

**CITY OF ELKO  
DIVISION 2 – SITE CONSTRUCTION**

**CATTLE DRIVE ACCESS ROAD and WATERLINE PROJECT**

## SECTION 02200

### EARTHWORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Furnish all labor, equipment, materials and services for the performance of all earthwork required for completion of all Work specified.
- B. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the Work, which shall include, but not be limited to:
  - 1. The finishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavation.
  - 2. All pumping, ditching, draining, and other required measures for the removal or exclusion of water from the excavation.
  - 3. The supporting of structures above and below the ground.
  - 4. All backfilling around structures and all backfilling of trenches and pits.
  - 5. The disposal of excess excavated materials.
  - 6. Borrow of materials to make up deficiencies for embankment and other fills.
  - 7. All other incidental earthwork, all in accordance with the requirements of the Construction
  - 8. Documents.

##### 1.02 REFERENCES

- A. Terms "Standard Specifications" refers to "Standard Specifications for Public Works Construction", (Orange Book), as currently in effect except that contractual, measurement, and payment provisions do not apply.
  - 1. Applicable sections of the Standard Specifications are:
    - a. Structure Backfill
    - b. Trench Excavation and Backfill
    - c. Aggregate Base
- B. American Society for Testing Materials (ASTM) Standards, most recent editions.
  - 1. ASTM D 422 Method for Particle-Size Analysis of soils.

2. ASTM D 1556 Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D 1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.
4. ASTM D 1633 Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
5. ASTM D 2167 Test Method for Density of Soil in Place by the Rubber Balloon Method.
6. ASTM D 2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D 2487 classification of Soils for Engineering Purposes.
8. ASTM D 2901 Test Method for Cement Content of Freshly-Mixed Soil-Cement.
9. ASTM D 2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
10. ASTM D 4253 Test Methods for Maximum Index Density of Soils Using A Vibratory Table.
11. ASTM D 4254 Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Granular Backfill as specified in the Orange Book, Latest Edition.
- B. Type 2 Aggregate Base as specified in Orange Book, Latest Edition.
- C. Selected Backfill as specified in Orange Book, Latest Edition.
- D. Slurry Cement Backfill as specified in Orange Book, Latest Edition.
- E. Drain Rock and Pea Gravel as specified in Orange Book, Latest Edition.
- F. Soluble sulfate content shall be less than 0.3 percent by dry soil weight for all backfill materials.
- G. Imported material shall comply with select backfill as specified in. Imported fill from off-site areas shall be approved by a Geotechnical Engineer prior to placement.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Inspect and check site of excavation for correct alignment.
- B. Check location of concrete structures, curb and gutters and valley gutters, if any.

### 3.02 EXCAVATION

- A. Excavate pipeline location to true lines and grades as shown. Over excavate in areas under concrete structures as shown.
- B. Contractor may tunnel or bore under existing concrete curb and gutter and valley gutters, if adequate support is provided to ensure the long term integrity of the gutters. If damaged, replace a minimum of 10 linear feet of damaged curb and gutter and valley gutters.
- C. Excavate to pads, footings, road subgrade, ditches, slopes and other facilities to true lines and grades as shown.
- D. Excavation within building areas shall extend a minimum of 2 feet below the deepest footing and extend 5 feet beyond outer edges of exterior footing. Exposed soil should then be scarified minimum 8-inches and compacted to 90% RC per ASTM D1557.
- E. Trenches deeper than 5 feet shall incorporate shoring or be laid in accordance with OSHA requirements.
- F. Excess excavated material and excavated material unsuitable for backfill, as determined by Engineer, shall be removed from the site of the work and disposed of by the Contractor at his own expense, at offsite locations to be approved by the Engineer.
- G. Engineer will approve such locations only after the Contractor has made all arrangements for disposal of materials at the location and files with Engineer the written consent of the owner of the property upon which the Contractor intends to dispose of such material.
- H. The owner's consent shall contain an acknowledgment of the type of materials to be disposed of on his/her property, and required preparation of the property prior to disposal thereon, and the manner in which material is to be disposed of on the property.
- I. Arrangements for disposal of excess materials shall be the responsibility of Contractor.

### 3.03 EXPLOSIVES AND BLASTING

- A. Blasting will not be permitted.

### 3.04 BACKFILLING

- A. Before pipe installation or structure construction, bedding or base shall be placed from bottom of excavation to designed elevation.
  - 1. The material shall be per City of Elko Detail.
  - 2. Compact backfill to at least 90 percent maximum density per ASTM D 1557.

- B. No clay material and drain backfill, known locally as pea gravel, shall be used as backfill or embankment, except where groundwater conditions exist.
- C. Where compaction in excess of 90 percent of maximum density is required or for structural backfill the Contractor shall use mechanical compaction.

### 3.05 FLOODING AND JETTING

- A. Flooding and Jetting will not be permitted.

### 3.06 EMBANKMENT

- A. Where shown on the Drawings, use selected backfill material for constructing embankments to the dimensions and side slopes shown.
- B. Perform compaction in 8-inch layers by mechanical methods to 90 percent maximum density for all embankments except under pavements and buildings.
- C. For embankment areas under pavements or buildings, perform compaction in 8-inch layers by mechanical methods to 95 percent of maximum density.

### 3.07 RESTORATION OF STREET SURFACING

- A. Replace all street surfacing, base and subgrade aggregate removed in connection with performing the Work in streets or rights-of-way pursuant with Lyon County and the NDOT Permit requirements.

### 3.08 FIELD TESTING

- A. Sampling and testing of backfill material shall be done by a testing laboratory acceptable to the Engineer and all material testing shall be performed under the responsible charge of a Registered Professional Engineer.
  - 1. All test data submitted shall unmistakably identify the name of the testing laboratory, the location of the source of stockpiled material, the date of the sampling, the date of the tests, and shall be signed by the Registered Professional Engineer in responsible charge.
  - 2. All samples of the proposed backfill material shall be obtained directly at the source by the testing laboratory.
  - 3. Engineer may determine how many and from where the test samples shall be obtained.
  - 4. No test data for a proposed backfill material will be accepted by Engineer unless the proposed backfill material has been sampled and tested within one year from the date of submittal.
  - 5. All test data required herein shall be provided at the sole cost and expense of the Contractor.

- B. Allot sufficient time during construction operations for the performance of any control testing deemed necessary by the Engineer.
  - 1. Permit Engineer to make field density tests of any compacted backfill layer prior to placing additional backfill material.
  - 2. Any layer, or portion thereof, that does not meet density requirements shall be reworked and re-compacted until it does meet the specified density requirements.
- C. Tests made by Engineer for verifying compliance with backfill density requirements shall constitute the ultimate authority as to the acceptability of the backfill density. Contractor is not precluded from making or having made soil tests for his own information and satisfaction; however, except when specifically agreed to in writing by Engineer, tests made by Contractor or by any other party not authorized by Engineer shall not take precedence over test results obtained by Engineer.

### 3.09 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS

- A. Protect all trees, plants and lawns that are not specified or shown on the Drawings to be removed for the performance of the Work, from injury or damage resulting from the construction operations.
- B. Signs, trees, plants and lawns which are removed, injured or damaged by the Contractor's operations shall be replaced or restored to their former state, or better, at the Contractor's expense.

**END OF SECTION**

## SECTION 02225

### TRENCH EXCAVATION AND BACKFILL

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

###### A. Description of Work

The work covered by this Section includes the furnishing of all plant, labor, tools, equipment and materials and performing all operations in connection with the excavation, trenching, backfilling, moisture conditioning, and surface repair of all pipelines, accessories and lines connected thereto, complete including sheeting and shoring, dewatering, grading and cleanup and traffic control all in accordance with these Specifications and the applicable Drawings. Excavation for appurtenant structures such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc. shall be included in this Specification.

###### B. Related Work Specified Elsewhere

1. Earthwork.....Section 02200
2. Water Line Construction.....Section 15100

###### C. Definitions

1. Trench – An excavation in which the depth is greater than the width of the bottom of the trench.
2. Foundation – Material on which pipe bedding or structure is to be directly placed.
3. Bedding – Granular material that surrounds pipe or structure. Pipe bedding shall be per City of Elko detail.
4. Maximum Density – The maximum density as determined by ASTM D1557 for the soil or aggregate under consideration.
5. Backfill – Material from top of bedding to finish subgrade or finish grade.

##### 1.02 QUALITY ASSURANCE

###### A. Provisions of Testing

1. All testing for compaction will be provided by the Owner. The Contractor shall be responsible for the cost of any retests required due to failed tests.

###### B. Testing Methods

1. ASTM C94, Standard Specification for Ready-Mixed Concrete

2. ASTM C117, Standard Test Method for Materials Finer than No. 200 Sieve by Washing.
3. ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
4. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
5. ASTM D 1556 Test Method for Density of Soil in Place by the Sand-Cone Method.
6. ASTM D 1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.
7. ASTM D2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
8. ASTM D3017, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.

#### 1.03 FREQUENCY OF TESTING

##### A. Maximum Dry Density and Optimum Moisture Content, ASTM 1557

1. Request one test for each different class or type of material, and
2. Request one test when previous test is suspect, due to subtle changes in the material, as determined by the Engineer.

##### B. Density of Soil In-Place by Sand Cone or Nuclear Methods

1. Request a minimum of one test per lift per 500 linear feet of trench.
2. The Engineer may test more or less frequently as he deems appropriate

#### 1.04 TESTING TOLERANCES

##### A. Percent Compaction.

1. Not less than as specified on Plans or in these Specifications.

##### B. Place Moisture Content as required to achieve minimum compaction requirements.

##### C. Soft or Yielding Surfaces.

1. Regardless of percent compaction obtained by test, areas that are soft and yield under the load of construction equipment (“pumping”) are to be removed and replaced at no additional cost.

