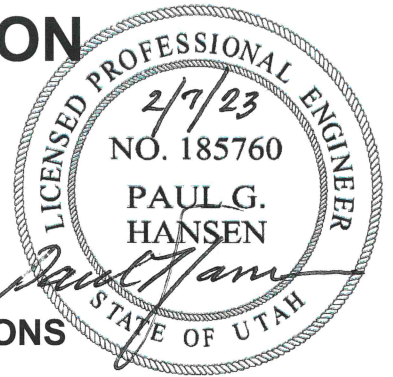


# TOOELE CITY CORPORATION

## WATER SYSTEM AMENDMENT

(Revised January 2023)

### APWA MANUAL OF STANDARD SPECIFICATIONS (2017 Edition)



This document modifies a portion of the 2017 APWA Standards, and shall be used on all projects located within Tooele City. Any specification not shown herein shall default back to the 2017 APWA Specifications and remain in full force and effect.

### SPECIFICATIONS

<u>Reference Number</u>	<u>Title</u>	<u>No. of Pages</u>
<b>DIVISION 1 - GENERAL REQUIREMENTS</b>		
01 45 00R	Quality Control .....	2
<b>DIVISION 3 - CONCRETE</b>		
03 30 04R	Concrete .....	10
03 30 05R	Concrete Testing .....	5
03 30 10R	Concrete Placement .....	6
03 39 00R	Concrete Curing .....	3
03 40 00R	Precast Concrete .....	5
<b>DIVISION 5 - METALS</b>		
05 05 23R	Bolts, Nuts and Accessories .....	2
<b>DIVISION 31 - EARTHWORK</b>		
31 23 23R	Backfilling for Structures .....	5
31 23 26R	Compaction .....	2

<u>Reference Number</u>	<u>Title</u>	<u>No. of Pages</u>
-------------------------	--------------	---------------------

**DIVISION 33 - UTILITIES**

33 05 05R	Ductile Iron Pipe	2
33 05 07R	Polyvinyl Chloride Pipe	3
33 05 20R	Backfilling Trenches	6
33 08 00R	Commissioning of Water Utilities	5
33 11 00R	Water Distribution and Transmission	8
33 12 16R	Water Valves	4
33 12 19R	Hydrants	4
33 12 33R	Water Meters	2

**STANDARD PLANS**

293R	Typical Street Section with Curb & Gutter	1
381R	Typical Trench Backfill Detail	2
511R	Fire Hydrant with Valve Detail	2
521R	3/4" and 1" Meter	2
522R	1.5" or 2" Compound Meter (Alternates No. 1 and 2)	3
523R	3" or 4" Compound Meter	2
525R	6" Compound Meter	2
527R	8" Compound Meter	2
529R	10" Compound Meter	2
530R	6" Fire Line Meter	2
531R	8" Fire Line Meter	2
541R	Water Service Line	2
546R	Fire Hydrant Replacement or Relocation	2
551R	3/4" and 1" Service Taps	2
552R	1.5" and 2" Service Taps	2
561R	Standard Direct Bearing Thrust Block Details	2
562R	Tie Down Thrust Restraint	2
571R	4" Washout Valve	2
572R	Detector Check Valve	2
573R	PRV (4" thru 12")	6
574R	Cover Collar for Water Valve Boxes	2
575R	Air Release Assembly	2
576R	Hot Tap Detail	2
593R	Pressurized Irrigation and Potable Water Interface (Alt. No. 1 and 2)	3
632R	Reduced Pressure Principal Assembly Station	2

**SECTION 01 45 00 (Revised)**  
**QUALITY CONTROL**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. CONTRACTOR responsibilities for quality control.

**1.2 QUALITY ASSURANCE**

- A. Employ an **independent** agency or staff to assure installed product and materials comply with Contract Documents, and to assure inspections, tests, and other services comply with industry standards.
- B. Use an AMRL (AASHTO Materials Reference Library) certified laboratory that has personnel certified by WAQTC (Western Alliance for Quality Transportation Construction).
- C. When requested by ENGINEER, provide a professional opinion from a testing agency concerning test results and quality of work covered by testing performed.
- D. Do more testing, if, in ENGINEER's opinion, work is not being adequately controlled.

**1.3 TESTING AGENCY**

- A. Provide sufficient personnel and cooperate with ENGINEER and CONTRACTOR in performing testing service.
- B. Obtain and secure samples using procedures specified in the applicable testing code.
- C. Perform product testing in accordance with applicable requirements of the Contract Documents.
- D. Correlate tests with ENGINEER's acceptance tests.
- E. When an out-of-tolerance condition exists, perform additional control testing until tolerance is attained.
- F. Report any non-compliance of materials and mixes to CONTRACTOR and ENGINEER immediately.

**1.4 SUBMITTALS – CONTRACTOR**

- A. **Before Construction:** Identify:
1. Name, address and telephone number of testing agency.
  2. Person whom agency has charged with engineering managerial responsibility.
  3. Licensed professional for testing agency who is to review services.
  4. Names and levels of certification and years of experience of testing agency's laboratory and field technicians.

- B. **During Construction:** Submit quality control test data requested by ENGINEER to demonstrate work performed complies with Contract Documents.

### 1.5 SUBMITTALS – TESTING AGENCY

- A. **During Construction:** Submit field test results immediately to ENGINEER and CONTRACTOR or not later than day of test. Submit laboratory test results within 48 hours of determination.
- B. **After Construction:** Submit a final summary report in tabular form. Show each failed test and its corresponding passing test.
- C. **Reports:** Include on all reports:
1. Project title, number and date.
  2. Date, time and location of test.
  3. Name and address of material Supplier.
  4. Identification of product being tested and type of test.
  5. Testing results and interpretation of results.
  6. Name of technician(s) who sampled and who performed test.

### 1.6 LIMITS ON TESTING AGENCY

- A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Agency may not suspend work.
- C. Agency has no authority to determine acceptance for ENGINEER.
- D. Samples must be collected and secured only by the testing agency.

---

## PART 2 PRODUCTS

---

### 2.1 MATERIALS

- A. Material furnished from sources that have been found satisfactory under OWNER's or ENGINEER's normal testing and sampling procedures may be used in the Work.
- B. Materials that are supported with a Supplier's certificate of compliance may be used in the Work. Certificate must be in possession of CONTRACTOR for review by ENGINEER before use.

---

## PART 3 EXECUTION

---

Not Used

END OF SECTION



**SECTION 03 30 04 (Revised)**  
**CONCRETE**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

A. Material requirements.

**1.2 REFERENCES**

**A. ACI Standards (Latest Editions):**

- 211.1 Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- 211.2 Selecting Proportions for Structural Lightweight Concrete.
- 211.3 Standard Practice for Selecting Proportions for No-Slump Concrete.
- 214 Evaluation of Strength Test Results of Concrete.
- 301 Specifications for Structural Concrete for Buildings.
- 305 Hot Weather Concreting.
- 306 Cold Weather Concreting.
- 318 Building Code Requirements for Reinforced Concrete.

**B. ASTM Standards (Latest Editions):**

- C 33 Concrete Aggregates.
- C 39 Compressive Strength of Cylindrical Concrete Specimens.
- C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- C 94 Ready-Mixed Concrete.
- C 117 Material Finer than 75 $\mu$  (No. 200) Sieve in Mineral Aggregates by Washing.
- C 123 Lightweight Particles in Aggregate.
- C 138 Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
- C 142 Clay lumps and Friable Particles in Aggregates.
- C 143 Slump of Hydraulic-Cement Concrete.
- C 150 Portland Cement.
- C 172 Sampling Freshly Mixed Concrete.
- C 227 Potential Reactivity of Cement-Aggregate Combinations (Mortar Bar Method).
- C 231 Air Content of Freshly Mixed Concrete by the Pressure Method.

- C 260 Air-Entraining Admixtures for Concrete.
  - C 289 Potential Reactivity of Aggregates (Chemical Method).
  - C 295 Petrographic Examination of Aggregates for Concrete.
  - C 441 Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to The Alkali-Silica Reaction.
  - C 494 Chemical Admixtures for Concrete.
  - C 535 Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - C 595 Blended Hydraulic Cements.
  - C 618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
  - C 1064 Temperature of Freshly Mixed Portland Cement Concrete.
  - C 1077 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
  - C 1116 Fiber-Reinforced Concrete and Shot Crete.
  - C 1157 Blended Hydraulic Cement.
  - C 1240 Use of Silica Fume as a Mineral Admixture in Hydraulic Cement Concrete, Mortar, and Grout.
  - C 1260 Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
  - C 1293 Concrete Aggregates by Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
  - C 1567 Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
  - C 1602 Mixing Water Used in The Production of Hydraulic Cement Concrete.
- STP 15-C Manual on Quality Control of Materials.

### 1.3 SUBMITTALS

#### A. **Quality Assurance:**

1. Independent Laboratory: Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM and ACI standards.
2. Mixing Equipment: Submit certification of plant equipment.

#### B. **Mix Design:** Allow ENGINEER 10 days to evaluate the submittal. Provide the following information.

1. Date of mix design. If older than 365 days from date of submission recertify mix design.
2. Physical properties of the aggregate (see this section's article 2.3). Test results shall not be older 455 days from the date of submission.

The information is for suitability of source and not for project control. A new report may be required if aggregate source is changed.

3. Identify whether mix is for hot, cold, or normal weather placement.
  4. Cement source, type and chemical composition.
  5. Aggregate soundness and potential reactivity.
  6. Average Strength ( $f_{cr}$ ), per quality control chart.
  7. Allowable range of slump and air content.
  8. Water cement ratio.
  9. Proportions of materials in the mix.
  10. Unit weight.
  11. ~~Analysis of water if water is not potable.~~ Water to be potable.
  12. Mortar bar or prism test results if a pozzolan is included in the mix.
  13. Technical data sheets for additives to be used at the plant and at the job site. Certify additives are compatible with each other.
- C. **Pre-approved Mix Design:** Submit name and address of Supplier and Suppliers mix design number if available.
- D. **Before Changing Mix Design:** Submit a new design and allow ENGINEER 10 days to evaluate the changes.

#### 1.4 QUALITY ASSURANCE

- A. General:
1. Use a laboratory that follows and complies with ASTM C 1077.
  2. Reject concrete that does not meet requirements of this section.
  3. If requested, submit a quality control and testing report describing source and field quality assurance activities performed by CONTRACTOR and Suppliers.
- B. At the Source:
1. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures except as allowed by mix design.
  2. Store bagged and bulk cement in weatherproof enclosures. Exclude moisture and contaminants.
  3. Prevent segregation and contamination of aggregate stockpiles.
  4. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.
- C. At the Site: Use of admixtures will not relax hot or cold weather placement requirements.

**1.5 ACCEPTANCE**

**A. Materials:**

1. Aggregate Source:
  - a. Verify suitability of aggregate source.
  - b. Verify aggregate gradation.
  - c. Verify percent of combined aggregate passing No. 200 sieve.
2. At the Site:
  - a. Verify mix identification, batch time, slump, air content, and temperature.
  - b. Verify drum rotation is less than 300 revolutions.
3. At the Laboratory: Verify strength in 28 days.

**B. Defective Material:**

1. Price adjustment, Section 01 29 00 and Section 03 30 10.
2. Dispute resolution, Section 01 35 10.

---

**PART 2 PRODUCTS**

---

**2.1 CEMENT**

**A. General:**

1. Do not use air entraining cement except for hand mixed applications.
2. Do not use cement containing lumps or is partially set.
3. Do not mix cement originating from different sources.

**B. Standard Set Cement:**

1. Type II cement per tables 1 and 3 in ASTM C 150, or Type V when necessary, or
2. Low-alkali cement per Table 2 in ASTM C 150.

**C. Blended Hydraulic Cement: The following are cement equivalencies when substituting blended cement for a portland cement.**

<b>Table 1 – Cement Equivalencies</b>		
<b>Portland Cement ASTM C 150</b>	<b>Blended Cement</b>	
	<b>ASTM C 595</b>	<b>ASTM C 1157</b>
Type I	IP	GU
Type II	IP (MS)	MS
Type III	--	HE
Type IV	--	--
Type V	--	HS

**D. Rapid Set Cement: As above and as follows:**

1. Initial set time: 15 minutes minimum.

2. Color: Acceptable to the ENGINEER.

## 2.2 WATER

- A. Clean, non-staining, non-detrimental per ASTM C 1602.
- B. Screen out extraneous material.
- C. Do not use alkali soil water.

## 2.3 AGGREGATES

- A. Gravel, crushed gravel, crushed stone, crushed concrete, slag, sand or combination with the following physical properties.

<b>Table 2 – Physical Properties</b>					
<b>Property</b>		<b>ASTM</b>	<b>Min</b>	<b>Max</b>	<b>Units</b>
<b>Coarse Aggregate</b>					
Wear (hardness or toughness) (a)		(a)	--	50	percent
Soundness (5 cycles)	Na <sub>2</sub> SO <sub>4</sub>	C88	--	12	percent
	Mg <sub>2</sub> SO <sub>4</sub>	C88	--	18	percent
Coal and lignite (SG = 2.4 min.) (b)		C123	0.5	1.0	
Clay lumps, friable particles, chert		C142	--	7	
Material finer than 200 sieve		C117	--	1.0	percent
<b>Fine Aggregate</b>					
Soundness (5 cycles)	Na <sub>2</sub> SO <sub>4</sub>	C88	--	10	--
	Mg <sub>2</sub> SO <sub>4</sub>	C88	--	15	--
Fineness modulus		C33	2.3	3.1	--
Coal and lignite (SG = 2.4 min.) (b)		C123	0.5	1.0	
Clay lumps, friable particles, chert		C142	--	3.0	percent
<b>Aggregate blend (meets one of the following)</b>					
1. Average prism length change in 12 months (c)		C1293	--	0.04	percent
2. Average mortar bar length change in 16 days (c)		C1260	--	0.10	percent
3. Petrography limits					
Quartz..... (d)		C295	--	5.0	percent
Chert or chalcedony .....			--	3.0	percent
Tridymite or cristobalite.....			--	1.0	percent
Opal.....			--	0.5	percent
Natural glass in volcanic rock .....			--	3	percent
4. Historical data acceptable to ENGINEER					
<b>NOTES</b>					
(a) Wear retained on No. 8 sieve. For aggregate less than 1 1/2" use ASTM C131. For larger aggregates use ASTM C 535.					
(b) Organic impurities producing a dark color concrete may cause rejection.					
(c) Prism length change and mortar bar length change based upon unmodified ASTM tests.					
(d) Quartz must NOT be optically strained, micro-fractured, or microcrystalline in nature.					

## 2.4 ADDITIVES

- A. Calcium Chloride: Not allowed in reinforced concrete.
- B. Air Entrainment: ASTM C 260. For extrusion enhancement use non-vinyl resin.
- C. Set Enhancement and Water Reducing Agents: ASTM C 494.
  - 1. Type A: Water reducing.
  - 2. Type B: Set retarding.
  - 3. Type C: Set accelerating.
  - 4. Type D: Water reducing and set retarding.
  - 5. Type E: Water reducing and set accelerating.
  - 6. Type F: High range water reducing (super plasticizer). \*
  - 7. Type G: High range water reducing and set retarding. \*
    - \* Keep the relative durability factor of water reducing additives not less than 90 and the chlorides content (as Cl<sup>-</sup>) not exceeding 1 percent by weight of the admixtures.
- D. Pozzolan:
  - 1. Natural or fly ash per ASTM C 618.
  - 2. Silica fume per ASTM C 1240.
- E. Special Admixtures: Allowed if mix design submittal is accepted:
  - 1. Lithium nitrate based solution for control of reactive aggregates.
  - 2. Calcium nitrite based solution for corrosion protection of reinforced structures subject to chloride-induced corrosion.
  - 3. Shrinkage reducer for controlling drying shrinkage in concrete.
  - 4. Viscosity modifier for enhancement of self consolidating concrete or for workability.

## 2.5 MIX DESIGN

- A. Selection of Cement: ASTM C 150 or C 1157.
  - 1. For sulfate resistance, use Type V portland cement, or Type II with Class F fly ash. Class F fly ash may be used as an addition to Type V portland cement.
  - 2. Do not use fly ash with Type IP(MS) or Type III portland cement.
- B. Selection of Aggregates:
  - 1. Maximum Particle Size:
    - a. 1/5 of narrowest dimension between forms.
    - b. 1/3 of depth of slab.
    - c. 3/4 of minimum clear spacing between reinforcing bars.
  - 2. Gradation: ASTM C 33.
    - a. Coarse Aggregate: Choose from the following grades. Gradations are based upon percent of material passing sieve by weight.

<b>Table 3 – Coarse Aggregate Gradation</b>				
<b>Sieve</b>	<b>Grade</b>			
	<b>357 (2")</b>	<b>467 (1.5")</b>	<b>57 (1")</b>	<b>67 (3/4")</b>
2-1/2"	100	--	--	--
2 Inch	95 - 100	100	--	--
1-1/2"	--	95 – 100	100	--
1"	35 – 20	--	95 – 100	100
3/4"	--	35 – 70	--	90 – 100
1/2"	10 – 30	--	25- 60	--
3/8"	--	10 – 30	--	20 – 55
No. 4	0 – 5	0 – 5	0 – 10	0 – 10

b. Fine Aggregate:

<b>Table 4 – Fine Aggregate Gradation</b>	
<b>Sieve</b>	<b>Percent Passing by Weight</b>
3/8"	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

- c. Silts and Clays: The amount of material smaller than the No. 200 sieve in any combined gradation sample is limited to the following percentages by weight of the combined sample:
- 1) 1.75 percent maximum for concrete subject to abrasion.
  - 2) 3.0 percent maximum for all other concrete.

C. Selection of Pozzolan:

1. General: If a blended aggregate passes an unmodified ASTM C 1293 test, use of a pozzolan is CONTRACTOR's choice. If aggregate does not pass ASTM C 1293, select a pozzolan (or blended cement, or both) and determine the effective dosage to meet one of the following tests:
  - a. ASTM C 1567. The expansion of a cement-pozzolan-aggregate job-mix mortar bar is less than or equal to 0.10 percent at 16 days. Do not use this test if a lithium admixture is used in the job-mix.
  - b. ASTM C 441. The expansion of a test mixture at 56 days is less than or equal to a control mixture prepared with cement with equivalent alkalis between 0.5 and 0.6 percent.
2. Fly Ash (Class F): Allowed as a cement replacement under the following conditions:
  - a. Before replacement is made, use the minimum cement content in the design formula to establish the water/cement ratio.
  - b. Replace up to 20 percent of the cement by weight on a one (1) part fly ash to one (1) part cement basis.

- c. Submit to ENGINEER a quality history of the fly ash identifying a minimum of 20 of the most current ASTM C 618 analysis.
  - 3. Natural Pozzolan (Class N): Allowed as a cement replacement if the 14 day expansion test (ASTM C 1567) with job aggregates, job cement and natural pozzolan does not exceed the 14 day expansion test of job aggregates, job cement and Class F fly ash.
  - 4. Silica Fume: Allowed as a cement replacement if replacement of hydraulic cement on a 1 part silica fume to 1 part cement does not exceed 10 percent, and water/cement ratio is established before cement is replaced with silica fume.
- D. Selection of Mix Properties: Select and proportion the mix to produce appropriate strength, durability and workability. Use ACI 211.1, 211.2, or 211.3, and meet the following properties and limitations:

Table 5 – Mix Properties and Limitations						
Properties		Test Method	Class			
			2000	3000	4000	5000
Compressive Strength ( $f_c'$ ) at 28 days, psi, minimum		ASTM C 39	2000	3000	4000	5000
Compressive Strength at 7 days, psi, (for reference only)		ASTM C 39	1340	2010	2680	3350
Average Strength, psi ( $f_{cr}$ )		ACI 214	(a)	(a)	(a)	(a)
Cement content, bags, minimum (b)		--	4.5	5.5	6.5	7.5
Water-cement ratio (by weight), maximum (c)		ACI 318	(d)	(d)	0.44	
Entrained air, percent (based upon aggregate size) (e)	2"	ASTM C 231	3.0 to 6.0	4.5 to 7.5	4.0 to 7.0	
	1-1/2"		"	"	4.5 to 7.5	
	1"		"	"	5.0 to 7.5	
	3/4"		"	"	5.0 to 7.5	
Slump		ASTM C 143	(d)	(d)	(d)	(d)
<p>NOTES</p> <p>(a). The amount by which average strength (<math>f_{cr}</math>) exceeds compressive strength (<math>f_c'</math>) is based upon statistical assurance that no more than 1 test in 100 tests will fall below compressive strength (<math>f_c'</math>).</p> <p>(b) Unless allowed otherwise by ENGINEER.</p> <p>(c) Before pozzolan substitution.</p> <p>(d) Specific to exposure conditions and finishing need.</p> <p>(e) Comply with ACI 211.1 if air content is changed.</p> <p>(f) 1 bag of cement = 94 pounds.</p>						



1. Cold Weather: ACI 306. Unless allowed otherwise by ENGINEER, increase cement content in the mix design by 1 class between **October 1 and March 1**, i.e. Class 3000 becomes Class 4000, Class 4000 becomes Class 5000, etc.
  2. Hot Weather: ACI 305. Reduce temperature of mix ingredients or use an admixture appropriate to job conditions when air temperature is over 75 deg F.
  3. Concrete Deposited Under Water: Increase cement content one (1) class for concrete placed above water or use viscosity modifying admixture.
- E. Selection of Fiber Reinforcement: The basis for determining material proportions of fiber-reinforced concrete is the Supplier's responsibility per ASTM C 1116 subject to mix property requirements of this Section. Unless specified otherwise provide synthetic fibers.

## 2.6 SOURCE QUALITY CONTROL

- A. General: Collect Samples randomly. Do not change source quality control sampling point.
- B. Aggregate:
1. Soundness, ASTM C 88.
  2. Alkali-silica reactivity, ASTM C 289, C 1567, C1260, C 227 and C 1293.
  3. Petrographically examine fine and coarse aggregate sources once every three (3) years, ASTM C 295.
- C. Concrete Mix: Obtain samples per ASTM C 172 and run the following tests:
1. Compressive strength, ASTM C 39.
  2. Unit weight, ASTM C 138.
  3. Slump, ASTM C 143.
  4. Air, ASTM C 231.
  5. Temperature, ASTM C 1064.
- D. Concrete Quality Charts: Comply with ACI 214 and ACI 301. Plot new results and identify trends on quality control charts that comply in form to ASTM STP 15-C. Show the Specified Strength ( $f_c'$ ), the required Average Strength ( $f_{cr}$ ), and the compressive strength versus date of Sample.
- E. Equipment: Certify at least every two (2) years through the services of a design professional licensed in the State of Utah, that plant equipment complies with requirements of the National Ready Mixed Concrete Association and ASTM C 94.
1. Transit Trucks: Equip transit trucks with plates indicating total volume, agitating volume and mix volume.
  2. Weights and Measures: Comply with regulatory requirements of State of Utah.

---

**PART 3 EXECUTION**

---

**3.1 INSTALLATION**

- A. Placement, Section 03 30 10.

**3.2 FIELD QUALITY CONTROL**

- A. Truck Mixed Concrete (Dry Batch): ASTM C 94.
1. Truck Mixer: Fill drum no more than 63 percent of the gross drum volume and no less than two (2) cubic yards. Use drum manufacturer's recommended mixing speed (between 12 – 18 rpm).
  2. Truck Agitator: Do not fill drum greater than 80 percent of the gross drum volume. Use drum manufacturer's recommended agitating speed (between 2 – 6 rpm).
- B. Mixing Plant: ASTM C 94.
1. Use option C and requirements in this Section for preparing ready-mixed concrete.
  2. Use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.
  3. Mixing time must exceed 80 seconds after adding air entrainment admixture.
- C. Hand Mixing:
1. Do not hand mix batches larger than 0.5 cubic yard.
  2. Hand mix only on a watertight platform.
  3. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency before adding water.

END OF SECTION

**SECTION 03 30 05 (Revised)**  
**CONCRETE TESTING**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Concrete sampling and testing requirements.

**1.2 REFERENCES**

A. **ACI Standards (Latest Edition):**

- 318 Building Code Requirements for Reinforced Concrete.

B. **ASTM Standards (Latest Edition):**

- C 31 Making and Curing Concrete Test Specimens in the Field.  
C 39 Compressive Strength of Cylindrical Concrete Specimens.  
C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.  
C 78 Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).  
C 136 Standard Method for Sieve Analysis of Fine and Coarse Aggregates.  
C 138 Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.  
C 143 Slump of Portland Cement Concrete.  
C 172 Sampling Freshly Mixed Concrete.  
C 173 Air Content of Freshly Mixed Concrete by Volumetric Method.  
C 231 Air Content of Freshly Mixed Concrete by the Pressure Method.  
C 567 Unit Weight of Structural Lightweight Concrete.  
C 1064 Temperature of Freshly Mixed Portland Cement Concrete.  
C 1077 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

**1.3 SUBMITTALS**

- A. Concrete Supplier: If requested, submit reports and material certificates verifying concrete quality control.
- B. Laboratory: Promptly submit test data results for seven (7) and 28 day breaks to Supplier, CONTRACTOR and ENGINEER.

#### 1.4 QUALITY ASSURANCE

- A. Provide an ASTM C 1077 compliant and ACI certified laboratory.
- B. Provide level I ACI certified field sampling technicians.

#### 1.5 SITE CONDITIONS

- A. Assist ENGINEER: Furnish labor to assist ENGINEER in obtaining and handling acceptance Samples at site or sources.
- B. Store and Cure Test Specimens: Safely store and cure concrete test specimens and acceptance test specimens for first 24 hours:
  - 1. Follow ASTM C 31 in making and curing cylinders or beams at site. Do not move the cylinders or beams for the initial 16 hour cure period. Provide initial cure temperature as follows:
    - a. 60 to 80 deg F for Class 4,000 or less.
    - b. 68 to 78 deg F for Class 5,000 or greater.
  - 2. Equip storage device with an automatic 24 hour temperature recorder with an accuracy of plus or minus two (2) deg F
  - 3. Use water containing hydrated lime if water is to be in contact with cylinders or beams.
  - 4. Ensure the device(s) can accommodate the required number of test cylinders or beams. Lack of capacity will cause the placement of concrete to cease.
  - 5. Have the storage devices available at the point of placement at least 24 hours before placement.
  - 6. A 24 hour test run may be required.

#### 1.6 ACCEPTANCE

- A. At the Laboratory:
  - 1. Compressive strength, ASTM C 31.
  - 2. Flexure strength, ASTM C 78.
- B. At the Site:
  - 1. Acceptance: Reject non-complying batches until two (2) consecutive batches are compliant then proceed in random batch testing for acceptance.
  - 2. Sampling Protocol: ASTM C 172. Unless indicated otherwise follow Table 1 sampling frequency requirements. Collect sample at discharge chute before placement, or at pumper hose after priming grout has been wasted.

<b>Table 1 – Sampling Frequency</b>				
<b>Rate of Placement (Cubic Yard / Day)</b>	<b>Temperature</b>	<b>Air</b>	<b>Slump</b>	<b>Strength</b>
0 - 8	1	1	1	Determined by ENGINEER
0 - 50	1	1	1	1
Each additional 50 cu. yd. or fraction thereof	1	1	1	1

3. Testing Protocol:
  - a. Temperature, ASTM C 1064.
  - b. Air content, ASTM C 231 or ASTM C 173 if lightweight aggregate is used.
  - c. Slump, ASTM C 143.

---

**PART 2 PRODUCTS** Not Used

---



---

**PART 3 EXECUTION**

---

**3.1 PRECAST PRODUCTS**

- A. Obtain composite Samples from different portions of the batch.
- B. Make and cure concrete test specimens for acceptance, ASTM C 31.
- C. Cure all precast products with water vapor or water.
- D. Do not damage precast products by stripping forms or handling before the concrete reaches its specified strength.

**3.2 CAST-IN-PLACE PRODUCTS**

- A. Obtaining Samples:
  1. Batch samples, ASTM C 172.
  2. Core samples, ASTM C 42.
- B. Identify location of tests on test reports.
- C. Compressive strength, ASTM C 39:
  1. Mold four (4) test specimens, ASTM C 31.
  2. For strength test perform slump, air, unit weight, and temperature test.
  3. Break 1 cylinder at seven (7) days and three (3) cylinders at 28 days. The average strength of three (3) cylinder breaks shall be considered the test result.
  4. If any one cylinder in a 28 days test shows definite evidence of

improper sampling, molding, handling, curing, or testing, discard the cylinder. The average strength of the remaining cylinders shall be considered the test result.

- D. Tensile (flexural) strength, ASTM C 78:
1. Mold ~~four (4)~~ **five (5)** test specimens, ASTM C 31.
  2. For strength test perform slump, air, unit weight, and temperature test.
  3. Break 1 beam at seven (7) days and three (3) beams at 28 days. The average strength of the three (3) beam breaks shall be considered the test result.
  4. If any one beam in a 28 days test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the beam. The average strength of the remaining beams shall be considered the test result.
  5. **If average strength of 28-day specimens does not meet strength requirement, test specimen #5 @ 56 days.**
- E. Aggregate, ASTM C 136 for fine and coarse aggregate.
- F. Slump test, ASTM C 143.
- G. Air Test:
1. Normal weight concrete, ASTM C 231.
  2. Light weight concrete, ASTM C 173.
- H. Unit Weight:
1. Normal weight concrete, ASTM C 138.
  2. Light weight concrete, ASTM C 567.
- I. When requested, test in-place concrete by impact hammer, sonoscope, or other non-destructive device:
1. To determine relative strengths in various locations in Work.
  2. To aid in evaluating concrete strength.
  3. To select areas to be cored.
  4. To verify quality control in the absence of control testing.

### 3.3 RETESTING DEFECTIVE CONCRETE STRENGTH

- A. If CONTRACTOR desires to do a retest, a request to ENGINEER for retesting must be made within 35 days from time of concrete placement. No coring or retesting shall be done after 40 days have elapsed from the time of placement:
1. Choose three (3) random test locations and verify choice with ENGINEER. Obtain retest samples per ASTM C 42 and test compressive strength per ASTM C 39 or flexure strength per ASTM C 78.
  2. Establish a chain of custody for all test samples.

3. If concrete placed in the Work will be dry under service condition, air dry cores for seven (7) days before tests. Unless otherwise specified, use air temperature 60 to 80 deg F and relative humidity less than 60 percent.
  4. If concrete placed in the Work will be more than superficially wet under service conditions, test cores after moisture conditioning (liquid or vapor water cure).
  5. If more than 1 core shows evidence of having been damaged before testing provide replacement cores, otherwise evaluation will be done on two (2) or more core samples.
  6. Evaluate cores in accordance with ACI 318 requirements.
  7. If core tests are inconclusive, or impractical to obtain, or if structural analysis does not confirm the safety of the Work, load test may be used and evaluated in accordance with ACI 318 requirements.
- B. Coat sides of core hole with concrete epoxy resin adhesive. Fill core holes with non-shrink concrete mortar. Match color and texture of surrounding concrete.
- C. Within 40 days from time of placement publish the chain of custody record and the results of retesting.

END OF SECTION

**SECTION 03 30 10 (Revised)**  
**CONCRETE PLACEMENT**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Concrete placement for slabs on grade, slabs on fill, structural building frame, and other concrete components.

**1.2 REFERENCES**

A. **ACI Standards (Latest Edition):**

- 301 Structural Concrete for Buildings.
- 305 Hot Weather Concreting.
- 306 Cold Weather Concreting.
- 309 Consolidation of Concrete.

**318 Building Code Requirements for Reinforced Concrete**

B. **ASTM Standards (Latest Edition):**

- C 881 Epoxy-Resin-Base Bonding Systems for Concrete.
- C 1059 Latex Agents for Bonding Fresh to Hardened Concrete.

**1.3 SUBMITTALS**

- A. Batch Delivery Ticket: For each batch delivered to site, identify:
1. Date and Project description.
  2. Producer and plant.
  3. Name of contractor.
  4. Serial number of ticket.
  5. Mix identification number or code.
  6. Truck number and time dispatched.
  7. Volume of concrete.
  8. Type and amount of cement.
  9. Total water and water/cement ratio.
  10. Water added for receiver of concrete and receiver's initials.
  11. Admixture types.
  12. Separate weights of fine and coarse aggregate.
  13. Statement of whether batch is pre-mixed at plant or mixed in transit.
- B. Record of Placed Concrete: Identify date of record, location of pour, quantity, air temperature, and CONTRACTOR's quality control test Samples taken.
- C. Bonding Compound: Identify product name, type, and chemical analysis.



#### 1.4 QUALITY ASSURANCE

- A. Provide ACI certified finishers.
- B. Remove and replace any placed concrete suffering hot or cold weather damage.
- C. For control testing follow Section 03 30 05 requirements.

#### 1.5 ACCEPTANCE

##### A General:

- 1. Price adjustment, Section 01 29 00. CONTRACTOR may request ENGINEER determine appropriate Modifications or payment adjustments to pay for Defective work.
  - 2. Retesting by CONTRACTOR, Section 01 35 10 and Section 03 30 05.
- B. Concrete work that fails to meet any of the following requirements will be considered defective. Replace Defective Work at no additional cost to OWNER:
- 1. Placement:
    - a. Reinforcing steel size, quantity, strength, position, damage, or arrangement is not as specified or does not comply with code.
    - b. Formwork differs from required dimensions or location in such a manner as to reduce concrete's strength or load carrying capacity or physical esthetics.
    - c. Workmanship likely to result in deficient strength.
  - 2. Finishing:
    - a. Concrete exposed to view has defects that adversely affect appearance.
    - b. Slab tolerances of Section 03 35 00 are not met.
  - 3. Protection:
    - a. Method of curing is not as specified.
    - b. Inadequate protection of concrete during early stages of hardening and strength development from:
      - 1) temperature extremes.
      - 2) rapid moisture loss.
    - c. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

---

## PART 2 PRODUCTS

---

## 2.1 MATERIALS

- A. Concrete: Section 03 30 04. Class as indicated:
  - 1. For roadway cuts, Section 33 05 25.
- B. Bonding Compound: ASTM C 1059. Either polyvinyl acetate base or acrylic base latex:
  - 1. Use type I in areas not subject to high humidity or immersion in water with minimum bond strength of 400 psi.
  - 2. Use type II in areas subject to high humidity or immersion in water with minimum bond strength of 1250 psi.
- C. Vapor Retarder: 10 mil thick clear polyethylene sheet. Type recommended for below grade application.
- D. Forms: Section 03 11 00.
- E. Reinforcement: Section 03 20 00.
- F. Coverings and Curing Compound: Section 03 39 00.
- G. Shrinkage Compensating Grouts: Section 03 61 00.
- H. Epoxy Adhesive: Section 03 61 00.

---

## PART 3 EXECUTION

---

### 3.1 EXAMINATION

- A. Verify items to be cast into concrete are accurately placed and held securely.
- B. Verify slump, air content range, mix identity, and batch time on delivery ticket matches mix design.
- C. Verify slab steel mats are supported by steel chairs, precast concrete blocks, or other slab bolsters. Do not pour if absent.

### 3.2 PREPARATION

- A. Implement the traffic control plan requirements Section 01 55 26.
- B. Notify ENGINEER no later than 24 hours before commencement of concrete placement.
- C. Do not allow construction loads to exceed structural capacity.
- D. Clean previously placed concrete. Apply bonding compound per manufacturer's instructions.
- E. At locations where new concrete is dowelled to existing work, drill, remove dust, insert and pack steel dowels with shrink compensating grout, and expansion caps where required.

### 3.3 DELIVERY

- A. Concrete Temperature: Keep mixed concrete temperature before placement between 60 deg F. and 90 deg F.
- B. Slump and Air Content: Keep within allowable ranges.

## C. Transport Time:

<u>Air Temperature</u>	<u>Time After Initial Batching</u>
Less than 90 deg F	1-1/2 hours
Greater than 90 deg F	1-hour (without retarder)
Greater than 90 deg F	1-1/2 hours (with retarder)

To increase time past 1-1/2 hours, a hydration stabilizer that is acceptable to Supplier may be used.

## D. Tempering:

1. Water may be added if all following conditions are met:
  - a. The mix design water/cement ratio is not exceeded.
  - b. The delivery ticket allows for addition of water based upon water/cement ratio.
  - c. The amount of water added is accurately measured to within 1 gallon of the design addition.
  - d. Water addition is followed by three (3) minutes of mixing at mixing speed before discharge.
  - e. Supplier and CONTRACTOR mutually agree on who is authorized to add water.
2. **Do not add water after 1 cubic yard of concrete has discharged from the delivery vehicle.**

## E. Super-plasticizer: Comply with manufacturer's requirements. If none, then as follows:

1. If added at site, add agent using injection equipment capable of rapidly and uniformly distributing admixture to concrete. Before discharge, mix for a minimum of five (5) minutes at a drum rate not less than 12 rpm or more than 15 rpm.
2. If added at plant, do not deliver to site unless batch delivery ticket displays water/cement ratio before super-plasticizer addition.

