SECTION 334200 - STORMWATER CONVEYANCE

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Corrugated-steel pipe and fittings.

ABS pipe and fittings.

PE pipe and fittings.

PVC pipe and fittings.

Concrete pipe and fittings.

Non-pressure transition couplings.

Backwater valves.

Cleanouts.

Drains.

Encasement for piping.

Catch basins.

Stormwater inlets.

Stormwater detention systems.

Pipe outlets.

Dry wells.

Stormwater disposal systems.

* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe, concrete pipe, and each type of precast structure within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings:

[**Catch basins**] [**stormwater inlets**] [**and**] [**dry wells**]. Include plans, elevations, sections, details, frames, covers, and grates.

Stormwater Detention Systems: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

* + - * 1. Field quality-control reports.
			1. QUALITY ASSURANCE
				1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
			2. DELIVERY, STORAGE, AND HANDLING
				1. Do not store plastic pipe, and fittings in direct sunlight.
				2. Protect pipe, pipe fittings, and seals from dirt and damage.
				3. Handle [**catch basins**] [**and**] [**stormwater inlets**] in accordance with manufacturer's written rigging instructions.
			3. FIELD CONDITIONS

Retain this article if interruption of existing storm drainage service is required.

* + - * 1. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by State or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

Notify Director’s Representative no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of service.

Do not proceed with interruption of service without Director’s Representative written permission.

1. PRODUCTS

Corrugated steel piping is normally used for larger diameter applications, for low-pressure applications, and where damage is possible from backfilling brittle piping. Pipe sizes range from 12 to 60 inches.

* + - 1. CORRUGATED-STEEL PIPE AND FITTINGS
				1. Source Limitations: Obtain corrugated-steel pipe and fittings from single manufacturer.
				2. Corrugated-Steel Pipe and Fittings: ASTM A760, Type I with fittings of similar form and construction as pipe.

Special-Joint Bands: Corrugated steel with O-ring seals.

Standard-Joint Bands: Corrugated steel.

Coating: [**Aluminum**] [**Zinc**].

Plastic piping is normally used in applications conveying acidic or corrosive wastewater sewer systems, and in applications where ease of jointing and reasonable flexibility is important, as in moving or expansive subsoils. Plastic piping is impervious to moisture infiltration or exfiltration.

* + - 1. ABS PIPE AND FITTINGS
				1. Source Limitations: Obtain ABS pipe and fittings from single manufacturer.

Retain "NSF Marking" paragraph below if required.

* + - * 1. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

Pipe and fittings in this article are available in NPS 1-1/4 to NPS 6 (DN 32 to DN 150). Retain "Solid-Wall ABS Pipe" or "Cellular-Core ABS Pipe" paragraph below, or both.

* + - * 1. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.
				2. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.
				3. ABS Socket Fittings: ASTM D2661, made to ASTM D3311, drain, waste, and vent patterns.
				4. Gaskets: ASTM F477, elastomeric seals.
				5. Solvent Cement: ASTM D2235.
			1. CORRUGATED-PE PIPE AND FITTINGS
				1. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

Piping in "Corrugated-PE Drainage Pipe and Fittings" paragraph below is available in NPS 3 to NPS 10 (DN 80 to DN 250). Joints are coupling type.

* + - * 1. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

Piping in "Corrugated-PE Pipe and Fittings" paragraph below is available in NPS 12 to NPS 60. Joints are coupling type.

* + - * 1. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.
				2. Corrugated-PE Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.
				3. Corrugated-PE Watertight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.
			1. PVC PIPE AND FITTINGS
				1. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
				2. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

Piping in "PVC Type PSM Sewer Piping" paragraph below is available in four SDRs and in NPS 4 to NPS 15. Joints are gasketed type.

* + - * 1. PVC Type PSM Sewer Piping:

Pipe: ASTM D3034, [**SDR 35**] <**Insert SDR**>, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.