#### 1.05 SUBMITTALS

##### A. Test Results



1. Provide moisture-density curves and gradations for bedding material per ASTM D1557, ASTM C131 and ASTM C136.

1.06 JOB CONDITIONS

A. Soils Report

1. Appendix A contains a soils report for this Project. It is recommended that the Contractor carefully review this report prior to construction on the Project.

**PART 2 PRODUCTS**

2.01 MATERIALS

A. Unsuitable material not to be incorporated in the work include:

1. Organic matter such as peat, mulch, organic silt or sod
2. Expansive clays
3. Material containing excessive moisture
4. Poorly graded coarse material
5. Rock or particle size in excess of 6 inches
6. Material that will not achieve density and/or bearing requirements
7. Construction debris such as broken concrete or asphalt concrete.

B. Bedding

1. Bedding shall be per City of Elko details and shall have graded material conforming to the following grading requirements:

Class	Sieve Size	Percent by Weight Passing Sieve
Class A	3/8 inch	100
	No. 4	90-100
	No. 50	10-40
	No. 100	3-20
	No. 200	0-15

C. Class E Backfill.

1. Class E Backfill shall be native excavated material or approved import material free from unsuitable materials defined herein.

D. Portland Cement Concrete

1. ASTM C94, 4,000 psi yield strength minimum.

E. Foundation

1. The Contractor may use any aggregate material that is free from unsuitable material for pipe foundation provided that a suitable foundation can be constructed with the material provided.

F. Type 2 Class B Aggregate Base

1. Type 2, Class B Aggregate Base shall conform to the following:

a. ASTM C136

Sieve Size	Percent by Weight Passing Sieve
1 inch	100
¾ inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

b. Plastic Limits according to ASTM D4318

Percentage by Weight Passing #200 Sieve	Percent by Weight Passing Sieve
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4

c. Other Requirements:

- |                                    |                 |
|------------------------------------|-----------------|
| 1) Percentage of Wear, ASTM C131   | 43 Percent Max. |
| 2) Liquid Limit, ASTM D4318        | 35 Max.         |
| 3) Resistance "R" Value, Nev. T233 | 70 Min.         |

**PART 3 EXECUTION**

### 3.01 INSPECTION BY CONTRACTOR

- A. Verify all preliminary work including construction staking has been performed in accordance with the Plans and these Specifications.

### 3.02 EXCAVATION

#### A. General

- 1. Perform all excavations of every description and of whatever substances encountered to the depths indicated on the Plans, including excavation ordered by the Owner of compacted fill for the purpose of performing tests. Use open cut excavation methods unless otherwise shown on the Plans or approved by the Engineer. Remove all loose material after excavation or compact to 90% maximum density prior to placing bedding.

#### B. Trench Widths

- 1. Excavate trenches for pipe to the dimensions indicated on the Plans.
- 2. Maintain trench walls as vertical as possible except as required by safety standards and for that required for sheeting and shoring. If the maximum trench width is exceeded at the top of the pipe, provide necessary additional load bearing capacity by means approved by the Owner at the Contractor's expense.

### 3.03 OVER-EXCAVATION

#### A. Unauthorized Over-excavation.

- 1. Fill and compact unauthorized beyond the specified grade line, at the contractor's expense, with aggregate base or bedding material.
- 2. Compact to 95 percent of the maximum density.

#### B. Rock

- 1. Over-excavate rock encountered in trench to provide a minimum of four inches of bedding below the pipe and the minimum width at the springline.

#### C. Unsuitable Material.

- 1. Over-excavate unsuitable material to the depth required as determined by the Owner to provide required support.
- 2. Backfill the overexcavation with bedding and compact to at least 95% of the maximum density.
- 3. Foundation material may be used for stabilization below the bedding zone.

### 3.04 EXCAVATION FOR MANHOLES, VALVES AND OTHER ACCESSORIES

- A. Provided excavated surfaces are firm and unyielding, the Contractor may elect to cast concrete for the structure directly against excavated surfaces. Over-excavate to provide foundation or bedding material where required or indicated on the Plans.

### 3.05 GRADING AND STOCKPILING

#### A. Grading.

1. Grade in the vicinity of the trench to prevent surface water from flowing into the trench.
2. Remove any water accumulated in the trench by pumping or other approved methods.
3. Stockpile excavated material in an orderly manner a sufficient distance back from the edges of the trench to avoid overloading and to prevent slides or cave-ins.

#### B. Topsoil.

1. Excavate topsoil and stockpile separately.
2. Replace topsoil upon completion of backfill to the elevation and grade indicated on the Plans

### 3.06 SHORING AND SHEETING

- A. Shore, sheet and brace excavations as set forth in the rules, orders and regulations of the United States Department of Labor Occupational Health and Safety Administration (OSHA).
- B. Provide detailed plans and calculations prepared by a Nevada-registered professional engineer for excavations twenty feet (20') in depth or greater or when shoring, sheeting or bracing deviates from OSHA standards.
- C. Place and remove shoring, sheeting and bracing so as no to damage adjacent improvements, utilities or utility being placed.
- D. Costs for shoring, sheeting and bracing shall be incidental to the pipe items.

### 3.07 OPEN TRENCH

#### A. Maximum Length.

1. The maximum length of open trench in the aggregate at any one location is not to exceed 500 feet.
2. The trench is open until fill is completed to adjacent finish grade elevation.

#### B. Temporary Provisions.

1. Furnish and install trench bracing and steel plating required to provide safe and convenient vehicular and pedestrian passage across trenches where required.

2. Maintain access to emergency facilities at all times.

3.08 AGGREGATE BASE

- A. Place the aggregate base upon backfill and embankments as indicated on the Plans.
- B. Grade the base to provide the depth and dimensions shown on the Plans.
- C. Compact the aggregate base to 95% of the maximum value determined by ASTM D1557.

3.09 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION

A. Foundation.

1. Place foundation when soils in the trench bottom are soft or yielding.
2. It is anticipated that foundation could be necessary in areas where groundwater is present or near the trench bottom.
3. Costs associated with dewatering and foundation shall be considered incidental to the pipe item.

B. Fine Grading.

1. Accurately grade the bottom of the trench to provide uniform bearing and support for each section of pipe at every point along its entire length.

3.010 MOISTURE CONDITIONING

- A. Moisture condition all bedding and backfill materials by aerating or wetting to achieve the moisture content required to obtain the minimum percent compaction.
- B. Mix until the moisture content is uniform throughout the lift.
- C. No additional payment will be made for moisture conditioning, import or native materials.

3.011 LIFT THICKNESS

Lift Description	Maximum Loose Lift Thickness, Inches
Bedding	6
Backfill	8
Aggregate Base Surfacing	6

- A. Lift thickness may be increased if Contractor can demonstrate through a series of density tests that minimum density is achieved throughout the lift thickness.

### 3.012 COMPACTION

#### A. Compaction Methods.

1. Water consolidation, water jetting or rubber tired tractor wheel rolling will not be allowed.

#### B. Pipe Haunch.

1. Hand compact initial backfill in pipe haunch with a hand compactor (J-bar) or a mechanical vibratory compactor sized to fit the narrow width between the trench wall and pipe.
2. Give special attention to provide proper compactive effort in the important pipe haunch zone.

#### C. Compaction Densities.

1. Thoroughly compact trench bedding and backfill to not less than the percent compaction indicated on the Plans.
2. Where not indicated on the Plans, compact bedding to 95% and backfill to 90%.

### 3.013 BACKFILL FOR MANHOLES, VALVES, MINOR STRUCTURES AND OTHER

#### A. Backfill appurtenances and structures as shown on the Plans.

#### B. Where not clearly indicated, the backfill, including bedding , backfill lift, lift thickness, and compaction, shall be identical to the adjacent trench detail.

### 3.014 SURFACE RESTORATION

#### A. Grading.

1. Perform all grading adjacent to backfilled trenches and structures as necessary.
2. Leave the area in a neat and satisfactory condition.
3. Grade area to provide proper drainage and to ensure that the existing drainage has not been changed.

#### B. Surface Restoration.

1. Resurface as specified or to match all existing surfaces broken or damaged by the installation of the new work.

#### C. Clean up remove all excess soil, concrete, etc. from the premises. Leave job site in a neat and clean conditions.

### 3.015 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS

- A. Protect all trees, plants and lawns that are not specified or shown on the Drawings to be removed for the performance of the Work, from injury or damage resulting from the construction operations.
- B. Signs, trees, plants and lawns which are removed, injured or damaged by the Contractor's operations shall be replaced or restored to their former state, or better, at the Contractor's expense.

**END OF SECTION**

## **SECTION 02226**

### **SILT FENCE**

#### **1.0 Silt Fence Systems**

##### **1.1 Description**

Silt fence systems are used as a temporary perimeter control around sites where there will be soil disturbance due to construction activities. Silt fence systems consist of filter fabric stretched across posts. The lower edge of the fence is vertically trenched into the ground and covered by compacted backfill.

##### **1.2 Materials**

Provide material for silt fence systems complying with the requirements specified herein, on the Plans, on details, or as approved by the Engineer.

###### **1.2.1 Geotextile Filter Fabric and Steel Post System**

This silt fence system is composed of geotextile filter fabric and steel posts.