### 3.4 CONCRETE PLACEMENT

## A. In General: ACI 301.

1. Do not disturb reinforcement, inserts, embedded parts, and formed joints.
2. Do not break or interrupt successive pours such that cold joints occur.
3. Honeycomb or embedded debris in concrete is not acceptable.

B. Hot Weather Placement: ACI 305. If the rate of evaporation approaches 0.2 lb./ft<sup>2</sup>/hr. precautions against plastic shrinkage cracking are necessary. (i.e. dampening Subgrade and forms; placing concrete at the lowest possible temperature; erecting windbreaks and sunshades; fog sprays; use of evaporation retardants; or rescheduling time of placement).

## C. Cold Weather Placement: ACI 306. Accelerating admixture may be used in concrete work placed at ambient temperatures below 50 deg F

Use of admixtures will not relax cold weather placement, curing, or protection requirements. If air temperature is forecasted to fall below 32 deg F. within 14 days of placement, proceed as follows:

1. Provide cold weather protection (cover, insulation, heat, etc.).
  2. Do not use chemical “anti-freeze” additives in the concrete. (NOTE: this does not apply to normal accelerators.)
  3. Do not proceed with the placement of concrete until the temperature of all contact surfaces is 35 degrees F and ambient temperature is ascending.
  4. Protect the concrete from freezing until a compressive strength of at least 90 percent of design strength has been achieved, determined by either:
    - a. Maturity meter. Refer to AASHTO T 325, or.
    - b. Field cured cylinders.
  5. Adequately vent combustion-type heaters that produce carbon monoxide.
  6. When applying external heat, maintain moist conditions to avoid excessive moisture loss from concrete.
  7. When removing heat, limit drop in temperature of concrete surfaces to 20 degrees F during any 12 hour period until the surface temperature of the concrete reaches that of the atmosphere.
- D. Concrete Temperature: Keep mixed concrete temperature at time of placement between 60 deg F and 90 deg F
- E. Do not disturb reinforcement, inserts, embedded parts, and formed joints.
- F. Do not break or interrupt successive pours such that cold joints occur.
- G. Honeycomb or embedded debris in concrete is not acceptable.

### 3.5 JOINTS AND JOINT SEALING

- A. Steel edging and jointing tools are acceptable. Preferred are magnesium, aluminum or wood tools
- B. Pavement joint sealing, Section 32 13 73.

### 3.6 CONSOLIDATION

- A. Keep spare vibrator available during concrete placement operations.
- B. Follow ACI 309 requirements.

### 3.7 CURING

- A. Section 03 39 00. Use a membrane forming compound unless specified otherwise.

3.8 FINISHING

A. Section 03 35 00 and as follows.

Table 1 – Finishes	
Type of work	Finish
Sidewalks, garage floors, ramps, exterior concrete Pavement	Broom or belt
Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials	Non-slip
Surfaces intended to receive bonded applied cementitious applications	Scratched
Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces that are future floors or sand bed terrazzo	Floated
Floors and roof surfaces that are floors intended as walking surfaces or to receive floor coverings	Troweled
Unpainted concrete surfaces not exposed to public view	Rough as-cast form finish
Unpainted concrete surfaces exposed to public view	Smooth as-cast form finish
Concrete surfaces to receive paint or plaster	Grout cleaned finish

3.9 PROTECTION AND REPAIR

A. Protection, Section 01 66 00:

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, graffiti, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

B. Repair:

1. Modify or replace concrete not conforming to required levels, lines, details, and elevations.
2. Structural analysis and additional testing may be required at no additional cost to OWNER when the strength of a structure is considered potentially deficient.
3. To patch imperfections refer to Section 03 35 00 requirements.
4. Remove graffiti and mechanical injury.

END OF SECTION

**SECTION 03 39 00 (Revised)**  
**CONCRETE CURING**

---

**PART 1 GENERAL**

---

**1.1. SECTION INCLUDES**

- A. Concrete curing requirements.

**1.2 REFERENCES**

**A. ACI Standards (Latest Editions):**

- 301 Structural Concrete for Buildings.
- 305 Hot Weather Concreting.
- 306 Cold Weather Concreting.

**B. ASTM Standards (Latest Editions):**

- C 171 Sheet Materials for Curing Concrete.
- C 1315 Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

**1.3 SUBMITTALS**

- A. Curing agent data sheet.
- B. Curing plan. Describe estimated cure quantity and procedure.
- C. Manufacturer certificates, Section 01 33 00 that shows product meets performance criteria.
- D. Manufacturer's recommended installation procedures which, when accepted by ENGINEER, will become the basis for accepting or rejecting installed product.

**1.4 QUALITY ASSURANCE**

- A. Use workers knowledgeable of ACI 301, 305, 306.

**1.5 PRODUCT HANDLING**

- A. Protect materials of this Section before, during, and after installation.
- B. Protect the work and materials of other trades.
- C. In the event of damage, immediately make replacements and repair at no additional cost to OWNER.

**1.6 WEATHER LIMITATIONS**

- A. Above 75 deg F, ACI 305
- B. Below 55 deg F, ACI 306.

---

## **PART 2 PRODUCTS**

---

### **2.1 COVERS**

- A. Water or Fog-spray: Clean, non-staining and non-detrimental to concrete.
- B. Sheet Coverings: White waterproof paper, polyethylene film, or polyethylene coated burlap sheet complying with ASTM C 171.
- C. Mat Coverings: Clean roll goods of cotton or burlap fabric.
- D. Insulating Coverings: Non-staining curing blankets.

### **2.2 MEMBRANE FORMING COMPOUND**

- A. Material:
  - 1. Styrene-acrylic.
  - 2. Styrene-butadiene.
  - 3. Alpha-methylstyrene.
- B. Reference: ASTM C 1315:
  - 1. Type II Class A or B (white pigmented).
  - 2. Type ID Class A (clear with fugitive dye).
- C. Volatile Organic Compounds (VOC): Comply with local, state and federal requirements.

---

## **PART 3 EXECUTION**

---

### **3.1 PREPARATION**

- A. *DO NOT DILUTE CURING COMPOUNDS.*
- B. Do not use membrane forming curing compound on surfaces that are to receive hardeners.
- C. Commence curing operation within 20 minutes after finishing.

### **3.2 APPLICATION – COVERS**

- A. Water: Apply water-fog spray or ponding.
- B. Absorptive Mat: Place absorptive mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers. Thoroughly saturate with water and keep continuously wet.
- C. Moisture-Retaining Sheet: Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss. Repair any holes or tears during curing period.
- D. Formed Surface Curing: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period. If forms are removed before curing completion, applying cure film or penetrant or use methods indicated above, as applicable.

**3.3 APPLICATION – MEMBRANE FORMING COMPOUND**

- A. Apply coating continuously and uniformly. Follow manufacturer's recommendations.
- B. Protect continuity of film coatings and repair damage during cure period.
- C. If forms are removed before expiration of cure period, apply coating to unprotected areas.

**3.4 CONCRETE CURE TEMPERATURE**

- A. During cure period, eliminate thermal shock of concrete by keeping cure temperature even throughout extent and depth of concrete.

**3.5 SCHEDULE**

- A. Concrete Exposed to Potable Water (as in Water Storage reservoirs):
  1. Moisture cover curing, or
  2. Acrylic cure, or
  3. Styrene acrylic silane co-polymer cure.

END OF SECTION



**SECTION 03 40 00 (Revised)**  
**PRECAST CONCRETE**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Pre-cast concrete, complete with required connecting and supporting devices.

**1.2 REFERENCES**

**A. ACI Standards (Latest Editions):**

- 318 Building Code Requirements for Reinforced Concrete.  
This reference standard includes ASTM material standards.

**B. ASTM Standards (Latest Editions):**

- A 36: Structural Steel.
- C 478 Precast Reinforced Concrete Manhole Sections.
- C 857 Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
- C 858 Underground Precast Concrete Utility Structures.
- C 891 Installation of Underground Precast Concrete Utility Structures.

**C. AWS Standards (Latest Editions):**

- D1.1 Structural Welding Code Steel.
- D1.4 Structural Welding Code Reinforcing Steel.

**D. PCI Standards (Latest Editions):**

- Design Handbook.
- MNL-116 Quality Control and Assurance for Plant Production of Prestressed Concrete.
- MNL-117 Quality Control and Assurance for Plant Production of Architectural Precast Concrete.

**1.3 DESIGN CRITERIA**

- A. Design structural precast concrete units, ACI 318 and PCI design handbook.
- B. Design utility precast units, ASTM C 857 and C 858.
- C. Under direct supervision of a design professional who is fully experienced in design of units.
- D. Design units to support required stripping and handling loads, and live, dead and construction loads.
- E. Design component connections to provide adjustment to accommodate misalignment of structure during installation.

#### 1.4 SHOP DRAWINGS

- A. Prepare Shop Drawings under seal of a licensed design professional.
- B. Submit Shop Drawings, Section 01 33 00.
- C. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points. Unit identification marks to appear on all manufactured units.
- D. Do not proceed with fabrication until Shop Drawings have been accepted.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer:
  - 1. Prestressed: PCI certified.
  - 2. Precast Concrete Units: PCI or NPCA certified
  - 3. Precast Utility Structures and Pipe: ACPA certified.
- B. Transporter: Acceptable to manufacturer.
- C. Erector:
  - 1. Prestressed: PCI certified.
  - 2. Precast: Has five (5) years minimum experience in erecting precast units.
- D. Welders: Certified, AWS D1.1 and AWS D1.4.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Handle precast units in positions consistent with their shape and design. Lift and support only from support points indicated on Shop Drawings.
- B. Embedded Lifting or Handling Devices: Capable of supporting units in positions anticipated during manufacture, storage, transportation, and erection.
- C. Block and laterally brace units while stored at manufacturers. Provide lateral bracing that is sufficient to prevent bowing and warping that is clean, nonstaining, and will not inhibit uniform curing of exposed surfaces.
- D. Provide edges of units with adequate protection to prevent staining, chipping, or spalling of concrete.
- E. Unless otherwise approved in writing, do not deliver units to job site until required for installation.

---

## PART 2 PRODUCTS

---

#### 2.1 CONCRETE

- A. Above Ground: 5000 psi minimum, Section 03 30 04 and ACI 318.
- B. Underground: Class 4000 minimum, Section 03 30 04 and ASTM C 478 or ASTM C 858.

## 2.2 ACCESSORIES

- A. Connecting and Supporting Devices: Steel, ASTM A 36.
- B. Bolts, Nuts, and Washers: High-strength steel. Section 05 05 23.
- C. Reinforcement: Grade 60 billet steel bars, Section 03 20 00 plain finish

## 2.3 FABRICATION

- A. Maintain plant records and quality control program during production of structural precast concrete. Make records available to ENGINEER.
- B. Use molds which are rigid and constructed of material that will result in uniform finished products.
- C. If self consolidating concrete is NOT used, vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and minimize entrapped air on surface.
- D. Fabricate required connecting devices, plates, angles, items fit to steel framing members, bolts and accessories.
- E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are sufficiently embedded, anchored and property located.
- F. Ensure finished surfaces of precast structural units are uniform.
- G. Cure units under identical conditions to develop specified concrete quality, and minimize appearance blemishes such as non-uniformity, staining or surface cracking.

## 2.4 DESIGN DEVIATIONS

- A. Deviation: Provide installation equivalent to basic intent without additional cost to OWNER. Deviations from exact required cross-section will be permitted only with approval.
- B. Manufacturer's Proposed Design: Supported by complete design calculations and drawings. When requested, submit design calculations for review bearing seal and signature of a licensed design professional.

## 2.5 OPENINGS

- A. Provide required openings, six (6) inches or larger. If approved, smaller sizes may be field constructed by coring or sawing.

## 2.6 FINISHES

- A. General: Required finish will be described in one of the following paragraphs. If no finish is indicated or selected by ENGINEER, provide Standard Finish.
- B. Standard Finish: Produced in forms such as plastic or metal lined that impart a smooth finish to the concrete. Small surface holes, normal form joint marks, minor chips and spall are acceptable if approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.
- C. Commercial Finish: Produced in forms such as plywood or lumber that impart texture to concrete. Remove fins and large projections. Fill holes over 3/8 inch. Make faces true and well defined. Correct exposed ragged edges by rubbing or grinding.

- D. Architectural Grade A Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using float. After paste coat has dried, rub with burlap to remove loose particles.
- E. Architectural Grade B Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch.
- F. Special Finishes: Sandblasting, acid washing, retarders or form liners as approved by ENGINEER. Special finishes require submittal of two 12 x 12 inch Samples showing a representative color and texture to be used.
- G. Painted Finishes: On concrete to be painted, use a form release agent acceptable to the paint manufacturer.

### 2.7 REPAIR

- A. Repair of damaged units is acceptable if structural integrity or appearance is not impaired.

### 2.8 ALLOWABLE TOLERANCES

- A. Length: Plus or minus 3/4 inch, or plus or minus 1/8 inch per 10 feet of length, whichever is greater, or as indicated.
- B. End Squareness: 1/2 inch maximum.
- C. Blockouts: 1 inch of centerline location indicated.

---

## PART 3 EXECUTION

---

### 3.1 INSTALLATION

- A. Do not install precast units until concrete has attained its design compressive strength.
- B. Install members plumb, level, and in alignment within PCI MNL-116 or PCI MNL-117 and indicated limits of erection tolerances.
- C. Clean weld marks or other marks, debris, or dirt from exposed surfaces of units.
- D. Install underground utility precast units per ASTM C 891.

### 3.2 PERFORMANCE REQUIREMENTS

- A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

- B. Rejection: Units may be rejected for any one of the following:
1. Exceeding specified installation tolerances.
  2. Damaged during construction operations.
  3. Exposed-to-view surfaces which develops surface deficiencies.
  4. Other defects as listed in PCI MNL-116 or PCI MNL-117.

END OF SECTION

**SECTION 05 05 23 (Revised)**  
**BOLTS, NUTS AND ACCESSORIES**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Stainless Steel bolts, nuts, washers, clamps, straps, rods and accessories.

**1.2 REFERENCES****A. AISC Standards:**

M011: Manual of Steel Construction.

**B. ASME Standards:**

B1.1 Unified inch Screw Threads (UN and UNR Thread Form), Supplement.

**C. ASTM Standards:**

A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings.  
A197 Cupola Malleable Iron.  
A307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.  
A325 High-Strength Bolts for Structural Steel Joints.  
A506 Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality.  
A575 Steel Bars, Carbon, Merchant Quality, M-Grades.  
F593 Stainless Steel Bolts, Hex Cap Screws, and Studs.

---

**PART 2 PRODUCTS**

---

**2.1 MATERIALS**

- A. General:
1. **Use Stainless Steel** bolts, nuts, and accessories **for all buried fittings.**
  2. All sizes bolts and nuts, American Standard machined heavy hexagon heads with class two (2) fit and threads, ASME B1.1.
- B. **Stainless Steel Bolts: Steel, ASTM F593.**
- C. High Strength Bolts: Steel, ASTM A325.
- D. Anchor Bolts: Steel, ASTM A307, or ASTM F593 if stainless steel is indicated.
- E. Washers: Grey iron, ASTM A126.

- F. Clamps and Straps: Steel, ASTM A506.
- G. Rods: Steel, ASTM A575.
- H. Rod Coupling: Malleable iron, ASTM A197.

---

**PART 3 EXECUTION**

---

**3.1 INSTALLATION**

- A. Torque all nuts and bolts by procedures contained in AISC M011 to secure items requiring fastening.
- B. Extend bolt through nut not less than 1/4 inch beyond nut.

END OF SECTION

**SECTION 31 23 23 (Revised)**  
**BACKFILLING FOR STRUCTURES**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Structural backfill materials.
- B. Structural backfilling requirements.

**1.2 REFERENCES**

**A. ASTM Standards:**

- D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D 4832 Preparation and Testing of Soil-Cement Slurry Test Cylinders.

**1.3 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.

**1.4 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements specified in this Section.
- C. If requested, submit a written quality control inspections and testing report describing source and field quality control activities performed by CONTRACTOR and Suppliers.

**1.5 STORAGE**

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.



## 1.6 SITE CONDITIONS

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section to required density.

## 1.7 ACCEPTANCE

- A. General: Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
- B. Material: For material acceptance refer to:
  1. Common fill, Section 31 05 13.
  2. Aggregate base course, Section 32 11 23.
  3. Cement treated fill, Section 31 05 15.
- C. Lift thickness: One test per Lot.
- D. Compaction: One test per Lot. Verify density using nuclear tests, ASTM D 2922. Compaction and Lot sizes as follows:

Table 1 – Compaction and Lot Sizes			
Structure Type	Compaction	Proctor	Lot Size
Strip Footings	95	Standard	<u>Subgrade</u> : 200 linear feet
	98	Modified	<u>Aggregate base course</u> : 200 linear feet per lift.
Structure Footing excluding strip footings	95	Standard	<u>Subgrade</u> : 225 square feet.
	98	Modified	<u>Aggregate base course</u> : Each 225 square feet per lift
Embankments	95	Standard	<u>Fill</u> : 625 square feet per lift
Interior Slab on Grade	98	Modified	<u>Aggregate base course</u> : 625 square feet
Side of Foundation Walls and Retaining Walls	95	Standard	<u>Exterior</u> :
	98	Modified	<u>Interior</u>
Miscellaneous small structures (e.g. Manholes, drainage boxes, etc.)	95	Standard	<u>Subgrade</u> : Each footprint area <u>Fill</u> : Each lift
	98	Modified	<u>Aggregate base course</u> : Each lift
NOTES			
(a) Standard proctor, ASTM D 698.			
(b) Modified proctor, ASTM D 1557.			

- E. Flowable Fill Strength. Lot size is one day production with sub-lots of 250 cubic yards or part thereof. Verify strength using cylinders, ASTM D 4832.

F. Grade, Cross Slope: Measured at random locations.

## 1.8 WARRANTY

A. Repair settlement damage at no additional cost to OWNER.

---

## PART 2 PRODUCTS

---

### 2.1 BACKFILL MATERIALS

- A. Common fill, Section 31 05 13. Granular material, CONTRACTOR's choice.
- B. Aggregate base course, Section 32 11 23. Untreated base course.
- C. Cement treated fill, Section 31 05 15. Use a flowable fill so vibration is not required.

### 2.2 WATER

- A. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
- B. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water provider.
- C. Culinary Water is **NOT AVAILABLE** from the City System.

---

## PART 3 EXECUTION

---

### 3.1 PREPARATION

- A. Implement the traffic control plan requirements, Section 01 55 26.
- B. Verify:
  - 1. Backfill material meets gradation requirements.
  - 2. Foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water.
  - 3. Ground surface is not frozen.
- C. If ground water is in the intended backfill zone, dewater.

### 3.2 PROTECTION

- A. Protect existing trees, shrubs, lawns, structures, fences, roads, sidewalks, paving, curb and gutter and other features.
- B. Protect above or below grade utilities. Contact utility companies to repair utility damage. Pay all cost of repairs.
- C. Avoid displacement of and damage to existing installations while compacting or operating equipment. Do not fill adjacent to structures until excavation is checked by ENGINEER.

- D. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become over-stressed or moved from alignment.
- E. Do not disturb or damage foundation perimeter drainage, foundation, damp-proofing, foundation waterproofing and protective cover, or utilities in trenches. Movement of construction machinery over work at any stage of construction is solely at CONTRACTOR's risk.
- F. Restore any damaged structure to its original strength and condition.

### 3.3 LAYOUT

- A. Identify required line, levels, contours, and datum.
- B. Stake and flag locations of underground utilities.
- C. Upon discovery of unknown utility or concealed conditions, notify ENGINEER.
- D. Maintain all benchmarks, control monuments and stakes, whether newly established by surveyor or previously existing. Protect from damage and dislocation.
- E. If discrepancy is found between Contract Documents and site, ENGINEER shall make such minor adjustments in the Work as necessary to accomplish the intent of Contract Documents without increasing the Cost of the Work to CONTRACTOR or OWNER.

### 3.4 SUBGRADE

- A. Protect Subgrade from desiccation, flooding, and freezing.
- B. Before backfilling over Subgrade, get ENGINEER's **observation** of subgrade surface preparations.
- C. If Subgrade is not readily compactable get ENGINEER's permission to stabilize the subgrade.

### 3.5 FOUNDATIONS AND SLABS ON GRADE

- A. Lift thickness before compaction is eight (8) inches.
- B. Do not backfill against walls until concrete has obtained 14 days strength. Backfill against foundation walls simultaneously on each side.
- C. Fill unauthorized excavations with material acceptable to ENGINEER at no additional cost to OWNER.
- D. Do not damage adjacent structures or service lines.
- E. Where flowable fill is used, use fill that flows easily and vibration for compaction is not required.

### 3.6 MODIFIED BACKFILL LAYER METHOD

- A. Section 33 05 20.

### 3.7 TOLERANCES

- A. Compaction: Ninety-five (95) percent or ninety eight (98) percent minimum relative to a standard or modified proctor density, Section 31 23 26.
- B. Lift Thickness (before compaction):
  - 1. Eight (8) inches when using riding compaction equipment.

2. Six (6) inches when using hand held compaction equipment.
  3. As proven in the modified backfill layer method, Section 33 05 20.
- C. Cement Treated Fill: Compressive strength targets are 60 psi in 28 days and 90 psi maximum in 28 days.

**3.8 CLEANING**

- A. Remove stockpiles from site. Grade site surface to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

**SECTION 31 23 26 (Revised)**  
**COMPACTION**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Compaction of granular fill materials.

**1.2 REFERENCES**

A. **ASTM Standards:**

- D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- D 2216 Laboratory Determination of Water (Moisture) Content of Soil and Rock.
- D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- D 3282 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
- D 3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

**1.3 DEFINITIONS**

- A. **A-1 Soil:** Defined in ASTM D 3282.
- B. **Modified Proctor Density:** The maximum laboratory density, as defined in and determined by ASTM D 1557 using procedure A, B or C as applicable.
- C. **Relative Density (or Relative Compaction):** The ratio of field dry density to the maximum laboratory density expressed as a percentage.
- D. **Standard Proctor Density:** The maximum laboratory density, as defined in and determined by ASTM D 698 using procedure A, B or C as applicable.

**1.4 QUALITY ASSURANCE**

- A. Use a soil and rock laboratory that complies with ASTM D 3740.

---

**PART 2 PRODUCTS**

---

Not Used

---

**PART 3 EXECUTION**

---

**3.1 COMPACTION**

- A. Moisten or dewater backfill material to obtain optimum moisture for compaction.
- B. When no density compactive effort is specified, compact **trench backfill to 95 percent or greater relative to a standard proctor density, and base course compaction to 95 percent or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches.**
- C. Correct deficient compaction conditions. Replace or repair materials and damaged facilities.

**3.2 FIELD QUALITY CONTROL**

- A. Testing: Perform control testing of materials. Perform additional testing at no additional cost to OWNER, for
  - 1. Changes in source of materials or proportions requested by CONTRACTOR, or
  - 2. Failure of materials to meet specification requirements, or
  - 3. Other testing services needed or required by CONTRACTOR.
- B. Optimum Soil Density: Use ASTM D 2216 and the following industry standards.
  - 1. For A-1 Soils: Method C of ASTM D 1557 (Modified Proctor)
  - 2. For All Other Soils: Method C of ASTM D 698 (Standard Proctor).
- C. Field Density:
  - 1. Use ASTM D 3017 and test method C of ASTM D 2922 for shallow depth nuclear testing.
  - 2. No density determinations are required on any material containing more than 65 percent material retained on the number 10 sieve or more than 60 percent material retained on the number 4 sieve. In lieu of reporting densities in such cases, report the sieve analysis to document the material type.

**3.3 REPORT**

- A. For each material tested, document the following:
  - 1. Vertical and horizontal location of the test.
  - 2. Optimum laboratory moisture content.
  - 3. Field moisture content.
  - 4. Maximum laboratory dry density.
  - 5. Field density.
  - 6. Percent compaction results.
  - 7. Certification of test results by Independent Testing Agency.

END OF SECTION

---

**SECTION 33 05 05**  
**DUCTILE IRON PIPE**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Ductile iron pipe, couplings, fittings, and joint materials.

**1.2 REFERENCES**

A. **AWWA Standards:**

- C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- C110 Ductile-Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- C115 Flanged Ductile-Iron and Gray Iron Pipe with Threaded Flanges.
- C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.

---

**PART 2 PRODUCTS**

---

**2.1 PIPE AND FITTINGS**

A. Buried Applications:

1. Class 52 or pressure class 350 psi ductile iron pipe, AWWA C151 with push-on joints, AWWA C111.
2. Cement lining for all pipe and fittings, AWWA C104.
3. Class 250 fittings with AWWA C110 joints.
4. Coupler with mechanical joint fittings, AWWA C104, C110, and C111.
5. Rubber gasket slip-on pipe joints, AWWA C111 with gasket lubricant.

6. Bronze wedges with current capacity of 400 amps each for each joint as follows:

<b>Pipe Diameter</b>	<b>No. of Wedges</b>
less than 10"	2
10"	3
12"	4
greater than 12"	6

- B. Above Ground Applications: As buried applications, except use bolted flanged fittings, AWWA C104, C110, and C115.
- C. Component Materials and Design - All materials used as part of the culinary water system shall comply with Utah State Code R309-550-6, which requires that all materials that may come in contact with drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of ANSI/NSF Standard 61. All components shall be appropriately stamped with the NSF logo.
- D. Standards for Mechanical Properties  
Pipe, joints, fittings, valves, and fire hydrants shall conform to ANSI/NSF Standard 61, and applicable sections of AWWA Standards C104-A21.4-08 through C550-05 and C900-07 through C950-07

## 2.2 COVERINGS

- A. Buried Mechanical Joints: Grease and eight (8) mil vinyl wrap plastic cover.

---

## PART 3 EXECUTION

---

### 3.1 INSTALLATION

- A Follow AWWA C600 requirements, pipe manufacturer's instructions and the following.
1. Gravity Systems: Section 33 31 00 (sanitary sewer) or Section 33 41 00 (storm drainage systems) and ASTM D 2321.
  2. Pressure Systems: Section 33 12 19 (water distribution and transmission) and AWWA C900 or ASTM D 2774.
  3. Underground Irrigation Systems: Section 32 84 23, (underground irrigation system) and ASTM D 2855.

END OF SECTION



**SECTION 33 05 07 (Revised)**  
**POLYVINYL CHLORIDE PIPE**

---

**PART 1 GENERAL**

---

**1.1. SECTION INCLUDES**

- A. Polyvinyl chloride pipe, couplings, fittings and joint materials.

**1.2 REFERENCES**

**A. ASTM Standards:**

- D 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- D 2241 Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR - Series).
- D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe.
- D 2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- D 2564 Solvent Cement for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- D 2729 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D 2774 Underground Installation of Thermoplastic Pressure Piping.
- D 2855 Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- F 656 Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- F 679 Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- F 949 Poly(vinyl Chloride) (PVC) Corrugated sewer Pipe with a Smooth Interior and Fittings.

**B. AWWA Standards:**

- C110 Ductile-Iron and Gray-Iron Fitting, 3 inches Through 48 inches, for Water and Other Liquids.
- C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution.
- C905 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In.
- C909 Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. Through 24 In., for Water, Wastewater, and Reclaimed Water Service.

**1.3 DEFINITIONS**

- A. **Standard Dimension Ratio (SDR):** Outside diameter of pipe divided by wall thickness.

---

**PART 2 PRODUCTS**

---

**2.1 GRAVITY PIPE SYSTEMS**

- A. Pipe:
  - 1. Solid smooth wall:
    - a. 4 to 15 inch diameter, ASTM D 3034.
    - b. 18 to 27 inch diameter, ASTM F 679.
  - 2. Corrugated wall with a smooth interior, 4 to 10 inches diameter, ASTM F 949.
- B. Fittings: ASTM D 1784.
- C. Stiffness: 50 psi minimum when measured at five (5) percent deflection, ASTM D 2412.
- D. Additives and Fillers: Not to exceed 10 parts by weight; 100 parts of resin in the compound.
- E. Joints: Bell and spigot with flexible elastomeric seals, ASTM D 3212.
- F. Flattening: No visual evidence of splitting, cracking, or breaking when flattened to 60 percent deflection, ASTM D 2412.

**2.2 PRESSURE PIPE SYSTEMS**

- A. Pipe: AWWA C900, C905, or C909 as applicable. Use outside diameters defined by ductile iron pipe sizes. Dimensions, class, SDR, and tolerances per ASTM D 2241. **(Use DR 18 Minimum)**
- B. Compounds: Type 1, Grade 1, Class 12454A, ASTM D 1784.
- C. Joints:
  - 1. Bell and spigot with flexible elastomeric seals, ASTM D 3139. Use non-toxic lubricant.
  - 2. Solvent weld, ASTM D 2564.

D. Fittings (4 inch and larger): Ductile iron Class 250, ASTM C110.

### 2.3 PERFORATED PIPE SYSTEMS

- A. Pipe: Refer to gravity pipe products above.
- B. Perforations: ASTM D 2729.
- C. Joints: Push-on, solvent weld or other.

### 2.4 SOLVENT WELDS

- A. Primer, ASTM F 656.
- B. Glue, ASTM D 2564.

### 2.5 PIPE AND FITTINGS

- A. Component Materials and Design - All materials used as part of the culinary water system shall comply with Utah State Code R309-550-6, which requires that all materials that may come in contact with drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of ANSI/NSF Standard 61. All components shall be appropriately stamped with the NSF logo.

---

## PART 3 EXECUTION

---

### 3.1 INSTALLATION

- A. Install pipe per manufacturer's instructions and the following.
  - 1. Gravity Systems: Section 33 31 00 (sanitary sewer) or Section 33 41 00 (storm drainage systems) and ASTM D 2321.
  - 2. Pressure Systems: Section 33 12 19 (water distribution and transmission) and AWWA C900, C905, C909 or ASTM D 2774.
  - 3. Underground Irrigation Systems: Section 32 84 23, (underground irrigation system) and ASTM D 2855.

END OF SECTION

**SECTION 33 05 20 (Revised)**  
**BACKFILLING TRENCHES**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Trench backfill materials.
- B. Trench backfilling requirements.

**1.2 REFERENCES**

**A. ASTM Standards:**

- D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- D 1557 Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- D 4832 Preparation and Testing of Soil-Cement Slurry Test Cylinders.

**1.3 DEFINITIONS**

- A. **Bedding:** That surface of the excavation or portion of the Pipe Zone below the pipe.
- B. **Pipe Zone:** That zone in a backfilling operation which supports, and surrounds the pipe barrel, and extends to 1 foot above the top of the pipe barrel.

**1.4 SUBMITTALS**

- A. Submit maximum laboratory dry density and optimum laboratory moisture content for:
  - 1. Subgrade material, and
  - 2. Each type of fill to be used.
- B. Submit aggregate batch delivery tickets showing name of material source, serial number of ticket, date and truck number, name of Supplier, job name and location, volume or weight. And aggregate classification or Supplier's identification code.

**1.5 QUALITY ASSURANCE**

- A. Do not change material sources, or aggregate without ENGINEER's knowledge.
- B. Reject backfill material that does not comply with requirements in this Section.
- C. If requested, submit a quality control inspections and testing report describing source and field quality control activities performed by CONTRACTOR and Suppliers.

**1.6 STORAGE**

- A. Safely stockpile backfill materials.
- B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

**1.7 SITE CONDITIONS**

- A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.
- B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.
- C. Reshape and compact damaged structural section to required density.
- D. Restore any damaged structure to its original strength and condition.
- E. Replace contaminated backfill at no additional cost to OWNER.

**1.8 SEQUENCING**

- A. Coordinate backfilling operation with pipeline commissioning, Section 33 08 00.

**1.9 ACCEPTANCE**

- A. General: Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
- B. Material: For material acceptance refer to:
  - 1. Common fill, Section 31 05 13.
  - 2. Aggregate base course, Section 32 11 23.
  - 3. Cement treated fill, Section 31 05 15.
- C. Lift Thickness: One test per lot.
- D. Compaction: One test per lot. Verify density using nuclear tests, ASTM D 2922. Compaction standard and Lot sizes as follows:

<b>Table 1: Compaction Standard and Lot Size</b>		
<b>Material</b>	<b>Proctor</b>	<b>Lot Size</b>
Subgrade	Standard	200 linear feet
Common Fill	Standard	200 linear feet per lift 25 square feet of footing area per lift
Aggregate base course	Modified	200 linear feet per lift 25 square feet of footing area per lift
NOTES		
(a) Standard proctor, ASTM D 698.		
(b) Modified proctor, ASTM D 1557.		
(c) Lift thickness above pipe zone before compaction, 8 inches.		

- E. Flowable Fill Strength: Lot size is one (1) day production with sub-lots of 50 cubic yards or part thereof. Verify strength using cylinders, ASTM D 4832.
- F. Grade, Cross Slope: Measured at random locations.

**1.10 WARRANTY**

- A. Correct any settlement of Trench backfill or structures built over Trench backfill at no cost to OWNER.
- B. Restore structures damaged by settlement at no additional cost to OWNER.

**PART 2 PRODUCTS**

**2.1 BACKFILL MATERIALS**

- A. Common fill, Section 31 05 13. Granular material, **Pea gravel shall not be allowed for pipe, trench, or structural backfill**
- B. Aggregate base course, Section 32 11 23. Untreated base course.
- C. Cement treated fill, Section 31 05 15. Use a flowable fill so vibration is not required.
- D. Slag or asphalt bearing material NOT ALLOWED in trench.
- E. **If existing materials cannot be made suitable for compaction, then import fill must be provided.**

**2.2 WATER**

- A. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
- B. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

**2.3 GEOTEXTILE FABRIC**

- A. Section 31 05 19. Use woven or non-woven stabilization-separation fabric. Select either moderate MARV or high MARV as needed.

**2.4 IDENTIFICATION TAPE**

- A. Permanent, bright colored, continuous printed magnetic plastic tape, intended for direct burial service; not less than six (6) inches wide by four (4) mils thick. Tape shall read "**CAUTION: BURIED INSTALLATION BELOW**". Color as follows.

Red	Electric power lines, cables, conduit and lighting cables
Yellow	Gas, oil, steam, petroleum or gaseous materials
Orange	Communications, alarm, signal, cables or conduits
Blue	Potable water
Purple	Reclaimed water, irrigation and slurry lines
Green	Sewer and storm drain lines

**PART 3 EXECUTION**

### 3.1 PREPARATION

- A. Implement the traffic control plan requirements, Section 01 55 26.
- B. Identify required line, levels, contours, and datum.
- C. Stake and flag locations of underground utilities.
- D. Verify:
  1. Backfill material meets gradation requirements.
  2. Foundation walls are braced to support surcharge forces imposed by backfilling operations, areas to be backfilled are free of debris, snow, ice or water.
  3. Trench bottom is not frozen.
- E. If ground water is in the intended backfill zone, dewater.

### 3.2 SUBGRADE

- A. Protect subgrade from desiccation, flooding, and freezing.
- B. Before backfilling over Subgrade, get ENGINEER's review of Subgrade surface preparations.
- C. If Subgrade is not readily compactable, get ENGINEER's permission to stabilize the subgrade:
  1. Excavation for Subgrade stabilization is incidental work, Section 31 23 16.
  2. Place geotextile fabric. Place acceptable fill in lifts. Compact.

### 3.3 PROTECTION

- A. During installation or repair, plug end of pipe or fitting except when installing next section of pipe or fitting.
- B. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

### 3.4 GENERAL BACKFILLING REQUIREMENTS

- A. Avoid injuring and displacement of conduit, pipe and structures while compacting soil or operating equipment next to pipeline.
- B. Place geotextile fabrics; Section 31 05 19.
- C. Do not damage corrosion protection on pipe.
- D. Repair or replace damaged pipe at no additional cost to OWNER.
- E. Withdraw sheathing, shoring, piles, and similar supports as backfilling progresses. Backfill and compact all holes left by removals.
- F. Provide sufficient water quality facilities to protect downstream fish and wildlife, and to meet State water quality requirements.
- G. Water settling of trench backfill is not permitted. "Jetting" of trench backfill is prohibited.

### 3.5 PIPE ZONE

- A. Maintain uniform foundation along barrel of pipe with sufficient relief for joint connections.
- B. Use backfill materials meeting pipe manufacturer's recommendations.

Maximum backfill particle size is 3/4 inch for plastic pipe.

- C. Do not permit free fall of backfill material that may damage pipe, pipe finish, or pipe alignment.
- D. Except where piping must remain exposed for tests, fill pipe zone as soon as possible.

### 3.6 TRENCH ABOVE PIPE ZONE.

- A. Maximum lift thickness before compaction is eight (8) inches.
- B. Fill unauthorized excavations with material acceptable to ENGINEER at no additional cost to OWNER.
- C. Do not damage adjacent structures or service lines.
- D. Install continuous identification tape directly over buried lines 18 inches below finished grade.