Fittings: ASTM D3034, PVC with bell ends.

Gaskets: ASTM F477, elastomeric seals.

Reinforced concrete pipe is normally used for larger-diameter applications, for low-pressure applications, or where subsoil pressure requires greater pipe strength than nonreinforced concrete pipe. Sizes range from 12 to 108 inches, depending on class and wall type. Absorption of moisture may be a concern if this pipe material is used.

* + - 1. CONCRETE PIPE AND FITTINGS
				1. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.

Piping in "Reinforced-Concrete Sewer Pipe and Fittings" paragraph below is available in five classes and three wall thicknesses, and in NPS 12 to NPS 144. Not all classes and wall thicknesses are available. Joints are gasketed type.

* + - * 1. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76.

[**Bell-and-spigot**] [**or**] [**tongue-and-groove**] ends and [**gasketed joints with ASTM C443, rubber gaskets**] [**sealant joints with ASTM C990, bitumen or butyl-rubber sealant**]

Retain first subparagraph below only for NPS 60 to NPS 144.

Class I, Wall [**A**] [**B**].

Retain one of four subparagraphs below for NPS 12 to NPS 144.

Class II, Wall [**A**] [**B**] [**C**].

Class III, Wall [**A**] [**B**] [**C**].

Class IV, Wall [**A**] [**B**] [**C**].

Class V, Wall [**B**] [**C**].

* + - 1. NONPRESSURE TRANSITION COUPLINGS
				1. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
				2. Sleeve Materials:

For Concrete Pipes: ASTM C443, rubber.

For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

* + - * 1. Unshielded, Flexible Couplings:

Source Limitations: Obtain unshielded, flexible couplings from single manufacturer.

Description: Elastomeric sleeve with[**stainless-steel shear ring and**] corrosion-resistant-metal tension band and tightening mechanism on each end.

* + - * 1. Shielded, Flexible Couplings:

Source Limitations: Obtain shielded, flexible couplings from single manufacturer.

Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

* + - * 1. Ring-Type, Flexible Couplings:

Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.

Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

* + - 1. BACKWATER VALVES
				1. PVC Backwater Valves:

Source Limitations: Obtain PVC backwater valves from single manufacturer.

Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

* + - 1. CLEANOUTS
				1. PVC Cleanouts:

Source Limitations: Obtain PVC cleanouts from single manufacturer.

Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to clean out of same material as sewer piping.

* + - * 1. Cleanout Lids and Frames:

Manufacturers:

Neenah Foundry Company, P. O. Box 729, Neenah, WI 54957, (414) 729-3661

East Jordan Iron Works, P.O. Box 190, South Bay Rd., Cicero, NY 13039, (315) 699-2601

Josam Company, 525 West Highway 20, Michigan City, IN 46360, (800) 365-6726.

Approved equivalent.

Materials: Cast iron.

Nominal Lid and Frame Size: <\_\_\_\_\_\_\_\_> inches **[diameter] [square]**.

* + - * 1. Concrete Collar

Material: Cast-in-place concrete, as specified in Section [033000 - Cast-in-Place Concrete] <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>.

* + - 1. DRAINS
				1. Cast-Iron Area Drains:

Source Limitations: Obtain cast-iron area drains from single manufacturer.

Description: ASME A112.6.3 gray-iron round body with anchor flange and round[**secured**] grate. Include bottom outlet with inside caulk or spigot connection, of sizes indicated.

Top-Loading Classification(s): [**Medium Duty**] [**and**] [**Heavy Duty**].

Grate Openings: [**1/4 inch circular**] [**3/8 inch circular**].

* + - * 1. Plastic Drain Basins:

Source Limitations: Obtain drain basins from single manufacturer.

Description: Plastic drainage structures used to change size, elevation, direction or pipe type in a pipe run. These structures also serve as a collection point where one or more drain lines converge.

