

DIVISION 02

SITE CONSTRUCTION

SECTION 02300

ROADWAY AND GENERAL EARTHWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating; filling and grading for street surfacing, concrete street improvements and appurtenances, as indicated on the drawings; removing and disposing of excess and unsuitable material; and compacting as required.
- B. Removing topsoil material; and stockpiling material on-site.
- C. Removing and disposing of existing concrete items as indicated.
- D. Backfilling, compacting and grading around and adjacent to new concrete work and paving, as indicated on the drawings.
- E. Finish grading.
- F. Dust control.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: trenching and backfilling for pipe work.
- B. Section 02315 - Structural Excavation: Building and foundation excavating.
- C. Section 02316 - Fill and Backfill: Backfilling for project pipe lines and at structures.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples, where required by the Engineer: 10 pound sample of each type of fill; submit to testing laboratory as directed by the laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.
- F. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with City of Saratoga Springs, Public Works Department standards.
 - 1. Maintain one copy of standards on job site.

1.05 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect landscaping, such as plants, lawns, rock out-croppings, and other features, adjacent to work areas, from excavating equipment and vehicular traffic.

- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. See Section 02316 - Fill and Backfill.

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities, where and as required.
- D. Verify that survey bench mark and intended elevations for the Work are as indicated.
- E. Identify any areas of collapsible soils within the work area, and inform the City Engineer of their locations.

3.02 EXCAVATING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil material when wet.
- C. Excavate to lines, grades and cross-sections as indicated on the drawings.
- D. Notify City Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- E. All excavating shall be done according to OSHA Standards and all other applicable regulations.
- F. Excavation and grading operations shall be conducted in such a manner so as to cause minimum inconvenience to adjacent property, including dust control.
- G. Surfaces of excavated areas shall be maintained reasonable smooth at all times to ensure proper drainage. If existing drainage is interrupted, provide temporary facilities to re-route and maintain drainage so that adjacent properties are not damaged. Temporary drainage facilities shall be considered incidental to work involved; and shall be removed after work is completed.
- H. When unsuitable material is encountered in excavated areas at subgrade elevations, excavate as required to remove unsuitable material and backfill areas with selected backfill material.
- I. Remove large rocks and boulders encountered at subgrade elevations to a depth of not less than 6-inches below subgrade, and fill and compact excavation with suitable material.
- J. Remove excess and unacceptable excavated material from site and dispose of in an acceptable manner.
- K. See Section 02316 for backfilling and filling procedures.
- L. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

- M. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- N. During construction, provide and maintain sufficient means and devices to promptly remove and properly dispose of all water entering excavations or other parts of the work.
 - 1. Dispose of water from work area in an acceptable manner, without damage to adjacent property.
 - 2. No pipe, concrete footings, foundations or floors shall be installed in water.
 - 3. Water shall not be allowed to rise over concrete until it has set for at least 24 hours.
 - 4. Water shall not be allowed to rise against walls and supporting beams for a period of 14 days after completion of walls and beams.
 - 5. Any damage to pipe work or concrete work caused by water shall be repaired by the Contractor, at his expense.
- O. The use of explosives will not be allowed; unless use has been specifically reviewed and accepted by the Engineer. All blasting shall be done by a reputable contractor specializing in the use of explosives, and is acceptable to the Engineer.

3.03 REMOVING MISCELLANEOUS CONCRETE ITEMS

- A. Remove existing concrete curb and gutter, sidewalk, waterways, and driveway pavement as indicated and as directed by the Engineer.
- B. Saw-cut existing concrete items at limit of removal as directed; break up and demolish the concrete item; and load, haul and dispose of concrete debris in an acceptable manner.

3.04 SOIL REMOVAL

- A. Segregate excavated material at time of excavation into topsoil material, acceptable material, and unsuitable material, as determined by the City Engineer.
- B. Stockpile topsoil to be re-used on site; remove excess material from site and dispose of in an acceptable manner.
- C. Stockpile acceptable subsoil to be re-used on site; remove unacceptable and excess material from site and dispose of in an acceptable manner.
- D. Stockpile materials separately in areas designated on site, within 200 feet of point of excavation; pile depth not to exceed four feet and protect from erosion.

3.05 BACKFILLING AND FILLING

- A. Remove all vegetation, debris, unsuitable soil materials, obstructions and deleterious materials from designated areas prior to placement of backfills or fills.
- B. Where existing ground surfaces have density less than that specified for particular area, plow area to required depth, pulverize existing material, moisture-condition to optimum moisture content and compact to required percentage of maximum density.
- C. Place backfill and fill material in layers of not more than 8-inches, loose depth. Moisture-control each layer to provide optimum moisture content of material; but keep moist enough at all times to provide dust control.
- D. Compact each layer to required percentage of maximum density for each area classification.
- E. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

- F. See Section 02316 for backfilling and filling procedures.
- G. Correct areas that are over-excavated.
 - 1. Use structural fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

3.06 COMPACTING

- A. Compact backfill and fill material to provide not less than the following percentages of maximum density for each area classification:
 - 1. Roadways: Under paving and similar construction, compact top 12-inches of subgrade and each later of backfill or fill material to 95 percent of maximum dry density.
 - 2. Concrete Items: Under curb and gutter, sidewalks, and other concrete items, compact top 6-inches of subgrades and each layer of backfill or fill material to 95 percent of maximum dry density.
 - 3. Non-Landscaped Unpaved Areas: Compact each layer of backfill or fill material to 85 percent of maximum dry density.
- B. Moisture Control. Before compaction, moisture control subgrades or layers of backfill and fill material, as required, to achieve optimum moisture content of material.
 - 1. For dry material, apply water uniformly to surface of material in a way that will prevent free water from appearing on surface during or after compaction operations.
 - 2. For soil material that is too wet to allow compaction, remove and replace backfill or fill material, or scarify subgrade material and air dry, until desired moisture content is reached.
- C. No compaction required for cut areas or undisturbed earth.

3.07 FINISH GRADING

- A. Grade project areas uniformly to lines and grades, as indicated, including adjacent transition areas.
- B. Finish surfaces shall be smooth and compact, with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades, as directed.
- C. Degree of finish required will be that which is normally obtainable from blader/grader operation.
- D. Place topsoil in areas where seeding, sodding, and planting is indicated and as directed.
 - 1. Place topsoil to the following compacted thicknesses:
 - a. Areas to be seeded with grass: 6 inches.
 - b. Areas to be sodded: 4 inches.
 - c. Areas for shrub beds: 18 inches.
 - d. Areas for flower beds: 12 inches.
 - 2. Remove roots, weeds, rocks, and foreign material while spreading.
 - 3. Near plants, spread topsoil manually to prevent damage.
 - 4. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
 - 5. Lightly compact placed topsoil.

3.08 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevations.
- B. Top Surface of Finish Grade: Plus or minus 1/2 inch from required elevations.

3.09 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. See Section 02316 for compaction density testing.
- C. Frequency of Testing: one test for each lift at 150 linear foot spacing for roadways, curb and gutter, sidewalks and other items, and as directed by the City Engineer or Inspector.

3.10 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 02312

TRENCHING FOR PIPE WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating, backfilling and compacting for project pipe lines.

1.02 RELATED SECTIONS

- A. Section 02315 - Structural Excavation: Excavating for miscellaneous structures.
- B. Section 02316 - Fill and Backfill: Backfilling for project pipe lines and at structures.

1.03 REFERENCES

- A. Use latest issue of the reference standards as of the date of the project.
- B. AASHTO T 99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and a 12-inch Drop.
- C. AASHTO T 180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch Drop.
- D. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- E. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3- F. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- G. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m<sup>3- H. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- I. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- J. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- K. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- L. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- M. Specification for Excavating on State Highways.
- N. General Safety Orders Covering Utah Industries - Section 69, Trenches.
- O. United States Department of Labor OSHA Publication 2085 - "Employer - Employee, Safe Practice for Excavation and Trenching Operations".
- P. Utah Occupational Safety and Health Rules and Regulations - General Standard (UOSHA).</sup></sup>

1.04 DEFINITIONS

- A. Pipe Line Grades and Elevations: Indicated on drawings.
- B. Trench Cross Sections: Indicated on standard trench detail drawings.
- C. Subgrade Elevations: Bottom of road base in paved areas, as indicated on drawings.
- D. Finish Grade Elevations: Top of pavement in paved areas, as indicated on drawings.
- E. Ground Elevations: Indicated on the drawings.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples, where required by the Engineer: 10 pound sample of each type of fill; submit to testing laboratory as directed by the laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated, as acceptable to the Engineer.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect plants, lawns, and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, and other improvements from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. See Section 02316 - Fill and Backfill.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities, where and as required.
- D. Identify any areas of collapsible soils within trench areas, and inform the City Engineer of their locations.

3.02 TRENCHING

- A. Excavate trenches as required to allow project pipe to be installed to line and grade as indicated on the drawings.
- B. Notify City Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. All trenching shall be done according to OSHA Standards and other applicable regulations.
- D. Do not interfere with 45 degree bearing splay of adjacent foundations.
- E. Excavate trenches to width, depth and cross section as indicated on the trench detail drawings.
- F. Hand trim excavations. Remove loose matter.
- G. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
- H. Remove excavated material that is unsuitable for re-use on the project from site and dispose of in an acceptable manner.
- I. When unsuitable material is encountered in trenches at subgrade elevations, excavate as required to remove the unsuitable material and backfill areas with selected backfill material as directed by the Engineer.
- J. Stockpile excavated material to be re-used in area designated on site.
- K. Remove excess excavated material from site and dispose of in an acceptable manner.
- L. Excavation beyond or below lines and grades indicated shall be refilled with fill material and compacted, at the Contractor's expense.
- M. During construction, provide and maintain sufficient means and devices to promptly remove and properly dispose of all water entering excavations or other parts of the work.
 - 1. Dispose of water from work area in an acceptable manner, without damage to adjacent property.
 - 2. No pipe, concrete footings, foundations or floors shall be installed in water.
 - 3. Water shall not be allowed to rise over concrete until it has set for at least 24 hours.
 - 4. Water shall not be allowed to rise against walls and supporting beams for a period of 14 days after completion of walls and beams.

5. Any damage to pipe work or concrete work caused by water shall be repaired by the Contractor, at his expense.
- N. The use of explosives will not be allowed; unless use has been specifically reviewed and accepted by the City Engineer. All blasting shall be done by a reputable contractor specializing in the use of explosives, and is acceptable to the City Engineer.
 1. Comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property.
 2. Contractor shall be fully responsible for all damage attributable to his blasting operations.
 3. Excessive blasting or over shooting will not be permitted.
 4. Remove any material outside of authorized cross-section which may be shattered or loosened by blasting operation.

3.03 PREPARATION FOR PIPE LINE PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with bedding material, Fill Type III, or stabilization material, Fill Type V, or other acceptable material, as directed by the Engineer.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

- A. Backfilling shall conform to the requirements of Section 02316 - Fill and Backfill.
- B. Backfill pipe zone with bedding material, Fill Type III, or other acceptable material.
- C. Backfill above pipe zone, up to subgrade or finish grade elevations, as indicated on the trench detail drawings.
- D. Employ a placement method that does not disturb or damage project pipe or other work.
- E. Do not backfill with wet or frozen materials.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- H. Soil Fill: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.
- I. Where directed by the City Engineer, backfill material may be consolidated by an acceptable method.
- J. Correct areas that are over-excavated.
 1. Thrust bearing surfaces: Fill with concrete.
 2. Use structural fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- K. Compaction Density Unless Otherwise Specified or Indicated:
 1. Under paving, concrete work, and similar construction: 95 percent of maximum dry density.

2. Within street rights-of-way: 95 percent of maximum dry density.
 3. At other locations: 90 percent of maximum dry density.
- L. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Project Pipe Lines:
1. Pipe Bedding: Use granular fill, Fill Type III.
 2. Backfill trench to subgrade or finish elevations with structural fill, Fill Type II.
 3. Compact bedding material in maximum 6 inch lifts to 95 percent of maximum dry density.
 4. Compact backfill material in maximum 12 inch lifts to 95 percent of maximum dry density.

3.06 TOLERANCES

- A. Top Surface of Backfilling in unimproved areas: Plus or minus 1 inch from required elevations.
- B. Top Surface of Backfilling in improved areas: Plus or minus 1/2 inch from required elevations.

3.07 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Testing is to be done as indicated in the Supplemental General Conditions; test results will be sent to the City Engineer or Inspector within 24 hours after the tests are completed.
- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Tests: one test per lift per 150 linear foot of trench, and as directed by the City Engineer or Inspector.

3.08 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 02315
STRUCTURAL EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for structure volume below grade, footings, slabs-on-grade, paving, curb and gutter, sidewalks and other concrete work.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, backfilling and compacting for project pipe lines.
- B. Section 02316 - Fill and Backfill: Fill materials, filling, and compacting.

1.03 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Identify any areas of collapsible soils within the work areas, and inform the City Engineer of their locations.

3.02 EXCAVATING

- A. Excavate to accommodate new structures and construction operations to lines and elevations indicated.
- B. Notify City Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. All excavating shall be done according the OSHA Standards and other applicable safety regulations.
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Cut excavations wide enough to allow construction of structures as indicated; bottom dimensions shall be sufficient to provide at least 12 inches clear between extreme outside of concrete work and side of excavation. No tunneling or under cutting will be permitted.
- F. Hand trim excavations. Remove loose matter.
- G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 02316.
- H. When unsuitable material is encountered in excavations at subgrade elevations, excavate as required to remove unsuitable material and backfill areas with selected backfill material, as directed by the Engineer.

- I. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- J. Remove excavated material that is unsuitable for re-use from site and dispose of in an acceptable manner.
- K. Stockpile excavated material to be re-used in areas designated on site.
- L. Remove excess excavated material from site and dispose of in an acceptable manner.

3.03 BACKFILLING

- A. Backfilling shall conform to the requirements of Section 02316 - Fill and Backfill.
- B. Backfill under structures with structural backfill material, Fill Type II, or other material acceptable to the City Engineer, and compact to 95 percent of maximum density.
- C. Backfill around structures with structural backfill material, Fill Type II, or other material acceptable to the City Engineer, up to subgrade or finish grade elevations, as indicated, and compact to 95 percent of maximum density.
- D. Employ placement method that will not disturb or damage structure.
- E. Backfill shall be brought up uniformly around structures, so as to eliminate any possibility of unbalanced loading on structure which could damage or movement.
- F. No backfill shall be placed against new concrete work until concrete has been accepted by the City Inspector; and backfill operation has been authorized.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted.
- H. Structural Backfill: Place and compact materials uniformly around structures in equal continuous layers not exceeding 12 inches compacted.
- I. Correct areas that are over-excavated with structural backfill material, compacted to minimum 95 percent of maximum dry density; at the Contractor's expense.

3.04 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.
- C. Testing is to be done as indicated in Supplemental General Conditions; test results will be sent to the City Engineer within 24 hours after the tests are completed.
- D. Perform compaction density testing on compacted backfill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017, as listed in Section 02312.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("Standard Proctor"), ASTM D 1557 ("Modified Proctor"), or AASHTO T 180, as indicated in Section 02312.
- F. If tests indicate work does not meet specified requirements, remove work, replace and re-test.
- G. Frequency of Tests: as required and as directed by the City Engineer or Inspector.

3.05 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.06 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 02316
FILL AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for project pipe lines.
- B. Filling, backfilling, and compacting for miscellaneous structures.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating for project pipe lines.
- B. Section 02315 - Structural Excavation: Excavating for structures.

1.03 REFERENCES

- A. AASHTO T 99 - Moisture-Density Relations of Soils Using a 5.5-lb (2.5 kg) Rammer and an 12-inch Drop.
- B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in.(457 mm) Drop; American Association of State Highway and Transportation Officials.
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- F. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)).
- G. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- H. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- I. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- J. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- K. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- L. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- M. Use the latest issue of the above reference standards as of the date of the Project.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.
- C. Pipe Invert Elevations: Indicated on drawings.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 pound sample of each type of fill; submit in air-tight containers to testing laboratory, if requested by the Engineer.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, if requested by the Engineer.
- E. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- #3 A. General Fill - Fill Type I: Imported borrow or soil excavated on-site if acceptable to the Engineer; conforming to **Type A-1-a** of AASHTO Classification of Soils and Soil-Aggregate Mixtures.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- #3
 - 3. Conforming to ASTM D 2487 Group Symbol CL; liquid **limit** less than 50.
 - 4. Not more than 15 percent passing No. 200 sieve.

- #3** B. Structural Fill - Fill Type II: Imported borrow or soil excavated on-site if acceptable to the Engineer; conforming to **Type A-1-a** of AASHTO Classification of Soils and Soil-Aggregate Mixtures.
1. Graded.
 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, deleterious matter and debris.
 3. Conforming to ASTM D 2487 Group Symbol GW, GP, SW and SP.
 4. Not more than 15% passing No. 200 sieve.
- C. Concrete for Fill: Lean concrete.
1. Conforming to Flowable Fill, Section 845, of the Utah Department of Transportation's Standard Specifications.
- D. Granular Fill - Gravel - Fill Type III: Angular crushed washed stone; free of shale, clay, friable material and debris.
1. Graded in accordance with ASTM C 136, within the following limits:
 - a. 2 inch sieve: 100 percent passing.
 - b. 1 inch sieve: 95 percent passing.
 - c. 3/4 inch sieve: 95 to 100 percent passing.
 - d. 5/8 inch sieve: 75 to 100 percent passing.
 - e. 3/8 inch sieve: 55 to 85 percent passing.
 - f. No. 4 sieve: 35 to 60 percent passing.
 - g. No. 16 sieve: 15 to 35 percent passing.
 - h. No. 40: 10 to 25 percent passing.
 - i. No. 200: 5 to 10 percent passing.
- #3** E. Granular Fill - 3/4" Gravel - Fill Type IV: Angular crushed, washed stone; washed, free of shale, clay, friable material and debris.
1. Graded in accordance with ASTM C 136, within the following limits:
 - a. 1 inch sieve: 100 percent passing.
 - b. 3/4 inch sieve: 90 to 100 percent passing.
 - c. 3/8 inch sieve: 30 to 65 percent passing.
 - d. No. 4 sieve: 5 to 25 percent passing.
 - e. No. 8 sieve: 0 to 10 percent passing.
 - f. No. 16: 0 to 5 percent passing.
- F. Granular Fill - Course Gravel - Fill Type V: Free draining granular backfill material; natural or crushed aggregate.
1. Graded in accordance with ASTM C-136, within the following limits:
 - a. 2 inch sieve: 100 percent passing.
 - b. 1 inch sieve: 95 to 100 percent passing.
 - c. 1/2 inch sieve: 25 to 60 percent passing.
 - d. No. 4 sieve: 0 to 10 percent passing.
- G. Sand - Fill Type VI: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
1. Graded in accordance with ASTM C 136; within the following limits:
 - a. No. 4 sieve: 100 percent passing.
 - b. No. 14 sieve: 10 to 100 percent passing.
 - c. No. 50 sieve: 5 to 90 percent passing.
 - d. No. 100 sieve: 4 to 30 percent passing.
 - e. No. 200 sieve: 0 to 5 percent passing.

- H. Topsoil - Fill Type VII: Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - 3. Acidity range (pH) of 5.5 to 7.5.
 - 4. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 - 5. Conforming to ASTM D2487 Group Symbol OH.
- I. On-Site Native Soil - Fill Type VIII: Material excavated during trenching or other excavating operations; free of organic matter and debris.
 - 1. On-site native soil may only be used as trench backfill if recommended by the developer's geotechnical engineer of record, and is acceptable to the City Engineer or City Inspector.
 - a. Percentage of material passing the #200 sieve may be a maximum of 25 percent; based on the written recommendation of the geotechnical engineer.
 - b. Testing frequency shall be as described in the City Standards, unless the testing frequency is increased as recommended by the geotechnical engineer of record.
 - c. If backfill material is used with more than 15 percent passing the #200 sieve, the geotechnical engineer of record shall be on site during all backfill and compacting operations to ensure 95% compaction of trench backfill.
 - 2. The geotechnical engineer of record shall define the moisture control, placement and compaction requirements needed for the native material to obtain 95% compaction of the trench backfill.
 - 3. The Developers shall employ and pay for quality control services of the geotechnical engineer of record.
 - 4. The geotechnical engineer shall prepare a letter or report summarizing:
 - a. Testing methods, test frequencies and observations.
 - b. Any non-conforming conditions and corrective actions taken to remedy the non-conformities.
 - c. Compliance of the work to the City Standard Specifications.
 - 5. The geotechnical engineer's letter or report shall be submitted to the City Engineer or City Inspector as described in the City Standards."

2.02 SOURCE QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type II or III.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to finish contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations where indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend project slopes into existing areas.
- I. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Use structural fill, Fill Type II, flush to required elevation, compacted to 95 percent of maximum dry density.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. Under structures: 95 percent of maximum dry density.
 - 3. At other locations: 90 percent of maximum dry density.
- K. Consolidation density shall be 85 percent of maximum dry density.
- L. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Fill in unimproved areas:
 - 1. Use general fill, Fill Type I, unless otherwise specified or indicated.
 - 2. Fill to finish grade elevations
 - 3. Maximum depth per lift: 12 inches, compacted.

4. Consolidate to minimum 85 percent of maximum dry density.
- B. Structural Fill at structures and embankments:
1. Use structural fill, Fill Type II.
 2. Fill up to subgrade elevations.
 3. Maximum depth per lift: 12 inches, compacted.
 4. Compact to minimum 95 percent of maximum dry density.
- C. Under curb and gutter, sidewalks, slabs-on-grade, and other concrete work:
1. Use granular fill, Fill Type II or III.
 2. Depth: six inches deep, or as indicated on drawings.
 3. Compact to 95 percent of maximum dry density.
- D. At Foundation Walls and Footings:
1. Use structural fill, Fill Type II.
 2. Fill up to finish grade elevation.
 3. Compact each lift to 95 percent of maximum dry density.
 4. Do not backfill against unsupported foundation walls.
 5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- E. Bedding and Backfill for Pipe Lines in Trenches:
1. Pipe Bedding: Within pipe zone - use granular fill, Fill Type III.
 - a. Use Type III Fill under, around and to one foot over PVC pressure pipe.
 - b. Use Type II or III Fill under, around and to one foot over ductile iron pressure pipe.
 - c. Use Type III Fill under, around and to one foot over PVC sewer pipe.
 - d. Use Type II or III Fill under, around and to the top of concrete drain pipe.
 - e. Compact pipe bedding in maximum 6 inch lifts to 95 percent of maximum dry density.
- F. Trench Backfill: Above pipe zone - use structural fill, Fill Type II.
1. Fill up to subgrade elevation or natural ground level.
 2. Compact trench backfill in maximum 12 inch lifts to 95 percent of maximum dry density.
- G. At Landscaped Areas:
1. Use general fill, Fill Type I.
 2. Fill up to 4 inches below finish grade elevations.
 3. Compact to 90 percent of maximum dry density.
- H. At Cultivated Areas:
1. Use general fill, Fill Type I.
 2. Fill up to 24 to 36 inches below finish grade elevations.

3. Fill top 24 to 36 inches of trench, up to finish grade elevations, with stockpiled top soil material.
4. Compact to 90 percent of maximum dry density.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

3.06 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Testing is to be done by an independent testing company for the Contractor, as indicated in the Supplemental General Conditions; test results for all tests will be sent to the City Engineer within 24 hours after the tests have been completed.
- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Tests: See Section 02300, 02312 and 02315.

3.07 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for project water lines, to include domestic water lines, fire water lines, and culinary water lines.
- B. Valves, Fire hydrants, and appurtenant items.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Bedding and backfilling.
- D. Section 02515 - Disinfection of Water Distribution Systems: Disinfection of site service utility water piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

1.03 REFERENCES

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers.
- C. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.
- D. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- E. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.
- F. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association (ANSI/AWWA C104/A21.4).
- G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association (ANSI/AWWA C105/A21.5).
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
- I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- J. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- K. AWWA C502 - Dry Barrel Fire Hydrants; American Water Works Association (ANSI/AWWA C502/C502a).
- L. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.

- M. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- N. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3 O. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- P. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- Q. ASTM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- R. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- S. AWWA C200 - Steel Water Pipe, 6-inches and Larger.
- T. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints:
 - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
 - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
 - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
 - 3. Jackets: AWWA C105 polyethylene jacket.

- B. Copper Tubing: ASTM B 88, Type K, annealed:
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or AWS A5.8, BCuP silver braze.
- C. PVC Pipe: AWWA C900 Class 150 or 200, as indicated:
 - 1. Fittings: AWWA C111, cast iron.
 - 2. Joints: ASTM D 3139 compression gasket ring.
- D. Polyethylene Pipe: ASTM D2737, C.T.S., 200 psi, SDR 9.
 - 2. Joints: Mueller compression type couplings.
- E. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.

2.02 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches:
 - 1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
 - 2. Product: Powell U.S. Bronze Gate Valves, or accepted equal.
 - 3. Substitutions: See Section 01600 - Product Requirements.
- C. Gate Valves 3 Inches and Over:
 - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - 2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 4. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
- D. Swing Check Valves From 2 Inches to 24 Inches:
 - 1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
 - 2. Product: Mueller Swing-Type Check Valve, or accepted equal.
- E. Butterfly Valves From 2 Inches to 24 Inches:
 - 1. AWWA C504, iron body, bronze disc, resilient replacement seat, mechanical joint or flanged ends as indicated, manual worm gear operator, and cast iron valve box where required.
 - 2. Underground manual operators shall be totally enclosed, factory grease packed and sealed, bronze worm gear operators with self-locking gearing; stops shall be provided to prevent over travel of valve disc.

3. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the Engineer.
 4. Product: Mueller "Lineseal III" Butterfly Valve with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
- F. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000, or acceptable equal, for up to 2-inch service line.
- G. Blow-Off Hydrants: shall be Eclipse No. 85, Non-Freeze Blow-Off Hydrants, or other hydrants acceptable to the City Engineer.

2.03 HYDRANTS

- A. Hydrants: AWWA C502, UL 246, dry barrel type.
1. Inside dimension: 7 inches minimum, with minimum 5 inches diameter valve seat opening.
 2. Minimum net water area of barrel not less than 190 percent of valve opening.
 3. 6 inch flanged inlet connection with accessories, gland bolts, and gaskets.
 4. Product: Mueller "Super Centurion 200" Fire Hydrants or Waterous Model # WB-67-250.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Two hose nozzles, 2 1/2-inch size, one pumper nozzle, 4 1/2 inch size.
- D. Finish: Buried portion of hydrant shall be painted with two coats of CA50 coal tar enamel. Exposed portion shall be painted with Primer and two coats of enamel in acceptable red color.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Sections 02312 and 02316.
- B. Backfill: As specified in Sections 02312 and 02316.

2.05 ACCESSORIES

- A. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or acceptable equal, for up to 2 inch service lines.
- B. Concrete for concrete collars, slabs, and thrust restraints: Concrete type specified in Section 03300.

2.06 RESIDENTIAL WATER CONNECTIONS

- A. Meter boxes, meter setters, meters, and appurtenant items shall be as indicated on the drawings and as directed by the City Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water main and main line tee size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.03 TRENCHING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square footage of thrust restraint bearing on subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with State code.
- B. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer or Inspector.
- C. Install pipe to indicated elevation to within tolerance of one inches.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Install PVC pressure pipe and fittings to ASTM D2774.
- F. Install pipe lines to line and grade indicated.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install access fittings to permit disinfection of water system performed under Section 02515.
- I. Install trace wire above top of PVC pipe; coordinate with Section 02312.

3.05 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on concrete block or other acceptable solid bearing.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- D. Set hydrants to grade, with bury mark at ground level and with nozzles at least 18 inches above ground level.
- E. Locate hydrant control valve as indicated on the drawings and as directed by the Engineer.
- F. Provide a drainage pit, 24 inches square by 12 inches deep, filled with 1/2-inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- G. Paint hydrants in accordance with manufacturer's standards.

#1 H. Deleted.

3.06 SERVICE CONNECTIONS

- A. Provide water service as indicated with meter box, meter yoke, reduced pressure backflow preventer and water meter.

3.07 CONNECTIONS TO EXISTING WATER LINES

- A. Connection to existing water lines shall be made where and as indicated on the drawings and as directed by the Engineer. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connection which involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.
- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with acceptable type drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the Owner.
- F. Cut and plug existing pipe lines where indicated and as directed by the Engineer. Excavate as required to locate existing pipe lines to be abandoned in place; cut the existing pipe, as required; and install permanent plug in end of pipe to be abandoned.

3.08 RECONNECT EXISTING WATER SERVICE LINES

- A. Reconnect existing water service lines where and as indicated on the drawings and as directed by the Engineer. The sizes of pipe, fittings, saddles, corporation stops, and appurtenant items required to make reconnections shall correspond to the sizes of existing service lines and of project pipe.
- B. Excavate as required to locate the existing service line; determine actual conditions of existing service line and all fitting and appurtenant items needed to make the reconnections; and have all materials needed on site prior to any shut down of existing service line.
- C. After project pipe line has been thoroughly tested, disinfected and put into operation, dis-connect existing water service lines from the existing water line. Excavate as required to expose the existing service line; cut the existing service line and remove a section of the line as required and as directed; and remove the existing corporation stop from the existing pipe and install a permanent plug in the tap in the existing water line which is to be abandoned.
- D. Tap the project pipe line with the appropriate size tapping machine and install a double strap service saddle, with corporation stop, on the project pipe. New copper tubing shall be furnished and installed to make the connection from the end of the existing service line to the new corporation stop. The new copper tubing shall be connected to the end of the existing service line with the appropriate type coupling and to the new corporation stop. In all reconnections, at least five feet of new tubing shall be installed, as indicated. Insulating couplings or adapters shall be used to connect pipe of dissimilar material.
- E. After the existing water service line has been disconnected from the existing water line, the reconnection work shall be pursued diligently so that the service line is reconnected to the project water line and put back into service in the shortest possible time.