### 3.7 MODIFIED BACKFILL LAYER METHOD

- A. At discretion of CONTRACTOR, backfill may be placed in thicker layers than indicated above subject to the following provisions:
  - 1. CONTRACTOR proves the ability of proposed method to achieve specified average compaction density.
  - 2. ENGINEER, on the basis of test results, approves the system in writing.
- B. Should CONTRACTOR find it necessary to change the method or any part of it, including the source of material, or the rate of placing the material, obtain approval of ENGINEER, who may require a further trial area.
- C. If testing shows a previously approved system is no longer producing the required degree of compaction, make changes to comply.
- D. Where vibration effects are creating environmental problems, make changes to eliminate problems.

### 3.8 TOLERANCES

- A. Compaction: Ninety-five (95) percent or greater relative to a standard or modified proctor density, Section 31 23 26.
- B. Lift Thickness (before compaction):
  - 1. Eight (8) inches when using riding compaction equipment.
  - 2. Six (6) inches when using hand held compaction equipment.
  - 3. As proven in the modified backfill layer method.
- C. Cement Treated Fill: Compressive strength targets are 60 psi in 28 days and 90 psi maximum in 28 days.

### 3.9 FIELD QUALITY CONTROL

- A. Test trench backfilling until a compaction pattern acceptable to CONTRACTOR and ENGINEER is achieved. Continue random quality control compaction testing.



**3.10 SURFACE RESTORATION**

- A. Provide temporary paved surfaces where trenches pass through roadways, driveway approaches or sidewalks.
- B. Restore paved surfaces, Section 33 05 25.
- C. Finish landscaped surfaces with grass, Section 32 92 00 or with other ground cover, Section 32 93 13.

**3.11 CLEANING**

- A. Remove stockpiles from site when work is complete. Grade site to prevent free standing surface water.
- B. Leave borrow areas clean and neat.

END OF SECTION

**SECTION 33 08 00 (Revised)**  
**COMMISSIONING OF WATER UTILITIES**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Identification of testing requirements for potable and non-potable water piping systems.
- B. Warning: DO NOT use hydrostatic pressures described in this Section for air-pressure testing.

**1.2 DEFINITIONS**

- A. **Leakage:** The quantity of water required to maintain specified hydrostatic test pressure after pipeline has been filled with water and air expelled.
- B. **Non-rigid Pipe:** Any pipe that requires bedding and pipe zone backfill material for structural support.

**1.3 SUBMITTALS**

- A. Pipeline Test Report: Submit:
  - 1. Type of test.
  - 2. Identification of pipe system.
  - 3. Size, type, location and length of pipe in test section.
  - 4. Test pressure and time.
  - 5. Video cassette and log of visual examination.
  - 6. Amount of leakage versus allowable.
  - 7. Date of test approval.
  - 8. Signature of test supervisor.
  - 9. Signature of Resident Project Representative witnessing the test.

**1.4 PROJECT CONDITIONS**

- A. Repair pipeline system at no additional cost to OWNER until it passes specified commissioning tests.

**1.5 WARRANTY**

- A. At the end of the one year correction period repeat any test requested by ENGINEER to verify warranty of pipeline performance.

**1.6 REFERENCES**

- A. AWWA C600, C602, and C606

---

**PART 2 PRODUCTS**

---

## 2.1 TESTING MATERIALS

- A. Medium: Water, air.
- B. Recording Equipment (pressure systems):
  1. Supply all equipment and power to perform pressure testing.
  2. Secure approval of pressure gages.
  3. Locate all gages and recording equipment away from affect of sunshine or unsuitable weather conditions.
  4. Place, vents, pressure taps and drains for the test. Repair pipeline at completion of test at no additional cost to OWNER.

---

## PART 3 EXECUTION

---

### 3.1 PREPARATION

- A. Notify ENGINEER 48 hours in advance of test.
- B. Carry out selected tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.
- C. Remove debris, sediment and other material from installed pipe before testing. Do not discharge or flush sand, gravel, concrete, debris or other foreign material into any existing pipeline system. Flushing with clean water only will be allowed but with minimal flows to eliminate exceeding capacities of the existing gravity systems. Flushing into existing pressurized water systems will not be allowed.

### 3.2 ALIGNMENT AND GRADE TEST

- A. Do not allow line and grade of pipe to vary more than 1/2 inch in 10 feet and not more than 1 inch variance from true line at any location.
- B. Do not allow grade of pipe to vary more than 1/4 inch in 10 feet for all design grades less than or equal to 1 percent and not more than 1/2 inch total variance from true grade at any location. Also, do not allow grade of pipe to vary more than 1/2 inch in 10 feet for all design grades greater than 1 percent and not more than 1 inch total variance from true grade at any location. These tolerances shall be acceptable provided that such variation does not result in a level or reverse sloping invert.
- C. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64 inch per inch of pipe diameter, or 1/4 inch maximum.

### 3.3 PRESSURE TEST

- A. Air Test: **Not Allowed**
- B. Hydrostatic test: **Complete per AWWA for the type of pipe used.** Two (2) tests are required, pressure and volume.
  1. Provide **200** psi test pressure for two (2) hours unless required otherwise, **at the lowest point in the line being hydrostatically tested.**
  2. Provide air release taps at pipeline's highest elevations and expel all air before the test. Insert permanent plugs after test has been completed.

3. No piping installed will be acceptable until the leakage is less than the amount allowed by AWWA C600 - Installation of Mains and their Appurtenances. Under no circumstances shall the test pressure vary by more than 5 psi during the 2 hour test, and the test pressure shall not be less than 200 psi. Prior to performance of the test, the Contractor shall review procedures with the City, and agree on the testing requirements for the specific pipe material tested.
- C. Locate and repair defective joints and retest until the leakage rate is less than allowable.
  - D. Repair any noticeable leakage even if total leakage is less than allowable.
- 3.4 OBSTRUCTION AND DEFLECTION TEST**
- A. Obstructions: Maximum protuberance is 1 inch.
  - B. Deflections:
    1. Do not use mechanical pulling equipment when passing mandrels through pipe.
    2. Maximum reduction of internal diameter in any plane measured full length of installation and not less than 30 days after installation as follows:
      - a. Polyvinyl chloride pipe, 7.5 percent.
      - b. High density polyethylene pipe, five (5) percent.
      - c. Ductile iron pipe, three (3) percent.
      - d. Corrugated metal pipe, 7.5 percent.
    3. Recommend an alternate method of measurement if mandrel testing would cause damage to internal pipe coating.
- 3.5 INFILTRATION TEST**
- A. Maximum is 50 gallons per inch diameter per mile per 24 hours.
- 3.6 VIDEO TEST**
- A. Run water through gravity system prior to video inspection.
  - B. Conduct test at least 30 days after backfill and prior to installation of pavements.
  - C. ENGINEER to be present during video inspection.
  - D. Inspect measure and record host pipe conditions using digital video recording equipment in MPEG 1 format with 352x240/320x240x30 fps resolution and audio bit rate of 256 Kbps.
  - E. Identify the date, pipe reach, slope, upstream and downstream manhole numbers, and manhole to manhole footage.

- F. Provide video inspection log as a computerized data report with a map of the system inspected with appropriate identification labels as referenced in the video.

### 3.7 TRACER WIRE CONTINUTIY TEST

- A. Test all tracer wire sections for continuity.

### 3.8 PIPE TESTING SCHEDULE

- A. Landscape Irrigation - Gravity System:
  - 1. Grade test: All laterals drain.
- B. Landscape Irrigation – Pressure System:
  - 1. Grade test: All lateral pipe drains.
  - 2. Pressure test.
  - 3. Operational Testing:
    - a. Perform operational testing after hydrostatic test is complete; backfill is in place and sprinkler heads adjusted to final coverage.
    - b. Demonstrate system meets coverage requirements and automatic controls function properly.
    - c. Coverage requirements are based on operation of 1 circuit at a time.
- C. Sanitary Sewers:
  - 1. Alignment and grade test.
  - 2. Obstructions and deflection test.
  - 3. Infiltration test for gravity pipeline systems.
  - 4. Pressure test for pressure pipeline systems.
  - 5. Video inspection. For lateral replacements constructed by bursting, camera in presence of ENGINEER.
  - 6. Air test.
- D. Subdrains:
  - 1. Grade test: All pipelines drain.
  - 2. Obstructions and deflection test.
- E. Storm Drains:
  - 1. Alignment and grade test.
  - 2. Obstructions and deflection test.
  - 3. Infiltration test for gravity pipeline systems.
  - 4. Pressure test for pressure pipeline systems.
  - 5. Video inspection for all mains and laterals.
  - 6. Air test
- F. Potable Water System:
  - 1. Obstruction and deflection test.

2. Pressure test.
  3. Disinfection (Section 33 13 00).
  4. Tracer wire continuity test.
- G. Secondary Nonpotable Water System
1. Obstruction and deflection test.
  2. Pressure test.
  3. Flushing (See Section 33 13 00 disinfection not required).
  4. Tracer wire continuity test.

END OF SECTION

**SECTION 33 11 00 (Revised)**  
**WATER DISTRIBUTION AND TRANSMISSION**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Water distribution and transmission pipe systems, identification, valves, boxes, service connections and accessories.
- B. This section is applicable to potable and non-potable water pressure systems.

**1.2 REFERENCES**

- A. **American Concrete Pipe Association (ACPA) Standards.**
- B. **APWA (Utah Chapter) Standards:**
  - Plan 255 Asphalt Concrete "T" Patch.
  - Plan 256 Concrete Pavement Patch.
  - Plan 381R Trench Backfill.
  - Plan 382 Pipe Zone Backfill.
  - Plan 521R 3/4" and 1" Meter.
  - Plan 522R 1-1/2" and 2" Meter.
  - Plan 541R Water Service Line.
  - Plan 542 Water Service Line Loop.
  - Plan 543 Watermain Loop.
  - Plan 551R 3/4" and 1" Service Taps.
  - Plan 552R 1-1/2" and 2" Service Taps.
  - Plan 561R Direct Bearing thrust Block.
  - Plan 562R Tie-Down Trust Restraints.
  - Plan 574R Cover Collar for Water Valve Boxes.
- C. **AWWA Standards:**
  - C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.
  - C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
  - C800 Underground Service Line Valves and Fittings.
  - C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. Through 3 in., for Water Service.
  - M11 Manual for Steel Pipe - Design and Installation.
- D. **Copper Development Association (CDA) Standards.**
- E. Applicable water company requirements standards.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Depth of Cover:
  - 1. **Minimum bury depth for main lines is 5-foot measured** from top of pipe to ground surface. 72 inches maximum unless **Public Works Director** authorizes otherwise.
  - 2. If less cover, provide additional protection to withstand frost and external loads **and must be approved by Public Works Director**
- B. Remove any section of pipe already placed that is found to be defective or damaged. Relay or replace without additional cost to OWNER.

### 1.4 SUBMITTALS

- A. Product data: Submit manufacturer's technical product data and installation instructions.
- B. Commissioning: Submit testing data indicated in Section 33 08 00R.
- C. Record Documents, Section 01 78 39: Include details of underground structures, connections, thrust blocks and anchors. Show interface and spatial relationship between piping and adjacent structures.
- D. Operating and Maintenance: Submit data, Section 01 78 23. Include maintenance data, parts list, product data and Shop Drawings.

### 1.5 SITE CONDITIONS

- A. Minimize neighborhood traffic interruptions. Barricade stockpiles.
- B. Secure acceptance of pipeline lateral tie-in work.
- C. Repair public and private facilities damaged by CONTRACTOR.
- D. Do not operate any currently active water valve **without authorization of the Public Works Director.**

---

## PART 2 PRODUCTS

---

### 2.1 PIPES AND FITTINGS

- A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities indicated. Use only **ANSI / NSF 61** approved products in drinking water systems. All such products shall be appropriately stamped with the **ANSI / NSF** logo.
- B. Where not indicated, provide proper selection as determined by installer and acceptable to ENGINEER to comply with installation requirements.
- C. Provide sizes and types of equipment connections for fittings of material that matches pipe material used in the piping system. Where more than one type of material or product option is indicated, selection is installer's choice.
- D. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.
- E. **Use of "Purple" pipe is only allowed for secondary water pipelines.**
- F. **All components shall be Lead Free.**



## 2.2 VALVES

- A. Section 33 12 16R.

## 2.3 VALVE BOX

- A. Buried Valves in Traffic Areas: Cast iron two (2) piece slip sleeve type, 5-1/4 inch shaft, with a drop lid.
- B. Buried Valves in Non-Traffic Areas: Cast iron two (2) piece screw adjustable sleeve of height required for installation.
- C. Markings: Cast appropriate utility lettering on cover.

## 2.4 VALVE CHAMBER

- A. Basin: Class 4000 concrete floor and walls.
- B. Steps: Plastic, cast into sidewalls greater than four (4) feet deep.
- C. Top: Flat slab class 4000 concrete.
- D. Frame and Cover: Scoriated asphalt coated, heavy duty ductile iron conforming to Section 05 56 00 with flat top design and appropriate utility lettering. Shape and size required.

## 2.5 MORTAR, GROUT, AND CONCRETE

- A. Mortar: Portland cement, Section 04 05 16.
- B. Grout: Portland cement, Section 03 61 00.
- C. Concrete:
  - 1. Cast-in-place: Class 4000, Section 03 30 04R.
  - 2. Precast: Class 5000, Section 03 40 00R.

## 2.6 TAPPING SADDLES

- A. Bronze alloy or stainless steel saddles with stainless steel straps (double straps on pipes over 12 inches diameter).
- B. Straight threads. Tapered threads not allowed.
- C. Rated working pressure, 300 psi minimum.
- D. Neoprene Buna N gaskets.

## 2.7 SERVICE CONNECTION

- A. Taps: Saddle clamp or direct type. Provide plastic spacers or nipples to separate non-similar metals. **Direct type tap shall only be used with authorization of the Public Works Director.**
- B. Service Line:
  - 1. Copper Pipe: Type K, Section 33 05 03 with 200 psi compression fittings according to AWWA C800.
  - 2. Polyethylene Pipe: AWWA C901 with 200 psi compression fittings, and ratings according to AWWA C800.

## 2.8 ACCESSORIES

- A. Bolts, Nuts, Washers: **Stainless** Steel, Section 05 05 23.
- B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
- C. Corporation Stops: All bronze, straight threads, full port, ball valve.
- D. Hydrant and Valve: Dry barrel, Section 33 12 19R.
- E. Water Meter and Valve: Section 33 12 19R and 33 12 16R, respectively.
- F. Grease: Non-oxide food grade required where in contact with potable water. Non-oxide poly-fm for all exposed buried metal surfaces for bolts, nuts, washers, restraints, etc.
- G. Polyethylene Sheet: Six (6) mil thick minimum.
- H. Joint Restraints: Acceptable to ENGINEER prior to installation.

---

## PART 3 EXECUTION

---

### 3.1 EXAMINATION

- A. Verify trench excavation is ready to receive work, and dimensions, and elevations are as required.
- B. Commencing installation means acceptance of existing conditions.

### 3.2 PREPARATION

- A. Excavation, Section 31 23 16. Hand trim to required elevations. Correct over excavations.
- B. Remove stones or other hard matter that manufacturer stipulates may damage pipe during embedment or impede backfilling or compaction.
- C. Examine areas and conditions under which materials and products are to be installed. Do not proceed with system installation until unsatisfactory conditions have been corrected in manner acceptable to system installer.
- D. Clearly identify and promptly set aside defective or damaged pipe.
- E. Use pipe cutting tool acceptable to pipe manufacturer.

### 3.3 LAYOUT

- A. Comply with Utah administrative rules R309-550-7 - **Basic Separation Standards**. As a minimum locate potable water pipe at least 18 inches vertical and 10 feet horizontal edge to edge between water and sewer lines. Place water lines above sewer line.
- B. Where potable water pipe crosses under gravity-flow sewer lines, fully encase sewer pipe in **a steel pipe casing, or concrete encasement as approved by the City**, for a distance at least 10 feet each side of the crossing:
  - 1. Do not locate any joint in the water line within 36 inches of the crossing.

2. Encase water line if it is within 24 inches of a sewer force main or a sewer inverted siphon.
  3. Encase sewer main joints in concrete if joints are horizontally closer than 36 inches to the water line.
- C. Do not put potable water lines in the same trench with sewer lines, storm drains or electric wires.

### 3.4 INSTALLATION - PIPE AND FITTING

- A. General:
1. Seal each open end of pipeline at end of day's work.
  2. Grease all bolts and nuts then apply polyethylene sheet and tape wrap.
- B. Steel Pipe: AWWA M11.
- C. Ductile Iron Pipe: AWWA C600.
- D. Copper Tube: CDA "Copper Tube Handbook". **City preference is to use polyethylene pipe. However, where used, it is only allowed for pipe 1-1/2" diameter and smaller**
- E. Polyethylene Pipe: For three (3) inches and smaller pipe follow AWWA C901. Install all other sizes per manufacturer's installation instructions.
- F. Polyvinyl Chloride Pipe: AWWA C605.
- G. Concrete Pipe: ACPA "Concrete Pipe Handbook".
- H. Wedges: Install metal wedges on metal pipe systems. Grease and plastic wrap exposed metal wedges.

### 3.5 INSTALLATION – CONCRETE THRUST BLOCK

- A. APWA Plan 561R or 562R.
- B. Do not make hydrostatic tests of Section 33 08 00R until thrust block concrete has cured for at least five (5) days.
- C. Provide thrust blocks on all plugs, caps, tees, hydrants and vertical or horizontal elbows.
- D. Provide stainless steel or epoxy coated steel tie rods and clamps or shackles to restrain thrust.
- E. Unless indicated otherwise or directed by ENGINEER, place base and bearing sides of thrust blocking directly against undisturbed earth.
- F. Sides of thrust blocking not subject to thrust may be placed against forms. Place thrust blocking so joint fittings will be accessible for repair.

### 3.6 INSTALLATION - VALVE AND VALVE BOX

- A. Valves:
1. Ensure all parts are in working order.
  2. Set location of valves outside of sidewalk limits, driveway approach and other pedestrian or vehicular interference.
  3. Install plumb with stem pointing up.
  4. Grease all exposed bolts and nuts then apply polyethylene sheet and tape wrap.

**B. Air Relief Valves:**

1. At high points in water mains where air can accumulate, air may be removed by means of hydrants or air relief valves.
2. DO NOT use automatic air relief valves where flooding may occur.

**C. Valve Box:**

1. Set over valve nut so operator's key is plumb with clearance in valve box when opening and closing the valve. Riser must NOT rest on valve or pipe system.
2. Adjust riser to finish grade and clean all dirt or foreign material out of riser.
3. Install concrete cover collar in paved surface, APWA Plan 574.

**3.7 INSTALLATION – JOINT RESTRAINTS**

- A. Without Thrust Blocks: Install joint restraints with all valves for the distance acceptable to the ENGINEER.
- B. With Thrust Blocks: Install joint restraints for the distance approved by the ENGINEER where concrete block design exceeds three (3) cubic yards, for vertical bends, where soil is disturbed, or where undisturbed soil bearing capacity is less than 1000 pounds per square foot.

**3.8 INSTALLATION – TAPS**

- A. APWA Plan 551R or 552R.
- B. Apply for and pay for applicable permits from water company for size and location of tap to water main. Comply with all connection requirements of water company.
- C. Make service taps with a tapping machine acceptable to water company. Use teflon tape on all taps unless indicated otherwise.
- D. Minimum distance between taps is 24 inches, with a five (5) degree stagger. Do not make service taps within 24 inches of the end of pipe. Install taps at 60 degrees from vertical, or authorized by ENGINEER.
- E. Service saddles are required on all taps except, 3/4 inch or 1 inch taps to new ductile iron pipe
- F. Grease all exposed bolts and nuts then apply six (6) mil thick polyethylene sheet and tape wrap.

**3.9 INSTALLATION – SERVICE LINE**

- A. Replacing Existing Water Service Line: APWA Plan 541.
  1. Follow AWWA C800, Utah drinking water Rules and Regulations (R309-550-11), and International Building Code requirements.
  2. When replacing water service lines, replace non-copper pipe with:
    - a. Type K copper pipe, Section 33 05 03, or
    - b. Polyethylene pipe, AWWA C901
  3. Minimum pipe diameter 3/4 inch, maximum 3 inches.
  4. Distance from nearest joint or existing tap is 24 inches minimum unless a greater distance is required by pipe manufacturer.
  5. **Service lines shall be capped until connected for service**

- B. Looping Existing Water Service: APWA Plan 542.
  - 1. Minimum pipe diameter is one (1) inch.
  - 2. Use liquid nitrogen to spot freeze active service lines. Pinching tools used to close active service lines may be used only if allowed in writing by ENGINEER.
  - 3. Soldered joints or connections not allowed.
  - 4. For copper to iron connections use a brass pack joint compression coupling with joint locking device.
  - 5. For copper-to-copper connections use a brass compression fittings. Flared end fittings are not allowed.
- C. Meter box: APWA Plan 521R or 522R. Install meter box back of curb, outside of sidewalk, outside of driveway approaches, or other vehicular or pedestrian interference. **All meters shall be located within the public way, unless approved otherwise by the Public Works Director**

### 3.10 INSTALLATION – WATERMAIN LOOP (SYPHON)

- A. APWA Plan 543.
- B. Existing water mains may not match standard size. Excavate to obtain actual pipe diameter and match size.
- C. Do not shutdown pipeline until couplings and fittings are on site. Coordinate shutdown with water company.
- D. Connections to steel or transite pipe require transition couplings or sleeves with transition gaskets.
- E. Grease all exposed bolts and nuts then apply six (6) mil thick polyethylene sheet and tape wrap.
- F. Provide thrust blocks except where joints are welded. Follow details shown on drawings.

### 3.11 DISINFECTION

- A. Secion 33 13 00.
- B. After disinfection, legally dispose of disinfection water.

### 3.12 BACKFILLING

- A. Before Backfilling:
  - 1. Secure ENGINEER's acceptance of brass wedge installation and concrete thrust block installation.
  - 2. For pressure pipe testing follow Section 33 08 00R requirements and for disinfection follow Section 33 13 00 requirements.
- B. Trenches: Section 33 05 20R:
  - 1. Pipe zone backfill, APWA Plan 382.
  - 2. Trench backfill, APWA Plan 381R.
- C. Landscapes: Section 31 23 23.

**3.13 SURFACING RESTORATION**

- A. Roadway Trenches and Patches: Section 33 05 25:
  - 1. Asphalt concrete “T” patch, APWA Plan 255.
  - 2. Concrete pavement patch, APWA Plan 256.
- B. Landscapes: Turfs and grass, Section 32 92 00 or Ground Cover, Section 32 93 13 as applicable.

END OF SECTION

**SECTION 33 12 16 (Revised)**  
**WATER VALVES**

---

**PART 1 GENERAL**

---

**1.1. SECTION INCLUDES**

- A. Gate, butterfly, plug, check, pressure reducing, pressure relief, control valves and their installation.

**1.2 REFERENCES**

A. **AWWA Standards:**

- C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- C504 Rubber-Seated Butterfly Valves.
- C508 Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS.
- C509 Resilient-Seated Gate Valves for Water and Sewerage Systems.
- C550 Protective Interior Coatings for Valves and Hydrants.
- C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.

**1.3 SUBMITTALS**

- A. Provide technical information for evaluating quality of valve. As a minimum include dimensions, weights, materials lists and operation charts.

---

**PART 2 PRODUCTS**

---

**2.1 VALVES - GENERAL**

A. Underground:

1. All components shall meet the requirements of R309-550-6 - Component Materials and Design. All materials that may come into contact with drinking water shall be ANSI-certified as meeting the requirements of ANSI/NSF Standard 61. All components shall be stamped with the NSF logo.
2. Less than three (3) inches: Screwed ends.
3. 3 inches and larger: Flanged or mechanical joint ends. Non-rising stem. Two inches square operating nut. Low alloy steel bolts, AWWA C111.

- B. Submerged or Above Sewage or Water:
  - 1. Valve body bolts per manufacturer's recommendations.
  - 2. For joining valve to piping system use stainless steel nuts and bolts, Section 05 05 23.
- C. Below an Operating Deck: Provide shaft extension from the valve to deck level.
- D. Above Ground: Non-rising stems equipped with a hand wheel.
- E. Manually Operated Valves Over six (6) feet Above Operating Level: Provide chain operated handles.
- F. Clearance: Install so handles clear all obstruction when moved from open to closed.
- G. Rated Working Pressure: ~~150~~ 300 psi if not indicated.
- H. Coating: Interior, AWWA C550. Exterior per manufacturer's recommendation.

## 2.2 GATE VALVES

- A. **Shall be Resilient Wedge as manufactured by Mueller, Clow, or East Jordan per AWWA C509.**
- B. 3 inches through 48 inches, cast iron body, bronze mounted, non-rising stem with "O" ring seals.
- C. Open counterclockwise.

## 2.3 BUTTERFLY VALVES

- A. **Shall be as manufactured by Mueller or Clow, per AWWA C504.**
- B. 3 inches through 48 inches, cast iron body, bronze mounted.
- C. Short body if disc will not interfere with adjacent fittings or long body at CONTRACTOR's option.
- D. Wafer Valves: Subject to ENGINEER's approval.

## 2.4 ECCENTRIC PLUG VALVES

- A. Material: Cast iron body, bronze mounted, non-lubricated, eccentric, quarter-turn type with resilient face plugs, ductile iron discs with upper and lower shafts integral.
- B. Markings: Indicate open and close position.
- C. Port Areas: At least 82 percent of full pipe area.
- D. Resilient Seat Seals: Buna N, field replaceable.

## 2.5 CHECK VALVES

- A. **Shall be as manufactured by Cla-Val, and conform to AWWA C508.**
- B. Less than three (3) inches: Y-pattern, bronze, regrinding, swing check valve, 200 psi working pressure.
- C. 3 inches and larger: Iron body, bronze mounted, swing valves with stainless steel hinge pins and outside weight and lever if not indicated otherwise.



**2.6 PRESSURE REDUCING VALVES - SERVICE LINE**

- A. Operation: Capable of reducing a varying higher upstream pressure to an adjustable constant lower downstream pressure.
- B. Spring and nylon reinforced diaphragm type construction.
- C. Equip with Y-strainer upstream of valve.

**2.7 PRESSURE REDUCING VALVES - MAIN LINE**

- A. Operation: Capable of maintaining an adjustable constant downstream pressure regardless of upstream pressure.
- B. Type: Hydraulically operated using a direct-acting, spring-loaded, normally open, pilot valve controlled diaphragm:
  - 1. Single removable seat and a resilient disc. No "O" ring type discs permitted. No external packing glands permitted. No pistons operating main valve or pilot controls permitted.
  - 2. Y-strainers on pilot controls, variable closing and opening speed controls and a valve position indicator.
- C. Rating: 250 psi working pressure.
- D. Connection: Flanged.
- E. Pressure Gage: Upstream and downstream of valve capable of accurately measuring system pressures.

**2.8 PRESSURE RELIEF VALVES**

- A. Operation: Maintain a constant upstream pressure by passing or relieving excess pressure.
- B. Closed Valves: Drip-tight.
- C. Type: Hydraulically operated, pilot control using a diaphragm with a single removable seat and resilient disc.
- D. Pilot Controls: Direct acting, adjustable between 20 and 200 psi, spring-loaded diaphragm valve.
- E. Rating: 250 psi working pressure.
- F. Connection: Flanged.

**2.9 CONTROL VALVE**

- A. Globe, or Angle, as shown on the Plans: Diaphragm actuated, single seated, composition disc, hydraulically operated.
- B. Pilot Controls: Externally mounted, four-way, solenoid pilot valve with self cleaning strainers and diaphragm type check valves:
  - 1. Equipped with a limit switch for pump control.
  - 2. Equipped with a built-in lift check valve to prevent flow reversal.
- E. Rating: 250 psi working pressure.
- F. Connection: Flanged.
- G. Solenoids and Limit Switch: Supplied with operating voltage indicated.

**2.10 LEAD FREE**

- A. All components shall be Lead Free

**PART 3 EXECUTION**

---

**3.1 INSTALLATION**

- A. Flush all lines before valve installation.
- B. In ductile iron water mains, AWWA C600.
- C. Install butterfly valve shafts vertical in vault boxes and horizontal otherwise.

END OF SECTION

**SECTION 33 12 19 (Revised)**  
**HYDRANTS**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Dry-barrel fire hydrants, valves, piping and accessories.

**1.2 REFERENCES**

**A. APWA (Utah Chapter) Standards:**

- Plan 511 Fire hydrant with valve.
- Plan 561 Direct bearing thrust block.
- Plan 562 Tie-down thrust restraints.

**B. AWWA Standards:**

- C110 Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- C209 Cold-Applied Tape Coatings for the Exterior of Special Section, Connections, and Fittings for Steel Water Pipelines.
- C210 Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel water Pipelines.
- C214 Tape Coating Systems for the Exterior of Steel Water Pipelines.
- C502 Dry-Barrel Fire Hydrants.
- M17 Manual for Installation, Operation, and Maintenance of Fire Hydrants.

**1.3 PRODUCT HANDLING**

- A. Package fire hydrants, gate valves, and valve boxes for protection against dirt and damage during shipment and storage.
- B. Do not plug drain hole.

**1.4 SUBMITTALS**

- A. Product Data: Manufacturer's technical product data and installation instructions.
- B. Shop Drawings: Show interface and spatial relationship between piping and adjacent structures.
- C. Field Quality Control Reports: For system commissioning.

## 1.5 JOB CONDITIONS

- A. Notify appropriate fire department as soon as hydrant is removed or placed in service.

---

## PART 2 PRODUCTS

---

### 2.1 DRY-BARREL FIRE HYDRANT

- A. **Shall be Mueller Modern Centurion, Clow Medallion, or East Jordan Iron Works (Syracuse Castings) 5CD250 per AWWA C502.**
- B. Cast iron compression type, opening against pressure and closing with pressure, base valve design, 150 psi working pressure, with 1/4 inch diameter minimum tapping and bronze plug in standpipe:
  1. Size: 5-1/4 inch valve opening.
  2. Direction to Open Hydrant: Counterclockwise.
  3. Size and Shape of Operating and Cap Nuts: Pentagon. 1-1/2 inch point to flat.
  4. Hose Nozzles: Two 2-1/2 inch national standard thread, cap, gasket and chain.
  5. Pumper Nozzle: One 4-1/2 inch national standard thread, cap, gasket and chain.
  6. Depth of Burial: 48 inches or consistent with main depth.
  7. Connection to Main: Six (6) inches flanges or mechanical joint.
  8. Pressure: 150 psi working pressure and 300 psi hydrostatic pressure.
  9. Inlet Bottom Connection: Six (6) inches mechanical joint or flanged in accordance with AWWA C110 and AWWA C111, designed to allow separation at the sidewalk or ground level when hydrant is sheared off.
  10. Automatic Drain: Opens as the hydrant is closed.

### 2.2 PIPE AND FITTINGS

- A. Ductile Iron: Section 33 05 05. Standard drilling with joints per AWWA C110.
- B. PVC: Section 33 05 07.
- C. Steel: Section 33 05 09. Standard drilling, 150 lb.
- D. Spool: Schedule 40 steel, epoxy lined, exterior wrapped with minimum six (6) mil thick polyethylene sheet and tape wrap, AWWA C210 or C213 and C209 or C214 with two welded in place 150 lb. steel ANSI B 16.5 slip on flanges.

### 2.3 VALVES

- A. Gate Valve: Section 33 12 19.
- B. If indicated, furnish an auxiliary six (6) inch diameter valve with end connections as required.

## 2.4 ACCESSORIES

- A. Bolts, Nuts, Washers: Stainless steel, Section 05 05 23.
- B. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
- C. Thrust Blocks: Concrete Class 2000 minimum cast-in-place, Section 03 30 04.
- D. Valve Box, Valve Chamber: Section 33 12 19.

## 2.5 LEAD FREE

- A. All components shall be Lead Free

---

# PART 3 EXECUTION

---

## 3.1 PREPARATION

- A. Excavation, Section 31 23 16.

## 3.2 INSTALLATION

- A. Install hydrant according to APWA Plan 511 and AWWA M17.
- B. Install hydrants, valves, and valve boxes as indicated and located. Hydrants shall not be connected to or located within 10 feet of a sanitary sewer or storm drain.
- C. Install so bottom of hydrant base flange is above grade four (4) inches plus or minus two (2) inches.
- D. Point 4-1/2 inch pumper nozzle to face the street.
- E. Drain holes at base of hydrant to remain clear with a minimum of 1 cubic yard of clean sewer rock (Section 32 11 23) placed around hydrant base and drain. Place sheet plastic over gravel to prevent silting.
- F. Coal tar and tape wrap steel pipe.
- G. Grease all buried nuts, bolts, and steel ancillaries then wrap with six (6) mil thick polyethylene sheet and tape wrap.
- H. Install thrust blocks according to APWA Plan 561 or 562.
- I. All hydrants shall have a minimum lateral size of 6-inches in diameter, with the valve at the main. Laterals longer than 50' shall be increased to 8-inch in diameter, and include an additional valve at the hydrant.

## 3.3 BACKFILLING

- A. Secure water company permission to commence backfilling operation.
- B. Trenches, Section 33 05 20.
- C. Structures, Section 31 23 23.
- D. Landscaping, Section 32 91 19.
- E. Pavements, Section 32 05 10.

**3.4 PAINT**

- A. Paint buried portion of hydrant with two coats of coal tar enamel or asphalt.
- B. Paint hydrant barrel and caps with one coat primer and final coat per water company paint standards.

**3.5 FIELD QUALITY CONTROL**

- A. Commissioning, Section 33 08 00.
- B. Disinfection, Section 33 13 00.

END OF SECTION

**SECTION 33 12 33**  
**WATER METER (Revised)**

---

**PART 1 GENERAL**

---

**1.1 SECTION INCLUDES**

- A. Water meters, service connections, materials.

**1.2 REFERENCES**

A. **AWWA Standards:**

- C704 Cold-Water Meters - Propeller Type for Main Line Applications.  
C800 Underground Service Line Valves and Fittings.

**1.3 SUBMITTALS**

- A. Manufacturer's test records for range and accuracy of meter being furnished.  
B. Equipment material diagram and parts schematic.

---

**PART 2 PRODUCTS**

---

**2.1 METERS FOR SYSTEM PIPING**

- A. Materials and Construction: AWWA C704:
1. Cast iron bodies, 175 psi working pressure, flanged connections.
  2. Built-in straightening vanes.
  3. Working pressure 150 psi.
  4. Polyethylene plastic propeller.
  5. Stainless steel shaft with stainless steel ball bearings, lubricated by means of a single pressure fitting.
- B. Accuracy: Plus or minus two (2) percent of scale for velocities over 1 foot per second.
- C. Totalizer: Six digits reading in units required.
- D. Water meter setters shall be per Plans 521R, 522.1R, 523R, 525R, 527R, 529R, 530R or 531R, as per the appropriate size meter required

**2.2 METERS FOR SERVICE PIPING**

- A. Provided by OWNER unless indicated otherwise.

### 2.3 SERVICE LINE, VALVES, AND FITTINGS

- A. Service Pipe: Copper, Section 33 05 03 or smooth wall polyethylene, Section 33 05 06. The service pipe between main and meter and to a point not less than 1 foot from the public way side of the property line cannot exceed the meter size.
- B. Service Valves and Fittings: AWWA C800.
- C. Meter Setters: Brass, with angle fittings, saddle nuts and gaskets.
- D. Corporation Stops and Angle Valves: Invert key design.
- E. Bypasses: Not allowed on any service installation without approval of ENGINEER.
- F. **Service lines shall be capped until connected for service.**

### 2.4 METER BOXES

- A. **Water meter boxes shall be per Plans 521R, 522.1R, 523R, 525R, 527R, 529R, 530R or 531R, as per the appropriate size meter required**
- B. Meters 1-1/2" and Larger: Reinforced concrete with a minimum clearance of 12" from each side of meter plumbing.
- C. Cover: Ductile or cast iron with utility inscription
- D. **Any meter placed within a driveway, or other driving surface, shall require a concrete vault.**

---

## PART 3 EXECUTION

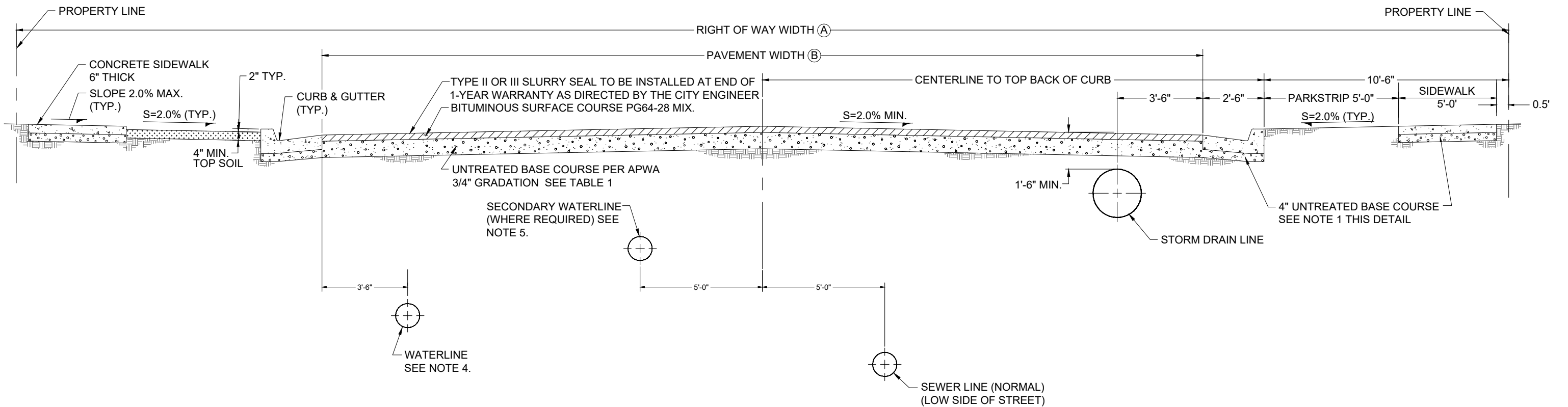
---

### 3.1 INSTALLATION

- A. Install meter box, meter setters, valves, etc. at indicated locations. If not indicated, install in street right-of-way parking strip or at a location approved by ENGINEER.
- B. Install meter setters level and horizontal. Provide suitable pipe lengths to prevent stress.
- C. DO NOT operate utility agency's main line valves. Contact agency if valves are to be operated. If required by water utility agency notify affected water users, Section 01 31 13.
- D. OWNER Supplied Meters: Installed by CONTRACTOR unless indicated otherwise.

