

CHAPTER 9 CONCRETE STRUCTURES, MANHOLES AND APPURTENANCES

9.1 **SCOPE**

This section covers the construction of wastewater pump station wetwells, manholes, including frames, covers and steps, as shown on the plans, Standard Detail Drawings, and as specified herein.

9.2 **MATERIALS**

All materials in this section shall meet Made in America Criteria. Shop drawings and related data for manhole material, frames, covers and steps shall be submitted to the ENGINEER for review.

- A. Concrete Structures: Structures with diameter of 10' or less shall be pre-cast reinforced Portland cement concrete sections complying with ASTM C150, Type II, 5,000 PSI with an absorption rate not exceeding 6%. Concrete shall be manufactured with granite stone. Calcium chloride or admixtures of calcium chloride shall not be used. Sections shall be cast with tongue and groove joints conforming to ASTM C478, latest revision. The riser sections shall be made as long as practical to minimize the number of joints. Sections shall be scored or stamped with the date of castings and the date shall appear on the inside of the each section.
- B. Manhole Wall Thickness: The minimum wall thickness of the manhole riser section shall be:

4' Diameter –	5" min. wall thickness
5' Diameter –	6" min. wall thickness
6' Diameter –	7" min. wall thickness
8' Diameter –	9" min. wall thickness
10' Diameter -	11" min. wall thickness

All manholes shall have pre-cast base sections. Doghouse style manholes shall not be used without written permission from the BJWSA Engineering Department. Base riser sections shall be monolithically cast and have minimum bottom thickness of:

4' Diameter – 6" min. bottom thickness
5' Diameter – 8" min. bottom thickness
6' Diameter – 10" min. bottom thickness
7' Diameter – 10" min. bottom thickness
8' Diameter – 12" min. bottom thickness

- C. Wetwells, receiving manholes, manholes adjacent to receiving manhole, control manholes, and manholes adjacent to control manhole shall be coated on the interior with hydrogen sulfide resistant coatings. Refer to Chapter 9.2.L (Interior Protective Coatings).
- D. Cone sections shall be eccentric and have a minimum wall thickness of 8" at the top. Manhole sections shall be scored or stamped with date of casting and the cone section shall show date on the inside.
- E. The tongue and groove joints shall not be less than the wall thickness.
- F. Joint sealant shall be factory-extruded formulation of 100% solids with top quality partially vulcanized butyl rubber.
- G. Exterior joint shall be primed and sealed with a 12" wide butyl rubber wrap. Joint sealant

material shall be resistant to sewage and industrial wastes, including oils, and shall provide a permanent watertight joint.

- H. Manhole Frames and Covers: Manhole frames and covers shall be gray cast iron conforming to minimum requirements ASTM A48, Class 35, and shall conform in general to the details for each type shown on the plans. Castings shall be of uniform quality, and free from blowholes, porosity, hard spots, shrinkage distortion and other defects. Frames and covers shall be smooth, well-cleaned by shot blasting and shall remain unpainted. All castings shall be manufactured true to pattern, and component parts shall fit together in a satisfactory manner. Frames shall have a clear opening of 23-3/4". There shall be no holes or perforations in the cover. The frame and cover shall have a rubber gasket that is fitted in a machined groove manufactured in the bottom of the cover. Manholes in pavement shall be designed to carry road loading without loading the manhole and to be adjustable to changes in final pavement elevation without the use of spaces or rings. Manholes in non-public right of ways shall have rim elevations 6" higher than first up stream manhole in public area and shall be marked with a pair of rural markers. Refer to Chapter 13 for a list of approved manufacturers.
- I. Steps: Manhole steps will NOT be permitted in structures requiring coating or lining. Manhole steps are NOT required by BJWSA. If steps are installed in approved manholes, they must meet the following spec:
 - 1. ASTM C478-02 16. Steps and Ladders.
 - 2. Composite plastic steel steps shall consist of a 1/2" deformed steel-reinforcing rod encapsulated in a co-polymer polypropylene plastic.
 - 3. Minimum design live load of steps shall be a single concentrated load of 300 LB.
 - 4. Steps shall have non-skid top surfaces, and shall be designed so that the foot cannot slip off the end.
 - 5. Steps shall have a minimum cross sectional dimension of 1", and a minimum length of 9.25".
 - 6. Steps shall be of the drop-front design.
 - 7. Reinforcing rods shall conform to ASTM A615, Grade 60, and polypropylene plastic shall conform to ASTM D2146, Type II, Grade 16906.
 - 8. Shall be aligned to form a continuous ladder with steps equally spaced vertically at not more than 16" on center.
- J. Resilient Pipe Connections: Resilient pipe connections will be provided in manholes. Such connections shall have a minimum thickness of 3/8" and conform to ASTM C923, and shall consist of a natural or synthetic rubber connector complete with stainless steel mechanical devices designed to provide a positive flexible watertight connection.
- K. Installation: Each section shall be handled and installed in such a manner and by such means as to prevent damage. All manhole sections damaged during handling and installation will be rejected as directed by the ENGINEER, and replaced at no additional cost to the OWNER. All lifting holes shall be plugged and sealed watertight as recommended by the manufacturer.
 - 1. Base sections shall be installed on a minimum of 12" foundation of compacted #57 stone embedment so prepared to prevent settlement and misalignment. Pipe openings shall be placed at the exact elevation and location to receive entering pipes. All inlets and outlets shall be cast in or core drilled.
 - 2. Risers and top sections shall be installed level and plumb, and such that all manhole steps are in alignment. Joint sealant shall be of the type specified above. Joints shall be

made in accordance with the manufacturer's recommendations, and to insure a watertight installation. Exterior shall receive a 12" wide butyl rubber wrap over the grout area.