Basin Size: **[8”] [10”] [12”] [15”] [18”] [24”] [30”] [36”]**

Grate/Cover:

Material: **[Ductile iron per ASTM A536 Grade 70-50-05] [Bronze]**

Type: **[Grate] [Solid] [Dome]**

Size: **[8”] [10”] [12”] [15”] [18”] [24”] [30”]**

Manufacturers:

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Approved equivalent.

* + - * 1. Plastic Inline Drains

Source Limitations: Obtain inline drains from single manufacturer.

Description: PVC structure with ductile iron grate designed to connect to a storm drain line using a tee or elbow and a riser pipe.

Top-Loading Classification(s): **[Light Duty**].

Grate/Cover:

Material: **[Ductile iron per ASTM A536 Grade 70-50-05] [Bronze]**

Type: **[Grate] [Solid] [Dome]**

Size: **[8”] [10”] [12”] [15”] [18”] [24”] [30”]**

Adapter Size: **[4”] [6”] [8”] [10”] [12”] [15”] [18”]**

Manufacturers:

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Approved equivalent.

* + - 1. ENCASEMENT FOR PIPING
				1. Standard: ASTM A674 or AWWA C105/A21.5.
				2. Material: [**Linear low-density polyethylene film of 0.008-inch**] [**or**] [**cross-laminated HDPE film of 0.004-inch**] minimum thickness.
				3. Form: [**Sheet**] [**or**] [**tube**].
				4. Color: [**Black**] [**or**] [**natural**] <**Insert color**>.
			2. CONCRETE
				1. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:

Cement: ASTM C150, Type II.

Fine Aggregate: ASTM C33, sand.

Coarse Aggregate: ASTM C33, crushed gravel.

Water: Potable.

* + - * 1. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A1064, steel, welded wire fabric, plain.

Reinforcing Bars: ASTM A615, Grade 60 deformed steel.

* + - * 1. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A1064, steel, welded wire fabric, plain.

Reinforcing Bars: ASTM A615, Grade 60 deformed steel.

* + - 1. CATCH BASINS
				1. Standard Precast Concrete Catch Basins:

Manufacturers:

Fort Miller Co., Inc., (518) 695-5000, PO Box 98, Schuylerville, NY 12871

Monarch Products, (717) 938-8303, 385 Sipe Road, York Haven, PA 17370.

Oldcastle Infrastructure, (888) 965-3227, 8392 Riverview Parkway, Littleton, CO 80125.

Approved equivalent.

Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

Joint Sealant: ASTM C990, bitumen or butyl rubber.

Retain "Adjusting Rings" or "Grade Rings" subparagraph below if required.

Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.

Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.

Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] <**Insert material**>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than [**60**] <**Insert dimension**>inches.

Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

* + - * 1. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

Manufacturers:

Fort Miller Co., Inc., (518) 695-5000, PO Box 98, Schuylerville, NY 12871

Monarch Products, (717) 938-8303, 385 Sipe Road, York Haven, PA 17370.

Oldcastle Infrastructure, (888) 965-3227, 8392 Riverview Parkway, Littleton, CO 80125.

Approved equivalent.

Joint Sealants: ASTM C990, bitumen or butyl rubber.

Retain "Adjusting Rings" or "Grade Rings" subparagraph below if required.

Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.

Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.

Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] <**Insert material**>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than [**60**] <**Insert dimension**>inches.

Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

* + - * 1. Frames and Grates:

Manufacturers:

Neenah Foundry Company, P. O. Box 729, Neenah, WI 54957, (414) 729-3661

East Jordan Iron Works, P.O. Box 190, South Bay Rd., Cicero, NY 13039, (315) 699-2601

US Foundry, 8351 NW 93rd St, Medley, Florida 33166-2096, (800) 348-8357.

Approved equivalent.

Design of each shall be the same throughout the project unless otherwise specified or indicated on the drawings.

