

REGULATION #10

Adopted: 02/10/09
Effective: 04/22/09

REQUIREMENTS FOR STORM SEWER MATERIALS, INSTALLATION, CLEANING AND TESTING, INCLUDING DRAIN MANHOLES AND CATCH BASIN SPECIFICATIONS

Storm sewer facility installations are subject to the provisions of all applicable City ordinances as well as this regulation.

Purpose and applicability: The purpose of this regulation is to protect the City's stormwater facilities from the negative effects of inferior stormwater systems. This regulation applies to any land use application that requires stormwater management review and approval by the Planning Board or Code Enforcement Officer.

Civil engineers are strongly encouraged to discuss a project's stormwater management plan with the City's Site Planner and Water Resource Protection Department Engineer **prior to** plan submissions.

The following *2009 Water Resource Protection Department Storm Sewer Material Standards and Specifications* apply to all proposed developments. The standards and specifications are outlined as follows:

- A. Storm Sewer Pipe Specifications Table and Applications Schedule
 - Table 1 – 2009 Storm Sewer Pipe Specifications
 - 1. SDR-35 Pipe Application Schedule
 - 2. N-12 Pipe Application Schedule
 - 3. Blue Brute (DR-18) Pipe Applications Schedule
- B. Storm Sewer Line Cleaning
- C. Final Storm Sewer Testing
- D. Catch Basins, Grates and Frames
- E. Drain Manholes, Grates and Frames
- F. Maintenance Requirements

A. Storm Sewer Pipe Specifications Table and Applications Schedule

Table 1 – 2009 Storm Sewer Pipe Specifications

SYMBOL	DESCRIPTION	LOCATION	DEPTH RESTRICTIONS	MATERIAL	JOINT SYSTEM	SIZE
SDR-35	Gravity Storm Sewer Lines	Exterior	Minimum depth 3'	PVC	Push - On	4" thru 48"
	Perforated Storm Sewer Lines	Exterior	Minimum depth 3'	PVC	Push - On	4" thru 48"
N-12	Gravity Storm Lines	Exterior	Minimum Depth 3'	Polyethylene	Push - On	4" thru 60"
	Perforated Storm Sewer Lines	Exterior	Minimum Depth 3'	Polyethylene	Push - On	4" thru 60"
Dr-18	Gravity Storm sewer Lines	Exterior	Minimum Depth 1'	PVC	Push - On	4" thru 12"
	Storm Sewer Line Cleaning	-	-	-	-	-
	Final Storm Sewer Testing	-	-	-	-	-
	Catch Basins	Exterior	-	Concrete	-	4' – 8'
	Drain Manholes	Exterior	-	Concrete	-	4' – 8'
Revision dated	February 4, 2009					

1. SDR-35 PIPE APPLICATION SCHEDULE

1. General:

- A. SDR-35 can be used as storm sewer drainage as well as sanitary sewer lines.
- B. SDR-35 may be used as driveway apron culverts.
- C. SDR-35 is available in sizes 4" thru 48".
- D. SDR-35 comes in standard lengths of 13' and 14'.

2. Quality:

A. Standards:

- 1. SDR-35 shall meet ASTM D3034 for sizes 4" thru 15".
- 2. SDR-35 shall meet ASTM F-679 for sizes 18" thru 27".
- 3. SDR-35 rubber seals shall meet ASTM D 3212.
- 4. All fittings and connectors shall meet ASTM D3034 and ASTM D 3212 Standards.

B. Manufacturers:

- 1. J-M Manufacturing
- 2. IPEX
- 3. Or equal to above

3. Materials:

- A. The gaskets shall be of a composition and texture that is resistant to common ingredients of storm sewer, including oils and groundwater, and that will permanently endure the conditions of the proposed use.
- B. All fittings and pipe shall have a water tight push on joint and must meet the ASTM D3034 and ASTM D3212 standards.
- C. Perforated pipe may be used to remove ground water where it is an issue but may not be used if tying into sanitary sewer lines. Perforations will be ½" holes every 5" on center and two rows at 120° apart.

