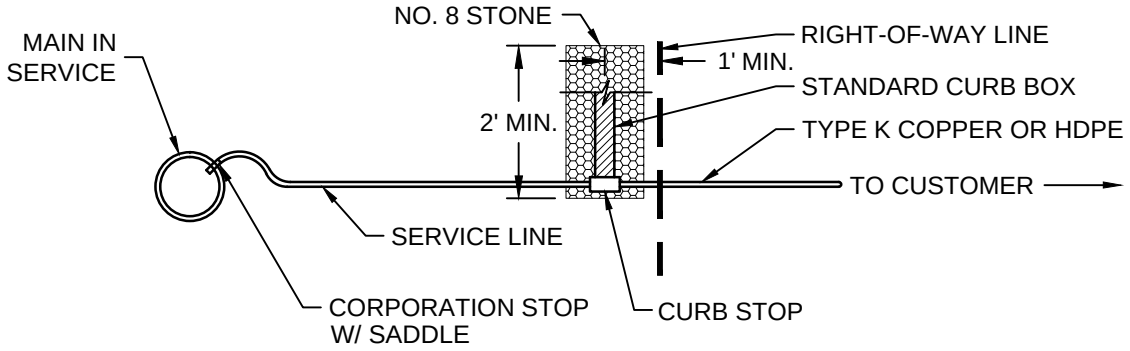
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-09 | GENERAL LOCATION OF FIRE HYDRANT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |



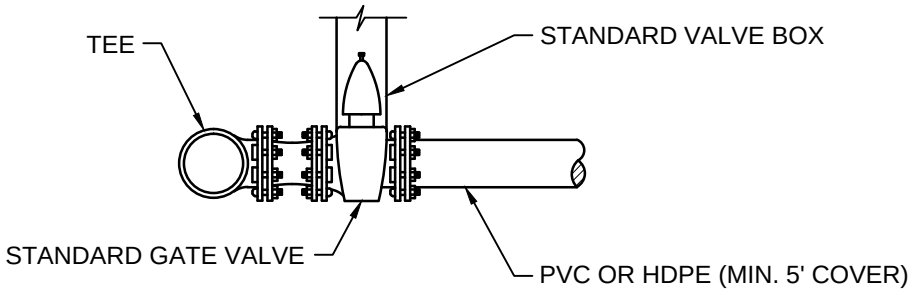

NOTES:

1. REMOVAL OF EXISTING METER PIT INCLUDED IN WORK. CONTRACTOR TO COORDINATE WITH TOWN FOR REMOVAL OF EXISTING METER.
2. TOWN TO PROVIDE METER PIT, SETTER, AND LID FOR INSTALLATION BY CONTRACTOR.
3. TOWN TO PROVIDE AND INSTALL METER.

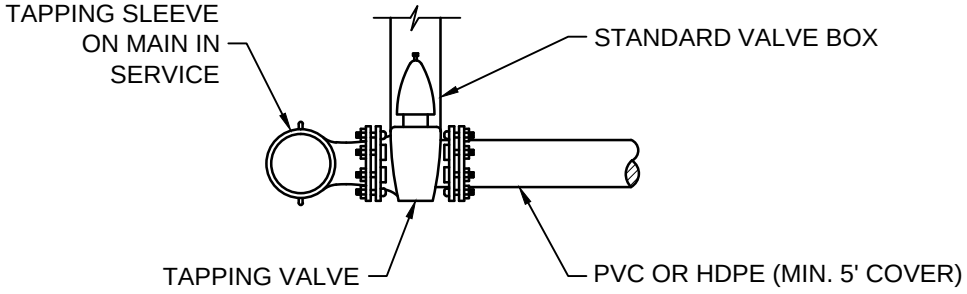
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-10 | WATER METER PIT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




SMALL SERVICE INSTALLATION
3/4" THRU 2" (MIN. 4'- 6" COVER)




LARGE SERVICE INSTALLATION WITH NEW WATER MAIN INSTALLATION
4" & LARGER

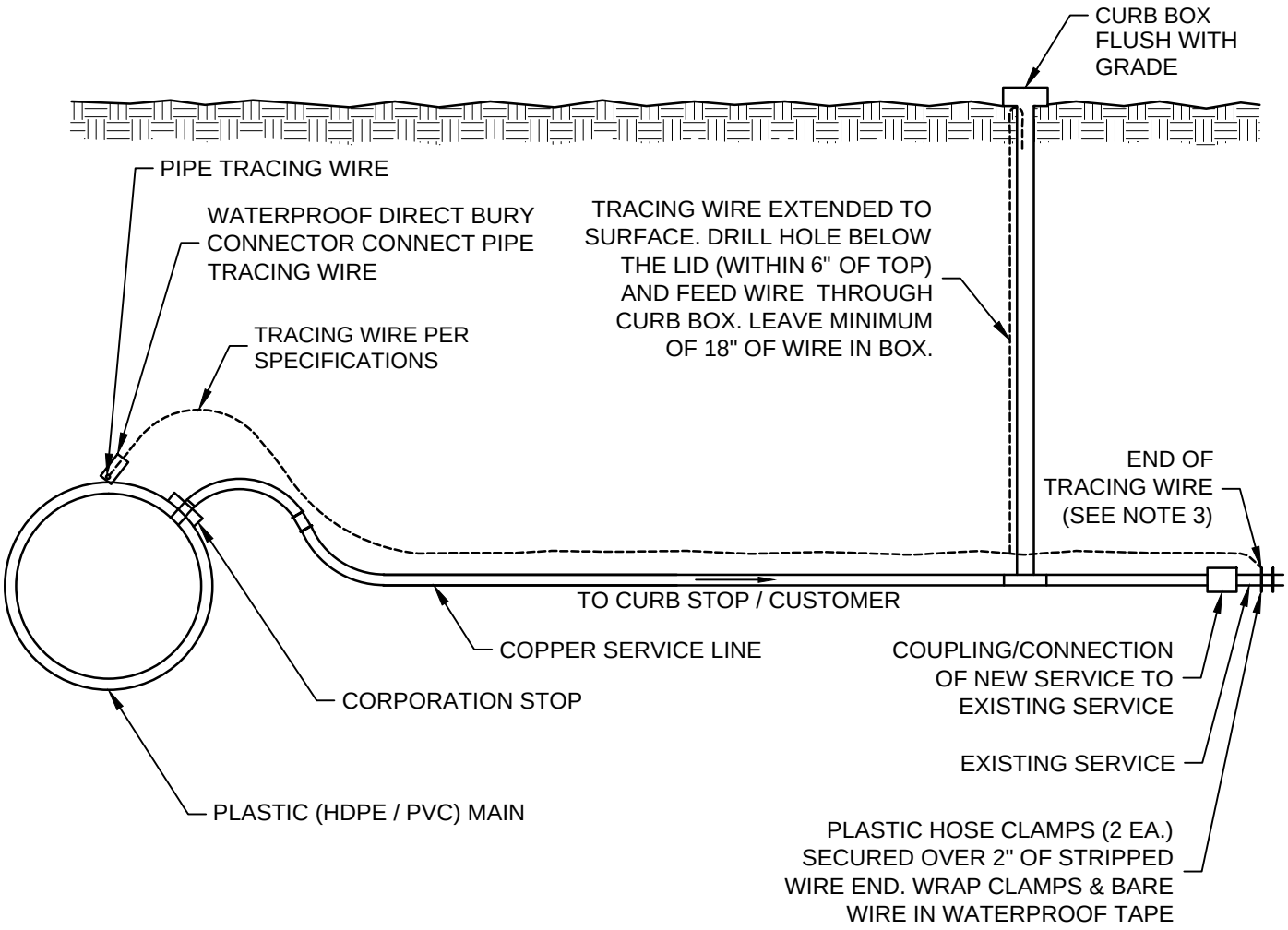



LARGE SERVICE INSTALLATION ON EXISTING WATER MAIN IN SERVICE
4" & LARGER

NOTES:
1. CONTRACTOR SHALL BORE SMALL DIAMETER SERVICE LINES BELOW PAVEMENT WHERE INDICATED ON CONTRACT DOCUMENTS.
2. PROVIDE TRACER WIRE ON SERVICE. CONNECT TO WATER MAIN TRACER AND BRING UP IN CURB / VALVE BOX PER REQUIREMENTS OF PLANS AND SPECIFICATIONS.
3. CORPORATION STOP SHALL MATCH SIZE OF SERVICE LINE.
4. DO NOT PLACE CURB BOX / METER BOX IN DRIVEWAY / SIDEWALK.

| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-11 | WATER SERVICE INSTALLATIONS |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

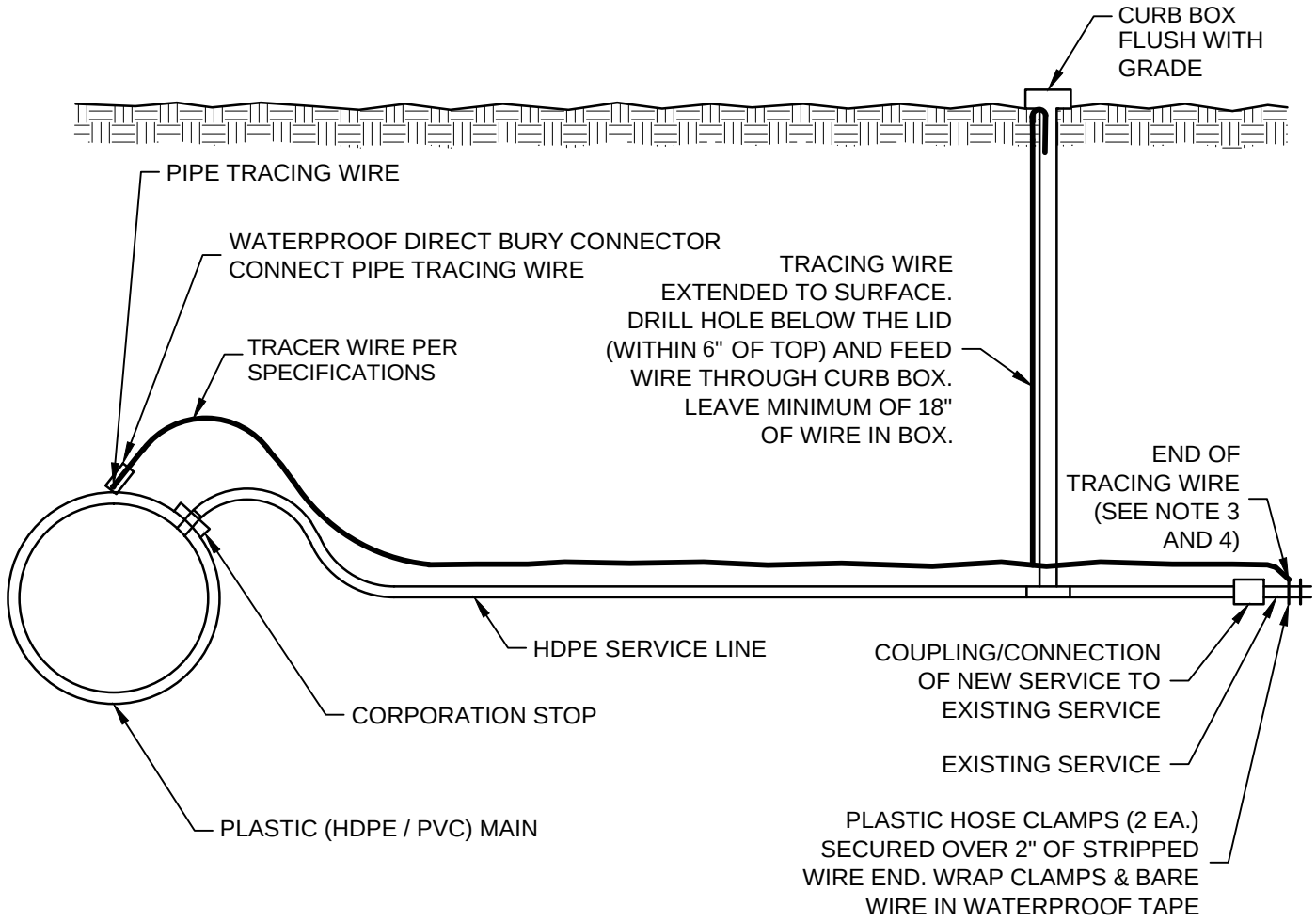
INTENDED USE: FOR WATER MAIN REPLACEMENT PROJECTS, WHERE EXISTING SERVICE IS COPPER




SMALL SERVICE - TRACING WIRE CONNECTION
(¾" THRU 2" COPPER TUBING)

NOTES:
1. ALL TRACING WIRE SPLICES AND CONNECTIONS SHALL BE MADE USING A DIRECT BURY WATERPROOF CONNECTION DEVICE DESIGNED FOR USE WITH LOW VOLTAGE TRACING WIRE.
2. PLASTIC HOSE CLAMPS (NON METALLIC ONLY) SHALL BE USED TO ENSURE CONDUCTIVITY IS MAINTAINED BETWEEN COPPER TRACING WIRE AND COPPER SERVICE TUBING.
3. IF CONNECTING TO EXISTING COPPER/LEAD SERVICE TRACING WIRE SHALL END AT THE EXISTING COPPER/LEAD SERVICE.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-12 | COPPER WATER SERVICE TRACER WIRE | |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE | |

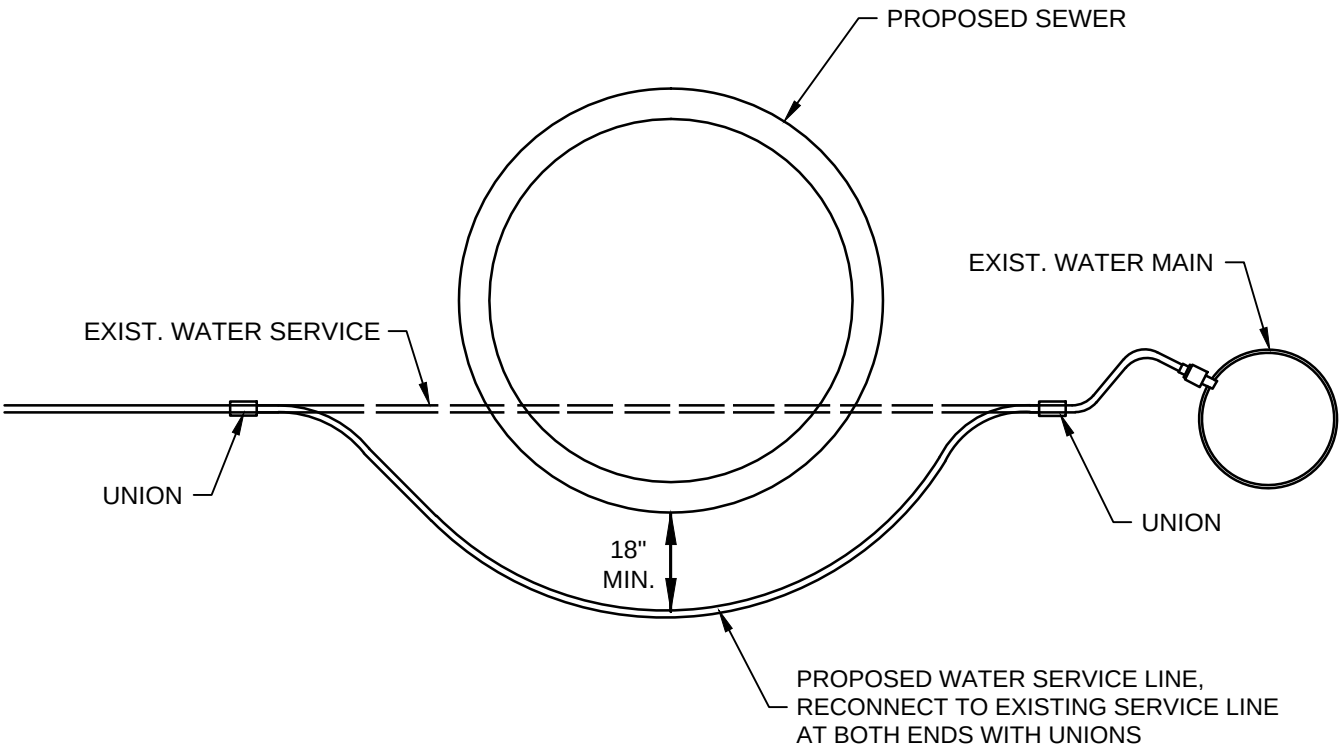



SMALL SERVICE - TRACING WIRE CONNECTION
(1" THRU 2" HDPE)

NOTES:

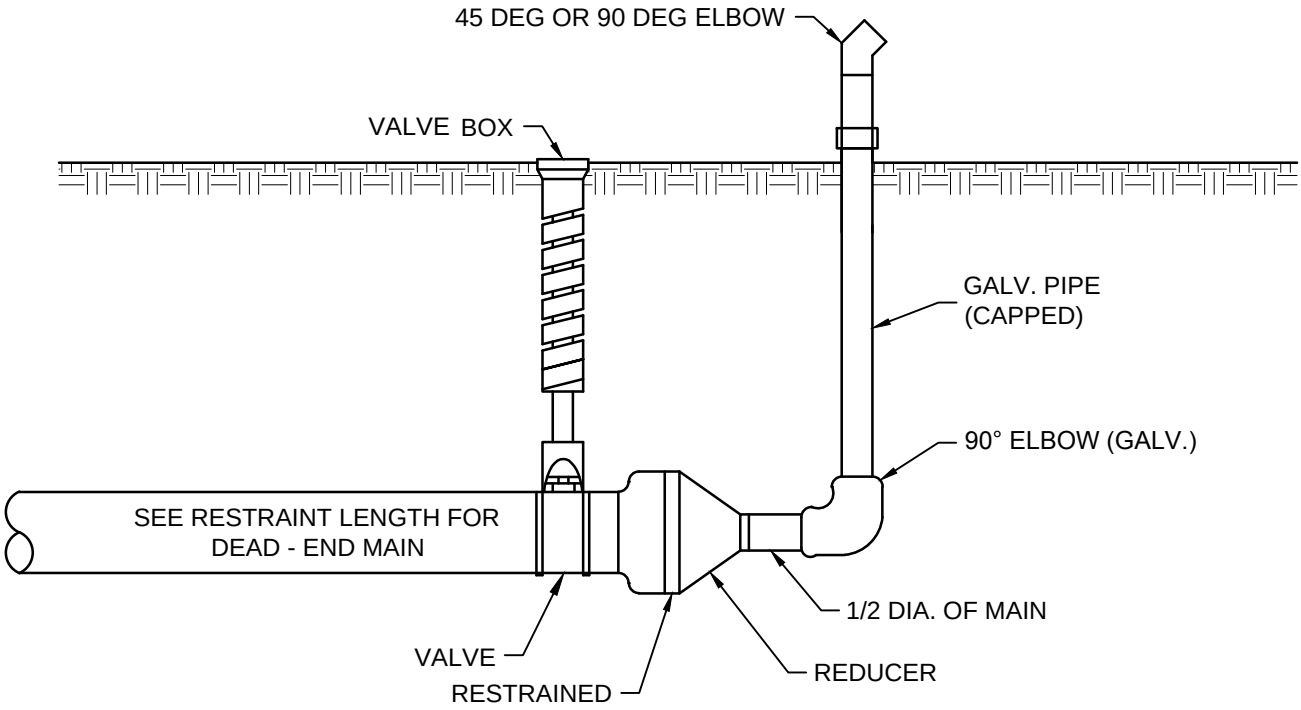
1. ALL TRACING WIRE SPLICES AND CONNECTIONS SHALL BE MADE USING A DIRECT BURY (EX. COPPERHEAD) WATERPROOF CONNECTION DEVICE DESIGNED FOR USE WITH LOW VOLTAGE TRACING WIRE.
2. PLASTIC HOSE CLAMPS (NON METALLIC ONLY) SHALL BE USED TO ENSURE CONDUCTIVITY IS MAINTAINED BETWEEN COPPER TRACING WIRE AND HDPE SERVICE TUBING.
3. IF CONNECTING TO EXISTING COPPER/LEAD SERVICE TRACING WIRE SHALL END AT THE EXISTING COPPER/LEAD SERVICE.
4. TRACING WIRE SHALL BE EXTENDED TO WATER METER FOR CONNECTION TO NEW OR EXISTING HDPE SERVICE.
5. FOR PROPERTIES THAT DO NOT HAVE AN EXISTING SERVICE, EXTEND TRACING WIRE FROM THE NEW WATER MAIN INTO THE CURB BOX AT AN APPROPRIATE LENGTH TO ALLOW FOR FUTURE SERVICE CONNECTION.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-13 | HDPE WATER SERVICE<br>TRACER WIRE | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

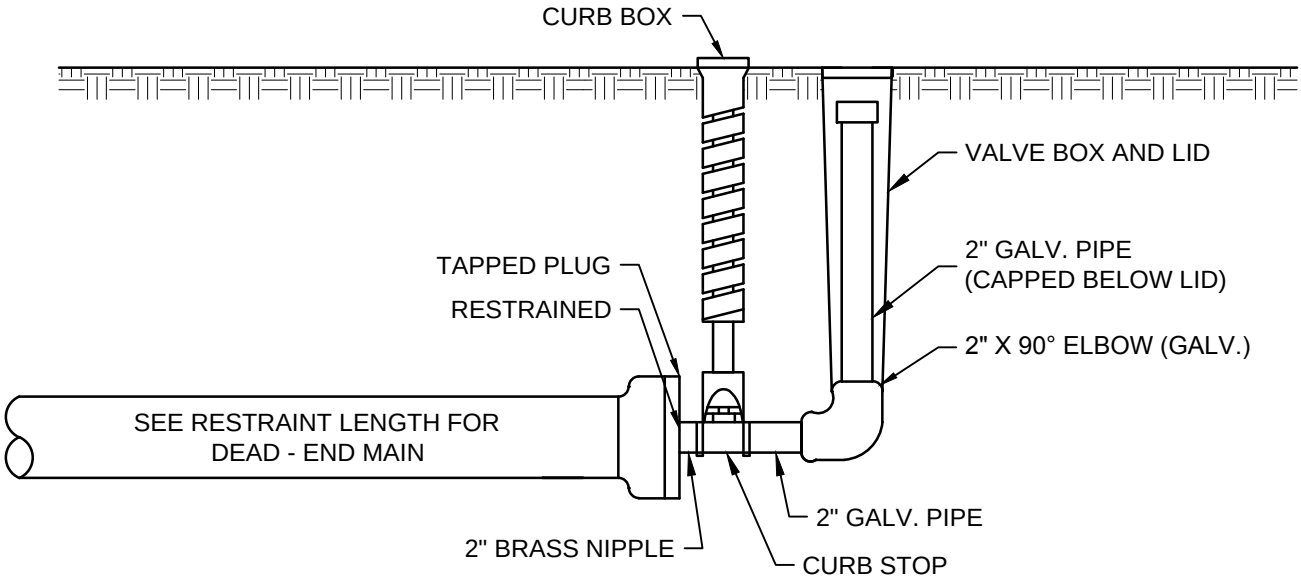



NOTE:
ALL RECONNECTIONS ENCOUNTERING LEAD CORPORATION STOPS SHALL BE REPLACED PER SPECIFICATIONS.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-14 | WATER SERVICE RECONNECTION | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