Units shall meet AASHTO H20 wheel loading requirements. Manufacture, workmanship and certified proof-load tests shall conform to AASHTO M306-89-Standard Specification for Drainage Structure Castings.

Provide frames and grates of the locking type when indicated on the drawings.

Material:

Cast iron: ASTM A48, Class 30B or 35B.

Delivered to Site free of any coatings, unless otherwise specified.

Frames:

Round

30-inch clear opening.

Square

Size: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> inches

Grates:

Bicycle safe.

ADA compliant where applicable.

Size:

Round

Diameter: <\_\_\_\_\_\_\_\_> inches

Square

Size: **[24 by 24] [<\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_>]** inches

* + - 1. STORMWATER INLETS

Stormwater inlets are made of precast concrete and brick. Retain options in "Curb Inlets," "Gutter Inlets," "Combination Inlets," and "Frames and Grates" paragraphs below to require compliance with utility standards. Delete if dimensions are indicated on Drawings.

* + - * 1. Curb Inlets: Made with vertical curb opening[**, of materials and dimensions in accordance with utility standards**].
				2. Gutter Inlets: Made with horizontal gutter opening[**, of materials and dimensions in accordance with utility standards**]. Include heavy-duty frames and grates.
				3. Combination Inlets: Made with vertical curb and horizontal gutter openings[**, of materials and dimensions in accordance with utility standards**]. Include heavy-duty frames and grates.
				4. Frames and Grates: Heavy duty[**, in accordance with utility standards**].
			1. STORMWATER DETENTION SYSTEMS

Detail these structures on Drawings. They are usually made of cast-in-place concrete or sections of large piping and often include features for special applications.

* + - * 1. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

Ballast: Increase thickness of concrete as required to prevent flotation.

Retain "Grade Rings" subparagraph below if grade rings are required.

Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.

Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] <**Insert material**>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of structure to finished grade is less than [**60**] <**Insert dimension**>inches.

Revise "Manhole Frames and Covers" paragraph below if casting frame in concrete top.

Manhole Frames and Covers: **[See Frames and Covers section below] [Refer to Section 330561 - Concrete Manholes]**

* + - * 1. Pipe Detention Systems: Solid walled manifold, header, and lateral piping complying with AASHTO M 252 for NPS 10 and smaller, AASHTO M 294 for NPS 12 to NPS 60. Include proprietary fittings, couplings, seals, and drainage filter fabric.

Source Limitations: Obtain pipe systems from single manufacturer.

Manufacturers

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Contech Engineered Solutions, (800) 338-1122, 9100 Centre Pointe Drive, West Chester, OH 45069.

Lane Enterprises, Inc., (717) 761-8175, 3905 Hartzdale Dr Suite 514, Camp Hill, PA 17011.

Approved equivalent.

* + - 1. PIPE OUTLETS

Detail outlets on Drawings. Delete "Head Walls" paragraph below if piping includes flared outlet fittings and concrete head walls are not required.

* + - * 1. Head Walls: Cast-in-place reinforced concrete as specified in as specified in Section 033000 - Cast-in-Place Concrete, with apron and tapered sides.
				2. Flared End Sections: Of size and material matching pipe, unless otherwise noted.

Manufacturers:

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Pacific Corrugated Pipe Company, LLC, (949) 650-4555, 19800 MacArthur Blvd, Ste 510, Irvine, CA 92612.

Contech Engineered Solutions, (800) 338-1122, 9100 Centre Pointe Drive, West Chester, OH 45069.

Approved equivalent.

* + - 1. DRY WELLS
				1. Precast Concrete Dry Wells:

Description: ASTM C913, precast, reinforced, perforated concrete structure.

Cover: **[Liftoff-type concrete cover with cast-in lift rings] [See Frames and Covers section below] [Refer to Section 330561 - Concrete Manholes]**.

Wall Thickness: 4 inches minimum.