4. Installation:

- A. Shall have minimum of 3' of cover over pipe from finished grade.
- B. Shall have minimum of 6" of ¾" crushed stone bedding under pipe.
- C. Shall have ¾" crushed stone to spring line of pipe.
- D. Shall have a minimum of 6" of either ¾" crushed stone or sand over top of pipe.
- E. Perforated pipe shall be completely enveloped with ¾" crushed stone, 6" minimum all the way around piping.
- F. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1½ inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4	0-5

G. Sand: Shall be well graded durable material free of organic matter and conform to the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
¾ inch	100
No. 4	95-100
No. 16	50-86
No. 50	10-30
No. 100	2-10
No. 200	0-5

H. Refer to Storm Sewer Line Cleaning and Final Storm Sewer Testing standards contained in this Regulation.

2. N-12 PIPE APPLICATION SCHEDULE

1. General:

- A. N-12 pipe may be used as storm sewer piping or road culverts.
- B. N-12 pipe is available in sizes 4" thru 60".
- C. N-12 pipe usually comes in 8 foot lengths.

2. Quality:

A. Standards:

- 1. N-12 pipe shall meet all specifications per 4" -10" AASHTO standards M 252 and 12" – 24" Type C M 294.
- 2. N-12 pipe shall meet the ASTM F 405 standard for corrugated Polyethylene Tubing and fittings.
- 3. N-12 pipe shall meet the ASTM F 667 specifications for 8" thru 15" pipe.
- 4. N-12 pipe will have walls that are smooth bore.
- 5. All N-12 pipe shall have a soil-tight joint system that meets the ASTM F477 standard.
- 6. Couplings, Tee's and fittings must meet AASHTO M294 standards. All connections must be a rubber gasket tight seal. No collared connections accepted.

B. Manufacturers:

- 1. Advanced Drainage Systems
- 2. Hancore Technology
- 3. Lane Companies
- 4. Or equal to above

3. Materials:

- A. The gaskets shall be of a composition and texture that is resistant to common ingredients of storm water, including oils and groundwater, and that will permanently endure the conditions of the proposed use.
- B. Perforated pipe may be used in any area that is wet due to ground water upon review and approval by the City.
- C. Perforated pipes may not be tied into any sanitary sewer.

4. Installations:

- A. Shall have minimum of 3' of cover over pipe from finished grade.
- B. Shall have minimum of 6" of $\frac{3}{4}$ crushed stone bedding under pipe.
- C. Pipe shall have $\frac{3}{4}$ crushed stone to spring line of pipe.
- D. Pipe shall be backfilled with $\frac{3}{4}$ crushed stone or sand from spring line of pipe to 6" of cover over top of pipe.
- E. Perforated pipe must be stoned with $\frac{3}{4}$ crushed stone from 6" below depth to 6" above the pipe.
- F. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1½inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4	0-5

G. Sand: Shall be well graded durable material free of organic matter and conform to the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
⅜ inch	100
No. 4	95-100
No. 16	50-86
No. 50	10-30
No. 100	2-10
No. 200	0-5

H. Refer to Storm Sewer Line Cleaning and Final Storm Sewer Testing standards contained in this Regulation.

3. BLUE BRUTE PIPE APPLICATION SCHEDULE (Class 150 = DR-18)

1. General:

- A: DR-18 can be used for shallow drainage culverts where there is less than 3' of cover.
- B. DR-18 can be used for shallow storm sewer mains and service laterals where there is less than 3' of cover.
- C: DR-18 pipe usually comes in 20 foot lengths.

2. Quality:

- A. Standards:
 - 1. DR-18 shall meet the AWWA C-900 standard.
 - 2. DR-18 fittings will meet the ASTM D 1784 and shall be class 150.
 - 3. DR-18 bells shall be gasketed and meet the ASTM D3139 standard.
 - 4. DR-18 gaskets shall meet the ASTM F477 standard.
 - 5. DR-18 comes in sizes 4" thru 12".
- B. Manufacturers:
 - 1. IPEX
 - 2. J-M Manufacturing
 - 3. Or equal to above

3. Materials:

- A. The gaskets shall be of a composition and texture that is resistant to common ingredients of storm water, including oils and groundwater, and that will permanently endure the conditions of the proposed use.
- B. All fittings shall be push on with rubber gasket joints, and shall meet class 150 and conform to ASTM D1784 standard.
- C. Standard retainer glands will not be permitted for use with class 150 PVC pipe.