END OF SECTION





NOTES:

1. PROVIDE 4" MINIMUM OF 3/4" OR 1" UNTREATED BASE COURSE UNDER SIDEWALKS, AND CURB & GUTTER, 6" UNDER DRIVE APPROACH (RESIDENTIAL AND 8" (COMMERCIAL).
2. PAVEMENT THICKNESS SHOWN ARE CONSIDERED AS CITY STANDARDS. ANY MODIFICATIONS WILL REQUIRE APPROVAL OF CITY ENGINEER BASED UPON SITE SPECIFIC CONSIDERATIONS.
3. ALL ROAD CUTS SHALL BE REPAIRED WITH BASE THICKNESS AND PAVEMENT THICKNESS (PLUS 1") AS SHOWN IN TABLE 1.
4. CULINARY WATER LINE SHALL HAVE A TYPICAL 5-FOOT BURY DEPTH. A BURY DEPTH LESS THEN 4- FEET, OR GREATER THEN 6- FEET, SHALL REQUIRE APPROVAL OF THE PUBLIC WORKS DIRECTOR.
5. SECONDARY WATER LINE SHALL HAVE A TYPICAL 4-FOOT BURY DEPTH.

TABLE 1

STREET CLASSIFICATION	R.O.W. WIDTH Ⓐ	PAVEMENT WIDTH Ⓑ	PAVEMENT THICKNESS	BASE COURSE THICKNESS
LOCAL	60'	34'	3" (RESIDENTIAL) 4" (COMMERCIAL)	8"
SUB-COLLECTOR	66'	40'	3" (RESIDENTIAL) 4" (COMMERCIAL)	8"
MODIFIED SUB-COLLECTOR	76'	50'	5"	10"
LIMITED ACCESS	84'	58'	5"	10"
ARTERIAL	106'	80'	7"	10"

## ***Trench Backfill***

### **1. GENERAL**

A. The drawing applies to backfilling a trench (and embankment) above the pipe zone.

### **2. PRODUCTS**

A. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 3-inches.

B. Flowable Fill: APWA Section 31 05 15. Target is 60 psi in 28 days with 90 psi maximum in 28 days, It must flow easily requiring no vibration for consolidation.

### **3. EXECUTION**

A. Trench Backfill Above the Pipe Zone: Follow requirement indicated in APWA Section 33 05 20R and the following provisions. See Standard Plan 382 for backfilling the pipe zone.

1) DO NOT USE sewer rock, pea gravel, or recycled RAP aggregate as trench backfill.

2) Maximum lift thickness is 8-inches before compaction. Compaction is 95 percent or greater relative to a standard proctor density, APWA Section 31 23 26R.

3) Water jetting is NOT allowed.

B. Flowable Fill: **If controlled low strength material is proposed to be placed in the trench, provide a submittal for review and approval by the ENGINEER.** Cure the material before placing surface restorations.

C. Embankment Backfill: When trench sides are sloped proceed as follows.

1) Maximum lift thickness is 8-inches before compaction.

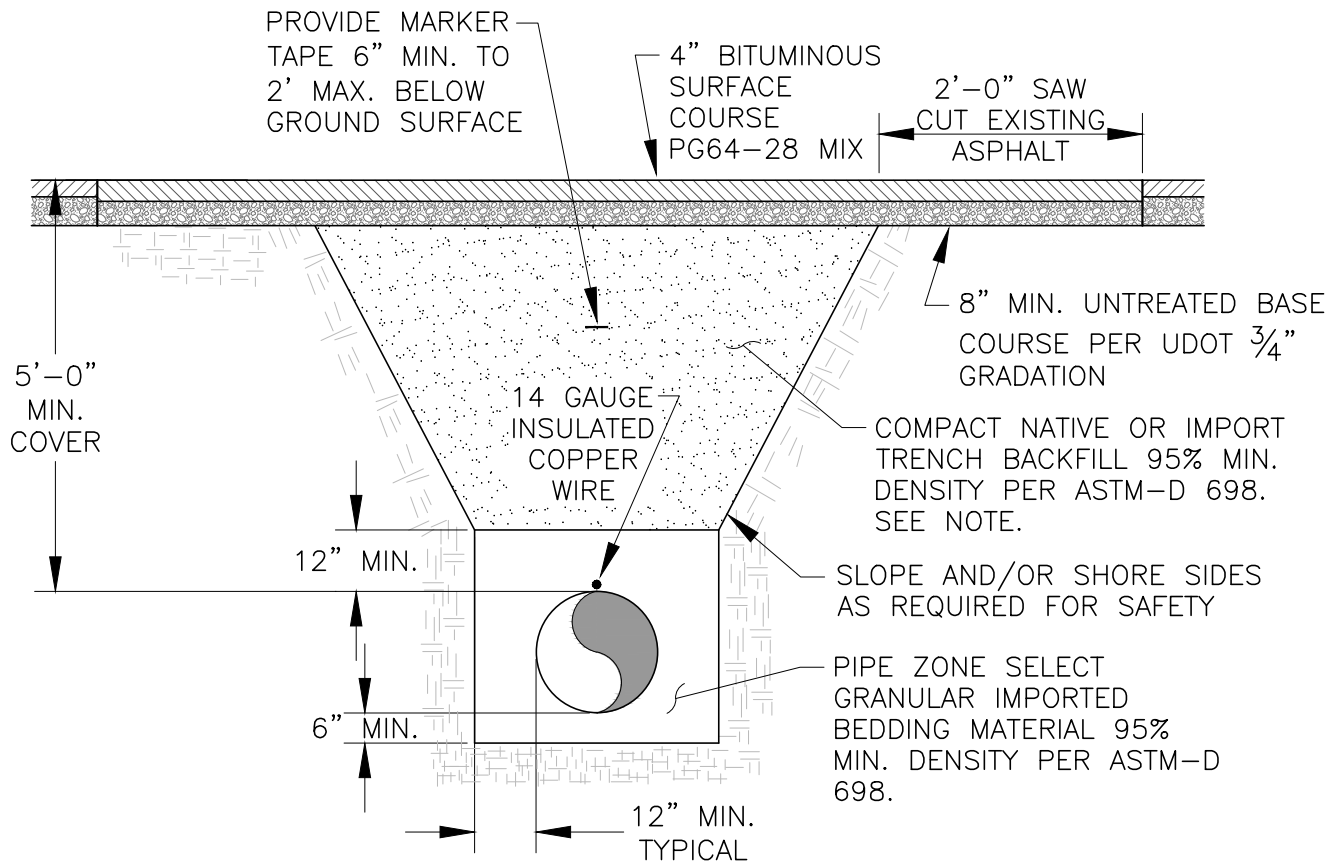
2) **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**

3) Submission of quality control compaction test result data may be requested by ENGINEER at any time. Provide results of tests immediately upon request.

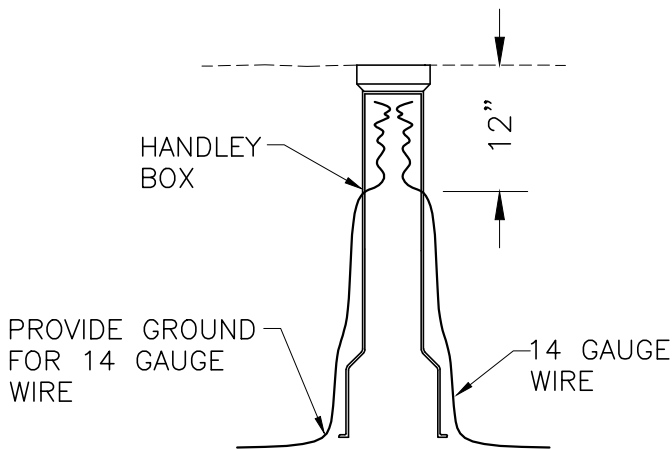
D. Surface Restoration:

1) Landscaped Surface: Follow APWA Section 32 92 00 (turf or grass) or APWA Section 32 93 13 (ground cover) requirements. Rake to match existing grade. Replace vegetation to match pre-construction conditions.

2) Paved Surface: Follow APWA Section 33 05 25R (bituminous pavement surfacing), or APWA Section 33 05 25R (concrete pavement surfacing). Do not install surfacing until compaction density is acceptable to ENGINEER. .



NOTE: IF USING NATIVE BACKFILL, IT MUST BE SCREENED TO 3" MINUS AND BLENDED AS NECESSARY TO ENSURE THERE IS A CONSISTENT PROCTOR. IF CONSISTENT FILL CANNOT BE MADE SUITABLE FOR COMPACTION, REMOVE AND REPLACE WITH A1a MATERIAL. COMPACT IN 8-INCH LIFTS OR AS REQUIRED BY THE GEOTECHNICAL REPORT.



PROVIDE HANDLEY BOX (OR APPROVED EQUAL) FOR TRACER WIRE WHERE VALVE BOX SPACING EXCEEDS 400'. BRING TRACER WIRE INTO BOX A MINIMUM OF 12" BELOW CAP AND PROVIDE 30" OF COILED WIRE. TRACER WIRE SHALL BE CHECKED FOR CONTINUITY PRIOR TO ACCEPTANCE.

**INSULATED COPPER WIRE  
AT HANDLEY AND VALVE  
BOXES**

**TYPICAL TRENCH  
DETAIL**

## ***Fire Hydrant with Valve***

### **1. GENERAL**

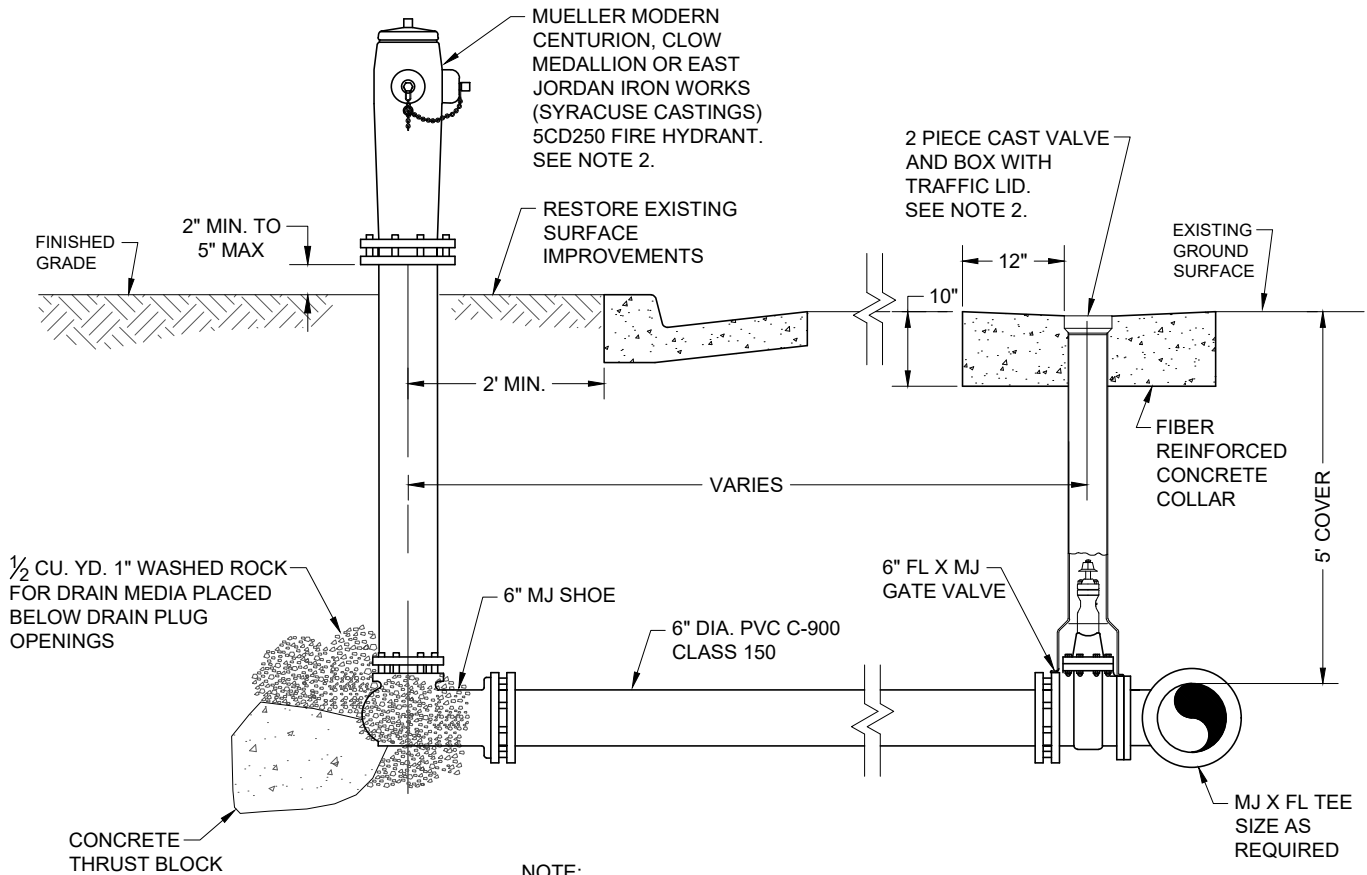
- A. Before backfilling, secure inspection of installation by ENGINEER.
- B. Additional requirements are specified in APWA Section 33 11 00R.

### **2. PRODUCTS**

- A. Hydrant: Dry barrel, AWWA C502. **Mueller Modern Centurion, Clow Medallion, or East Jordan Iron Works (Syracuse Castings) 5CD250**
- B. Thrust Blocks: Concrete Class 4000, APWA Section 03 30 04R.
- C. Reinforcement: Deformed, 60 ksi yield grade steel, ASTM A615.
- D. Backfill: APWA Section 31 05 13. Maximum particle size 2-inches.
  - 1) Sewer Rock: ASTM Size No. 3 (2" to 1") or larger.
  - 2) Other Type of Common Fill: CONTRACTOR's choice,.
- E. Geotextile: Stabilization-separation fabric, APWA Section 31 05 19.

### **3. EXECUTION**

- A. Installation:
  - 1) Provide at least 1 cubic yard of sewer rock around drain hole at base of hydrant spool. Wrap geotextile around sewer rock and tape geotextile to hydrant spool to prevent silting of sewer rock.
  - 2) Paint fire hydrant to agency's fire hydrant paint code.
  - 3) Apply non-oxide grease to all buried metal fittings. Wrap with polyethylene sheet and tape wrap. Provide slits around base to allow hydrant plug to drain.
  - 4) Notify fire department as soon as hydrant is placed in service.
- B. Thrust Blocks:
  - 1) Before pouring concrete, wrap pipe system with polyethylene sheet to prevent bonding of concrete to pipe system.
  - 2) Not required for flange or welded pipe systems.
- C. **Base Course and Backfill Placement: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**



NOTE:

1. PROVIDE MEGALUG JOINT RESTRAINT ON ALL MJ FITTINGS.
2. PROVIDE 14-GAUGE TRACER WIRE AND BRING ALONG SIDE OF HYDRANT BARREL AND TEST FOR CONTINUITY. SEE PLAN 381R FOR VALVE BOX TRACER WIRE.

## ***3/4" and 1" Meter***

### **1. GENERAL**

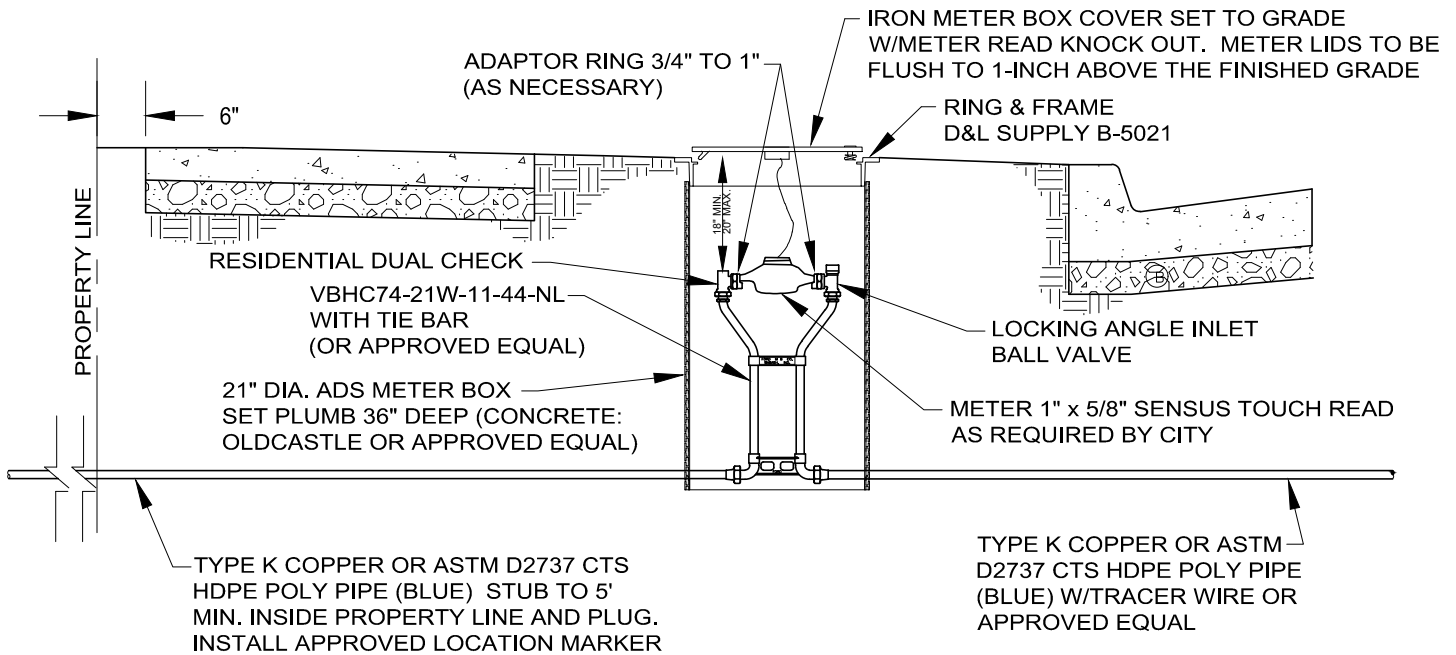
- A. In street surfaces or other vehicular traffic areas (like driveway approaches), all meter boxes shall be concrete as directed by ENGINEER.
- B. Before backfilling, secure inspection of installation by ENGINEER.
- C. **All residential laterals and meters vaults shall be 1" min per Plan 521R**

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Castings: Grey iron class 35 minimum per ASTM A48, coated with asphalt based paint or better.

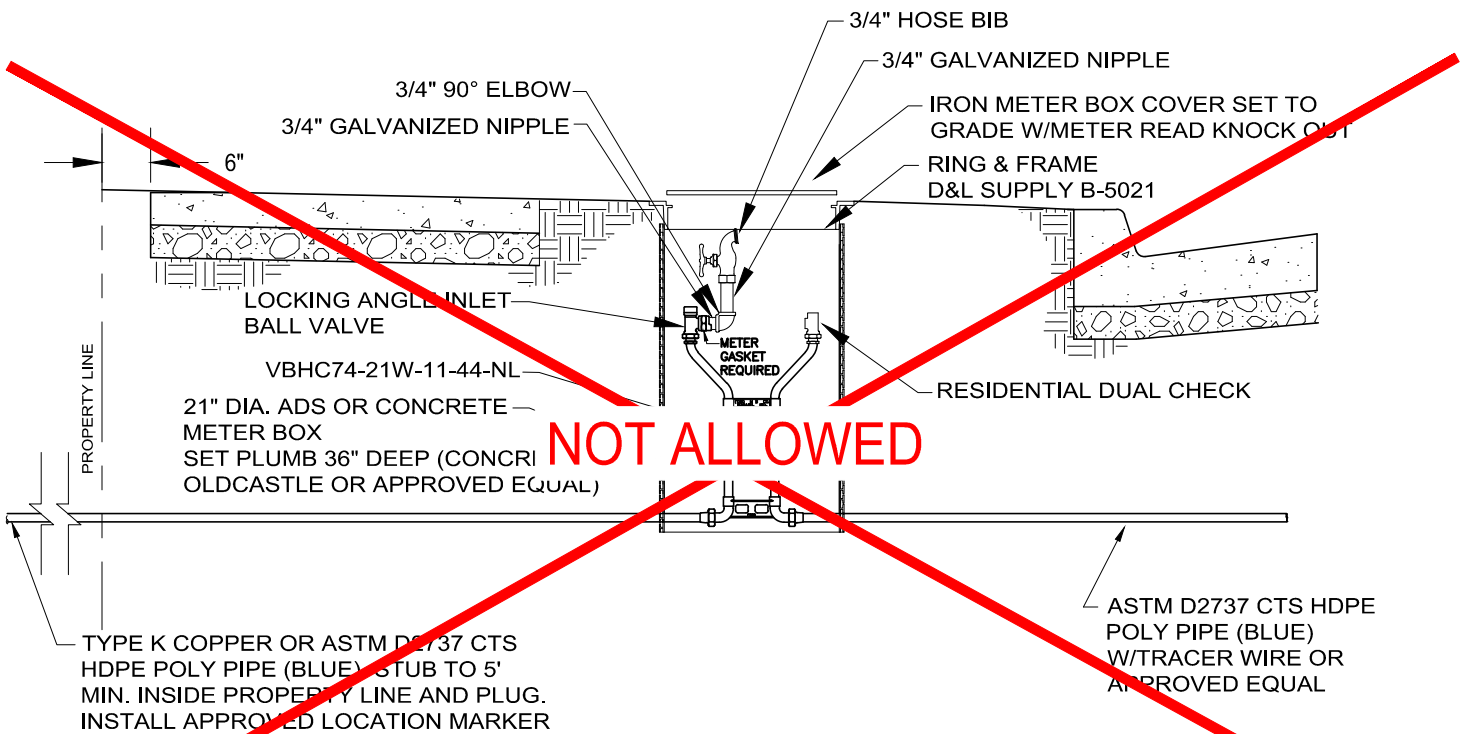
### **3. EXECUTION**

- A. Meter Placement:
  - 1) All meters are to be installed in the park strip or within 7 feet of the property line (street side) **or as shown on the approved plans.**
  - 2) Do not install meters under driveway approaches, sidewalks, or curb and gutter without ENGINEER approval. **Any meter placed within a driveway or other driving surface will require a concrete vault and traffic rated lid.**
- B. Meter Box: Set box so grade of the frame and cover matches the grade of the surrounding surface.
- C. Pipe Outside of Right-of-Way: Coordinate with utility agency or adjacent property owner for type of pipe to be used outside of right-of-way.
- D. Inspection: Before backfilling around meter box, secure inspection of installation by ENGINEER.
- E. Base Course and Backfill Placement: **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**



NOTE: USE 1" SERVICE AND METER SET FOR ALL NEW CONNECTIONS. PROVIDE TRACER WIRE WHEN CTS HDPE IS USED. TRACER WIRE SHALL BE CHECKED FOR CONTINUITY.

## RESIDENTIAL WATER METER



NOTE: USE 1" SERVICE AND METER SET FOR ALL NEW CONNECTIONS. PROVIDE TRACER WIRE WHEN HDPE IS USED. TEST FOR CONTINUITY.

## TEMPORARY WATER METER CONNECTION (MUST BE APPROVED FOR USE BY CITY)

## 1 1/2" and 2" **Compound Meter**

### 1. **GENERAL**

- A. Turbine meters may be used exclusively for irrigation or fire, as approved by ENGINEER.
- B. Where domestic use is applicable, use a compound meter.
- C. Before backfilling, secure inspection of installation by ENGINEER.

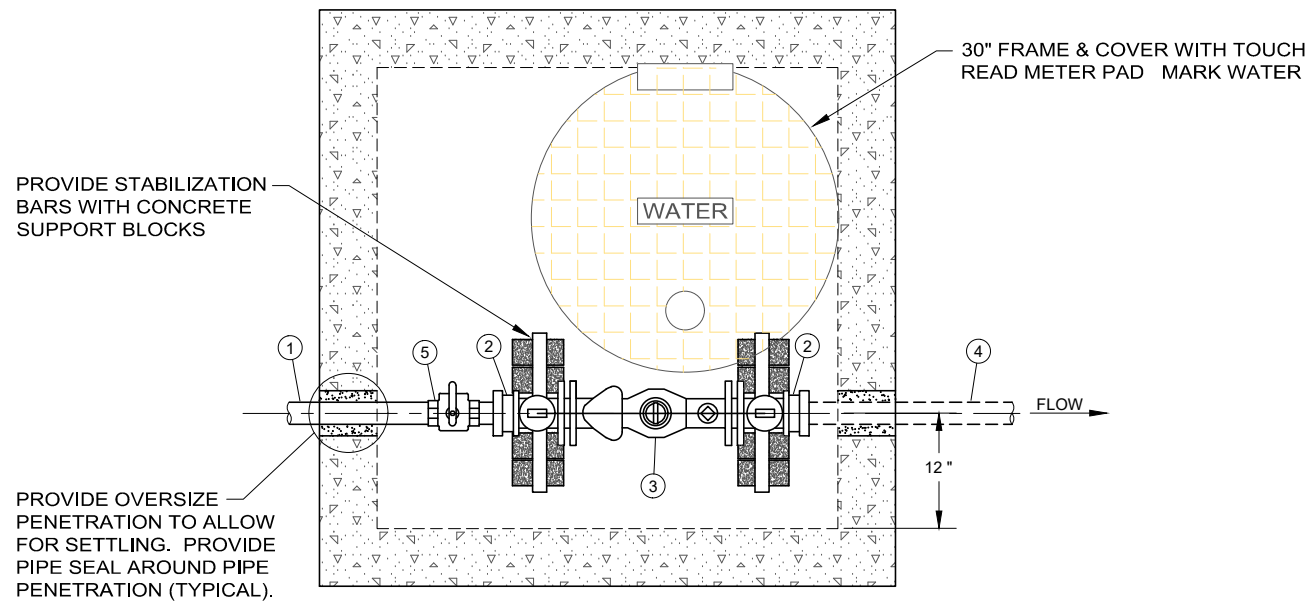
### 2. **PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Castings: Grey iron class 35 minimum per ASTM A48, coated with asphalt based paint or better.

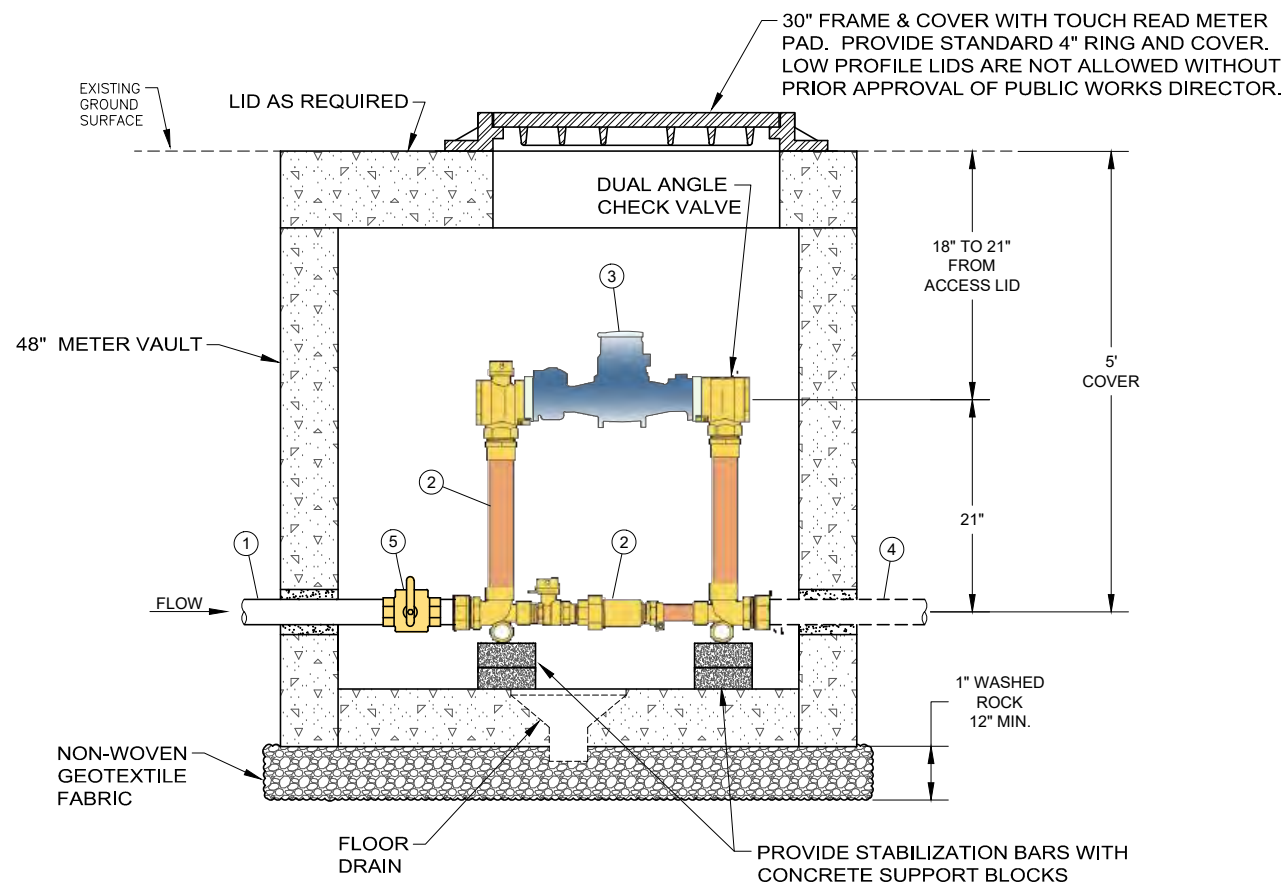
### 3. **EXECUTION**

- A. Meter Placement:
  - 1) All meters are to be installed in the park strip or within 7 feet of the property line (street side) **or as shown on the approved plans.**
  - 2) Do not install meters under driveway approaches, sidewalks, or curb and gutter. **Any meter placed within a driveway or other driving surface will require a concrete vault and traffic rated lid.**
  - 3) In new construction, install meter at center of lot or per agency requirements.
- B. Meter Box: Set box so grade of the frame and cover matches the grade of the surrounding surface.
- C. Bypass Valve: Lock in off position.
- D. Blocking: Use clay brick or concrete block.
- E. Concrete Box:
  - 1) Center frame and cover over water meter.
  - 2) Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.
- F. Pipe Outside of Right-of-Way: Coordinate with utility agency or adjacent property owner for type of pipe to be used outside of right-of-way.
- G. Base Course and Backfill Placement: **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**





PLAN



SECTION

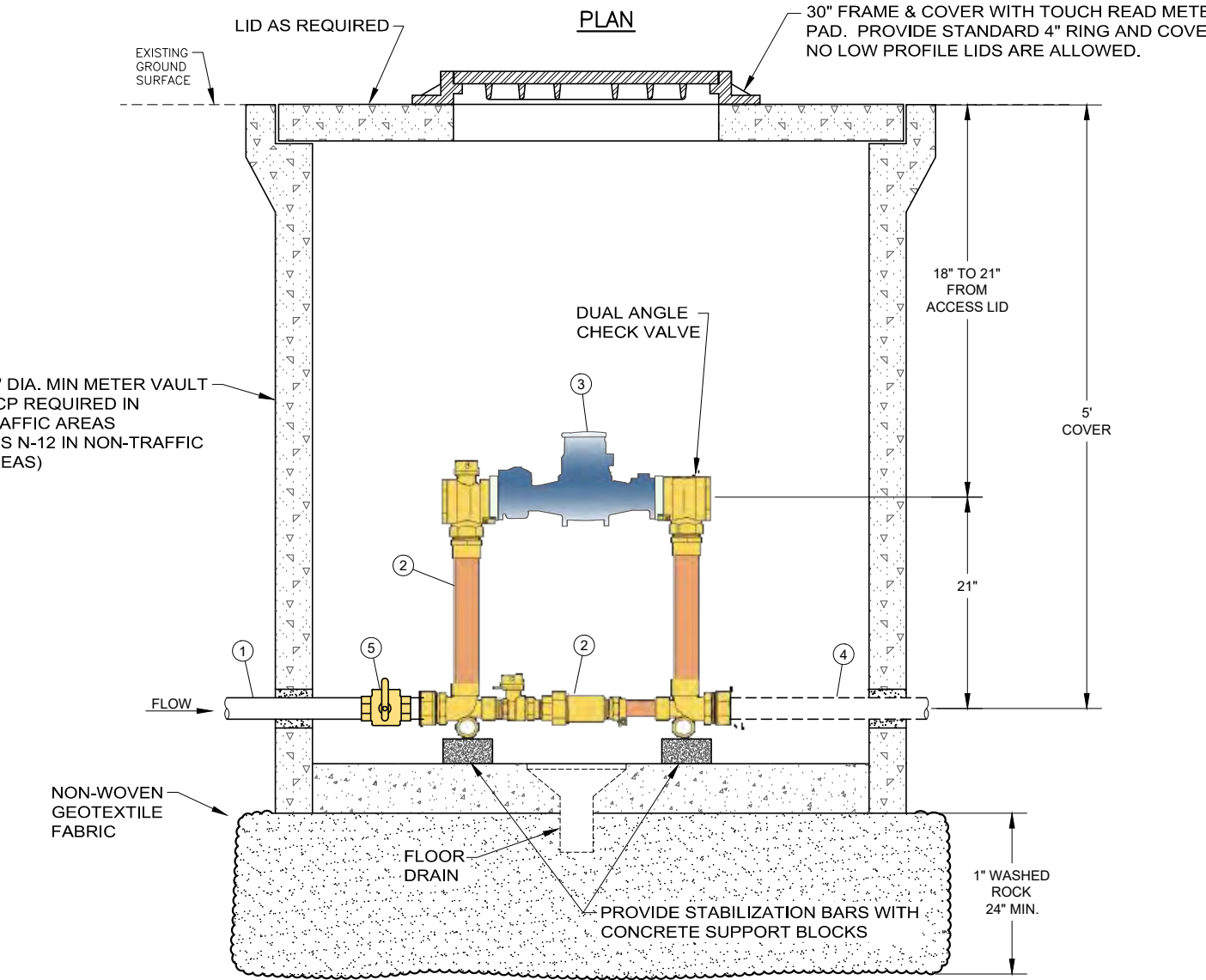
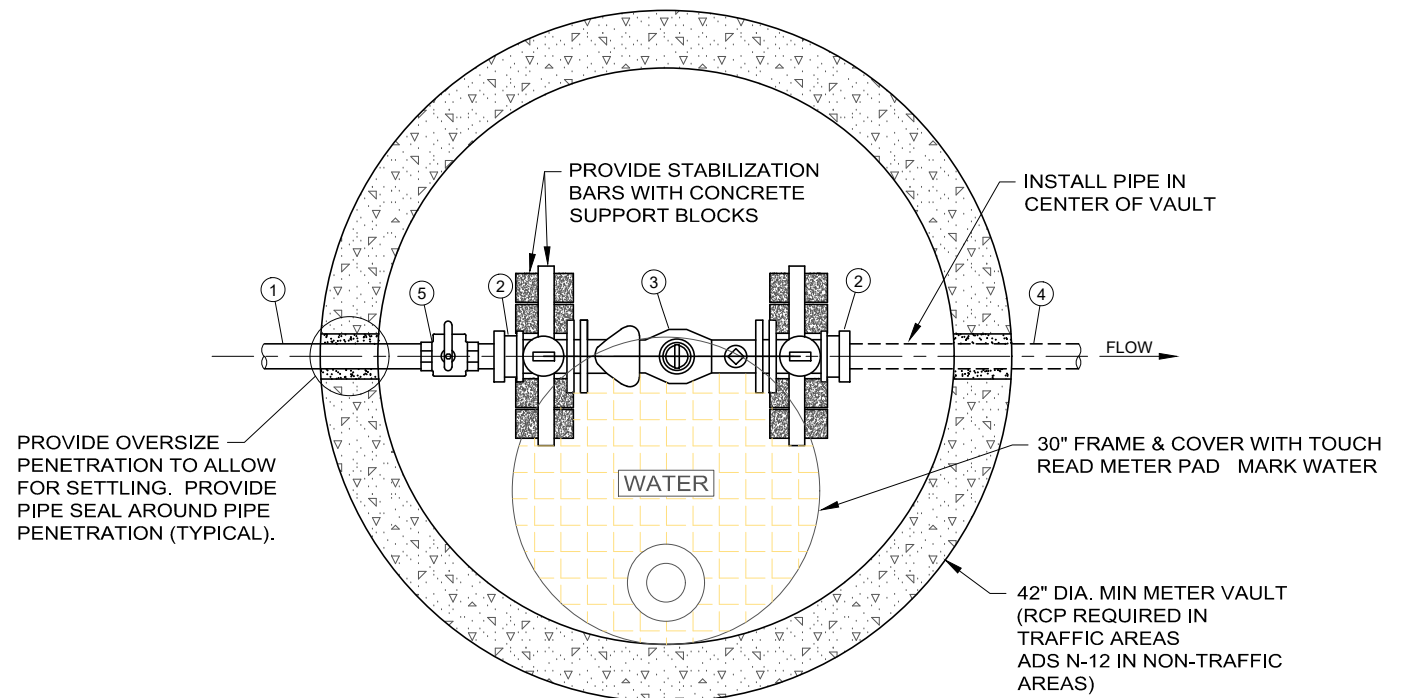
### METER VAULT VALVE AND FITTING SCHEDULE

NO.	DESCRIPTION	SIZE	JOINT
1.	ASTM D2737 CTS HDPE POLY PIPE (BLUE) W/TRACER WIRE	1.5" OR 2"	COMP.
2.	FORD SERIES 70 COPPER SETTER (H=21"), WITH BALL VALVE INLET & ASSE APPROVED ANGLE DUAL CHECK VALVE OUTLET AND STANDARD BYPASS & CARTRIDGE DUAL CHECK VALVE (2" MODEL VBHC74-21W-11-44-NL) (1½" MODEL VBHC76-21B-11-66-NL)	1.5" OR 2"	FLG
3.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> RADIO READ FURNISHED & INSTALLED BY CITY)	1.5" OR 2"	FLG
4.	OUTLET LINE AS PER PLAN	1.5" OR 2"	-
5.	BRASS BALL VALVE (MUELLER 300 BALL)	1.5" OR 2"	-

NOTE: PROVIDE GRIP JOINT FOR COPPER OR PLASTIC TUBE AS NEEDED. THE METER SETTER SHALL BE NO SMALLER IN SIZE THAN THE LATERAL FROM THE MAIN TO THE METER SETTER INSTALLED.