###### **1.2.1.1 Wood Posts**

Furnish wood posts meeting the following minimum physical requirements:

- Minimum length of 4 feet.
- Composed of a hardwood such as Douglas fir. Pine wood posts are not acceptable.
- Rectangular in shape with a minimum dimension of 1¼ inches by 1¾ inches.
- Has a 2-foot long, 1-inch wide, 3/8-inch thick bonding strip applied to secure the fabric to each wood

###### **1.2.1.2 Geotextile Filter Fabric**

Provide a geotextile filter fabric Ensure that the filter fabric is composed of fibers consisting of long chain synthetic polymers composed of at least 85% by weight of polyolefins, polyesters, or polyamides. Ensure that the fibers are formed into a network so that the filaments or yarns retain dimensional stability relative to each other. Do not treat or coat the filter fabric with materials which might adversely alter its physical properties after installation. Do not use fabric with defects or flaws that significantly affect its physical and/or filtering properties. Provide a filter fabric with

#### **1.3 Construction Requirements**

##### **1.3.1 Installation**

Construct the silt fence system in accordance with the Plans or latest revision, or as approved by the Engineer. Install the silt fence system before major construction in an area is started.

Install the fence perpendicular to the direction of flow at the proper distance from the toe of steep slopes to provide sediment storage and access for maintenance and cleanout.

###### **1.3.1.2 Fabric and Wood Post System**

1. Install the wood posts into the ground to a minimum depth of 24 inches while allowing a minimum of 24 inches of BSRF fabric to be left above the ground. Space the wood posts on a maximum of 4-foot centers.
2. Tightly stretch the fabric along the inside 1¾-inch dimension of the wood post and attach the



fabric to the wood post with a 2-foot long, 1-inch wide, 3/8-inch thick bonding strip with 1½-inch by ½-inch staples. The strip is used to tightly bond the fabric to the support post, preventing tear-down from the top and adds linear support by stabilizing the fabric. Use 4 staples to secure the fabric to the hardwood post.

3. Install the fabric at a minimum height of 24 inches above the ground. When necessary, the height of the fabric above ground may be greater than 24 inches.
4. When placing fabric by hand, excavate a trench approximately 6 inches wide and 6 inches deep and place 12 inches of the fabric into the 6-inch deep trench, extending the remaining 6 inches towards the upslope side of the trench, backfill the trench with soil or gravel and compact. Bury 12 inches of fabric into the ground when pneumatically installing silt fence with a slicing method.
5. Purchase fabric in continuous rolls and cut to the length of the barrier to avoid joints. When joints are necessary, wrap the fabric together at a support post with both ends fastened to the post, with a 6-inch minimum overlap.

### 1.3.2 Inspection and Maintenance

1. Inspect the silt fence system every 7 days. Immediately correct any deficiencies. Check for sediment buildup and fence integrity. Check where runoff has eroded a channel beneath the fence, or where the fence has sagged or collapsed by fence overtopping.
2. Remove fabric and replace whenever it has deteriorated to such extent that it reduces the effectiveness of the silt fence system. In addition, review daily the location of silt fence systems in area where construction activities have changed the natural contour and drainage runoff to ensure that the silt fence systems are properly located for effectiveness. Install additional silt fence systems as directed by the Engineer where deficiencies exist.
3. Maintain the silt fence system until its capacity has been reached or erosion activity in the area has been stabilized. Remove sediment accumulated along the fence when it reaches approximately one-third the height of the fence, especially if heavy rains are expected. Remove trapped sediment or stabilize on site.
4. If a silt fence system or portion of fence is located in an area where removing the sediment is not possible, install a second silt fence, if necessary, at the direction of the RCE. In this case, payment for both silt fence systems and portions involved is made at the unit price for silt fence systems.
5. Remove the silt fence system within 30 days after final stabilization is achieved or after temporary Best Management Practices (BMPs) are no longer needed. Permanently stabilize disturbed areas resulting from silt fence system removal. The fence material remains the property of the contractor and may be used in other locations provided the materials meet the appropriate requirements contained in this Specification and/or on the Plans.
6. The Engineer will approve all silt fence system installations.

**END OF SECTION**

## SECTION 02232

### AGGREGATE BASE

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This section includes the specifications for the material makeup and placement for Type 2, Aggregate Base. Type 2, Aggregate Base shall be placed and compacted as shown on the Drawings and as specified herein.

#### PART 2 PRODUCTS

##### 2.01 MATERIAL SPECIFICATIONS

- A. Type 2 Aggregate Base shall be placed in trenches, and beneath concrete foundations, as shown on the Drawings. Type 2, Aggregate Base shall meet the material requirements stated in the referenced "Standard Specifications".

#### PART 3 EXECUTION

##### 3.01 EXECUTION OF WORK

- A. Type 2, Aggregate Base shall be placed at the locations shown on the Drawings and shall be installed in accordance with the following requirements:
  - 1. Type 2, Aggregate Base shall be placed at the locations shown on the Drawings and shall meet or exceed the minimum thicknesses indicated.
  - 2. Type 2, Aggregate Base shall be placed uniformly on the compacted subgrade surface.
  - 3. Type 2, Aggregate Base shall be placed in such a manner as to prevent segregation of the aggregate sizes.
  - 4. Type 2, Aggregate Base shall be spread in compacted layers not to exceed 8-inches in compacted thickness.
  - 5. The aggregate material shall be placed and compacted to a minimum of 95 percent maximum dry density measured in accordance with test method ASTM D1557.
  - 6. Upon placement, the aggregate base shall be kept moist and shall be bladed as often as necessary to prevent waves, corrugations, and ruts from forming on the aggregate base surface.
  - 7. The aggregate base shall be placed to the lines and grades as shown on the Project Drawings. The finished surface of the aggregate base shall not deviate by more than 0.5 inches at any point when measured from the bottom of a 10-foot straight edge.

8. Placement of the aggregate base shall be in accordance with AGGREGATE BASE COURSES of the referenced “Standard Specifications”.

**END OF SECTION**

## **SECTION 02275**

### **ROCK RIP-RAP**

#### **PART 1 GENERAL**

##### **1.01 DRAINAGE CHANNEL LINING**

- A. Drainage Channel Lining shall be placed as designated on the Plans and as specified herein. This section of Work shall include all labor, geotextile fabric; rock developed on-site, materials, equipment and incidentals for performing all Drainage Channel Lining work.
- B. All rock developed on-site which meets the grading requirements specified herein shall be placed on the cut and fill slopes as directed by the Engineer. The placement of the rock shall be in accordance with the Plans.

##### **1.02 GEOTEXTILE FABRIC**

- A. The geotextile fabric shall be furnished and installed at all rip-rap locations and to the extent shown on the Plans.

#### **PART 2 PRODUCTS**

##### **2.01 DRAINAGE CHANNEL LINING**

- A. Rock rip-rap used for channel lining shall have a  $D_{50}$  value of 15 inches. Rock shall be durable material not subject to fracturing when placed in the drainage channel and comply with section 200.06.03 of the Standard Specifications.
- B. Rock shall be clean and free of fine or deleterious materials. The Contractor shall remove all such undesirable materials before placing rock rip-rap.

##### **2.02 GEOTEXTILE FABRIC**

- A. The fabric shall consist of a needle-punched, non-woven polypropylene geotextile staple fiber utilized for soil stabilization. The fabric shall be inert such that it will not react (degrade) with biological and chemical environments. The fabric shall have a grab strength of 250 lbs., a grab elongation of 50%, puncture strength of 160 lbs., Mullen burst of 510 psi, and trapezoidal tear of 100 lbs. The fabric shall be UV resistant and have an apparent opening size equivalent to the Standard U.S. Sieve 100.

#### **PART 3 EXECUTION**

##### **3.01 DRAINAGE CHANNEL LINING**

- A. Rocks shall be placed with their longitudinal axis normal to the embankment face and arranged so that each rock above the foundation course has a 3-point bearing on the underlying rocks. Foundation course is the course placed on the slope in contact with the

ground surface. Bearing on smaller rocks, which may be used for chinking voids, will not be acceptable. Placing of rocks by dumping will not be permitted.

3.02 GEOTEXTILE FABRIC

- A. The fabric shall be installed pursuant with manufacturer's recommendations. The geotextile fabric shall be GEOTEX 1001, as manufactured by Synthetic Industries, or approved equal.

**END OF SECTION**

## SECTION 02502

### HIGH DENSITY POLYETHYLENE (HDPE) DOUBLE WALL CORRUGATED AND

### SMOOTH LINED THERMOPLASTIC PIPE SPECIFICATION: (FOR GRAVITY FLOW DRAINAGE PIPE APPLICATIONS)

#### 1. Description:

For the furnishing and installing of all High Density Polyethylene (HDPE) Double Wall Corrugated and Smooth- Lined Pipe and / or materials for constructing of culverts, side road pipes, storm sewers, stubs, and all related connections and fittings, all of which shall conform to ASTM F 2306, latest edition. The pipes shall be of the sizes, types, and dimensions shown on the plans, and contained in this specification. In addition, it shall include all connections and joints to new or existing pipes, storm sewer manholes, inlets, headwalls, and other appurtenances as may be required to complete the work.

