SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work may include construction, modification, and/or installation of storm drain pipes, storm drain manholes, catch basins, drop inlets, storm drain structures, junction boxes, and appurtenances in accordance with the requirements of the Contract Documents.

1.02 RELATED REQUIREMENTS

A. BASIC SITE MATERIALS AND METHODS Section 02 00 01

B. TEMPORARY FACILITIES AND CONTROLS Section 01 51 00

C. ASPHALT PAVING Section 32 12 33

D. CURBS, GUTTERS, SIDEWALK, AND DRIVEWAY Section 32 16 00

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI)
ACI 318 Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM International):

ASTM A36/A36M-08	Standard Specification for Carbon Structural Steel
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C76-13	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C150	Standard Specification for Portland Cement
ASTM C361-12	Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
ASTM D2241-09	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D2244-11	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2672 -96a(2009)	Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement
ASTM D3139-98(2011)	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3350-12	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

C. State of California Department of Transportation Standard Specifications (SS):

Section 52	Reinforcement Subsection 52-1.02 Materials
Section 65	Concrete Pipes Subsection 65-2.02E Joints Subsection 65-2.03D Laying Pipe
Section 66	Corrugated Metal Pipe Subsection 66-1.02F Corrugated Aluminum Pipe Subsection 66-1.03 Construction
Section 68	Subsurface Drains Subsection 68-2.02F Permeable Material
Section 70	Miscellaneous Drainage Facilities
Section 73	Concrete Curbs And Sidewalks Subsection 73-1.03 Construction
Section 75	Miscellaneous Metal Subsection 75-1.02B Frames, Grates, and Covers
Section 90	Concrete Subsection 90-1.03B Curing Concrete Subsection 90-2 Minor Concrete

D. City of San Bruno- Standard Drawings

ST-06A	Trench Construction for Sewer or Storm Mains

1.04 QUALITY ASSURANCE

To validate that specified final elevations have been provided, the Contractor shall provide to the City applicable grade certificates. No separate payment will be made for providing such certification; all cost therefore shall be included in the payment for various work item(s) requiring certification.

PART 2 - PRODUCTS

2.01 PIPE SIZE AND MATERIAL

The minimum size for storm drain pipe shall be fifteen-inch (15") diameter. Pipe material within City's or public right-of-way shall be Reinforced Concrete Pipe (RCP). Corrugated metal and plastic pipes may be used outside City's or public right-of-way.

2.02 CONCRETE

Minor Concrete: Conform to SS Section 90 and Subsection 90-2 unless shown otherwise on Drawings. Portland cement Type II Modified shall be in conformance with ASTM C150.

2.03 CEMENT MORTAR

Cement mortar composed of 1 part Portland Cement and 2 parts sand by volume shall conform to SS Section 65-2.02E, "Joints".

2.04 PRECAST CONCRETE MANHOLES

Precast storm drain manholes shall conform to SS Section 70, "Miscellaneous Drainage Facilities". Storm drain precast manhole sections shall be jointed by sealing compounds like "RAM-NEK" or "ADEKA ULTRA SEAL". Manhole base shall be Cast-In-Place unless specifically indicated in the contract documents and drawings or directed by the City Engineer. Concrete for manhole base shall be 6-sack with a 4,000 psi rating.

2.05 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be Phoenix Model P-1090, as manufactured by Phoenix Iron Works, Second and Castro Streets, Oakland, California 94604, or approved equal, and stamped "STORM DRAIN."

2.06 REINFORCING BAR

Reinforcing bars shall be Grade 60 in conformance with ASTM A615, SS Section 52-1.02, "Materials", and ACI 318.

2.07 CATCH BASIN FRAMES AND GRATES

Frames and grates for catch basins shall be fabricated from structural steel conforming to ASTM A36, galvanized, and in accordance with SS Section 75-1.02B, "Frames, Grates, and Covers"..

2.08 PRECAST CATCH BASINS AND DROP INLETS

For alternate construction, Contractor may use precast drainage box like "CHRISTY" U43, or "SANTA ROSA" Type G0, or approved equal.

2.09 REINFORCED CONCRETE PIPE

Reinforced Concrete Pipe (RCP) shall be manufactured in conformance with ASTM C76 and other applicable provisions of ASTM C361, with rubber-gasketed compression joints. The joints shall be all concrete bell and spigot type using a round O-ring rubber gasket seal. Upon closure of the joint, the gasket shall be self-contained and compressed in a groove on the spigot end of the pipe. Mortared joints will not be acceptable. At all times, plant facilities will be made available for the Engineer's inspection. In any case, all required testing and certifications of testing compliance in conformance with referenced ASTM Specifications shall be furnished to the Engineer prior to the time of pipe delivery. Pipe may be made by centrifically spun, packerhead or vertically cast production methods. Machine tamped production methods will not be acceptable. If elliptically reinforced pipe is furnished, it shall be clearly marked for proper installation. Unless otherwise specified in the Special Provisions or shown on the Plans, provide Class III RCP pipes.