NOTES:

1. CONTRACTOR SHALL RESTORE ALL SURFACE IMPROVEMENTS TO PRE-CONSTRUCTION CONDITION WHERE REQUIRED.
2. CONTRACTOR SHALL PROVIDE ANY ADDITIONAL PIPE & FITTINGS AS NECESSARY.



METER VAULT VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	ASTM D2737 CTS HDPE POLY PIPE (BLUE) W/TRACER WIRE	1.5" OR 2"	COMP.
2.	FORD SERIES 70 COPPER SETTER (H=21"), WITH BALL VALVE INLET & ASSE APPROVED ANGLE DUAL CHECK VALVE OUTLET AND STANDARD BYPASS & CARTRIDGE DUAL CHECK VALVE (2" MODEL VBHC74-21W-11-44-NL) (1 1/2" MODEL VBHC76-21B-11-66-NL) (OR APPROVED EQUAL)	1.5" OR 2"	FLG
3.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> RADIO READ FURNISHED & INSTALLED BY CITY)	1.5" OR 2"	FLG
4.	OUTLET LINE AS PER PLAN	1.5" OR 2"	-
5.	BRASS BALL VALVE (MUELLER 300 BALL)	1.5" OR 2"	-

NOTE: PROVIDE GRIP JOINT FOR COPPER OR PLASTIC TUBE AS NEEDED. THE METER SETTER SHALL BE NO SMALLER IN SIZE THAN THE LATERAL FROM THE MAIN TO THE METER SETTER INSTALLED.

- NOTES:
1. FOR EXISTING LINE, CONTRACTOR SHALL POTHOLE EXISTING PIPE TO VERIFY DEPTH & SHALL ADJUST BOX DEPTH ACCORDINGLY.
  2. CONTRACTOR SHALL RESTORE ALL SURFACE IMPROVEMENTS TO PRE-CONSTRUCTION CONDITION WHERE REQUIRED.
  2. PROVIDE ANY ADDITIONAL PIPE & FITTINGS AS NECESSARY.

## ***3" and 4" Compound Meter with 2" Bypass***

### **1. GENERAL**

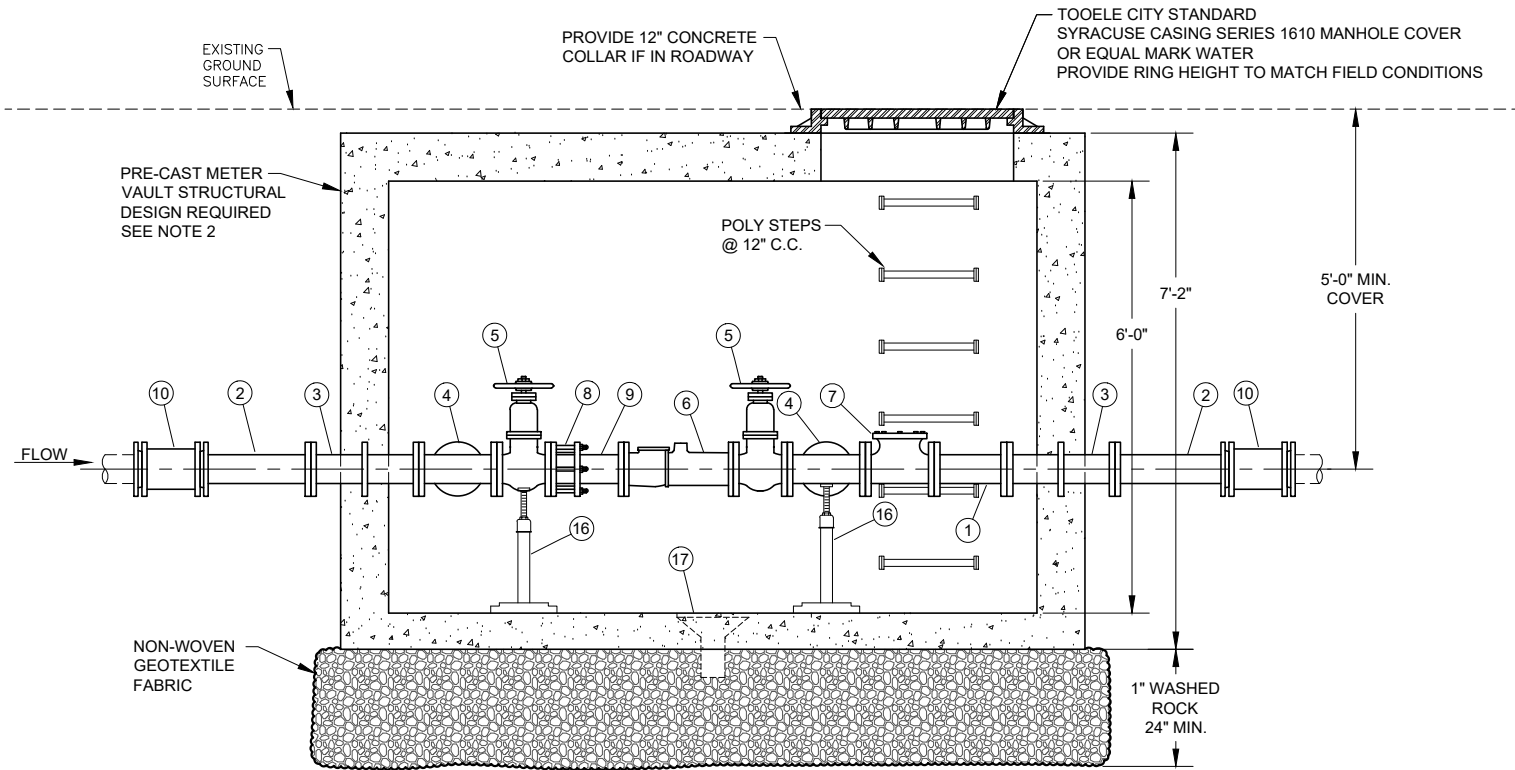
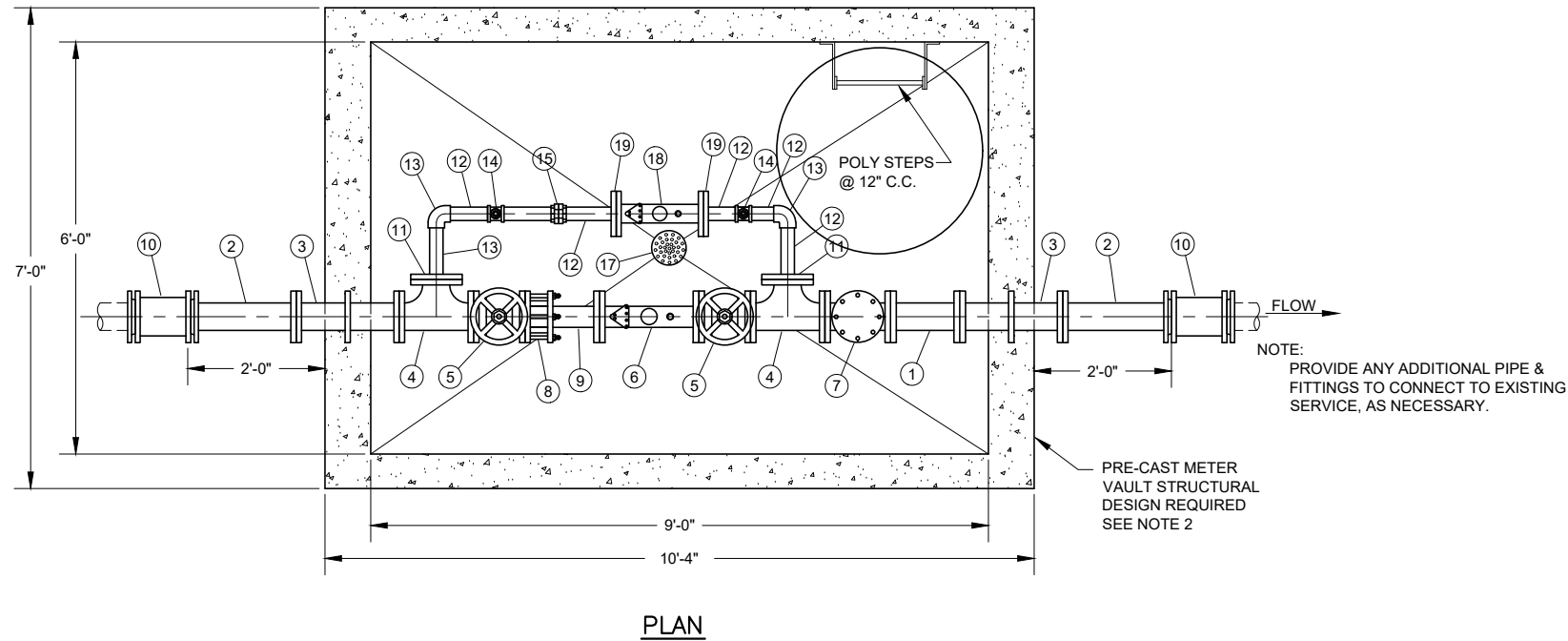
- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### **2 PRODUCTS**

- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### **3. EXECUTION**

- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.



METER VAULT VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	SPOOL PIECE (12" LONG)	3" OR 4"	FLG
2.	NIPPLE	3" OR 4"	FLG X PE
3.	WALL PIPE W/TRUST RING	3" OR 4"	FLG
4.	TEE	3" OR 4"	FLG
5.	GATE VALVE (MUELLER RESILIENT SEAT)	3" OR 4"	FLG
6.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> RADIO READ)	3" OR 4"	FLG
7.	SWING CHECK VALVE	3" OR 4"	FLG
8.	FLANGE COUPLING ADAPTER W/TIE RODS	3" OR 4"	FLG X PE
9.	NIPPLE	3" OR 4"	FLG X PE
10.	SOLID SLEEVE	3" OR 4"	MJ
11.	BLIND FLANGE W/2" TAP	3" OR 4"	FLG
12.	BRASS PIPE	2"	THD
13.	BRASS 90° ELBOW	2"	THD
14.	GATE VALVE BRONZE (LOCKING TYPE)	2"	THD
15.	BRASS UNION	2"	THD
16.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
17.	FLOOR DRAIN	6" X 4"	-
18.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> RADIO READ)	2"	FLG
19.	FORD METER FLANGE ADAPTOR (BRASS)	2"	THD X FLG

UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
ALL FLANGES ARE ANSI CLASS 125.  
PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.

- NOTES:
1. CONTRACTOR SHALL POTHOLE EXISTING PIPE TO VERIFY DEPTH & SHALL ADJUST BOX DEPTH ACCORDINGLY.
  2. PROVIDE SHOP DRAWING & DESIGN CALCULATIONS FOR PRECAST BOX AS H<sub>2</sub>O LOADING.
  3. CONTRACTOR SHALL RESTORE ALL SURFACE IMPROVEMENTS TO PRE-CONSTRUCTION CONDITION.
  4. CONTRACTOR SHALL MAINTAIN FLOW IN 4" DIA. LINE UNTIL READY TO INSTALL METER BOX AND SHALL ANTICIPATE INSTALLATION TO OCCUR AT A PRE-DETERMINED TIME IN ORDER TO MINIMIZE IMPACT. COORDINATE WATER CONNECTION WITH CITY A MINIMUM 48 HOURS IN ADVANCE.
  5. IF METER VAULT IS INSTALLED IN ROADWAY OR DRIVING SURFACE, PROVIDE MODIFIED DESIGN FOR COVER AND RING ACCESS FOR APPROVAL PRIOR TO INSTALLATION.

## ***6" Compound Meter with 2" Bypass***

### **1. GENERAL**

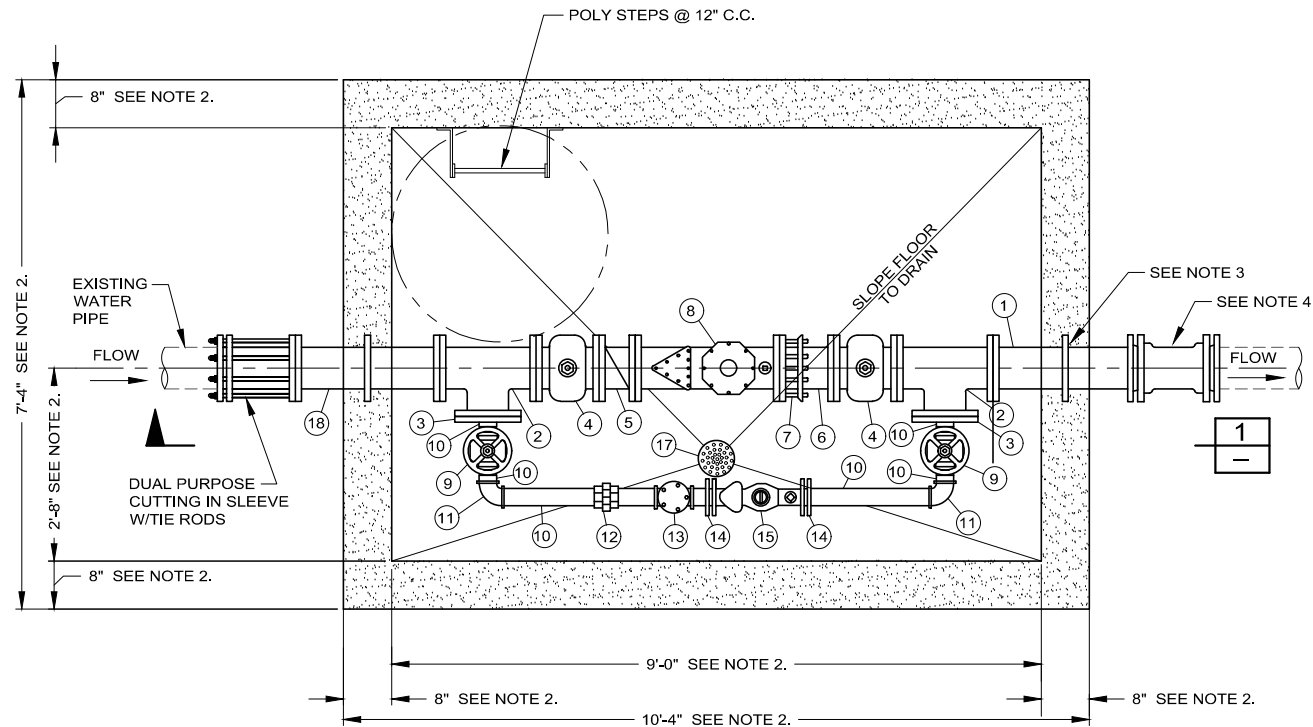
- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### **2 PRODUCTS**

- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### **3. EXECUTION**

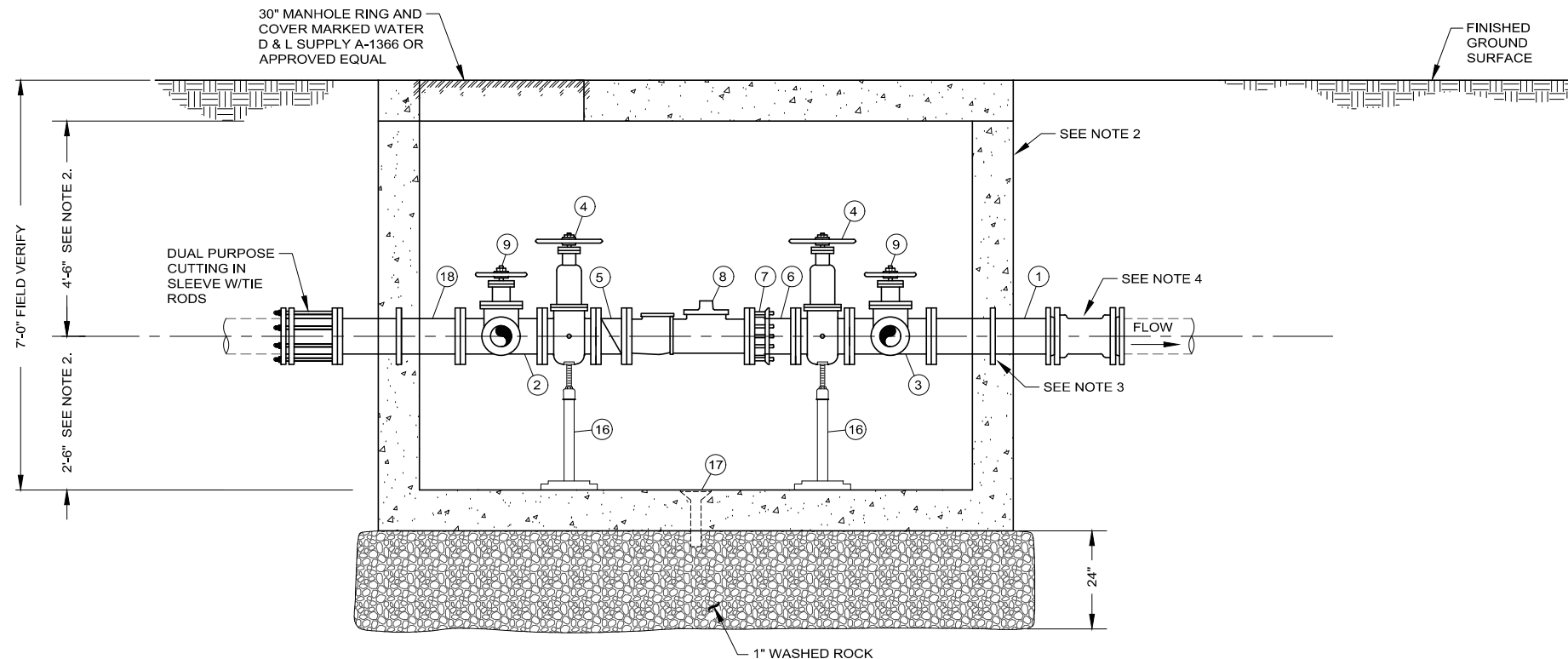
- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.



**6" METER STATION PLAN**  
NOT TO SCALE

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	WALL PIPE W/THRUST RING	6" X 2'-0"	FL X PE
2.	TEE	6"	FLG
3.	BLIND FLANGE W/2" TAP	6"	FLG
4.	GATE VALVE (SEE TABLE NOTES)	6"	FLG
5.	SILENT CHECK VALVE	6"	FLG
6.	NIPPLE	6"	FL X PE
7.	FLANGE COUPLING ADAPTER W/TIE RODS	6"	FL X PE
8.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> )	6"	FLG
9.	GATE VALVE (BRONZE)	2"	THD
10.	BRASS PIPE	2"	THD
11.	BRASS 90° ELBOW	2"	THD
12.	BRASS UNION	2"	THD
13.	CHECK VALVE	2"	THD
14.	FORD METER FLANGE	2"	THD X FLG
15.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> )	2"	FLG
16.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
17.	FLOOR DRAIN	6" X 2"	-
18.	WALL PIPE W/THRUST RING	6" X 2'-0"	FLG
19.	-	-	-

TABLE NOTES: UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53. ALL FLANGES ARE ANSI CLASS 125. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS. PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT. MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.



**SECTION 1**  
NOT TO SCALE

NOTES:  
 1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.  
 2. DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.  
 3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE.  
 4. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.

## **8" Compound Meter with 2" Bypass *and Meter***

### **1. GENERAL**

- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

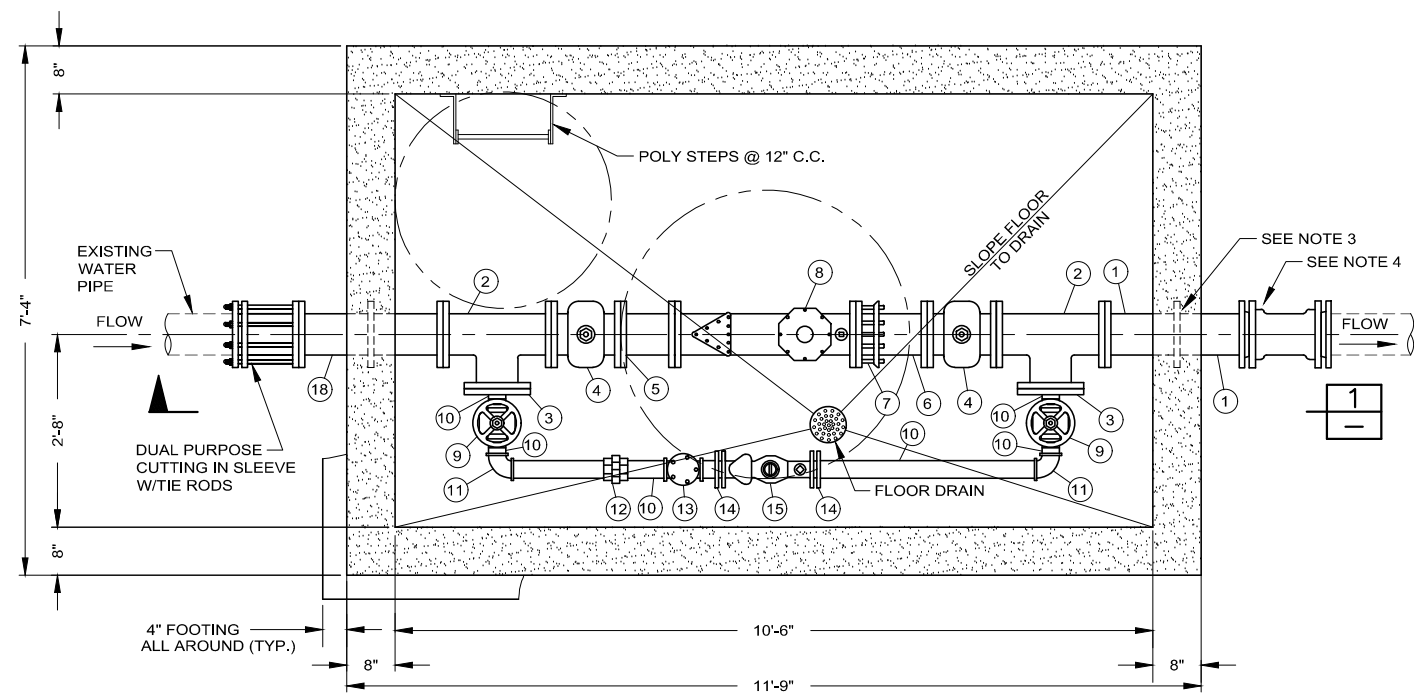
### **2. PRODUCTS**

- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### **3. EXECUTION**

- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.

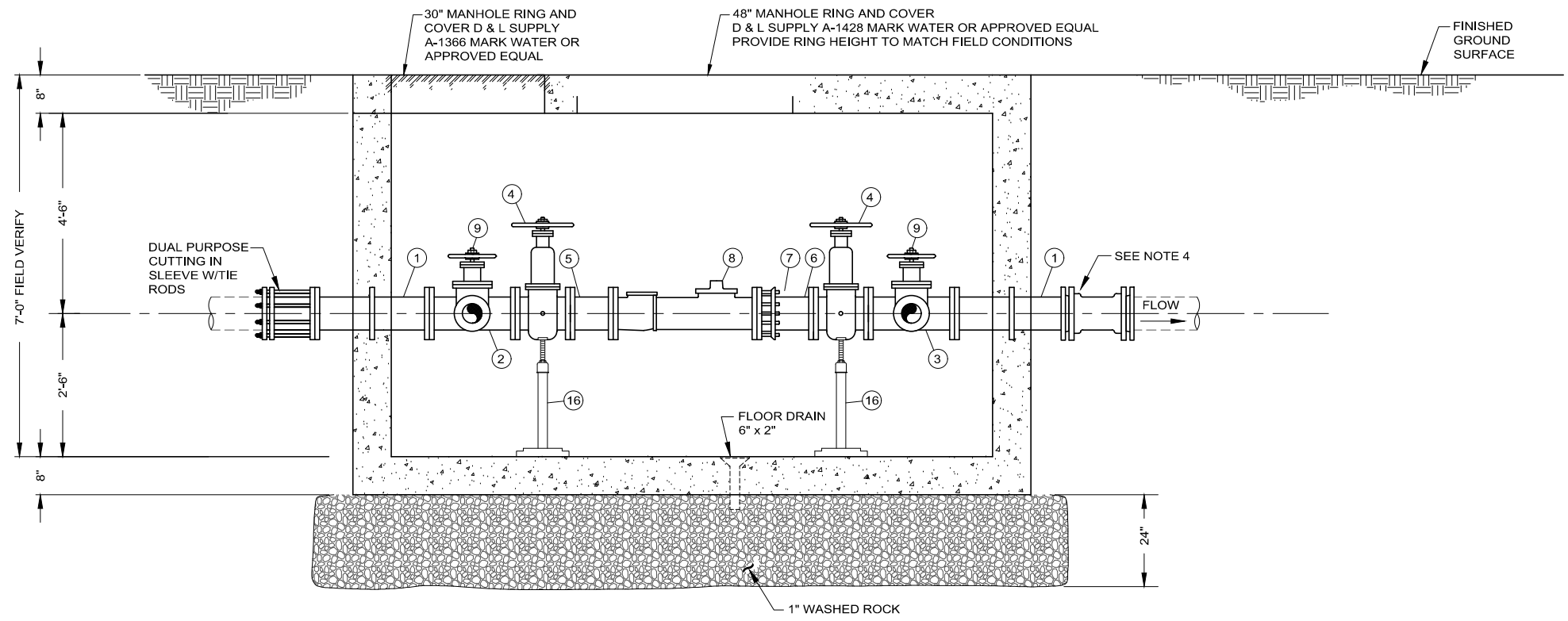




**8" METER STATION PLAN**  
NOT TO SCALE

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	WALL PIPE W/THRUST RING	8" X 2'-0"	FLG
2.	TEE	8"	FLG
3.	BLIND FLANGE W/2" TAP	8"	FLG
4.	GATE VALVE (SEE TABLE NOTES)	8"	FLG
5.	SPOOL PIECE	8"	FLG
6.	NIPPLE	8"	FL X PE
7.	FLANGE COUPLING ADAPTER W/TIE RODS	8"	FL X PE
8.	COMPOUND METER (SENSUS OMNI C) 2	8"	FLG
9.	GATE VALVE (BRONZE)	2"	THD
10.	BRASS PIPE	2"	THD
11.	BRASS 90° ELBOW	2"	THD
12.	BRASS UNION	2"	THD
13.	CHECK VALVE	2"	THD
14.	FORD METER FLANGE	2"	
15.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> )	2"	FLG
16.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
17.	FLOOR DRAIN	6" X 2"	-
18.	WALL PIPE W/THRUST RING	8" X 2'-0"	FLG
19.	-	-	-

UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
ALL FLANGES ARE ANSI CLASS 125.  
PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.



**SECTION 1**  
NOT TO SCALE

- NOTES:
1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
  2. DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.
  3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE.
  4. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.



## **10" Compound Meter with 2" Bypass and Meter**

### **1. GENERAL**

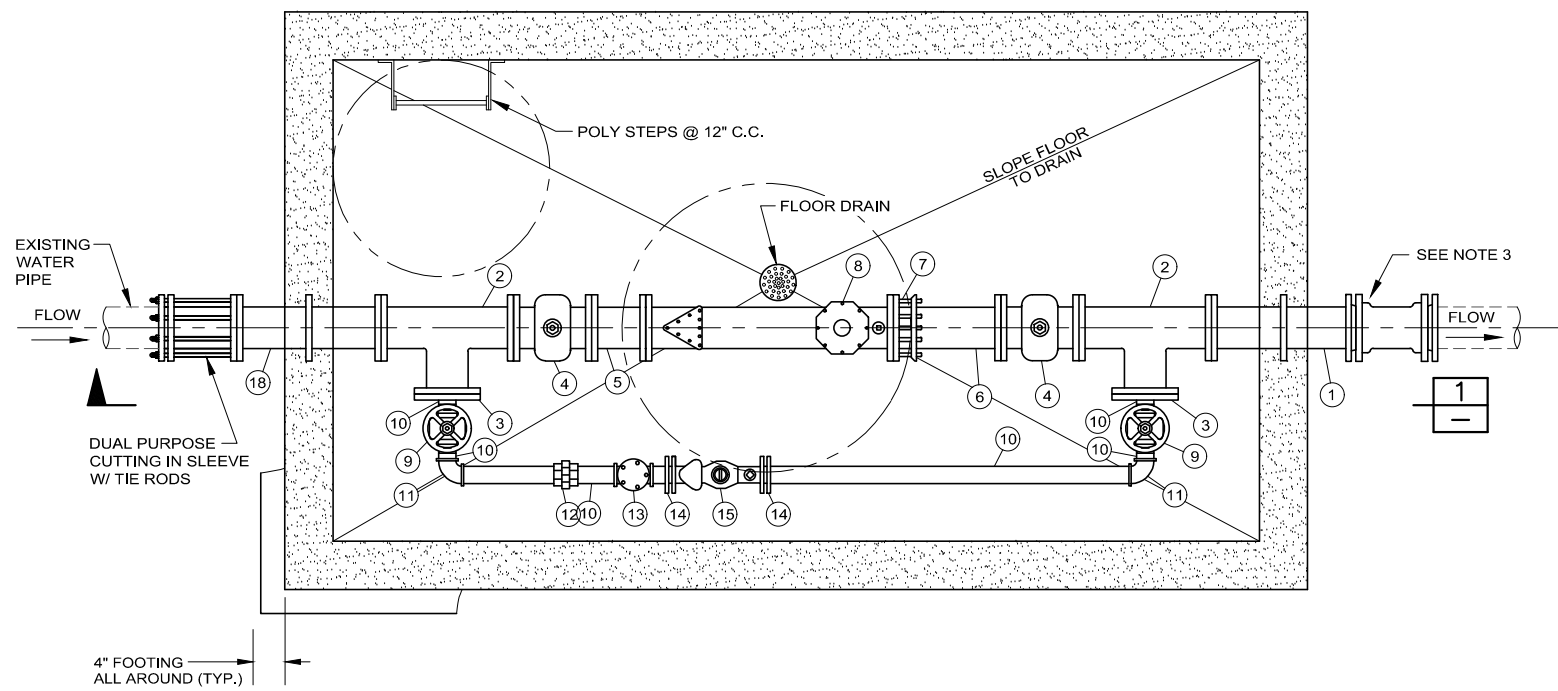
- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### **2 PRODUCTS**

- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### **3. EXECUTION**

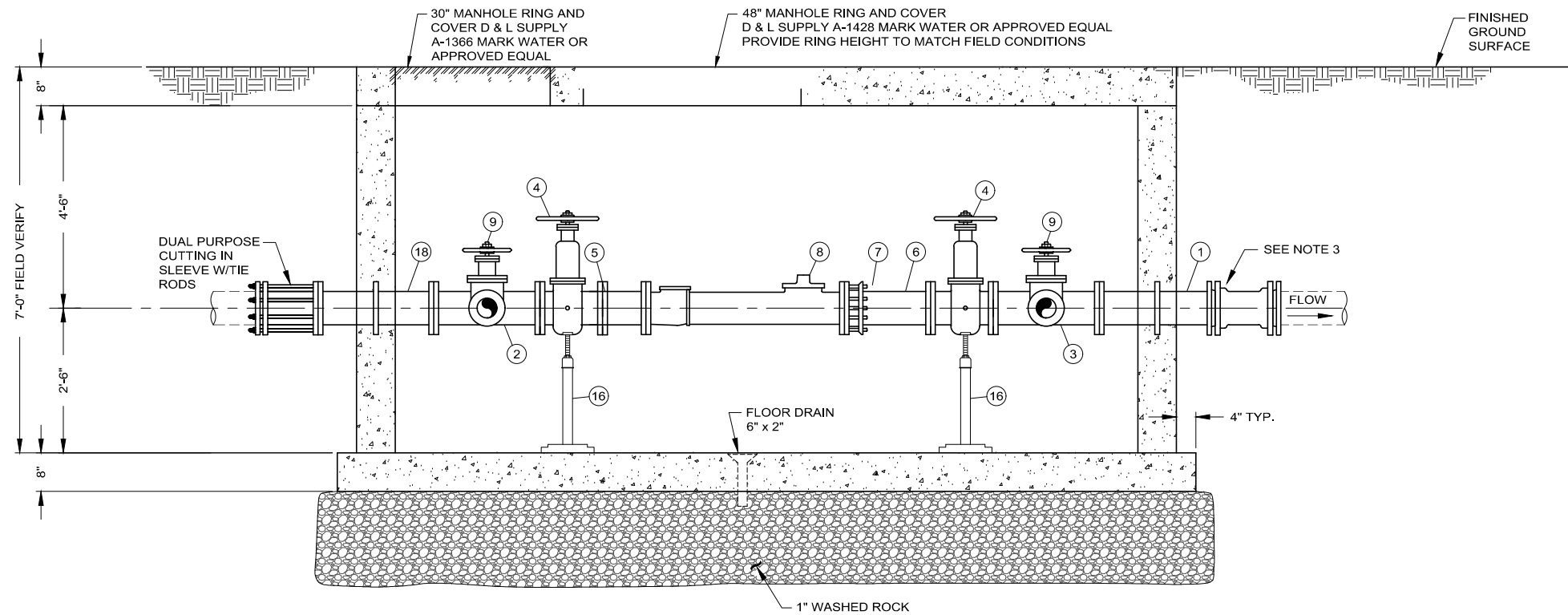
- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.



**10" METER STATION PLAN**  
NOT TO SCALE

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	WALL PIPE W/THRUST RING	10" X 2'-0"	FLG
2.	TEE	10"	FLG
3.	BLIND FLANGE W/2" TAP	10"	FLG
4.	GATE VALVE (MUELLER RESILIENT SEAT)	10"	FLG
5.	SPOOL PIECE	10"	FLG
6.	NIPPLE	10"	FL X PE
7.	FLANGE COUPLING ADAPTER W/TIE RODS	10"	FL X PE
8.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> )	10"	FLG
9.	GATE VALVE (BRONZE)	2"	THD
10.	BRASS PIPE	2"	THD
11.	BRASS 90° ELBOW	2"	THD
12.	BRASS UNION	2"	THD
13.	CHECK VALVE	2"	THD
14.	FORD METER FLANGE	2"	THD X FLG
15.	COMPOUND METER (SENSUS OMNI C <sup>2</sup> )	2"	FLG
16.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
17.	FLOOR DRAIN	6" X 2"	-
18.	WALL PIPE W/THRUST RING	10" X 2'-0"	FLG
19.	-	-	-

UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
ALL FLANGES ARE ANSI CLASS 125.  
PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.