#### 2. Materials:

Unless otherwise specified on the plans or herein, thermoplastic pipe and joint fittings shall conform to the following:

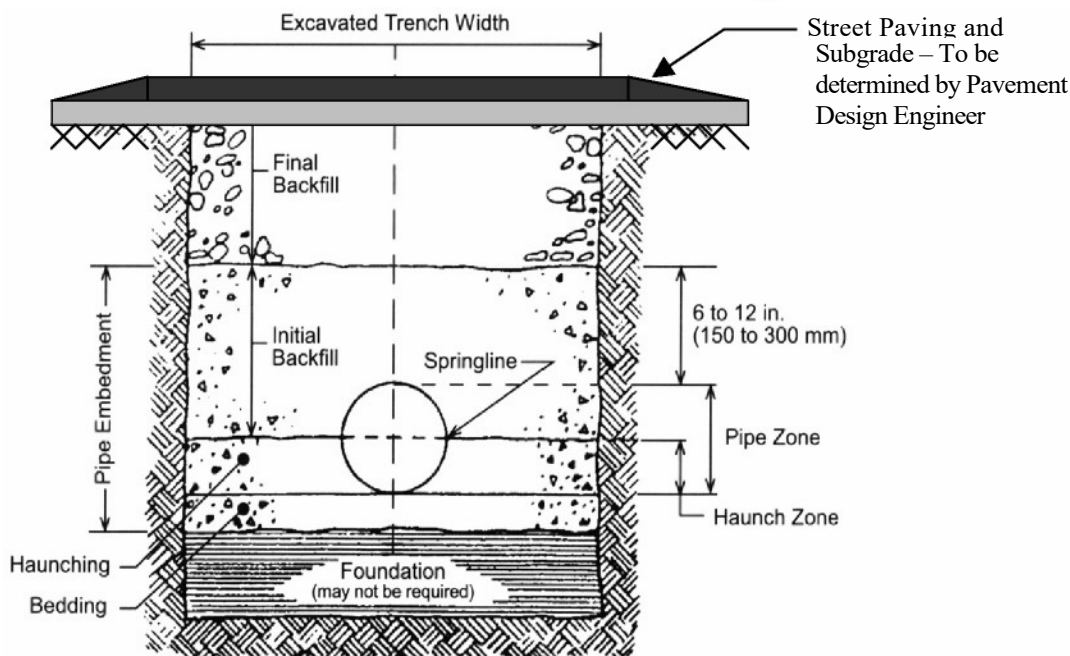
- A. High Density Polyethylene (HDPE) double wall Corrugated and Smooth Lined Pipe & Fittings shall be manufactured in accordance with requirements of ASTM F 2306, latest edition. Type S: This pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner wall.
- B. High Density Polyethylene (HDPE) double wall Corrugated and Smooth Lined Pipe shall be manufactured from virgin PE compounds which conform with the requirements of cell class 435400C as defined and described in ASTM D 3350.
- C. Minimum Pipe Stiffness (PS) at five percent deflection shall be as described in ASTM F 2306, Section 6.3 when tested in accordance with ASTM D 2412.
- D. All HDPE Corrugated and Smooth Lined Pipe shall be certified through the AASHTO National Transportation Product Evaluation Program (NTPEP) 3<sup>rd</sup> Party Certification program.

#### 3. Installation:

Installation shall be in accordance with ASTM D 2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications".

All contractors and inspectors shall be trained and certified by the manufacturer prior to installing HDPE pipe. A copy of the training certification and proof of insurance shall be provided to the City Engineer before any work shall commence. Upon completion of these requirements the contractor will be considered for the City's Approved HDPE Installers List.

Figure 1: Definitions of Terms for Backfill in Trench Condition:



**A. General Installation Requirements:**

Thermoplastic pipe shall be unloaded and handled with reasonable care. Pipe shall be placed in the bed starting at the downstream end. Trenches shall be excavated in such a manner as to insure that the trench sidewalls will be stable under all working conditions.

Trench walls shall be sloped or supported in conformance with generally accepted standards of safety, including Standard Specifications for Public Works (Orange Book). Only as much trench as can be safely maintained shall be opened. Trenches with thermoplastic pipe in place shall be backfilled as soon as practicable, but no later than the end of each working day.

Trench details, including foundation, bedding, haunching, initial backfill, final backfill, pipe zone, and trench width are shown in Figure 1.

**B. Trench Widths:**

Trench width shall be in accordance with ASTM D2321 and shall be sufficient to ensure working room to properly and safely place and compact haunching and other backfill materials. Minimum trench width shall not be less than 1.25 times the pipe outside diameter plus 12 inches, (1.25 x O.D. + 12”). On multiple pipe barrel runs the clear distance between pipes shall be 0.50 times the pipe diameter, (1/2 x Diameter).

**C. Bedding and Backfill:**

Bedding material shall meet the requirements of ASTM D2321 Class I or Class II material. A minimum of 6” of bedding shall be provided prior to placement and shall be loosely compacted. Bedding material size shall be 1 1/2” maximum granular material. Initial backfill material shall meet the same requirements as the bedding material and shall extend to 6 inches above the top of the pipe.

Final backfill material shall meet the requirements of ASTM D2321 Class II or Class III material. All initial and final backfill material shall be placed in 6 inch lifts and compacted to a minimum 90% Standard Proctor Density. The contractor shall provide density reports and a Proctor on materials as requested by the City project representative. The descriptions for Class I, II and III material are as shown below:

Class I - Angular crushed stone or rock, dense or open graded with little or no fines (1/4 inch to 1 1/2 inches in size)

Class II - Clean, coarse-grained material, such as gravel, coarse sands and gravel/sand mixtures (1 1/2 inches maximum in size).

Class III - Coarse grained material with fines including silty or clayey gravels or sands. Gravel or sand must comprise more than 50 percent of the Class III material (1 1/2 inches maximum size).

In areas not supporting a complete roadbed or paving section, the final backfill material may consist of the natural topsoil and / or other natural material originally excavated from the site. In these areas, the backfill shall be placed in uniform layers and compacted to meet the density requirements as shown in the plans. Backfill material with large lumps or material that cannot be spread evenly may be rejected.

**D. Minimum Cover:**

The minimum cover is 18 inches below the bottom of stabilized Subgrade for HS-25 Live Loads (from 18” to 42” Pipe Diameters) and 24 inches below the bottom of stabilized Subgrade for larger diameter structures (from 48” to 60” Pipe Diameters).

Extreme care should be taken when heavy construction equipment loads cross the pipe trench during construction. If the passage of construction equipment over an installed pipeline is necessary during construction, compacted fill in the form of a ramp shall be constructed to a minimum elevation of three (3.0’) feet over the top of the pipe. Any damaged pipe shall be replaced at the contractor’s expense.

**E. Installation Deflection:**

At the Engineer’s discretion, all pipe exceeding 7.5% deflection (as per AASHTO Section 30) may require replacement or re-compaction at the contractor’s expense when measured or



inspected not less than 30 days following completion of installation. Deflection is defined per ASTM D 2321.

**F. Joints:**

Joints shall be installed such that the connection of pipe sections will form a continuous line free from irregularities in the flow line. All installations within and outside of the City right-of-way shall require watertight joints that meet a 74kPa (10.8 psi) laboratory test per ASTM D3212 and utilize a bell and spigot design with a gasket meeting ASTM F477.

**G. High Groundwater:**

In installations where high groundwater is encountered, a soil filter fabric shall be installed, as per manufacturer's recommendations, around the initial backfill material unless sufficient fill cover can be provided over the pipe. In flowable fill or high groundwater installations, pipe shall be restrained as per manufacturer's recommendations.

## SECTION 02668

### PVC PRESSURE PIPE

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, material, tools, and equipment required for the complete construction of pipelines, clean-outs, and other allied structures and appurtenances as stated on the Bidding Sheets, shown on the Plans, and specified herein.
- B. These provisions establish the requirements for the use of plastic pipe (i.e., PVC) for reclaimed water, pressure service.

##### 1.02 CARE & HANDLING

- A. Pipe shall be stored at the jobsite in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage or deformation to bell ends of the pipe. If pipe is to be exposed to direct sunlight for more than 14 days, pipe must be covered with an opaque material while permitting adequate air circulation above and around the pipe to prevent excessive heat accumulation.
- B. If pipe is strung along trench prior to installation, string only pipe to be used within a 24-hour period. All pipe is to be laid on a flat surface. The interior as well as all sealing surfaces of pipe, fittings, and other accessories shall be kept free from dirt and foreign matter. Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. Solvent cement when used shall be stored in tightly sealed containers away from excessive heat.

##### 1.03 GUARANTEE

- A. All work, materials, and equipment shall be guaranteed for the periods of time set forth elsewhere in the Contract Documents for general guaranty or warranty.

##### 1.04 SUMMARY

- A. This section covers the requirements for Polyvinyl Chloride (PVC) Pressure Pipe for water distribution systems for nominal diameters 4 Inch - 12 inch. Polyvinyl Chloride pressure pipe shall be installed in the locations and of the sizes shown on the Plans.

#### PART 2 PRODUCTS

##### 2.01 PIPE

- A. PVC pipe shall conform to the requirements of AWWA C900 "Standard for PVC pressure pipe 4" - 12" and AWWA C905 "Standard for PVC pressure pipe 14" - 36" shall be furnished in cast iron O.D. sizes, as stipulated on the Plans, with a minimum Pressure Rating (PR) of

235 psi (DR 18) for the C900 (4"-12") PVC piping and a minimum Pressure Rating (PR) of 235 psi (DR 18) for the C905 (18") PVC piping.

- B. All PVC reuse piping will be wrapped with "purple" polyethylene encasement. The polyethylene shall conform to ANSI/AWWA C105/A21.5 with a minimum thickness of 8 mils. The polyethylene shall come in either tube or sheet form.

## 2.02 JOINTS

- A. Unless otherwise indicated, the PVC pipe shall be furnished with integral bell and spigot joints. The bell shall consist of an integral wall section with a bonded-in, solid cross section elastomeric ring meeting the requirements of ASTM F-477.

