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DIVISION

EARTHWORK

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DIVISION 31: EARTHWORK

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SECTION 311000

SITE CLEARING

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for removal of vegetation at the site, including stripping of sod and soil for site clearing.

1.2 SITE CLEARING

- A. Clearing and grubbing obstructions, trees, shrubs, and other vegetation, including removal of stumps, roots, and debris.
- B. Provide temporary erosion- and sedimentation-control measures.

LEED SUGGESTIONS

- 2.1 As a prerequisite for LEED certification, an erosion- and sedimentation-control plan is required for the project. This plan must comply with the more stringent of either the “2003 EPA Construction General Permit” or local erosion- and sedimentation-control standards and codes. According to the EPA, the permit applies to construction sites greater than 1 acre except for smaller sites that are part of a larger common plan of development or sale. However, for LEED certification, the requirements are applied to all projects for this prerequisite.

END OF SECTION

SECTION 312000

EARTH MOVING

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for grading, excavation, embankments, and sedimentation and erosion control. Earth moving for foundations, structures, pavement, ditches, culverts, drains, and utilities.

1.2 MATERIALS

- A. Satisfactory Soils: ASTM D 2487 soil classification groups **and Geotechnical Engineer.**
- B. **Engineered Fill: Graded mixture of gravel, crushed stone, and sand with 90% passing a 1-1/2-inch sieve and not more than 12% passing a No. 200 sieve.**
- C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
 - 1. Aggregates used for subsurface storage of storm water or for use with underdrains shall be washed limestone, washed gravel, or river rock. In all cases the aggregates shall be 100 percent crushed.
- E. Topsoil: Shall be fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter or stones larger than 1/2 inch.
 - 1. Provide 6 inches minimum topsoil.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- G. Sand: ASTM C33; Clean, general purpose sand, free of organic and deleterious materials.
- H. **Geotextiles: Subsurface drainage geotextile and separation geotextile.**
- I. Geogrid.
- J. **Controlled Low-Strength Material.**

1.3 EXCAVATION

- A. **Explosives: Not allowed.**

1.4 FIELD QUALITY CONTROL

- A. Special Inspector and Testing Agency: Owner engaged.**

LESSONS LEARNED

- 2.1 During the design process, several professionals on the Design Team might need to revise this section to coordinate Specification Sections within the project manual. Besides input from the Architect and the Geotechnical Engineer, the Civil, Structural, Mechanical, Plumbing, and Electrical Engineers might share editing and review obligations. Each Design Professional's responsibilities and scope of service depends on the agreement with the Prime Consultant or the Owner.**
- A. Assigning specification-review responsibility can be overlooked during the design process. Review may be inferred or expected without expressly stating this in the various agreements, particularly where the agreement is directly with the Owner. Clearly delineate the responsibilities for editing and reviewing this Section in consultants' agreements.**
- 2.2 A dewatering system should be designed to keep the excavation continuously stable and dry. For deep excavations, ground-water extraction must be carefully controlled. For this purpose, piezometers measuring hydrostatic pressure are installed at various depths in sufficient number to detect the important piezometric water level changes resulting from removing the ground water.**
- 2.3 Adjacent Structures: Occasionally, settlement of adjacent structures might be attributed to dewatering. Existing structures founded on weak, compressible soils or on saturated, loose sand could settle. The condition of structures, type of foundation, and water table elevations immediately adjacent to the project should be determined before dewatering. If dewatering and excavation will lower the water table significantly at such structures, underpinning precautions may be necessary.**
- 2.4 Typically, the type of damage produced by dewatering is caused by settlement, particularly differential settlement. Settlement under walls, foundations, and stone and concrete masonry can cause cracking in these structures and in finishes. Buildings with deep foundations will usually be less affected by dewatering than those with shallow foundations; older buildings are usually more affected than newer ones.**

END OF SECTION

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DIVISION

EXTERIOR IMPROVEMENTS

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SECTION 321216

ASPHALT PAVING

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for base course and pavements above base course including conventional pavements for walks, roads, parking lots, and recreation areas. Also includes bituminous base courses, bituminous binder courses, and bituminous surface courses; tack coats.