**SECTION 1**  
NOT TO SCALE

NOTES:

1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
2. LOCATION OF PRESSURE RELIEF PIPE TO BE FIELD FIT BY ENGINEER.
3. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.

## 6" Fire Line Meter

### 1. GENERAL

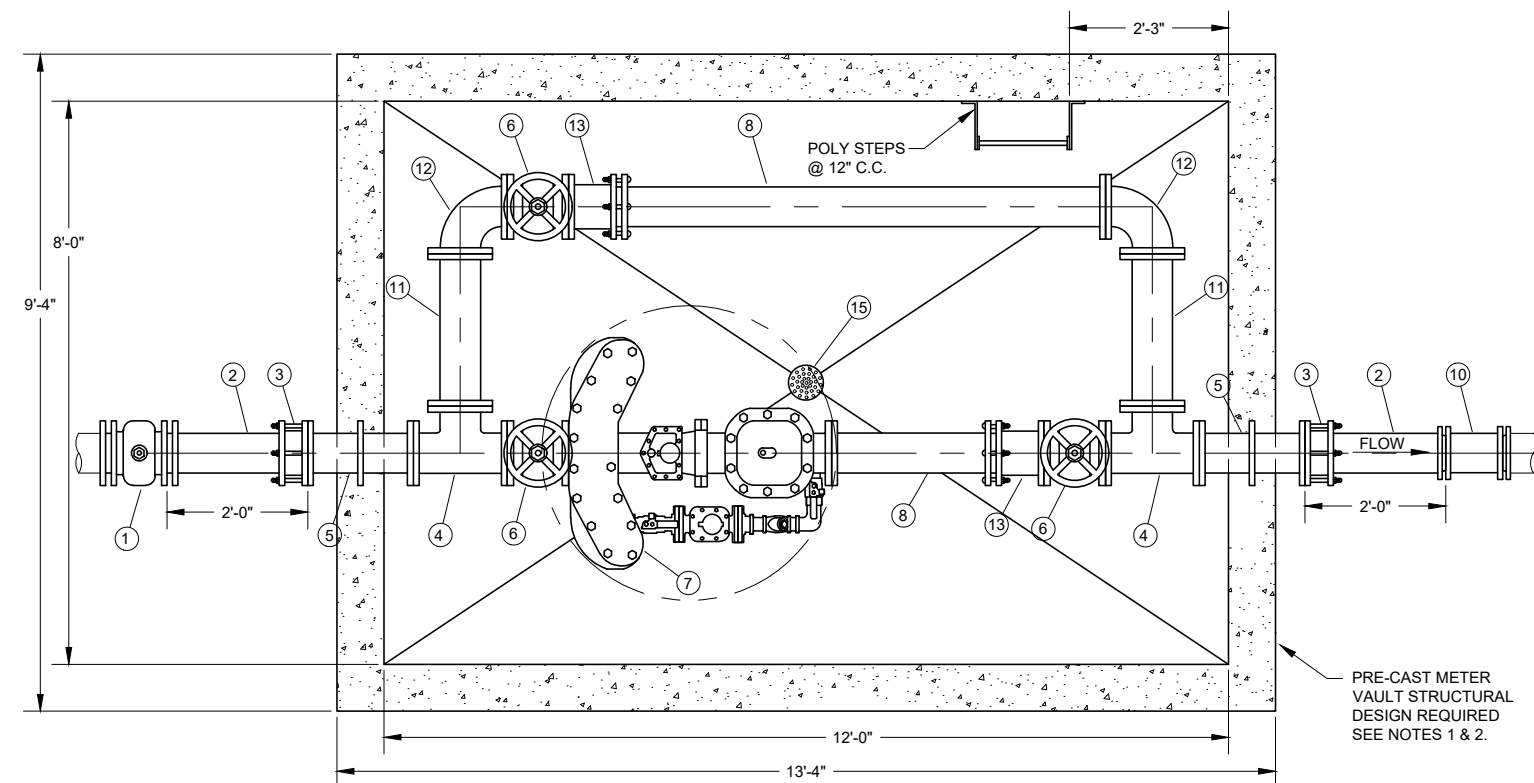
- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### 2 PRODUCTS

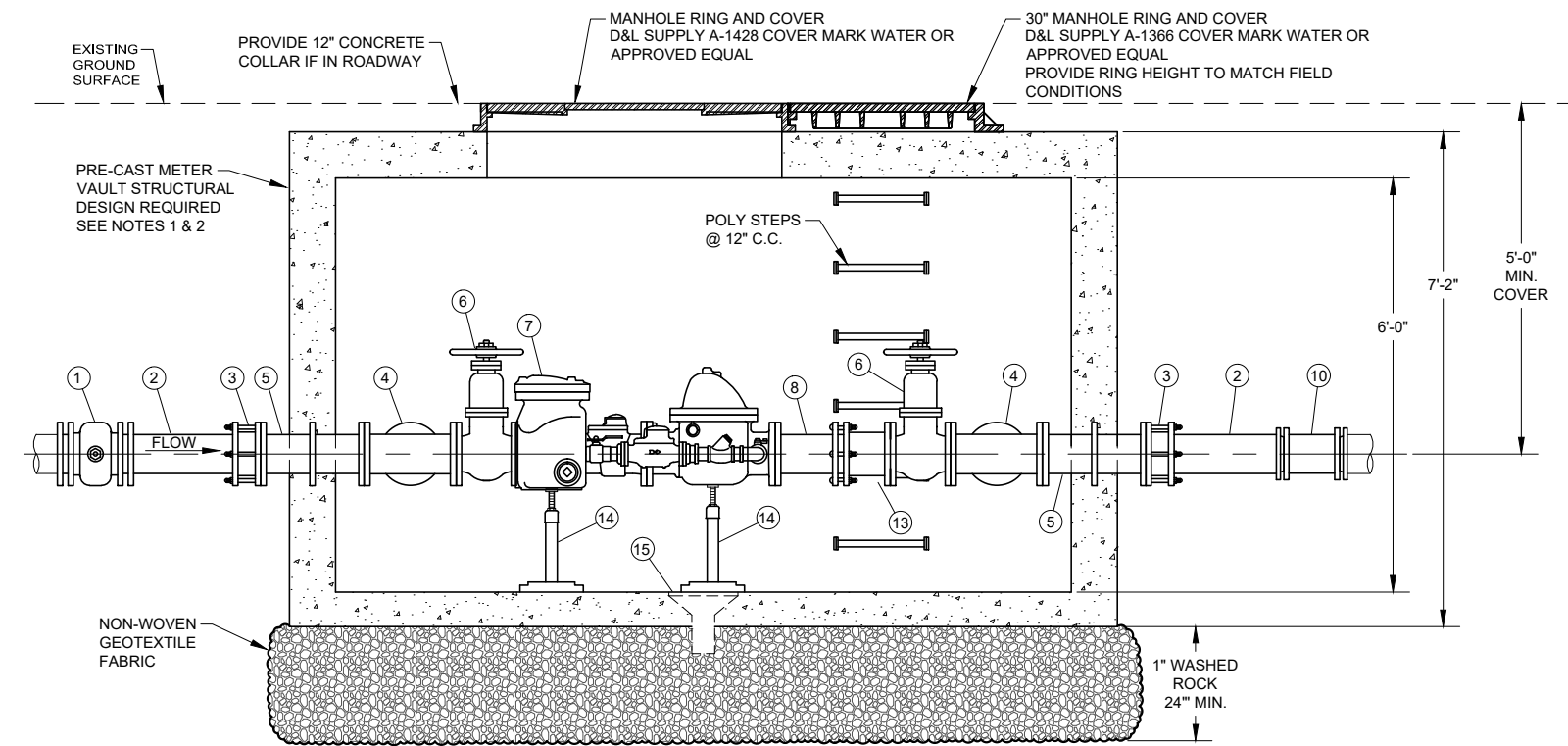
- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### 3. EXECUTION

- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.



**PLAN**



**SECTION**

**NOTES:**

1. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.
2. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
3. PROVIDE ANY ADDITIONAL PIPE & FITTINGS TO CONNECT TO EXISTING SERVICE, AS NECESSARY. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.

METER VAULT VALVE AND FITTING SCHEDULE							
NO.	DESCRIPTION	SIZE	JOINT				
1.	GATE VALVE (MUELLER RESILIENT SEAT) W/VALVE BOX)	6"	MJ	9.	FLANGE COUPLING ADAPTER W/TIE RODS	6"	FLG X PE
2.	DIP CLASS 53	6"	PE	10.	SOLID SLEEVE	6"	MJ
3.	FLANGE COUPLING ADAPTER	6"	FLG X PE	11.	SPOOL PIECE	6"	FLG
4.	TEE	6"	FLG	12.	BEND 90°	6"	FLG
5.	WALL PIPE W/THRUST RING	6"	FLG	13.	DUAL PURPOSE CUTTING-IN SLEEVE	6"	FLG X PE
6.	GATE VALVE (MUELLER RESILIENT SEAT)	6"	FLG	14.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
7.	COMPACT FIRE LINE METER (SENSUS FM-721 RADIO HEAD)	6"	FLG	15.	FLOOR DRAIN	6" X 4"	-
8.	NIPPLE	6"	FLG X PE	16.	-	-	-

UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53. ALL FLANGES ARE ANSI CLASS 125. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS. PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.



**6" FIRE LINE METER**

Plan No.  
**530 R**

1/2023

## 8" Fire Line Meter

### 1. GENERAL

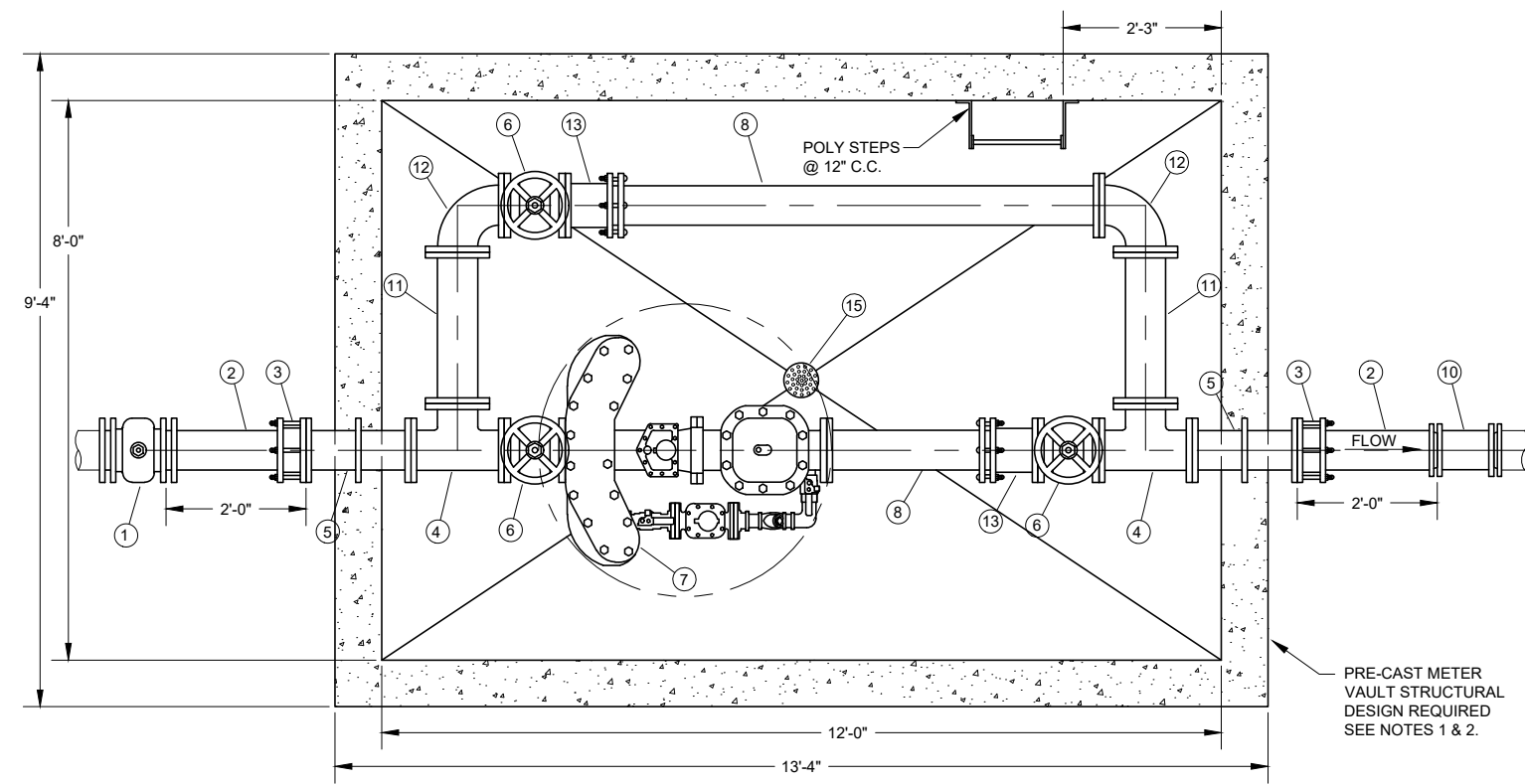
- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### 2 PRODUCTS

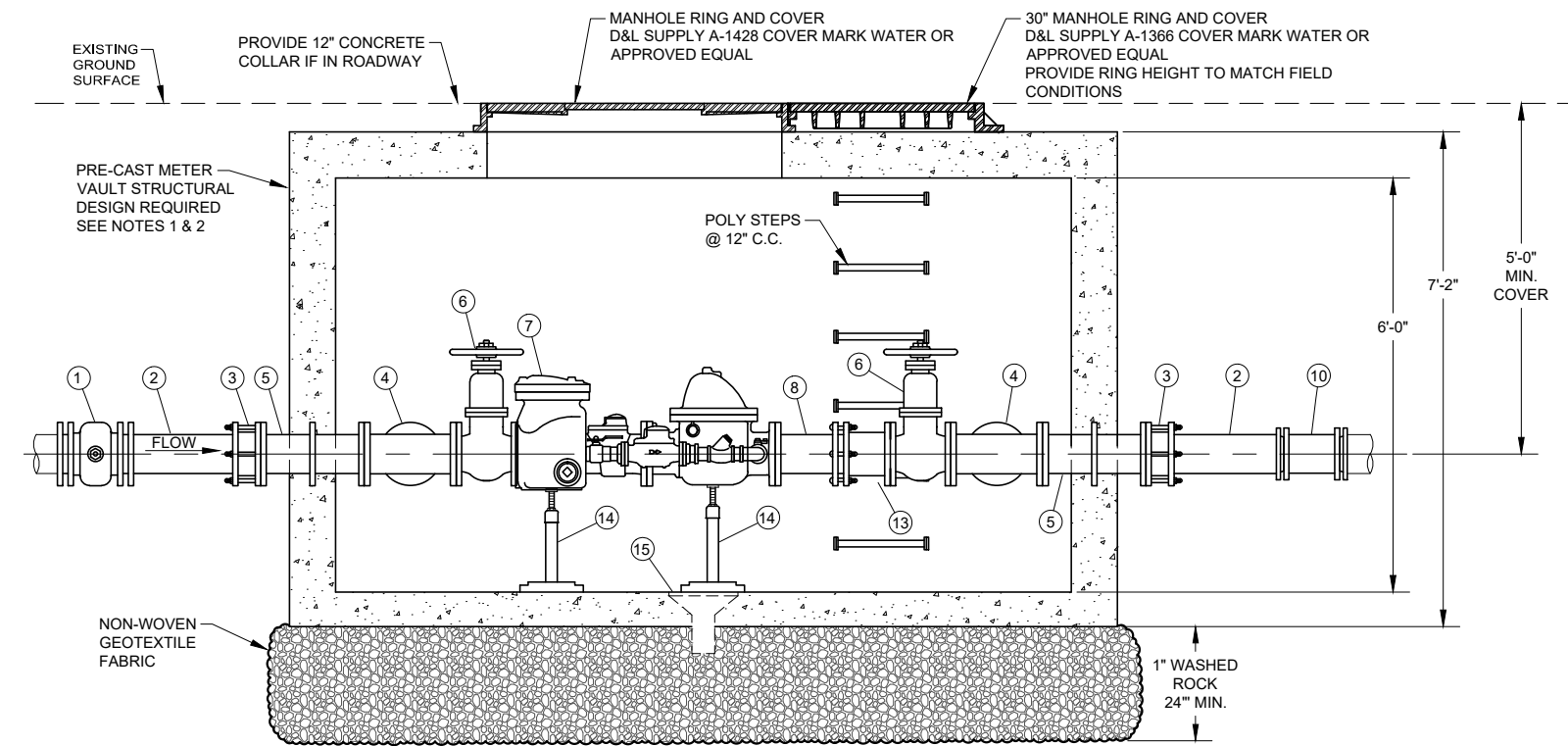
- A. Small Fittings: Brass. Do not use galvanized materials.
- B. Blocking: Clay brick or concrete block.
- C. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

### 3. EXECUTION

- A. Control Valve: Install valve with valve box adjacent to main.
- B. Center frame and cover over water meter.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.



**PLAN**



**SECTION**

**NOTES:**

1. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.
2. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
3. PROVIDE ANY ADDITIONAL PIPE & FITTINGS TO CONNECT TO EXISTING SERVICE, AS NECESSARY. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.

METER VAULT VALVE AND FITTING SCHEDULE						
NO.	DESCRIPTION	SIZE	JOINT			
1.	GATE VALVE (MUELLER RESILIENT SEAT) W/VALVE BOX)	8"	MJ	9.	FLANGE COUPLING ADAPTER W/TIE RODS	8" FLG X PE
2.	DIP CLASS 53	8"	PE	10.	SOLID SLEEVE	8" MJ
3.	FLANGE COUPLING ADAPTER	8"	FLG X PE	11.	SPOOL PIECE	8" FLG
4.	TEE	8"	FLG	12.	BEND 90°	8" FLG
5.	WALL PIPE W/THRUST RING	8"	FLG	13.	DUAL PURPOSE CUTTING-IN SLEEVE	8" FLG X PE
6.	GATE VALVE (MUELLER RESILIENT SEAT)	8"	FLG	14.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-
7.	COMPACT FIRE LINE METER (SENSUS FM-721 RADIO HEAD)	8"	FLG	15.	FLOOR DRAIN	6" X 4"
8.	NIPPLE	8"	FLG X PE	16.	-	-

UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53. ALL FLANGES ARE ANSI CLASS 125. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS. PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.

## ***Water Service Line***

### **1. GENERAL**

A. Before backfilling, secure inspection of installation by ENGINEER.

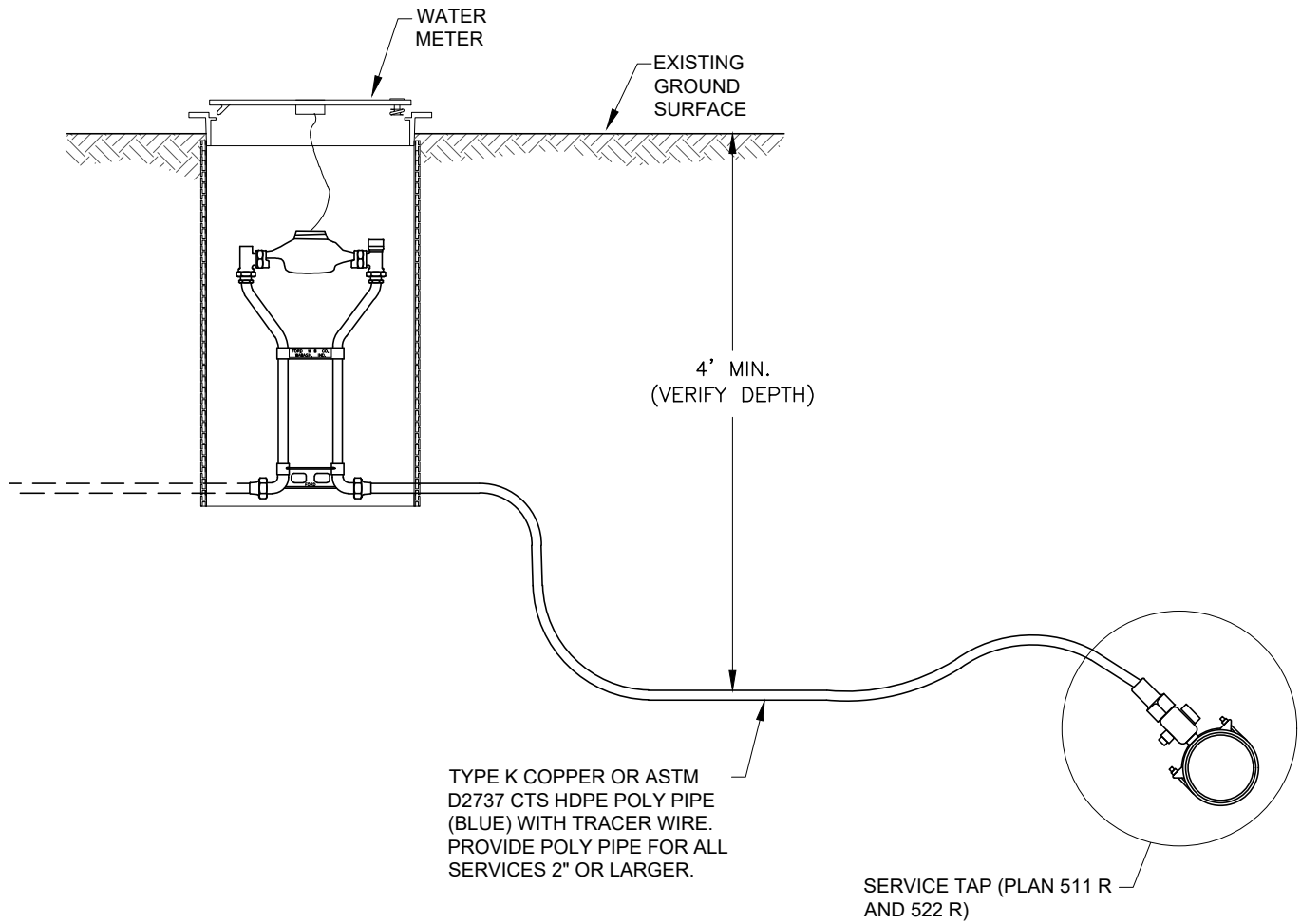
### **2. PRODUCTS**

A. Fittings: Provide brass fittings and nipples. Do not use galvanized materials.

B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.

### **3. EXECUTION**

A. Base Course and Backfill Placement: **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**



## WATER SERVICE LINE



## ***Fire Hydrant Replacement or Relocation***

### **1. GENERAL**

- A. Drawing is a single line diagram showing a minimum and typical connection.
- B. Additional water system requirements are specified in APWA Section 33 11 00R - **Water Distribution and Transmission, 33 12 16R - Water Valves, and 33 12 19R - Hydrants.**
- C. Before backfilling, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Piping: Match existing pipe, fittings, coupling sizes and materials.
- C. Thrust Blocks: Concrete Class 4000, APWA Section 03 30 04R.
- D. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- E. Grease: Non-oxide poly-FM.

### **3. EXECUTION**

- A. Hydrant: Adjust to grade with pipe spool if necessary.
  - 1) Provide at least 1 cubic yard of sewer rock, APWA Section 31 05 13 around drain hole at base of hydrant. Wrap plastic over sewer rock to prevent silting.
  - 2) Paint fire hydrant to agency's fire hydrant paint code.
  - 3) Apply grease to all buried metal surfaces. Wrap with polyethylene sheet and tape wrap.
  - 4) Notify fire department as soon as hydrant is placed in service.
- B. Connections: If existing valve and hydrant have O.B. connections, delete MJ x Flange adapter and install 6-inch MJ sleeve. Add a new valve at the tee connection.
- C. Valve Boxes. Salvage any C.I.S.T. valve boxes and reuse. Adjust to grade as necessary on relocated hydrant.
- D. Thrust Blocks: Required. Before pouring concrete, wrap pipe system plastic sheet to prevent bonding of concrete to pipe system.
- E. **Base Course and Backfill Placement: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**
- F. Surface Restoration:
  - 1) Landscaped Surface: Rake to match existing grade. Replace vegetation to match pre-construction conditions. Follow APWA Section 32 92 00 (turf or grass) or APWA Section 32 93 13 (ground cover) requirements.
  - 2) Paved Surface: Do not install bituminous concrete or Portland cement concrete surfacing until trench compaction is acceptable to ENGINEER. Follow APWA Section 33 05 25 (bituminous concrete surfacing), or APWA Section 33 05 25 (concrete surfacing).

SECOND VALVE AT HYDRANT MAY BE  
REQUIRED IF LENGTH EXCEEDS 50 FEET.

SEE PLAN 511R

6" PIPE (USE 8" IF LENGTH IS  
GREATER THAN 50 FEET)

NEW LATERAL REQUIRED

NEW 6"  $\phi$  PIPE

REMOVE EXISTING TEE  
OR PLUG AND ABANDON

NEW  
MJ SLEEVE

FL X MJ GATE VALVE

MJ X FL TEE OR  
HOT TAP AS APPROVED BY CITY

EXISTING WATERMAIN

EXISTING LATERAL REMAINS

SEE PLAN 511R

EXISTING VALVE

NOTE: THRUST BLOCKS REQUIRED  
(PLANS NO. 561R AND 562R)



# FIRE HYDRANT REPLACEMENT OR RELOCATION

Plan No.  
**546 R**  
1/2023

## ***3/4" and 1" Service Taps***

### **1. GENERAL**

A. Before backfilling around taps, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.

B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.

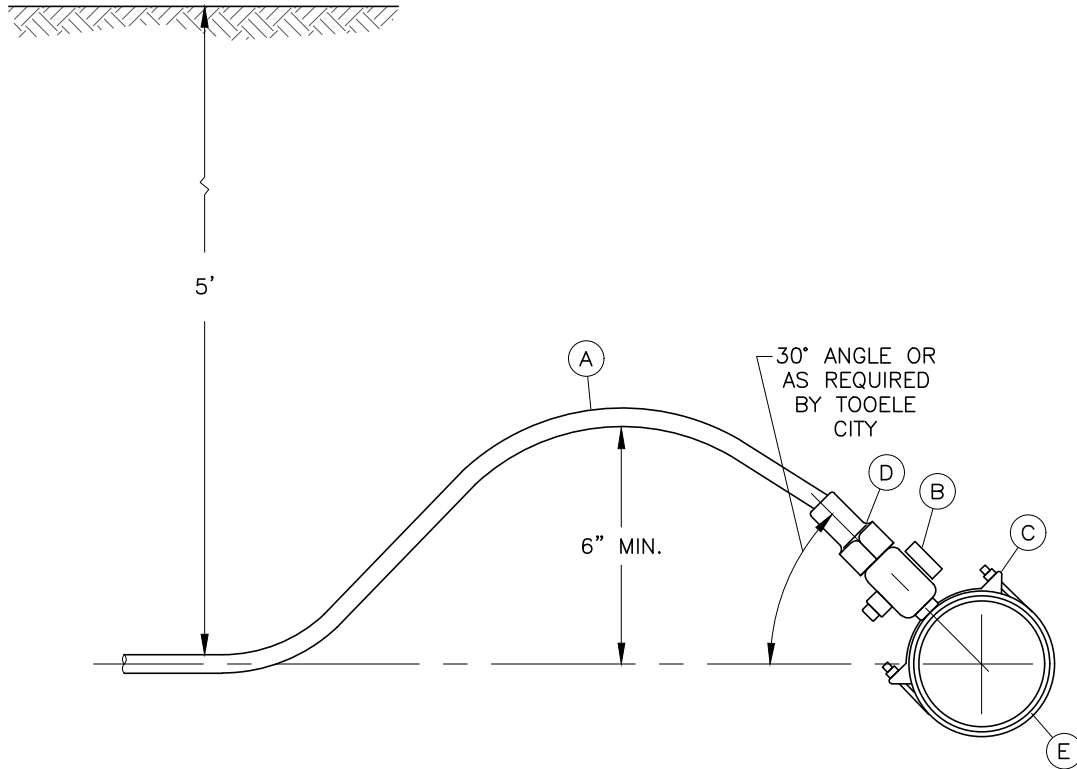
C. Tape: Teflon tape is required on all taps.

### **3. EXECUTION**

A. Tapping: Place taps a minimum of 36-inches apart. Use a tapping tool which is sized corresponding to the size of the service line to be installed. No taps within 36-inches of end of pipe.

B. PVC or AC Pipe: A service saddle clamp is required on all PVC and AC pipe taps unless specified otherwise.

C. **Base Course and Backfill Placement:** When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.



NOTE: DIRECT TAP TO WATER LINE NOT ALLOWED.

LEGEND	
NO.	DESCRIPTION
A	TYPE K COPPER OR CTS POLY PIPE
* B	CORPORATION STOP
C	DOUBLE BRASS STRAP SADDLE CLAMP
D	COMPRESSION FITTING
E	WATER MAIN PIPE

\* MUELLER 300 TYPE CORPORATION VALVE WITH AWWA TAPER MUELLER "CC" THREAD (OR APPROVED EQUAL).

## 3/4" AND 1" SERVICE TAPS

## **1 1/2" and 2" Service Taps**

### **1. GENERAL**

A. Before backfilling around taps, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.

B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.

C. Tape: Teflon tape is required on all taps.

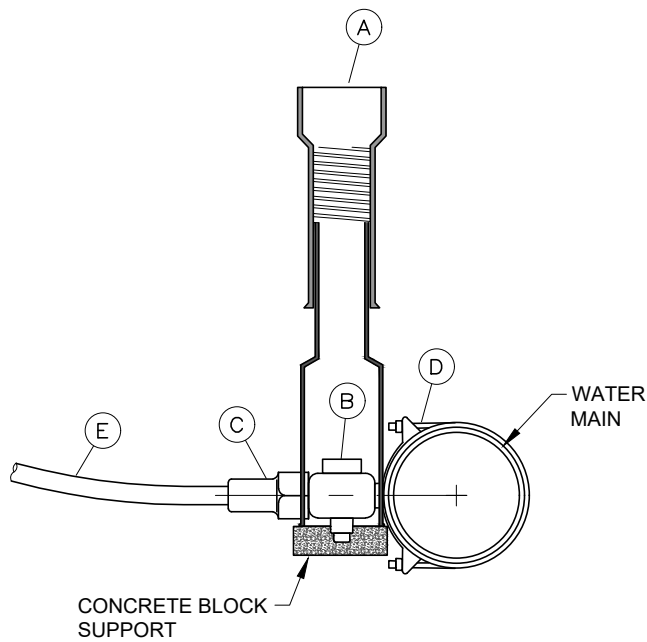
### **3. EXECUTION**

A. Tapping: Place taps a minimum of 36-inches apart. Use a tapping tool that is sized corresponding to the size of the service line to be installed. No taps within 36-inches of end of pipe.

B. PVC or AC Pipe: A service saddle clamp is required on all PVC and AC pipe taps unless specified otherwise.

C. **Backfill and Base Course: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**

D. Blocks: Clay brick or concrete block required under valve box to assure a 1" or greater space between the box and the corporation stop and pipe assembly.



NOTE: DIRECT TAP TO WATER LINE NOT ALLOWED.

LEGEND	
NO.	DESCRIPTION
A	VALVE BOX WITH LID MARKED WATER
* B	CORPORATION STOP
C	COMPRESSION FITTING
D	DOUBLE BRASS STRAP SADDLE CLAMP
E	CTS POLY PIPE

\* MUELLER 300 TYPE CORPORATION VALVE WITH AWWA TAPER MUELLER "CC" THREAD (OR APPROVED EQUAL).

## 1 1/2" AND 2" SERVICE TAPS

## ***Direct Bearing Thrust Block***

### **1. GENERAL**

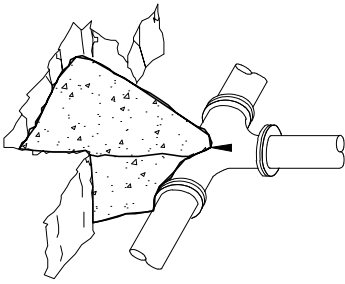
- A. Thrust design for pipe sizes or configurations not shown require special design.
- B. Bearing areas, volumes, and special thrust blocking details shown on Drawings take precedence over this plan.
- C. Restraint sizing is based upon a maximum operating pressure of 150 psi and a test pressure of 200 psi, and a minimum soil bearing strength of 2,000 psf. Operating pressures in excess of 150 psi or soils with less than 2,000 pound bearing strength will require special design.
- D. Before backfilling around thrust block, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

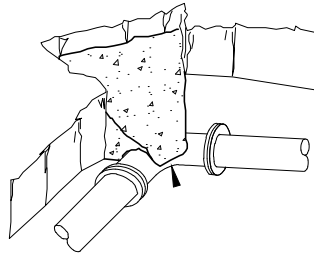
- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Thrust Blocks: Concrete Class 4000, APWA Section 03 30 04R.
- D. Grease: Non-oxide poly-FM.

### **3. EXECUTION**

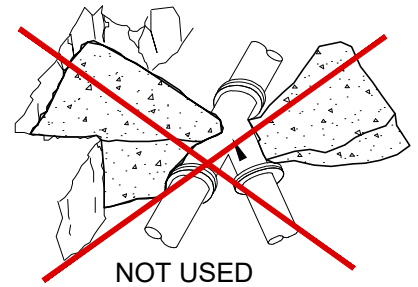
- A. Pour concrete against undisturbed soil.
- B. Pipe Joints: Do not cover with concrete. Leave completely accessible.
- C. Grease: Apply grease to all buried metal surfaces. Wrap with polyethylene sheet and tape wrap.
- D. Locking restraint devices may be used in conjunction with concrete thrust blocking (at discretion of ENGINEER).
- E. **Backfill and Base Course: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**
- F. Maximum lift thickness before compaction is 8-inches.



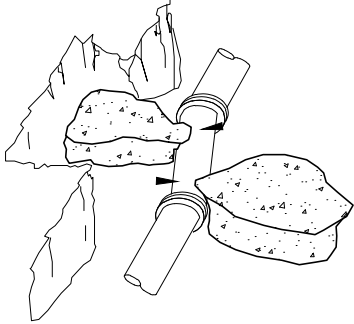
CONDITION I



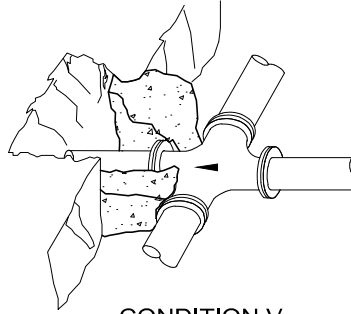
CONDITION II



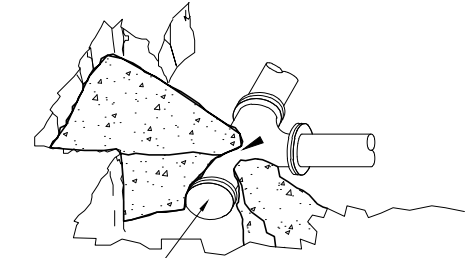
NOT USED  
CONDITION III



CONDITION IV

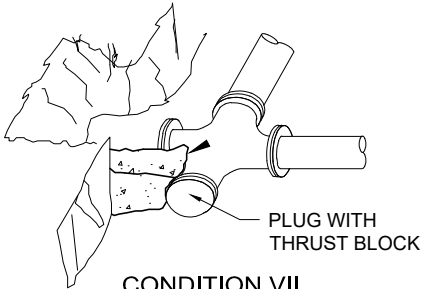


CONDITION V



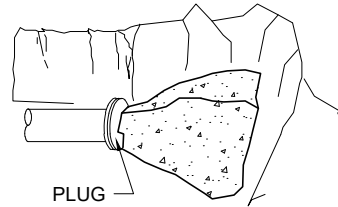
PLUG WITH  
THRUST BLOCK

CONDITION VI



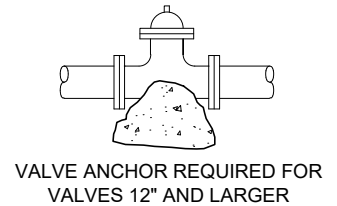
PLUG WITH  
THRUST BLOCK

CONDITION VII



PLUG

CONDITION VII

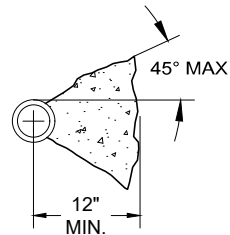


VALVE ANCHOR REQUIRED FOR  
VALVES 12" AND LARGER

VALVE ANCHOR  
12" & LARGER

**THRUST BLOCK BEARING AREA IN SQ. FEET**

PIPE SIZE (IN.)	CONDITION							
	I	II	III	IV	V	VI	VII	VIII
4	2.6	3.3	2.6	1.3	1.3	2.0	3.3	2.6
6	4.6	6.5	3.9	2.0	2.6	3.3	6.5	4.6
8	7.8	11.0	5.9	3.3	3.9	5.9	11.0	7.8
10	12.4	17.5	9.8	5.2	6.5	9.1	17.5	12.4
12	17.5	24.8	13.6	7.8	9.1	12.3	24.8	17.5
14	24.0	33.8	18.2	9.7	12.3	16.9	33.8	24.0
16	31.1	44.0	23.8	12.7	15.5	23.2	44.0	31.1
20	48.6	68.8	37.2	19.8	24.2	36.6	68.8	48.6
24	89.8	90.1	48.8	24.9	-	-	-	-



TYPICAL SECTION THROUGH  
THRUST BLOCK

**NOTES:**

1. ALL THRUST BLOCK BEARING FACES SHALL BE POURED AGAINST UNDISTURBED SOIL OR APPROVED COMPACTED BACKFILL.
2. CONCRETE CLASS 4000, APWA SECTION 03 30 04
3. ALL THRUST BLOCK SIDES SHALL BE FORMED.
4. CALCULATED ON 200 PSI TEST PRESSURE AND ALLOWABLE BEARING PRESSURE OF 2000 LBS. PER SQUARE FOOT.
5. IN POORER SOILS SPECIAL DESIGN IS REQUIRED.
6. USE MJ DUCTILE IRON RESTRAINED GLANDS AND CONCRETE THRUST BLOCKS.