2.10 CORRUGATED METAL PIPE

Corrugated metal pipe shall not be used within City's or public right-of-way, except as approved by the City Engineer. Metal pipe shall be corrugated aluminum pipe, conforming to applicable provisions of SS Section 66-1.02F, "Corrugated Aluminum Pipe".

2.11 PLASTIC PIPE

Plastic pipe shall not be used within the City's or public right of way, except as approved by the City Engineer.

Polyvinyl chloride (PVC) of the types and classifications shown on the plans and shall conform to applicable requirements of ASTM D 2241, ASTM D 2672, and ASTM D 3139.

High-Density Polyethylene (HDPE) pipes. Corrugated and Smooth Lined pipe shall be manufactured from virgin PE compounds in accordance with ASTM D 3350.

Type S: This pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner wall.

2.12 **WARNING TAPE AND TRACER WIRE:** Installation shall be in accordance with City Standard Drawing ST-06A "Trench Construction for Sewer or Storm Mains".

Warning Tape shall be 3-inch wide **"Green"** color for with an overall minimum thickness of 6 mil and a solid aluminum foil core with minimum thickness of 3 mil. The solid foil core shall be encased between two clear layers of 100% virgin polypropylene or polyethylene film. Warning Tape shall be permanently printed on both sides with a repeating warning "Caution: STORM PIPE BELOW" at maximum interval of 2 feet. Warning Tape shall be placed 1 foot above the top of pipe.

Tracer wire shall be 8 AWG Solid Copper conductor with a 45 mil thick, high-density, high molecular weight polyethylene (HDPE) insulation and rated for 600 volts. Insulation shall be RoHS compliant and utilize virgin grade material. Jacket shall be "**Green**" color for storm drain utilities application. Tracer wire should be placed in the same orientation to all installed pipe, and taped to the pipe using a spacer every 8-10 feet on top of the pipe.

2.13 PIPE BEDDING

A. Pipe bedding shall be place in accordance with City Technical Specifications **Section 31 23 33** "**Trench Excavation and Backfill"** and City Standard Drawing **ST-06A "Trench Construction for Sewer or Storm Mains".** Unless otherwise specified, pipe bedding for storm main shall be ¾" drain rock.

2.14 BACKFILL MATERIALS

A. Unless otherwise specified, trench backfill material and backfill requirements shall be as provided under City Technical Specifications **Section 31 23 33** "**Trench Excavation and Backfill"** and City Standard Drawings **ST-06A "Trench Construction for Sewer or Storm Mains".**

B. Initial backfill material for ground areas saturated by water shall be granular material, clean and free of clay, silt or organic matter, and shall be Class 1, Type B, conforming to the requirements of SS Section 68-2.02F, "Permeable Material".

PART 3 – EXECUTION

3.01 CATCH BASINS AND DROP INLETS

A. Catch basins and drop inlets shall be constructed or modified at the location and of the type indicated on the plans or as directed by the Engineer and shall be verified on the site by the Contractor.

B. Catch basins and drop inlets shall be concrete structures and shall be fitted with frames and grates, as shown on applicable City Standard Drawings for the specified type of structure.

C. Upon completion, in accordance with City Standards, curbs adjacent to the catch basin shall be labeled with **"No Dumping, Flows to Ocean/Bay".**

3.02 CONCRETE STRUCTURES

Concrete structures shall be either cast in place or precast units and shall be installed in conformance with Section SS 90-2, "Minor Concrete,". Concrete structures shall not be plastered.

3.03 STORM DRAIN MANHOLES

A. Manholes shall be constructed at the location and of the type indicated on the plans.

B. Manhole base shall be cast-in place. Manhole sections shall be precast concrete units conforming to Section 70-1.02H, "Precast Concrete Structures", of the State Specifications, and constructed in accordance with applicable City Standard Drawings.

3.04 PIPE CONNECTION

Pipe connection to existing manhole shall be made in such a manner that the finish work conforms to the applicable requirements specified for new manholes, including all necessary concrete work, cutting and shaping.

3.05 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall be laid in accordance with SS Section 65-2.03D, "Laying Pipe".

3.06 CORRUGATED METAL PIPE

Corrugated metal pipe shall be laid in accordance with SS Section 66-1.03, "Construction".

3.07 PLASTIC PIPE

Except in street and driveway areas, plastic pipe shall be installed in accordance with applicable requirements of ASTM D 2241, ASTM D 2672, and ASTM D 3139.

3.08 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be as specified in **Section 31 23 00 Trench Excavation and Backfill** of the City Technical Specification and applicable Standard Drawings.

B. All pipe materials and accessories shall be on site prior to excavation. Unless otherwise specifically approved by Engineer, the length of open trench shall not exceed one hundred feet (100') ahead of pipe laying, and no more than twenty-five feet (25') of excavated trench shall remain un-backfilled at end of day.