3.09 REMOVING EXISTING FIRE HYDRANTS

- A. Existing fire hydrant installations shall be removed and delivered to the Owner as indicated and as directed by the Engineer.
- B. Excavate as required to locate the existing hydrant supply line and control valve; determine actual conditions of existing supply line and all fitting required to complete the removal; and have all material needed at the job site prior to any shut down or cutting into existing pipe.
- C. After project pipe line has been thoroughly tested, disinfected and put into operation, cut the existing hydrant supply line and remove a section of the existing pipe from the cut the hydrant and install a plug in the end of the pipe to be abandoned.. Remove the existing hydrant, control valve and valve box and deliver the material to the Owner as directed.
- D. After the hydrant installation has been completely removed and the existing pipe plugged, backfill the excavation to match adjacent ground surfaces; and compact material as described herein.

3.10 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02512

PRESSURE REGULATING VALVE STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure regulating valve (PRV) station; including reinforced concrete vault, pipe, fittings, valves, and appurtenant items.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Bedding and backfilling.
- C. Section 02510 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02515 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

1.03 REFERENCES

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- C. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3 E. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C151).
- F. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE VAULT

- A. Reinforced Concrete Vault. The reinforced concrete vault is shown on the drawings as constructed of poured-in-place concrete; but a precast reinforced concrete vault may be provided at the option of the Contractor.
 - 1. The vault shall be sized to adequately accommodate all valves, pipe, fittings and appurtenant items to be enclosed in the vault; and the vault dimensions shall be acceptable to the City Engineer.
 - 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the construction drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
 - 3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics, as determined by the City Engineer during shop drawing review, may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
 - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-White, Inc., Dura-Crete, or other manufacturers acceptable to the City Engineer.
 - 4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the construction drawings.
 - 5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening, as directed by the Engineer. Steps shall be copolymer polypropylene-encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc., or other manufacturers accepted to the City Engineer.
 - a. An aluminum ladder may be provided and permanently installed as acceptable to the City Engineer.
- B. Access Doors: The access door leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors shall have recessed hasp covered by a hinged lid flush with the surface of the door.
 - a. The access doors shall be Type J Access Doors as manufactured by The Bilco Company, or companies acceptable to the City Engineer, of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or acceptable equals.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the pressure regulating station, as described herein and as shown on the drawings.
 - 1. Codes. Specifications for the Design, Fabrication and Erection of Structural Steel For Buildings of the American Institute of Steel Construction shall govern the work. Welding shall be done in accordance with applicable American Welding Society Standards.
 - 2. Substitutions. Substitutions of sections or modifications of details, or both, and the reasons therefor shall be submitted for acceptance by the City Engineer.

3. Responsibility for Errors. The Contractor shall be responsible for all errors of detailing, fabrication, erection, and correct fitting of the miscellaneous metal work.
4. Materials. Material shall conform to their respective specifications as follows:
 - a. Bolts and Nuts: ASTM Standard A-307
 - b. Gray Iron Castings: A-48 Class 40 or Better
 - c. Structural Steel: ASTM Standard A-36
 - d. Washers: ASTM Standard B-27.2, Type B
 - e. Miscellaneous Items: Miscellaneous items shall be as indicated on the drawings or as required.
- E. Painting. All exposed pipe, valves, fittings, and metal work inside of the station shall be painted with either: four coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2); or four coats of phenolic paint, Painting System III (Steel Structural Painting Council - Specification No. 3). Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils. Aluminum surfaces which will be in contact with concrete after erection shall be coated with bituminous mastic coating, SSPC-Paint 12, prior to erection.

2.02 VALVE STATION PLUMBING

A. Pipe and Fittings.

1. Ductile Iron Pipe: AWWA C151: See Section 02510. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02510.
3. Galvanized Steel Pipe: ASTM A 53: Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.

B. Valves.

1. Manufacturer's name and pressure rating marked on valve body.
2. Gate Valves Up To 3 Inches:
 - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
 - b. Product: Powell U.S. Bronze Gate Valves, or accepted equal.
 - c. Substitutions: See Section 01600 - Product Requirements.
3. Gate Valves 3 Inches and Over:
 - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
 - #3 b. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
4. Butterfly Valves From 2 Inches to 24 Inches:
 - a. AWWA C504, iron body, bronze disc, resilient replacement seat, flanged ends as indicated, and manual worm gear operator.
 - b. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the Engineer.
 - c. Product: Mueller "Lineseal III" Butterfly Valve with appropriate type manual worm gear operator.

5. Pressure Reducing Valves:
 - a. Valves shall have cast iron bodies, with bronze pilot and trim; designed to reduce a higher inlet pressure to a steady lower pressure downstream, regardless of flow rate.
 - b. Valves shall be hydraulically operated; capable of holding delivery pressure to within one or two psi of valve setting; and shall be adjustable, with downstream pressure range of 30 to 110 psi.
 - c. Pressure reducing valves shall be Clayton Model 90G-01AB Pressure Reducing Valves, as manufactured by Cla-Val Company.
 - d. Other type valves may be required for specific applications within the water system, as acceptable to the City Engineer.

 6. Strainers:
 - a. Strainers shall have cast iron bodies and covers, stainless steel strainer and stainless steel bolts.
 - b. End flanges shall be ANSI class 125 standard flanges
 - c. Stainless steel strainers shall have an area of two times the nominal inlet pipe opening.
 - d. Strainers shall be designed for easy access and in-line servicing of strainer element; and shall have drain plugs for periodic flushing.

 7. Combination Air-Vacuum Release Valves.
 - a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
 - b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves, No. 143C", as manufactured by Valve and Primer Corp. (APCO); and shall meet the provisions of these specifications.

 8. Hose Gate Valves.
 - a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
 - b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527, or acceptable equal.
- C. Miscellaneous Items.
1. Flanged Coupling Adapters. The flanged coupling adapters shall be Rockwell Type 912 or Type 913, or other couplings acceptable to the City Engineer, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to flanged valves, equipment and fittings.
 2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell, or other couplings acceptable to the City Engineer; for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or approved rust preventing wax compound.
 3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
 4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744, or accepted equal.
 5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or acceptable equal, for up to 2 inch service lines.
 6. Other Items. Other miscellaneous materials shall be as indicated on the drawings.

D. Hangers, Supports and Blocks.

1. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.
 - a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.
2. Supports.
 - a. Concrete supports shall be installed under pipe and valves wherever shown on the drawings. Concrete supports shall be neatly constructed and finished, as indicated on the drawings and as directed by the Engineer. No supports shall be made until all pipe is in its final position.
 - b. All other pipe supports shall be of the adjustable type of the style and size recommended by the manufacturer; and shall be located as indicated on the drawings and as directed by the Engineer. Floor flanges shall be of the size required to fit the pipe attached to the saddle support and as recommended by the manufacturer. Adjustable pipe supports shall be used as kick blocks for pipe in open locations.
3. Blocks. Concrete thrust blocks shall be used wherever shown on the drawings or where thrust is great enough, in the Engineer's opinion, to cause movement of the piping.

- E. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

2.03 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02315 and 02316.
- B. Backfill: As specified in Sections 02315 and 02316.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.03 EXCAVATING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.

- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square foot of thrust restraint bearing on undisturbed subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

3.04 CONSTRUCTION - VALVE VAULT

- A. Construct the vault for the pressure regulating station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the construction drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
 - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
 - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

3.05 INSTALLATION - PLUMBING

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with State plumbing codes.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. Strainers shall be installed upstream of all pressure regulating valves.
- D. All material and workmanship shall conform to applicable requirements of the Utah Plumbing Code.
- E. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer.
- F. Install pipe to indicated elevation to within tolerance of one inches.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install access fittings to permit disinfection of water system performed under Section 02515.

- J. Set valves on concrete block or other acceptable solid bearing.
- K. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.06 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02514

WATER METER STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water meter stations, complete, including:
 - 1. Reinforced concrete vault.
 - 2. Pipe, fittings, valves, meter, and appurtenant items.
- B. Station testing.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Pipe bedding and excavation backfilling.
- C. Section 02510 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02515 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

1.03 REFERENCES

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- D. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- E. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- F. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- G. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- H. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- I. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- J. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- K. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).

- #3 L. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).
- M. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- N. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, meters, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, meters, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves, valves and appurtenant items in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE VAULT

- A. Reinforced Concrete Vault. The reinforced concrete vault is shown on the drawings as constructed of poured-in-place concrete; but a precast reinforced concrete vault may be provided at the option of the Contractor.
1. Concrete work shall conform to applicable requirements of Section 03300.
 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
 - a. Poured-in-place concrete vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
 - b. Submit construction drawings of the vault for review by the City Engineer, before any work is begun. The drawings shall be stamped by a structural engineer.
 3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics, as determined by the Engineer during shop drawing review, may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
 - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-White, Inc., Dura-Crete, or other manufacturer acceptable to the City Engineer.
 4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the drawings.
 5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening, as directed by the Engineer. Steps shall be copolymer polypropylene-encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc., or steps accepted to the City Engineer.

- B. Access Doors: The access door leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors shall have recessed hasp covered by a hinged lid flush with the surface of the door.
 - a. The access doors shall be Type J Access Doors as manufactured by The Bilco Company, or other manufacturers acceptable to the City Engineer, of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or items acceptable to the City Engineer.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the pressure regulating station, as described herein and as shown on the drawings.
 - 1. Codes. Specifications for the Design, Fabrication and Erection of Structural Steel For Buildings of the American Institute of Steel Construction shall govern the work. Welding shall be done in accordance with AWS D1.1 of the American Welding Society Standards.
 - 2. Substitutions. Substitutions of sections or modifications of details, or both, and the reasons therefor shall be submitted for acceptance by the City Engineer.
 - 3. Responsibility for Errors. The Contractor shall be responsible for all errors of detailing, fabrication, erection, and correct fitting of the miscellaneous metal work.
 - 4. Materials. Material shall conform to their respective specifications as follows:
 - a. Bolts and Nuts: ASTM Standard A-307
 - b. Gray Iron Castings: A-48 Class 40 or Better
 - c. Structural Steel: ASTM Standard A-36
 - d. Washers: ASTM Standard B-27.2, Type B
 - e. Miscellaneous Items: Miscellaneous items shall be as indicated on the drawings or as required.
- E. Painting. All exposed pipe, valves, fittings, and metal work inside of the station shall be painted with either: four coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2); or four coats of phenolic paint, Painting System III (Steel Structural Painting Council - Specification No. 3). Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils. Aluminum surfaces which will be in contact with concrete after erection shall be coated with bituminous mastic coating, SSPC-Paint 12, prior to erection.

2.02 METER STATION PLUMBING

- A. Pipe and Fittings.
 - 1. Ductile Iron Pipe: AWWA C151: See Section 02510. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
 - 2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02510.
 - 3. Galvanized Steel Pipe: ASTM A 53: Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.
- B. Valves.
 - 1. Manufacturer's name and pressure rating marked on valve body.
 - 2. Gate Valves Up To 3 Inches:
 - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.

- b. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.
- c. Substitutions: See Section 01600 - Product Requirements.

3. Gate Valves 3 Inches and Over:

#3

- a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
- b. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
- c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.

#3

4. Butterfly Valves From 2 Inches to 24 Inches:

- a. AWWA C504, iron body, bronze disc, resilient replacement seat, flanged ends as indicated, and manual worm gear operator.
- b. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the Engineer.
- c. Product: Mueller "Lineseal III" Butterfly Valve with appropriate type manual worm gear operator.

5. Swing Check Valves From 2 Inches to 24 Inches:

- a. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
- b. Product: Mueller Swing-Type Check Valve, or other valves acceptable to the City Engineer.

6. Combination Air-Vacuum Release Valves.

- a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
- b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves, No. 143C", as manufactured by Valve and Primer Corp. (APCO); and shall meet the provisions of these specifications.

7. Strainers:

- a. Strainers shall have cast iron bodies and covers, stainless steel strainer and stainless steel bolts.
- b. End flanges shall be ANSI class 125 standard flanges
- c. Stainless steel strainers shall have an area of two times the nominal inlet pipe opening.
- d. Strainers shall be designed for easy access and in-line servicing of strainer element; and shall have drain plugs for periodic flushing.

8. Hose Gate Valves.

- a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
- b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527, or other valves acceptable to the City Engineer.

C. Meters. Meters shall be of design, type, size and manufacturer as acceptable to the City Engineer.

D. Miscellaneous Items.

- 1. Flanged Coupling Adapters. The flanged coupling adapters shall be Rockwell Type 912 or Type 913, or other couplings acceptable to the City Engineer, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to the flanged valves, equipment and fittings.
- 2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell, or other couplings acceptable to the City Engineer, for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or approved rust preventing wax compound.

3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
 4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744, or other valves acceptable to the City Engineer.
 5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or other clamps acceptable to the City Engineer, for up to 2 inch service lines.
 6. Other Items. Other miscellaneous materials shall be as indicated on the drawings.
- E. Hangers, Supports and Blocks.
1. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.
 - a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.
 2. Supports.
 - a. Concrete supports shall be installed under pipe and valves wherever shown on the drawings. Concrete supports shall be neatly constructed and finished, as indicated on the drawings and as directed by the Engineer. No supports shall be made until all pipe is in its final position.
 - b. All other pipe supports shall be of the adjustable type of the style and size recommended by the manufacturer; and shall be located as indicated on the drawings and as directed by the City Engineer. Floor flanges shall be of the size required to fit the pipe attached to the saddle support and as recommended by the manufacturer. Adjustable pipe supports shall be used as kick blocks for pipe in open locations.
 3. Blocks. Concrete thrust blocks shall be used wherever shown on the drawings or where thrust is great enough, in the City Engineer's opinion, to cause movement of the piping.
- F. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

2.03 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02315 and 02316.
- B. Backfill: As specified in Sections 02315 and 02316.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the water meter station, complete, as described herein, as shown on the drawings, and as directed by the City Engineer.
- B. All work shall be done according to local plumbing codes, and to manufacturer's written instructions and recommendations.

- C. The Contractor shall test the station to assure proper operation.

3.02 EXAMINATION

- A. Verify that design drawings conform to project conditions.
- B. Verify that water main size, location, and invert are as indicated.

3.03 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.04 EXCAVATING

- A. Excavating for the meter station shall be done to ensure proper grades and alignment as shown on the drawings.
- B. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- C. Hand trim excavation for accurate construction or placement of concrete vault to elevations indicated.
- D. Backfill around structure with backfill material, tamp in place and compact to required densities.

3.05 CONSTRUCTION - VALVE VAULT

- A. Construct the vault for the meter station at the location indicated on the drawings and as directed by the City Engineer or Inspector; in accordance with the details shown on the drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete and reinforcement.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
 - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
 - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

3.06 INSTALLATION - PLUMBING

- A. All pipe, fittings, meters, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with State plumbing codes.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. Strainers shall be installed upstream of all meters.
- D. All material and workmanship shall conform to applicable requirements of the Utah Plumbing Code.
- E. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer or City Inspector.
- F. Install pipe to indicated elevation to within tolerance of one inches.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install access fittings to permit disinfection of water system performed under Section 02515.
- J. Set valves on concrete block or other acceptable solid bearing.
- K. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.07 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.08 OPERATIONAL TESTING

- A. Provide City Engineer with seven days written notice of operational test of backflow preventer.
- B. Test shall consist of the operation of the station for propose of checking operation and assuring of absence of leaks.
 - 1. Repair pipe, fittings, valves, or connections which show evidence of leakage.
- C. After all repairs or replacements have been made and accepted by the City Engineer, repeat the above required test.

END OF SECTION

SECTION 02515

DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of project pipe lines specified in Section 02510.
- B. Disinfection of site domestic water lines, site fire water lines, and hydrant supply lines and water service lines specified in Section 02510.
- C. Testing and reporting results.

1.02 RELATED SECTIONS

- A. Section 02510 - Water Distribution System.

1.03 REFERENCES

- A. AWWA B300 - Hypochlorites; American Water Works Association; (ANSI/AWWA B300).
- B. AWWA B301 - Liquid Chlorine; American Water Works Association; (ANSI/AWWA B301).
- C. AWWA B302 - Ammonium Sulfate; American Water Works Association; (ANSI/AWWA B302).
- D. AWWA B303 - Sodium Chlorite; American Water Works Association; (ANSI/AWWA B303).
- E. AWWA C651 - Disinfecting Water Mains; American Water Works Association; (ANSI/AWWA C651).
- F. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Test Reports: Indicate results comparative to specified requirements.
- C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- D. Disinfection report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.

- E. Bacteriological report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water conforms, or fails to conform, to bacterial standards of State.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of Utah.
- C. Submit bacteriologist's signature and authority associated with testing.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code or regulation for performing the work of this Section.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite; AWWA B301, Liquid Chlorine; AWWA B302, Ammonium Sulfate; and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.

3.02 EXECUTION

- A. Provide and attach required equipment to perform the work of this Section.
- B. Introduce treatment into piping system.
- C. Maintain disinfectant in system for 24 hours.
- D. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- E. Replace permanent system devices removed for disinfection.
- F. Pressure test system to 1.25 times the system working pressure, in psi. Repair leaks and re test.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Test samples in accordance with AWWA C651.

END OF SECTION

SECTION 02516

AIR-VACUUM VALVE STATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-Vacuum Valve Stations; including reinforced concrete vault, pipe, fittings, valves, and appurtenant items, as indicated on the drawings and as described herein.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Bedding and backfilling.
- C. Section 02510 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02515 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

1.03 REFERENCES

- A. ASTM B 43 - Standard Specifications for Seamless Red Brass Pipe, Standard Sizes.
- B. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- D. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- E. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3 F. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Associations; (ANSI/AWWA C515).
- G. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 GRAVEL BASE. Gravel shall conform to the requirements of Section 02316.

2.02 REINFORCED CONCRETE VAULT

- A. Precast Riser Sections. Riser sections shall be reinforced concrete pipe sections, class IV, with tongue and groove joints; meeting the requirements of ASTM C 76. Riser sections shall extend from the top of the base to the bottom of the cover slab.
 - 1. Joints. Joints between precast sections, except grade rings, shall be sealed with pre-lubricated rubber gaskets conforming to requirements of ASTM C443 and C361; and shall be equal to Forsheda No. 114 Seal, as manufactured by Forsheda Pipe Seal Company.
- B. Top Sections. Top sections shall be precast flat slab tops, with top opening of 30-inch diameter, minimum. Design shall be based on H-20 live loading and one-foot minimum earth cover.
- C. Grade Rings. Precast grade rings shall be provided as required to adjust height of cover slab. The maximum height of the grade rings shall be 12-inches; and shall have key locks and use mastic sealer to insure water-tightness.
- D. Concrete. Concrete, poured-in-place, and grout shall conform to applicable requirements of Section 03300.
- E. Frames and Covers. Frames and covers shall be cast iron with a 22 3/4-inch diameter clear opening; and shall be gravity, solid, non-rocking, heavy duty type meeting requirements for Salt Lake City Standard Manhole Rings and Covers. Covers shall be vented in improved areas and solid in unimproved areas, as directed; shall have cleated surfaces and pick holes; and shall be marked with "SARATOGA SPRINGS" and either "WATER" or "PRESSURE IRRIGATION".
 - 1. Castings. Castings shall be of uniform quality free of porosity, hard spots, and shrinkage defects. Exposed surfaces shall be smooth and true to pattern. Iron shall conform to ASTM A48, Gray Iron Castings, Grade B.
- F. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or other items acceptable to the City Engineer.

2.03 VALVE STATION PLUMBING

- A. Pipe and Fittings.
 - 1. Ductile Iron Pipe: AWWA C151: See Section 02510. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
 - 2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02510.
 - 3. Galvanized Steel Pipe: ASTM A 53, Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.
 - 4. Red Brass Pipe: ASTM B 53, Red brass pipe shall be Schedule 80, seamless pipe with threaded ends. Fittings shall be Schedule 80 with screwed ends.
- B. Valves.
 - 1. Manufacturer's name and pressure rating marked on valve body.

2. Gate Valves Up To 3 Inches:
 - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel operator.
 - b. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.
 - c. Substitutions: See Section 01600 - Product Requirements.
3. Gate Valves 3 Inches and Over:
 - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
 - #3 b. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
4. Combination Air-Vacuum Release Valves.
 - a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
 - b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves", of the appropriate type and size, as manufactured by Valve and Primer Corporation (APCO); and shall meet the provisions of these specifications.
5. Hose Gate Valves.
 - a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
 - b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527, or other valves acceptable to the City Engineer.

C. Miscellaneous Items.

1. Flanged Coupling Adapters. The flanged coupling adapters shall be Rockwell Type 912 or Type 913, or other couplings acceptable to the City Engineer, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to the flanged valves, equipment and fittings.
 2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell, or other couplings acceptable to the City Engineer, for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or approved rust preventing wax compound.
 3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
 4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744, or other valves acceptable to the City Engineer.
 5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or other clamps acceptable to the City Engineer, for up to 2 inch service lines.
 6. Other Items. Other miscellaneous materials shall be as indicated on the drawings and as required to complete the station.
- D. Hangers and Supports. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.

- a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.

2.04 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02315 and 02316.
- B. Backfill: As specified in Sections 02315 and 02316.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.03 EXCAVATING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of station to elevations indicated.
- C. Backfill around sides and to top of valve vault with backfill material, tamp in place and compact.

3.04 CONSTRUCTION - VALVE VAULT

- A. Construct the vault for the air-vacuum valve station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the City Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Items. Precast riser sections shall be installed, from the gravel base to the cover slab, in accordance with the manufacturer's recommendations; and shall be installed to stand plumb. Precast flat slab tops shall be installed on the top riser section; with the opening positioned as directed. The top of concrete flat slab tops shall be approximately 12-inches below final surface elevations, unless otherwise directed by the City Engineer.

- E. Placement of Frame and Cover.
 - 1. Placement. After the top slab of the station has been placed, the cast iron frame and cover shall be installed into the opening in the top slab; using precast grade rings to place the cover flush with adjacent finish grade.
 - 2. Grouting. After placement of the frame and cover, grout around the exterior of the frame from the top of concrete top slab to the top of frame, as indicated on the drawing and as directed by the City Engineer, to insure a watertight condition.
- F. Flexible Pipe Couplings. A pipe joint or flexible coupling shall be provided on all pipes connected to the stations, located approximately 18-inches from the outside of the station. The joint or coupling shall be of the same size as the pipe, and shall be as recommended by the pipe manufacturer.
- G. Miscellaneous Metal Work.
 - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
 - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

3.05 INSTALLATION - PLUMBING

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed and connected to operate as specified herein and as indicated on the drawings; in conformity with State plumbing codes, and in conformity to good and acceptable plumbing practices.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. All material and workmanship shall conform to applicable requirements of the Utah Plumbing Code.
- D. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer or City Inspector.
- E. Install pipe as required to indicated elevation to within tolerance of one inches.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- G. Install access fittings to permit disinfection of water system performed under Section 02515.
- H. Set valves on concrete block or other acceptable solid bearing.
- I. Mechanical couplings exposed to soil shall be primed and coated with 1/4-inch layer of coal tar, or accepted rust preventing wax compound.
- J. Adjustable pipe supports shall be used to support pipe and valves, as directed by the City Engineer; and shall be equal to Grinnell Company Figure 264.
- K. After plumbing system has been installed and completed, it shall be tested to show its functional fitness by operating the station as directed; and shall be tested for water-tightness as specified herein; and disinfected as specified herein. Tests shall be performed in the presence of the City Engineer or his authorized representative.
- L. Buried pipe or otherwise inaccessible pipe shall be tested before it is concealed, and again in connection with the final testing.

3.06 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.

- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02518

BOOSTER PUMP STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Booster pump station; including reinforced concrete vault or masonry building, pipe, fittings, valves, pumps, electrical system, and appurtenant items.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Bedding and backfilling.
- C. Section 02510 - Water Distribution System: Pipe, fittings, valves and appurtenant items.
- D. Section 02515 - Disinfection of Water Distribution Systems: Disinfection of station piping.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

1.03 REFERENCES

- A. See appropriate sections of these specifications.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store pumps, valves, equipment and appurtenant items in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE VAULT

- #1
- A. Reinforced Concrete Vault. Below grade booster pump stations shall be housed inside of a reinforced concrete vault. The vault may be constructed of either poured-in-place concrete or a precast reinforced concrete vault. **Below grade booster pump stations will only be allowed when approved by the City Engineer; otherwise, all booster pump stations will be constructed above ground.**
1. The vault shall be sized to adequately accommodate all pumps, valves, pipe, fittings, electrical system and appurtenant items to be enclosed in the vault; and the vault dimensions shall be acceptable to the City Engineer.
 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the construction drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
 3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics, as determined by the City Engineer during shop drawing review, may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
 - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-White, Inc., Dura-Crete, or other manufacturers acceptable to the City Engineer.
 4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the construction drawings.
 5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening, as directed by the Engineer. Steps shall be copolymer polypropylene-encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc., or other steps acceptable to the City Engineer.
 - a. An aluminum ladder may be provided and permanently installed as acceptable to the City Engineer.
- B. Access Doors and Hatches: The access door or hatch leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors and hatches shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors and hatches shall have recessed hasp covered by a hinged lid flush with the surface of the door.
1. The access doors and hatches shall be Type J Access Doors as manufactured by The Bilco Company, or other manufacturers acceptable to the City Engineer, of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
 2. Access hatches shall be installed in pump station roof slab, centered over each pump, to allow removal of and servicing of pump and motor.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or acceptable equals.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the booster pump station, as described herein and as shown on the drawings; conforming to the requirements of Section 05200.
- E. Painting. All pumps, exposed pipe, valves, fittings, and metal work inside of the station shall be painted as described in Section 09900.

2.02 MASONRY BUILDING

- A. Masonry Building. Above grade booster pump stations shall be housed inside of a masonry building.
 - 1. The building shall be sized to adequately accommodate all pumps, valves, pipe, fittings, electrical system and appurtenant items to be enclosed in the building; and the building dimensions shall be acceptable to the City Engineer. Engineering plans and specifications shall be submitted and approved by the City Engineer before any work on the building can be started.
 - 2. Poured-in-Place Concrete. Poured-in-place reinforced concrete for footings, foundation walls, floors and appurtenant concrete items shall conform to applicable requirements of Section 03300.
 - a. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the construction drawings.
 - 3. Masonry Work. Masonry work shall conform to applicable requirements of DIVISION 04.
 - 4. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the booster pump station, as described herein and as shown on the drawings; conforming to the requirements of Section 05200.
 - 5. Carpentry Work. Carpentry work, including framing, wood trusses, and appurtenant work shall conform to applicable requirements of DIVISION 06.
 - 6. Moisture Protection. Roofing shingles, metal panels, metal flashing and trim, joint sealers and appurtenant items shall conform to applicable requirements of DIVISION 07.
 - 7. Doors. Steel doors, skylights, door hardware and appurtenant items shall conform to applicable requirements of DIVISION 08.
 - a. Access hatches shall be as described in Paragraph 2.01.B above.
 - 8. Finishes. Finish work, including gypsum board, painting, and appurtenant work shall conform to applicable requirements of DIVISION 09.
 - 9. Louvers. Louvers and appurtenant work shall conform to applicable requirements of DIVISION 10.
 - 10. Mechanical Work. Mechanical work, including plumbing, fans, heating, and appurtenant work shall conform to applicable requirements of DIVISION 15.
 - 11. Electrical Work. Electrical work shall conform to applicable requirements of DIVISION 16.
 - 12. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or acceptable equals.

2.03 BOOSTER PUMPS

- A. Pump Type: Booster pumps may be either:
 - 1. Vertical turbine, multiple stage, pumps for insertion in appropriate diameter pump can; or
 - 2. Horizontal or vertical centrifugal split case pumps .
- B. Operating Performance: indicate flow capacity, in gallons per minute (gpm), total dynamic head, in feet, and motor size, in horsepower (hp).
- C. Casting: Cast iron casting with stainless steel accessories.
- D. Impellers and Diffusers: Bronze.
- E. Shaft: Stainless steel with stainless steel shaft sleeves.

- F. Motor: to be compatible with pump; manufactured to conform to all applicable NEMA requirements.
 - 1. Characteristics: indicate motor type, size, in horsepower (hp); and power requirements in voltage and phase.
- G. Pump Controller: NEMA 250 Type 1 enclosure with main disconnect interlocked with door, containing "soft start" electric motor starter with starting relay, motor circuit protector and ambient compensate quick trip overloads in each phase with manual trip button and reset button; circuit breaker, control transformer, hand-off-automatic selector switches, pilot light. Size controller to accommodate pump motor; conforming to NEMA requirements.
- H. Disconnect Switch: NEMA 250 Type 1 enclosure; sized for connected load.
- I. Low Pressure Cut-Off Switch: Low voltage relay type; shut-off pump at pre-set water pressure in suction line.
- J. Pressure Sensing Switch: Low voltage relay type, fixed settings to start and shut-off pump motor at pre-set pressure points; and low pressure cutoff set at pre-set pressure point.
- K. Control Voltage: 120 VAC.

2.04 PUMP STATION PLUMBING

- A. Pipe and Fittings.
 - 1. Ductile Iron Pipe: AWWA C151: See Section 02510. Exposed pipe and fittings shall not be coated with coal tar pitch varnish; but shall be painted as specified herein.
 - 2. Copper Tubing: ASTM B 88, Type K, annealed: See Section 02510.
 - 3. Galvanized Steel Pipe: ASTM A 53: Galvanized steel pipe shall be Schedule 80, seamless or welded pipe, with threaded ends. Fittings shall be 150 lb. galvanized malleable iron banded type, with screwed ends. Unions shall be galvanized railroad type with ground brass-to-iron seats.
- B. Valves.
 - 1. Manufacturer's name and pressure rating marked on valve body.
 - 2. Gate Valves Up To 3 Inches:
 - a. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
 - b. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.
 - c. Substitutions: See Section 01600 - Product Requirements.
 - 3. Gate Valves 3 Inches and Over:
 - a. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends as indicated, and cast iron valve box.
 - #3 b. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 c. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
 - 4. Butterfly Valves From 2 Inches to 24 Inches:
 - a. AWWA C504, iron body, bronze disc, resilient replacement seat, flanged ends as indicated, and manual worm gear operator.
 - b. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the Engineer.