Filtering Material: **[No. 2 coarse aggregate] [<Insert other>]** as specified in Section 310001 - Earthwork Materials.

Manufacturers:

Fort Miller Co., Inc., (518) 695-5000, PO Box 98, Schuylerville, NY 12871

Mid-Hudson Concrete Products, (845) 265-3265, 3504 US 9, Cold Spring, NY 10516.

LHV Precast Incorporated, (845) 336-8880, 540 Ulster Landing Road, Kingston NY 12401.

Approved equivalent.

* + - * 1. Manufactured PE Dry Wells:

Description: Manufactured PE side panels and top cover that assemble into 50-gal. storage capacity units.

Source Limitations: Obtain manufactured PE dry wells from single manufacturer.

Side Panels: With knockout ports for piping and seepage holes.

Top Cover: With knockout port for drain.

Drainage Filter Fabric: As specified in Section 310001 - Earthwork Materials.

Filtering Material: **[No. 2 coarse aggregate] [<Insert other>]** as specified in Section 310001 - Earthwork Materials.

* + - 1. STORMWATER DISPOSAL SYSTEMS
				1. Chamber Systems:

Chambers made by different manufacturers are not uniform but are similar with different capacities. Detail systems and indicate total chamber capacities on Drawings.

Source Limitations: Obtain chamber systems from single manufacturer.

Storage and Leaching Chambers: Molded PE with **[perforated sides and]** open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.

Filtering Material: **[No. 2 coarse aggregate] [<Insert other>]** as specified in Section 310001 - Earthwork Materials.

Drainage Filter Fabric: As specified in Section 310001 - Earthwork Materials.

Manufacturers:

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Contech Engineered Solutions, (800) 338-1122, 9100 Centre Pointe Drive, West Chester, OH 45069.

Cultec, Inc., (203) 775-4416, 878 Federal Rd, PO Box 280, Brookfield, Connecticut 06804.

Approved equivalent.

* + - * 1. Modular/GeoCellular Systems:

Source Limitations: Obtain chamber systems from single manufacturer.

Modules/GeoCells: **[Insert Description]**. Include number of modules/geocells, distribution piping, and other standard components as required for system total capacity.

Filtering Material: **[No. 2 coarse aggregate] [<Insert other>]** as specified in Section 310001 - Earthwork Materials”.

Drainage Filter Fabric: As specified in Section 310001 - Earthwork Materials.

Manufacturers:

ABT, Inc., (704) 528-9806, 259 Murdock Rd, Troutman, NC 28166.

ACO, Inc., (800) 543-4767, 9470 Pinecone Dr, Montor, OH 44060.

Brentwood Industries, Inc., (610) 374-5109.

Approved equivalent.

* + - * 1. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252 for NPS 10 and smaller, AASHTO M 294 for NPS 12 to NPS 60. Include proprietary fittings, couplings, seals, and drainage filter fabric.

Source Limitations: Obtain pipe systems from single manufacturer.

Filtering Material: **[No. 2 coarse aggregate] [<Insert other>]** as specified in Section 310001 - Earthwork Materials.

Drainage Filter Fabric: As specified in Section 310001 - Earthwork Materials.

Manufacturers

Advanced Drainage Systems, (607) 565-3033, 1 William Donnelly Pkwy, Waverly, NY 14892.

Lane Enterprises, Inc., (717) 761-8175, 3905 Hartzdale Dr Suite 514, Camp Hill, PA 17011.

Approved equivalent.

* + - 1. FRAMES AND COVERS
				1. Manufacturers:

Neenah Foundry Company, P. O. Box 729, Neenah, WI 54957, (414) 729-3661

East Jordan Iron Works, P.O. Box 190, South Bay Rd., Cicero, NY 13039, (315) 699-2601

US Foundry, 8351 NW 93rd St, Medley, Florida 33166-2096, (800) 348-8357.

Approved equivalent.