1.2 QUALITY ASSURANCE

- A. Road and paving materials and methods shall be in accordance with the State of Ohio Department of Transportation (ODOT), "Construction and Material Specifications", latest edition.
- B. Pavement markings within public right-of-ways shall be in accordance with US Manual on Uniform Traffic Control Devices.

1.3 COMPACTED AGGREGATE

- A. Aggregate base shall consist of stone, gravel, or slags with composition and gradation described as "Item 304," and conforming to requirements of 703.04 of the State of Ohio Department of Transportation (ODOT), "Construction and Material Specifications."

1.4 PAVING MATERIALS

- A. Bituminous Base Course: ODOT "Item 301".
- B. Binder Course Asphalt Concrete: ODOT "Item 448".
- C. Surface Course Asphalt Concrete: ODOT "Item 448".
- D. Tack Coat: Emulsified asphalt.

1.5 AUXILIARY MATERIALS

- A. ***Paving Geotextile: Non-woven polypropylene.***
- B. ***Pavement-Marking Paint.***
- C. ***Wheel Stops: Precast concrete or solid, recycled plastic with galvanized-steel dowels.***

1.6 FIELD QUALITY CONTROL

- A. ***Testing: By Owner-engaged agency.***

END OF SECTION

EXTERIOR IMPROVEMENTS

SECTION 321313

CONCRETE PAVING

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for rigid cement concrete pavements above base course including conventional and modified pavements for walks, roads, parking lots, and service areas.

1.2 QUALITY ASSURANCE

- A. Quality Standard: ACI 301.

1.3 MATERIALS

- A. Concrete: ASTM C 150.
 - 1. Normal-weight aggregate.
 - 2. Air-entraining admixture.
 - 3. Color pigment (optional).
 - 4. Finish: Broom finish.
- B. Wire Mesh: Welded plain steel wire fabric.
- C. Reinforcing Bars: Deformed steel bars.
- D. Fabricated Bar Mats: Steel bar or rod mats.
- E. Joint Dowel Bars: Plain steel bars.
- F. Detectable Warnings.
- G. *Fiber Reinforcement: Synthetic fiber.***

1.4 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

END OF SECTION

SECTION 321314

PERVIOUS CONCRETE PAVEMENT

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for pervious concrete paving.

1.2 QUALITY ASSURANCE

- A. State of Ohio Department of Transportation (ODOT), "Construction and Material Specifications".

B. ACI 522R-06 Pervious Concrete**C. ACI 522.1-08 Specification for Pervious Concrete Pavements**

1.3 PRODUCTS

- A. Stormwater Detention Layer or Groundwater Recharge Bed
 - 1. Test Subgrade
 - a. Field Method: ASTM D 3385.
 - 2. Coarse Aggregate for Stormwater Detention Layer: ODOT Item 703.1, AASHTO size No. 2.
 - 3. Choker Base Coarse Aggregate for Stormwater Detention Layer: ODOT Item 703.1, AASHTO size No. 57.
 - 4. Impervious Liner.
 - 5. Filter Fabric.
 - 6. Isolation Joint Material.
 - 7. Curing Materials.
- B. Pervious Concrete Pavement
 - 1. Cement: ASTM 150 or ASTM C 595.
 - 2. Supplementary Cementitious Materials
 - a. Fly Ash
 - b. Ground Granulated Blast-Furnish Slag.
 - 3. Admixtures
 - a. Air Entraining Admixture.
 - b. Chemical Admixtures
 - 1) Mid-range water reducing admixtures or high range water-reducing admixtures.
 - 2) Extended set control admixtures or water-reducing/retarding admixtures.
 - 3) Viscosity modifying admixtures.
 - 4. Aggregates for Pervious Concrete: ASTM C33 and ODOT Item 703.02, No. 67, 7, 8, and 89 or 9.
 - 5. Water.
 - 6. Mixture Proportions: Appendix 6 of ACI 211.3R.

1.4 FIELD QUALITY CONTROL

- A. Owner engaged.