- c. Product: Mueller "Lineseal III" Butterfly Valve with appropriate type manual worm gear operator.
5. Pressure Reducing Valves:
 - a. Valves shall have cast iron bodies, with bronze pilot and trim; designed to reduce a higher inlet pressure to a steady lower pressure downstream, regardless of flow rate.
 - b. Valves shall be hydraulically operated; capable of holding delivery pressure to within one or two psi of valve setting; and shall be adjustable, with downstream pressure range of 30 to 110 psi.
 - c. Pressure reducing valves shall be Clayton Model 90G-01AB Pressure Reducing Valves, as manufactured by Cla-Val Company.
 - d. Other type valves may be required for specific applications within the water system, as acceptable to the City Engineer.
 6. Combination Air-Vacuum Release Valves.
 - a. Valves shall be designed to release large quantities of air from pipes during filling, admit large quantities of air into pipes during draining, and release small accumulations of air during normal operation of pipes.
 - b. Valves shall be equal in quality to "Heavy-Duty Combination Air Release Valves, No. 143C", as manufactured by Valve and Primer Corp. (APCO); and shall meet the provisions of these specifications.
 7. Hose Gate Valves.
 - a. Hose gate valves shall be high grade brass with handwheel, inside screw ends, rising stem, screwed bonnet, taper wedge double disc. Valve shall be designed to operate at 200 psi water pressure.
 - b. Hose gate valves shall be equal to Powell U.S. Bronze Hose Gate Valve No. 527, or other valves acceptable to the City Engineer.
- C. Miscellaneous Items.
1. Flanged Coupling Adapters. The flanged coupling adapters shall be Rockwell Type 912 or Type 913, or other couplings acceptable to the City Engineer, with anchor studs as recommended by the manufacturer; for connecting ductile iron pipe to the flanged valves, equipment and fittings.
 2. Mechanical Couplings. The mechanical couplings shall be Dresser, Rockwell, or other couplings acceptable to the City Engineer, for connecting the size and type of pipe shown on the drawings. Couplings exposed to soil shall be primed and coated with a 1/4-inch layer of coal tar or approved rust preventing wax compound.
 3. Gauges. Gauges shall be as shown on the drawings and of the size and quality equal to or better than United States Gauge "A" Line, Figure No. 5000. Gauges shall have a range of 0 to 350 psi.
 4. Gauge Cocks. Gauge cocks shall be of high grade bronze with tee head; designed for 200 psi water pressure, and factory-tested to 300 psi; Crane Nos. 708, 712, 744, or other valves acceptable to the City Engineer.
 5. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or clamps acceptable to the City Engineer, for up to 2 inch service lines.
 6. Other Items. Other miscellaneous materials shall be as indicated on the drawings.
- D. Hangers, Supports and Blocks.
1. Provide all hangers, supports, clamps, guides, sleeves, inserts, anchors and other such devices required for hanging or supporting pipe, preserving alignment, prevention of movement, passage of pipe through walls and floors, or securing pipe in any manner. The required number, location and detail of such items may or may not be indicated on the drawings; but, in any case, such work shall be provided as work incidental to furnishing and installing any type of pipe, fittings and appurtenances, and no extra payment will be made for this work.

- a. Piping shall be supported or suspended in such manner as to prevent sagging or over stressing of pipe, valves, fittings or connections; and so that no pipe, fittings, valves or other items transfer load or strain to equipment of any kind.
2. Supports.
 - a. Concrete supports shall be installed under pipe and valves wherever shown on the drawings. Concrete supports shall be neatly constructed and finished, as indicated on the drawings and as directed by the City Engineer. No supports shall be made until all pipe is in its final position.
 - b. All other pipe supports shall be of the adjustable type of the style and size recommended by the manufacturer; and shall be located as indicated on the drawings and as directed by the City Engineer. Floor flanges shall be of the size required to fit the pipe attached to the saddle support and as recommended by the manufacturer. Adjustable pipe supports shall be used as kick blocks for pipe in open locations.
3. Blocks. Concrete thrust blocks shall be used wherever shown on the drawings or where thrust is great enough, in the City Engineer's opinion, to cause movement of the piping.
- E. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

2.05 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02315 and 02316.
- B. Backfill: As specified in Sections 02315 and 02316.

2.06 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.03 EXCAVATING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square foot of thrust restraint bearing on undisturbed subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

3.04 CONSTRUCTION - VALVE VAULT

- A. Construct the vault for the pressure regulating station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the construction drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the City Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials, as determined by the City Engineer, shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
 - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
 - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

3.05 CONSTRUCTION - MASONRY BUILDING

- A. Construct the masonry building for the booster pump station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the construction drawings and as specified herein.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Masonry Building. The masonry building shall be constructed with reinforced concrete footings, foundation walls and floor; reinforced masonry walls; hollow metal doors and frames, and hardware; roof system, including roof trusses, plywood, asphalt shingle roofing, metal siding, rain gutters and downspouts, skylights, access hatches, and appurtenant items; gypsum board; heating and ventilating systems, including heater, thermostat, exhaust fans, louvers, and appurtenant items; floor drains; electrical system, including lighting panel, light fixtures, wire and conduit, switches, outlets, SCADA system, and appurtenant items; and all appurtenant work to complete building.
 - 1. The booster pump station construction shall conform to the requirements of the Uniform Building Code, of the City of Saratoga Springs, and of the following Divisions of the City's Standard Specifications:
 - a. DIVISION 03 - Concrete Work.
 - b. DIVISION 04 - Masonry Work.
 - c. DIVISION 05 - Miscellaneous Metal Work.
 - d. DIVISION 06 - Carpentry Work and Wood Trusses.
 - e. DIVISION 07 - Roofing Shingles, Metal Panels, Metal Flashing and Trim, and Joint Sealers.
 - f. DIVISION 08 - Steel Doors, Skylights and Door Hardware.

- g. DIVISION 09 - Gypsum Board and Painting.
 - h. DIVISION 15 - Meters, Plumbing, Fans and appurtenant Items.
 - i. DIVISION 16 - Electrical Work.
2. Pump station piping shall:
 - a. be designed so that friction losses and velocities will be low;
 - b. have centerline of piping at least 2 feet above the pump house floor;
 - c. be protected against the entrance of contamination;
 - d. be equipped with booster pumps, control valves, check valves, combination air-vacuum relief valve, pressure gauges, and appurtenant items, as indicated on the construction drawings and approved by the City Engineer.
 3. Access hatches shall be installed in pump house roof, centered over each pump, to allow removal of and servicing of pump and motor.
 4. The floor surface of the pump house shall be at least 6 inches above the final ground elevation of the site and shall slope to floor drains. Floor drains shall drain to daylight, unless highly impractical.
 5. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or acceptable equals.

3.06 INSTALLATION - PLUMBING

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with State plumbing codes.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. Strainers shall be installed upstream of all pressure regulating valves.
- D. All material and workmanship shall conform to applicable requirements of the Utah Plumbing Code.
- E. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer.
- F. Install pipe to indicated elevation to within tolerance of one inches.
- G. Install ductile iron piping and fittings to AWWA C600.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install access fittings to permit disinfection of water system performed under Section 02515.
- J. Set valves on concrete block or other acceptable solid bearing.
- K. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.06 INSTALLATION - PUMPS

- A. All pumps, controls, accessories and appurtenant items, together with supports and anchors, shall be installed according to the manufacturer's written instructions and recommendations, as specified herein and as indicated on the drawings; in conformity with State plumbing codes.
- B. Install pumps plumb and to indicated elevation to within tolerance of one-half inch.

- C. After pumps have been installed and completed, they shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.07 INSTALLATION - ELECTRICAL SYSTEM

- A. The complete electrical system and appurtenant items shall be installed as specified herein and as indicated on the drawings; in conformity with State and local electrical codes.
- B. The electrical system shall include all equipment required for the SCADA system for monitoring and controlling the operation of the booster pump station. The equipment shall be compatible with the City's system and shall be approved by the City Engineer.
- C. After the electrical system and SCADA system has been installed and completed, it shall be tested as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.08 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02520

WATER WELLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drilling and casing water well.
- B. Pump and controller.
- C. Water and system testing and certification.

1.02 RELATED SECTIONS

- A. Section 16155 - Equipment Wiring.

1.03 UNIT PRICES - MEASUREMENT AND PAYMENT

- A. See Section 01270 - Unit Prices, for additional unit price requirements.

1.04 REFERENCES

- A. API Spec. 10 - Specification for Materials and Testing of Well Cement.
- B. API RP13B - Recommended Practice and Standard Procedure for Testing Drilling Fluids.
- C. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. AWWA A100 - Standard for Water Wells; American Water Works Association; (ANSI/AWWA A100).
- E. AWWA C200 - Standard Specification for Welded Steel Pipe; (ANSI/AWWA C 200).
- F. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- G. ASTM C33 - Specification for Concrete Aggregate.
- H. ASTM C150 - Specification for Portland Cement.
- I. AWS - American Welding Society.
- J. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
- K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.
- L. State of Utah Administrative Code, Rules for Public Drinking Water Systems, Section R309, for the Utah Department of Environmental Quality, Division of Drinking Water.
- M. Regulations of the Utah Division of Water Rights.
- N. Use the latest issue of the above reference standards as of the date of the Project.

1.05 MOBILIZATION AND DEMOBILIZATION

- A. Mobilization and demobilization includes moving materials and equipment, to and from the well site, for constructing and developing the well.
 - 1. Perform all site work required to prepare areas around the well for drilling rigs. Size of work area to be determined by the Contractor.
 - 2. Furnish and install a temporary 20-foot high sound wall all around the work site, as required and as directed by the City Engineer; and remove the wall from the site after the work is completed. The Contractor will be responsible to adhere to all local ordinances related to sound control.
 - 3. Furnish and install surface casing, complete, where and as required.
 - 4. Furnish and erect a 6-foot high temporary security fence around the work area and areas that will be flooded with water during test pumping.
- B. This item also includes cleaning up the work site upon completion of the work.

1.06 EXPLORATORY INVESTIGATION

- A. General. Exploratory investigations shall be performed, according to AWWA A100, to establish the geologic and hydrologic conditions for the well site, and parameters for groundwater quality.
- B. Test Wells.
 - 1. Drill test wells, as required, to gather reliable information on specific geologic materials and aquifer conditions to establish the optimum design for various elements for the final production well; including casing size and length, aperture of well screens, and gradation of gravel pack.
 - 2. Data acquired from test wells shall provide information on pumped well efficiencies, field permeability, storage capabilities of aquifers, and groundwater quality.
 - 3. Perform step-drawdown tests in test wells to provide data for design of production wells.
 - 4. Measurements shall be made of drilling fluid lost to aquifers and the depths at which these fluids losses occur; and shall be recorded by the driller.
- C. Formation Sampling. Formation samples shall be taken, collected, marked and stored according to AWWA A100, and as directed by the City Engineer. Samples shall be delivered as directed by the Engineer.
 - 1. Representative samples shall be taken of all material encountered in the formations drilled in the well; and as indicated in the following schedule:
 - a. One sample at the beginning of each change in lithology.
 - b. One sample for at least each five feet drilled in non-waterbearing formations or in highly impermeable material.
 - c. Two samples for each three feet drilled through a waterbearing zone. More frequent sampling may be required by the Engineer.
 - 2. Samples shall be taken by methods that insure that a representative formation sample is obtained that is free from drill cuttings or other introduced material.
 - 3. Care shall be taken to accurately determine the depth of the material sampled.
 - 4. Each sample shall be at least one pint in size and shall be placed in double plastic bags
 - a. Each sample bag shall be clearly labeled with the location of the well, the depth at which the sample was taken, the number of feet that the sample represents, and the date and time taken.
 - b. All samples shall be stored in a suitable and safe place until the drilling has been completed.

- D. Geophysical Logging. Geophysical logs of the bore hole shall be performed by methods acceptable to the City Engineer; and shall provide qualitative information on aquifer types and characteristics.
- E. Water Sampling and Analyses.
1. Water Sampling. Water samples shall be taken for chemical analyses from each aquifer designated as a possible source for development. The method used to collect samples shall not contaminate the aquifer.
 2. Water Analyses. The analyses of the water shall be done according to the requirements of applicable sections of AWWA A100. Water temperature, pH, and dissolved gases shall be determined by field tests and recorded.
- F. Reports.
1. Driller's Log. During drilling and completion of the well, the drilling contractor shall maintain a complete log, setting forth the following items:
 - a. the reference point for all depth measurements;
 - b. the depth at which each change of formation occurs;
 - c. the depth at which the first water was encountered, when applicable to the drilling method;
 - d. the location and thickness of each aquifer;
 - e. the identification of the stratigraphy and lithology encountered in the bore hole;
 - f. the depth interval from which each water and formation sample was taken;
 - g. the depth for each bore-hole diameter;
 - h. the depth to the static water level (SWL) and observable changes in SWL with well depth;
 - i. total depth of completed well;
 - j. location limits of lost circulation zones;
 - k. the depth of the surface seal, if applicable;
 - l. the nominal hole diameter of the well above and below the casing seal;
 - m. the quantity of cement installed for the seal, if applicable;
 - n. the depth and description of well casing;
 - o. data regarding well-screen type, diameter, wall thickness, aperture, and depth interval in the bore hole;
 - p. the sealing off of water-bearing strata, if any, and the exact location thereof; and
 - q. any and all other pertinent information required by the well specifications and City Engineer.
 2. Rate of Penetration. During the drilling of the hole, a time log shall be maintained showing rate of penetration and the types of hits used in each portion of the hole.
 3. Stratigraphic Log. The stratigraphic log shall be prepared to accompany the set of drilling samples, indicating:
 - a. depth;
 - b. strata thickness;
 - c. lithology, including size, range, and shape of constituent particles, as well as smoothness, rock, type, and rate of penetration; and
 - d. such special notes as might be helpful.
 - e. Material shall be described according to the United States Geological Survey (USGS) standard gradation of grain sizes, as shown in AWWA A100.
- G. Identification of Principal Aquifers. Identification of principal aquifers shall be done by following methods and as acceptable to the City Engineer.
1. Based on Geophysical Bore Hole Logs.
 - a. Principal aquifers occurring throughout the depth of a well shall be identified using interpretation of results generated by geophysical bore-hole logging devices.
 - b. Identification shall be made by a qualified engineer, hydrogeologist, or well drilling contractor.
 2. Base on Formation Samples.
 - a. Differentiation of principal aquifers in a well shall be determined on the basis of formation samples obtained.

- H. Records. The following records shall be given to the Engineer:
1. Three copies of the driller's log, signed and dated by the well driller or drilling machine operator.
 2. Three copies of geophysical logs.
 3. A record of all static water level measurements, and the times at which they were taken.
 4. A complete casing and screen location record, showing the lengths of each casing and screen section and the location of packers, plugs, and seals.
 5. Pumping test data from all pumping tests conducted on the well and test well; showing dates, water levels, discharge rates, times of stopping and starting the pumps, and other conditions that could affect test data.
 6. All records shall be submitted in plastic clear-covered three ring binders with each record submitted tabbed and subdivided, including an index for each box.

1.07 APPROVAL OF WATER WELL

- A. Water well shall be approved according to Section R309-204-6, paragraph (5), of the State of Utah Administrative Rules for Public Drinking Water Systems.
- B. Construction on water well shall not begin until the following items have been approved by the State; and copies of the approval have been submitted to the City Engineer.
1. The Evaluation Report on source protection.
 2. Engineering plans and specifications governing the well construction.

1.08 SYSTEM DESCRIPTION

- A. The engineering plans and specifications shall describe the water well characteristics and construction, to include:
1. Water well characteristics:
 - a. Upper Drill Hole: diameter in inches and depth in feet.
 - b. Lower Drill Hole: diameter in inches and depth in feet.
 - c. Casing Size: outside diameter in inches and depth in feet.
 - d. Grout Seal: depth in feet.
 - e. Total Well Depth: depth in feet.
 - f. Pump Depth: depth in feet.
 2. Well Performance Requirements
 - a. Water well production capacity in gallons of water per minute.
 - b. Maximum Sand Suspended in Delivered Water: in parts per million (ppm).

1.08 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.
- D. Accurately record actual locations of well, depth, subsoil strata, and drilling difficulties encountered.
- E. Submit signed copy of driller's log book statements.

- F. Submit executed certification of well pump after performance testing.

1.09 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA A100; and with the UAC R309 and R655.
- B. Perform Work in accordance with regulations of Utah Division of Water Rights.
- C. Perform Work in accordance with applicable utility company requirements.
- D. Conform to applicable code for water well flow capabilities and water quality.
- E. Drilling Firm: Company specializing in performing the work of this Section with minimum five years of documented experience.
 - 1. Submit proof of State Water Well Contractor's license issued by the Utah Department of Natural Resources to perform this work.
- F. Provide certificate of compliance from authority having jurisdiction indicating suitability of water for human consumption.

PART 2 PRODUCTS

2.01 MATERIALS

- A. STANDARDS. Interior surfaces of all products used in the well must comply with ANSI/NSF Standard 61; and all substances introduced into the well during construction or development shall be certified to comply with ANSI/NSF Standard 60.
- B. DRILLING FLUIDS. Drilling fluids shall be used in the process of drilling to facilitate the removal of formation cuttings and stabilize drilling and completion operations.
 - 1. Types of drilling fluids. The following types of drilling fluids are acceptable for water well drilling:
 - a. Fresh water based drilling fluids.
 - b. Natural drilling fluids.
 - c. Air-based drilling fluids.
 - 2. Fluid Additives. Additives to drilling fluids that are acceptable for water well drilling are classified as follows:
 - a. Dissolved additives.
 - (1) Mud-thinning agents, inorganic phosphates.
 - (2) Surfactants, drilling detergents, and foaming agents.
 - b. Non-dissolved additives.
 - (1) Native soils (clay and sand).
 - (2) Bentonite.
 - (3) Density increasing materials.
 - (3) Loss-circulation materials (not to be used in the production zones).
 - 3. Properties and Tests.
 - a. During the drilling operation, when additives to fresh water are used, drilling fluid properties shall be maintained within limits that will allow their complete removal from the well, if necessary; and shall not damage the potential capacity, efficiency, or quality of the well.
 - b. Drilling fluid properties shall be maintained during normal drilling operations within the following limits, using test procedures conforming to API RP13B:
 - (1) Weight (fluid density) -- 70 to 85 lbs/cu.ft.; test equipment: mud balance (API).
 - (2) Viscosity -- 32 to 40 seconds per quart; test equipment: Marsh funnel (API).
 - (3) Filtration (wall cake & filtration loss) -- 3/32 inch (2.38 mm) with maximum 20 cc water loss; test equipment: filter press (API).

- (4) Sand content (solids larger than 200 mesh) -- 2 to 4 percent, by volume; test equipment: sand-content set (API).
4. Recording. The Well Contractor shall measure and record the drilling fluid properties set forth in this section. Records shall include:
 - a. Date, time, depth and results of all drilling fluid tests.
 - b. All drilling fluid additives added to the system, to include kind, amount, time, depth and any other pertinent comments.
 - c. Variances or modifications from agreed to drilling fluid program, to include time, depth, reason and authorization
5. Frequency of drilling fluid property tests. Drilling fluid properties shall be tested once during each 50 feet of hole drilled or 4 hours of circulating time, whichever is more frequent.
6. Management System. The Well Contractor shall provide a self-contained fluid control system of appropriate capacity. The control system shall be acceptable to the City Engineer.
 - a. System shall be equipped with desilting-desanding cones and shale shakers of adequate size and quantity to maintain the fluid properties as required in the fluid control program.
 - b. All tank compartments shall be equipped with agitators capable of keeping all drill cuttings and solids suspended until they can be removed by the desilting-desanding cones.
 - c. Earth pits shall be constructed to control solids and fluid runoff from the desilting-desanding and shale shake equipment.
 - d. Drilling fluid mixing equipment shall allow the fluids to recirculate as drilling additives are introduced to allow time for hydration and thorough mixing. After all additives have been thoroughly mixed, the drilling fluids shall then be added into the main drilling fluids control system to be used in the drilling process.

C. WELL CASING.

1. Provide permanent protective well casing for all wells; conforming to AWWA A100..
 - a. Well casing shall be continuous and watertight from top to bottom of the installed casing, except for well screens.
 - b. Casing diameter shall meet the minimum requirements given in AWWA A100.
2. Casing shall be constructed of new steel pipe; conforming to AWWA C-200.
3. Wall thickness of the well casing shall be sufficient to withstand anticipated formation and hydrostatic pressures imposed on the casing during its installation, well development, and use.
 - a. Minimum wall thickness shall meet the requirements listed in AWWA A100; and shall be as shown in Table 1 of R655-4-9.2 of the Utah Administrative Code.
4. Casing joints shall be either welded or threaded; conforming to AWWA C-206.
5. Steel drive shoes shall be heat-treated (Rockwell C Hardness 30-32) SAE 1040 steel ring or equivalent.

D. WELL SCREENS.

1. Well screens shall be designed according to the requirements of AWWA A100.
2. Well screens shall be of wire-wound, continuous-slot type screens.
3. Screens shall be constructed of type 304 stainless steel; and designed to minimize the possibility of damage during installation, development and use. Submit screen-strength specifications and supporting drawings and data for review.
 - a. Screens shall have same outside diameter as the well casing pipe.
 - b. Screens shall have a collapse strength of 110 lbs. per square inch.
 - c. Selection of screen type shall be based on the basis of the well design parameters and provide at least 20 percent opening area.
 - d. Size of well screen openings will be based on sieve analysis of water bearing formations or gravel pack materials.

4. Joints between screen sections, and between screen sections and blank casing sections shall be either welded or threaded.
5. Screens shall be as manufactured by UOP Johnson Division, or other screens acceptable to the City Engineer.
6. Screen design shall be acceptable to the City Engineer prior to placing the order for the screens; and shall be such that when screens are operating at 50 percent efficiency, they will maintain an entrance velocity of 0.1 feet per second at the anticipated flow rate.

D. GRAVEL PACK.

1. Material.
 - a. Specific Gravity. Gravel pack material shall have an average specific gravity of not less than 2.5; with not more than 1 percent, by weight, of the material with specific gravity of 2.25 or less.
 - b. Shape. Thin, flat, or elongated pieces, the maximum dimension of which exceeds three times the minimum, shall not be in excess of 2 percent, by weight, of the material furnished.
 - c. Acid Solubles. Not more than 5 percent of the gravel shall be soluble in hydrochloric acid.
 - d. The material shall be washed and free of shale, mica, clay, dirt, loam, and organic impurities of any kind; and shall contain no iron or manganese in a form or quantity that will adversely affect the quality of the well water.
2. Gradation.
 - a. Test for gradation of the gravel pack material shall be performed according to the method of testing specified in ASTM C136.
 - b. The gradation of the gravel pack material shall conform to Section 6.4 of AWWA A100.
3. Samples of gravel pack, including sieve analysis, shall be acceptable to the Engineer in advance of delivery and placement. All samples shall be plainly labeled to indicate the source of the material, the date, and the name of the supplier. Methods of sampling shall be according to ASTM D75.
4. The gravel pack material shall be delivered to the well site after acceptance by the Engineer.
 - a. The material may be delivered in bags or in bulk.
 - b. Material delivered in bags shall be protected from weather until it is installed.
 - c. Material delivered in bulk shall be stored on a surface covered with a plastic sheet having a minimum thickness of 2 mil.
 - d. Gravel pack material that comes in contact with the ground shall not be used, and all materials shall be protected from contamination until it is installed.

E. SURFACE SEAL.

1. Neat cement grout shall be used to seal annular space between the casing and bore hole, where and as required.
2. Mix. Grout shall be a sand-Portland cement grout consisting of a mixture of Portland cement (ASTM C150, Type 2), sand, and water in the proportion of equal parts, by weight, of sand and cement, with not more than 6 gallons of water per 94-pound sack of cement.
 - a. Grout shall have consistency that can be forced through grout pipes; and shall be mixed to a smooth, fluid consistency.
 - b. Grout shall contain approximately 4 percent bentonite and 2 percent calcium chloride.
3. The mixture, method of mixing, and consistency shall be as accepted by the City Engineer.

2.02 WELL PUMP AND MOTOR

A. Pump Type: Vertical turbine, multiple stage, well pump, for insertion in appropriate diameter well casing.

1. Operating Performance: indicate flow capacity, in gallons per minute (gpm), total dynamic head, in feet, and motor size, in horsepower (hp).

2. Casting: Cast iron casting with stainless steel intake screen.
 3. Impellers and Diffusers: Bronze.
 4. Shaft: Stainless steel with stainless steel shaft sleeves.
- B. Column: welded steel pipe of the appropriate size and type for the design flow; and compatible with the pump and discharge head.
 - C. Discharge Head: cast iron casting with appropriate size pipe flanges and motor mount.
 - D. Motor: to be compatible with pump; manufactured to conform to all applicable NEMA requirements.
 1. Characteristics: indicate motor type, size, in horsepower (hp); and power requirements in voltage and phase.
 - E. Pump Controller: NEMA 250 Type 1 enclosure with main disconnect interlocked with door, containing "soft start" electric motor starter with starting relay, ambient compensate quick trip overloads in each phase with manual trip button and reset button and all other required motor protection devices; circuit breaker, control transformer, hand-off-automatic selector switches, pilot light. Size controller to accommodate pump motor; conforming to NEMA requirements.
 - F. Disconnect Switch: NEMA 250 Type 1 enclosure; sized for connected load.
 - G. Low Level Cut-Off Switch: Low voltage relay type; shut-off well pump at pre-set water level in well.
 - H. Pressure Sensing Switch: Low voltage relay type, fixed settings to start and shut-off pump motor at pre-set pressure points; and low pressure cutoff set at pre-set pressure point.
 - I. Control Voltage: 120 VAC.
 - J. Screens: Stainless steel type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions will support equipment for performing drilling operations and testing.

3.02 PREPARATION

- A. Protect structures near the well from damage.
- B. Construct necessary retention ponds to hold drilling fluids, as required and as directed.

3.03 WELL CONSTRUCTION

- A. General. Methods of well construction and well configuration shall be selected based on aquifer configuration, intended well use, and local experience. Construction method shall be approved by the State, as described in Paragraph 1.08 of this section, and shall be acceptable to the City Engineer.
 1. Throughout the duration of well construction, open ends of all pipe lines shall be covered and effectively sealed at the end of each day's work to avoid potential contamination.
 2. Contractor shall obtain grout seal witness certification by an authorized representative of the State's Division of Drinking Water (DDW). The DDW shall be contracted at least three days before anticipated start of well grouting operations.
 3. All welding shall be done in conformity with all applicable requirements of AWS.

- B. Drill concentric well shaft to diameters and depths indicated on the engineer drawings.
 - 1. Drilling shall be done by the cable-tool method or rotary method, as described in AWWA A100.
 - 2. Drilling fluids shall be used in the process of drilling to facilitate the removal of formation cuttings and stabilize drilling and completion operations.
 - 3. A 6-inch diameter pilot hole shall be drilled for the full deep of the proposed well, and as acceptable to the City Engineer.
 - 4. The bore hole for the finished well shall be of the design diameter; and the depth shall be determined after the pilot hole has been drilled and logged, and approved by the City Engineer.
- C. Install well casing immediately after drilling bore hole for finished well, and as directed by the City Engineer.
 - 1. Method of installing well casing shall be at the option of the drilling contractor; and shall be acceptable to the City Engineer. Installation method shall conform to the requirements of AWWA A100; and shall not alter the shape, size, configuration, or strength of the casing.
 - 2. Casing shall be set firmly in place, according to requirements of AWWA A100..
 - 3. Screens shall be accurately installed where and as indicated on the engineer drawings.
 - a. The exact locations and lengths of screens shall be determined by the project engineer after the pilot hole has been logged, and as acceptable to the City Engineer.
 - 4. Completed well shall be constructed round, plumb, and true to line as defined in AWWA A100.
 - 5. Clean shaft bottom of loose material.
 - 6. Maintain well opening and casing free of contaminating materials.
 - 7. Cut off top of casing 24 inches above finish grade. Do not permit metal cuttings to enter casing.
 - 8. The ground immediately surrounding the top of the well casing shall be sloped away from the well to prevent surface runoff from entering the completed well.
 - 9. After the well casing has been cut off, square the end of the casing and weld an appropriate size flange on the end of the casing.
 - 10. After the well has been developed, tested and completed, weld an appropriate size steel plate over the well flange to prevent contamination of the well.
- D. Inspect casing prior to placement of surface seal; and perform tests for plumbness and alignment..
- E. Install gravel pack material in the annular space between the screens and casing and the bore hole for the purpose of stabilizing the aquifer material.
 - 1. The selection of the gravel pack thickness surrounding the screens is dependent on individual aquifer characteristics; and shall be determined after the pilot hole has been logged.
 - a. The minimum thickness to allow proper placement of gravel pack shall be 4 inches.
 - b. The maximum thickness shall not exceed 12 inches.
 - 2. Gravel pack material shall be placed in annular space adjacent to well screens and shall extend at least 20 feet above the screens.
 - 3. Gravel shall be placed to ensure continuity of the gravel pack without bridging, voids, and segregation, by method acceptable to the City Engineer.

4. Before placement of gravel pack, drilling fluid shall be reconditioned, unless different properties are needed to protect the well, until it has the following properties:
 - a. Weight – maximum of 68 pounds per cubic foot;
 - b. Viscosity – maximum of 30 seconds, API Marsh funnel test; and
 - c. Sand content of fluid in system – maximum of one percent by volume.
 5. Unusual Drilling Conditions. Where aquifer conditions make it necessary to continue drilling operations with drilling fluid that does not meet the standards listed above, the drilling contractor shall be responsible for the complete removal of the drilling fluid and development of the well.
 6. Disinfect gravel pack material as it is installed, according to AWWA A100.
- F. Place surface seal.
1. The annular space between the well casing and the bore hole shall be filled with cement grout to a depth of 100 feet below the ground surface, to prevent leakage of undesirable water into the water bearing aquifers.
 2. Method of installation shall be acceptable to the City Engineer.
 - a. Method of installation will specify forcing grout from the bottom of the annular space to be grouted upward toward the ground surface.
 - b. Grout shall be placed using a 1-1/2-inch or 2-inch tremie line.
 - c. Grouting shall be done continuously and in such a manner as will insure filling the entire annular space in one operation.
 - c. After cement grout has been placed, work on the well shall be suspended until the grout has properly set; at least 48 hours.
- G. The completed well shall be constructed round, plumb and true to line. Tests for plumbness and alignment shall be made after the construction of the well has been completed, in accordance with AWWA A100.