* + - * 1. Description:

Material:

Cast iron.

Comply with **[ASTM A48, Class 30B] [AASHTO M306]**.

Lid:

Bearing Surface: Machined flat.

Configuration: Removable.

Security: **[Lockable] [Boltable] [None]**.

Cover Design: **[Closed] [Open checkerboard grille] [Waterproof] <\_\_\_\_\_\_\_\_>.**

Live-Load: **[AASHTO HS-20 with 30% impact]**.

**[Furnish sealing gasket.]**

Nominal Cover Size: <\_\_\_\_\_\_\_\_> inch diameter.

1. EXECUTION
	* + 1. EARTHWORK
				1. Excavation, trenching, and backfilling are specified in Section 310000 - Earthwork.
			2. PIPING INSTALLATION
				1. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
				2. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
				3. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
				4. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
				5. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
				6. Install gravity-flow, nonpressure drainage piping in accordance with the following:

Install piping pitched down in direction of flow.

Install piping [**NPS 6**] <**Insert value**> and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.

Install piping with [**36-**] [**48-**] [**60-**] [**72-**] <**Insert dimension**> inch- minimum cover.

Install corrugated-steel piping in accordance with ASTM A798.

Install ABS sewer piping in accordance with ASTM D2321 and ASTM F1668.

Install PE corrugated sewer piping in accordance with ASTM D2321.

Install PVC cellular-core piping in accordance with ASTM D2321 and ASTM F1668.

Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.

Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.

Install PVC water-service piping in accordance with ASTM D2321 and ASTM F1668.

Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

* + - 1. PIPE JOINT CONSTRUCTION
				1. Join gravity-flow, nonpressure drainage piping in accordance with the following:

Join corrugated-steel sewer piping in accordance with ASTM A798.

Join ABS sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.

Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.

Join PVC cellular-core piping in accordance with ASTM D2321 and ASTM F891 for solvent-cemented joints.

Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.

Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.

Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.

Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

Join dissimilar pipe materials with nonpressure-type flexible couplings.

* + - 1. BACKWATER VALVE INSTALLATION
				1. Install horizontal-type backwater valves in piping where indicated.
				2. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
				3. Install terminal-type backwater valves on end of piping and in manholes where indicated.
			2. CLEANOUT INSTALLATION
				1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

Use Light-Duty, top-loading classification cleanouts in [**earth or unpaved foot-traffic**] <**Insert other**> areas.

Use Medium-Duty, top-loading classification cleanouts in [**paved foot-traffic**] <**Insert other**> areas.

Use Heavy-Duty, top-loading classification cleanouts in [**vehicle-traffic service**] <**Insert other**> areas.

Use Extra-Heavy-Duty, top-loading classification cleanouts in [**roads**] <**Insert area**>.

* + - * 1. Set cleanout frames and covers in earth in cast-in-place concrete block, [**18 by 18 by 12**] <**Insert dimensions**> inches deep. Set with tops [**1**] <**Insert dimension**> inch(es) above surrounding earth grade.
				2. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.
			1. DRAIN INSTALLATION
				1. Install type of drains in locations indicated.

Use Light-Duty, top-loading classification drains in [**earth or unpaved foot-traffic**] <**Insert other**> areas.

Use Medium-Duty, top-loading classification drains in [**paved foot-traffic**] <**Insert other**> areas.

Use Heavy-Duty, top-loading classification drains in [**vehicle-traffic service**] <**Insert other**> areas.

Use Extra-Heavy-Duty, top-loading classification drains in [**roads**] <**Insert area**>.