EXTERIOR IMPROVEMENTS**LEED SUGGESTIONS**

- 2.1 Pervious Paving: Credit for Sustainable Sites, SS 6.1 for stormwater design awards one point for stormwater management practices that reduce runoff to meet certain criteria. Pervious paving can be used as part of a stormwater management design to obtain this point.

LESSONS LEARNED

- 3.1 Pervious paving, also called porous paving, gap-graded paving, permeable paving, or enhanced porosity paving, can be used as part of a stormwater management design to reduce stormwater runoff and replenish aquifers.
- 3.2 Most concrete paving is produced from dense mixes of well-graded aggregate sizes that interlock with each other, making a stable low-porosity mass. This paving is designed to shed rather than absorb water. Pervious paving uses an open-graded aggregate mix with a large percentage of one-sized coarse aggregate, also called gap-graded or uniformly graded aggregate. Fine aggregates are typically not used in the mixes. The course of porous paving is placed over a reservoir of uniformly graded clean aggregate. Stormwater flows through the pervious paving into the reservoir, which has about 40% voids to store runoff and allow it time to infiltrate through subgrade soils.
- 3.3 Because paving structures that absorb or allow passage of water are fairly sophisticated systems, care must be taken in their design, detailing, and construction. If subgrades do not drain quickly enough under cold conditions, trapped water may freeze and damage paving. Passage of water may also allow more dissolved salts to reach embedded reinforcing, thereby increasing the opportunity for salt damage.

END OF SECTION

SECTION 321443

POROUS UNIT PAVING

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for porous paving consisting of concrete pavers set in aggregate setting beds.

1.2 MATERIALS

- A. Concrete Grid Pavers.
- B. Solid Interlocking Concrete Pavers of shapes that provide openings between units.
- C. Edge Restraints: Plastic or aluminum.
- D. Curbs: Precast concrete.
- E. Graded Aggregate for Subbase: Open graded for stormwater storage.
- F. Graded Aggregate for Base: Well graded.
- G. Leveling Course: Sand or crushed stone.
- H. Paver Fill: Crushed stone.

LEED SUGGESTIONS

- 2.1 Porous paving can reduced stormwater runoff, compared to nonporous paving, by increasing infiltration. The effectiveness of porous paving for providing stormwater infiltration can be further increased by providing a highly porous base course, and possibly subbase, to store stormwater until the underlying soil can absorb it. Stormwater runoff carries pollutants from paved surfaces directly into streams and scours exposed soil surfaces, causing silt buildup downstream and degrading water quality. Infiltrated stormwater is filtered by subsurface soil layers, removing pollutants. It also recharges aquifers, resulting in steadier stream flows; peak flows are absorbed and then released during times of low flow. Porous paving may also help reduce heat buildup resulting from the absorption of solar energy by pavement materials, thereby helping to reduce the urban heat island effect.
- 2.2 LEED Credit SS 6.1 provides one point for stormwater management practices that reduce runoff to meet certain criteria, and LEED Credit SS 6.2 provides one point for removing suspended solids and phosphorous from stormwater runoff. Porous paving can be used as part of a stormwater management design that can obtain both of these points. LEED Credit SS 7.1 also provides a point for using an open-grid paving system that is less than 50% impervious for at least 50% of the parking lot area. Although porous pavers are more than 50% impervious, using them for more than 50% of the parking lot area can provide an equivalent pervious area, which complies with the intent of the credit.

EXTERIOR IMPROVEMENTS**LESSONS LEARNED**

- 3.1 Traffic loads are usually a primary design consideration. Where light loads are expected, such as in parking areas and possibly including access aisles, grid-type pavers that will allow maximum water infiltration may prove suitable. Where heavy vehicular loads are expected such as in drive aisles, especially those that will carry frequent truck traffic, solid paving or porous paving with minimal open area may be required.
- 3.2 Consider snow removal needs; critical areas that must be kept clear of snow at all times might better be paved with a smooth material such as concrete or asphalt.
- 3.3 Subgrade preparation is also important for a successful installation. Remove vegetation and organic materials from the area to be paved. Remove soft spots containing poor subgrade material, and refill them with suitable material properly compacted. Refer to the project's geotechnical report for specific compaction requirements.
- 3.4 Drainage: Surface and subsurface drainage is of major importance. Exterior paving is usually sloped at least 1/4 inch per foot (2%), but porous pavers may be sloped as little as 1/8 inch per foot (1%). Porous paving should typically have at least a minimal slope so that during heavy rains, when water cannot infiltrate the paving as fast as it falls, water will not build up on the surface. Paving should be sloped away from buildings, retaining walls, and other elements capable of collecting surface water. Localities with impervious soils may require subsurface drains to allow excess water to flow out of the subbase and base course.