3.04 WELL DEVELOPMENT

- A. The well shall be developed using appropriate and acceptable techniques designed to bring the well to its maximum production capacity with attendant optimization of well efficiency, specific capacity, stabilization of aquifer material, and control of suspended solids. Development shall be done as described in AWWA A100, and as acceptable to the City Engineer.
1. Test Pumping.
 - a. A test pump shall be installed with a capacity in excess of the anticipated lift and final production capacity of the well. The test pump shall be set to a depth in excess of the anticipated pumping level.
 - (1) The capacity of the test pump shall be 1.5 times the anticipated well capacity.
 - b. Provide all material, equipment and facilities for delivering power to operate the test pumps; and remove these items after the test pumping has been completed.
 - c. The development equipment and method used shall permit adjustable pumping flow rates.
 - d. Provide and install measuring device, with minimum accuracy of 95 percent; and all required discharge piping to convey water being pumped from the well to an acceptable discharge point.
 - e. Provide all equipment and facilities required to measure water levels in the well.
 - f. Provide all equipment and facilities to measure sand content in the water.
 - g. The well shall be test pumped until it has been fully developed, under the direction of the City Engineer, and the following conditions have been met.
 - (1) Sand content shall average not more than 5 mg/L for a complete pumping cycle of 2 hour duration when pumping at the designated capacity.
 - (2) No less than 10 measurements shall be taken at equal intervals to permit plotting of sand content as a function of time and production rate and to determine the average sand content for each cycle.
 - (3) There shall be no increase in specific capacity during at least 24 hours of continuous pumping and surging.

2. A written report of the test pumping shall be furnished to the City Engineer with the following data:
 - a. test pump capacity versus head characteristics;
 - b. static and pumping water levels;
 - c. depth of pump setting;
 - d. time of starting and ending each test cycle;
 - e. remarks describing the water;
 - f. description of flow measuring device;
 - g. quantity of gravel pack material added during development;
 - h. sand content as a function of production rate and time;
 - i. sand content as a function of production rates and specific capacity;
 - j. and other pertinent information.

3. Provide recordings and graphic evaluations of the following at one hour intervals, or less:
 - a. date and time;
 - b. pumping rate in gpm;
 - c. pumping water level;
 - d. drawdown; and
 - e. water recovery rate levels after the pump is shut off.

3.05 PERFORMANCE TESTING

- A. Perform tests for well performance to secure water samples for analysis and to determine well capacity, drawdown, and production on a long term basis.

- B. Step-drawdown tests, constant-rate tests, and water level measurements shall be done according to AWWA A100.

- C. Maintain all required records; and submit to City Engineer accurate written reports regarding water levels, pumping rates, time intervals, and other pertinent details on the testing of the production well.

3.06 WELL DISINFECTION

- A. The well shall be disinfected to remove bacteriological contamination that may cause the well water supply to be unsafe for human consumption. Disinfection procedures shall meet the requirements of AWWA C654.

- B. Disinfection Procedure.
 1. The chlorine solution used for disinfecting the well shall be of such volume and strength and shall be so applied that a concentration of at least 50 mg/L of available chlorine shall be obtained for the entire depth of the well; and this solution shall remain in the well for a period of at least 24 hours. The chlorine solution shall be prepared and applied to produce a contaminant-free sample.

 2. If the samples continue to show bacteriological contamination, prepare and apply to the entire depth of the well a total volume of the chlorine solution equal to at least four times the volume of the water in the well and allow this solution to remain in the well for a period of at least 24 hours.

3.07 WATER QUALITY TESTING

- A. Water quality (physical, biological, and chemical composition) shall be determined by analyses of water samples collected from the well. The analyses shall be performed by a laboratory acceptable to the appropriate regulatory agency and the City Engineer.

- B. Sampling Procedures. The procedures outlined in the latest edition of the U.S. Environmental Protection Agency "Manual of Methods for Chemical Analysis of Water and Wastes" shall be followed.
 1. Field Tests. Water temperature, pH, and dissolved gases shall be determined on samples collected and analyzed in the field.

 2. Samples for Tests. Water samples shall be taken at the end of the pumping test for chemical analyses as required by the local regulations and the City Engineer.

- C. Analytical Procedures. All analyses shall be performed according to the methods prescribed by regulatory agencies having jurisdiction over the well construction.

3.08 INSTALLATION - PUMP

- A. Install pump and accessories as indicated on the engineering drawings; and in accordance with manufacturer's written instructions and recommendations.
- B. Electrical Connections: Refer to Section 16155.

3.09 PUMP HOUSE CONSTRUCTION

- A. General. Construct pump house building of adequate size to accommodate well pump motor, discharge piping, electrical controls and panels, and all appurtenant items. Engineering plans and specifications shall be submitted and approved by the City Engineer before well can be approved.
 - 1. Building shall be constructed with reinforced concrete footings, foundation walls and floor; reinforced masonry walls; hollow metal doors and frames, and hardware; roof system, including roof trusses, plywood, asphalt shingle roofing, metal siding, rain gutters and downspouts, skylights, and appurtenant items; gypsum board; heating and ventilating systems, including heater, thermostat, exhaust fans, louvers, and appurtenant items; floor drains; electrical system, including lighting panel, light fixtures, wire and conduit, switches, outlets, SCADA system, and appurtenant items; and all appurtenant work to complete building.
 - 2. The pump house construction shall conform to the requirements of the Uniform Building Code, of the City of Saratoga Springs, and of the following Divisions of the City's Standard Specifications:
 - a. DIVISION 03 - Concrete Work.
 - b. DIVISION 04 - Masonry Work.
 - c. DIVISION 05 - Miscellaneous Metal Work.
 - d. DIVISION 06 - Carpentry Work and Wood Trusses.
 - e. DIVISION 07 - Roofing Shingles, Metal Panels, Metal Flashing and Trim, and Joint Sealers.
 - f. DIVISION 08 - Steel Doors, Skylights and Door Hardware.
 - g. DIVISION 09 - Gypsum Board and Painting.
 - h. DIVISION 15 - Meters, Plumbing, Fans and appurtenant Items.
 - i. DIVISION 16 - Electrical Work.
 - 3. Well Discharge piping shall:
 - a. be designed so that friction losses and velocities will be low;
 - b. have centerline of piping at least 2 feet above the pump house floor;
 - c. be protected against the entrance of contamination;
 - d. be equipped with (in order of placement from the well head) a smooth-nosed sampling tap, a combination air-vacuum relief valve, a check valve, a pressure gauge, a pump control valve, a pressure relief valve, a flow meter, and a control valve.
 - 4. Water Level Measurement. Provide permanent water level measuring equipment to measure water levels in the well.
 - 5. An access hatch shall be installed in pump house roof, centered over well pump, to allow removal of and servicing of pump and motor.
 - 6. The floor surface of the pump house shall be at least 6 inches above the final ground elevation of the site and shall slope to floor drains. Floor drains shall drain to daylight, unless highly impractical.
- B. Well Casing.
 - 1. The permanent casing shall project at least 12 inches above the pump house floor.
 - 2. Weld flange on top of well casing; flange to match flange on well discharge head.

3. The top of the well casing, at sites subject to flooding, shall terminate at least 3 feet above the 100 year flood level or the highest known flood elevation, whichever is higher.

C. Disinfect discharge piping as described in Section 02515 of these specifications.

3.10 TOLERANCES

A. Maximum Variation From Plumb: In accordance with AWWA A100.

B. Maximum Offset From True Position: 1 inch.

3.11 FIELD QUALITY CONTROL

A. Notify authority having jurisdiction and City Engineer, 3 days prior to flow rate testing.

B. Test flow rate and certify.

3.12 CLEANING

A. Clean piping in preparation for disinfecting and testing.

END OF SECTION

SECTION 02535

SANITARY SEWER SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewer piping, fittings and accessories.
- B. Casing pipes and accessories.
- C. Connection of project pipe to existing manholes.
- D. Sewer Service Connections.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating of trenches.
- B. Section 02316 - Fill and Backfill: Pipe bedding and trench backfilling.
- C. Section 02640 - Manholes and Covers.
- D. Section 03300 - Cast-In-Place Concrete: Concrete for manhole base construction.

1.03 REFERENCES

- A. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
- B. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- D. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- E. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- F. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- G. ASTM F 679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Gravity Sewer Pipe and Fittings; 18-inch through 24-inch smooth solid wall sewer pipe.
- H. ASTM F 794 - Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter; 21-inch through 30-inch ribbed or close profile sewer pipe with smooth interior wall.
- I. ASTM F 949 - Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings; 24-inch through 36-inch sewer pipe.
- J. Use the latest issue of the above reference standards as of the date of the Project.

1.04 DEFINITIONS

- A. Pipe Bedding: Fill placed within the pipe zone, which is under, beside and directly over pipe, prior to subsequent backfill operations; see standard trench detail drawing.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and fittings.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe lines, connections, manholes, sewer laterals, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

1.07 PROJECT CONDITIONS

- A. Coordinate the Work on sewer lines and connections to existing manholes with the City Engineer or City Inspector.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Concrete Pipe: Non-reinforced, ASTM C 14 (ASTM C 14M), Class 3; inside nominal diameter of 8 inches through 15 inches, bell and spigot end joints.
- B. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class III (minimum) with Wall type B; mesh reinforcement; inside nominal diameter of 18 inches and larger, bell and spigot end joints.
- C. Cement for concrete sewer pipe shall be Type V, sulfate resistant, conforming to ASTM C 150.
- D. Joint Seals for Concrete Pipe: ASTM C 443 (ASTM C 443M) rubber compression gaskets.
- E. Plastic Pipe: ASTM D 3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 4 inches through 15 inches, bell and spigot joint ends with gaskets.
- F. Plastic Pipe: ASTM F 679, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 18 inches through 24 inches, bell and spigot joint ends with gaskets.
- G. Plastic Pipe: ASTM F 794, Poly(Vinyl Chloride) (PVC) material, cell classification of 12454C or 12364A; ribbed or close profile pipe; inside nominal diameter of 21 inches through 36 inches, bell and spigot joint ends with gaskets.
- H. Plastic Pipe: ASTM F 949, Poly(Vinyl Chloride) (PVC) material, cell classification of 12454C or 12364A; corrugated pipe with smooth interior wall; inside nominal diameter of 24 inches through 36 inches, bell and spigot joint ends with gaskets.
- I. Joint Seals for Plastic Pipe: ASTM C 477 rubber compression gaskets for positive seal.
- J. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required configurations.

2.02 CASING PIPE MATERIALS

- A. Welded Steel Pipe: AWWA C 200, steel water pipe; diameter as indicated.
- B. Casing Insulators: fusion coated steel casing insulators with 12-inch wide band and 2-inch wide glass reinforced plastic runners; Model C12G-2, manufactured by Pipeline Seal and Insulator, Inc. or acceptable equal.
- C. Casing End Seals: flexible S-shaped seals fabricated on synthetic rubber with stainless steel bands and clamps; Model S Pull-On End Seals, manufactured by Pipeline Seal and Insulator, Inc., or acceptable equal.

2.03 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Section 02316.
- B. Trench Backfill Material: As specified in Section 02316.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 02312 for trenching; Sections 02315 and 02316 for structural excavation and fill and backfill.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill pipe zone with bedding material, tamp in place and compact; then complete backfilling of trench and compact.

3.02 INSTALLATION - SEWER PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on project plan and profile drawings.
- B. Install pipe, fittings, and accessories in accordance with appropriate ASTM standards and manufacturer's instructions. Seal joints watertight.
- C. Install pipe to alignment and slope gradients noted on project drawings; with maximum variation from design alignment of 0.25 foot and from design elevations of 0.10 foot.

3.03 INSTALLATION - CASING PIPES

- A. See Sections 02315 and 02316 for structural excavation and fill and backfill; and for additional requirements.
- B. Install casing pipes by ramming process where indicated; method to be acceptable to the City Engineer.
- C. Install casing pipes at the line and grade as required to allow carrier pipes to be installed within the casing pipes at the design line and grade, as indicated on the drawings.
- D. Place casing insulators on carrier pipes to properly center and position carrier pipe inside the casing pipes; space insulators as recommended by the pipe manufacturer.
- E. Seal each end of casing with appropriate size flexible end seals; install according to manufacturer's instructions and recommendations.
- F. Seal bore holes at each end, around periphery of casing, with grout, impervious clay or brick masonry, as acceptable to the City Engineer or City Inspector.

- G. Contractor shall be solely responsible for the accuracy, safety and adequacy of construction methods and procedures for installing casing pipes, and for any damage which may result from their failure. All operations of the Contractor for installation of casing pipes shall be subject to approval by the agency having jurisdiction over the item being crossed.
- H. Contractor shall enter any agreement with, and furnish any and all indemnity and other bonds that may be required by, the agency listed above, for their protection against injury and interference with flow of water caused by the operations of the Contractor.
- I. Contractor shall secure required permission from the agency listed above before commencing with the installation of casing pipes and related work along and across the respective areas.

3.04 CONNECT PROJECT PIPE INTO EXISTING SEWER MANHOLE

- A. See Sections 02315 and 02316 for structural excavation and fill and backfill.
- B. Connection of project pipe into existing sewer manhole shall include:
 - 1. All excavating required for the connection; and backfilling excavations after the connection is completed, and compacting backfill as required.
 - 2. Removing existing pipes where and if required.
 - a. Cleaning existing hole through wall and base of existing manhole; and preparing hole for connection, as required and as directed.
 - 3. Core-cutting hole through wall and base of existing manhole, where required, with appropriate size coring machine; and preparing hole for connection, as required and as directed.
 - 4. Installing new pipe in place and connecting to manhole wall with appropriate type flexible coupling, as recommended by the coupling manufacturer.
 - 5. Reforming manhole floor and invert channel to provide smooth channel transitions to accommodate new connected pipes.
 - 6. Sealing around new pipe where it intersects manhole wall; make connection watertight.
 - 7. Perform all other operations necessary to restore existing manhole to condition acceptable to the City Engineer or City Inspector.
- C. If existing manhole does not have steps, connection shall also include furnishing and installing new manhole steps. Steps shall be installed as described in Section 02640, Manholes.
- D. Provide temporary facilities to divert existing sewer flow around work areas as described in Supplemental General Conditions of these specifications.

3.05 SEWER SERVICE CONNECTIONS

- A. Sewer service lines shall extend from a 4-inch or 6-inch wye branch placed in the sewer main, as indicated on the drawings or as directed by the City Engineer or City Inspector.
 - 1. Normally, a 22 1/2 degree or 45 degree bend, rotated so that proper alignment and grade is established, shall be installed in the main line wye branch.
 - 2. In some instances, the bend may be omitted; and in some instances, two bends may be required.
- B. Sewer service lines shall extend to a location designated by the City Engineer or City Inspector, which will be near the property line of the property to be served, or at the edge of a permanent easement, as indicated on the drawings and as directed.

- C. All pipe and fittings shall be heavy wall PVC sewer pipe conforming to the specifications found elsewhere in this Section.
- D. Installation:
 - 1. Each section of sewer main between any two manholes shall have the service lines extended within twenty days of completion of that portion of the main.
 - 2. Pipe and fittings for sewer service lines shall be installed as described herein and as directed by the City Engineer or City Inspector.
 - 3. 4-inch sewer service lines shall be installed at a minimum slope of 1/4-inch per foot, which is about a 2.0 percent grade; unless approved otherwise by the City Engineer. But in no case shall the slope be less than 1/8-inch per foot, which is about a 1.0 percent grade.
 - 4. Sewer service lines shall be installed at a uniform grade and alignment; and shall be free of low spots or adverse grades.
- E. Cleaning and Testing.
 - 1. Sewer service lines shall be cleaned, flushed and tested in accordance with applicable requirements of this Section.
 - 2. After flushing and testing have been completed, the end of the service line shall be permanently plugged.

3.06 CONSTRUCTING COLLARS AROUND EXISTING MANHOLE COVERS

- A. Construct collars around existing manhole covers after street pavement has been restored.
- B. Collars shall be constructed according to City standards.

3.07 FIELD QUALITY CONTROL

- A. Clean and Flush new sewer pipe as follows.
 - 1. Take every precaution to prevent dirt, grease, and all other foreign matter from entering each length of pipe before making connections in field.
 - 2. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping or other methods that will not harm lining of pipe.
 - 3. For safety and to prevent rocks and other foreign matter from entering pipe, all open ends of pipe shall be plugged when workmen are not on the job or in the immediate area.
 - 4. All sections of sewer lines between manholes and sewer laterals extending from the sewer main shall be completely flushed.
 - a. Pipe 12 inch diameter and larger shall be flushed at a rate of 3.0 feet per second.
 - b. Pipe under 12 inch diameter shall be flushed at a rate of 4.0 feet per second.
 - 5. Water required for flushing and testing shall be furnished by the Contractor.
 - 6. All temporary cross-connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor after completion of the operation.
- B. Perform field inspection and testing in accordance with Section 01400.

- C. Pipe installation shall be inspected by the City Engineer or Inspector prior to backfilling of trench; backfilling will be done only after it is authorized by the City Engineer or City Inspector.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.
- E. Test for Leakage: Test all pipe, fittings and other items for leakage, in presence of City Engineer or City Inspector, after items have been cleaned. All joints, couplings, fittings shall be watertight.
 - 1. Infiltration Test. Infiltration test required when pipe is below ground water level. Amount of water leaking into pipe shall be measured. Leakage for concrete pipe shall not be more than one gallon per day per inch diameter per mile of pipe; and for PVC sewer pipe shall not be more than one gallon per day per inch diameter per mile of pipe.
 - 2. Exfiltration Test. Exfiltration test required when pipe is above ground water level. The section of pipe being tested, including upstream manhole, shall be filled with water to not less than four feet nor more than eight feet above the lowest point of section being tested. Amount of water added during test period to maintain water level shall be measured. Amount of water added for concrete pipe shall not be more than one gallon per day per inch diameter per mile of pipe; and for PVC sewer pipe shall not be more than one gallon per day per inch diameter per mile of pipe..
 - 3. Air Test: Low pressure air test may be performed. Section of pipe being tested shall be sealed; line under test shall be pressurized to approximately 3.5 psi; and pressure allowed to stabilize for a minimum of two minutes. During this period air shall be added if pressure drops below 3.5 psi. After this stabilization period, timing shall begin. The time of test, in minutes, shall be equal to the pipe diameter in inches. The maximum allowable pressure drop during specified time period shall be 1.0 psi.
- F. Deflection Test, PVC Sewer Pipe: After PVC sewer pipe has been cleaned, perform deflection test on each section of pipe line between manholes. The maximum allowable pipe deflection, the reduction in vertical inside diameter, shall be 5 percent. Maximum allowable deflection shall be applied to the base inside diameters shown in Table 63, Base Inside Diameters For Deflection Measurements of ASTM D 3034 SDR35 PVC Sewer in the Uni-Bell "Handbook of PVC Pipe", to determine minimum permissible diameter, or other appropriate sources. Testing devices shall include deflectometer, calibrated television or photography, or properly sized mandrel or sewer ball.
- G. Televiser Sewer Lines. After pipe lines have been tested for leakage and deflection, the main sewer lines shall be televised, along with appropriate narrative, by company specializing in this type work. A copy of the videotape shall be provided to the City Engineer.

3.08 PROTECTION

- A. Protect pipe and bedding material from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02538
SEWAGE LIFT STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sewage lift station; including pump chamber, wet well, pipe, fittings, valves, pumps, electrical system, and appurtenant items.

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Bedding and backfilling.
- C. Section 02535 - Sanitary Sewer System: Pipe, fittings and appurtenant items.
- D. Section 02640 - Manholes and Covers: Precast concrete manholes and covers.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for concrete vault and thrust restraints.

1.03 REFERENCES

- A. See appropriate sections of these specifications.

1.04 CODES AND STANDARDS

- A. Sewer lift stations shall be designed and constructed to meet all applicable requirements of the Utah Division of Water Quality Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal Systems, Section R317.
- B. Provide complete design calculations for sizing the lift station wet well, pumps and appurtenant items to the City Engineer for review and acceptance.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner's requirements as described herein.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store pumps, valves, equipment and appurtenant items in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 FACTORY-BUILT PUMP STATIONS

- A. Factory-built sewage pump stations shall be equal to pump station as designed and manufactured by Smith & Loveless, Inc., and acceptable to the City Engineer.

2.02 PRECAST MANHOLES AND COVERS

- A. Reinforced concrete manholes shall be of the size indicated on the construction drawings; and shall conform to applicable requirements of Section 02640.

2.03 REINFORCED CONCRETE VAULT

- A. Reinforced Concrete Vault. The vault may be constructed of either poured-in-place concrete or a precast reinforced concrete vault.
 - 1. The vault shall be sized to adequately accommodate all pumps, valves, pipe, fittings, electrical system and appurtenant items to be enclosed in the vault; and the vault dimensions shall be acceptable to the City Engineer.
 - 2. Poured-in-Place Concrete. A poured-in-place reinforced concrete vault, of the size indicated on the construction drawings, may be constructed; which shall conform to applicable requirements of Section 03300.
 - 3. Precast Concrete. A precast reinforced concrete vault of equal dimensional and strength characteristics, as determined by the City Engineer during shop drawing review, may be provided. Precast vault shall have wall thickness of 9-inch minimum, bottom slab thickness of 6-inch minimum, and top slab thickness of 9-inch minimum; designed for H-20 highway loading.
 - a. Precast vault shall conform to ASTM C 858; and shall be as manufactured by Amcor-White, Inc., Dura-Crete, or acceptable equal.
 - 4. Reinforcement. Reinforcing steel shall be as specified in Section 03300, using Grade 60 bar of the size(s) shown on the construction drawings.
 - 5. Steps. Plastic encased steel steps shall be installed in station walls; spaced at 12-inches on center and centered under the access opening, as directed by the Engineer. Steps shall be copolymer polypropylene-encased, 60,000 tensile strength steel, Model PSI-FF manhole steps, as manufactured by M. A. Industries, Inc., or accepted equal.
 - a. An aluminum ladder may be provided and permanently installed as acceptable to the City Engineer.
- B. Access Doors and Hatches: The access door or hatch leaf and channel frame, with strap anchors, shall be constructed of steel with hot-dip galvanized finish (ASTM 123); designed for H-20 highway loading. Doors and hatches shall be provided with 316 stainless steel hardware throughout; including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. The doors and hatches shall have recessed hasp covered by a hinged lid flush with the surface of the door.
 - 1. The access doors and hatches shall be Type J Access Doors as manufactured by The Bilco Company, or acceptable equal, of the size indicated on the drawings. The manufacturer shall guarantee the door against defects in material and workmanship for a period of five years.
 - 2. Access hatches shall be installed in pump station roof slab, centered over each pump, to allow removal of and servicing of pump and motor.
- C. Proprietary Items. Provide proprietary items of the type, size and manufacture noted on the drawings or as required to complete the work, or acceptable equals.
- D. Miscellaneous Metal Work. Furnish and erect miscellaneous metal work as required to complete the lift station, as described herein and as shown on the drawings; conforming to requirements of Section 05200.

- E. Painting. All pumps, exposed pipe, valves, fittings, and metal work inside of the station shall be painted as described in Section 09900.

2.04 SEWER PUMPS

- A. Pump Type: Sewer pumps may be either:
 - 1. Horizontal or vertical centrifugal split case sewer pumps .
 - 2. Submersible sewer pumps.
- B. Operating Performance: indicate flow capacity, in gallons per minute (gpm), total dynamic head, in feet, and motor size, in horsepower (hp).
- C. Casting: Cast iron casting with stainless steel accessories.
- D. Impellers and Diffusers: Bronze.
- E. Shaft: Stainless steel with stainless steel shaft sleeves.
- F. Motor: to be compatible with pump; manufactured to conform to all applicable NEMA requirements.
 - 1. Characteristics: indicate motor type, size, in horsepower (hp); and power requirements in voltage and phase.
- G. Pump Controller: NEMA 250 Type 1 enclosure with main disconnect interlocked with door, containing electric motor starter with starting relay, motor circuit protector, and ambient compensate quick trip overloads in each phase with manual trip button and reset button; circuit breaker, control transformer, hand-off-automatic selector switches, pilot light. Size controller to accommodate pump motor; conforming to NEMA requirements.
- H. Disconnect Switch: NEMA 250 Type 1 enclosure; sized for connected load.
- I. Low Level Cut-Off Switch: Low voltage relay type; shut-off pump at pre-set water level in wet well.
- J. Control Voltage: 120 VAC.

2.05 PUMP STATION PLUMBING

- A. Pipe, fittings, valves and appurtenant plumbing items shall conform to the requirements of Section 15145 - Plumbing Piping.
- B. Miscellaneous. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

2.06 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02315 and 02316.
- B. Backfill: As specified in Sections 02315 and 02316.

2.07 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sewer main size, location, and invert are as indicated.

3.02 EXCAVATING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of station with backfill material, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - FACTORY BUILT PUMP STATION

- A. Factory-built pump station shall be installed according to manufacturer's written instruction, shop drawings, and recommendations.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Construct concrete items as indicated on the manufacturer's shop drawings and as approved by the City Engineer. Concrete work shall comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.

3.04 CONSTRUCTION - WET WELL

- A. Construct the wet well for the pump station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the construction drawings, and as specified herein; conform to the requirements of Section 02640.
- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.

3.05 CONSTRUCTION - VALVE VAULT

- A. Construct the vault for the pump station at the location indicated on the drawings and as directed by the City Engineer; in accordance with the details shown on the construction drawings and as specified herein.

- B. Earthwork shall be done in accordance with applicable requirements of Section 02315.
 - 1. Foundation Material. Where native material encountered at the foundation depth is considered unsuitable by the Engineer, the unsuitable material shall be removed and replaced by the appropriate borrow material.
 - 2. Excess Material. Unsatisfactory and excess excavated materials shall be removed from the work site and legally disposed of.
- C. Concrete Work. Comply with requirements of Section 03300, for placement, consolidation, finishing and protection of cast-in-place concrete.
- D. Precast Concrete Vault. Precast concrete vault shall be installed level and plumb, in accordance with the manufacturer's written instructions and recommendations.
- E. Access Door: Install according to manufacturer's written instructions and recommendations.
- F. Miscellaneous Metal Work.
 - 1. Miscellaneous metal work shall be fabricated and assembled in the shop to the greatest extent possible.
 - 2. Miscellaneous metal work shall be erected in conformity with AISC Code of Standard Practice.

3.06 INSTALLATION - PLUMBING

- A. All pipe, fittings, valves, equipment and appurtenant items, together with supports and anchors, shall be installed as specified herein and as indicated on the drawings; in conformity with State and local plumbing codes.
- B. Equipment shall be installed as shown on the drawings, and in accordance with accepted manufacturer's written instructions.
- C. All material and workmanship shall conform to applicable requirements of the Utah Plumbing Code.
- D. Establish elevations of buried piping to ensure not less than four feet of cover over pipe; or as indicated on the drawings and as directed by the City Engineer.
- E. Install pipe to indicated elevation to within tolerance of one inches.
- F. Install ductile iron piping and fittings to AWWA C600.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Set valves on concrete block or other acceptable solid bearing.
- I. After plumbing system has been installed and completed, it shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.07 INSTALLATION - PUMPS

- A. All pumps, controls, accessories and appurtenant items, together with supports and anchors, shall be installed according to the manufacturer's written instructions and recommendations, as specified herein and as indicated on the drawings; in conformity with State and local plumbing codes.
- B. Install pumps plumb and to indicated elevation to within tolerance of one-half inch.
- C. After pumps have been installed and completed, they shall be tested and disinfected as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.08 INSTALLATION - ELECTRICAL SYSTEM

- A. The complete electrical system and appurtenant items shall be installed as specified herein and as indicated on the drawings; in conformity with State and local electrical codes.
- B. The electrical system shall include all equipment required for the SCADA system for monitoring and controlling the operation of the booster pump station. The equipment shall be compatible with the City's system and shall be approved by the City Engineer.
- C. After the electrical system and SCADA system has been installed and completed, it shall be tested as specified herein; including an operating test for acceptance of the work. Tests shall be performed in the presence of the City Engineer or his authorized representative.

3.09 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 02635
STORM DRAIN SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drain pipe, fittings, and accessories.
- B. Connection of project storm drain pipe line to existing storm drains.
- C. Cleanout boxes, gutter inlet boxes, inlet boxes, diversion boxes, and appurtenant items.
- D. Storm water treatment systems.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Bedding and backfilling.
- D. Section 02640 - Manholes and Covers.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for miscellaneous construction.

1.03 REFERENCES

- A. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
- B. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- D. Use the latest issue of the above reference standards as of the date of the Project.

1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and miscellaneous structures.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe lines, connections, cleanouts, gutter inlet boxes, inlet boxes, miscellaneous structures and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

1.07 PROJECT CONDITIONS

- A. Coordinate the Work with other contractor working in the area.

PART 2 PRODUCTS

2.01 DRAIN PIPE MATERIALS

- A. Concrete Pipe: Nonreinforced, ASTM C 14 (ASTM C 14M), Class 3 minimum; inside nominal diameter as indicated, bell and spigot end joints.
- B. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class III minimum with Wall type B; mesh reinforcement; inside nominal diameter as indicated, bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M), rubber compression gasket joint.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Trash Grates: shall be fabricated galvanized steel grates of design and size required and acceptable to the City Engineer.