* + - * 1. Embed drains in 4-inch- minimum concrete around bottom and sides.
				2. Fasten grates to drains if indicated.
				3. Set drain frames and covers with tops flush with pavement surface.
			1. CATCH BASIN INSTALLATION
				1. Construct catch basins to sizes and shapes indicated.
				2. Set frames and grates to elevations indicated.
			2. STORMWATER INLET[**AND OUTLET**] INSTALLATION
				1. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
				2. Construct riprap of broken stone, as indicated.
				3. Install outlets that spill onto grade, anchored with concrete, where indicated.
				4. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
				5. Construct energy dissipaters at outlets, as indicated.
			3. DRY WELL INSTALLATION
				1. Excavate hole to diameter of at least 6 inches greater than outside of dry well. Do not extend excavation into ground-water table.
				2. Install precast, concrete dry wells in accordance with the following:

Assemble structure to depth indicated.

Extend structure to height where top of cover will be approximately 8 inches below finished grade.

Backfill bottom of inside of structure with filtering material to level at least 12 inches above bottom.

Extend effluent inlet pipe 12 inches into structure and terminate into side of tee fitting.

Backfill around outside of structure with filtering material to top level of structure.

Install cover over top of structure.

* + - * 1. Install manufactured, PE dry wells in accordance with manufacturer's written instructions and the following:

Assemble and install panels and cover.

Backfill bottom of inside of unit with filtering material to level at least [**12**] <**Insert dimension**> inches above bottom.

Extend effluent inlet pipe [**12**] <**Insert dimension**> inches into unit and terminate into side of tee fitting.

Install drainage filter fabric around outside of unit.

Install filtering material around outside of unit.

* + - 1. CONCRETE PLACEMENT
				1. Place cast-in-place concrete in accordance with ACI 318.
			2. STORMWATER DISPOSAL SYSTEM INSTALLATION
				1. Chamber Systems: Excavate trenches of width and depth, and install system and backfill in accordance with chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and drainage filter fabric.
				2. Modular/GeoCell Systems: Excavate system bed of width and depth, and install system and backfill in accordance with manufacturer's written instructions. Include modules/cells, filtering material, and drainage filter fabric.
				3. Piping Systems: Excavate trenches of width and depth, and install piping system, drainage filter fabric, and backfill, in accordance with piping manufacturer's written instructions.
			3. CONNECTIONS
				1. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 - Facility Storm Drainage Piping.
				2. Make connections to existing piping and underground manholes.

Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

* + - * 1. Connect to sediment interceptors specified in Section 221323 - Sanitary Waste Interceptors.
				2. Pipe couplings may be used in applications below unless otherwise indicated.

Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

[**Unshielded**] [**Shielded**] flexible couplings for same or minor difference OD pipes.

Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

* + - 1. CLOSING ABANDONED STORM DRAINAGE SYSTEMS
				1. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

Close open ends of piping with at least [**8-**] <**Insert dimension**> inch- thick, brick masonry bulkheads.

Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

* + - * 1. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

Remove manhole or structure and close open ends of remaining piping.

Remove top of manhole or structure down to at least [**36**] <**Insert dimension**> inches below final grade. Fill to within [**12**] <**Insert dimension**> inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

* + - * 1. Backfill to grade in accordance with Section 310000 - Earthwork.
			1. IDENTIFICATION
				1. Materials and their installation are specified in Section 310000 - Earthwork. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

Use[**warning tape or**] detectable warning tape over ferrous piping.

Use detectable warning tape over nonferrous piping and over edges of underground structures.

* + - 1. FIELD QUALITY CONTROL
				1. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

Submit separate reports for each system inspection.

Defects requiring correction include the following:

Alignment: Less than full diameter of inside of pipe is visible between structures.

Damage: Crushed, broken, cracked, or otherwise damaged piping.

Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

Reinspect and repeat procedure until results are satisfactory.

* + - * 1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for defects.

Do not enclose, cover, or put into service before inspection and approval.

Test completed piping systems in accordance with requirements of authorities having jurisdiction.

Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

Submit separate report for each test.

* + - 1. CLEANING
				1. Clean interior of piping of dirt and superfluous materials.[**Flush with potable water.**][**Flush with water.**]

END OF SECTION 334200