## 2.03 FITTINGS

- A. Fittings shall be cast iron with mechanical or no-remove joints conforming to AWWA C110.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF PIPE

- A. The assembly of the gasketed joint should be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or pre-positioned in the bell joint or coupling at the factory. When gaskets are color coded, be sure to consult the pipe manufacturer or his literature for the significance. In all cases, clean the gaskets, the bell or coupling interior, especially the groove area (except when gasket is permanently installed) and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. When gaskets are separate, use only gaskets, which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer.
- B. Lubricant should be applied as specified by the pipe manufacturer. Bacterial growth, damage to the gaskets or the pipe, may be promoted by use of non-approved lubricants. Use only lubricant supplied by the pipe manufacturer. After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing into the bell. When field-cut is necessary, a square cut is required. Use a factory-finished beveled end as guide for proper bevel angle and depth of bevel plus distance to the insertion reference mark.
- C. Installation shall start at the low end of each section and proceed upgrade. All bell and spigot pipe shall be laid with the bell end upgrade. Assembly of all types of pipe shall be done in strict conformance with the requirements of the pipe manufacturer.
- D. Pipe shall be accurately laid to alignment and grade shown on the Plans or established by the Engineer.
- E. Damaged pipe must be removed and not reused.

1. All pipes shall be laid in a bed prepared by hand work, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length. Adjustment of pipes to lines and grade shall be made by scraping away or filling in and tamping material under the body of the pipe throughout its entire length, and not by blocking or wedging. Where a hand-shaped trench bottom conforming to barrel of pipe is not available or practical.
2. The flexibility of plastic pipe may cause a possible problem in maintaining line and grade. Therefore, special care must be taken in the preparation of the subgrade and in the placement of bedding to ensure that the pipe is laid true to line and grade as required in this specification.
3. Plastic pipe shall be bedded with Class A bedding – 42” of cover:

<b>Type of Pipe</b>	<b>Depth of Cover</b>	<b>Bedding Required</b>
PVC	0' to 6'	Class A
PVC	greater than 6'	See Plans

- F. Bell Holes shall be provided at the ends of each pipe length, of sufficient size to permit making up the particular type of joint being used.
- G. Pipes shall be laid in accurate conformity with the prescribed lines and grades. Pipe alignment shall not deviate from that shown on the plans by more than 3/4 pipe diameter, nor shall it change in alignment more than 2 inches in 20 feet.
- H. After each length of pipe has been laid to line and grade, it shall be jointed to the preceding section as hereinafter specified, and after said jointing procedure has commenced. There shall be no movement of the pipe whatsoever in subsequent operations.
- I. Pipe Cleaning. Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be tightly closed to prevent entrance of animals and foreign materials.
- J. The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage due to this cause and shall at his own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating.
- K. Standard laying lengths shall be 20 feet (+/- 1"). PVC pipe shall be installed in accordance with the manufacturers recommendations (AWWA C900) and the recommended practices as given in ASTM D2774.

### 3.02 PRESSURE TESTING OF PVC PIPE .

- A. Pipe sections shall be pressure tested accordance with AWWA C605 as described in specification 02675.

**END OF SECTION**

## **SECTION 02669**

### **APPURTENANCES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

The Contractor shall furnish all labor, materials, equipment and services necessary for the completion of the work specified and as shown on the contract drawings.

##### **1.02 CONTRACTOR SUBMITTALS**

- A. Submittal shall be delivered to Engineer in accordance with Section 01300 - Submittals of the Technical Specifications.

#### **PART 2 PRODUCTS**

##### **2.01 CAP EXISTING PIPELINES**

- A. The Contractor shall, after the new water main has been installed complete with all service installations, pressure tested, health sampled, and accepted by the City, cut the existing pipeline where shown on the drawings and install a mechanical joint cap. Where a joint or coupling in the existing pipeline is uncovered at the cut and cap locations shown on the drawings, the Engineer may allow, upon the request of the Contractor, the existing pipeline to be disconnected at such joint or coupling and the installation by the Contractor of a cap or plug approved by the Engineer.
- B. The Contractor shall install a concrete thrust block in accordance with the provisions of the contract drawings at all installed caps and/or plugs.
- C. The Contractor shall not operate any valves required to be set in the closed position to isolate a section of pipeline to be cut or disconnected except in the presence of the Engineer. When such valves are so closed, the Contractor shall place in the valve box a 2 inch by 4 inch piece of lumber which shall be long enough to extend within 2 inches of the existing surface grade when resting on the valve operating nut. When the pipeline is operational, the piece of lumber shall be removed by the Contractor, and the valve shall be reopened in the presence of the Engineer.

##### **2.02 SLEEVE-TYPE COUPLINGS**

- A. Middle ring and follower rings shall be made of carbon steel or ductile iron meeting requirements of ASTM A-536. Couplings shall be in sizes to fit the pipe and fittings shown on the drawings. The middle ring shall not be less than 1/4 of an inch in thickness and a minimum of 5 inches long.
- B. Bolts, nuts and washers for couplings to be buried shall be cadmium plated, high-strength, low-alloy steel meeting the composition requirements of AWWA C111, stainless steel 304 or 316. All other installations shall have bolts and nuts meeting the requirements of AWWA C111. Type II Service Class 1, zinc-plated bolts, nuts and washers are also acceptable.

- C. Gaskets shall contain no reclaimed rubber and shall be suitable for use in potable water systems.
- D. All ferrous surfaces shall be epoxy coated at the factory.
- E. Couplings which are to be buried shall be entirely coated with an approved asphaltic material in the field and shall be wrapped.
- F. Sleeve-type couplings shall be as manufactured by Smith-Blair, Dresser, Apac, or Engineer's approved equal.

#### 2.03 MECHANICAL-TYPE COUPLINGS

- A. Mechanical-type couplings shall conform to ANSI/AWWA C606, "Standard for Grooved and Shouldered Type Joints."
- B. Mechanical-type couplings of nominal size less than 12 inches shall be used with cut-grooved standard IPS pipe and shall be Gustin-Bacon Gruvagrip Number 100, ITT Grinnell Gruvlock 7001, Victaulic Style 77, or Engineer's approved equal.
- C. Mechanical-type couplings of nominal size greater than 12 inches shall be used with Type D shoulders as shown in Figure 2 of ANSI/AWWA C606-81 and shall be Victaulic Style 44 or Engineer's approved equal.
- D. Bolts, nuts and washers for couplings to be buried shall be cadmium plated, high-strength, low-alloy steel meeting the composition requirements of AWWA C111, stainless steel 304 or 316. All other installations shall have bolts and nuts meeting the requirements of AWWA C111. Type II Service Class 1, zinc-plated bolts, nuts and washers are also acceptable.

#### 2.04 FLANGE GASKETS

- A. Flange gaskets shall be full-face, 1/8 inch thick, cloth-inserted rubber sheet or Engineer's approved equal.

#### 2.05 BLIND FLANGE GASKETS

- A. Blind flange gaskets shall consist of 1/8 inch thick, cloth-inserted rubber sheet or Engineer's approved equal which shall cover the entire inside surface of the blind flange.

#### 2.06 SERVICE SADDLES

- A. Service saddles for ductile-iron pipe 4 inch through 12 inch and 16 inch in diameter shall be double strap bronze service saddles, Jones J-979, Smith-Blair 323, or Engineer's approved equal. Service saddles for ductile-iron pipe 14 inch in diameter shall be double strap bronze service saddles, Baker Series 183 or Engineer's approved equal.
- B. Service saddles for polyvinyl chloride pressure pipe 12 inches and smaller in diameter shall be Ford Style 202BS with a stainless steel band, grade 18-8, factory pre-sized to fit polyvinyl chloride pressure pipe (AWWA C900), or Engineer's approved equal. The Contractor shall

install service saddles for polyvinyl chloride pressure pipe in accordance with the manufacturer's specifications using care not to over tighten the restraining bolts.

- C. Except where authorized by the Engineer, service saddles shall not be installed closer than 12 inches to the end of the pipe upon which it is installed nor closer than 18 inches to any other service saddle.

#### 2.07 VALVE BOXES AND COVERS

- A. Cast iron sliding type adjustable valve boxes with covers shall be provided for all buried valves and shall consist of a top and bottom section with slide-type extensions and large bottom base where specified. The cover shall be a drop type with minimum skirt length of 2-inches. The cover shall also be marked with the word "WATER."
- B. Valve boxes shall be installed plumb and centered over the valve operating nuts.
- C. Valve boxes shall be installed in accordance with the contract drawings.
- D. Valve extension stems shall be provided where the depth to the top of the operating nut exceeds 5 feet. The extension stem shall be a 1-¼ inch solid round steel shaft fitted with a 2 inch AWWA nut and a self-centering device. The top of the extension stem operating nut shall be punch marked or welded with a 1-½ inch high letter "E."

#### 2.08 PIPE LOCATOR RIBBON

- A. Pipe locator ribbon shall be installed over the entire length of all types, sizes, and locations of water mains and shall be in accordance with standard detail shown on the contract drawings. Pipe locator ribbon shall be 3 inches wide plastic coated aluminum and shall be clearly marked "CAUTION BURIED WATER LINE" continuously along the length of the ribbon with minimum 1-¼ inch letters.
- B. Per City of Elko details

#### 2.09 FIRE HYDRANTS

- A. All fire hydrants shall conform to the requirements of the City standard details.