END OF SECTION

SECTION 321816

PLAYGROUND SURFACING

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for surfaces for exterior recreational activities.

1.2 QUALITY ASSURANCE

- A. Impact Attenuation: According to ASTM F 1292.
- B. Accessibility of Surface Systems: According to ASTM F 1951.
- C. Minimum Characteristics for Organic Loose-Fill Surfaces: According to ASTM F 2075.

1.3 PLAYGROUND SURFACE SYSTEMS

- A. ***Provide one or a combination of the following:***
 - 1. ***Organic Loose-Fill Surface***, Engineered Wood Fibers: Random-sized wood fibers, in manufacturer's standard fiber size, approximately 10 times larger than wide; containing no bar, leaves, twigs, or foreign or toxic materials according to ASTM F 2075; graded according to manufacturer's standard specification for material consistency for playground surfaces and for accessibility according to ASTM F 1951.
 - 2. ***Unitary synthetic poured rubber seamless surface: Poured-in-place, two-layer system with wearing course over cushion course. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.***
 - a. ***Wearing Course: Formulation of EPDM rubber particles, with minimum of 20 percent and maximum of 26 percent of ethylene propylene-diene-saturated polymethylene main chain along with other organic and inorganic components.***
 - b. ***Cushion Course: Manufacturer's standard formulation of SBR particles and polyurethane, site mixed and applied.***
- B. Accessories
 - 1. Edgings.
 - 2. Stabilizing Mats.
 - 3. Drainage / Separation Geotextile.
 - 4. Weed-Control Barrier.

EXTERIOR IMPROVEMENTS**LESSONS LEARNED**

- 2.1 Organic loose-fill systems include wood chips, wood mulch, and engineered wood fibers and should be installed over graded soil or compacted drainage fill with an interlayer of geotextile fabric that may also include premolded drainage matrix. The perimeter curb of the playground surface usually contains the loose material within the equipment area. Engineered wood fibers should be tested according to ASTM F 2075, Specification for Engineered Wood Fiber for Use as a Playground Safety Surface under and around Playground Equipment, for the presence of contaminants such as toxic substances and for consistently sized wood particles. Wood-based, loose-fill materials are flammable and subject to compaction, decomposition, and pulverization. This surface is less abrasive than sand and not as likely to be fouled by animals.
- 2.2 Manufacturers test the resilience of their products according to ASTM F 1292. Loose-fill sand, gravel, wood chips, and wood mulch are not furnished by playground surface system manufacturers, so product testing is not done for specific CH design depths. Field testing according to ASTM F 1292 can also be done at the completion of installation or periodically during the service life of the installation to verify performance.
- A. The International Play Equipment Manufacturers Association provides a third-party product certification service to validate a member manufacturer's certification of compliance with ASTM F 1292.
- 2.3 Testing for accessibility is done according to ASTM F 1951, Specification for Determination of Accessibility of Surface Systems under and around Playground Equipment. This standard is designed to measure the amount of effort required to propel a wheelchair across the surface for straight and turning movement. The test is primarily directed at loose-fill surfaces to show comparison with the same movements over a smooth, hard surface. Some loose-fill systems will require additional surface mats over the accessible route to play equipment required by the Americans with Disabilities Act (ADA) to meet this standard. Accessible routes are also discussed in 36 CFR 1191, Americans with Disabilities Act (ADA) Accessibility Guidelines; Play Areas. Sloping surfaces should be limited to 2%.
- 2.4 Testing loose-fill wood systems for the presence of toxic substances such as heavy metals, metal scraps such as nails, and correct particle size is done according to ASTM F 2075. This test is done by engineered wood fiber manufacturers but is not generally conducted for wood chips or wood mulch.