2.03 STORM DRAIN STRUCTURES

- A. Frames and Covers: Heavy duty cast iron, as indicated or acceptable equal; designed for H-20 highway loading.
 - 1. Gutter Inlet Box:
 - a. Lid Design: bicycle proof design grate; size and type as indicated.
 - 2. Cleanout box:
 - a. Lid Design: solid, with pick holes; size and type as indicated.
 - 3. Inlet Box:
 - a. Lid Design: bicycle proof design grate; size and type as indicated.
 - 4. Manholes: see Section 02640.
- B. Precast Box: type and size as indicated; minimum wall thickness of 6-inches, minimum top and bottom slab thickness of 8-inches; design for H-20 highway loading; sleeved to receive storm drain pipe sections. Concrete work shall conform to Section 03300.
- C. Cast-in-Place Box: of type and size indicated; concrete work shall conform to Section 03300; sleeved to receive storm drain pipe sections.
- D. Joint Filler: flexible, bituminous mastic, gasket type sealant.

2.04 STORM WATER TREATMENT SYSTEMS

- A. Storm water treatment systems shall be either a vortex type or separation type treatment system, as described in Section 02650.

2.05 BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02312 and 02316.
- B. Backfill: As specified in Sections 02312 and 02316.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 02312, Trenching for Pipe Work, and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around pipe with bedding material as indicated, tamp in place and compact; then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.
- B. Install concrete pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- C. Install pipe to slope gradients noted on drawings; with maximum variation from true slope of 0.10 feet.
- D. Connect to existing storm drain boxes as indicated.
- E. Install trash grates over the ends of all exposed pipe, 15-inch diameter and larger. Installation shall be acceptable to the City Engineer.

3.03 INSTALLATION - STORM DRAIN STRUCTURES

- A. Trim bottom of excavation clean and smooth to correct elevation; place bedding as indicated.
- B. Install precast boxes plumb, according to the manufacturer's instructions, at the design elevations as indicated; connect project pipes with appropriate type flexible couplings.
- C. Construct cast-in-place concrete boxes, as indicated; connect project pipes with appropriate type flexible couplings.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Install lid and frame level in top slab of box, as indicated, according to manufacturer's instructions.
- F. Fill all joints between box sections, grade rings, and cover frames with joint sealant.

3.04 INSTALLATION - STORM WATER TREATMENT SYSTEMS

- A. Storm water treatment systems shall be constructed where and as required applicable regulations and requirements, and as directed by the City Engineer.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

- C. Infiltration Test: Infiltration test required when pipe line is below groundwater level. The amount of water leaking into the pipe shall be measured; allowable infiltration shall be one gallon per day per inch diameter of pipe per mile of pipe.
- D. Exfiltration Test: Exfiltration test required when pipe line is above groundwater level. The section of pipe to be tested, including upstream structure, shall be filled with water to not less than four feet nor more than eight feet above lowest point of pipe section being tested. The amount of water added during the test period to maintain water level shall be measured; allowable exfiltration shall be one gallon per day per inch diameter of pipe per mile of pipe.
- E. Deflection Test: Check alignment by sighting through pipe or by measurements. Pipe lines shall not vary from alignment shown on the drawings by more than 0.25 foot.

3.06 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02640
MANHOLES AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Monolithic cast-in-place concrete manholes with masonry or precast transition to lid frame, covers, anchorage, and accessories.
- B. Modular precast concrete manhole sections with tongue-and-groove joints, precast transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES

- A. ASTM A 48 - Standard Specification for Gray Iron Castings.
- B. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- C. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- D. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of pipe inverts.
- C. Product Data: Provide manhole covers, component construction, manhole steps, features, configuration, and dimensions.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with at least three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Amcor-White, Inc.
- B. Geneva Pipe Company.
- C. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with gaskets in accordance with ASTM C 923 (ASTM C 923M).
- B. Concrete: As specified in Section 03300.
- C. Concrete Reinforcement: As specified in Section 03300.

2.03 COMPONENTS

- A. Manhole Base: precast concrete manhole base of appropriate size.
 - 1. Provide appropriate size flexible sleeves of synthetic rubber, with stainless steel clamps and bolts, for all pipe openings in base section.
 - 2. Construct poured-in-place manhole base where manhole is to be constructed over existing sewer pipe line, as directed by the Engineer. Manhole base shall be constructed as indicated on the drawings.
- B. Manhole Rise Sections: precast riser sections of appropriate size and length, extending from top of base section to bottom of top section.
- C. Manhole Top Section: precast eccentric cone section of appropriate size, with 30-inch diameter top opening.
 - 1. Flat slab top sections can be used only where indicated on the plan drawings and accepted by the City Engineer or City Inspector; designed for H-20 live loading and one-foot minimum earth cover.
- D. Joints: Base section, riser sections, and top section shall have lipped male/female ends, which shall provide uniform and continuous interior wall surface.
 - 1. Joints shall be sealed with pre-lubricated rubber gaskets, conforming to requirements of ASTM C 443 and C 361; Forsheda No. 114 Seal, manufactured by Forsheda Pipe Seal Company, or equal.
- E. Grade Rings: precast grade rings, as required, to adjust height of manhole lid and frame.
 - 1. Grade rings shall have key locks and use flexible, bituminous mastic, gasket-type sealer to insure watertight installation.
 - 2. Maximum height of grade rings shall be 12 inches.
- F. Lid and Frame: ASTM A 48, Class 30B Cast iron construction, machined flat bearing surface, removable lid with cleated surface and pick holes, lockable lid if indicated, vented lid design in improved areas and solid lid design in unimproved areas, H-20 highway load rating; lid molded with identifying name. Provide Model A-1180 manufactured by D & L Supply., or acceptable equal. Lids shall be marked with "SARATOGA SPRINGS" and with either "WATER", "SEWER", "PRESSURE IRRIGATION", or "STORM DRAIN", as applicable and as directed.
- G. Manhole Steps: Formed, copolymer polypropylene-encased, steel rungs; 3/4 inch diameter minimum. Cast-in-place or vibrate into green concrete. Model PSI-FF manhole steps, manufactured by M. A. Industries, Inc., or acceptable equal.
- H. Collars: constructed of concrete or bituminous as indicated on the drawings.

2.04 CONFIGURATION

- A. Manholes shall be constructed as indicated on the Standard Manhole Detail drawing.
- B. Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints; sleeved to receive pipe sections.

- C. Shape: Cylindrical, unless indicated otherwise.
- D. Clear Inside Dimensions: 48 inch, 60 inch or 72 inch diameter, as indicated.
- E. Design Depth: As indicated.
- F. Clear Lid Opening: 30 inch diameter, as indicated.
- G. Pipe Entry: Provide openings for all pipes entering manhole, as indicated.
- H. Steps: 12 inches on center vertically, set into manhole wall directly under opening.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Where native material encountered at foundation depth of manhole is considered unsuitable, remove unsuitable material; and place and compact bedding material, to limits directed by the City Engineer or City Inspector.

3.03 MANHOLES

- A. Install precast concrete manhole base level on a compacted foundation, according to manufacturer's instructions.
- B. Construct cast-in-place manhole base over existing sewer lines, as acceptable to the City Engineer. Manhole base shall be constructed as indicated on the drawing.
 - 1. After new manhole has been completed, saw-cut into top of existing sewer pipe, remove section of pipe as required, and dispose of the removed material; construct watertight grout invert channels through new manhole, between new pipe and existing pipe line, as directed. Invert channel shall be formed to direct sewage flows through the manhole as indicated.
 - 2. Divert existing sewage flows around work area to allow connection to existing pipe line to be made.
- C. Place manhole riser sections plumb and level, from the manhole base to the top section, as indicated and according to manufacturer's instructions; anchor to base; align steps perpendicular to sewer line, and seal joints.
- D. Place top section, cone section or flat slab, on top riser section, with opening positioned over steps. Top of cone section or flat slab shall be from 10-inches to 18-inches below final surface elevation, as directed by the City Engineer or City Inspector.
- E. Install grade rings, as required, to adjust top of lid and frame to match finish elevation.
- F. Connect pipe to manhole with appropriate type flexible coupling as recommended by manufacturer. Provide pipe joint or flexible coupling on all pipes approximately 18-inches from outside of manhole. Grout around pipe after installation is complete. Make connections watertight.

- G. Provide sewer pipe stubs for future connections of the same type of pipe used on the project, and of the size indicated.
 - 1. Alignment and grade of stub to be determined by the City Inspector.
 - 2. Install permanent, watertight plug or cap on end of stub, outside of the manhole.
- H. Grout inside of manhole base sections to form channel between connected pipes, as indicated. Trowel smooth. Top of channel shall be a same elevation as top of outlet pipe.
- I. Set cast iron frames and covers level without tipping, to correct elevations. After placement, grout around the exterior of frame from top of concrete top section to top of frame, as indicated, to ensure watertight condition. No wood or other unacceptable material shall be used to place frames in final position; only solid materials shall be used as directed by the City Inspector.
- J. After manhole base has been completed, furnish and install temporary pipe plugs to seal all interior pipe openings; plugs to be Brent DuoSeal Pipe Plug by Burke Rubber Company, Cherne Pipe Plug by Cherne Manufacturing Company, or acceptable equal. Pipe plugs shall remain in place until final review and acceptance of completed sewer . Plugs shall then be removed; and shall be property of Contractor.
- K. In paved areas, collars shall be constructed around covers as indicated. Collars shall be constructed after new pavement has been placed and accepted by the City Engineer or City Inspector.
- L. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 FIELD QUALITY CONTROL

- A. Manholes shall be tested using vacuum test method to demonstrate integrity of installed materials and construction procedures. Method and material for repair shall be as acceptable to the City Engineer or City Inspector.
 - 1. Each manhole shall be tested immediately after assembly and backfilling.
 - 2. Plug all lift holes with an acceptable non-shrink grout.
 - 3. Plug all pipes entering manhole; securely brace plugs during test.
 - 4. Test head shall be placed at inside top of cast iron frame, or as accepted by the City Engineer or City Inspector; and the seal shall be inflated in accordance with manufacturer's recommendations.
- B. Testing shall conform to ASTM C 1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
- C. If manhole fails initial test, make necessary repairs with non-shrink grout. Manhole shall be re-tested until satisfactory test is obtained.

END OF SECTION

SECTION 02650

STORM WATER TREATMENT SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm water treatment systems.
- B. Reinforced concrete structures.

1.02 RELATED SECTIONS

- A. Section 02315 - Structural Excavation: Excavating for structures and appurtenant items.
- B. Section 02316 - Fill and Backfill: Bedding, backfilling and compacting.
- C. Section 02635 - Storm Water System.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for structures and appurtenant items.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data on storm water treatment system and appurtenant items.
- C. Shop Drawings:
 - 1. Provide dimensional shop drawings; prepared at a scale of not less than 3/16-inches per foot (1 :75).
 - 2. Shop drawings shall be annotated to indicate all materials to be used and all applicable standards for materials, required tests of materials, and design assumptions for structural analysis.
 - 3. Submit six (6) hard copies of equipment shop drawings to the Engineer for review and approval.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record actual locations structures and appurtenant items. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.04 QUALITY CONTROL INSPECTION

- A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the City Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places.
 - 1. The sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture.
 - 2. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once.
 - 3. All sections which have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

- B. All sections shall be inspected for general appearance, dimensions, soundness, and related items. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.
- C. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result.
 - 1. Repairs shall be carefully inspected before final acceptance.
 - 2. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days when tested in 3 inch diameter by 6 inch long cylinders stored in the standard manner.
 - 3. Epoxy mortar may be utilized for repairs.

PART 2 PRODUCTS

2.01 VORTEX-TYPE STORM WATER TREATMENT SYSTEMS

- A. Reinforced Concrete Structure.
 - 1. Construct the reinforced concrete structure for the treatment system as indicated on the drawings and as directed by the Engineer.
 - 2. Structure dimensions, wall thicknesses, and slab thicknesses shall be as indicated on the dimensional drawings and as directed by the Engineer.
 - 3. Concrete for structure shall conform to Section 03300; and shall meet the following additional requirements:
 - a. All concrete shall be cured by an approved method. Concrete sections shall not be stripped until the concrete has attained a compressive strength of 4,000 psi or 5 days after fabrication and/or repair, whichever is the longer.
 - b. Joints shall be as shown on the drawings with a butyl mastic sealant conforming to ASTM C 990.
 - 4. Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed with a hydraulic cement conforming to ASTM C 595M or Link-Seal.
 - 5. Internal aluminum plate components shall be aluminum alloy 5052-H32 in accordance with ASTM B 209.
 - 6. Outlet weirs shall be of the size and type as recommended by the system manufacturer
 - 7. Sealant to be utilized at the base of the swirl chamber shall be extruded EPDM.
 - 8. Brick or masonry used to build the manhole frame to grade shall conform to ASTM C 32 or ASTM C 139 and shall be installed in conformance with Section 02640 and all City requirements.
 - 9. Manhole frames and covers shall be in accordance with Section 02640; with the VortechTM logo and the words "VortechTM Stormwater Treatment System" cast in covers.
 - 10. A bitumen sealant in conformance with ASTM C 990 shall be utilized in affixing the aluminum swirl chamber to the concrete vault.
- B. Treatment System Components and Design.
 - 1. Storm water treatment system shall include a circular aluminum "swirl chamber" (or "grit chamber") with a tangential inlet to induce a swirling flow pattern that will accumulate and store settleable solids in a manner and a location that will prevent re-suspension of previously captured particulates. Swirl chamber diameter shall be sized for the anticipated storm water flows.

2. Storm water treatment system shall be of a hydraulic design that includes flow controls designed and certified by a professional engineer, using accepted principles of fluid mechanics, that raise the water surface inside the tank to a pre-determined level in order to prevent the re-entrainment of trapped floating contaminants.
3. Storm water treatment system shall have a design treatment capacity sized for the anticipated storm water flows; and shall not re-suspend trapped sediments or re-entrain floating contaminants at flow rates up to and including the design treatment capacity.
5. Storm water treatment system shall have usable sediment storage capacity of volume designed by the manufacturer for the anticipated storm water flows.
6. The system shall be designed such that the pump-out volume is less than one-half of the total system volume.
7. The system shall be designed to not allow surcharge of the upstream piping network during dry weather conditions.
8. A water-lock feature shall be incorporated into the design of the storm water treatment system to prevent the introduction of trapped oil and floatable contaminants to the downstream piping during routine maintenance and to ensure that no oil escapes the system during the ensuing rain events.
9. Direct access shall be provided to the sediment and floatable contaminant storage chambers to facilitate maintenance. There shall be no appurtenances or restrictions within these chambers.
10. Storm water treatment system shall be completely housed within one rectangular concrete structure, as indicated on the drawings and as recommended by the system manufacturer.
11. The manufacturer shall certify that storm water treatment system conforms to the performance requirements described herein for the anticipated storm water flows.

C. Manufacturer.

1. Storm water treatment systems shall be of a type that has been installed and used successfully for a minimum of 5 years. The manufacturer of said systems shall have been regularly engaged in the engineering design and production of systems for physical treatment of storm water runoff during the aforementioned period.
2. Storm water treatment system shall be a Vortechs™ System as manufactured by Vortechtechnics, Inc., 200 Enterprise Drive, Scarborough, Maine 04074, phone: 207-885-9830, fax: 207-885-9825; and as protected under U.S. Patent #5,759,415. The local representative is Richard Larson with Contech, phone: 801-363-3873.

2.02 SEPARATION TYPE STORM WATER TREATMENT SYSTEMS

A. Reinforced Concrete Structures.

1. Construct the reinforced concrete manholes for the treatment system as indicated on the drawings and as directed by the Engineer.
2. Manholes shall be sized by the manufacturer to conform with the performance requirements described herein and as accepted by the City Engineer.
3. Manholes shall be constructed as described in Section 02640.
4. Pipe openings shall be sized to accept pipes of the specified size(s) and material(s), and shall be sealed with a hydraulic cement conforming to ASTM C 595M or Link-Seal.

5. Manhole frames and covers shall be in accordance with Section 02640; with the words "BaySaver™ Storm Water Treatment System" cast in covers.

B. Treatment System Components and Design.

1. The storm water treatment system shall include a primary manhole, separator unit, storage manhole, HDPE pipe and fittings, and appurtenant items.
2. The primary manhole will accumulate and store coarse settleable solids; and the storage manhole will accumulate and store fine settleable solids, oils and floatable contaminants. Manholes shall be designed to prevent re-suspension of previously captured particulates; and shall be sized for the anticipated storm water flows.
3. The separation unit and piping shall be designed and certified by a professional engineer, to totally treat the anticipated storm water flows; as acceptable to the City Engineer. No overflow of the system will be allowed.

C. Manufacturer.

1. Storm water treatment systems shall be of a type that has been installed and used successfully for a minimum of 5 years. The manufacturer of said systems shall have been regularly engaged in the engineering design and production of systems for physical treatment of storm water runoff during the aforementioned period.
2. Storm water treatment system shall be a BaySaver™ System as manufactured by BaySaver, Inc. , 1302 Rising Ridge Road Unit 1, Mount Airy, Maryland 21771, phone: 301-829-6470, fax: 301-829-3747; protected by one or more U.S. and international patents. The local representative is Ralph Kunz at Amcor; phone: 801-399-1171.

2.03 STORM WATER TREATMENT SYSTEM PERFORMANCE

- A. Performance. Storm water treatment systems shall adhere to the following performance specifications at the anticipated design treatment capacities.
- B. The design engineer shall determine the following performance requirements:
 1. Total treatment capacity.
 2. Sediment storage capacity.
- C. The design engineer shall submit calculations used to determine anticipated storm water flows.
- D. The manufacturer shall design and size the treatment system to treat the total storm water flow through the treatment system to the following requirements:
 1. Treatment system shall be capable of removing 80% of the net annual Total Suspended Solids (TSS) load based on a 50-micron particle size.
 - a. Annual TSS removal efficiency models shall be based on documented removal efficiency performance from full scale laboratory tests.
 - b. Annual TSS removal efficiency models shall only be considered valid if they are corroborated by independent third party field testing. Said field testing shall include influent and effluent composite samples from a minimum of ten storms at one location.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the storm drain pipe line sizes, locations, and invert elevations are as indicated on the drawings.

3.02 PREPARATION

- A. Prepare ends of storm drain pipe for connections to treatment system structures, as indicated and as directed.

3.03 EXCAVATION

- A. See Sections 02315 and 02316 for additional requirements.
- B. Excavate to the limits as described in Section 02316 and as directed by the Engineer.
- C. After the concrete structures have been completed and accepted by the Engineer, backfill around and over the structure, tamp in place and compact. See Section 02316 for requirements.

3.04 CONSTRUCTION - CONCRETE STRUCTURE

- A. Furnish all labor, materials, equipment and appurtenant items required to construct the reinforced concrete structure for the storm water treatment system, in accordance with the drawings and the specifications.
- B. Furnish, place and compact granular base of the thickness indicated; conforming to Section 02316.
- C. Construct the reinforced cast-in-place concrete structure as indicated on the drawings and as directed by the Engineer.
 - 1. Precast concrete vaults may be used as acceptable to the Engineer.
 - a. Concrete shall conform to the requirements of Section 03300.
 - b. Precast concrete vaults shall be designed for HS20-44 loading as determined by a Licensed Professional Engineer.
 - c. Precast sections shall have tongue and groove joints with a butyl mastic sealant conforming to ASTM C990
 - d. Vaults shall conform to the dimensions indicated for the cast-in-place vault, and to the appropriate required described herein.
 - e. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of Stormwater Treatment Systems shall conform to ASTM specification C 891 "Standard Practice for Installation of Underground Precast Utility Structures".
 - f. Holes made in the concrete sections for handling or other purposes shall be plugged with a non-shrink grout or by using grout in combination with concrete plugs.
 - g. Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen the mortar joints. The Contractor shall make all pipe connections; connections shall be watertight.
- D. The treatment system shall be installed inside of the vault before the top slab for the vault is constructed or installed.
- E. Outlet weirs shall be constructed where and as required and as directed by manufacturer.
- F. After constructing the roof section of the vault, set precast concrete manhole riser sections, to the height required to bring the cast iron manhole covers to grade, so that the sections are vertical and in true alignment with a 1/4-inch maximum tolerance allowed.
- G. Backfill around vault in a careful manner, bringing the fill up in 6-inch lifts on all sides.
- H. If leaks appear, clean the inside joints and caulk with lead wool to the satisfaction of the Engineer.

3.05 CONSTRUCTION - CONCRETE MANHOLES

- A. Furnish all labor, materials, equipment and appurtenant items required to construct reinforced concrete manholes for the separation type storm water treatment system, in accordance with the drawings and the specifications.

- B. Furnish, place and compact granular base of the thickness indicated; conforming to Section 02316.
- C. Construct the reinforced concrete manholes as indicated on the drawings and as directed by the Engineer; conforming to Section 02640..

3.06 INSTALLATION - TREATMENT SYSTEMS

A Vortex-Type Treatment System.

1. Furnish all labor, materials, equipment and appurtenant items required and install storm water treatment systems and appurtenances in accordance with the Drawings and these specifications, and according to manufacturer's written instructions and recommendation.
2. After constructing the base and wall sections, prepare to install the swirl chamber.
 - a. Place the 3/4-inch thick by 3/4-inch wide butyl mastic seal vertically on the outside of the swirl chamber starting one inch above the bottom of the swirl chamber and continuing to a height equal to the elevation of the bottom of the upper aperture of the swirl chamber.
 - b. The butyl mastic seal should abut the downstream side of the pre-drilled mounting holes that attach the swirl chamber to the long walls of the concrete vault.
 - c. Next, install the extruded EPDM seal on the bottom edge of the 180 degree downstream section of the swirl chamber by first applying a bead of Sikaflex-1a polyurethane elastomeric sealant into the extruded slot, then slide the seal onto the swirl chamber. The extruded seal should extend 3-inches upstream of the mounting holes, toward the inlet end of the vault.
 - d. Set the swirl chamber into position and keep the seal approximately 1/2-inch above the floor of the concrete vault. Apply a continuous bead of Sikaflex-1 a sealant under the cupped bottom of the seal.
 - e. Set and anchor the circular swirl chamber by bolting the swirl chamber to the side walls of the concrete vault at the three (3) tangent points and at the inlet tab using HIL TI brand stainless steel drop-in wedge anchors, or equivalent, 3/8-inch diameter by 2-3/4 inch minimum length at heights of approximately three (3) inches off the floor and at fifteen (15) inch intervals to approximately the same height of the butyl mastic sealant (at locations of pre-drilled holes in aluminum components). Apply a continuous bead of Sikaflex-1 a sealant to the intersection of the inside bottom edge of the extruded seal and the vault floor.
3. Prior to constructing the roof section, bitumen sealant equal to ASTM C 990 shall be placed along the top of the baffle wall, using more than one layer of mastic if necessary, to a thickness at least 1-inch greater than the nominal gap between the top of the baffle and the roof section.
 - a. The nominal gap shall be determined either by field measurement or the shop drawings.
 - b. After construction of the roof section has compressed the butyl mastic sealant in the gap, finish sealing the gap with an approved non-shrink grout on both sides of the gap using the butyl mastic as a backing material to which to apply the grout.
 - c. Also apply non-shrink grout or Sikaflex-1a to the joints at the side edges of the baffle walls.

B. Separation Type Treatment System.

1. Furnish all labor, materials, equipment and appurtenant items required and install storm water treatment systems and appurtenances in accordance with the Drawings and these specifications, and according to manufacturer's written instructions and recommendation.
2. Manholes shall be constructed as described herein, and according to the requirements of the treatment system manufacturer.
3. The separator unit, pipe and fittings, and appurtenant items, shall be installed according to the shop drawings and as recommended by the manufacturer.

3.07 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate that the Work does not meet specified requirements, remove the Work and replace or repair the Work as required; and retest at no cost to the City Engineer.

3.08 PROTECTION

- A. Protect the treatment systems from damage or displacement until backfilling operations have been completed.

END OF SECTION

SECTION 02655

STORM WATER DETENTION PONDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm water detention ponds.
- B. Pond pipe lines, structures, and appurtenant items.

1.02 RELATED SECTIONS

- A. Section 02300 - General Excavation: General excavating, embankments and compacting.
- B. Section 02312 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- C. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- D. Section 02316 - Fill and Backfill: Bedding, backfilling and embankment material.
- E. Section 02635 - Storm Drain System.
- F. Section 02685 - Automatic Sprinkling System.
- G. Section 02926 - Landscaping.
- H. Section 03300 - Cast-in-Place Concrete: Concrete for structures.

1.03 REFERENCES

- A. See Section 02635 for storm water system materials.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- E. Storm water detention ponds, structures and all appurtenant items shall be sized and designed by the developer's engineer. Ponds shall be designed and constructed according to the City's standards. The plan drawings shall be submitted to the City Engineer for review; along with all calculations required to show how the various components were sized and how they are intended to operate. No work shall be done until the plan drawings have been accepted by the City Engineer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials as recommended by the manufacturers.

PART 2 PRODUCTS

2.01 EMBANKMENT AND BACKFILL MATERIALS

- A. Embankment and Backfill Materials: As specified in Sections 02312, 02315 and 02316.

2.02 PIPE LINES AND STRUCTURES

- A. Pipe lines and structures shall be constructed as specified in Section 02635, and as directed by the City Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that location and elevations are as indicated.

3.02 PREPARATION

- A. Clear and grub the pond site, as required; and dispose of cleared material in an acceptable manner.
- B. Remove top soil material as described in Section 02300.

3.03 POND CONSTRUCTION

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. See Section 02635 for installation of pipe lines.
 - 1. Construct pipe lines through bottom of detention ponds, as indicated on approved construction drawings and as directed by the City Engineer, to convey low flows of storm water through the ponds.
- C. Excavate for ponds and structures to the limits indicated on the drawings and as directed by the City Engineer or City Inspector; conforming to the requirements of Section 02300.
 - 1. Furnish, place and compact gravel base, as indicated on the drawings, for structures.
 - 2. Furnish, place and compact pipe bedding and backfill material for pipe trenches.
- D. Compact sub-base as described in Section 02315.
- E. Construct embankments as indicated on the drawings and as described in Section 02300.
 - 1. Embankments shall have minimum slopes of 3 horizontal to 1 vertical.
 - 2. Construct 12-foot wide (minimum) access road around perimeter of pond and embankments.
- F. Construct pond structures as indicated on the approved construction drawings and as directed by the City Engineer.
 - 1. Bubble-up type inlet boxes shall be constructed in the pond to discharge high flows of storm water into the pond; and to allow water to drain from the pond at controlled rates, as required. Boxes shall be as indicated on the construction drawings; and shall be constructed with floor of boxes at least 6-inches below pipe inverts.
 - 2. Construct an overflow box in the pond of an approved type and size. Overflow box shall have a trash grate of approved design.

- G. Construct automatic sprinkling system for pond area, as indicated on approved construction drawings and as directed by the City Engineer; conforming to Section 02685.
- H. Landscape the pond area, as indicated on approved construction drawings and as directed by the City Engineer; conforming to Section 02926.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

END OF SECTION

SECTION 02680

SECONDARY WATER SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for project water lines, to include secondary water lines.
- B. Valves and appurtenant items.
- C. Water Service Connections.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Bedding and backfilling.
- D. Section 02640 - Manholes and Covers.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

1.03 REFERENCES

- A. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- B. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- C. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- D. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- E. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- F. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- H. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- I. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3 K. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).

- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- M. ASTM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- N. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- #3 O. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inch, for Water Service; American Water Works Association.
- #3 P. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution; American Water Works Association.
- #3 Q. AWWA C200 - Steel Water Pipe, 6-inches and Larger.
- #3 R. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with the City's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints:
 - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
 - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
 - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
 - 3. Jackets: AWWA C105 polyethylene jacket; purple color.
- B. PVC Pipe: AWWA C900 Class 150 or 200, as indicated:
 - 1. Fittings: AWWA C111, cast iron.
 - 2. Joints: ASTM D 3139 compression gasket ring.

- C. Polyethylene Pipe: ASTM D 3035, for 160 psig pressure rating:
 - 1. Fittings: AWWA C901, molded or fabricated.
 - 2. Joints: Compression.
- D. High Density Polyethylene Pipe: AWWA C906:
 - 1. Material: PE 3408 High Density Polyethylene (HDPE) meeting ASTM D3350 cell classification of 345434C.
 - 2. Fittings: AWWA C906, molded or fabricated; or mechanical joint ductile iron fittings.
 - 3. Joints: Butt fusion.
- E. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.

2.02 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches:
 - 1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
 - 2. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.
 - 3. Substitutions: See Section 01600 - Product Requirements.
- C. Gate Valves 3 Inches and Over:
 - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - 2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 4. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
- D. Ball Valves Up To 2 Inches:
 - 1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.
- E. Swing Check Valves From 2 Inches to 24 Inches:
 - 1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
 - 2. Product: Mueller Swing-Type Check Valve, or other valves acceptable to the City Engineer.
- F. Butterfly Valves From 2 Inches to 24 Inches:
 - 1. AWWA C504, iron body, bronze disc, resilient replacement seat, mechanical joint or flanged ends as indicated, manual worm gear operator, and cast iron valve box where required.

2. Underground manual operators shall be totally enclosed, factory grease packed and sealed, bronze worm gear operators with self-locking gearing; stops shall be provided to prevent over travel of valve disc.
 3. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the Engineer.
 4. Product: Mueller "Lineseal III" Butterfly Valve with appropriate type Pacific States Cast Iron Valve Box, or other valves acceptable to the City Engineer.
- G. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000, or other stops acceptable to the City Engineer, for up to 2-inch service line.
- H. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, or other valves acceptable to the City Engineer, of size indicated on the drawings.
- I. Blow-Off Hydrant: shall be Eclipse No. 85, Non-Freezing Blow-Off Hydrants, or other hydrants acceptable to the City Engineer.

2.03 SECONDARY WATER CONNECTIONS

- A. Secondary water connections shall be constructed as indicated on the drawings and as directed by the City Engineer.
- B. Connections shall include meter boxes, meters, valve boxes, stop & water valves, and all appurtenant items, As indicated on the drawings and as directed.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Sections 02312 and 02316.
- B. Backfill: As specified in Sections 02312 and 02316.