TEMPORARY BLOW-OFF ASSEMBLY INSTALLATION

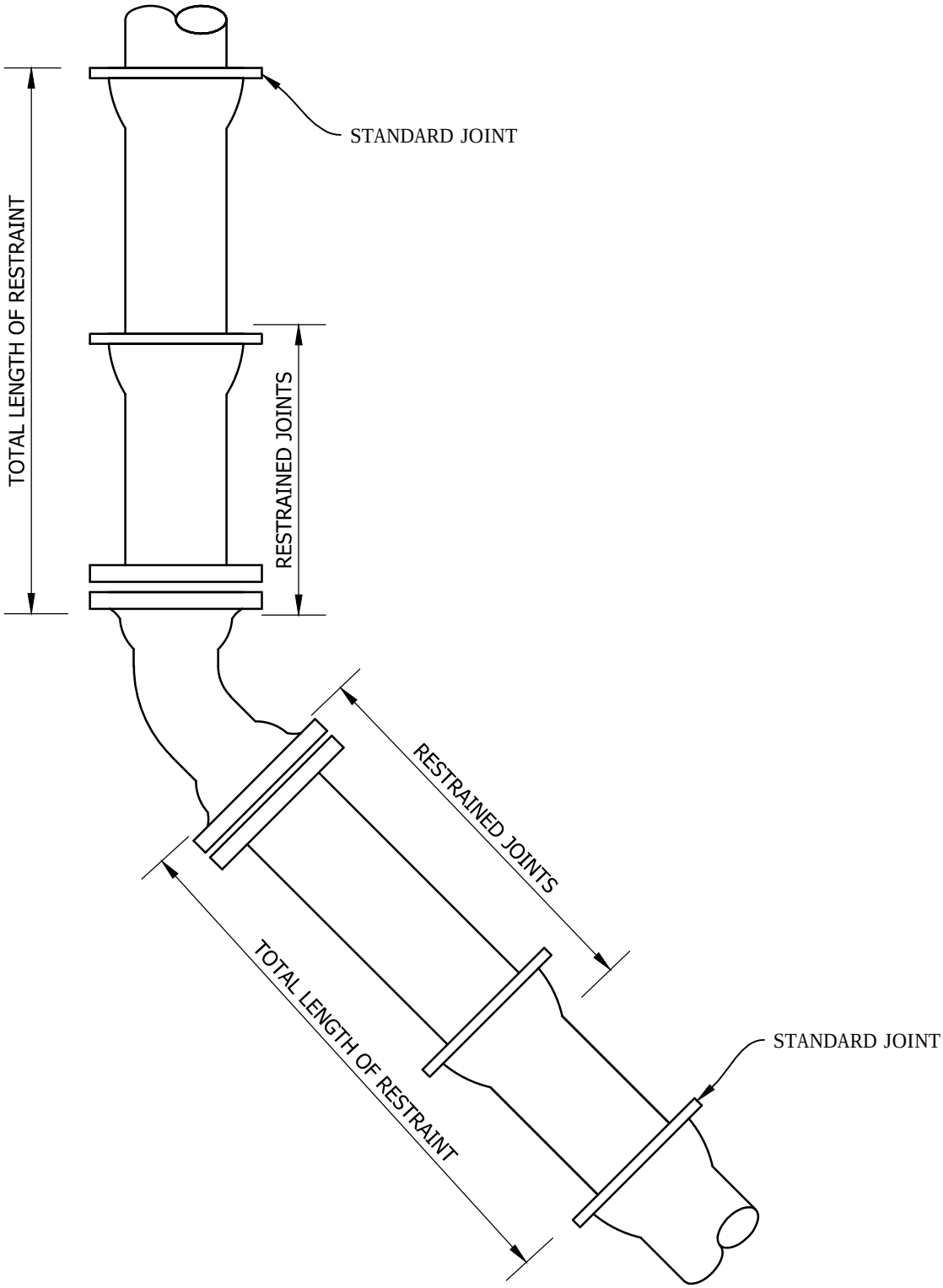



PERMANENT BLOW-OFF ASSEMBLY INSTALLATION

NOTES:

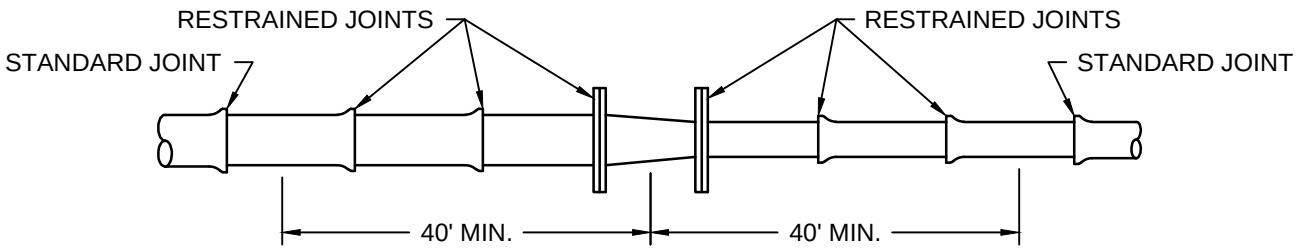
1. ALL MATERIALS FURNISHED BY CONTRACTOR AND INSTALLED BY CONTRACTOR, UNLESS OTHERWISE SPECIFIED.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-15 | BLOW-OFF INSTALLATIONS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTE:
1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-16 | RESTRAINT OF ELBOWS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |

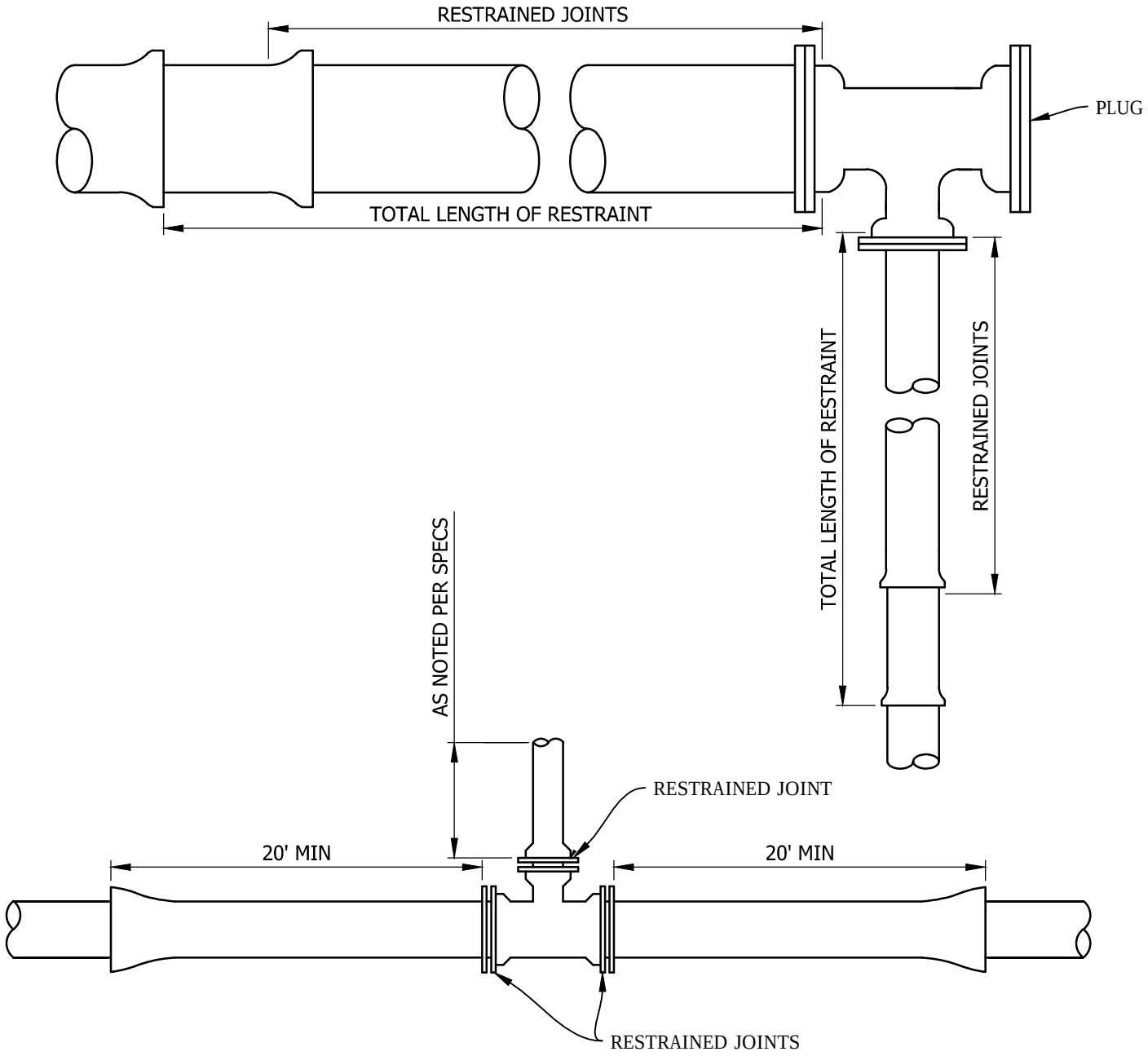



REDUCERS, LARGER PIPE DIAMETER IS 20" OR SMALLER

NOTES:

1. ASSUMPTIONS (PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY)
   - 1.1 BASED ON REDUCTION OF ONE PIPE SIZE
   - 1.2 BASED ON 150 PSI DESIGN / TEST PRESSURE
   - 1.3 SAFETY FACTOR 1.5
   - 1.4 TYPE 3 LAYING CONDITION
   - 1.5 5' COVER
   - 1.6 SOIL / BACKFILL CONDITIONS = CLAY 2
2. IF FITTINGS ARE IN CLOSE PROXIMITY TO EACH OTHER AND THE RESTRAINT LENGTHS OVERLAP, REFER TO THE DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

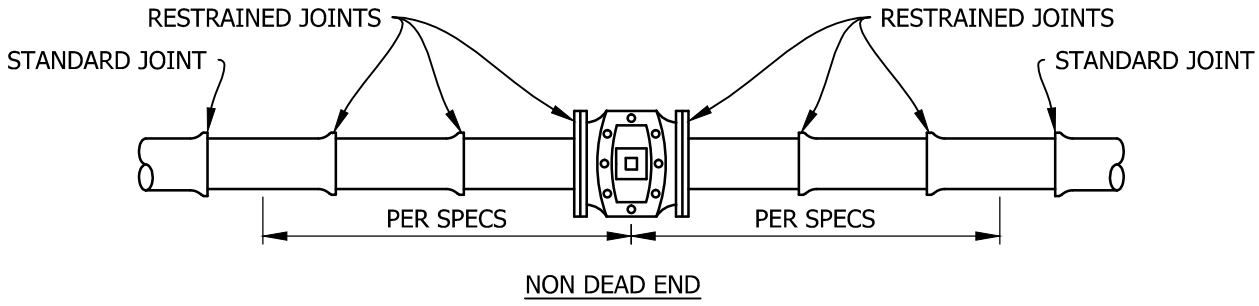
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-17 | RESTRAINT OF REDUCERS | |
| | STANDARD DRAWINGS | APPROVED 06/13/16 | REVISED: | SCALE: NONE |



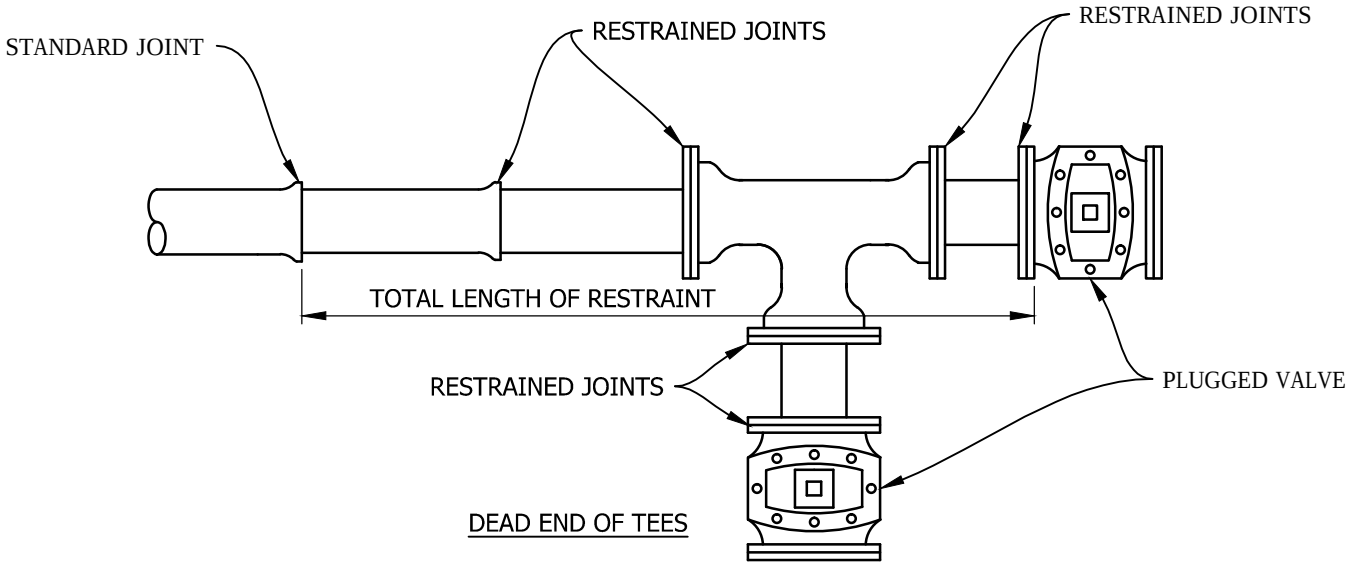

NOTE:

1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

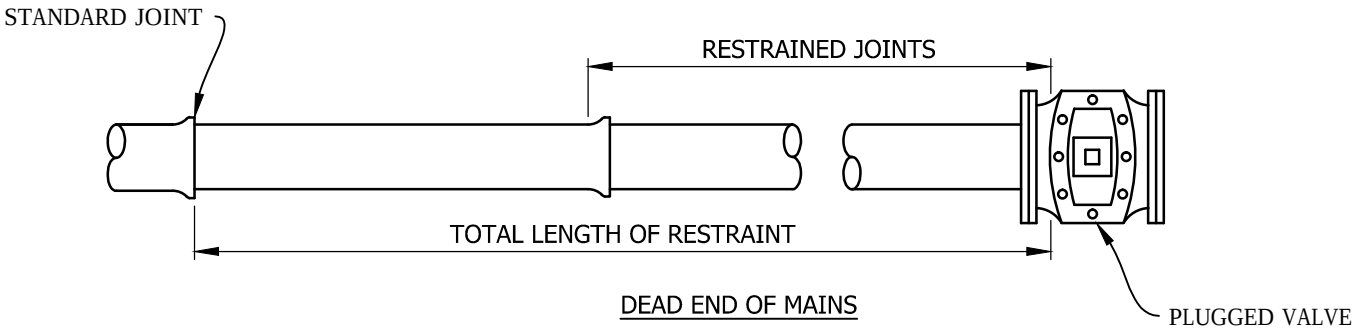
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-18 | RESTRAINT OF TEES | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |




NON DEAD END




DEAD END OF TEES




DEAD END OF MAINS

NOTE:

1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-19 | RESTRAINT OF VALVES | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: AS NOTED |

| NON-POLYWRAPPED DIP THRUST RESTRAINT CALCULATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIPE DIA. | HORIZONTAL BENDS AND VERTICAL UP BENDS | | | | VERTICAL DOWN BENDS | | DEAD ENDS | PIPE DIA. |
| | 11.25° | 22.5° | 45° | 90° | 22.5° | 45° | | |
| 4" | 1 | 3 | 6 | 15 | 5 | 11 | 27 | 4" |
| 6" | 2 | 4 | 9 | 21 | 8 | 16 | 39 | 6" |
| 8" | 3 | 5 | 11 | 27 | 10 | 21 | 51 | 8" |
| 10" | 3 | 7 | 14 | 33 | 12 | 26 | 62 | 10" |
| 12" | 4 | 8 | 16 | 40 | 15 | 31 | 74 | 12" |
| 16" | 5 | 10 | 21 | 52 | 19 | 41 | 98 | 16" |
| 20" | 6 | 13 | 26 | 64 | 24 | 50 | 122 | 20" |
| 24" | 7 | 15 | 31 | 76 | 29 | 60 | 145 | 24" |
| 30" | 9 | 19 | 39 | 93 | 36 | 75 | 180 | 30" |
| 36" | 11 | 22 | 46 | 110 | 43 | 89 | 215 | 36" |

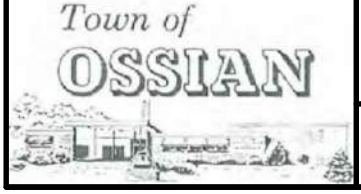
| TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20FT EACH SIDE OF TEE) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TEE BRANCH DIAMETER | | | | | | | | | | |
| TEE RUN DIA. | 4" | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" | 36" | TEE RUN DIA. |
| 4" | 0 | | | | | | | | | | 4" |
| 6" | 0 | 0 | | | | | | | | | 6" |
| 8" | 0 | 0 | 0 | | | | | | | | 8" |
| 10" | 0 | 0 | 0 | 5 | | | | | | | 10" |
| 12" | 0 | 0 | 0 | 0 | 11 | | | | | | 12" |
| 16" | 0 | 0 | 0 | 0 | 3 | 22 | | | | | 16" |
| 20" | 0 | 0 | 0 | 0 | 0 | 16 | 34 | | | | 20" |
| 24" | 0 | 0 | 0 | 0 | 0 | 9 | 28 | 45 | | | 24" |
| 30" | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 39 | 62 | | 30" |

NOTES:

1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.

1.1 NON- POLYWRAPPED DUCTILE IRON PIPE
1.2 DESIGN / TEST PRESSURE = 150 PSI
1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
1.5 5' COVER
1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)

2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.




TOWN OF OSSIAN
507 N. JEFFERSON ST.
OSSIAN, IN 46777

WAT-20

NON-POLYWRAPPED D.I. THRUST RESTRAINT CALCULATIONS

STANDARD DRAWINGS

APPROVED: 06/13/16

REVISED:

SCALE: NONE

| POLYWRAPPED DUCTILE IRON THRUST RESTRAINT CALCULATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIPE DIA. | HORIZONTAL BENDS AND VERTICAL UP BENDS | | | | VERTICAL DOWN BENDS | | DEAD ENDS | PIPE DIA. |
| | 11.25° | 22.5° | 45° | 90° | 22.5° | 45° | | |
| 4" | 2 | 3 | 7 | 17 | 8 | 16 | 39 | 4" |
| 6" | 2 | 5 | 10 | 25 | 11 | 23 | 55 | 6" |
| 8" | 3 | 6 | 13 | 33 | 14 | 30 | 73 | 8" |
| 10" | 4 | 8 | 16 | 40 | 18 | 37 | 89 | 10" |
| 12" | 5 | 9 | 20 | 47 | 21 | 44 | 106 | 12" |
| 16" | 6 | 12 | 23 | 62 | 28 | 58 | 140 | 16" |
| 20" | 7 | 15 | 31 | 76 | 35 | 72 | 174 | 20" |
| 24" | 9 | 18 | 37 | 90 | 41 | 86 | 207 | 24" |
| 30" | 11 | 22 | 46 | 110 | 51 | 107 | 257 | 30" |
| 36" | 13 | 26 | 54 | 131 | 61 | 127 | 308 | 36" |

| TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20' EACH SIDE OF TEE) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TEE BRANCH DIAMETER | | | | | | | | | | |
| TEE RUN DIA. | 4" | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" | 36" | TEE RUN DIA. |
| 4" | 0 | | | | | | | | | | 4" |
| 6" | 0 | 0 | | | | | | | | | 6" |
| 8" | 0 | 0 | 0 | | | | | | | | 8" |
| 10" | 0 | 0 | 0 | 7 | | | | | | | 10" |
| 12" | 0 | 0 | 0 | 0 | 16 | | | | | | 12" |
| 16" | 0 | 0 | 0 | 0 | 4 | 32 | | | | | 16" |
| 20" | 0 | 0 | 0 | 0 | 0 | 23 | 48 | | | | 20" |
| 24" | 0 | 0 | 0 | 0 | 0 | 14 | 41 | 65 | | | 24" |
| 30" | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 55 | 89 | | 30" |
| 36" | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 46 | 81 | 113 | 36" |

NOTES:

1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.
   1.1 POLYWRAPPED DUCTILE IRON PIPE
   1.2 DESIGN / TEST PRESSURE = 150 PSI
   1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
   1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
   1.5 5' COVER
   1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)
2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-21 | POLYWRAPPED DIP THRUST RESTRAINT CALCULATIONS | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |

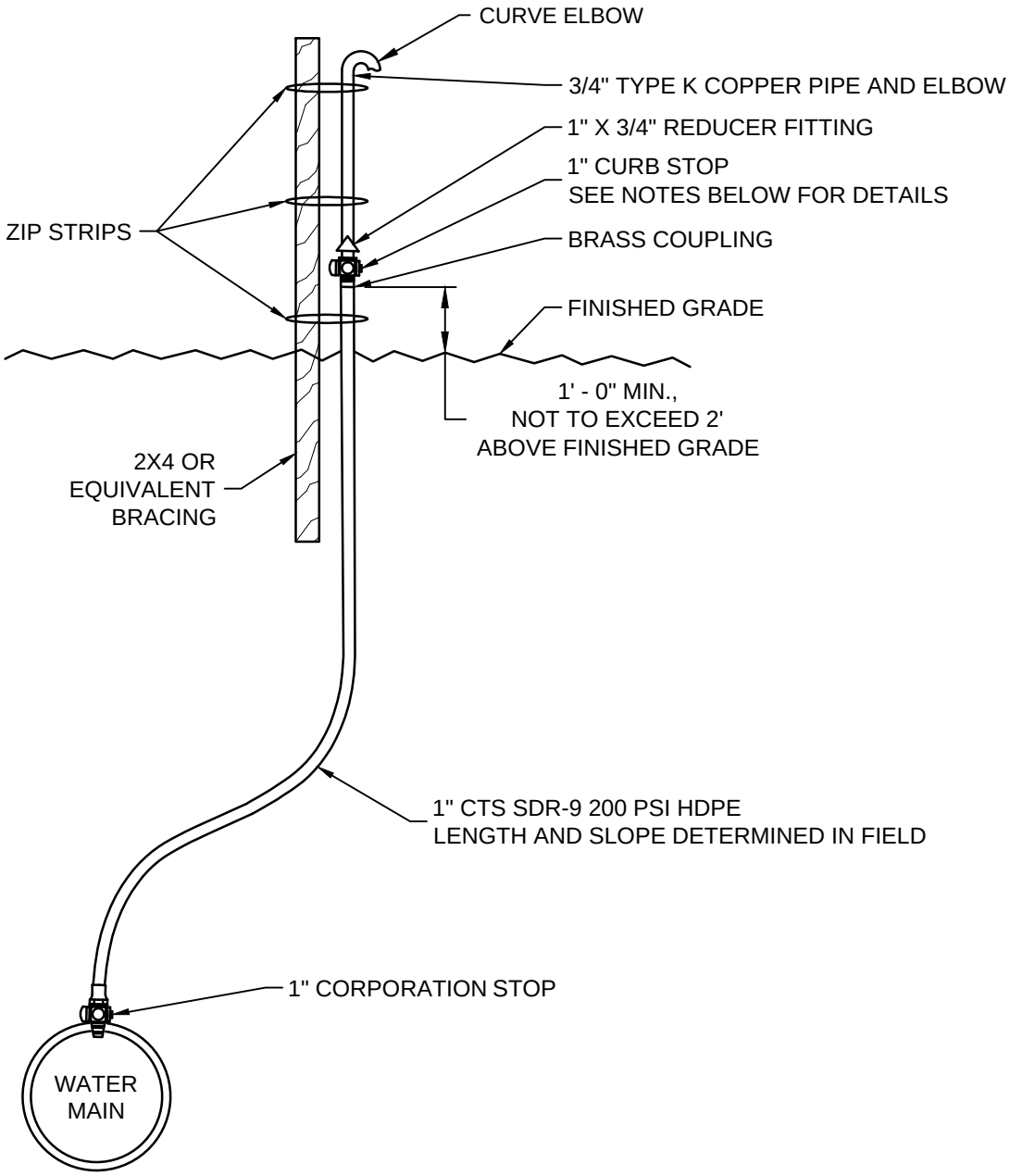
| PVC NON-ENCROACHING THRUST RESTRAINT CALCULATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PIPE DIA. | HORIZONTAL BENDS AND VERTICAL UP BENDS | | | | VERTICAL DOWN BENDS | | DEAD ENDS | PIPE DIA. |
| | 11.25° | 22.5° | 45° | 90° | 22.5° | 45° | | |
| 4" | 1 | 3 | 5 | 13 | 7 | 15 | 25 | 4" |
| 6" | 2 | 4 | 8 | 19 | 10 | 22 | 35 | 6" |
| 8" | 2 | 5 | 10 | 24 | 13 | 28 | 47 | 8" |
| 10" | 3 | 6 | 12 | 29 | 16 | 34 | 56 | 10" |
| 12" | 3 | 7 | 14 | 35 | 19 | 40 | 67 | 12" |
| 16" | 4 | 9 | 19 | 45 | 25 | 53 | 87 | 16" |
| 20" | 5 | 11 | 23 | 55 | 31 | 65 | 107 | 20" |
| 24" | 6 | 13 | 27 | 65 | 37 | 76 | 127 | 24" |
| 30" | 8 | 16 | 32 | 78 | 45 | 93 | 156 | 30" |
| 36" | 9 | 18 | 38 | 92 | 53 | 110 | 185 | 36" |

| TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20' EACH SIDE OF TEE) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TEE BRANCH DIAMETER | | | | | | | | | | |
| TEE RUN DIA. | 4" | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" | 36" | TEE RUN DIA. |
| 4" | 0 | | | | | | | | | | 4" |
| 6" | 0 | 0 | | | | | | | | | 6" |
| 8" | 0 | 0 | 0 | | | | | | | | 8" |
| 10" | 0 | 0 | 0 | 0 | | | | | | | 10" |
| 12" | 0 | 0 | 0 | 0 | 0 | | | | | | 12" |
| 16" | 0 | 0 | 0 | 0 | 0 | 13 | | | | | 16" |
| 20" | 0 | 0 | 0 | 0 | 0 | 0 | 33 | | | | 20" |
| 24" | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 52 | | | 24" |
| 30" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 81 | | 30" |
| 36" | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 65 | 110 | 36" |

NOTES:

1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.
 1.1 PVC PIPE
 1.2 DESIGN / TEST PRESSURE = 150 PSI
 1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
 1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
 1.5 5' COVER
 1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)
2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

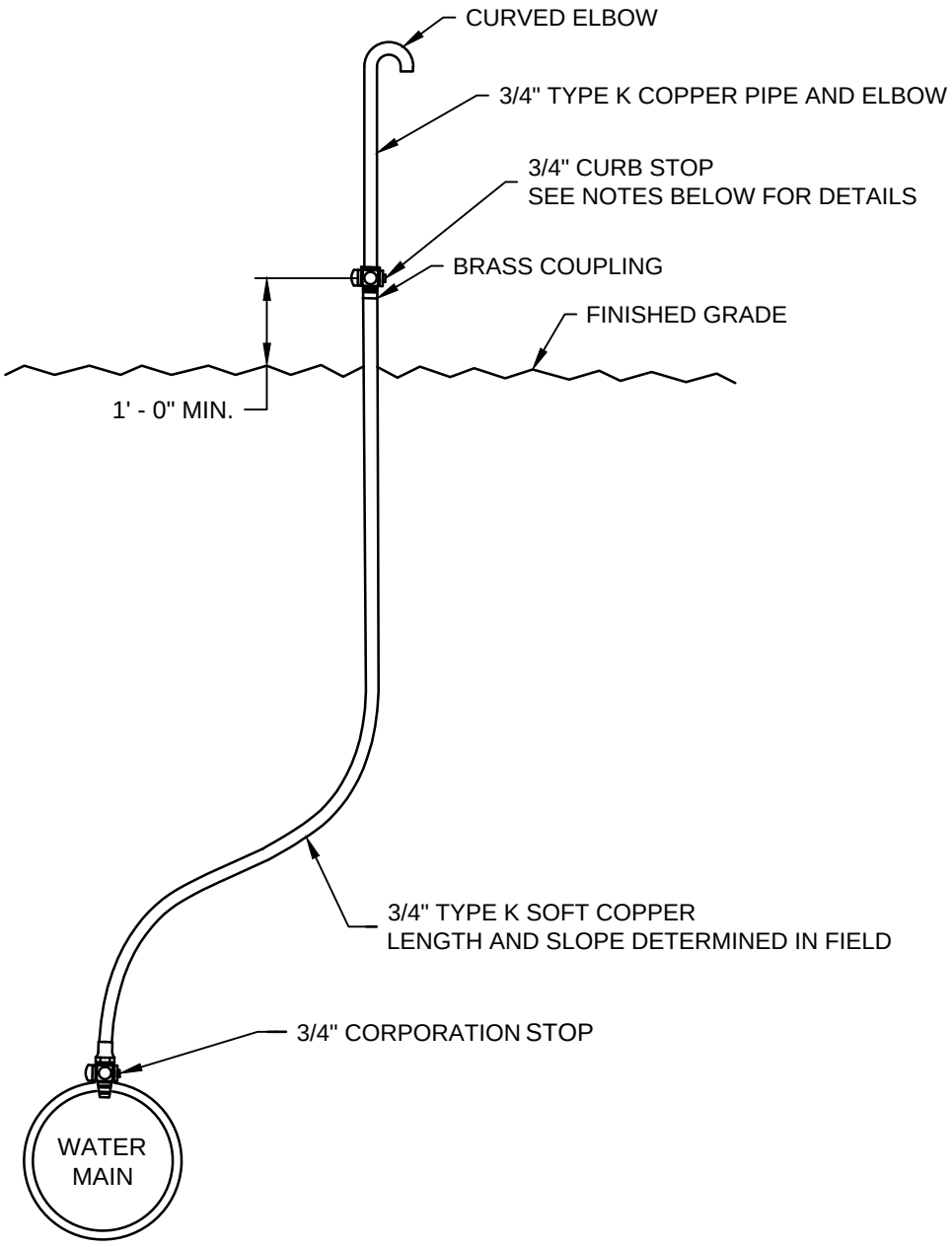
| | | | |
|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-22 | PVC THRUST RESTRAINT CALCULATIONS |
| STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. FOR TEST RISER LOCATIONS NOT PROPOSED TO BE IN PAVEMENT, CURB STOP SHALL BE INSTALLED A MIN. OF 1 FT. ABOVE FINISHED GRADE.
2. FOR TEST RISER LOCATIONS PROPOSED TO BE IN PAVEMENT, CORPORATION SHALL BE INSTALLED 4 IN. BELOW FINISHED GRADE IN VALVE BOX OR COPPER SHOULD BE EXTENDED FROM TAP TO POINT OUTSIDE PAVEMENT; SEE "TEST RISER IN PAVEMENT" DETAIL.
3. TEST RISERS SHALL BE INSTALLED AND REMOVED BY CONTRACTOR UNLESS NOTED OTHERWISE.
4. TEST RISER REMOVAL SHALL CONSIST OF CLOSING LOWER CORPORATION AND REMOVING ALL OTHER MATERIALS.
5. ALL TEST RISER INSTALLATIONS SHALL BE APPROVED BY OWNER & ENGINEER.