3. Entering pipes shall be secured in the resilient pipe connectors, properly aligned, and set to grade. Pipe shall be firmly held in place and the annular space between the pipe and opening sealed watertight with a non-shrink catalyzed metallic aggregate mortar.
4. Leveling and final grading of manhole frames and covers shall be accomplished by using a maximum of two (2) concrete grade rings except in pavement where leveling grade rings are not allowed. Concrete grade rings shall not exceed 4" in thickness. Grade rings shall be laid in a full bed of non-shrink grout and covered after laying with a smooth coating of non-shrink grout or hydraulic cement a minimum of 2" thick. Deviation from this requirement shall require prior approval from the AUTHORITY.
5. Mortar Mix: Mortar used in manhole invert construction shall consist of 1 part Portland cement and 2 parts clean washed sand, with the required amount of potable water added to produce a workable mixture. Sand shall be uniformly graded from fine to coarse, and when dry shall pass a screen having 8 meshes per inch. Mortar shall be used before initial set has occurred. Re-tempering of mortar will not be permitted.
6. Drop Manholes: Manhole drops shall be external to the manhole sections. Drop piping shall be constructed of sewer grade PVC, properly supported and encased in concrete as detailed, and the backfill thoroughly compacted. Drop manholes are required where the invert differential is 20 inches or more.
7. Manhole Top Grade: Manhole tops shall be set to the proper elevation as required by the location, or as directed by the ENGINEER.
8. Where manholes are located in streets, roads, drives or parking areas, tops shall be set to conform to the finished grade of the pavement or surfacing and installed to prevent storm water runoff from entering the system.
9. Where manholes are placed in unpaved roads, the tops shall be 4 inches below road grade. Manholes this section shall be identified by markers adjacent to the location on each side of the right of way.
10. In fields, wooded areas, and rural easements or Right-of-ways manhole tops shall be set approximately 2" above final ground elevation. Cast in place sloped concrete collars shall be installed as shown in drawings. In locations subjected to flooding manhole tops shall be bolt down lids. Manholes of this section shall be marked with "**Rural Marker**"

L. Interior Protective Coatings:

1. Protective coating shall be applied to the interior of wetwells, receiving manholes, manholes adjacent to receiving manhole, control manholes, and manholes adjacent to control manhole. Protective coating shall be either a HDPE form cast/field completed system or high build epoxy system. Coating shall be applied according to manufacturer's specifications. Only coating systems pre approved by BJWSA may be used.
2. Any ductile iron interior wetwell piping and fittings shall be coated with a system compatible with interior coating selected for the wetwell.

M. Inspection and Acceptance:

1. Manholes and Wetwells shall be plumb. Structures out of plumb more than 1" in 20' are not allowed and shall be removed to the base and replaced on sound level foundation.

2. Manholes shall be true circles of acceptable concrete work with properly corbel tops, satisfactory inverts, complete interior coatings where required and properly placed frames, covers and steps. All leaks in manholes shall be repaired to the satisfaction of the AUTHORITY, prior to acceptance.

9.3 TESTS OF STRUCTURES:

- A. Prior to backfill, each cast-in-place or prestressed concrete tank, basin or other liquid retaining structure shall be tested by filling the structure with clear water to its intended operating level or a greater level as directed by the ENGINEER, and letting it stand for at least 24 hours. All wall castings, sleeves, and other openings shall be plugged temporarily during the test period.
- B. During cold weather, the CONTRACTOR shall take measures to insure that ice does not form on or in the structure prior to installation. These measures shall be submitted to the ENGINEER for approval.
- C. All exterior surfaces shall be examined for leakage. Leakage is not allowed. If leakage exceeds 0.3% in 24 hours, the work shall be repaired by draining the structure and removing and replacing the defective areas, or by other methods as approved by the ENGINEER, and then performing a second leakage test.
- D. In cast-in-place structures, hairline cracks that leak shall be enlarged to a V-shaped groove, 1-inch wide at the surface by 1-inch deep, and repaired to the satisfaction of the ENGINEER. Cracks may also be pressure grouted if required by the ENGINEER.
- E. All repairs to prestressed tanks shall be made in strict accordance with the recommendations of the tank constructor.
- F. Disposal of water after testing shall be satisfactory to the ENGINEER.
- G. Repair and retesting of the structure shall continue until leakage is within the allowable limits and all leaks are repaired to the satisfaction of the ENGINEER.
- H. Unless otherwise specified, all expenses of the leakage test, including measuring devices, temporary plugs, repairs and retesting, shall be paid for by the CONTRACTOR at no additional cost to the OWNER. Water necessary for the first leak test will be furnished by the OWNER, at no cost to the CONTRACTOR. Water used in retesting shall be paid for by the CONTRACTOR.
- I. If any structure fails to pass the leakage test after five times, the entire structure shall be removed and rebuilt at no additional cost to the OWNER; such rebuilt structure shall be subject to all leakage test requirements as specified herein.

END OF SECTION