### **PART 3 EXECUTION**

NOT USED

**END OF SECTION**

## **SECTION 02670**

### **VALVES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. The Contractor shall furnish all valves in accordance with the drawings and specifications. All valves, including component parts thereof, shall equal or exceed the requirements set forth herein, and shall be manufactured by a firm normally engaged in the manufacture of such valves. All valves furnished for the work shall be new and shall be currently under manufacture.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURER**

- A. All valves shall be manufactured by the Mueller Company, Decatur, Illinois, 800-423-1323, or equal.

##### **2.02 TESTING/STANDARDS**

- A. All valves shall be designed for a water working pressure of 150 psi, unless otherwise shown on the drawings or set forth in these specifications.
- B. The Contractor shall install and test all valves furnished in conformance with the drawings and specifications.
- C. The Contractor shall supply to the Engineer records of tests performed on valves or component parts thereof that are required by the AWWA Valve Standard specified in these specifications, if requested by the Engineer any time within a period of one year after the acceptance of the work.
- D. The Contractor shall provide to the Engineer, when requested by the Engineer, an Affidavit of Compliance with the specified AWWA Valve Standard or Section 6.3 of AWWA C550 for each lot or valve size furnished for the work.

##### **2.03 SHOP DRAWINGS**

- A. Shop drawings shall be furnished in accordance with Division 01300 of these specifications. Shop drawings shall be submitted with the valve operator in the position and orientation as shown on the drawings. Shop drawing submittals shall not be required for butterfly valves and gate valves 12-inches in diameter and smaller, resilient-seated gate valves, angle meter stops, or corporation stops unless requested by the Engineer.

##### **2.04 FLANGES**



- A. Valves shall be furnished with flanged ends, hub ends, "Ring Tite" ends or any combination thereof as required by the drawings or these specifications.
- B. Valve flanges may be raised or plain faced with either a smooth or serrated finish and shall be faced and drilled to ANSI B 16.1, Class 250 cast iron flange dimensions, unless otherwise shown on the drawings or specified in these specifications.
- C. All interior bronze parts of valves, except gate valve stems, shall be NSF/ANSI 61 and NSF/ANSI 372 certified, unless otherwise required by these specifications or shown on the drawings.

#### 2.05 COATINGS

- A. All ferrous surfaces in the water passages of valves 12-inches in diameter and larger, and all resilient-seated gate valve sizes shall have a fusion bonded epoxy coating such as Scotch Kote 134 or approved equal.

#### 2.06 OPERATOR

- A. All valve operators shall turn clockwise to close.

#### 2.07 SEAT

- A. The Contractor shall lubricate the seat of all rubber-seated valves prior to installation with 111 Silicone Compound as manufactured by Dow Corning, G661 Silicone Compound as manufactured by General Electric, or Engineer's approved equal.
- B. All valves 12-inches in diameter and smaller shall be epoxy coated gate valves or resilient-seated gate valves.

#### 2.08 RESILIENT-SEATED GATE VALVES (3-INCHES THROUGH 12-INCHES)

- A. Resilient-seated gate valves and component parts thereof shall conform to the following standards, except as otherwise specified in these specifications:
  1. AWWA C509, Resilient-Seated Gate Valves, 3 Through 20 NPS, for Potable Water Supply Service.
  2. NSF/ANSI 61 and NSF/ANSI 372 certified.
  3. AWWA C550, Protective Interior Coatings for Valves and Hydrants.
- B. Resilient-seated gate valves shall be of the iron-bodied, non-rising stem type with O-ring stem seals.
- C. All interior parts of resilient-seated gate valves in contact with water, except the valve body and stem, shall be made of bronze conforming to the requirements of ASTM B62. Valve stems shall be of bronze containing not more than 5 percent of zinc, not more than two percent of aluminum, and shall have a minimum tensile strength of 60,000psi, a yield strength of 40,000psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured.

- D. Resilient-seated gate valves shall be suitable for installation in the vertical or horizontal position.
- E. Resilient-seated gate valves shall have the bonnet connected to the body by means of bolts and nuts or studs which are cadmium-plated steel or stainless steel 304 or 316. Type II, Service Class 1, zinc-plated bolts are also acceptable.
- F. Resilient-seated gate valves shall be provided with a 2 inch square operating nut or handwheel where specified on the drawings. Valves shall be opened by turning the operating nut or handwheel in a counterclockwise direction.

## 2.09 BUTTERFLY VALVES

- A. Butterfly valves, butterfly valve operators, and component parts thereof shall conform to the following standards, except as otherwise specified in these specifications:
  - 1. AWWA C504, Rubber-Seated Butterfly Valves.
  - 2. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
  - 3. ASTM A436, Austenitic Gray Iron Castings.
  - 4. ASTM B 62, Composition Bronze or Ounce Metal Castings.
  - 5. AWWA C550, Protective Interior Coatings for Valves and Hydrants.
- B. All butterfly valves shall be Class 250B and shall be short-bodied unless otherwise shown on the drawings.
- C. Butterfly valve discs shall be manufactured of any of the materials listed in Section 4.1 of AWWA C504, except bronze. Prior to application of the required coating, any casting holes in the disc shall be plugged.
- D. Butterfly valve seats shall be removable and replaceable while installed in the pipeline for valves 24 inches in diameter and larger. The rubber seat shall be applied to either the valve body or the disc. If the rubber seat is applied to the disc, the rubber seat shall be secured to the disc by means of cap screws by one of the two following methods:
  - 1. If the cap screws penetrate the rubber seat, the cap screws shall bear against a metal retaining ring which shall be an integral part of the rubber assembly. The metal retaining ring shall be applied to the rubber seat by vulcanizing or bonding process in such a manner that the metal retaining ring and the rubber seat are installed and removed as a single unit.
  - 2. If the cap screws do not penetrate the rubber seat, a portion of the rubber seat shall be installed in a groove or recess in the disc, and the metal retaining ring shall then bear upon that portion of the rubber seat that is installed in the groove or recess.

For the applicable above method the Contractor shall furnish the Engineer with the manufacturer's specified torque to be used to set the cap screws, or clearance to be attained between the rubber seat and the mating surface when replacing or adjusting the rubber seat.

- E. The inside flow diameter (smallest flow area not including any portions occupied by the seat) shall not be less than 1-½inches smaller than the nominal diameter.
- F. Surfaces that mate with the rubber seat of a butterfly valve to effect the valve closure shall be stainless steel ASTM A276, Type 304 or 316, or an alloy of nickel-chromium (nichrome).
- G. Shaft seals shall be designed for the use of standard split "V" type packing or standard O-ring seals.
- H. Valves shall be bubble tight with rated pressure applied from either side of the valve. Valves shall be bi-directional for control of flow from either direction.
- I. There shall be no travel stops for the disc on the interior of the body.
- J. All butterfly valves larger than 12 inches in diameter and smaller than 48 inches in diameter shall meet the requirements of these specifications for butterfly valves and shall be manufactured by Mueller, Keystone, Pratt or Engineer's approved equal.

#### 2.010 BUTTERFLY VALVE OPERATORS

- A. Butterfly valve operators and component parts thereof shall conform to the following standards, except as otherwise specified in these specifications:
  - 1. AWWA C504, Rubber-Seated Butterfly Valves.
  - 2. ASTM B 62, Composition Bronze or Ounce Metal Castings.
- B. Butterfly valves shall be provided with counterclockwise opening manual operators. The operating torque of each valve and operator shall be computed in accordance with Chapter 2 of AWWA M49. The operators shall be sized for bi-directional flow.
- C. Handwheel Operators
  - 1. Butterfly valve operators shall produce required torque with a maximum handwheel pull of 80 pounds for handwheels and chainwheels and 150 pounds for operating nuts.
  - 2. Handwheels shall be 8 inches in diameter for valves 3 inches through 12 inches in size. Handwheel sizes shall conform to detail drawings in checking for adequate operating space.

#### 2.011 AIR-VACUUM VALVES

- A. Air vacuum valves shall have screwed ends, unless otherwise shown on the drawings.

- B. Valve bodies shall be of high strength cast iron and the float and seat shall be of Type18-8 stainless steel.
- C. All moving parts of the valves shall be bronze conforming to the requirements of ASTM B584, Copper Alloy Sand Casting for General Applications, or of Type18-8 stainless steel.
- D. Valve seat washers and gaskets shall be of a material insuring watertightness.
- E. Valves shall have a water working pressure equal to the design pressure of the pipe and shall be tested under a hydrostatic pressure of at least 300psi.
- F. Valves shall be Crispin, Combination Air Valves as manufactured by Multiplex Manufacturing Company, APCO "Heavy Duty" Air-Vacuum Valves as manufactured by Valve and Primer Corporation, or Engineer's approved equal.

#### 2.012 AIR RELEASE VALVES

- A. Air release valves shall have screwed ends, unless otherwise shown on the drawings.
- B. Air release valve bodies shall be of high-strength cast iron and the float and seat shall be of Type18-8 stainless steel.
- C. All moving parts of the air release valves shall be lead free bronze conforming to the requirements of ASTM B584, Copper Alloy Sand Casting for General Applications, or of Type18-8 stainless steel.
- D. Air release valve seat washers and gaskets shall be of a material insuring watertightness.
- E. Air release valves shall have a water working pressure equal to the design pressure of the pipe and shall be tested under a hydrostatic pressure of at least 300psi.
- F. Air release valves shall be APCO Air Release Valves as manufactured by Valve and Primer Corporation, Crispin Universal Air Valves as manufactured by Multiplex Manufacturing Company, or Engineer's approved equal.
- G. Air release vent caps shall be equipped with a stainless steel screen that is 22 to 24 mesh per inch (NAC 445A.67135 (3)(b)).

#### 2.013 CORPORATION STOPS

- A. Corporation stops shall be James Jones No. J-41, Mueller H-10012, or Engineer's approved equal.