4. Installation:

- A. Shall have a minimum depth of 1' of cover over top of pipe from finished grade.
- B. Shall have minimum of 6" of $\frac{3}{4}$ " crushed stone bedding under pipe.
- C. Pipe can be backfilled with $\frac{3}{4}$ " crushed stone or sand to a minimum of 6" over top of pipe.

- D. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1½ inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4	0-5

- E. Sand: Shall be well graded durable material free of organic matter and conform to the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
⅜ inch	100
No. 4	95-100
No. 16	50-86
No. 50	10-30
No. 100	2-10
No. 200	0-5

- F. Refer to Storm Sewer Line Cleaning and Final Storm Sewer Testing standards contained in this Regulation.

B. STORM SEWER LINE CLEANING

1. General:

A. Description

1. Upon completion of installation or repair of storm sewer lines, proper cleaning may be necessary.

2. Materials:

- A. Movable dams shall be permitted for the purpose of cleaning storm sewers. Movable dams need to be collapsible in case of upstream line surcharging, so the dam could be removed to allow flow to resume down the storm sewer line. Movable dams must be the same size as the inside diameter of the storm sewer line being cleaned, and have a flexible scraper attached so a thorough cleaning of debris is accomplished.
- B. High pressured water jetting equipment is the preferred way of cleaning storm sewer lines. This method allows for a thorough cleaning and does not disrupt regular flow from passing through the storm sewer line as line cleaning is being performed. This method also allows easier control of water flow, for efficiency for a light cleaning or heavy cleaning, depending on the amount of debris in the storm sewer line.
- C. Take precautions when using test balls and other methods of damming up lines, as these methods are not easily able to be removed in case of upstream surcharging.

3. Execution:

- A. Select the best method of cleaning the line by the condition and volume of flow at the time of cleaning.
- B. Select the best method of cleaning based on amount of debris in the line.
- C. Select the best method of cleaning for protecting the existing storm sewer line at the time of cleaning.
- D. Select the best method so as to capture all debris for removal in a downstream manhole.
- E. Removal of all debris is required when cleaning the storm sewer lines, passing of material down the line will not be permitted.
- F. All debris will be removed from the site and be disposed of in an approved manner upon completion of line cleaning.
- G. All line cleaning may be inspected to check for efficiency and quality of cleaning performed.

C. FINAL STORM SEWER TESTING

1. General:

A. Description

1. Work Included:

- a. Final storm sewer testing work includes the performance of testing and inspecting each and every length of storm sewer pipe, pipe joint and each item of appurtenant construction.
- b. Perform testing at a time acceptable to the City's engineer, which may be during the construction operations, after completion of all pipe laying operations.
- c. Provide all labor and equipment and any other necessary apparatus for the testing.

2. Execution

A. Performance

1. General:

- a. All storm sewers and appurtenant work, in order to be eligible for acceptance, shall be subjected to tests that will determine the degree of horizontal and vertical alignment.
- b. Thoroughly clean and flush all storm sewer lines to be tested, prior to initiating test procedures.
- c. Perform all tests and inspections in the presence of the City engineer, or others assigned by the engineer, to ensure accuracy and compliance.
- d. Remedial work:
 - i. Perform all work necessary to correct deficiencies discovered as a result of testing and or inspections.
 - ii. Completely retest all portions of the original construction on which remedial work has been performed.

2. Alignment tests:

- a. Perform tests for the correctness of horizontal and vertical alignment on each and every length of gravity storm sewer pipeline between manholes.
- b. Alignment tests to be conducted after all pipes have been installed and backfilled.
- c. The observation test shall be conducted after all upstream work has been completed and the pipeline cleaned of debris.
- d. Notify the City engineer at least 24 hours in advance of the proposed observation testing.
- e. Introduce water into the storm sewer lines to be tested from the upstream manhole prior to the observation test but no more than 24 hours in advance of the test.