## ***Tie-Down Thrust Restraints***

### **1. GENERAL**

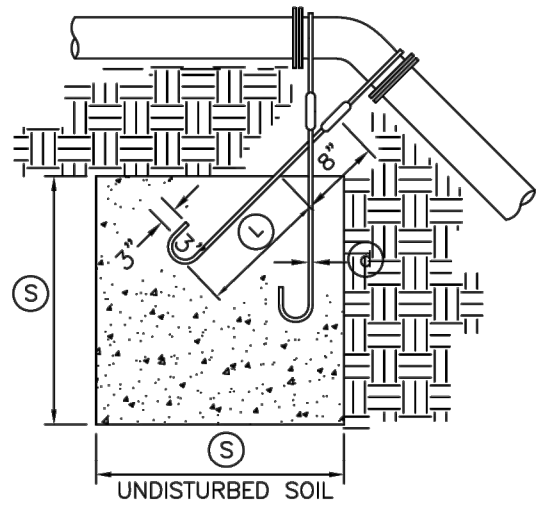
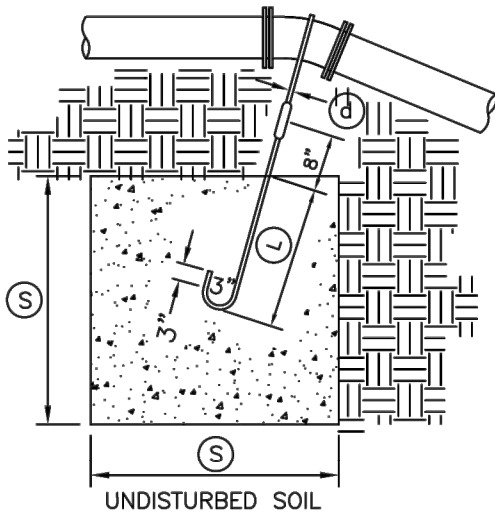
- A. Thrust design for pipe sizes or configurations not shown require special design.
- B. Bearing areas, volumes, and special thrust blocking details shown on Drawings take precedence over this plan.
- C. Restraint sizing is based upon a maximum operating pressure of 150 psi and a test pressure of 200 psi, and a minimum soil bearing strength of 2,000 psf. Operating pressures in excess of 150 psi or soils with less than 2,000 pound bearing strength will require special design.
- D. Before backfilling around thrust block, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Concrete: Class 4,000 minimum, APWA Section 03 30 04R.
- D. Reinforcement: Deformed, steel, ASTM A615. Give bars an epoxy coating at least 15 mils thick. Minimum stress yield strength of steel tie-down bars is 70,000 ksi.
- E. Grease: Non-oxide poly-FM.

### **3. EXECUTION**

- A. Pour concrete against undisturbed soil. Concrete must be allowed to cure in thrust restraints for 5 days before pressurizing water lines or have additional approved thrust restraints installed before pressurizing the water line.
- B. Pipe Joints: Do not cover with concrete. Leave completely accessible.
- C. Grease: Apply grease to all buried metal surfaces. Wrap with polyethylene sheet and tape wrap.
- D. Locking restraint devices may be used in conjunction with concrete thrust blocking (at discretion of ENGINEER).
- E. **Base Course and Backfill Placement: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**



**TYPE A RESTRAINT**  
FOR 11 1/4° - 22 1/2° VERTICAL BENDS

**TYPE B RESTRAINT**  
FOR 45° VERTICAL BENDS

~~TABLE OF DIMENSIONS~~

	VB		(S)	(d)	(L)
PIPE SIZE NOMIN. DIAMETER - INCH	VERTICAL BEND DEGREES	NO. OF CU FT. OF CONCRETE BLOCKING	SIDE OF CUBE FEET	DIAMETER OF SHACK OR REBAR RODS - INCH	DEPTH OF RODS IN CONCRETE FT.
4"	11 1/4°	8	2.0	5/8"	1.5
					2.0
6"	11 1/4°	8	2.0	5/8"	2.0
					2.0
					2.0
8"	11 1/4°	27	3.0	5/8"	2.0
					22 1/2°
12"	11 1/4°	64	4.0	3/4"	2.0
					22 1/2°
16"	11 1/4°	107	4.25	7/8"	3.0
					22 1/2°
20"	11 1/4°	138	5.17	1"	3.5
					22 1/2°
24"	11 1/4°	240	6.22	1"	4.0
					22 1/2°
30"	11 1/4°	369	7.17	1"	4.0
					22 1/2°

**USE ENGINEERS CALCULATIONS**

~~TABLE OF DIMENSIONS~~

	VB		(S)	(d)	(L)
PIPE SIZE NOMIN. DIAMETER - INCH	VERTICAL BEND DEGREES	NO. OF CU YD. OF CONCRETE BLOCKING	SIDE OF CUBE FEET	DIAMETER OF SHACK OR REBAR RODS - INCH	DEPTH OF RODS IN CONCRETE IN FEET
4"	45°	3.0	3.0	5/8"	2.0
					2.0
6"	45°	3.0	3.0	5/8"	2.5
					2.5
8"	45°	3.97	4.75	5/8"	2.0
					2.0
12"	45°	9.04	6.25	5/8"	4.0
					4.0
16"	45°	17.24	7.75	3/4"	4.0
					4.0
20"	45°	26.52	92.17	3/4"	4.0
					4.0
24"	45°	37.82	10.07	3/4"	4.0
					4.0
30"	45°	58.26	11.63	3/4"	4.0
					4.0

**USE ENGINEERS CALCULATIONS**

## **4" Washout Valve**

### **1. GENERAL**

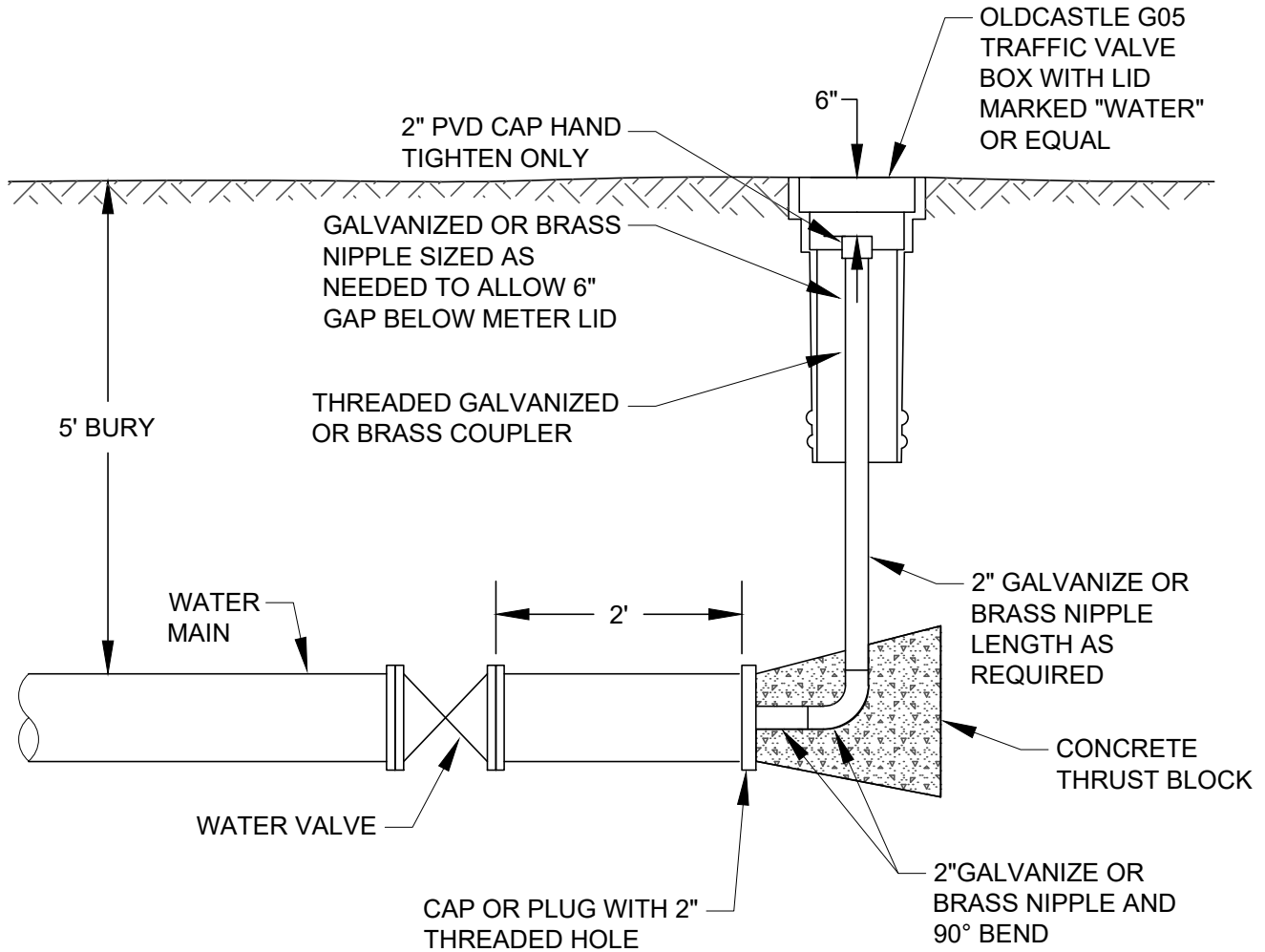
- A. Before backfilling, secure inspection of installation by ENGINEER.
- B. Water mains 12-inches and larger will require a special washout assembly design.

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Concrete: Class 4000, APWA Section 03 30 04R.

### **3. EXECUTION**

- A. Pour concrete against undisturbed soil.
- B. Apply tape wrap to the exterior of all galvanized pipe per AWWA C209.
- C. Place plastic sheet at least 6 mils thick over drain gravel to prevent silting.
- D. After installation of washout valve assembly, verify the washout valve riser drains to gravel.
- E. Base Course and Backfill Placement: **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**



NOTE:  
 PROVIDE MEGALUG JOINT  
 RESTRAINT ON ALL MJ FITTINGS.

THIS TYPE OF VALVE IS ONLY ALLOWED FOR DISINFECTION  
 FLUSHING. PERMANENT FLUSHING REQUIRES A FIRE  
 HYDRANT.

## ***Detector Check Valve with 3/4" Bypass Meter***

### **1. GENERAL**

- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

### **2. PRODUCTS**

- A. Blocking: Clay brick or concrete block.
- B. Small Fittings: Brass. Do not use galvanized materials.
- C. Grade Ring: 6-inch concrete grade ring required in roadways, Plan 361.
- D. Spools: Length of flange x plain end spool vary.

SPOOLS	
Pipe Size	Pipe Length
6"	10"
8"	8 1/4"
10"	6"

### **3. EXECUTION**

- A. Install control valve with valve box adjacent to main.
- B. Concrete Box: Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal. Center frame and cover over water meter.
- C. Valve Option: The valve in the box (item B legend) closest to the main, and the top section of the valve box (item J legend) may be eliminated at the discretion of the ENGINEER.

**A DESIGN PLAN FOR DETECTOR CHECK VALVES IS NOT PROVIDED. RATHER, DETECTOR CHECK VALVES REQUIRE SPECIAL DESIGN AND APPROVAL OF THE CITY.**

## ***Pressure Reducing Valve***

### **1. GENERAL**

- A. Configuration may be changed at ENGINEER's discretion.
- B. Additional requirements are specified in APWA Section 33 12 16R.

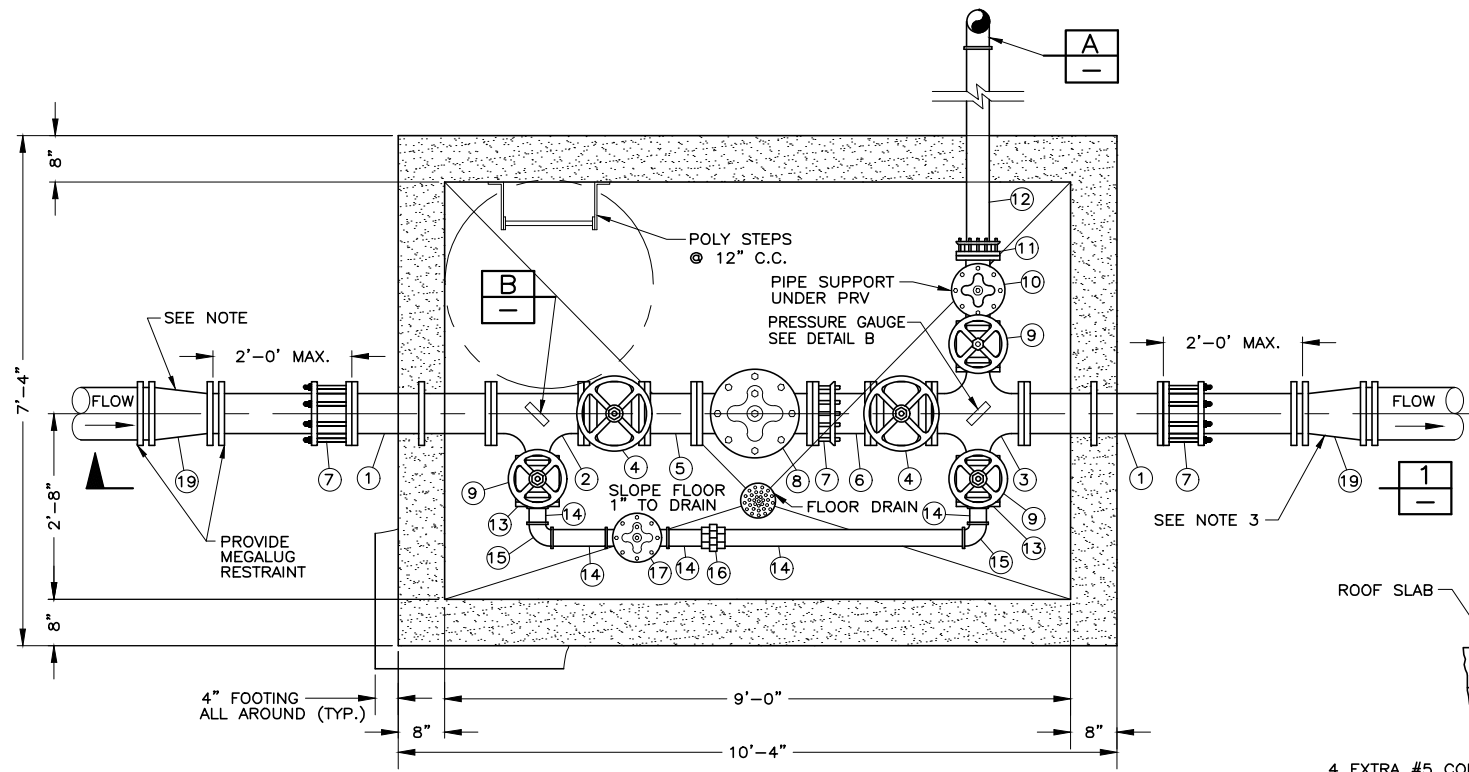
### **2. PRODUCTS**

- A. Pressure reducing valves shall be of the size shown on the Plan.
- B. Small Fillings: Brass. Do not use galvanized materials.
- C. Blocking: **Pipe supports shall as shown.**
- D. Taps: Provide two 3/4" I.P. taps with plugs for pressure gages.
- E. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.

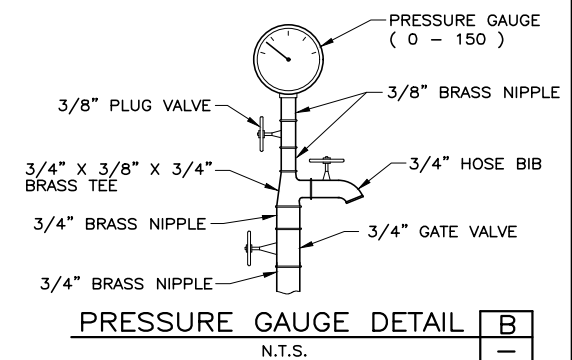
### **3. EXECUTION**

- A. Center frame and cover over water meter.
- B. Apply tape wrap to the exterior of all galvanized pipe per AWWA C209.
- C. Allow 1-inch clearance around waterline where water line passes through concrete box wall. Seal opening with compressible seal.

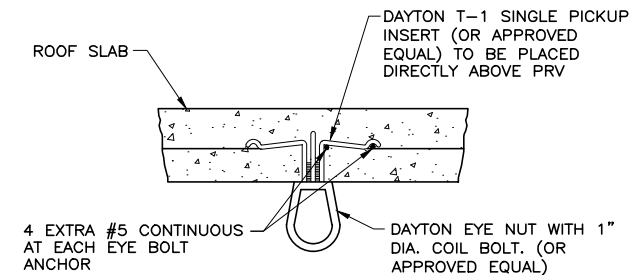
**573R 4" (573AR) THRU 12" (573ER)**



**6" PRV STATION PLAN**  
N.T.S.



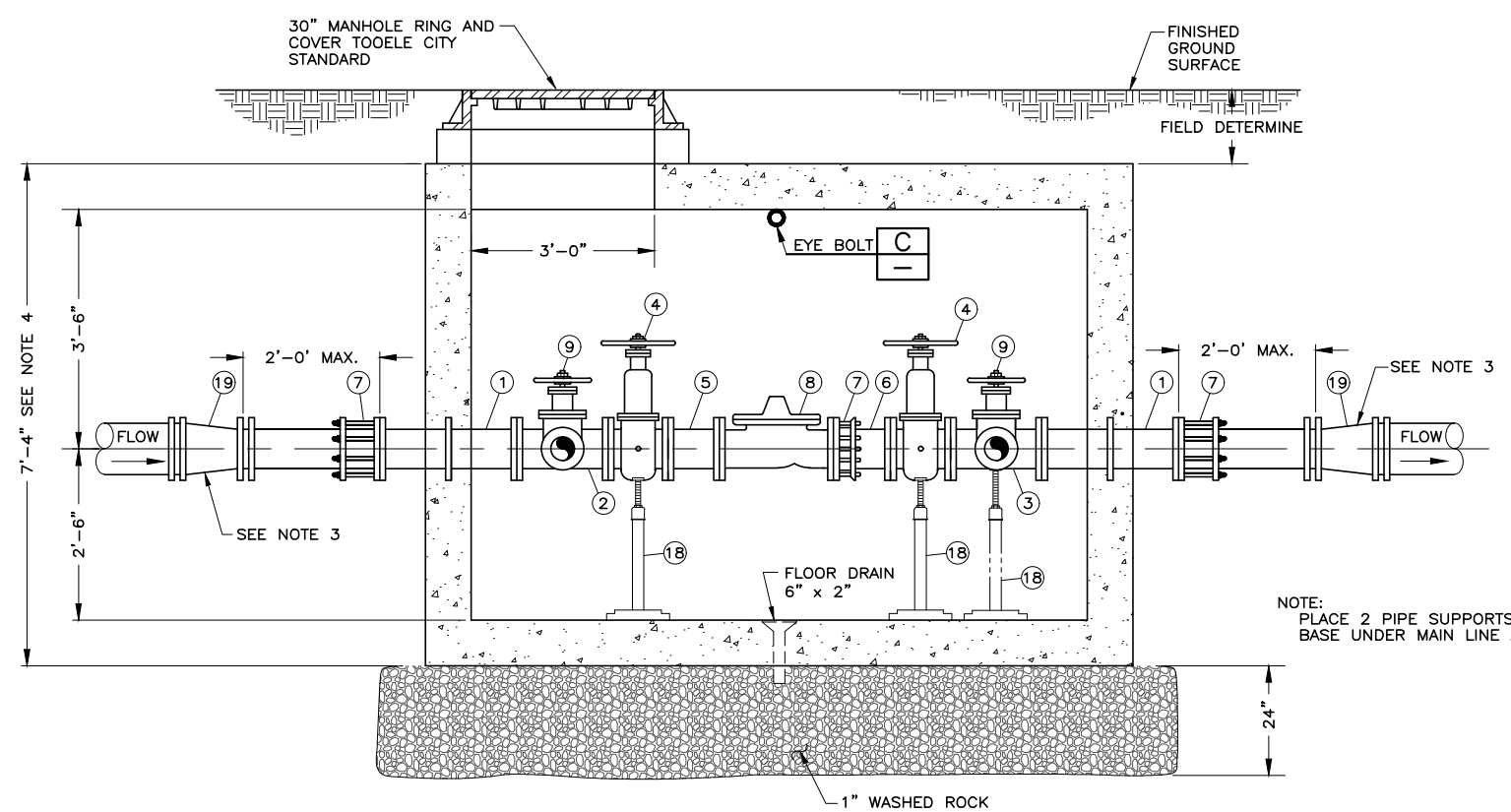
**PRESSURE GAUGE DETAIL B**  
N.T.S.



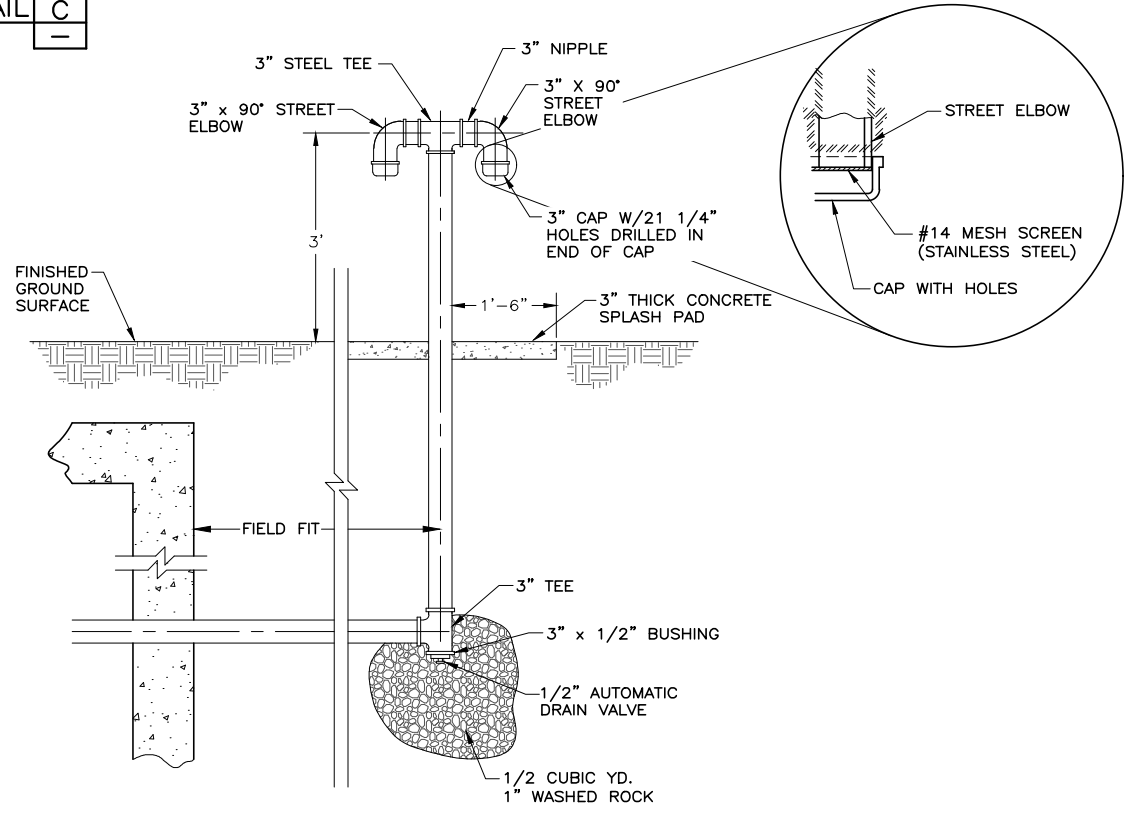
**EYE BOLT DETAIL C**  
N.T.S.

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	WALL PIPE W/THRUST RING	4" X 2'-0"	FLG
2.	TEE W/ 3/4" TAP	4" X 3"	FLG
3.	CROSS W/ 3/4" TAP	4" X 3"	FLG
4.	GATE VALVE (SEE TABLE NOTES)	4"	FLG
5.	SPOOL PIECE	4" X 9"	FLG
6.	NIPPLE	4"	FL X PE
7.	FLANGE COUPLING ADAPTER	4"	FL X PE
8.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	4"	FLG
9.	GATE VALVE (MUELLER RESILIENT SEAT)	3"	FLG
10.	PRESSURE RELIEF VALVE (CLA-VAL 50-01)	3"	FLG
11.	FLANGE COUPLING ADAPTER	3"	FLG X PE
12.	BRASS PIPE	3"	THD
13.	REDUCING FLANGE	7 1/2" X 2"	FLG X THD
14.	BRASS PIPE	2"	THD
15.	BRASS 90° ELBOW	2"	THD
16.	BRASS UNION	2"	THD
17.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	2"	THD
18.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
19.	REDUCER WITH MEGALUG RESTRAINT ON INFLOW SIDE	8" X 6"	MJ

TABLE NOTES: UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53. ALL FLANGES ARE ANSI CLASS 125. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS. PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT. MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.



**SECTION 1**  
N.T.S.



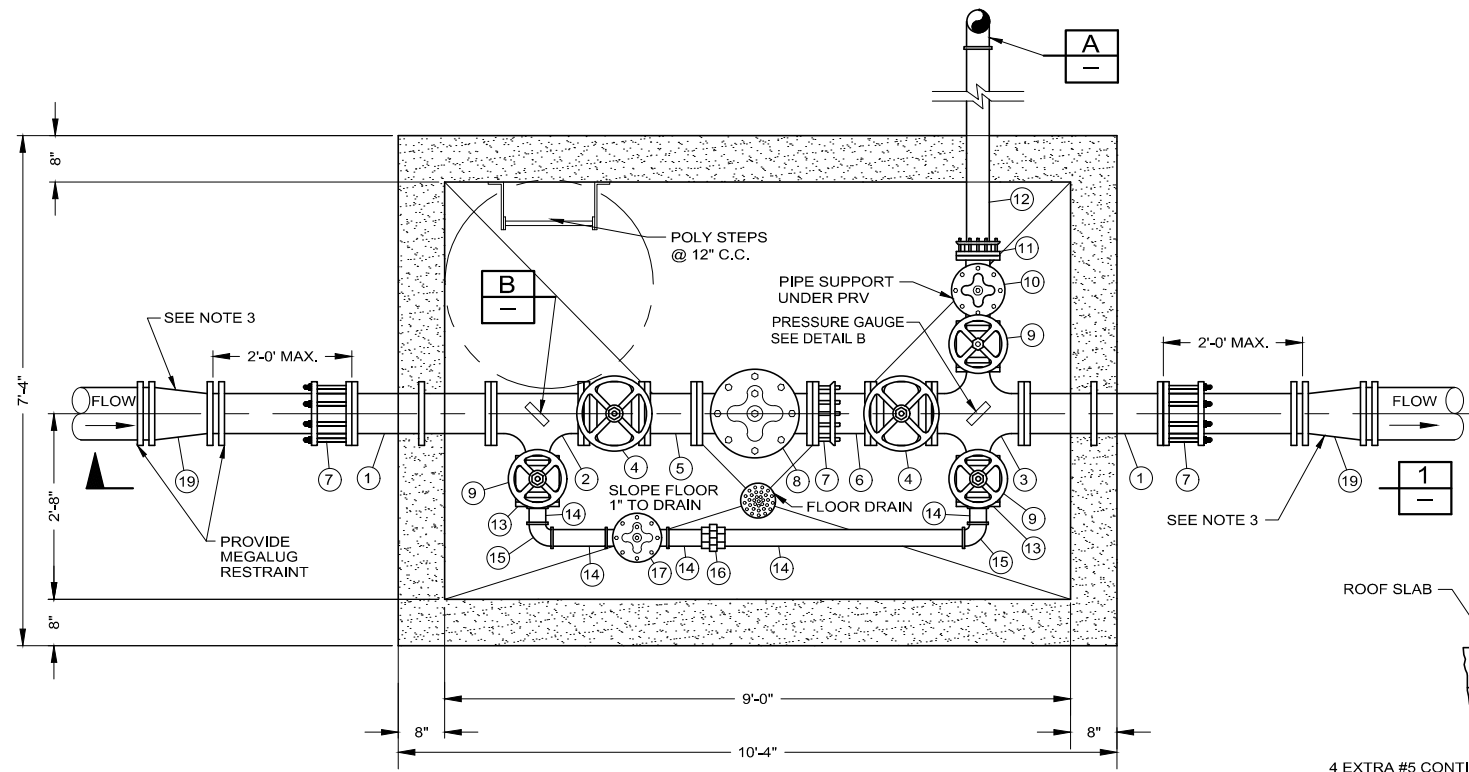
**PRESSURE RELIEF PIPE A**  
N.T.S.

- NOTES:
1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
  2. LOCATION OF PRESSURE RELIEF PIPE TO BE FIELD FIT BY ENGINEER.
  3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
  4. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.

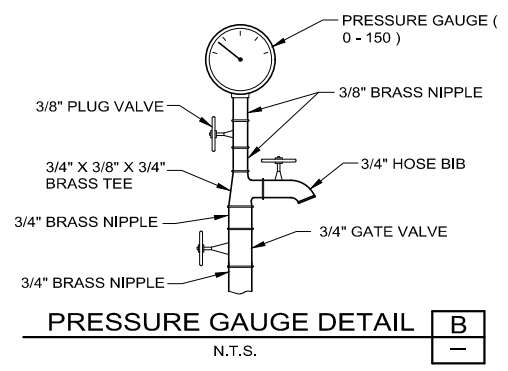
**4" PRESSURE REDUCING VALVE WITH 2" BYPASS**



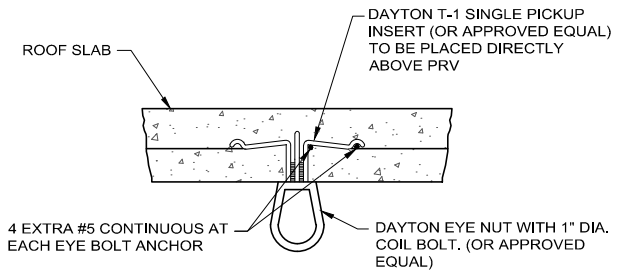




**6\"/>**



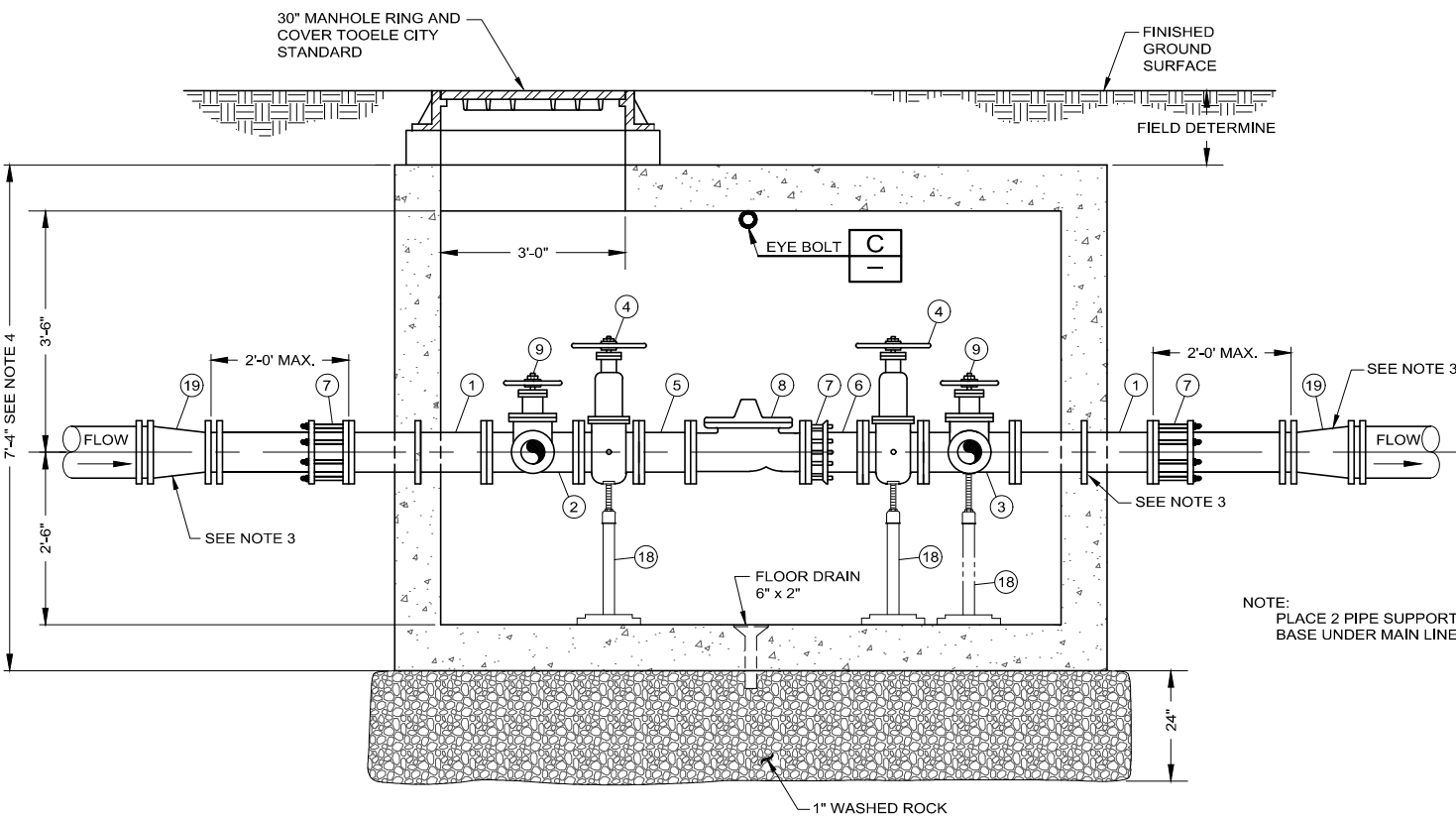
**PRESSURE GAUGE DETAIL B**  
N.T.S.