   Excavations in public streets shall be coordinated so as to minimize traffic interference. Trenching in paved areas shall be saw cut or scored and broken ahead of trenching operations and shall be cut or trimmed to a neat edge after backfilling. Any pavement damaged outside of the cuts shall be saw cut and restored prior to final paving.

C. Roots four inches (4") or greater found during excavation shall be exposed but not severed and shall be wrapped in burlap to protect them while exposed. Roots two to four inches (2"-4") in diameter that are severed in the course of construction shall be neatly trimmed and coated with a heavy coat of tree seal. In the event major roots of smaller trees are damaged or severed the Engineer may require the Contractor to consult with a qualified arborist to determine the proper method to protect the trees.

   Trenches must be kept free from water while the pipe or structures are being installed, concrete is setting and until backfill has progressed to a sufficient height to anchor the work against possible flotation or leakage.

3.09 SUBSURFACE DRAINS

Subsurface drains shall be tied to drain inlets or manholes as shown on the Plans.

3.10 TESTING

A. The Contractor shall perform a video inspection of the piping system and shall furnish the City with a copy of the video.

B. The Contractor shall have all storm drain lines cleared by either mechanical or hydraulic balling before a video inspection is performed. A screen trap shall be installed at the downstream manhole of the line to be cleared to prevent debris from entering existing mains.

C. The Contractor shall pay for all associated testing costs.

D. All defects and leaks noted shall be corrected by the Contractor to the satisfaction of the Engineer.

3.11 SETTING MANHOLE FRAMES AND COVERS TO GRADE

All manhole castings shall be raised to new grade by bricks, and mortar and/or Pre-Cast Grade Rings in compliance with these specifications, as outlined for a new casting, after street paving has been replaced.

3.12 ABANDONMENT OF STORM DRAIN PIPES AND MANHOLES

A. Twelve-inch (12") and larger storm drain pipes to be abandoned shall be plugged and filled with slurry mixture containing a minimum of two (2) sacks of Type II cement per cubic yard of mixture.

B. Filling with slurry shall be accomplished by pumping or gravity, and will be checked by comparing the volume of the pipe with the volume of mixture used. If the volume is more than 10 percent (10%) greater than the actual volume of slurry used, the Contractor shall excavate two (2) or more exploratory holes where directed by the Engineer, and shall do all work necessary to satisfactorily fill any encountered voids.

C. Ten-inch (10") and smaller pipes to be abandoned shall be plugged at both ends with a mortar plug not less than twelve inches (12") in length.

D. Manholes to be abandoned shall have their cones removed, backfilled with slurry, or native material compacted to ninety-five percent (95%) relative compaction. Frames and covers not to be reused shall be delivered to the City.

PART 4 - MEASUREMENT AND PAYMENT

4.01 WORK INCLUDED

A. Constructing and modifying storm drain catch basins with frames and covers, as indicated on the plans and specified herein.

B. Installing new storm drain structures and junction boxes as shown on the plans and specified herein.

C. Constructing and modifying storm drain manholes with frames and covers, as indicated on the plans and specified herein.

D. Furnishing, installing, and connecting storm drain pipes and appurtenances as shown on the plans and specified herein.

E. Separate payment shall not be made for single items unless specifically noted.

4.02 CATCH BASINS

A. Catch basins shall be measured and paid for at the unit price bid, which price shall include full compensation for excavation, backfill, rebar, concrete, frames and grates, pavement replacement, and all incidental work and services involved in the construction of the completed structure.

B. Payment for modifying the existing catch basins near accessible ramp will be payable under " Modify Existing Catch Basin" unit price bid item. Quantities shall be measured in the field by the actual count of existing catch basin modified. The contract price shall include modifying, relocating, or lowering the existing catch basin, and shall include full compensation for furnishing transportation, labor, materials, tools, equipment, and incidental costs.

4.03 STORM DRAIN STRUCTURES AND JUNCTION BOXES

Storm drain structures and junction boxes shall be paid for at the unit price bid, which price shall include full compensation for excavation, backfill, castings, forms, concrete, rebar, pavement replacement, and all incidental work and services involved in the construction of the completed structure.

4.04 MANHOLES

A. Manholes including frames and covers shall be measured and paid for at the unit price bid, which price shall include full compensation for excavation, backfill, rebar, concrete, castings, pavement replacement, and all incidental work and services involved in the construction of the completed structure.

A. Manhole modification shall be measured and paid for at the unit price bid, which price shall include full compensation for excavation, backfill, rebar, concrete, pavement replacement, and all incidental work and services involved in the construction of the completed structure.

4.05 PIPES

A. Pipes shall be measured and paid for per linear foot for the different sizes and classes of pipes, as listed on the Bid Schedule.

B. Payment shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals for doing all work involved in installing different sizes, classes, and types of pipe, complete in place, including trenching, excavation and backfill, and connecting new pipe to existing or new facilities, concrete collars, or concrete tees and reinforcements, as shown on the plans and as specified in these specifications and Special Provisions, and as directed by the Engineer.

-END OF SECTION-