#### 2.014 CHECK VALVES

- A. Check valves shall be weight-and-lever operated swing check valves.
- B. Check valves shall be iron body, bronze mounted.
- C. Check valves shall meet or exceed ANSI/AWWA C508 standard.

D. All internal components shall be removable through the top of the valve.

**PART 3 EXECUTION**

A. Valves shall be installed at the locations indicated on the plans and per manufacturer's recommendations.

**END OF SECTION**

**SECTION 02671**  
**BORING AND JACKING**

**PART 1 GENERAL**

1.01 SUMMARY

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings, install casings by horizontal directional boring or horizontal directional drilling and to properly complete pipeline construction as shown on the Drawings and described herein.

1.02 SUBMITTALS

- A. Materials submittals shall include shop drawings for casing pipe showing sizes and connection details and details on any casing spacers that will be used.
- B. Experience submittals shall be required as boring and jacking casings is considered specialty work. If the Contractor elects to perform the work, the Contractor shall provide evidence of a minimum of five continuous years of experience in steel casing construction.
- C. Contractor shall submit allowable tensile loads ATLs for various pipe sizes and lengths and a proposed “weak-link” or breakaway device in accordance with those ATLs for approval by the Owner prior to any pull-in installation including directional drilling. ATLs shall be determined using manufacturer’s recommendations and be in accordance with ASTM F 1804 Standard Practice for Determining Allowable Tensile Load for Polyethylene (PE) Gas Pipe During Pull-In Installation.

1.03 SAFETY

- A. Perform all excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA publication 2226.

**PART 2 PRODUCTS**

- A. **Steel Pipe Casing:** Steel pipe casing shall be manufactured from steel conforming to ASTM Grade 2 as amended to date, with a minimum yield strength of 35,000 psi before cold forming.
  - (1) Pipe may be straight seam or spiral welded. A protective coat will not be required. Spacers for installation of the carrier pipe shall be installed by the Contractor.
  - (2) The diameter and wall thickness of the steel piping shall be as listed in the following table.

			Casing Thickness (inches)
4	6.71	8	0.250
6	8.90	10	0.250
8	11.16	16	0.281
12	15.37	20	0.344
24	28.50	36	0.532
30	34.95	42	0.625

- (3) The thicknesses of casing shown in (2) are minimum thicknesses. Actual thicknesses shall be determined by the casing installer based on an evaluation of the required jacking forces. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.

- B. Casing Spacers:** Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick, also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float in the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company or Advanced Products and Systems, Inc., or equal.
- C. HDPE Casing:** The casing pipe shall be either iron pipe size or ductile iron pipe size with an SDR of 17 or less. Casing pipe shall be supplied by the same supplier approved for water mains. The pipe shall be produced by Performance Pipe, or equal.

### PART 3 EXECUTION

- A. Installation of Steel Pipe Casing by Boring:** Installation of steel pipe casing shall be by the dry bore method at locations requested by the Owner. Installation of steel pipe casing shall be in accordance with the applicable regulations of Nevada Department of Transportation (NDOT), the Detail Drawings, these specifications, and any permits acquired with respect to the particular boring. All excavation for the pit and bore shall be unclassified. Steel casing pipe shall be required for all NDOT crossings.
- (1) Boring pit: The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe operation. The Contractor shall take all precautions, and comply with all requirements as may be necessary to protect private or public property.
  - (2) Line and Grade: The Contractor shall set the boring rig so that after the casing is complete, and the water or sewer pipe is installed, the invert of the pipe shall conform to grade and alignment as shown on the Contract Drawings. As the casing is installed, Contractor shall check the horizontal and vertical alignment frequently. Contractor shall install the boring at a 90-degree angle to the crossing unless Owner approves a different crossing angle.
  - (3) Boring: Boring and jacking of the casing pipe shall be accomplished by the dry auger boring method without jetting, sluicing, or wet boring. The hole shall be bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The boring of the hole and installation of the casing pipe shall be simultaneous. Lengths of the casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedure.
  - (4) Diameter of Hole: Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
  - (5) Casing Pipe Length: Lengths of casing pipe shall be as long as practical for site conditions. Joints between sections shall be completely welded in accordance with AWS recommended procedures. Prior to welding joints, the

Contractor shall ensure that both ends of the casing sections being welded are square.

- (6) The Contractor shall plan to use a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- (7) Once the jacking procedure has begun, it should be continued without stopping until completed.
- (8) Installation of the Carrier Pipe: The carrier pipe for the water line shall be as shown on the Detail Sheet. Spacers for installation of the carrier pipe shall be furnished and installed by the Contractor.
- (9) Payment: The price bid for the steel casing shall include all necessary excavation and sheeting for the pit, protective service, and all other miscellaneous materials and work required for complete installation. Payment for steel casing shall be for total number of feet installed. Payment for the carrier pipe shall be by the unit price bid for the water line. The spacers shall be furnished and installed by the Contractor.

**B. HDPE Casing by the Boring Method:** HDPE casing pipe shall be installed by the Directional Bore Method in accordance with manufacturer's recommendations and where requested by the Owner. HDPE casing shall be installed where requested by the Owner and where the carrier pipe is also HDPE. Directional bores will be used for crossing creeks, rivers, and County Roads where approved by the Owner.

- (1) Boring pit: The boring pit shall be solid sheeted, braced, and shored as necessary to provide a safe operation. The Contractor shall take all precautions, and comply with all requirements as may be necessary to protect private or public property.
- (2) Line and Grade: The Contractor shall set the boring rig so that after the casing is complete, and the water or sewer carrier pipe is installed, the invert of the pipe shall conform to grade and alignment as shown on the Contract Drawings. As the casing is installed, Contractor shall check the horizontal and vertical alignment frequently. Contractor shall install the boring at a 90 degree angle to the crossing unless Owner approves a different crossing angle.
- (3) Centering spacers shall not be used for HDPE pipe installed in HDPE casing.
- (4) The annulus between the casing and the pipe shall not be grouted.
- (5) Contractor will join leading end of carrier pipe using a restrained mechanical joint or a flange adapter with a split backup ring.
- (6) Diameter of Hole: Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- (7) Casing Pipe Length: Lengths of casing pipe shall be as long as practical for site conditions. Joints between sections shall be completely fused in accordance with the manufacturer's recommendations.

**C. HDPE Casing by Horizontal Directional Drilling:** HDPE casing pipe shall be installed by the Directional Drilling Method in accordance with manufacturer's recommendations, ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacle, Including River Crossings, Plastic Pipe Institute Polyethylene Pipe for Horizontal Directional Drilling. Directional drilling will be used only where requested by the Owner. HDPE casing shall be installed where the carrier pipe is also HDPE. Directional



drilling techniques may be used for crossing creeks, rivers, and County Roads where approved by the Owner.

- (1) The movement of the pipe string and the pulling load on the polyethylene pipe shall be monitored and a weak link device shall be used to ensure that the pipe is not damaged during installation.
- (2) Contractor shall allow a 24-hour relaxation period for pipe installed by directional drilling before fusing additional pipe to the pulled in pipe.

**END OF SECTION**

## **SECTION 02675**

### **PRESSURE TESTING**

#### **PART 1 GENERAL**

##### 1.01 SUMMARY

- A. Furnish all equipment labor and materials required for testing the potable water main pipeline.
  - 1. Water for testing will be provided, in limited quantities, by the City.
  - 2. Tested in accordance with AWWA C605.

##### 1.02 CONTRACTOR SUBMITTALS

- A. Submit proposed testing schedule for review and approval by the Engineer, at least 3 days prior to testing.
- B. Proposed plans for water conveyance, control and disposal shall also be submitted in writing.

#### **PART 2 PRODUCTS**

Not Used

#### **PART 3 EXECUTION**

##### 3.01 GENERAL

- A. Water for testing will be furnished in limited quantities by the City; however, the Contractor shall make all necessary provisions for conveying the water from the City's designated source to the points of use.
  - 1. Testing operations shall be performed in the presence of the Engineer.

##### 3.02 TESTING

- 1. This specification supersedes Section 336.03.08, Pressure Line - Pressure and Leakage Tests, of the Standard Specifications. Water mains shall be pressure tested in accordance with AWWA C605 and all the following requirements.

##### 3.03 TEST PRESSURE

- 1. Test pressure for water distribution pipe shall be the class designation/rating of the pipe.

##### 3.04 PROCEDURE

- 1. Pressure and leakage tests shall be performed at the same time. The total testing time for each section of a new main installed shall be a minimum of two (2) hours.
- 2. When pipeline installation, testing and backfilling can be accomplished in the same day,

backfill only enough to prevent lifting of the pipe prior to filling with water and field testing. When conditions require that trenches be backfilled immediately after the pipe has been laid, testing shall be conducted prior to placement of permanent surface.

3. After the main has been laid it shall be filled with water for a minimum of twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly with water and all air expelled by means of taps at points of highest elevation.
4. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to Engineer. The test pressure shall be maintained for the specified time during which all exposed pipe, couplings, fittings, valves, and hydrants shall be examined carefully.
5. All cracked or defective elements shall be removed and replaced and the test repeated until all visible leakage has been stopped and the requirements as specified in Subsection 4 Allowable Leakage have been met.

3.05 ALLOWABLE LEAKAGE

1. No pipe installation will be accepted if the leakage for the section of the line that is tested is greater than that determined by the following formula:

$$Q = \frac{LD \sqrt{P}}{148,000}$$

Where: Q = Allowable Leakage (gallons per hour)  
L = Length of Pipe Tested (feet).  
D = Nominal diameter of pipe (inches).  
P = Test pressure (psig).