END OF SECTION

SECTION 323113

FENCES AND GATES

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for fences for protective, security, and right-of-way purposes; also pipe gates.

1.2 QUALITY ASSURANCE

- A. Comply with Chain Link Fence Manufacturers Institute "Product Manual".

1.3 MATERIALS

- A. Fabric: ASTM A 392, CLFM 1 CLF 2445
 - 1. Aluminum-coated steel, ASTM A 491, Type I, 0.40 ounce per square foot.
 - 2. Size: 2 inch mesh, 9 gauge steel.
- C. Framework: ASTM F 1043.
- D. Gates: Swinging type.
 - 1. Chain link pedestrian (single gate leaf) and vehicular (double gate leaf with gate keepers).
 - 2. Pipe gate.
 - 3. Mechanical yard gate.
- E. Framing and Fittings: ASTM F 626.

END OF SECTION

EXTERIOR IMPROVEMENTS

CHAPTER 9: SPECIFICATIONS

SECTION 329200

TURF AND GRASSES

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for application of seed, sod, or plants; fertilizer; lime and mulch; and maintenance until acceptance.

1.2 QUALITY ASSURANCE

- A. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil testing agency stating percentages or organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant nutrient content of topsoil.

1.3 MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but not for less than the following periods:
 1. Seeded Lawns: 60 days after date of Contract Completion.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.
 2. Sodded Lawns: 30 days after date of Contract Completion.

1.4 **MATERIALS**

- A. **Seed or Turfgrass Sod**
- B. **Planting Soils**
- C. **Mulch**
- D. **Erosion-Control Materials**
- E. **Grass-Paving Materials**

LEED SUGGESTIONS

- 2.1 **Grass paving is cellular, three-dimensional “eggcrate” matting specifically designed for locations load-bearing strength for occasional vehicular or heavy pedestrian traffic on turfgrass is anticipated. It will protect vegetation root systems from soil compaction that can restrict growth or kill plants. To obtain higher load-bearing capability, these units are often installed over a specially prepared base course as determined by the manufacturer. Load-bearing capacity can exceed 5000 psi (34.5 MPa).**
- 2.2 **Seldom-used “green-space” areas for overflow parking or fire lines are good use for grass paving. Where anticipated loads are significant or greater traction is needed, the use of concrete grid-type pavers should be considered.**

END OF SECTION

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DIVISION

UTILITIES

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334600	Subdrainage

SECTION 330513

MANHOLES AND STRUCTURES

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for manufactured units and components for utility services including hydrants, manholes, meters, utility boxes, and valves.

1.2 HYDRANTS

- A. Yard Hydrants: As approved by Local Fire Department.
 - 1. Hydrants within 20 feet of playgrounds shall be protected.

1.3 MANHOLES

- A. Precast Concrete Manholes: ASTM C 478.
- B. Manhole Steps: Ductile iron, cast aluminum, or steel reinforced plastic.
- C. Drainage castings: Gray iron, ASTM A 48, Class 35 B to meet or exceed AASHTO axle loading specifications for specific site location, with lettering. Lettering shall be "STORM" or "SANITARY" as applicable.

1.4 METERS

- A. Water Meter: AWWA C700 or utility company water meter.
- B. Meter Box: Cast iron body and cover with lettering.

1.5 UTILITY BOXES

- A. Valve Pits and Meter Pits: Reinforced concrete with ladder and cast iron manhole frame and cover.

1.6 VALVES

- A. Nonrising stem gate valves 3 inches and larger, AWWA C500.
- B. Rising stem gate valves 3 inches and larger, AWWA C500 or AWWA C509.
- C. Nonrising stem gate valves 2 inches and smaller, MSS SP-80.
- D. Valve Accessories: Cast iron valve boxes, curb stops, and service boxes for curb stops.
- E. Tapping sleeve and tapping valve for new connections larger than 2 inches.
- F. Service clamps and corporation stops for new connections 2 inches and smaller.