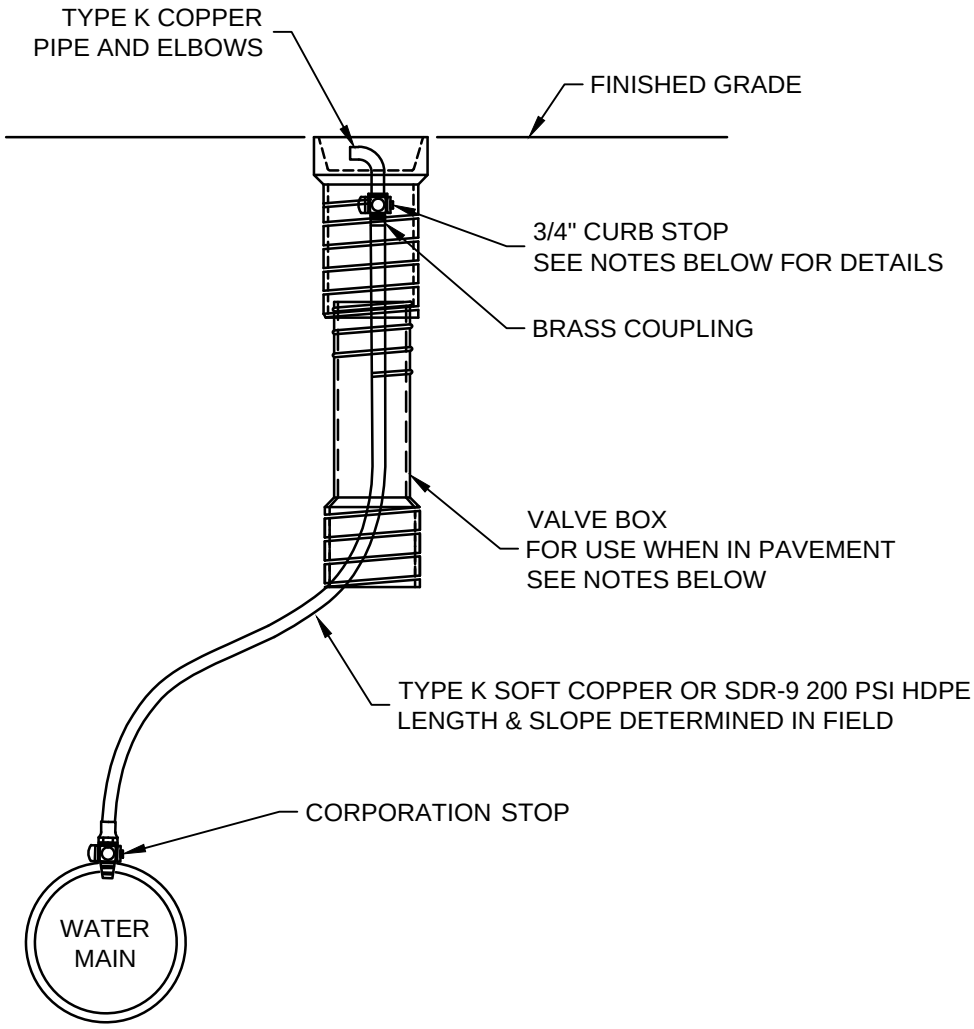
| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-23 | HDPE TEST RISER | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. FOR TEST RISER LOCATIONS NOT PROPOSED TO BE IN PAVEMENT CURB STOP SHALL BE INSTALLED A MIN. OF 1 FT ABOVE FINISHED GRADE.
2. FOR TEST RISER LOCATIONS PROPOSED TO BE IN PAVEMENT, CORPORATION SHALL BE INSTALLED 4 IN BELOW FINISHED GRADE IN VALVE BOX OR COPPER SHOULD BE EXTENDED FROM TAP TO POINT OUTSIDE PAVEMENT. SEE "TEST RISER IN PAVEMENT" DETAIL.
3. TEST RISERS SHALL BE INSTALLED AND REMOVED BY CONTRACTOR UNLESS NOTED OTHERWISE.
4. TEST RISER REMOVAL SHALL CONSIST OF CLOSING LOWER CORPORATION AND REMOVING ALL OTHER MATERIALS.
5. ALL TEST RISER INSTALLATIONS SHALL BE APPROVED BY OWNER & ENGINEER.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-24 | COPPER TEST RISER | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |




NOTES:

1. FOR TEST RISER LOCATIONS PROPOSED TO BE IN PAVEMENT, CURB STOP SHALL BE INSTALLED 4 IN. BELOW FINISHED GRADE IN VALVE BOX OR COPPER SHOULD BE EXTENDED FROM TAP TO POINT OUTSIDE PAVEMENT.
2. TEST RISERS SHALL BE INSTALLED AND REMOVED BY CONTRACTOR UNLESS NOTED OTHERWISE.
3. TEST RISER REMOVAL SHALL CONSIST OF CLOSING LOWER CORPORATION STOP AND REMOVING ALL OTHER MATERIALS.
4. ALL TEST RISER INSTALLATIONS SHALL BE APPROVED BY OWNER & ENGINEER.

| | | | | |
|---|---|---|---|---|
| Town of OSSIAN | TOWN OF OSSIAN<br>507 N. JEFFERSON ST.<br>OSSIAN, IN 46777 | WAT-25 | TEST RISER IN PAVEMENT | |
| | STANDARD DRAWINGS | APPROVED: 06/13/16 | REVISED: | SCALE: NONE |