2.05 ACCESSORIES

- A. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or other clamps acceptable to the City Engineer, for up to 2 inch service lines.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03300.
- C. Manhole and Cover: Refer to Section 02640.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that water main and main line tee size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.03 TRENCHING

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required sq ft of thrust restraint bearing on subsoil as indicated on the drawings.
- D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Group piping with other piping work whenever practical.
- B. Establish elevations of buried piping to ensure not less than two ft of cover over pipe; or as indicated on the drawings and as directed by the City Engineer or Inspector.
- C. Install pipe to indicated elevation to within tolerance of one inches.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Install PVC pressure pipe and fittings to ASTM D2774.
- F. Install pipe lines to line and grade indicated.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Slope water pipe and position drains at low points.
- I. Install trace wire above top of PVC and PE pipe; coordinate with Section 02312.

3.05 INSTALLATION - VALVES

- A. Set valves on concrete block or other acceptable solid bearing.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.

3.06 INSTALLATION - AIR RELEASE STATIONS

- A. Locate air release stations as indicated on the construction drawings and as directed by the City Engineer.
- B. Set air valve and piping plumb according to manufacturer's written instructions and recommendations; set vault plumb on solid foundation.
- C. Set top of valve box to grade, with cover matching finish grade.

3.07 SERVICE CONNECTIONS

- A. Provide water service lines, as indicated on the drawings. Service lines shall include stop & waste valves with valve boxes; meter boxes with meter, valve and appurtenant items; and valve boxes with ball valve; and all appurtenant work.
- B. Water service lines shall extend to locations designated by the City Engineer, which will be near property lines of property being served, as indicated.
- C. All pipe, fittings and valves shall conform to the specifications found elsewhere in this Section.

- D. Pipe, fittings and valves shall be installed as described herein and as directed by the City Engineer.
- E. Service lines shall be installed at uniform grades and alignments; and shall be free of low spots or adverse grades.
- F. Service lines shall be cleaned, flushed and tested in accordance with applicable requirements of these specifications.

3.08 CONNECTIONS TO EXISTING WATER LINES

- A. Connection to existing water lines shall be made where and as indicated on the drawings and as directed by the Engineer. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connection which involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.
- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with acceptable type drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the City Engineer or City Inspector.
- F. Cut and plug existing pipe lines where indicated and as directed by the Engineer. Excavate as required to locate existing pipe lines to be abandoned in place; cut the existing pipe, as required; and install permanent plug in end of pipe to be abandoned.

3.09 CONNECTIONS TO CULINARY WATER LINES

- A. Connections of secondary water systems to culinary water systems shall be done as indicated on the drawings and as described in Section 02686 BACKFLOW PREVENTER STATION.
- B. Connections of secondary water services to culinary water systems shall be done as indicated on the drawings and as described in Section 02687 SERVICE WATER BACKFLOW PREVENTER STATION.

3.10 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

END OF SECTION

SECTION 02682

SECONDARY WATER STORAGE PONDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Secondary water storage ponds.
- B. Sedimentation Basins.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Bedding and backfilling.
- D. Section 02680 - Secondary Water System.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

1.03 REFERENCES

- A. See Section 02680 for secondary water system materials.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- E. Secondary water storage ponds, structures and all appurtenant items shall be sized and designed by the developer's engineer. Ponds shall be designed and constructed according to the City's standards. The plan drawings shall be submitted to the City Engineer for review; along with all calculations required to show how the various components were sized and how they are intended to operate. No work shall be done until the plan drawings have been accepted by the City Engineer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials as recommended by the manufacturers.

PART 2 PRODUCTS

2.01 POLY-LINER

- A. Polypropylene Liner: 36-mil reinforced polypropylene liner as manufactured by Lange Containment Systems, Inc. of Denver, Colorado; or other lines acceptable to the City Engineer.
- B. Geotextile Fabric: non-woven geotextile, Amoco 4553, or fabrics acceptable to the City Engineer.

2.02 CONCRETE LINER

- A. Concrete Liner: shall conform to all requirements of Section 03300, Cast-in-Place Concrete.

2.03 GRAVEL BASE AND CLAY BASE MATERIALS

- A. Gravel Base Material: As specified in Sections 02315 and 02316.
- B. Clay Base Material: As specified in Sections 02315 and 02316.

2.04 EMBANKMENT AND BACKFILL MATERIALS

- A. Embankment and Backfill Materials: As specified in Sections 02312, 02315 and 02316.

2.05 SEDIMENTATION BASINS

- A. Provide reinforced concrete sedimentation basins, where ponds are poly-lined and as directed by the City Engineer.
 - 1. Reinforced Concrete: shall conform to all requirements of Section 03300, Cast-in-Place Concrete.
 - 2. Gates: shall be of manufacturer's standard design; and shall be as recommended by the manufacturer for the intended purpose. Manufacturer shall be Waterman, or acceptable equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that location and elevations are as indicated.

3.02 PREPARATION

- A. Clear and grub the pond site, as required; and dispose of cleared material in an acceptable manner.
- B. Prepare pipe connections to structures with mechanical joints.

3.03 EARTHWORK

- A. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- B. See Section 02680 for installation of pipe lines.
- C. Excavate for ponds and structures to the limits indicated on the drawings and as directed by the City Engineer or City Inspector.
- D. Compact sub-base as described in Section 02315.
- E. Construct berms and dikes as indicated on the drawings.

- F. Furnish, place and compact gravel base, as indicated on the drawings, for concrete lined ponds.
- G. Furnish, place and compact clay base, as indicated on the drawings, for poly-lined ponds.

3.04 INSTALLATION - LINER

- A. Construct concrete liners over the gravel base, as indicated on the drawings; conforming to all requirements of Section 03300. Reinforcement shall be installed in the center of the slab.
- B. Furnish and install geotextile fabric over the clay base, as indicated on the drawings; conforming to the manufacturer's written instructions and recommendations.
- C. Furnish and install reinforced polypropylene liner over the geotextile fabric, as indicated on the drawings; conforming to the manufacturer's written instructions and recommendations.

3.05 SEDIMENTATION BASIN

- A. Sedimentation basins shall be designed to match existing conditions and to handle anticipated water quality; providing at least one-half hour retention time. Design and drawings shall be reviewed and accepted by the City Engineer before construction is begun.
- B. Basins shall be constructed of reinforced concrete as indicated on the drawing; conforming to all requirements of Section 03300.

3.09 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

END OF SECTION

SECTION 02685

AUTOMATIC SPRINKLING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete automatic sprinkling system, including:
 - 1. Pipe and fittings.
 - 2. Valves, valve boxes, and appurtenant items.
 - 3. Automatic controller, control valves, valve boxes, wires and appurtenant items.
 - 4. Sprinkler heads and appurtenant items.
 - 5. Connections to water main lines.
- B. System design and testing.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, pipe bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Pipe bedding and excavation backfilling.
- D. Section 02686 - Backflow Preventer Station.
- E. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

1.03 REFERENCES

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120.
- D. ASTM D 2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- E. ASTM D 2241 - Standard Specification for Poly(Vinyl Chloride)(PVC) Pressure-Rated Pipe (SDR Series).
- F. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- G. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedules 40.
- H. ASTM D 2564 - Standard Specification for Solvent Cement for Poly(Vinyl Chloride)(PVC) Plastic Piping Systems.
- I. ASTM D 2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

- J. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- K. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- L. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- M. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- N. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- O. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- P. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- Q. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- R. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- S. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3** T. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Associations: (ANSI/AWWA C515).
- U. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- V. STM D2774 - Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- W. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution; American Water Works Association; (ANSI/AWWA C900/C900a).
- X. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 4 inch through 63 inch, for Water Distribution; American Water Works Association.
- Y. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, controllers, sprinkler heads, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, controllers, sprinkler heads, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 SYSTEM DESIGN

- A. The sprinkling system shall be designed to provide adequate coverage to all areas to be watered.
- B. Project drawings of the system shall be submitted to the City Engineer, showing design and general layout of pipe distribution system and sprinkler heads required to provide adequate coverage.
 - 1. Drawings shall indicate pipe sizes, control valves, quick-coupling valves, automatic controller, control wiring, electrical service line, connections to water mains, backflow preventors, and all appurtenant items.
 - 2. Pipe system for spray heads shall have minimum pipe size of 1/2-inch; for rotor pop-up sprinklers shall have minimum pipe size of 3/4-inch; and for the impact rotor pop-up shall have minimum pipe size of 1-inch.
 - 3. Quick-coupling valves shall be placed in the system where and as directed by the City Engineer.
- #3 4. Drawings shall show system design pressures and PVC pipe classifications (either Schedule 40 or Schedule 80).
- C. Design a pipe distribution system to provide water to each of the heads, as required; minimum water pressure at each head is to be 40 psi.
- D. The Contractor may modify the layout of heads to better fit project conditions; providing that adequate coverage is maintained.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves, controllers, heads, and appurtenant items in shipping containers with labeling in place.

1.08 OPERATING AND MAINTENANCE DATA

- A. Provide instructions covering full operation, care and maintenance of system and controls; and manufacturer's parts catalog.
- B. Instruct City's designated maintenance personnel in the proper operation of the system, including adjustment of sprinkler heads.
- C. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the system from year to year.
 - 1. Submit prior to expiration of required one year guarantee period.
 - 2. Provide information in the manuals that include the following:
 - a. written index near front of Manual listing location in the Manual of all emergency data regarding the installation;
 - b. complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
 - c. copy of all guarantees and warranties issued on the installation showing all dates of expiration.

PART 2 PRODUCTS

2.01 GENERAL

- A. All sprinkler heads, control valves, quick-coupling valves, automatic controllers and appurtenant items for the sprinkling system shall be supplied by the same supplier. All materials shall be reviewed and accepted by the City Engineer prior to installation. Materials shall be as manufactured by Rainbird Sprinkling Mfg. Corporation, or acceptable equal.

2.02 WATER SUPPLY AND DISTRIBUTION PIPE

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints:
 - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
 - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
 - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.
 - 3. Jackets: AWWA C105 polyethylene jacket.
- B. PVC Pipe: AWWA C900 Class 150 or 200, as indicated:
 - 1. Fittings: AWWA C111, cast iron.
 - 2. Joints: ASTM D 3139 compression gasket ring.
- C. Polyethylene Pipe: ASTM D 3035, for 160 psig pressure rating:
 - 1. Fittings: AWWA C901, molded or fabricated.
 - 2. Joints: Compression.
- D. High Density Polyethylene Pipe: AWWA C906:
 - 1. Material: PE 3408 High Density Polyethylene (HDPE) meeting ASTM D3350 cell classification of 345434C.
 - 2. Fittings: AWWA C906, molded or fabricated; or mechanical joint ductile iron fittings.
 - 3. Joints: Butt fusion.
- E. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters for all plastic pipe.

2.03 SPRINKLING SYSTEM DISTRIBUTION AND LATERAL PIPE

- A. PVC Pipe: ASTM D 1785, Schedule 40 or 80, as required.
 - 1. Fittings: ASTM D 2466, Schedule 40 or 80, as required.
 - 2. Joints: Cemented.
- #3** 3. Schedule 80 pipe shall be used between stop & waste valves and master valves; and Schedule 40 pipe shall be used downstream from master valves.
- B. Polyethylene Pipe: ASTM D 3035, for 160 psig pressure rating:
 - 1. Fittings: AWWA C901, molded or fabricated.

2. Joints: Compression.

C. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters for all plastic pipe.

#3 D. The minimum pipe size for distribution and lateral pipes to be 3/4-inch.

2.04 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:

1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.

2. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.

3. Substitutions: See Section 01600 - Product Requirements.

C. Gate Valves 3 Inches and Over:

1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.

2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.

#3 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.

#3 4. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.

D. Ball Valves Up To 2 Inches:

1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.

E. Swing Check Valves From 2 Inches to 24 Inches:

1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

2. Product: Mueller Swing-Type Check Valve, or other valves acceptable to the City Engineer.

F. Butterfly Valves From 2 Inches to 24 Inches:

1. AWWA C504, iron body, bronze disc, resilient replacement seat, mechanical joint or flanged ends as indicated, manual worm gear operator, and cast iron valve box where required.

2. Underground manual operators shall be totally enclosed, factory grease packed and sealed, bronze worm gear operators with self-locking gearing; stops shall be provided to prevent over travel of valve disc.

3. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the City Engineer.

4. Product: Mueller "Linesal III" Butterfly Valve with appropriate type Pacific States Cast Iron Valve Box, or other valves acceptable to the City Engineer.

- G. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000, or other stops acceptable to the City Engineer, for up to 2-inch service line.
- H. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, or other valves acceptable to the City Engineer, of size indicated on the drawings.

2.05 SPRINKLER HEADS

A. Part Circle Rotor Pop-Up Sprinklers.

1. Part circle rotor pop-up sprinklers shall be a single nozzle gear drive type, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer; and shall have an infinitely adjustable arc of coverage from 40° to 360°.
2. Sprinkler case shall be constructed of rugged ABS plastic. The internal assembly shall include water-lubricated gear drive, pressure-activated wiper seal, SAM check device and heavy duty screen. The rotation of the sprinkler shall be accomplished by a gear drive.
3. The sprinkler nozzle shall have an outlet trajectory of 25° from the horizontal, with adjustment screw to decrease radius up to 25 percent.
4. The sprinkler shall have a heavy-duty stainless steel retract spring to ensure positive pop-down. Pop-up height shall be not less than 4-inch; and the inlet shall be one-inch (FNPT).
5. The sprinkler shall be constructed so that all internal parts, including inlet screen, are accessible through the top of the sprinkler case without disturbing the soil around the case. The sprinkler shall have a rubber cover and vandal resistant cover screws.
6. Sprinklers shall be Part Circle Rotor Pop-up Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter Industries, or other sprinklers acceptable to the City Engineer.

#3

B. Full Circle Rotor Pop-Up Sprinklers.

1. Full circle rotor pop-up sprinklers shall be a single nozzle gear drive type, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer.
2. Full circle sprinklers shall have the same construction as the part circle sprinklers described above.
3. Sprinklers shall be Full Circle Rotor Pop-up Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter Industries, or other sprinklers acceptable to the City Engineer.

#3

C. Full/Part Circle Rotor Pop-Up Sprinklers.

1. Rotor pop-up sprinklers shall have full or part circle capabilities in one unit; and shall be a single nozzle, water lubricated, turbine drive type with internal impact speed reduction, capable of covering the design radius at the site pressure with a discharge rate as recommended by the manufacturer.
2. Part circle sprinkler shall have an infinitely adjustable arc of coverage from 25° to 350°. The sprinkler shall not reverse direction during continuous operation in the full circle mode. Arc adjustment shall not require any tools.
3. The sprinkler case shall be constructed of rugged ABS plastic. The sprinkler shall include a stainless steel locking set-screw at cap threads to provide vandal resistance and a "Seal-A-Matic" (SAM) device built onto the inlet screen shall hold back 8 feet of elevation change to prevent puddling. The sprinkler shall have a non-strippable drive mechanism and shall permit manual rotation of the pop-up stem; and shall have a pressure-activated, multi-function, soft elastomer wiper seal that positively seals against the

nozzle flange to keep debris out of the rotor and to clean debris from the pop-up stem as it retracts. The sprinkler range nozzle shall have an outlet trajectory of 23° from the horizontal. The sprinkler shall have a screen attached to the drive housing to filter inlet water and prevent the nozzle from clogging.

4. Sprinklers shall have a heavy-duty stainless steel retract spring to ensure positive pop-down. Pop-up height shall be not less than 3 5/8-inch; and the bottom inlet shall be 3/4-inch (FNPT).
5. Sprinklers shall be constructed so that all internal parts, including inlet screen, are accessible through the top of the sprinkler case without disturbing the soil around the case. The sprinkler shall have a rubber cover and vandal resistant cover screws.
6. Sprinklers shall be Full/Part Circle Pop-up Rotor Sprinklers, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter Industries, or other sprinklers acceptable to the City Engineer.

#3 D. Sprinkler Types and Spacing.

1. Large Area Rotors: Hunter I-40 at 50 foot maximum spacing.
2. Medium Area Rotors: Hunter I-20 at 35 foot maximum spacing.
3. Small Area Rotors: Hunter PGP at 30 foot maximum spacing.
4. Spray Heads: Rainbird # 1804 for turf areas; # 1812 for shrub beds.
 - a. East to west park strips: provide 120 percent coverage; 12 foot spacing typical.
 - b. North to south park strips: provide 100 percent coverage; 15 foot spacing typical.
 - c. Built in check valves required if elevation changes from one head to next head.
5. Drip Systems: Rainbird # 1400 series bubbler nozzles.
6. Landscape areas are to determine flow requirements.

2.06 ELECTRIC CONTROL VALVES

- A. Electric remote control valves shall be normally closed 24 VAC, 60 cycle, solenoid actuated globe pattern design capable of having a flow rate as required with a pressure loss not to exceed 1.5 psi. The valve pressure rating shall not be less than 200 psi.
- B. Valve body and bonnet shall be constructed of heavy-duty glass-filled UV resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced nitrile rubber.
- C. Valve shall have both internal and external manual open/close control, for manually opening and closing the valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
- D. Valves shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. The 24 VAC, 60 Hz solenoid shall open with 19.6 VAC minimum at 200 psi. At 24 VAC, average inrush current shall not exceed 0.41 amps.
- E. Valves shall have a brass flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than one minute at 200 psi, and less than 30 seconds at 20 psi.
- F. Valves shall have a self-cleaning stainless steel screen designed for use in dirty water applications.
- G. Valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

- #3 H. Control valves shall be Electric Remote Control Plastic Scrubber Valves, of the appropriate size and type, as manufactured by Rain Bird Sprinkling Mfg. Corporation, Hunter ICV Control Valves with Filter Sentry, or other valves acceptable to the City Engineer.

2.07 QUICK-COUPLING VALVES

- A. Quick-coupling valves shall be one piece type; constructed on heavy cast brass. The cover shall be durable, self-closing, locking rubber cover. The valves shall be opened and closed by a brass key of the same manufacturer, having an appropriate outlet. The valve throat shall have a keyway with detent positions for regulating flow.
- B. Quick-coupling valves shall be Model 3-RC, as manufactured by Rain Bird Sprinkling Mfg. Corp., or other valves acceptable to the City Engineer.

2.08 CONTROL WIRE

- A. Control wire shall be UF No. 14 gauge or larger; conforming to the requirement of Section 16123.

2.09 SPRINKLING SYSTEM CONTROLLER

- A. Sprinkling system controller shall be an electro-mechanical type, capable of fully automatic or manual operation of the system. It shall be housed in a pedestal mountable, heavy gauge steel, lockable cabinet, suitable for outdoor installation.
- B. The controller shall operate on a 17 VAC, plus or minus 10%, power input; and be capable of operating four 24 VAC electric remote control valves per station. The controller shall have a reset circuit breaker to protect it from power overload.
- C. The controller shall have the minimum number of stations as indicated. Each station shall have a time setting knob capable of being set for incrementally variable timing from 6 to 60 minutes in 2 minute increments; or set to omit the station from the sprinkling cycle.
- D. The controller shall have a 14-day calendar dial with captive three-position pins for setting the A or AB program start days, and a 24-hour clock dial with 23 captive hour pins for programming the sprinkling cycle start times. A master on/off switch shall allow the valve power output to be interrupted, while retaining the program.
- E. The controller shall be constructed such that all internal parts are accessible through the controller door without disturbing the cabinet installation.
- #3 F. The controller shall be an Hunter ICC Clock Controllers, of the appropriate size and type, or other controllers acceptable to the City Engineer.
- #3 G. The enclosure for the controller shall be a combined 120 volt or 240 volt commercial meter socket with enclosure, as required.
1. The enclosure unit shall have a compact, double door, front and back design; to provide viewing and programming convenience.
 - a. Construction shall be 100 percent stainless steel; finish shall be brushed stainless steel.
 - b. The unit shall be weather and vandal resistant, NEMA TYPE 3R rated, with three-point locking system; and shall be UL listed.
 - c. The unit shall have a 10-year limited warranty.
 2. Meter section:
 - a. UL listed, E.U.S.E.R.C. approved commercial meter socket, 100 amp rated, with test block bypass provision.
 - b. Hinged viewing window to provide convenient access for metering agency.
 - c. Shall include 100 amp load center with 8 positions.

3. Enclosure section:
 - a. Consists of a 12-inch deep storage area on backside of unit; with side louvers at bottom and top to provide cross-flow ventilation.
 - b. Shall have removable, pre-drilled backboard to provide easy installation of controller.
 - c. Shall have a large door-mounted storage area to provide easy access to plans and scheduling information.
4. The enclosures shall be Strong Box Metered Stainless Steel Combination Enclosure, Model SB-24SS / 120 V or 240 V, as required and as manufactured by V.I.T. Products, Inc."

2.10 MISCELLANEOUS ITEMS

- A. Miscellaneous appurtenant items shall be provided as indicated on the drawings or as required to complete the sprinkler system.

2.11 PIPE BEDDING AND BACKFILL MATERIALS

- A. Bedding: As specified in Sections 02312 and 02316.
- B. Backfill: As specified in Sections 02312 and 02316.

2.12 ACCESSORIES

- A. Service Clamps: shall be bronze, double-strap type; Mueller No. H-16134, or acceptable equal, for up to 2 inch service lines.
- B. Concrete for Thrust Restraints: Concrete type specified in Section 03300.
- C. Manhole and Cover: Refer to Section 02640.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the complete automatic, underground sprinkling system, as described herein and as shown on the design drawings, as indicated on the submittal drawings, and as acceptable to the City Engineer; and shall furnish and install all supplementary and miscellaneous items, appurtenances, and devices incidental to or necessary for a workable and complete sprinkling system installation.
- B. All material shall be installed according to the manufacturer's written instructions and recommendations.
- C. The Contractor shall test the entire sprinkling system to assure proper operation.

3.02 EXAMINATION

- A. Verify that design drawings conform to project conditions.
- B. Verify that existing water main sizes and locations are as indicated on the drawings.

3.03 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges, mechanical joints or mechanical couplings.

3.04 TRENCHING

- A. Trenching for the sprinkling system shall be done to ensure proper grades, slopes and alignment; and to provide minimum cover over main lines of 24-inches and 12-inches over laterals.
- B. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- C. Hand trim excavation for accurate placement of pipe to elevations indicated.
- D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required area of thrust restraint bearing on subsoil as indicated on the drawings.
- E. Backfill around sides and to top of pipe zone with pipe bedding material, tamp in place and compact to required density.
- F. Backfill trench from top of pipe zone to top of trench with trench backfill material, tamp in place and compact to required density.

3.05 INSTALLATION - PIPE

- A. Group piping with other piping work whenever practical.
- B. Establish elevations of buried piping to ensure not less than 2 feet of cover over main lines and 12 inches over laterals; or as indicated on the drawings and as directed by the City Engineer.
- C. Install pipe to indicated elevation to within tolerance of one inches.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Install PVC pressure pipe and fittings to ASTM D2774.
- F. Install pipe lines to line and grade indicated.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Slope water pipe and position drains at low points.
- I. Install trace wire above top of PVC and PE pipe; coordinate with Section 02312.

3.06 INSTALLATION - VALVES

- A. Set valves on concrete block or other acceptable solid bearing.
- B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.

3.07 INSTALLATION - CONTROL VALVES

- A. Install control valves where and as shown on the submittal drawings.

- #3 1. Each control valve shall have unions installed immediately upstream and downstream of all valves.
- #3 2. Each control valve shall have it's own isolation valve, immediately upstream of the first union.
- #3 3. Install only one control valve per rectangular box.
- #3 4. Use of male adapters are prohibited.

- B. Set valves on concrete block or other acceptable solid bearing.

- C. Center and plumb valve boxes over valves. Set box cover flush with finished grade as directed by the City Engineer.

3.08 INSTALLATION - QUICK-COUPLING VALVES

- A. Quick-coupling valves shall be installed where and as shown on the submittal drawings and as directed by the City Engineer.
- B. Quick-coupling valves are to be installed in the system to provide the Owner access so that the system can be winterized by blowing out the system with compressed air; therefore, the valves shall be located as directed by the City Engineer.

3.09 INSTALLATION - AUTOMATIC CONTROLLER

- A. The controller and remote control valves shall be of the same manufacturer, having similar operational and adjustment features.
- B. The controller shall have a weatherproof panel enclosure; with the controller mounted on a pedestal, where and as indicated on the drawings and as directed by the City Engineer; in such a manner that all normal adjustments can be conveniently made by the operator.
- C. The controller shall be properly grounded in accordance with local codes.
- D. Control wire shall be installed from the controller to all control valves and other equipment as required for proper operation of the sprinkling system.

3.10 WIRE AND ELECTRICAL WORK

- A. Electrical control and ground wire shall be suitable for sprinkler control cable of sizes indicated on the drawings and as recommended by the manufacturer or supplier.
- B. Use Type "UF", 600 volt, stranded or solid copper, single conductor wire, with PVC insulation and bearing UL approval for direct underground burial, for connecting the automatic remote control valves to the automatic controller.
 - 1. Use wire with 4/64-inch insulation, minimum covering of ICC-100 compound for positive weatherproofing protection.
 - 2. For wire sizes 14, 12, 10 and 8 use a single conductor solid copper wire; and for sizes 6 and 4 use stranded copper wire.
 - 3. Control or "hot" wires shall be red and all common or "ground" wires shall be white.
- C. Make all connections with UL approval Pen-tite type seal to make a waterproof connection.
- D. Bury wires in the same trench as the pipe where possible.
- E. Verify that all wire types and installation procedures conform to NEC and local codes.

3.11 INSTALLATION - SPRINKLER HEADS

- A. Flush the sprinkler system thoroughly to remove all foreign materials prior to the installation of sprinkler heads.
- B. Install rotor pop-up heads with a swing joint connection, as indicated on the drawings.
 - 1. All swing joints shall consist of three 90 degree Schedule 40 PVC street ells and Schedule 80 nipples with a minimum length of 12 inches.
 - 2. Size of swing joint pipe and fittings shall be as shown on the drawings.

- C. Install spray heads as indicated on the drawings.

3.12 BACKFLOW PREVENTER STATION

- A. Provide backflow preventer station, where and as indicated on the drawings; see Section 02686.

3.13 CONNECTIONS TO EXISTING WATER LINES

- A. Connection to existing water lines shall be made where and as indicated on the drawings and as directed by the Engineer. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.
- B. Excavate to existing pipe line at point of connection; determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipe lines.
- C. Connection which involve cutting into existing pipe lines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.
- D. Connection into existing pipe lines under pressure include: furnishing and installing mechanical joint tapping sleeve of the appropriate size on the existing pipe at point of connection; furnishing and installing tapping valve, with valve box, on sleeve; tapping existing pipe with acceptable type drilling machine and equipment, without interrupting flow in existing pipe line; and all appurtenant work required to complete the connection.
- E. Connection to existing pipe line shall be made at such times and within the time limits and according to the directions as agreed to between the Contractor and the City Engineer.

3.14 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Pressure test water piping to 1.25 times pipe line working pressure in psi.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

3.15 OPERATIONAL TESTING

- A. Provide the City Engineer or City Inspector with seven days written notice of sprinkling operational system test.
- B. Test shall consist of the operation of the entire system through one cycle of controller for propose of checking coverage and assuring of absence of leaks.
 - 1. Repair water lines, valves, or connections which show evidence of leakage.
- C. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the above required test.

END OF SECTION

SECTION 02686

BACKFLOW PREVENTER STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backflow preventer stations, complete, including:
 - 1. Backflow preventer valves.
 - 2. Pipe, fittings, valves, and appurtenant items.
- B. Station testing.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, pipe bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Pipe bedding and excavation backfilling.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

1.03 REFERENCES

- A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- B. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- C. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; (ANSI/AWWA C104/A21.4).
- D. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; (ANSI/AWWA C105/A21.5).
- E. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; (ANSI/AWWA C111/A21.11).
- F. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; (ANSI/AWWA C151/A21.51).
- G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association.
- H. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association.
- I. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; (ANSI/AWWA C508/C508a).
- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C509/C509a).
- #3 K. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; (ANSI/AWWA C515).

- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; (ANSI/AWWA C600).
- M. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, controllers, sprinkler heads, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of pipe lines, valves, controllers, sprinkler heads, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves and appurtenant items in shipping containers with labeling in place.

1.07 OPERATING AND MAINTENANCE DATA

- A. Provide instructions covering full operation, care and maintenance of backflow preventer valves; and manufacturer's parts catalog. Information shall be included in the manual for operation and maintenance of the backflow preventer station.
- B. Instruct Owner's designated maintenance personnel in the proper operation of the valves.
- C. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the valves from year to year.
 - 1. Submit prior to expiration of required one year guarantee period.
 - 2. Provide information in the manuals that include the following:
 - a. written index near front of Manual listing location in the Manual of all emergency data regarding the installation;
 - b. complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
 - c. copy of all guarantees and warranties issued on the installation showing all dates of expiration.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Ductile Iron Pipe: AWWA C151:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints:
 - a. Push-On Joints: AWWA C111, push-on type with rubber gasket.
 - b. Mechanical Joints: AWWA C111, mechanical joint type with gasket, bolts, and nuts.
 - c. Flange Joints: AWWA C110, flange type with gasket, bolts, and nuts.

3. Jackets: AWWA C105 polyethylene jacket.
- B. Steel Pipe: ASTM A 53:
1. Fittings: ASTM A 47.

2.03 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches:
1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, and handwheel.
 2. Product: Powell U.S. Bronze Gate Valves, or other valves acceptable to the City Engineer.
 3. Substitutions: See Section 01600 - Product Requirements.
- C. Gate Valves 3 Inches and Over:
1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 3. AWWA C515, ductile iron, bronze trim, non-rising stem with square operating nut, single ductile iron wedge, mechanical joint or flanged ends as indicated, and cast iron valve box.
 - #3 4. Product: Mueller Gate Valves or Resilient Seat Gate Valves, or American Flow Control Series 2500 Resilient Seat Gate Valves; with appropriate type Pacific States Cast Iron Valve Box, or accepted equal.
- D. Ball Valves Up To 2 Inches:
1. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, compression inlet end, compression outlet, with control rod, valve key, and extension box.
- E. Swing Check Valves From 2 Inches to 24 Inches:
1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
 2. Product: Mueller Swing-Type Check Valve, or other valves acceptable to the City Engineer.
- F. Butterfly Valves From 2 Inches to 24 Inches:
1. AWWA C504, iron body, bronze disc, resilient replacement seat, mechanical joint or flanged ends as indicated, manual worm gear operator, and cast iron valve box where required.
 2. Underground manual operators shall be totally enclosed, factory grease packed and sealed, bronze worm gear operators with self-locking gearing; stops shall be provided to prevent over travel of valve disc.
 3. Valve operator shall be geared to close valves slowly. Number of turns to close valve from full open position shall be: 32 turns for 10-inch and smaller valves, 52 turns for 12-inch thru 16-inch valves, and 76 turns for 18-inch thru 24-inch valves. Closing times for larger valves shall be accepted by the City Engineer.
 4. Product: Mueller "Linesal III" Butterfly Valve with appropriate type Pacific States Cast Iron Valve Box, or other valves acceptable to the City Engineer.