END OF SECTION

SECTION 331000

WATER UTILITIES

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for site water distribution systems for domestic consumption, fire fighting, and irrigation.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressures: The following are minimum pressure requirements for piping and specialties, unless otherwise indicated:
 1. Potable Water Service: 160 psig (1100 kPa).
 2. Fire Protection Water Service: 150 psig (1035 kPa).
 3. Fire Protection Water Service, Downstream from Fire Department Connections: 250 psig (1725 kPa).

1.3 QUALITY CONTROL

- A. Comply with NSF 61, "Drinking Water System Components - Health Effects," for materials for potable water.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," for materials, installation, tests, flushing, and valve and hydrant supervision.
- C. Water main testing shall be performed in accordance with local agency jurisdiction. Pressure testing – comply with AWWA (American Water Works Association) guidelines.
- D. Utility Compliance: Comply with regulations pertaining to water distribution systems.

1.4 MATERIALS

- A. Ductile Iron Pipe 4 to 12 Inches: AWWA C151, Class 52 minimum.
 1. Lining: AWWA C104, cement mortar, seal coated.
 2. Gaskets: AWWA C111.
 3. Ductile iron and cast iron fittings, AWWA C110 or AWWA C153, 250 psi minimum pressure rating; AWWA C104 cement mortar lining; AWWA C111 rubber gaskets.
- B. Ductile Iron Pipe Greater Than 12 Inches: AWWA C151, Class 51 minimum.
 1. Lining: AWWA C104, cement mortar, seal coated.
 2. Gaskets: AWWA C111.
 3. Ductile iron and cast iron fittings, AWWA C110 or AWWA C153, 250 psi minimum pressure rating; AWWA C104 cement mortar lining; AWWA C111 rubber gaskets.
- C. Couplings: ASTM A 126, gray iron sleeve assembly with followers, rubber gaskets, bolts, nuts, and enamel paint finish.

- D. Valves
1. Nonrising stem gate valves 3 inches and larger, AWWA C500.
 2. Rising stem gate valves 3 inches and larger, AWWA C500 or AWWA C509.
 3. Nonrising stem gate valves 2 inches and smaller, MSS SP-80.
 4. Valve Accessories: Cast iron valve boxes, curb stops, and service boxes for curb stops.
 5. Tapping sleeve and tapping valve for new connections larger than 2 inches.
 6. Service clamps and corporation stops for new connections 2 inches and smaller.
- E. Anchorages
1. Clamps, Straps, and Washers: ASTM A 506, steel.
 2. Rods: ASTM A 575, steel.
 3. Rod Couplings: ASTM A 197, malleable iron.
 4. Bolts: ASTM A 307, steel.
 5. Cast Iron Washers: ASTM A 126, gray iron.
 6. Concrete Reaction Backing: ASTM C 150, Type I Portland cement for 3000 psi, 28-day minimum compressive strength.
- F. Fire Service Main Accessories
1. Hose House: 16 gauge steel with red baked enamel finish, hoses, and nozzles.
 2. Alarm Devices: UL 753 and FM approved including water flow indicators, supervisory switches, and pressure switches.

END OF SECTION

SECTION 333000

SANITARY SEWERAGE UTILITIES

GENERAL GUIDELINES**1.1 SECTION INCLUDES**

- A. Qualitative requirements for site sanitary sewerage construction to buildings and municipal sanitary mains.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity Flow, Nonpressure Piping Pressure Ratings: At least equal to system test pressure.
- B. Force Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig (1035 kPa).

1.3 PIPE AND FITTINGS

- A. Provide one of the following for Gravity Systems:
 - 1. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35 for solvent cement or elastomeric gasket joints.
 - 2. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for rubber gasket joints.
 - 3. ABS Sewer Pipe and Fittings: ASTM D 2751, for solvent cement or elastomeric gasket joints (4 and 6 inch only).
 - 4. Gaskets: Compatible with pipe materials joined.
- B. Provide the following for Forced Main Systems:
 - 1. Piping shall be PVC D18, Class 150, C-900 AWWA piping with push-on joints. Piping and fittings shall meet ASTM D 1784 and ASTM 3139.