- f. Beam a source of light, acceptable to the City engineer, through the pipeline from both ends and the City engineer will directly observe the light in the downstream, and/or upstream manhole of each test section.
- g. The length of pipe between manholes, diameter of pipe and amount of light observed in the manhole at the end of each pipe section will determine acceptance of the alignment test by the City engineer.
- h. The amount of vertical and horizontal deflection shall not be greater than the ASTM allowance and (manufacturer's recommendations) for the pipe being tested.
- i. **NO STANDING WATER SHALL BE ALLOWED.** The presence of standing water shall be cause for rejection of that pipe (including manhole) section.
- j. Improper alignment will be corrected by re-excavation and resetting of pipe.

3. Pipe Deflection:

- a. Pipe provided under this specification shall be installed so there is no more than a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (normal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
- b. The contractor shall wait a minimum of 30 days after completion of a section of storm sewer, including placement and compaction of backfill, before measuring the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the City engineer.
- c. Should the installed pipe fail to meet this requirement, the contractor shall do all work to correct the problem as the City engineer may require without additional compensation.

4. Television Inspection Tests (gravity storm sewers)

- a. Where television inspection testing is required, test procedures shall be in compliance with the requirements outlined in Specification Section.
- b. No standing water shall be allowed. The presence of standing water may be cause for rejection of that pipe.
- c. Any standing water, detectable leaks, improper joints or any other unacceptable feature detected by the television inspection will be corrected by re-excavation and resetting pipe at no additional cost to the owner.

D. CATCH BASINS, GRATES AND FRAMES

1. General:

A. Description

1. Construct catch basins, grates, frames, and brick masonry in conformance with the following specification.

B. Quality assurance

1. Precast Catch Basin Base, Barrel, and Top Sections:
 - a. Conform to ASTM C478-72 (AASHTO M199-795) except as modified herein, or as directed by the City engineer.
 - b. Average strength of 4,000 psi at 28 days.
 - c. Testing:
 - i. Determine concrete strength by tests on 6 inch by 12 in vibrated test cylinders cured in the same manner as the bases, barrels and tops.
 - ii. Have tests conducted at manufacturer's plant or at an approved testing laboratory.
 - iii. Have not less than 2 tests made for each 100 vertical feet of precast catch basin sections.
2. Frames and Covers:
 - a. Acceptable Manufacturers:
 - i. Etheridge Foundry Company: Type E245, Round, E 24x51/4.
 - ii. No equals.
3. Masonry:
 - a. Brick: Shall comply with ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
 - b. Cement: ASTM C-150.
 - c. Hydrated Lime: ASTM C-207.
 - d. Sand: ASTM C33.

C. Submittals To The Engineer

1. Bases, Barrel Sections and Tops: Submit test results and receive approval from the City engineer prior to delivery to the site.

2. Products:

A. Precast Catch Basin Sections

1. Use flat tops or eccentric cones as appropriate. Exterior face of cone sections shall not flare out beyond the vertical.
2. Joints: Bell-and-Spigot or tongue-and-groove formed on machine rings to insure accurate joint surfaces.
3. Constructed to support an HS-20 wheel loading.
4. The base section shall have a 2-foot minimum and 3-foot maximum sump.
5. Openings:
 - a. Provide openings in the risers to receive pipes entering the catch basin of the types and materials approved by the City engineer.
 - b. Make openings at the manufacturing plant or cut openings in the field.

