1. **GENERAL**
   1. **Summary**
      1. Provide storm drainage systems, including piping and all necessary accessories as designated in this Section.
   2. **References and Related BCIT Standards**
      1. ASTM A74 Standard Specification for Cast Iron Soil Pipe and Fittings, latest adopted edition.
      2. ASTM A536-84 Standard Specification for Ductile Iron Castings, latest adopted edition.
      3. ASTM D2665 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings, latest adopted edition.
      4. BC Building Code, Latest Edition (BCBC).
      5. CISPI 301-04 Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
      6. MSS SP-72-2010A Ball Valves with Flanged or Butt-Welding Ends for General Service.
   3. **Submittals**
      1. Submit in accordance with Section 01 33 00 Submittal Procedures, and all items listed in Part 2 - Products.
      2. Product Data: Include manufacturer's literature and data with full item description and optional features and accessories. Provide detailed Shop Drawings where clamping devices and extensions are required in connection with waterproofing membrane or floor drain.
      3. Prior to submitting the request for final inspection, provide Certification documentation to include the following:
         1. Test results.
         2. Names of individuals performing work for the testing agency on this project.
         3. Detailed procedures followed for all tests.
         4. Certification that all results of tests were within limits specified.
2. **PRODUCTS**
   1. **Storm Water Drain Piping**
      1. Cast iron storm pipe and fittings:
         1. Location:
            1. Pipe buried in or in contact with earth may be PVC/ABS to within 100 mm of the top of the slab on grade.
            2. Interior storm piping above grade.
            3. All mechanical equipment rooms or other areas containing mechanical air handling equipment.
         2. Cast Iron Storm Pipe: Hubless (plain end or no-hub) as required by selected jointing method.
         3. Pipe and Fittings Material: Cast iron soil pipe and fittings conforming to the requirements of CISPI Standard 301 or equivalent.
      2. Polyvinyl Chloride (PVC):
         1. Polyvinyl chloride storm sewer pipe and fittings are permitted for single storey structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.
         2. Polyvinyl chloride storm sewer pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D1785 and D 2665.
   2. **Specialty Pipe Fittings**
      1. Ensure that transition pipe couplings join piping with small differences in outside diameters or be of different materials.
         1. End connections: Same size and compatible with pipes being joined.
         2. Transition coupling: Elastomeric, sleeve type reducing or transition pattern and includes shear erring and corrosion resistant metal tension band and tightening mechanism on each end.
         3. The transition coupling sleeve coupling shall be of the following material:
            1. For cast iron soil pipes: Rubber sleeve material conforming to ASTM C564.
            2. For PVC soil pipes sleeve material: Elastomeric seal conforming to ASTM F 477.
            3. For dissimilar pipes: PVC sleeve material conforming to ASTM D5926.
      2. Dielectric fittings:
         1. Conforming to ASSE 1079 with a pressure rating of 860 kPa at a minimum temperature of 82°C.
         2. End connection: Solder joint copper alloy and threaded ferrous.
      3. Dielectric flange insulating kits:
         1. Non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa.
         2. Gasket: Neoprene or phenolic.
         3. Bolt sleeves: Phenolic or polyethylene.
   3. **Cleanouts**
      1. Cleanouts:
         1. Same size as pipe, up to 100 mm; and not less than 100 mm for larger pipe.
         2. Ensure cleanouts are easily accessible, gastight and watertight. Provide minimum clearance of 600 mm for clearing clogged sanitary lines.
      2. Floor Cleanouts:
         1. Gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M.
         2. Ensure cleanout is vertically adjustable for a minimum of 50 mm. When waterproof membrane is used in floor system, provide clamping collars on the cleanouts.
         3. Cleanouts in resilient tile floors, quarry tile and ceramic tile floors:
            1. Provide with square top covers recessed for tile insertion.
            2. Provide carpet cleanout markers in carpeted areas.
            3. Provide two-way cleanouts where indicated on drawings and at every building exit.
         4. Cleanouts in sidewalk areas or areas subject to vehicular traffic: Heavy duty type loading classification.
      3. Provide cleanouts at or near the base of vertical stacks with cleanout plug approximately 600mm above the floor.
         1. Where no fixtures are installed on the lowest floor, install cleanout at base of stack. Extend cleanouts to the wall access cover. Cleanout shall consist of sanitary tees.
         2. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 x 150 mm at each wall cleanout.
      4. Horizontal Runs Above Grade: Use cleanouts of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule.
   4. **Roof Drains and Connections**
      1. Roof Drains (RD): Cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, provide a soft copper membrane 300 mm in diameter greater than outside diameter of drain collar.
         1. Flat Roofs: Roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm in diameter. For insulated roof, provide a roof drain with adjustable drainage collar, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp.
         2. Canopy Roofs: Roof drain shall have a beehive or dome shaped strainer with the integral flange not larger than 200 mm in diameter.
         3. Promenade Decks: Roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
         4. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected.
         5. Protective Roof Membrane Insulation Assembly: Roof drain shall have a perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp. Roof Drains identified as overflow drains shall have a 50mm water dam integral to the drain body.
   5. **Waterproofing**
      1. Sleeve Flashing Device:
         1. Provide at points where pipes pass through membrane waterproofed floors or walls.
         2. Manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane.
         3. Provide a galvanized steel pipe extension in the top of the fitting that will extend 50 mm (2 inches) above finished floor and in the bottom of the fitting that will extend through the floor slab.
   6. **Catchbasins and Manholes**
      1. Catch basins and storm manholes: Pre-cast concrete with a solid concrete base where adequate depth is available for using standard pre-cast sections.
         1. Barrel: 48 in. (1200 mm) in diameter with minimum personnel access of 30 in. (750 mm) in diameter if the invert elevation is more than 4 ft. (1200 mm) below the surface.
      2. Use curb-inlet grates in parking or driving areas whenever possible.
      3. Ensure that catch basin covers in parking lots or pedestrian areas do not have inlet holes large enough for canes and crutches to get caught.
      4. Ensure catch basin covers in roads, parking lots and pedestrian areas are bicycle-safe.
   7. **Backwater Valves**
      1. Cast Iron: ANSI A112.21.2; galvanized cast iron body and cover, brass valve, 150 mm (6 in.) extension sleeve, and access cover.
      2. Plastic: ABS or PVC body and valve, 150 mm (6 in.) extension sleeve, and access cover.
3. **EXECUTION**
   1. **Pipe Installation**
      1. Piping shall conform to the following:
         1. Storm Water Drain and Vent Drain to main stacks:

|  |  |
| --- | --- |
| **Pipe Size** | **Minimum Pitch** |
| 80 mm and smaller | 2% |
| 100 mm and larger | 1% |

* + 1. Lay pipe runs to avoid interference with other work.
    2. Install seismic restraint where required by Code.
    3. Minimum horizontal slope shall be one inch for every 1.22 m (2%) of pipe length, unless otherwise stated in documentation.
    4. Do not change direction of flow more than 90°.
    5. Where pipes of different sizes are connected, use proper size of standard increaser and reducers.
    6. Reducing size of drainage piping in direction of flow is prohibited.
    7. Buried storm drainage piping:
       1. Install piping true to grades and alignment indicated with unbroken continuity of invert. Place hub ends upstream.
       2. Install required gaskets according to manufacturer’s written instruction for use of lubricants, cements, and other installation requirements.
    8. Aboveground PVC piping: Install according to ASTM D2665. Underground PVC piping: Install according to ASTM D2321.
  1. **Joint Construction**
     1. Hub and spigot, cast iron piping with gasket joints: Join in accordance with CISPI’s “Cast Iron Soil Pipe and Fittings Handbook” for compression joints. Hubless, cast iron piping: Join in accordance with CISPI’s “Cast Iron Soil Pipe and Fittings Handbook” for hubless coupling joints. Threaded joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Join pipe fittings.
     2. PVC piping: Install in accordance with requirements of ASTM F402. Ensure joints conform to ASTM D2855.
  2. **Specialty Pipe Fittings**
     1. Transition coupling: Install at pipe joints with small differences in pipe outside diameters.
     2. Install dielectric fittings at connections of dissimilar metal piping and tubing.
  3. **Pipe Hangars, Supports, and Accessories**
     1. Support horizontal piping and tubing within 300 mm of each fitting or coupling.
     2. Support horizontal cast iron piping with the following maximum horizontal spacing and minimum hanger rod diameters**:**
        1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm with 10 mm rod.
        2. NPS 3 (DN 80): 1500 mm with 13 mm rod.
        3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm with 16 mm rod.
        4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm with 19 mm rod.
        5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm with 22 mm rod.
     3. The maximum support spacing for horizontal plastic shall be 1.22 m.
     4. Support vertical piping and tubing at the base, at each floor, and at intervals no greater than 4m.
     5. If vertical distance exceeds 6 m for cast iron pipe, provide auxiliary steel for additional support in the center of that span.
     6. Penetrations:
        1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop providing an effective barrier against the spread of fire, smoke and gases.
        2. Water proofing: At floor penetrations, seal and make watertight with sealant all clearances around the pipe.
  4. **Field Quality Control**
     1. Storm Water Drain Tests: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test as directed.
        1. Water test for entire system: Tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow.
        2. Water test for sections: Tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m head of water.
        3. Air test: Maintain air pressure of 35 kPa gauge for at least 15 minutes without leakage. Use a force pump and mercury column gauge for the test.

\*\*\* END OF **FACILITY STORM DRAINAGE** SECTION \*\*\*