1.4 MANHOLES

- A. Precast Concrete Manholes: ASTM C 478.
- B. Manhole Steps: Ductile iron, cast aluminum, or steel reinforced plastic.
- C. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy duty-ductile iron with lettering.

1.5 CLEANOUTS

- A. PVC with cast iron adapter.

END OF SECTION

SECTION 334000

STORM DRAINAGE UTILITIES

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative Requirements for:
1. Site storm drain construction to buildings and municipal storm drainage.
 2. Storm drainage piping for surface, or a combination of surface and subsurface water.
 3. Structures for access to underground pipe.
 4. Conduit, chambers, and units for drain pipe, catch basins, inlets, and underground water detention chambers.

1.2 PIPE AND FITTINGS

- A. Provide one of the following:
1. Ductile Iron Pressure Pipe: AWWA C151, Class 52 for push-on joints.
 2. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for rubber gasket joints.
 3. Polyvinyl Chloride (PVC): ASTM D 3034, SDR 35, or ASTM F 949 for solvent cemented or gasketed joints.
 4. Aluminized Steel: Type 2 per AASHTO M36 or ASTM A 760 with gasketed joints or bell and spigot joints.
 5. Polyethylene Pipe: AASHTO M252 or M294; Type S or Type SP **or** **ASTM F 2648; solid or perforated.**
 6. **Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers: ASTM F 2418.**
- B. For diameter greater than 24 inches, pipe shall be concrete, aluminized steel, or HDPE.

1.3 CLEANOUTS

- A. Cast iron.

1.4 CATCH BASINS FOR STORM SEWERAGE SYSTEM

- A. Precast Concrete Catch Basins: ASTM C 478 or ASTM C 858.
- B. Catch Basin Steps: Ductile iron, cast aluminum, or steel reinforced plastic.
- C. Catch Basin Frames and Grates: ASTM A 536, Grade 60-40-18, heavy-duty ductile iron.
- D. PVC plastic body catch basins: H-20 DOT rated for roadway applications with a minimum 6" concrete collar and ductile iron frame and grate and meet all applicable ASTM standards and environmental regulations.**

1.5 DRAINAGE STRUCTURES

- A. Curb Inlets: Precast concrete, stone, or brick conforming to utility standards.

- B. Outfalls for Storm Sewerage System: Cast-in-place reinforced concrete pipe, head wall apron, tapered sides, and rip rap.
- C. Dry Wells for Storm Sewerage System: ASTM C 858, precast reinforced perforated concrete rings with cast-in-place concrete floor and lift-off concrete cover.
- D. Slot Drain: Interlocking precast polymer concrete modular units with grates, channel caps, and related accessories.
- E. Stormwater Collection Chambers: Polypropylene (PP) chambers with open bottom, buried chambers of corrugated wall construction used for collection, detention, and retention of stormwater runoff per ASTM F2418.**
- F. Curb inlets: PVC plastic body catch basins: H-20 DOT rated for roadway applications with a minimum 6" concrete collar and ductile iron frame and grate and meet all applicable ASTM standards and environmental regulations.**

END OF SECTION

SECTION 334600

SUBDRAINAGE

GENERAL GUIDELINES

1.1 SECTION INCLUDES

- A. Qualitative requirements for subdrains for interception and removal of water from pavements and structures.

1.2 SUBDRAINAGE

- A. Drainage Pipe - ***Provide one of the following:***
 - 1. Perforated PVC pipe, ASTM D 2729.
 - 2. ***Perforated PE pipe, AASHTO M 252, Type SP or AASHTO M 294, Type CP.***
 - 3. ***Solid Wall PVC pipe, ASTM D 3034.***
 - 4. ***Solid Wall PE pipe, AAHSHTO M 252 or AASHTO M 294, Type S.***
- B. ***Drainage Panels: Molded-sheet, mesh fabric or net fabric drainage panels.***
- C. ***Geotextile filter fabrics.***

END OF SECTION

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