- c. Provide flexible boot or solidly fill annular spaces around pipes entering the catch basin with non-shrink grout or other material approved by the City engineer.
 - d. Size: To provide a uniform annular space between the outside wall of pipe and the riser.
 - e. Location: To permit setting of the entering pipes at the correct elevations.
6. Joints:
- a. Joint gaskets to be flexible self seating butyl rubber joint sealant installed according to manufacturer's recommendations.
 - b. Acceptable Joint Gasket Materials:
 - i. Kent-Seal No. 2
 - ii. Ram-Neck
 - iii. Or equivalent
 - c. Joints between precast sections shall conform to related standards and manufacturer's instructions.
7. Frames and Grates:
- a. All frames and grates shall be made of cast iron and shall have machined bearing surfaces to prevent rocking under traffic.
 - b. Grate castings will be smooth with no sharp edges.
 - c. Constructed to support an HS-20 wheel loading.
8. Masonry:
- a. Brick:
 - i. Sound, hard, uniformly burned, regular and uniform in shape and size, compact texture, and satisfactory to the City engineer.
 - ii. Immediately remove rejected brick from the work.
 - iii. Adjust frame to grade with bricks laid flat with minimum of 1 course and a maximum of 5 courses.
 - b. Mortar:
 - i. Composition (by volume):
 - a. 1 part portland cement.
 - b. ½ part hydrated lime.
 - c. 4 ½ parts sand.
 - ii. The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed 3 times the sum of the volume of cement and lime.
 - c. Cement:
 - i. Shall be Type II portland cement.
 - d. Sand:
 - i. Shall consist of inert natural sand.
 - ii. Grading:

<u>Sieve</u>	<u>Percent Passing</u>
3/8	100
4	95-100
8	80-100
16	50-85
50	10-30
100	2-10
Fine Modulus	2.3-3.1

3. Execution:
 - A. Performance
 1. Precast Catch Basin Sections:
 - a. Perform jointing in accordance with manufacturer's recommendations and as approved by the City engineer.
 - b. Install barrels and tops level and plumb.
 - c. Make all joints water tight. Apply two rows of joint gasket material per barrel joint.
 - d. Cut openings (as required) carefully to prevent damage to barrel sections and tops. Damaged barrel sections and tops shall be replaced by the Contractor at no additional expense to the City.
 - e. For cold weather applications, install joint sealant per manufacturer's recommendations.
 2. Masonry:
 - a. Laying Brick:
 - i. Use only clean bricks in brickwork for catch basin.
 - ii. Moisten the brick by suitable means until they are neither so dry as to absorb water from the mortar or so wet as to be slippery when laid.
 - iii. Lay each brick in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and thoroughly bond as directed.
 - iv. Construct all joints in a neat workmanlike manner, construct the brick surfaces inside the manholes so they are smooth with no mortar extending beyond the bricks and no voids in the joints. Maximum mortar joints shall be ½ inch.
 - b. Curing:
 - i. Protect brick masonry from drying too rapidly by using burlaps which are kept moist, or by other approved means.
 - ii. Protect brick masonry from the weather and frost as required.
 3. Frames and Grates:
 - a. Set all frames in a full bed of mortar, true to grade and concentric with the catch basin opening.
 - b. Completely fill all voids beneath the bottom flange to make a watertight fit.
 - c. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the catch basin all around its circumference.
 - d. Clean the frame seats before setting the covers in place.
 4. Bedding and Backfill:
 - a. Bedding material of catch basin shall be a minimum of 6 inches of crushed stone.

- b. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1½ inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4	0-5

- c. Backfill 18 inches all around catch basin with select fill.
- d. Select Fill: Shall consist of well graded granular material free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and having no rocks with a maximum dimension of over 4 inches and meeting the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
4 inch	100
3 inch	90-100
No. 4	20-55
No. 40	5-40
No. 200	0-8

E. DRAIN MANHOLES, GRATES AND FRAMES

1. General:

A. Description

1. Construct drain manhole, grates, frames, brick masonry, inverts and apply waterproofing in conformance with the following specification.

B. Quality Assurance

1. Precast Drain Manhole Base, Barrel, and Top Sections:

- a. Conform to ASTM C478-97.
- b. Average strength of 4,000 psi at 28 days.
- c. Testing:
 - i. Determine concrete strength by tests on 6 inch by 12 in vibrated test cylinders cured in the same manner as the bases, barrels and tops.
 - ii. Have tests conducted at manufacturer's plant or at an approved testing laboratory.
 - iii. Have not less than 2 tests made for each 100 vertical feet of precast catch basin sections.

2. Drain Manhole Steps:

- a. Reliance Steel Products, Inc.
- b. M.A. Industries, Inc.
- c. Or equal.

3. Frames and Covers:

- a. Acceptable Manufacturers:
 - i. Etheridge Foundry Company: Type E245, Round.
 - ii. No equals.