- G. Corporation Stops: shall be type for connecting to copper or polyethylene pipe; Mueller No. H- 15000, or other stops acceptable to the City Engineer, for up to 2-inch service line.
- H. Air Release Valves: shall be combination air release valves; APCO Combination Air Release Valves, or other valves acceptable to the City Engineer, of size indicated on the drawings.

2.04 BACKFLOW PREVENTER

- A. The backflow preventer shall be a reduced pressure type valve.
 - 1. The backflow preventer shall be bronze for 6-inch and smaller valves, and epoxy coated ductile iron for 8-inch and larger valves.
 - 2. The backflow preventer shall consist of two independently acting, spring-loaded check valves with a differential pressure relief valve located between the check valves.
 - 3. The backflow preventer shall include inlet and outlet shutoff valves; and four test cocks, three on the backflow preventer valve bodies and one on the inlet shutoff valve.
- B. The backflow preventers shall be of the appropriate size and type, as manufactured by Febco, Conbraco, or other valves acceptable to the City Engineer

2.05 MISCELLANEOUS METAL WORK

- A. Miscellaneous metal work shall be provided as indicated on the drawings, as required to complete the station, and as specified in Section 05200.

2.06 PAINTING

- A. All exposed pipe, valves, fittings, and metal work for the station shall be painted.
 - 1. Painting shall consist of either:
 - a. 4 coats of alkyd paint, Painting System II (Steel Structural Painting Council - Specification No. 2);
 - b. 4 coats of phenolic paint, Painting System III (S. S. P. C. - Specification No 3).
 - 2. Painting shall include surface preparation, pretreatment, primer coat, inter-mediate coats, and finish coat, as specified; with total dry film thickness not less than 4.0 mils.
 - 3. Aluminum surfaces which will be in contact with concrete after erection shall be coated with bituminous mastic coating, SSPC-Paint 12, prior to erection.

2.07 MISCELLANEOUS ITEMS

- A. Miscellaneous appurtenant items shall be as indicated on the drawings or as required to complete the station.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall furnish all labor, materials and equipment as required to construct the backflow preventer station, complete, as described herein, as shown on the drawings, and as directed by the City Engineer.
- B. The backflow preventer station shall be constructed on the supply line to the sprinkling system, as shown, where the supply line is connected to a culinary water line.
- C. All work shall be done according to local plumbing codes, and to manufacturer's written instructions and recommendations.

- D. The Contractor shall test the station to assure proper operation.

3.02 EXAMINATION

- A. Verify that design drawings conform to project conditions.
- B. Verify that water line sizes and locations are as indicated on the drawings.

3.03 PREPARATION

- A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside of pipes before assembly.
- C. Prepare pipe connections to equipment with flanges, mechanical joints or mechanical couplings.

3.04 EXCAVATING

- A. Excavating for the backflow preventer station shall be done to ensure proper grades and alignment as shown on the drawings.
- B. See Section 02312 and Sections 02315 and 02316 for additional requirements.
- C. Hand trim excavation for accurate placement of pipe to elevations indicated.
- D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required area of thrust restraint bearing on subsoil as indicated on the drawings.
- E. Backfill around sides and to top of pipe zone with pipe bedding material, tamp in place and compact to required density.
- F. Backfill trench from top of pipe zone to top of trench with trench backfill material, tamp in place and compact to required density.

3.05 INSTALLATION - PIPE

- A. Establish elevations of buried piping to ensure not less than 2 feet of cover over secondary water lines and 4 feet over culinary water lines; or as indicated on the drawings and as directed by the City Engineer or City Inspector.
- B. Install pipe to indicated elevation to within tolerance of one inches.
- C. Install ductile iron piping and fittings to AWWA C600.
- D. Install pipe lines to the line and grade indicated.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Slope water pipe and position drains at low points.

3.06 INSTALLATION - VALVES

- A. Set valves level and plumb, as indicated.
- B. Install adjustable pipe supports under each valve, as indicated and as directed.
- C. Reduced pressure (RP) backflow preventer assemblies shall be installed as indicated on the drawings and as described herein.

1. The assemblies shall be installed in a horizontal position only.
2. The assemblies shall be maintained as an intact assembly.
3. The bottom of the RP assembly shall be minimum of 12-inches above the ground or floor level; and shall not be closer than 12 inches to any wall, ceiling or other encumbrance. Assemblies shall be readily accessible for testing, repair and maintenance.
4. RP assemblies shall NOT be installed in a pit.
5. The relief valve on the RP assembly shall not be directly connected to any waste disposal line, including sanitary sewer, storm drains or vents.
6. RP assemblies shall be protected from freezing and vandalism where applicable and as directed.

3.07 CONCRETE WORK

A. Construct a concrete slab for the station over a compacted gravel base, as shown on the drawing and as directed by the City Engineer or City Inspector.

B. Concrete work and reinforcing shall conform to the requirements of Section 03300 of these specifications.

3.08 MISCELLANEOUS ITEMS

A. Miscellaneous appurtenant items shall be furnished and installed as indicated on the drawings or as required to complete the station.

3.09 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. Pressure test water piping to 1.25 times pipe line working pressure in psi.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to City.

3.10 OPERATIONAL TESTING

A. Provide the City Engineer or City Inspector with seven days written notice of operational test of backflow preventer.

B. Test shall consist of the operation of the station for propose of checking operation and assuring of absence of leaks.

1. Repair pipe, fittings, valves, or connections which show evidence of leakage.

C. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the above required test.

END OF SECTION

SECTION 02687

SERVICE WATER BACKFLOW PREVENTER STATION

PART 1 GENERAL

1.01 GENERAL INFORMATION

- A. Saratoga City has installed a secondary pressurized water system for irrigation purposes of the users. In order to protect the culinary water supply from contaminants in this secondary supply from reversing flow (backflow) into the culinary piping an approved separation must be installed.
- B. A Reduced Pressure Zone (RPZ) backflow preventer is required to protect the culinary supply of contaminants in the secondary supply from reversing flow (backflow) into the culinary piping. The RPZ has two (2) check valves with varying spring pressures creating an area of reduced pressure. The relief valve opens and discharges water when the supply pressure drops or back pressure conditions exist. The RPZ is required to be above ground and have a minimum of 12 inches of clearance to prevent the relief valve from being submerged in the event of an occasional discharge.
- C. Two (2) options are allowed to provide an approved separation of the culinary and secondary water supplies.
- D. The City Water Department must inspect each connection to this system to insure no cross connection exists.

1.01 SECTION INCLUDES

- A. Secondary Backflow Preventer Station Specifications.
- B. Approved Separation Options
- C. Backflow Station Inspection.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work: Excavating, pipe bedding, backfilling and compacting.
- B. Section 02315 - Excavation: Excavating for structures and appurtenant items.
- C. Section 02316 - Fill and Backfill: Pipe bedding and excavation backfilling.
- D. Section 03300 - Cast-in-Place Concrete: Concrete for structures and thrust blocks.

1.03 REFERENCES

- A. City of Saratoga Springs
- B. 1997 International Plumbing Code
- C. USC "Manual of Cross Connection Control" Ninth Edition Enclosures:
- D. Service Backflow Preventer Drawings WT-13, WT-14 & WT-15. (See Standard Waterline Details)

PART 2 PRODUCTS

2.01 BACKFLOW PREVENTER

- A. The backflow preventer shall be Reduced Pressure Zone Type Assembly (RPZ).

- B. The backflow preventer shall be as manufactured by Febco or Watts Regulator of the appropriate size and type, or acceptable equal.

PART 3 EXECUTION

3.01 INSTALLATION OPTIONS

- A. Two (2) options are allowed to provide an approved separation of the culinary and secondary water supplies as described below.
- B. Option 1
 - 1. The culinary sprinkler supply can be abandoned by removing the stop and waste valve, capping the line or fitting, and reburying it. In lieu of this, the stop and waste access pipe and supply line must be abandoned 18 inches below ground level and 10 (ten) inches of separation shall be created between the disconnection of secondary supply and the culinary supply.
 - 2. Systems which supply both irrigation and culinary water for the inside of the house must be disconnected on both sides of the foundation wall and the irrigation (secondary) water connected outside. Consult local sprinkler contractors or suppliers for more details.
 - 3. All disconnects must be available for inspection prior to acceptance of the system. All existing culinary sprinkler systems must be disconnected or have an RPZ backflow preventer properly installed before the secondary service will be activated. In the event a culinary supply sprinkler system is not installed an inspection is required for verification prior to activation of the secondary system
- C. Option 2
 - 1. If it is desired to use the either the culinary or secondary source a swing connection and a reduced pressure backflow preventer (RPZ) is required. (see dwg WT-15). Both sources cannot be connected at the same time, consequently the requirement for a swing connection.
 - 2. The flexible piping shall be anchored to the sprinkler head side of the system so it can be hooked to either supply with quick coupler or other removable connection.

3.01 INSPECTION AND TESTING

- A. Within ten (10) days of installation and yearly thereafter the backflow assembly shall be inspected by a certified backflow technician. A list of these testers is available at the **Saratoga City Water Department**.
- B. It is the responsibility of the property owner to have the backflow test completed and send the results to the Saratoga City Water Department Backflow Technician. The test procedure verifies that the backflow assembly is operating properly.
- C. Faulty assemblies create a dangerous cross connection and must be repaired or replaced and then tested again. Failure to complete a test and/or the repairs can result in termination of both culinary and secondary water services.

END OF SECTION

SECTION 02721

GRAVEL SURFACING AND ROAD BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. New gravel road base.
- B. Restore gravel road base.
- C. New gravel road surfacing.
- D. Restore gravel road surfacing.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching for Pipe Work.
- B. Section 02316 - Fill and Backfill: Compacted fill under base course.
- C. Section 02741 - Bituminous Paving: Binder and finish asphalt courses.

1.03 REFERENCES

- A. AASHTO M 147 - Materials for Aggregate and Soil-Aggregate; American Association of State Highway and Transportation Officials.
- B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in.(457 mm) Drop; American Association of State Highway and Transportation Officials.
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.05 PROJECT CONDITIONS

- A. Provide sufficient quantities of gravel material to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Gravel Road Base: Gravel road base, conforming to State Department of Transportation Standard Specifications, Section 301.
- B. Gravel Road Surfacing: Gravel road surfacing, conforming to State Department of Transportation Standard Specifications, Section 301.
- C. Gravel material shall be a Blended Aggregate material: Angular crushed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM C 136, within the following limits:
 - a. 1 inch sieve: 100 percent passing.
 - b. 1/2 inch sieve: 79 to 91 percent passing.
 - c. No. 4 sieve: 49 to 61 percent passing.
 - d. No. 16 sieve: 27 to 35 percent passing.
 - e. No. 200: 7 to 11 percent passing.
- D. Portion of aggregate passing through No. 40 sieve shall be non-plastic.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. For new gravel road base and gravel surfacing, verify that sub-base has been compacted and accepted by the City Engineer or City Inspector, that gradients and elevations are correct, and that it is dry.
- B. Verify that all areas of collapsible soil have been identified and properly prepared for road base.

- C. For restoration of gravel road base and gravel surfacing, verify trenches and excavations have been backfilled, compacted and accepted by the City Engineer or City Inspector, that gradients and elevations are correct, and that they are dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. New gravel road base and surfacing.
 - 1. Place gravel road base material over prepared substrate to provide total compacted thickness as indicated and as directed by the City Inspector.
 - 2. Spread gravel surfacing material over prepared substrate to provide total compacted thickness as indicated and as directed by the City Inspector.
- B. Restoration of gravel road base and surfacing.
 - 1. Restore gravel road base, along with temporary gravel surfaces, within one day after trench backfill has been placed, compacted and accepted by the City Inspector.
 - 2. Place temporary gravel surfaces, where gravel surfacing is to be restored, within one day after trench backfill has been placed, compacted and accepted by the City Inspector.
 - 3. Restore gravel surfacing within 7 days after trench backfill has been placed, compacted and accepted by the City Inspector.
 - 4. Temporary gravel shall be maintained by blading, sprinkling, rolling, adding additional gravel as required, and appurtenant work to provide a safe, uniform surface over trench area satisfactory to the City Inspector. The temporary surface shall be restored at least every 7 days until the final surfacing is to be placed; and sprinkled with water at least once each day, including weekends and holidays.
 - 5. When final surfacing is to be placed, remove the temporary gravel to the bottom of the surface to be restored. After removing temporary gravel, the sub-base shall be graded and rolled to provide a compact, smooth base for placement of final surfacing.
 - 6. Spread gravel surfacing material over prepared substrate to provide total compacted thickness equal to the adjacent surfacing, but not less than the thickness as indicated.
 - 7. Place gravel road base material over prepared substrate to provide total compacted thickness equal to the adjacent road base, but not less than the thickness as indicated.
- C. Place material at near optimum moisture.
- D. Place aggregate in maximum 4 inch layers and roller compact to 95 percent of maximum dry density.
- E. Level and contour surfaces to elevations and gradients indicated.
- F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556 or ASTM D2922.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: At least one test per lift per 150 linear foot of new or restored road base or surfacing, and as directed by the City Engineer or Inspector.

3.06 CLEAN-UP

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 02741
BITUMINOUS PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous paving for new surfaces.
- B. Bituminous paving for restoration of bituminous surfaces.
- C. Bituminous paving for overlay.

1.02 RELATED SECTIONS

- A. Section 02316 - Fill and Backfill: Compacted subgrade for paving.
- B. Section 02721-Gravel Road Base Course: Gravel road base course.

1.03 REFERENCES

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute.
- B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute.
- C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- #3 D. Utah Department of Transportation Standard Specifications, Section 02741.
- E. Use the latest issue of the above reference standards as of the date of the Project.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with appropriate sections of Utah Department of Transportation Standard Specifications.
- B. Mixing Plant: Conform to U.D.O.T. Standard Specifications.
- C. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable City requirements for paving work on City streets.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Place asphalt mix when ambient air or base surface temperature is 50 degrees F and rising for new roads, or 70 degrees F and rising for overlay; and do not place when surfaces are wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: Grade AC-20; conforming to U.D.O.T. Standard Specifications, Section 704.
- B. Aggregate for Binder Course: Angular crushed washed stone; free of shale, clay, friable material and debris.
 - 1. 3/4-inch Mix; graded in accordance with ASTM C 136, within the following limits:
 - a. 3/4 inch sieve: 100 percent passing.
 - b. 1/2 inch sieve: 74 to 99 percent passing.
 - c. 3/8 inch sieve: 69 to 91 percent passing.
 - d. No. 4 sieve: 49 to 65 percent passing.
 - e. No 8 sieve: 33 to 47 percent passing.
 - f. No. 16 sieve: 21 to 35 percent passing.
 - g. No. 50 sieve: 6 to 18 percent passing.
 - h. No. 200: 2 to 6 percent passing.
 - 2. 1/2-inch Mix; graded in accordance with ASTM C 136, within the following limits:
 - a. 1/2 inch sieve: 100 percent passing.
 - b. No. 4 sieve: 60 to 80 percent passing.
 - c. No. 16 sieve: 28 to 42 percent passing.
 - g. No. 50 sieve: 11 to 23 percent passing.
 - h. No. 200: 5 to 9 percent passing.
- C. Tack Coat: Homogeneous, rapid curing, liquid asphalt; conforming the U.D.O.T. Standard Specifications.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Binder Course: 5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2; and conforming to U.D.O.T. Standard Specifications.
- C. Submit proposed mix design of each class of mix for review prior to beginning of work.
- #3 D. The mix design shall meet the following requirements:

Marshall Stability	1,200 pounds (minimum)
Flow (0.01 inch)	10 - 18
Voids Content	3% to 5%
Voids in Mineral Aggregate (VMA)	14% (minimum)

2.03 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads; and that subgrade has been accepted by the City Inspector.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

- A. Section 02721 - Gravel Base Course forms the base construction for work of this section.

3.03 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat to contact surfaces of curbs, gutters and existing pavement.
- C. Apply tack coat to contact surfaces of manhole frames.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with U.D.O.T. Standard Specifications.
- B. Place asphalt within two hours of applying tack coat.
- C. Place to compacted thickness indicated.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within two hours of applying tack coat.
- B. Place binder course to compacted thickness required and as directed.
- C. Place wearing course within two hours of placing and compacting binder course.
- D. Place wearing course to compacted thickness required to obtain total pavement thickness indicated.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

3.07 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for general requirements for quality control.
- B. Provide field inspection and testing. Take samples and perform tests in accordance with U.D.O.T. Standard Specifications.

3.08 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for two days or until surface temperature is less than 140 degrees F.

END OF SECTION

SECTION 02751

BITUMINOUS SEAL COAT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous seal coat for overlay.

1.02 REFERENCES

- A. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute.
- B. Utah Department of Transportation Standard Specifications, Section 405.
- C. Use the latest issue of the above reference standards as of the date of the Project.

1.03 QUALITY ASSURANCE

- A. Perform all Work in accordance with appropriate sections of Utah Department of Transportation Standard Specifications.
- B. Obtain materials from same source throughout.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable City requirements for paving work on City streets.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Place seal coat when ambient air or base surface temperature is 70 degrees F and rising. Pavement surfaces may not be above 120 degrees F.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: Rapid-cure emulsified asphalt, CRS-2h; conforming to requirements of AASHTO Designation M-208.
- B. Aggregate for Cover Material: Angular crushed aggregate; free of shale, clay, friable material and debris. Maximum dry-unit weight of 100 pounds per cubic foot.
 - 1. Graded in accordance with ASTM C 136, within the following limits:
 - a. 1/2 inch sieve: 100 percent passing.
 - b. 3/8 inch sieve: 85 to 100 percent passing.
 - c. No. 4 sieve: 0 to 5 percent passing.
 - d. No. 200: 0 to 1 percent passing.
 - 2. Cover material shall maintain wear at less than 30 percent; and weight loss at less than 10 percent.

- C. Temporary Raised Pavement Markers. Markers shall have polyurethane plastic bodies with reflective tape, clear flexible polyvinyl-chloride protective covers, and solid butyl rubber adhesive on bottom surface. Markers shall be 2-inches high and 4-inches wide; and of the color selected by the Engineer. Pavement markers shall be Temporary Raised Pavement Markers as manufactured by Davidson Plastics Company, or as acceptable to the City Engineer.

2.02 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean existing paved surfaces of all dirt, sand, dust and other objectionable material with use of power broom, prior to placing seal coat. Power broom shall be of a type acceptable to the City Engineer or City Inspector.
- B. Protect all existing structures from being spattered or marred, including curb and gutter, etc.

3.02 PLACING TEMPORARY ROAD MARKERS

- A. Prior to placing seal coat, install markers in accordance with U.D.O.T. Standard Specifications.
- B. Install markers in accordance with the manufacturer's written instructions and recommendations, and as directed by the City Engineer or City Inspector.
- C. Remove covers immediately after rolling is complete.

3.03 PLACING ASPHALT MATERIAL

- A. Asphalt material shall be placed in accordance with U.D.O.T. Standard Specifications.
- B. Place material with a distributor equipped with a hydrostatic system and full circulating spray bar to spray the emulsion.
 - 1. Distributors shall be equipped with devices and charts to provide accurate and rapid determination and control of the amount of material being applied per square yard of surface; and with tachometers reading speeds in feet per minute.
 - 2. Equipment shall be able to control the rate that a uniform application of material may be made, ranging from 0.05 to 0.75 gallons per square yard of surface; to a width of at least 12 feet; and with a range of pressure from 25 to 75 pounds per square inch.
 - 3. Distributors shall be self-powered and shall have sufficient power to maintain a constant and uniform speed; and shall be equipped with a thermometer well, thermometer, adjustable spray bar and positive shut-off valves.
- C. The rate of application shall be 0.25 to 0.35 gallons per square yard, as directed by the Engineer; maintain a tolerance of 0.03 gallons, more or less, per square yard.
- D. Take special care to insure that joints between spreads are properly made, by starting and stopping the distributor on paper or by other methods acceptable to the City Inspector.
- E. Maintain a distance of not more than 100 feet between the distributor and the chip spreader.

3.04 PLACING COVER MATERIAL

- A. Cover material shall be spread by means of a spreader box, which can be adjusted to uniformly spread cover material at the required rate per square yard, as required and as directed by the City Engineer or City Inspector. Spreader box shall be of type acceptable to the City Engineer or City Inspector.
- B. Rate of application of cover material shall be 20 to 25 pounds per square yard; with a tolerance of plus 1 to a minus 2 pounds per square yard.
- C. After applying cover material, hand broom material, as required, to distribute the material uniformly over the surface.

3.05 ROLLING SURFACES

- A. After the cover material has been uniformly spread over surfaces, surfaces shall be rolled until the cover material is thoroughly embedded in the asphalt material.
- B. Use pneumatic-tire rollers in a longitudinal direction to roll surface. Equipment shall have at least two rollers up front and one roller behind; this last roller serves as a finish roller.

3.06 CLEAN-UP

- A. After seal coat has thoroughly set, excess cover material shall be broomed from the surface.
- B. Sweep surfaces before allowing uncontrolled traffic on the seal coat.
- C. On sections of streets where paved gutters are present, excess cover material shall be loaded, hauled and disposed of as required and as directed by the City Engineer or Inspector; which includes removing cover material from the gutters and waterways.

END OF SECTION

SECTION 02821

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases; concrete foundation for posts.
- C. Manual swing gates and related hardware.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCES

- A. ASTM A 116 - Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- E. ASTM A 570/A 570M - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
- F. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- G. ASTM F 567 - Standard Practice for Installation of Chain-Link Fence.
- H. ASTM F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- I. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute.
- J. Use the latest issue of the above reference standards as of the date of the Project.

1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
- D. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Posts, Rails, Frames and Extension Arms: ASTM F 1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 25 ksi.
- B. Wire Fabric: ASTM A 392 zinc coated steel chain link fabric; with black or green epoxy coating, as approved by the Engineer.
- C. Concrete: ASTM C 94; Normal Portland Cement, 2,500 psi strength at 28 days, 3 inch slump; 3/4 inch nominal sized coarse aggregate.

2.02 COMPONENTS

- A. Line Posts: 1.90 inch outside diameter.
- B. Corner and Terminal Posts: 2.38 inch outside diameter.
- C. Gate Posts: 3.5 inch outside diameter, or as required for gate size.
- D. Top and Brace Rail: 1.66 inch outside diameter, plain end, sleeve coupled.
- E. Gate Frame: 1.66 inch diameter for welded fabrication.
- F. Fabric: 2 inch diamond mesh interwoven wire, 9 gauge thick, top selvage knuckle end closed, bottom selvage twisted tight.
- G. Tension Wire: 7 gauge thick steel, single strand.
- H. Tension Band: 3/16 inch thick steel.
- I. Tension Strap: 3/16 inch thick steel.
- J. Tie Wire: Aluminum alloy steel wire.
- K. Barbed Wire: 11 gauge strand, with 4 point barbs at 3 inch spacing.

2.03 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Extension Arms: provided for all posts where barbed wire is required; to hold 3 strands of barbed wire and designed to withstand 200 pound weight.
- C. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- D. Gate Hardware: Fork latch with gravity drop; two 180 degree gate hinges per leaf and hardware for padlock.

2.04 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A 123/A 123M, at 1.7 oz/sq ft.
- B. Hardware: Galvanized to ASTM A 153/A 153M, 1.8 oz/sq ft coating.
- C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F 567.
 - B. Place fabric on outside of posts and rails.
 - C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
 - D. Line Post Footing Depth Below Finish Grade: ASTM F 567.
 - E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F 567.
 - F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
 - G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
 - H. Do not stretch fabric until concrete foundation has cured 28 days.
 - I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
 - J. Position bottom of fabric 2 inches above finished grade.
 - K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
 - L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
 - M. Install bottom tension wire stretched taut between terminal posts.
 - N. Do not attach the hinged side of gate to building wall; provide gate posts.
 - O. Install gate with fabric to match fence. Install three hinges per leaf, latch, catches, drop bolt.
 - P. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
 - Q. Provide extension arms and three strands of barbed wire on 6-foot high chain link fences, where required and as directed by the City Engineer.
 - R. 6-foot high chain link fence with three strands of barbed wire shall be installed around all public facilities, as directed by the City Engineer.
- #3** S. Construct concrete mow strips under all fences. Mow strips are to be 12-inch wide, centered on the fence, and 6-inch thick.

3.02 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 02850

CONCRETE STREET IMPROVEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place concrete curb and gutter and appurtenant items.
- B. Cast-in-place concrete waterways and appurtenant items.
- C. Cast-in-place concrete sidewalks and appurtenant items.
- D. Cast-in-place concrete driveway pavement and appurtenant items.
- E. Handicap ramps and appurtenant items.
- F. Curb-cut type driveway entrances and appurtenant items.
- G. Cast-in-place concrete speed tables.

1.02 RELATED SECTIONS

- A. Section 02300 - Roadway and General Excavation.
- B. Section 02315 - Structural Excavation.
- C. Section 02316 - Fill and Backfill.
- D. Section 02721 - Gravel Road Base.
- E. Section 03300 - Cast-In-Place Concrete.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: As specified in Section 03300 - Cast-in-Place Concrete; using 3/4 inch maximum aggregate.
- B. Concrete Reinforcement: As specified in Section 03300.
- C. Gravel Base: As specified in Section 02721 - Gravel Road Base.
- D. Expansion Joint Filler: Shall be 1/2-inch thick; conforming to ASTM D 1751 or AASHTO M 213. Joint filler shall be one-piece; and shall extend full width and depth of concrete section; 1/4-inch below and conforming to finished top surfaces of concrete items.

#3 E. Handicap Ramp Warning Panels.

- 1. Panels shall be detectable warning systems conforming to ADA, FHWA and other appurtenant regulations; designed for exterior use and surface application.

2. Panels shall be durable panels molded from polyurethane, with truncated domes, meeting both state and federal guidelines for handicap detection.
3. Panels shall be molded from high strength polyurethane.
 - a. Submit manufacturer's literature describing products, installation procedures and routine maintenance; and three samples of surface applied mat to be supplied.
 - b. Panels shall have slip resistance in wet and dry environments.
 - c. Panel color shall be yellow; conforming to Federal Color # 33538. Color shall be homogenous throughout the mat.
4. Panels shall comply with Americans with Disabilities Act, Title 49, Section 4.29 2.
5. Mats shall be installed according to manufacturer's written instructions and recommendations.
 - a. Mats shall be applied to concrete surfaces with heavy-duty elastomeric two-part polyurethane ground adhesive, as recommended by the manufacturer.
 - b. Edges and seams shall be sealed with cyanoacrylate sealer, as recommended by the manufacturer.
 - c. Low profile nylon expansion anchors shall be installed after mats are installed, according to the manufacturer's instructions and recommendations.
6. After mats have been installed, the mats shall be protected from damage as recommended by the manufacturer.
7. Mats shall be cleaned by method specified by manufacturer.
8. Panels shall be Detectable Warning Mats as manufactured by Detectable Warning Systems, Inc., or or acceptable equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify excavation for concrete items is correct.
- B. Verify that sub-base has been compacted and accepted by the City Engineer or City Inspector, and that gradients and elevations are correct.
- C. Verify that all areas of collapsible soil have been identified and properly prepared for sub-base.

3.02 EARTHWORK

- A. See Section 02300 - General Excavation and Section 02315 - Structural Excavation for requirements for excavating, backfilling and compacting; See Section 02316 - Fill and Backfill for requirements for filling and backfilling; and see Section 02721 - Gravel Road Base for requirements for gravel base.
- B. Hand trim excavations for accurate placement of gravel base for concrete items.
- C. Furnish, place, grade and compact gravel base for concrete work, as indicated on the drawings and as directed.
 1. Curb and Gutter: compacted thickness shall be 6 inches.
 2. Waterways: compacted thickness shall be 6 inches.
 3. Sidewalks: compacted thickness shall be 6 inches.
 4. Driveway Pavement: compacted thickness shall be 6 inches.

D. Backfill around completed concrete items to required elevations, tamp in place and compact as required.

3.03 CONSTRUCTION

A. Form Work.

1. Forms shall be set to the required grade and lines, as indicated on the drawing; rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuous progress of work; and so that forms can remain in place for at least 24 hours after placement of concrete.
3. Check completed form work for grade and alignment, before placing any concrete. Tolerances for form work shall not exceed 1/8-inch in 10 feet for the top of forms; and 1/4-inch in 10 feet for the vertical face.
4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Concrete Placement.

1. Comply with applicable requirements of Section 03300 - Concrete for design, mixing and placement of concrete; and with the requirements herein.
2. Do not place concrete until subgrade and forms have been checked for line and grade; and are acceptable to the City Engineer or City Inspector.
3. Moisten subgrade as required to provide a uniform dampened condition at time concrete is placed.
4. Place concrete using methods which will prevent segregation of concrete mix, and with as little re-handling as possible.
5. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
6. Consolidate concrete along the face of forms with an internal vibrator. Keep vibrator away from joint assemblies or side frames. Consolidate with care to prevent dislocation of reinforcement and joint materials.
7. Use only square-faced shovels for hand spreading and consolidation.
8. Where handicap ramps and curb-cut type driveway entrances are to be constructed, the curb of new curb and gutter shall be eliminated down to the limits and for the width indicated on the drawings and as directed; and the curb shall be sloped on each side of the ramp and driveway entrance as indicated.