2. If the test leakage in any section is greater than permitted, Contractor shall, at his own expense, locate and repair the defective materials until the leakage is within the permitted allowance. All visible leaks shall be repaired regardless of the amount or rate of leakage.

3.06 MEASUREMENT OF LEAKAGE

1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi (0.35 Bar) of the specified test pressure after the air in the pipeline has been expelled and the pipe filled with water. The quantity of water supplied to maintain pressure shall be quantified by means of a positive displacement measurement from a reservoir of known volume. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

END OF SECTION

## SECTION 02701

### PRECAST UTILITY VAULT

#### PART 1--GENERAL

##### 1.01 SCOPE

This section specifies all buried precast utility vaults.

##### 1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A48	Grey Iron Casting
ASTM C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C990	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C857	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
CBC	2001 California Building Code

##### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01300.
- B. Details of construction, joints, sealants, frames and covers and appurtenances.
- C. Structural calculations of precast utility vaults in accordance with ASTM C857 and sealed by civil or structural engineer licensed in the State of Nevada.

## 1.04 WARRANTY

The Contractor shall furnish the Construction Manager with the manufacturer's standard 1-year bonded warranty against defects in material or workmanship provided by a surety acceptable to the Owner.

## PART 2--PRODUCTS

### 2.01 CONCRETE

Concrete shall be as specified in Section 03300.

### 2.02 REINFORCING

Reinforcing shall be as specified in Section 03200.

### 2.03 (NOT USED)

### 2.04 MATERIALS AND DESIGN

Precast structural sections shall conform to ASTM C478 and meet the following additional requirements:

1. The wall and slab thickness shall not be less than 8 inches with minimum of one layer of reinforcing steel.
2. Sections shall have tongue and groove joints with sealants.
3. Total weight of precast vaults with content including backfill and superimposed live loads shall not exceed 3500 psf.
4. Prevent buoyancy from fully submerged conditions with safety factor of 1.5.
5. ASHTG H20 traffic loading on structure.
6. Lateral at-rest earth pressure at 70 pcf above groundwater and 40 pcf plus hydrostatic pressure below groundwater.
7. Lateral passive earth pressure at 350 pcf above groundwater and 200 pcf below groundwater.

Sealant shall be Ram-Nek by K.T. Snyder Co. Inc., or equal.

Steps in walls of precast utility vaults and manholes shall be safety steps per ASTM C478 as shown on the drawings. Steps shall be installed at 12 inches on center. Bottom step shall be installed 12 inches above floor of structure. Top step shall be installed within 14 inches of ground surface or top of structure openings, as applicable.

Grout used in the shaping of inverts, setting and anchoring ring and cover, etc., shall consist of one part Type II Portland cement and two parts of fine, clean sand. Only sufficient water shall be added to provide a stiff, workable, cement mixture of proper troweling. Hydrated lime or masonry cement shall not be used.

## PART 3--EXECUTION

### 3.01 GENERAL

Precast vaults shall be constructed to the dimensions as shown on the drawings and as specified in these specifications.

Precast vaults shall be set on (minimum) 12 inches of foundation material with filter fabric wrap unless shown otherwise. Top of manholes at vaults shall be set at the elevation as noted on the drawings to match existing grade.

Precast sections shall be set so as to be vertical and with sections in true alignment with a ¼-inch maximum tolerance to be allowed. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. Contractor shall provide overexcavation as required in Section 0220. If leaks appear in the manholes, the inside joints shall be recalked with the sealing compound to the satisfaction of the Construction Manger. The Contractor shall install the precast sections in a manner that will result in a watertight joint.

Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

### 3.02 TESTING

Manholes, vaults and other appurtenances shall be subject to visual inspection by the Construction Manager. Any defects or leaking noted at the time of such inspection shall be corrected by the Contractor at no additional cost to Owner.

**\*\*END OF SECTION\*\***

## SECTION 02831

### CHAIN LINK FENCE & GATES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. The work to be performed under this section shall be the construction and installation of a 6-foot chain link fence with 3 strands of barbed wire on top. Fence to stand 6 feet above grade. All fence material, except barbed wire, shall be galvanized and vinyl coated brown. The fence shall be constructed and installed per this specification and as shown on the Drawings.
- B. The fence may be erected at any time after the earthwork, pipe work, and structures, to which the fence is related, have been completed. The fence shall be protected against damage and, if damaged, it shall be repaired to the satisfaction of the Engineer prior to final acceptance.

#### PART 2 PRODUCTS

##### 2.01 FENCE AND GATES

- A. The chain link fence and gates shall be a USS Cyclone-Type I, Anchor Post Products, Inc., or equal. The components shall be as listed and specified below:

- 1. Fabric:

a. Height	6'-0"
b. Mesh	2-inch
c. Size wire	9-gauge
d. Coating	Zinc coating, vinyl coated
e. Coating specifications	ASTM A 392 - Class 1
f. Tensile strength	80,000 psi minimum

- 2. Barbed Wire:

a. Total No. of Strands	3
b. Wires per Strand	2
c. Size of Wires	12 gauge
d. Barbs	14-gauge, 14-point @ 4" o.c.

- 3. Top Rail Size:

1-7/8-inch O.D. Sch. 40  
pipe weighing 2.72 pounds  
per lineal foot, galvanized, vinyl coated

- 4. Tension Wire:

7-gauge galvanized coil  
spring wire

- 5. Line Posts:

2-7/8-inch O.D. Sch. 40

pipe weighing 5.79  
pounds per L.F., galvanized, vinyl coated

- 6. Terminal, Corner, Angle,  
And Pull Posts Sizes      4-inch O.D. Sch. 40  
Weighing 9.11 pounds per L.F.

B. Except where shown differently on the Plans, gate posts shall be as determined by the following schedule:

Gate Leaf Width Feet	Size OD Inches	Weight lb/LF
0 to 6	4	9.11
Over 6 to 13	4	9.11
Over 13 to 18	6-5/8	18.75
Over 18	8-5/8	24.70

- C. All posts, rails, and appurtenances shall be hot-dipped zinc, vinyl coated steel per ASTM A 120, A 121, A 123, or A 153, whichever is applicable. Pipe posts shall have tops, which exclude moisture. End, corner, and gate posts shall be braced with the same material as top rail and trussed to line posts with 3/8-inch rods and tighteners.
- D. The fabric shall be connected to the line posts with 6-gauge hot-dip galvanized wire clips every 14 inches, to end, corner, and gate posts by using 1/4" x 3/4" stretcher bars tied to posts every 14 inches with 11-gauge, 1-inch wide, hot-dip galvanized steel bands and 3/8-inch diameter bolts and nuts, and to tension wires and top rail with 11-gauge hog rings every 24 inches.
- E. A 7-gauge, galvanized coiled, spring tension wire shall be installed along the bottom of the fence fabric and at the top when the top rail is not shown on the Plans.
- F. Swing chain link gates shall be provided where indicated on the Plans. Gate frames shall be made of 2.00-inch O.D. galvanized pipe, vinyl coated weighing 2.72 pounds per linear foot. Corner fittings shall be heavy pressed steel or malleable castings.

**PART 3 EXECUTION**

**3.01 CONSTRUCTION OF FENCE**

- A. The chain link fence shall be located as indicated on the Plans. Finished fence shall be plumb, taut, true to line and grade, and complete in all details. End, corner, slope, and gate posts shall be braced to the midpoint of the nearest line post or posts with horizontal braces used as compression members and the said line posts trussed from the brace back to the bottom of the end, corner, slope, or gate post with 3/8 inch steel truss rods with turnbuckles or other suitable tightening devices used as tension members.
- B. Unless otherwise specified, all fences shall be installed with a top rail and a bottom tension wire. When top rail is omitted, a top and bottom tension wire shall be used.



- C. The fabric shall be placed on the outward facing side of the posts and shall be installed so that the top edge projects over the top rail of the fence. The fabric shall be stretched taut and securely fastened to the posts, the top rail and the bottom tension wire. The tension wire shall be installed parallel to the line of the fabric.
- D. The fence shall follow the general finished grade of the ground and shall have pull posts at all points where required to conform to a change in grade. Space between the bottom of the fence and the finished ground line shall not exceed 3 inches. The ground shall be graded before fence posts are located to permit the grade of the fence to remain constant over any local elevations or depressions in the ground line. The surplus dirt, concrete, etc., shall be cleaned up and the grade dressed up after completion of the work.
- E. Fence posts shall be set in concrete foundations at least 3 feet into the ground and shall be spaced not over 10 feet apart. Concrete shall be a minimum of 10 inches in diameter for line posts and 12 inches in diameter for corners and gates or 3 times the diameter of the post, whichever is greater. Solid rock is to be cored and grouted 2-inch annulus to 2-foot depth. Exposed concrete fence post caps shall be finished off in a workmanlike manner. A minimum of 1-inch of concrete shall be above the finished grade and shall be sloped to drain away from the post.

### 3.02 CONSTRUCTION OF SWING GATES

- A. Except as otherwise shown or specified, all chain link fence gates shall be swing gates.
- B. The corners of gate frames shall be fastened together and reinforced with a fitting designed for the purpose or by welding. All welds shall be ground smooth.
- C. Chain link fence fabric shall be attached to the gate frame by the use of tension bars and tie wires as specified for fence construction, and suitable tension connectors spaced at approximately 16-inch intervals.
- D. Gates shall be provided with a combination steel or malleable iron catch and locking attachment of approved design. Stops to hold gates open and a center rest with catch shall be provided where required.

**END OF SECTION**