4. Masonry:

- a. Brick: Shall comply with ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
- b. Cement: ASTM C-150.
- c. Hydrated Lime: ASTM C-207.
- d. Sand: ASTM C33.

5. Waterproofing:

- a. Acceptable Manufacturers:
 - i. Minwax Fibrous Brush Coat, Minwax Co., N.Y., N.Y.
 - ii. Tremco 121 Foundation Coating, Tremco Mfg. Co., Newark, N.J.
 - iii. Or equal.

C. Submittals To The Engineer

1. Bases, Barrel Sections and Tops: Submit test results and receive approval from the City engineer prior to delivery to the site.

2. Products:

A. Precast Drain Manhole Sections

1. Use flat tops or eccentric cones as appropriate.

a. Tops:

- i. Diameter: Eccentric cone type, 24 inches I.D. at top, 48 inches minimum at bottom.
- ii. Length: 4 feet.
- iii. Wall Thickness: Not less than 5 inches at the base, tapering to not less than 8 inches at the top.
- iv. Joints: Bell-and-Spigot or tongue-and-groove formed on machine rings to insure accurate joint surfaces.
- v. Exterior face of cone sections shall not flare out beyond the vertical.

b. Flat Slab Tops:

- i. Location: Where shallow installations do not permit the use of a cone-type top.
- ii. Slab Thickness: Not less than 6 inches.
- iii. Constructed to support an HS-20 wheel loading.

2. Openings:

- a. Provide openings in the risers to receive pipes entering the catch basin of the types and materials approved by the City engineer.
- b. Make openings at the manufacturing plant or cut openings in the field.
- c. Size: To provide a uniform annular space between the outside wall of pipe and the riser.
- d. Location: To permit setting of the entering pipes at the correct elevations.
- e. Openings shall have a flexible watertight union between pipe and the manhole base.
 - i. Cast into the drain manhole base and sized to the type of pipe being used.
 - ii. Type of flexible joint being used shall be approved by the City engineer. Install materials according to the Manufacturer's instructions.
 - a. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.
 - b. Kor N Seal made by National Pollution Control System, Inc.
 - c. Press Wedge II made by Press-Seal Gasket Corporation.
 - d. A-Lok Manhole Pipe Seal made by A-Loc Corporation.
 - e. Or equal.

3. Joints:

- a. Joint gaskets to be flexible self seating butyl rubber joint sealant installed according to manufacturer's recommendations.
- b. Acceptable Joint Gasket Materials:
 - i. Kent-Seal No. 2
 - ii. Ram-Neck
 - iii. Or equivalent
- c. Joints between precast sections shall conform to related standards and manufacturer's instructions.

4. Waterproofing:
 - a. The exterior surface of all manholes shall be given two coats of bituminous waterproofing material at an application rate of 75 to 100 square feet per gallon, per coat.
 - b. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.
 - c. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.
5. Frames and Grates:
 - a. All frames and grates shall be made of cast iron and shall have machined bearing surfaces to prevent rocking under traffic.
 - b. Grate castings will be smooth with no sharp edges.
 - c. Constructed to support an HS-20 wheel loading.
 - d. Dimensions and Style:
 - i. Covers – solid with drain in 3-inch letters diamond pattern.
 - ii. Frame – 24 inch diameter clear opening, with flange bracing ribs.
 - e. Minimum weight of frame and cover shall be 350 lbs.
6. Manhole Steps
 - a. Polyethylene coated steel safety type designed with a minimum concentrated live load of 300 pounds.
 - b. All steps shall be cast into walls of the precast section so as to form a continuous ladder with a distance of 12 inches between steps.
7. Masonry:
 - a. Brick:
 - i. Sound, hard, uniformly burned, regular and uniform in shape and size, compact texture, and satisfactory to the City engineer.
 - ii. Immediately remove rejected brick from the work.
 - iii. Adjust frame to grade with bricks laid flat with minimum of 1 course and a maximum of 5 courses.
 - b. Mortar:
 - i. Composition (by volume):
 - a. 1 part portland cement.
 - b. ½ part hydrated lime.
 - c. 4 ½ parts sand.
 - ii. The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed 3 times the sum of the volume of cement and lime.