C. Expansion Joints. Construct expansion joints true-to-line, with face perpendicular to the surface of the concrete item and at right angle to centerline of the concrete item, unless shown otherwise. Joints shall be filled with joint filler material.

#1

1. Curb and Gutter. Provide expansion joints at a spacing not to exceed **100** feet, on center; where curb and gutter abuts drainage structures and other concrete construction; and elsewhere as indicated on the drawings and as directed by the City Engineer.
2. Waterways. Provide expansion joints as indicated on the drawings and as directed by the City Engineer.
3. Sidewalks. Provide expansion joints at a spacing not to exceed 40 feet, on center; where new sidewalks abuts ramps, curb and gutter, and other concrete construction; and elsewhere as indicated on the drawings and as directed by the City Engineer.

4. Driveway Pavement. Provide expansion joints as indicated on the drawings and as directed by the City Engineer; and where pavement abuts other concrete construction.
 5. Speed Tables. Provide expansion joints as indicated on the drawings and as directed by the City Engineer; and where speed tables abut other concrete construction.
- D. Construction Joints. Construct construction joints true-to-line, with face perpendicular to the surface of the concrete item and at right angle to centerline of the concrete item, unless shown otherwise. Joints shall be filled with joint filler material.
1. Provide construction joints where required and as directed by the City Engineer.
- E. Contraction Joints. Construct contraction (weakened-plane) joints true-to-line, with face perpendicular to the surface of the concrete item and at right angle to centerline of the concrete item, unless shown otherwise.
1. Curb and Gutter. Provide contraction joints at a spacing not to exceed 10 feet, on center; unless indicated otherwise on the drawings and as directed by the City Engineer. Construct joints by inserting a 1/8-inch thick steel division plate, matching cross-section of curb and gutter, into concrete; plate shall not extend into bottom 4-1/2 inches of the curb and gutter. Set division plate into plastic concrete and carefully remove after concrete has hardened.
 2. Waterways. Provide contraction joints at a spacing not to exceed 10 feet, on center; unless indicated otherwise on the drawings and as directed by the City Engineer. Construct joints by inserting a 1/8-inch thick steel division plate, matching cross-section of waterway, into concrete; plate shall be embedded 1/4 of waterway thickness, measured from the flow line of waterway. Set division plate into plastic concrete and carefully remove after concrete has hardened.
 3. Sidewalks. Provide contraction joints at a spacing not to exceed 4 feet, on center; unless indicated otherwise on the drawings and as directed by the City Engineer. Construct joints by inserting a 1/8-inch thick steel division plate into concrete; plate shall be embedded 1/4 of sidewalk thickness, measured from the top of sidewalk. Set division plate into plastic concrete and carefully remove after concrete has hardened.
 4. Driveway Pavement. Provide contraction joints at a spacing not to exceed 6 feet, on center; unless indicated otherwise on the drawings and as directed by the City Engineer. Construct joints by inserting a 1/8-inch thick steel division plate into concrete; plate shall be embedded 1/4 of sidewalk thickness, measured from the top of pavement. Set division plate into plastic concrete and carefully remove after concrete has hardened.
 5. Speed Tables. Provide contraction joints at a spacing not to exceed 10 feet, on center; unless indicated otherwise on the drawings and as directed by the City Engineer. Construct joints by inserting a 1/8-inch thick steel division plate, matching cross-section of speed table, into concrete; plate shall be embedded 6-inches, measured from the top of the table. Set division plate into plastic concrete and carefully remove after concrete has hardened.
- F. Finishing and Ruling.
1. After striking off and consolidating concrete, smooth exposed surfaces by screeding and floating; adjust floating to compact surfaces and produce uniform texture.
 2. After floating, check surfaces for trueness with a 10-foot long straightedge. Distribute concrete as required to remove surface irregularities; and refloat repaired surfaces to provide smooth, continuous surfaces with a tolerance of 1/4-inch when measured by the 10-foot long straightedge.
 3. Work edges of gutters, waterways, sidewalks and driveway pavement, transverse joints, and contraction joints with an edging tool; and round to 1/4-inch radius, unless indicated otherwise.

4. Work edges of top back of curbs with an edging tool; and round to 1/2-inch radius, unless indicated otherwise.
5. Finishing:
 - a. Curb and Gutter. After completion of floating and when excess moisture and surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance.
 - b. Waterways. After completion of floating and when excess moisture and surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance. Surfaces shall be warped to match flow lines of gutters at each end of waterway, as indicated on the drawings and as directed by the City Engineer.
 - c. Sidewalks. After completion of floating and when excess moisture and surface sheen has disappeared, broom finish exposed surfaces by pulling a fine-hair broom across concrete surfaces, perpendicular to line of traffic, until uniform in texture and appearance, and acceptable to the City Engineer.
 - d. Driveway Pavement. Pavement shall be finished as specified for sidewalks; with rough flat finish acceptable to the City Engineer.
 - e. Speed Tables. After completion of floating and when excess moisture and surface sheen has disappeared, trowel finish exposed surfaces smooth, free of trowel marks, and uniform in texture and appearance.

G. Form Removal and Repair Work.

1. Forms shall not be removed for at least 24 hours after concrete has been placed, unless otherwise acceptable to the City Engineer.
2. After form removal, clean ends of joints and point-up minor honeycombed areas.
3. Remove and replace areas or sections of concrete with major honeycomb areas, as required and as directed by the City Engineer.

H. Curing Concrete.

1. Protect and cure finished concrete, complying with applicable requirements of Section 03300 - Concrete.
2. Use moist-curing methods for initial curing, whenever possible.
3. A membrane-forming curing compound shall be used, when directed by the City Engineer; applied in accordance with the manufacturer's written instructions.

3.04 SPECIAL CONSTRUCTION

- A. Curb-Cut Type Driveway Entrances. Driveway entrances shall consist of modifying the curb of 30 inch curb and gutter and warping surfaces of 6-inch thick concrete driveway pavement or concrete sidewalk for the width and to the configuration indicated on the drawings, as described herein, and as directed by the City Engineer.
 1. Curb of curb and gutter shall be eliminated down to the limits indicated on the drawings, and to the width of the existing driveway, or as directed; and the curb shall be sloped on each side of the driveway as indicated.
 2. Where there is a park strip between the sidewalk and back of curb and gutter, driveway pavement, 6-inches thick, shall be constructed between the sidewalk and the back of curb. The surfaces of the driveway pavement shall be shaped to form a smooth entrance from the curb-cut at the curb and gutter to the edges of the sidewalk, as indicated.

3. Where the sidewalk is adjacent to the back of curb and gutter, 6-inches thick sidewalk shall be constructed at the driveway entrance, as indicated. The surfaces of the sidewalk shall be shaped to form a smooth entrance from the curb-cut at the curb and gutter to the edge of the sidewalk adjacent to the property line, as indicated and as directed.

B. Handicap Ramps. Handicap ramps shall be constructed at curb and gutter radius sections at street intersections, as indicated on the drawings. Work shall consist of modifying the curb of 30 inch curb and gutter and warping surfaces of concrete sidewalk for the width and to the configuration indicated on the drawings, as described herein, and as directed by the City Engineer.

1. Excavate as required to establish the proper sub-base for the gravel base for the ramp.

#3

2. Furnish, place, grade and compact gravel base, 6-inches thick.

3. Curb of curb and gutter shall be eliminated down to the limits and to the width indicated on the drawings, or as directed; and the curb shall be sloped on each side of the handicap ramp as indicated.

#3

4. Where there is a park strip between the sidewalk and back of curb and gutter, concrete pavement, 5-inches thick, shall be constructed to match back of curb and gutter radius section and the ends of the sidewalk on each side of the ramp. The surfaces of the concrete pavement shall be shaped to form a smooth ramp from the curb-cut at the curb and gutter to the ends of the sidewalk, as indicated.

#3

5. Where the sidewalk is adjacent to the back of curb and gutter, concrete pavement, 5-inches thick shall be constructed to match back of curb and gutter radius section and the ends of the sidewalk on each side of the ramp, as indicated. The surfaces of the concrete pavement shall be shaped to form the handicap ramp from the curb-cut at the curb and gutter to the ends of the sidewalk, as indicated and as directed.

#3

6. Warning panels shall be installed as indicated on the standard drawings; according to the manufacturer's drawings, written instructions and recommendations.

C. Speed Tables. Speed tables shall be constructed as indicated on the drawings, as described herein, and where and as directed by the City Engineer.

3.05 REPAIR AND MAINTENANCE

A. Contractor shall repair and maintain project curb and gutter, waterways, sidewalks, driveway pavement, driveway entrances, handicap ramps, and other concrete structures as required, during the guarantee period.

1. All repairs shall be made with materials similar and equal to those described in these specifications.
2. All construction shall be done as described in these specifications.

B. Contractor shall, just before expiration of the guarantee period, make all such repairs as may be necessary to produce concrete items which will:

1. Conform substantially in contour to the concrete item as first constructed.
2. Be free from cracks or depressions showing disintegration of the concrete mixture of the concrete item.
3. Be free from all settlement of the surface of the concrete pavement holding water, or other settlements showing variation of 3/8-inch or more from the edge of a four-foot long straightedge.
4. Not have settled because of incomplete compaction of the subgrade.

C. When repairs, that are necessary to be made during the guarantee period, amount to more than fifty percent of a section between two expansion joints, the entire section shall be removed and disposed of; and that section shall be reconstructed in accordance with these specifications.

3.06 PROTECTION OF CONSTRUCTED CONCRETE ITEMS

- A. Protect concrete items of this section from damage by subsequent construction activities.
- B. Replace damaged concrete items which cannot be repaired to the City Engineer's satisfaction.

END OF SECTION

SECTION 02925

RESTORING WETLANDS AREAS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Restoration of wetlands areas.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

1.03 REFERENCES

- A. Standards of Official Seed Analysis of North America.

1.04 DEFINITIONS

- A. Weeds: Includes Cheatgrass (*Bromus Tectorum*), Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, and Perennial Sorrel.

1.05 SUBMITTALS

- A. See appropriate sections of the Contract Documents for submittal procedures.
- B. Certification: Submit certification of grass species and location of seed source.

1.06 QUALITY ASSURANCE

- A. Seed Vendor: Company specializing in seed with minimum five years experience, and certified by the State of Utah.
- B. Installer Qualifications: Company approved by the seed vendor.

1.07 REGULATORY REQUIREMENTS

- A. Comply with the requirements of the U.S. Army Corps of Engineer for work within wetlands areas.
- B. Comply with regulatory agencies for fertilizer and herbicide composition.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wetlands Seed Mix.
 - 1. Seed Mix. Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by the Association of Seed Analysis of North America. Provide seed of species, mechanically premixed to the specified proportions, with minimum percentages of purity, germination and maximum percentages of weed seed as certified. Seed Mix shall be a blend of the listed seeds, as supplied by Granite Seed Company of Lehi, Utah.
 - 2. Standards. Seed mix shall comply with "Standards of Official Seed Analysis of North America"; for 85% purity, 80% germination and 1% (maximum) weed seed.
 - 3. Submit seed vendor's certified statement for each seed mixture required; stating botanical and common name, percentage by weight, and percent of purity, germination and weed seed for each seed species.
 - 4. Provide Wetland seed mix of the following species and with proportions as approved by the Corps of Engineers:
 - a. Nebraska Sedge (*Carex nebrascensis*)
 - b. Baltic Rush (*Juncus balticus*)
 - c. Redtop (*Agrostic alba*)
 - d. Garrison Creeping Foxtail (*Alopecurus Arundinaceus*)
 - 5. Sow the seed mix in quantities to provide pure, live seed at the coverage rate of 20 pounds per acre.
 - 6. Delivery. Seed shall be delivered to the site in original unopened containers, bearing the dealer's guaranteed analysis and germination percentage and a certificate or stamp or release by a County agriculture commissioner.
- B. Fertilizer: Recommended for seed mix, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.02 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 01400.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

- A. Prepare sub-grade in accordance with Section 02312.
- B. Place topsoil, where required, in accordance with Section 02312.

3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to seeding.
- C. Apply fertilizer no more than 48 hours before installing erosion control mat and seeding.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 RESTORATION OF WETLANDS AREAS

- A. Restore existing wetlands areas which are disturbed or damaged by project trenching operations or structural excavations, as indicated on the drawings and as directed by the City Engineer. Wetlands areas shall be as classified by the U.S. Army Corps of Engineers, following field reconnaissance and testing; and shall be to the limits designated by the Engineer..
 - 1. Restoration shall be done according to the wetlands permit included with the approved project drawings.
 - 2. Remove the top 2 feet of top soil material and store separately from other excavated material, as directed by the Engineer.
 - 3. After the lower portions of trench or excavations are backfilled with acceptable materials and compacted, the stockpiled top soil material shall be placed in the upper portion of the trench or excavations and compacted, as directed by the Engineer.
 - 4. Top of restored top soil shall match adjacent ground surfaces.
 - 5. Restoration of wetlands areas shall include preparation of seedbeds and seeding the areas to be restored.
 - 6. Condition of restored wetlands areas shall match original conditions and shall be acceptable to the City Engineer and the Corps of Engineers.
- B. Planting.
 - 1. Preparation.
 - a. Till area to be planted to a depth of not less than 4 inches prior to seeding; and to a homogeneous mixture of fine texture, free of lumps and clods.
 - b. Grade planting areas to provide smooth, even surfaces with a loose, uniformly fine texture. Roll and rake and remove ridges and fill in depressions as required.
 - c. Moisten prepared areas by sprinkling before planting, if soil is dry. Water thoroughly and allow surface to dry off before planting. Do not create muddy soil condition. Sprinkling will not be required if seeding is done during spring or fall seeding season.
 - 2. Seeding.
 - a. Seed shall be applied by hydraulic method with a hydro-seeder at the coverage rate recommended by the seed vendor and as accepted by the City Engineer. Seeding may be done using spreader or seeding machine, at the rate indicated and as recommended by the seed vendor, as acceptable to the City Engineer. Do not use wet, moldy or damaged seed.
 - b. Distribute seed evenly over entire area by sowing equal quantities in two opposite directions.
 - c. Seeding shall not be performed when the wind velocity exceeds 5 miles per hour, or is determined detrimental to the uniform distribution of seed.

3. All materials must be available for inspection prior to application.
4. Restore prepared areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

END OF SECTION

SECTION 02926

LANDSCAPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Fertilizing.
- C. Seeding
- D. Maintenance.

1.02 RELATED SECTIONS

- A. Section 02312 - Trenching: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

1.03 REFERENCES

- A. Standards of Official Seed Analysis of North America.
- B. ANSI Z60.1, American Standard for Nursery Stock.

1.04 DEFINITIONS

- A. Weeds: Includes Cheatgrass (*Bromus Tectorum*), Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, and Perennial Sorrel.

1.05 SUBMITTALS

- A. See appropriate sections of the Contract Documents for submittal procedures.
- B. Certification: Submit certification of grass species and location of seed source.
- C. Maintenance Data: Include maintenance instructions, cutting method and maximum height; types, application frequency, and recommended coverage of fertilizer.

1.06 QUALITY ASSURANCE

- A. Seeds.
 - 1. Vendor: Company specializing in supplying seed with a minimum five years experience, and certified by the State of Utah.
 - 2. Installer Qualifications: Company approved by the seed vendor.
- B. Trees.
 - 1. Vendor: Company specializing in growing and cultivating trees with a minimum five years experience, and certified by the State of Utah.
 - 2. Installer Qualifications: Company specializing in installing and planting trees and approved by tree supplier.

1.07 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

1.08 MAINTENANCE SERVICE

- A. Furnish service and maintenance of seeded areas for three months from Date of Substantial Completion.
- B. Maintain seeded areas immediately after placement until vegetation is well established and exhibits a vigorous growing condition.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Seed.
 - 1. Land Grass Mix. Lawn grass seed shall be fresh, clean, new crop seed; mechanically premixed to the specified proportions. Lawn grass seed shall be a blend of the following seeds, as supplied by Granite Seed Company of Lehi, Utah: Kentucky Bluegrass, 90 %, Rye Grass, 10 %; planted at a rate of 3.0 pounds per 1000 square feet.
 - 2. Native Grass Seed Mix. Native grass seed shall be fresh, clean, new crop seed; mechanically premixed to the specified proportions. Native grass seed shall be a blend of the following seeds, as supplied by Granite Seed Company of Lehi, Utah:

#1	<u>TYPE</u>	<u>PLANTING RATE</u> <u>(Pounds of Pure Live Seed / Acre)</u>		
		<u>BROADCAST</u>	<u>DRILLED</u>	<u>PERCENTAGE</u>
	Slender Wheat Grass (<i>Agropyron trachucaulum</i>)	2.75	2.06	13.75 %
	Bluebunch Wheat Grass (<i>Agropyron spicatum</i>)	2.75	2.06	13.75 %
	Sheep Fescue (<i>Festuca ovina</i>)	0.80	0.60	4.00 %
	Sandberg Bluegrass (<i>Poa sandbergii</i>)	0.50	0.38	2.50 %
	Western Wheat Grass (<i>Agropyron smithii</i>)	2.75	2.06	13.75 %
	Green Needlegrass (<i>Stipa viridula</i>)	2.75	2.06	13.75 %
	Prostrate Summer Cypress (<i>Kochia prostata</i>)	1.50	1.13	7.50 %
	Blanket flower (<i>Gaillardia aristata</i>)	2.00	1.50	10.00 %
	Blue flax (<i>Linum lewisii</i>)	1.50	1.13	7.50 %
	Red Mexican Hat (<i>Ratibida columnaris</i>)	0.25	0.18	1.25 %
	Basin Bid Sagebrush (<i>Artemisia tridentata tridentata</i>)	0.15	0.11	0.75 %
	Rubber Rabbitbrush (<i>Chrysothamnus nauseosus</i>)	0.30	0.23	1.50 %
	Winterfat (<i>Ceratoides lanata</i>)	2.00	1.50	10.00 %
	Totals	20.0	15.00	100.00 %

- 3. Standards. Grass seeds shall comply with "Standards of Official Seed Analysis of North America"; for 85% purity, 80% germination and 1% (maximum) weed seed.
- 4. Delivery. Seed shall be delivered to the site in original unopened containers, bearing the dealer's guaranteed analysis and germination percentage and a certificate or stamp or release by a County agriculture commissioner.

- #1 5. Seed to be applied by hydraulic method shall be mixed with wood fiber mulch, fertilizer and polymer at 50 pounds per 100 square feet.
- B. Trees: Shall be Grade A trees of the type acceptable to the City Engineer; with 2-1/2-inch caliper. Trees shall be grown in climatic conditions similar to those in locality of the Work; with branching, configuration and cane requirements as indicated in ANSI Z60.1, American Standard for Nursery Stock. Provide trees of normal growth and uniform heights, according to the species, with straight trunks and well developed leaders, laterals and roots. Provide legible labels attached to tree indicating botanical genus, species, and size. The following trees are acceptable to the City of Saratoga Springs for Landscaping Dedicated to the City:

- #2 1. **Coniferous.** Trees are to be Grade A, 6 feet in height.
- | | |
|-------------------------|--------------------------|
| a. Serbian Spruce | Picea omorika |
| b. Black Hills Spruce | Picea glauca var.densata |
| c. Colorado Blue Spruce | Picea pungens |
| d. Austrian Pine | Pinus nigra |
| e. Ponderosa Pine | Pinus ponderosa |
| f. Douglas Fir | Pseudotsuga menziesii |

- #2 2. **Deciduous.** Trees are to be Grade A with 2 1/2 inch caliper.
- | | |
|-------------------------------------|------------------------------------|
| a. Sycamore Maple | Acer pseudoplatanus |
| b. Hedge Maple | Acer campestre |
| c. White Ash | Fraxinus americana |
| d. Green Ash | Fraxinus pennsylvanica |
| e. Thornless Honey locust | Gleditsia triacanthos var. inermis |
| f. Shademaster Honey locust | Gleditsia triacanthos F. inermis |
| g. Little Leaf Lindon | Tilia cordata |
| h. Silver Leaf Lindon | Tilia tomentosa |
| i. English Oak | Quercus robur |
| j. Carolina Poplar or other Hybrids | Populuscanadensis and others |
| k. White Poplar | Populus alba |
| l. Goldenrain tree | Koelreuteria paniculata |
| m. Chinese Juniper | Juniperus chinensis |
| n. Rocky Mountain Juniper | Juniperus scopulorum |
| o. American Planetree | Platanus occidentalis |
| p. Spring Snow Crabtree | Malus X |
| q. Callery Pear | Pyrus calleryana |

- C. Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
- D. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.02 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 01400.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is are ready to receive the work of this section.

3.02 PREPARATION

- A. Prepare sub-grade in accordance with Section 02316.
- B. Place minimum thickness of 4-inches of topsoil, where required, in accordance with Section 02316.

- #3** C. Top of sod or soil to be one-inch below edge of sidewalks, curb & gutter, ball courts, mow strips and other concrete surfaces.

3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to seeding.
- C. Apply fertilizer no more than 48 hours before installing erosion control mat and seeding.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 PLANTING SEED

- A. Seeding.
 - 1. Landscaped Areas. Landscaped areas shall be seeded with grass seed, as required, as described herein, and as directed by the City Engineer.
 - 2. Off-Site Restoration. All off-site work through areas that are covered with native grasses shall be reseeded with native grass seed, as required, as described herein and as directed by the City Engineer.
- B. Seeding shall not be performed when the wind velocity exceeds 5 miles per hour, or is determined detrimental to the uniform distribution of seed.
- C. Till areas to be planted to a depth of not less than 4-inches prior to seeding.
- D. Grade planting areas smooth, even surface with a loose, uniformly fine texture. Roll and rake and remove ridges and fill in depressions as required.
- E. Moisten prepared seeding area by sprinkling to a depth of six inches before planting; the area shall be surface dry at the time of application. Do not create a muddy soil condition.
- F. Seed shall be applied by hydraulic method with a hydro-seeder at the coverage rate recommended by the seed vendor and as accepted by the Engineer. Seed may be applied by broadcast or drilled method at the recommended coverage and as accepted by the Engineer.

- #1** 1. Minimum application rate to be 12 to 15 pounds per 1000 square feet.

- G. Rate of Application.
 - 1. Lawn Grass seed mix shall be applied at rate of 3 pounds per 1000 square feet.
 - 2. Native Grass seed mix shall be applied at rate of 0.459 pounds per 1000 square feet, or 20 pounds per acre when broadcast; or 0.344 pounds per 1000 square feet, or 15 pounds per acre when drilled.

- H. All materials must be available for inspection prior to application.
- I. Restore prepared areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.05 PLANTING TREES

- A. Trees. Trees shall be planted where and as accepted by the City Engineer.
- B. Trees shall be planted during normal planting season.
 - 1. Excavate only for depth of root ball. The excavated area for tree planting shall be at least three times the diameter of the root ball, or as recommended by the supplier.
 - 2. Place trees for final orientation review by the Engineer prior to backfilling the root ball.
- #1 3. Installation of trees shall be done according Drawing No. LS-13; and as recommended by the supplier. Backfill material shall be acceptable to the supplier and City Engineer.
- 4. After installation, trees shall be pruned as required, complying with ANSI A300, and as directed by the supplier.
- 5. Trees shall be protected as recommended by the supplier and as directed by the Engineer.
- C. Trees will be accepted by the City Engineer not less than 60 days after planting, watering and successful growth.

3.06 LANDSCAPED AREAS

- A. Landscaped areas that are to be covered with landscaping bark, rocks or other materials, shall be treated with herbicide to kill weeds and covered with a landscaping fabric to control weed growth.
- B. Landscaped areas shall be watered with an acceptable, water saving type sprinkler system.

3.07 MAINTENANCE REQUIREMENTS FOR OPEN SPACES DURING WARRANTY PERIODS #3

- #3 A. Turf.
- #3 1. General: Maintain seeded areas for a period of **two years** after planting. Supply additional top soil, where necessary and as directed, including areas affected by erosion or settlement.
- 2. Watering: Water to ensure uniform seed germination and to keep surfaces of soil damp. Apply water slowly so soil will not puddle or crust.
- #3 3. Fertilizing:
 - a. Fertilize during planting; and two weeks after planting.
 - b. Fertilize formulation to be determined from soil analysis taken yearly.
- #3 4. Mowing:
 - a. Cut lawn grass for the first time when it reaches a height of 3-inches.
 - b. After first mowing, water to moisten soil from 3-inches to 5-inches deep.
 - c. After first mowing, mow on a 7-day cycle, preferably on Thursdays or Fridays.
 - d. Use string trimmers on all hardscape edging, posts, utilities, etc. on the same day as mowing.
 - e. Use metal blade edgers against concrete/turf areas one time per month.
- 5. Grading: Roll when required to remove minor depressions or irregularities.

- 6. Control Growth of Weeds: Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
 - #3 a. Apply 2-4-D chemical for control of broadleaf weeds. Apply when conditions are most beneficial for control of weeds, usually mid-April and mid-September.
- 7. Reseeding: Immediately replace seed to areas which show deterioration or bare spots.
- 8. Protection: Protect seeded areas with warning signs during maintenance period. When necessary or as directed, erect temporary fences or barriers to control pedestrians.

B. Trees.

- #3 1. General: Maintain trees for a period of at least **two years** after planting, until accepted. Supply additional top soil, where necessary and as directed, including areas affected by erosion or settlement.
- 2. Maintain tree health immediately after planting. Notify Owner of tree watering practice. Trim only dead or broken branches; remove clippings and dead branches from the site. Control diseases.
 - #3 a. Prune dead and broken branches only during first year. For deciduous trees, remove branches less than 5 feet above grade during the second year.
- #3 3. Watering:
 - a. After planting, keep ground continuously moist until healthy growth is established.
 - b. Thereafter, deep root water trees two times per month during first year of establishment.
 - c. Deep root watering is required for coniferous trees during winter months.
- 4. Weeding: Uproot and remove weeds completely. Do not allow growth and germination of weed seeds. Fill in large holes caused by weeding with top soil and rake smooth.
 - #3 a. Maintain weed free tree rings with 3-inch mulch depth. Tree rings to have 2 foot radius.
- 5. Protection: Protect trees against traffic by erecting temporary barriers and warning signs. Replant damaged trees.
- 6. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep wire tight. Repair or replace accessories where required and as directed.

#3 C. Aeration. Aerate turf areas a minimum of two times per year; in the spring and in the fall, as directed by the City Engineer. Core aerate; leave cores and break up if needed and as directed.

#3 D. Irrigation System.

- 1. Repair all breaks immediately.
- 2. Perform weekly inspections and make needed adjustments.
- 3. Make seasonal adjustments to controllers as needed and as directed.

#3 E. Erosion and Settlement. Repair trench settling, ruts, and rivulets caused by mowing equipment, irrigation and/or precipitation immediately, as directed.

3.07 WARRANTY

- A. All landscaping will be covered by a warranty for a period of two years from the date of acceptance by the City Engineer.
- B. Seeded Areas. At the end of the warranty period, seeded areas shall have a 100 percent coverage of full, established growth; free of all noxious weeds.

1. At end of warranty period, replant areas showing root growth failure, bare or thin spots, and eroded or settled areas within 10-days of written notice. Plant with materials of like kind and size, planted in the next growing season, with a new warranty commencing on the date of planting. All corrective work will be at no additional cost to the Owner.
- C. Trees. Warranty for trees shall include death, unhealthy conditions, or if trees die from poor planting practices. Replace any unsatisfactory or dead tree within 10-days of written notice. Provide replacement trees of same size and species, planted in the next growing season, with a new warranty commencing on the date of planting. All corrective work will be at no additional cost to the Owner.

END OF SECTION

SECTION 02928

MISCELLANEOUS EQUIPMENT FOR PLAYGROUNDS AND OTHER AREAS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acceptable equipment and materials for playgrounds, open space areas and miscellaneous other areas.

1.02 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on equipment, materials, and appurtenant items.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of installed equipment, materials and appurtenant items as directed by the City Inspector. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with City's requirements as described herein.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store all equipment, materials and appurtenant items in shipping containers with labeling in place.

1.05 OPERATING AND MAINTENANCE DATA

- A. Provide instructions covering full operation, care and maintenance of system and controls; and manufacturer's parts catalog.
- B. Instruct City's designated maintenance personnel in the proper maintenance of all equipment, materials, and appurtenant items.
- C. Submit 3 copies of written instructions recommending procedures to be established by the City Engineer for the maintenance of the equipment, materials and appurtenant items from year to year.
 - 1. Submit prior to expiration of required one year guarantee period.
 - 2. Provide information in the manuals that include the following:
 - a. written index near front of Manual listing location in the Manual of all emergency data regarding the installations;
 - b. complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of the nearest vendor of replacement parts; and
 - c. copy of all guarantees and warranties issued on the installation showing all dates of expiration.

PART 2 PRODUCTS

2.01 GENERAL

- A. All equipment, materials, and appurtenant items shall be as manufactured by manufacturers acceptable to the City Engineer.
- B. Acceptable equipment and materials for playgrounds, open space areas and miscellaneous other areas shall be as listed in the table on page # 02928-3, as acceptable equals.
- C. All equipment, materials and appurtenant items shall be reviewed and accepted by the City Engineer prior to installation.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall furnish all labor, materials and equipment as required to install the equipment, materials and appurtenant items for playgrounds, open space areas, and other miscellaneous areas, as described herein and as shown on the design drawings, as indicated on the submittal drawings, and as acceptable to the City Engineer; and shall furnish and install all supplementary and miscellaneous items, appurtenances, and devices incidental to or necessary for completion of the installations.
- B. All material shall be installed according to the manufacturer's written instructions and recommendations.
- C. The Contractor shall test the installations, as required and as directed, to assure proper operation.

3.02 EXAMINATION

- A. Verify that design drawings conform to project conditions.

3.03 ELECTRICAL WORK

- A. All required electrical work shall be done as specified in Division 16.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. If tests indicate that installations do not meet specified requirements, remove installations, replace and retest at no cost to City.

3.05 OPERATIONAL TESTING

- A. Where required, provide the City Engineer or City Inspector with seven days written notice of operational tests.
- B. After all repairs or replacements have been made and accepted by the City Engineer or City Inspector, repeat the required tests.

END OF SECTION