- c. Cement:
 - i. Shall be Type II portland cement.
- d. Sand:
 - i. Shall consist of inert natural sand.
 - ii. Grading:

<u>Sieve</u>	<u>Percent Passing</u>
3/8	100
4	95-100
8	80-100
16	50-85
50	10-30
100	2-10
Fine Modulus	2.3-3.1

3. Execution:

A. Performance

1. Precast Drain Manhole Sections:
 - a. Perform jointing in accordance with manufacturer's recommendations and as approved by the City engineer.
 - b. Install barrels and tops level and plumb.
 - c. Make all joints water tight. Apply two rows of joint gasket material per barrel joint.
 - d. Cut openings (as required) carefully to prevent damage to barrel sections and tops. Damaged barrel sections and tops shall be replaced by the Contractor at no additional expense to the City.
 - e. For cold weather applications, install joint sealant per manufacturer's recommendations.
 - f. Install barrel sections and top so that the steps are in alignment.
2. Invert Channels:
 - a. Smooth and semicircular in shape.
 - b. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.
 - c. Stop the pipes at the inside face of the manhole where changes of direction occur.
 - d. Form invert channels and shelf with brick. Fill the void area for constructing the brick shelf with mortar. Stone, gravel, or other material will not be permitted to fill the void area for constructing the brick shelf.
 - e. Shape invert to make smooth transition in vertical grade.
 - f. Slope brick shelf towards the flow channel.

3. Masonry:
 - a. Laying Brick:
 - i. Use only clean bricks in brickwork for catch basin.
 - ii. Moisten the brick by suitable means until they are neither so dry as to absorb water from the mortar or so wet as to be slippery when laid.
 - iii. Lay each brick in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and thoroughly bond as directed.
 - iv. Construct all joints in a neat workmanlike manner, construct the brick surfaces inside the manholes so they are smooth with no mortar extending beyond the bricks and no voids in the joints. Maximum mortar joints shall be $\frac{1}{2}$ inch.
 - b. Curing:
 - i. Protect brick masonry from drying too rapidly by using burlaps which are kept moist, or by other approved means.
 - ii. Protect brick masonry from the weather and frost as required.
4. Frames and Covers:
 - a. Set all frames in a full bed of mortar, true to grade and concentric with the catch basin opening.
 - b. Completely fill all voids beneath the bottom flange to make a watertight fit.
 - c. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the catch basin all around its circumference.
 - d. Clean the frame seats before setting the covers in place.
5. Plugging and Patching:
 - a. Fill all exterior cavities with non-shrink grout and with bituminous waterproofing once the concrete and mortar has set.
 - b. Touch up damaged water proofing.
6. Bedding and Backfill:
 - a. Bedding material of drain manhole shall be a minimum of 6 inches of crushed stone.
 - b. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2 inch	100
1½ inch	95-100
¾ inch	35-70
⅜ inch	10-30
No. 4	0-5

- c. Backfill 18 inches all around drain manhole with select fill.
- d. Select Fill: Shall consist of well graded granular material free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and having no rocks with a maximum dimension of over 4 inches and meeting the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
4 inch	100
3 inch	90-100
No. 4	20-55
No. 40	5-40
No. 200	0-8

F. MAINTENANCE REQUIREMENTS

1. General

- A. The developer, applicant, his/her/its heirs, successors and assigns, shall maintain all components of the stormwater management system until the system is formally accepted by the City or is placed under the jurisdiction of a lawfully existing property owners' association whose rights and responsibilities include maintenance of the stormwater management system and that possesses adequate financial capacity to carry out these responsibilities.
- B. The property owner(s) and/or property owners' association responsible for the maintenance of all stormwater management facilities shall provide for the services necessary to implement the stormwater management plan and include details of such to the Planning Board as part of the Planning Board review process. A copy of the maintenance log book shall be submitted annually **on or before July 15th** to the Director of the City of South Portland Water Resource Protection Department. At a minimum, the appropriate and relevant maintenance, inspection and record keeping activities for each of the stormwater management structures, measures and devices will be performed on the prescribed schedule contained in the approved stormwater management plan.