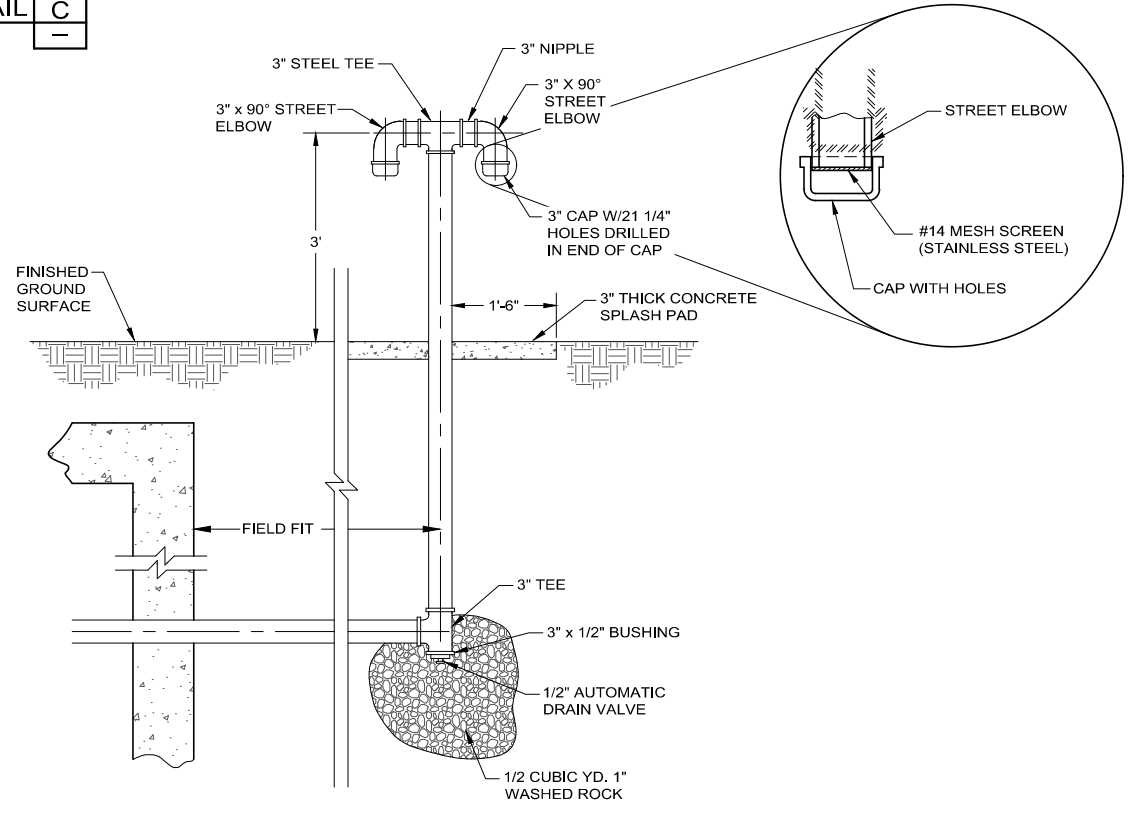
**EYE BOLT DETAIL C**  
N.T.S.

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	WALL PIPE W/THRUST RING	6" X 2'-0"	FLG
2.	TEE W/ 3/4" TAP	6" X 3"	FLG
3.	CROSS W/ 3/4" TAP	6" X 3"	FLG
4.	GATE VALVE (SEE TABLE NOTES)	6"	FLG
5.	SPOOL PIECE	6" X 9"	FLG
6.	NIPPLE	6"	FL X PE
7.	FLANGE COUPLING ADAPTER	6"	FL X PE
8.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	6"	FLG
9.	GATE VALVE (MUELLER RESILIENT SEAT)	3"	FLG
10.	PRESSURE RELIEF VALVE (CLA-VAL 50-01)	3"	FLG
11.	FLANGE COUPLING ADAPTER	3"	FLG X PE
12.	BRASS PIPE	3"	THD
13.	REDUCING FLANGE	7 1/2" X 2"	FLG X THD
14.	BRASS PIPE	2"	THD
15.	BRASS 90° ELBOW	2"	THD
16.	BRASS UNION	2"	THD
17.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	2"	THD
18.	PIPE SUPPORT (GRINNELL MODEL NO. 264)	-	-
19.	REDUCER WITH MEGALUG RESTRAINT ON INFLOW SIDE	8" X 6"	MJ

TABLE NOTES:  
 UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
 ALL FLANGES ARE ANSI CLASS 125.  
 PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
 PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.  
 MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.



**SECTION 1**  
N.T.S.

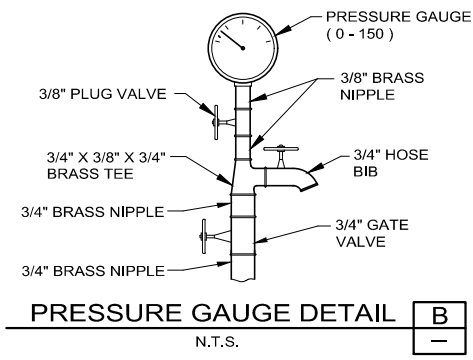
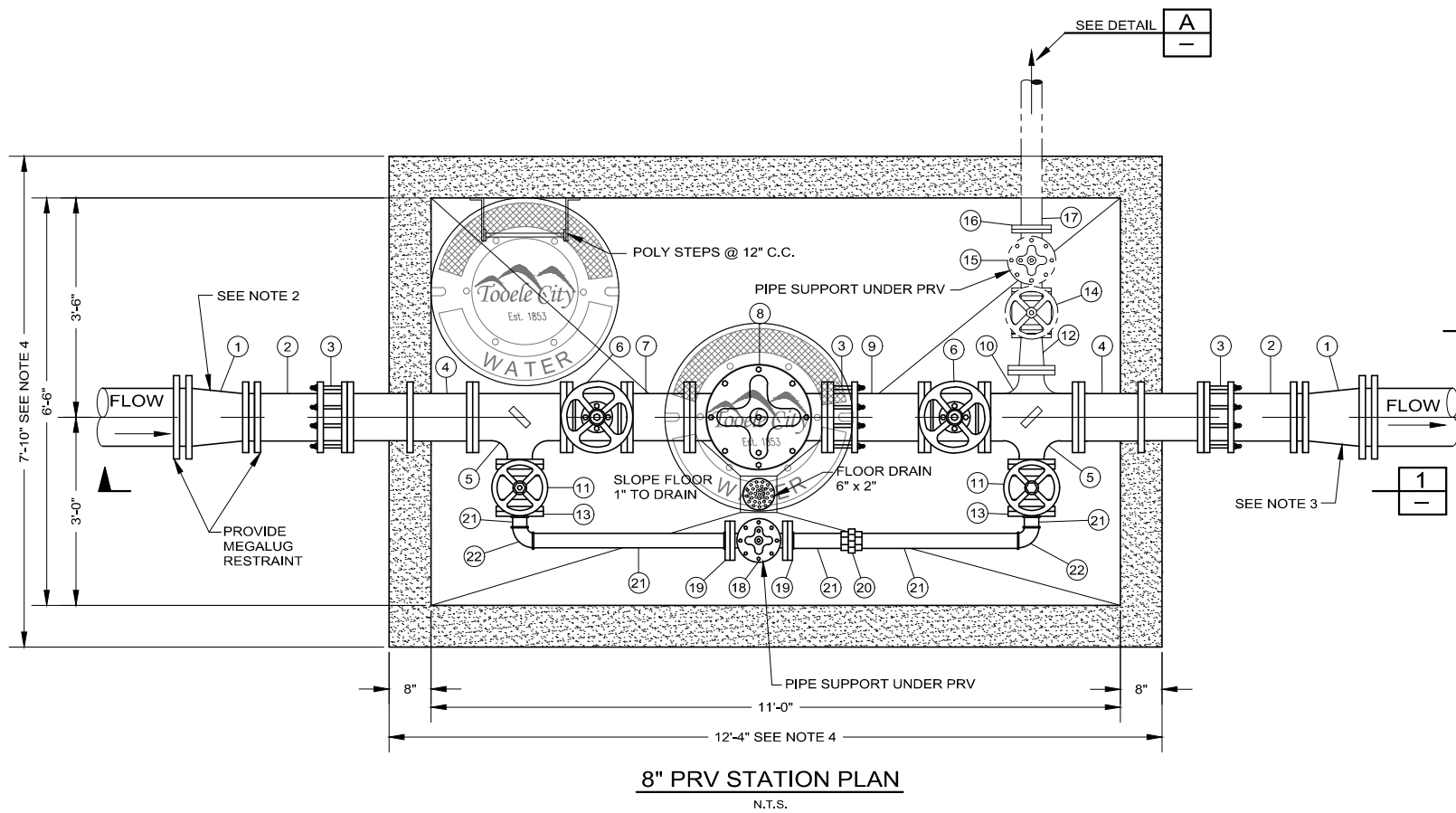


**PRESSURE RELIEF PIPE A**  
N.T.S.

- NOTES:
1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
  2. LOCATION OF PRESSURE RELIEF PIPE TO BE FIELD FIT BY ENGINEER.
  3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
  4. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.

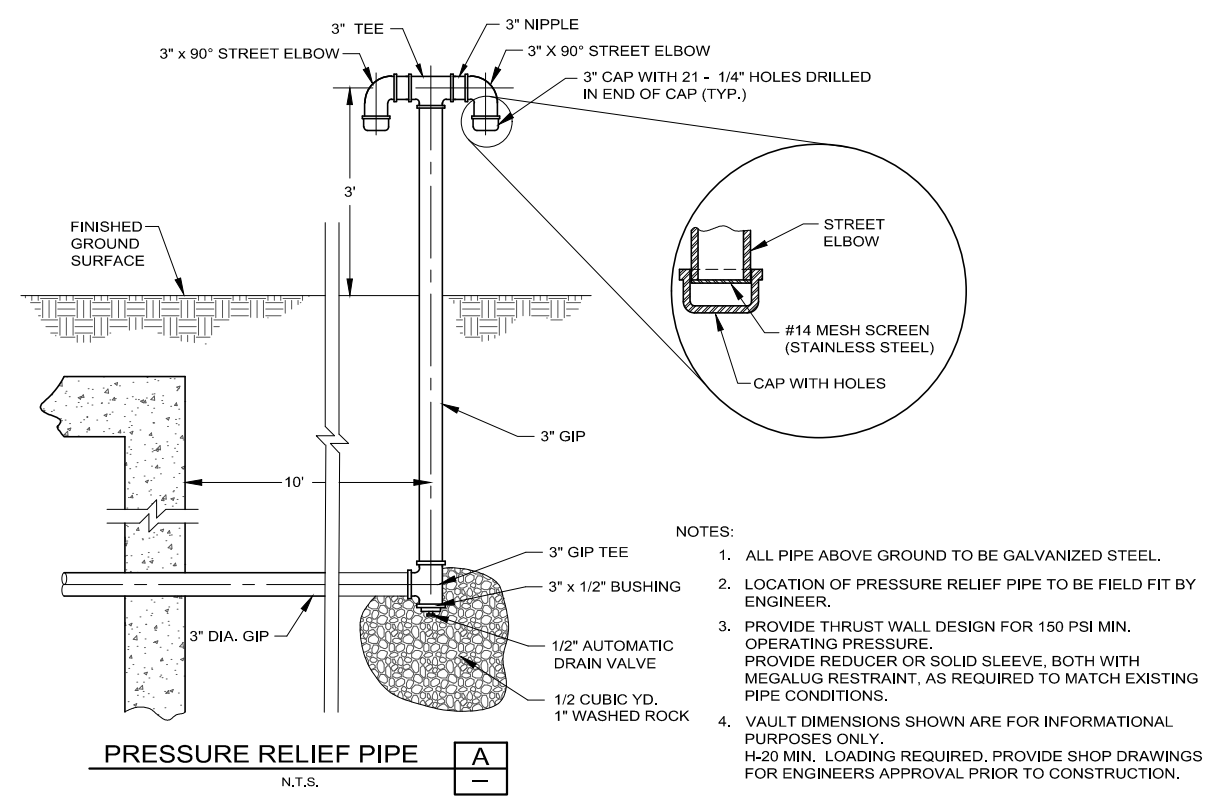
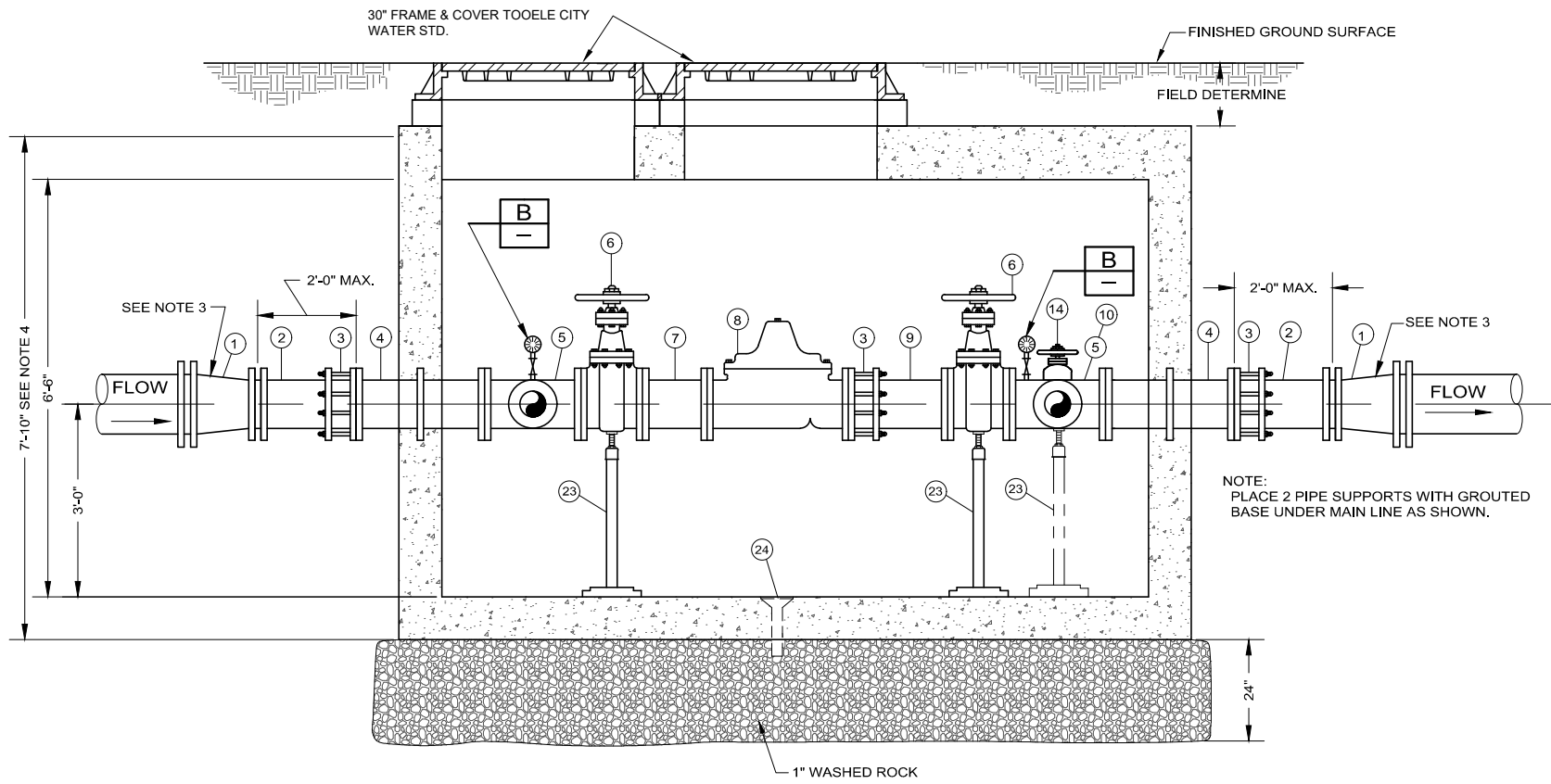


**6\"/>**



PRESSURE REDUCING STATION			
VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	REDUCER WITH MEGALUG RESTRAINT ON INFLOW SIDE	10" X 8"	MJ
2.	DUCTILE IRON PIPE	8"	-
3.	FLANGE COUPLING ADAPTER	8"	FLG X PE
4.	WALL PIECE WITH THRUST RING	8" X 2'-0"	FLG
5.	TEE W/ 3/4" TAP	8" X 4"	FLG
6.	GATE VALVE (SEE TABLE NOTES)	8"	FLG
7.	SPOOL PIECE	8" X 1'-0"	FLG
8.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	8"	FLG
9.	NIPPLE	8"	FLG X PE
10.	CROSS WITH 3/4" TAP	8" X 4"	FLG
11.	GATE VALVE (MUELLER RESILIENT SEAT)	4"	FLG
12.	REDUCER	4" X 3"	FLG
13.	REDUCING FLANGE	9" X 2 1/2"	FLG X THD
14.	GATE VALVE (SEE TABLE NOTES)	3"	FLG
15.	PRESSURE RELIEF VALVE (CLA-VAL 50-01)	3"	FLG
16.	COMPANION FLANGE	3"	FLG X THD
17.	GALVANIZED IRON PIPE	3"	THD
18.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	2 1/2"	FLG
19.	COMPANION FLANGE	2 1/2"	THD
20.	UNION (BRASS)	2 1/2"	THD
21.	BRASS PIPE	2 1/2"	THD
22.	90° ELBOW (BRASS)	2 1/2"	THD
23.	PIPE SUPPORT (GRINNELL NO. 264 - 4 REQUIRED)	-	-
24.	FLOOR DRAIN	6" X 2"	-

TABLE: UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
 NOTES: ALL FLANGES ARE ANSI CLASS 125.  
 PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
 PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.  
 MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.

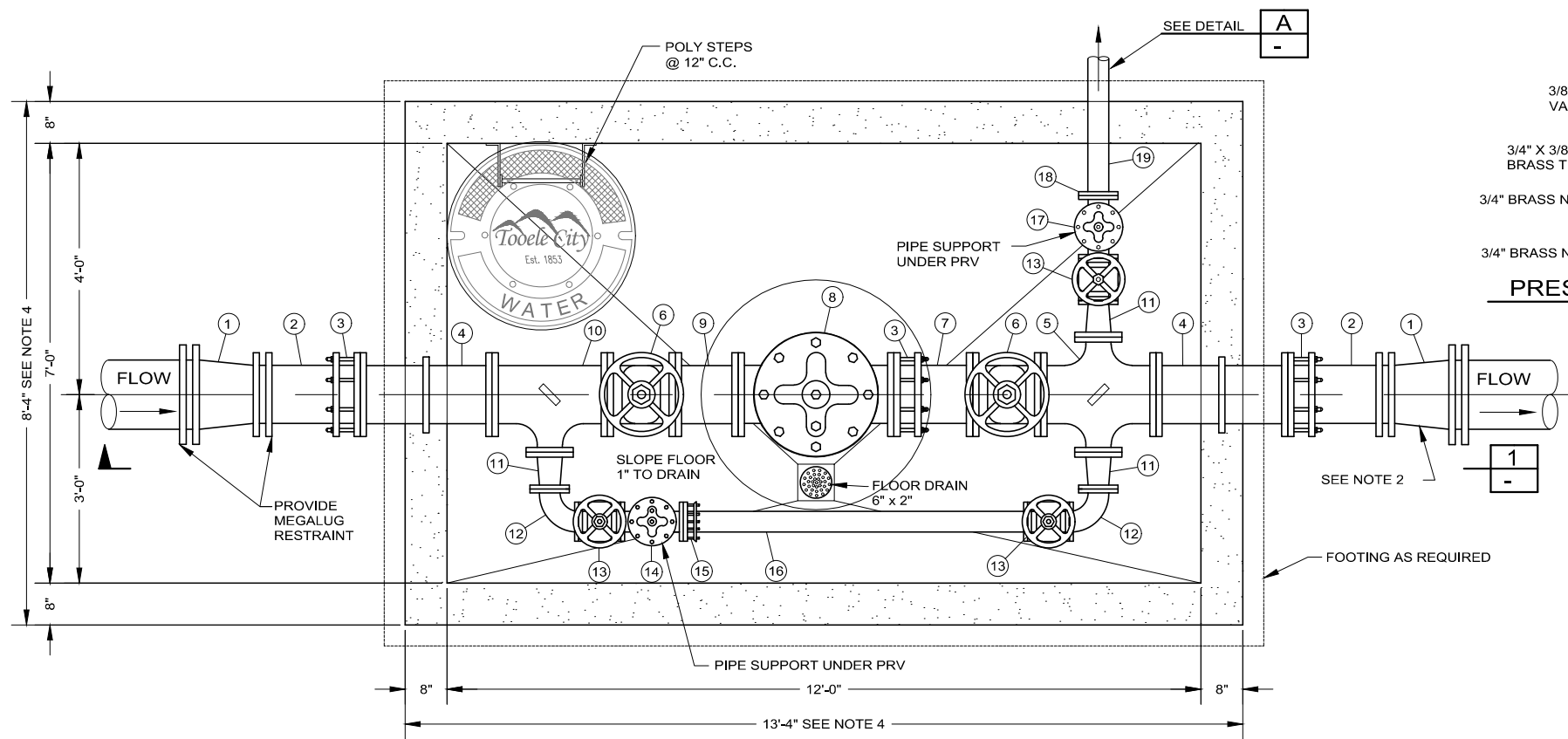


SECTION 1  
N.T.S.

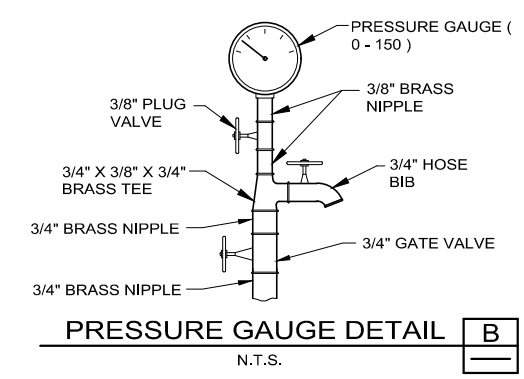
PRESSURE RELIEF PIPE  
N.T.S.

### 8" PRESSURE REDUCING VALVE WITH 2 1/2" BYPASS





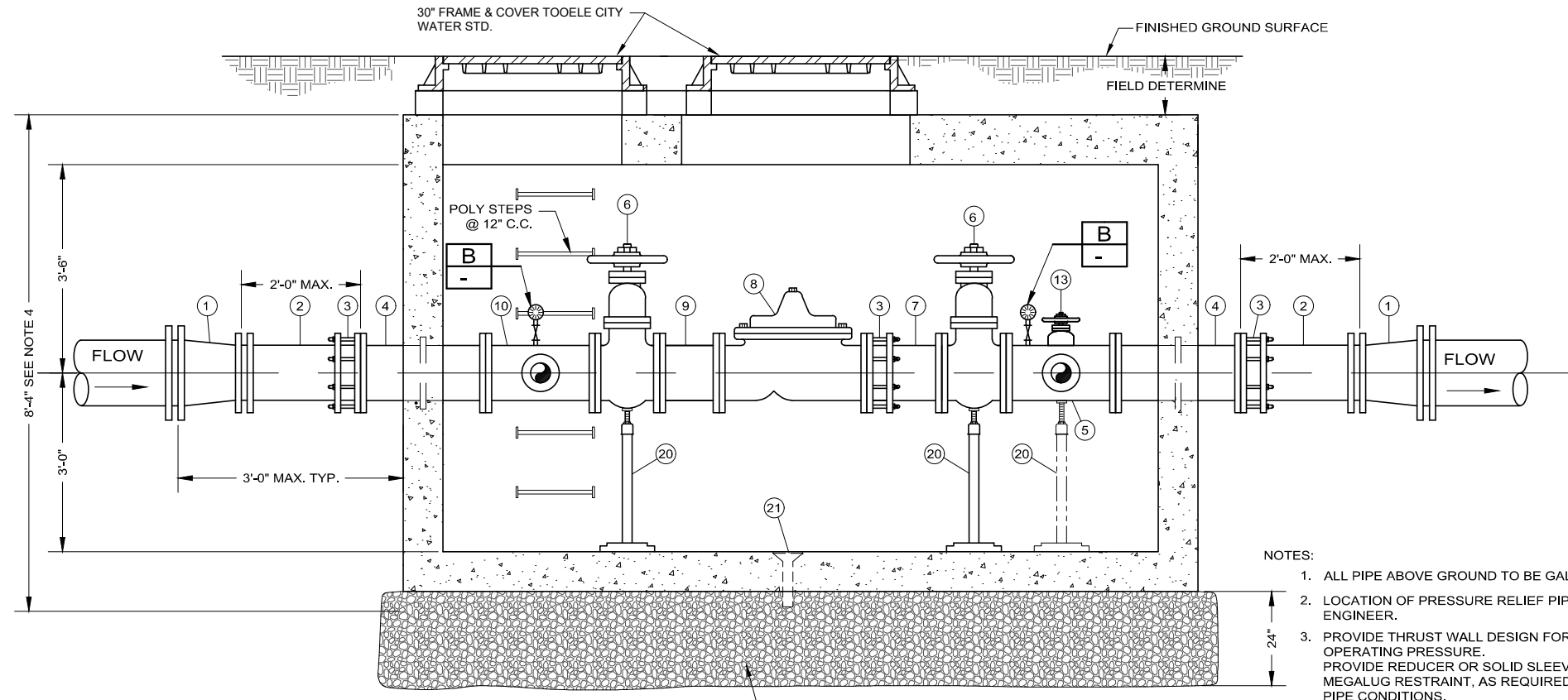
**10" PRV STATION PLAN**  
N.T.S.



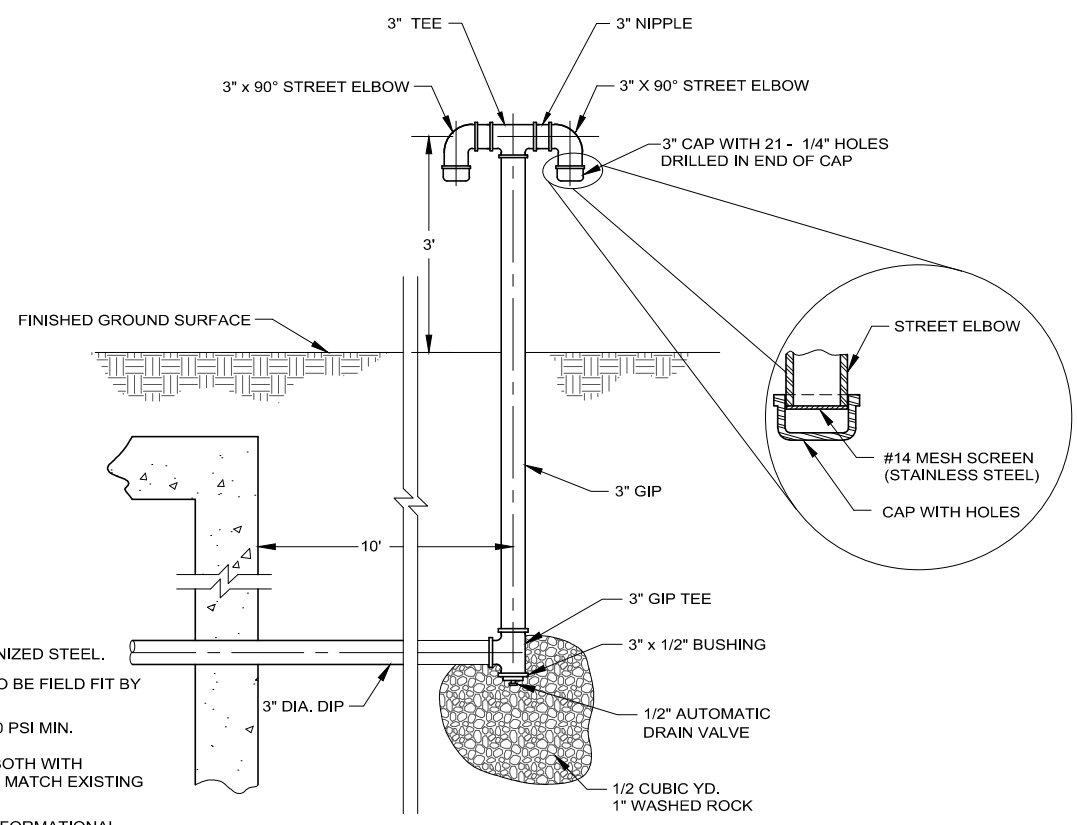
**PRESSURE GAUGE DETAIL B**  
N.T.S.

PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	REDUCER WITH MEGALUG RESTRAINT ON INFLOW SIDE	12" X 10"	MJ
2.	DUCTILE IRON PIPE	10"	-
3.	FLANGE COUPLING ADAPTER	10"	FLG X PE
4.	WALL PIECE WITH THRUST RING	10" X 2'-0"	FLG
5.	CROSS W/ 3/4" TAP	10" X 4"	FLG
6.	GATE VALVE (SEE TABLE NOTES)	10"	FLG
7.	NIPPLE	10"	FLG
8.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	10"	FLG
9.	SPOOL PIECE	10" X 1'-0"	FLG X PE
10.	TEE WITH 3/4" TAP	10" X 4"	FLG
11.	REDUCER	4" X 3"	FLG
12.	90° ELBOW	3"	FLG
13.	GATE VALVE (SEE TABLE NOTES)	3"	FLG
14.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	3"	FLG
15.	FLANGE COUPLING ADAPTER	3"	FLG X PE
16.	NIPPLE	3"	FLG X PE
17.	PRESSURE RELIEF VALVE (CLA-VAL 50-01)	3"	FLG
18.	COMPANION FLANGE	3"	FLG X THD
19.	GALVANIZED IRON PIPE	3"	THD
20.	PIPE SUPPORT (GRINNELL NO. 264 - 4 REQUIRED)	-	-
21.	FLOOR DRAIN	6" X 2"	-

TABLE NOTES: UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53. ALL FLANGES ARE ANSI CLASS 125. PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS. PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT. MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.



**SECTION 1**  
N.T.S.



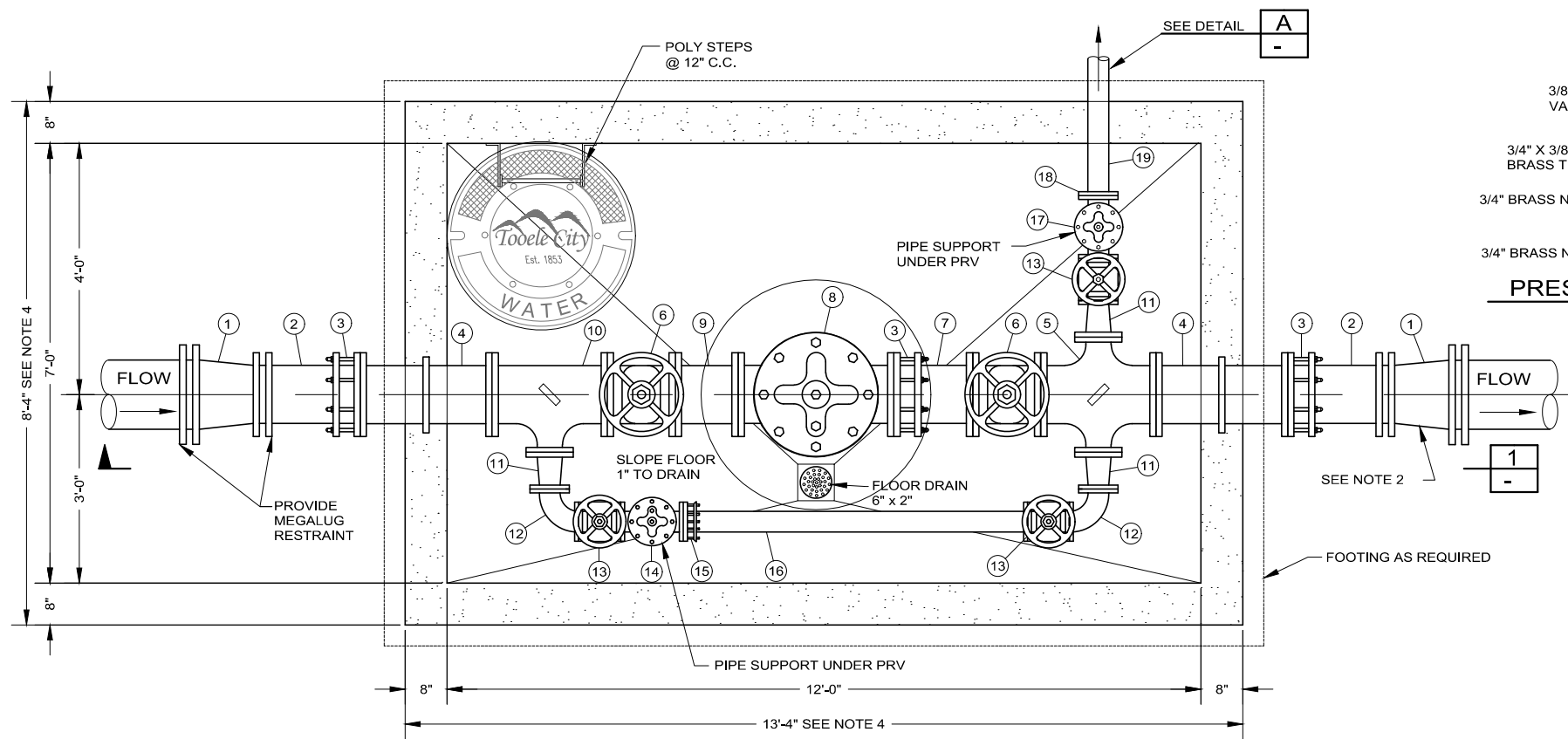
**PRESSURE RELIEF PIPE A**  
N.T.S.

- NOTES:
1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
  2. LOCATION OF PRESSURE RELIEF PIPE TO BE FIELD FIT BY ENGINEER.
  3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
  4. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.

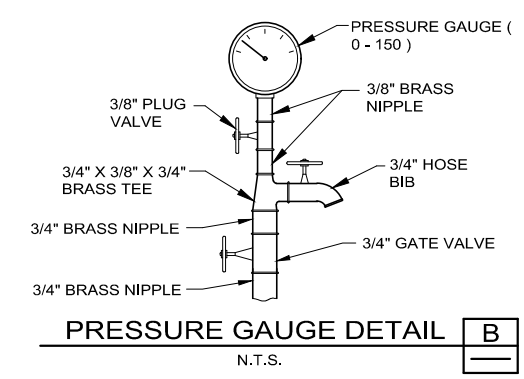


**10" PRESSURE REDUCING VALVE WITH 3" BYPASS**





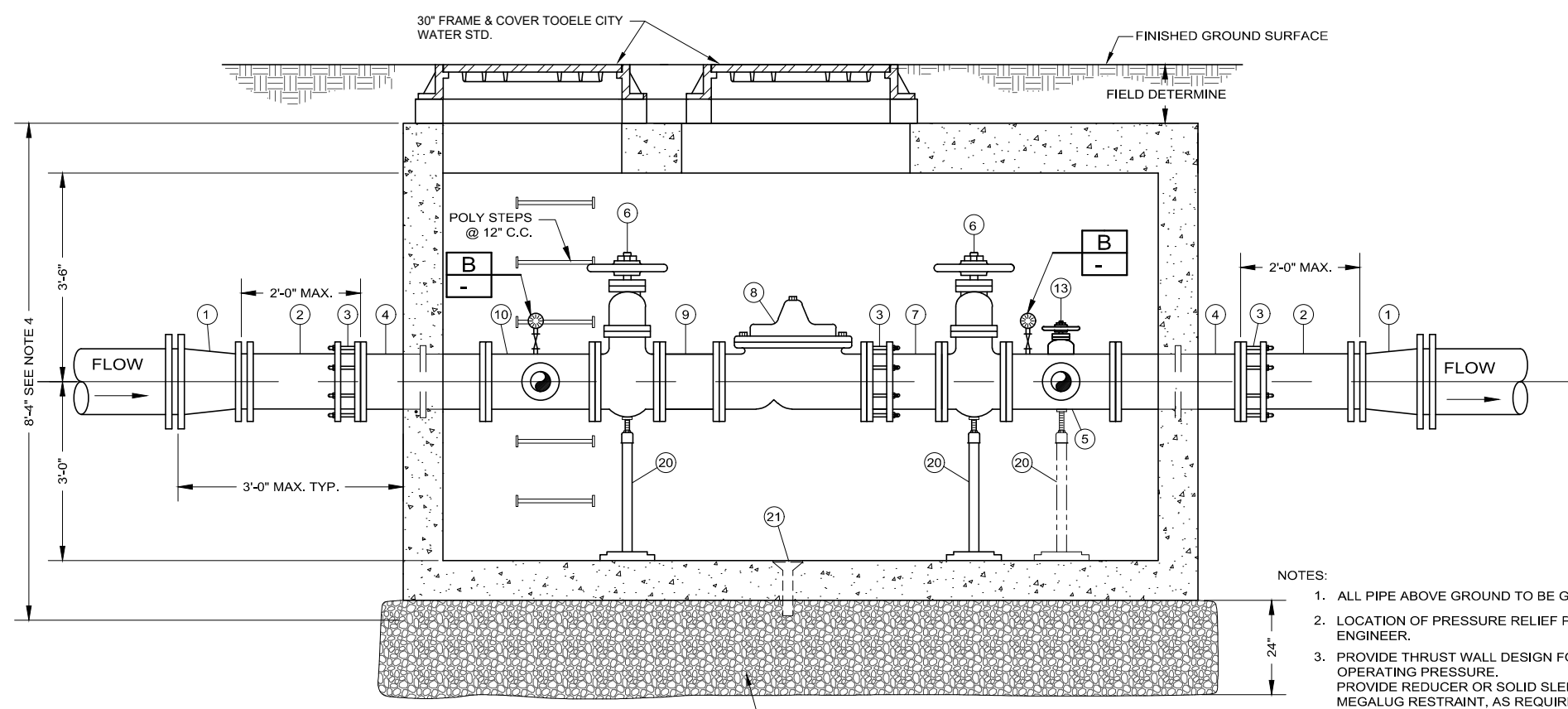
**10" PRV STATION PLAN**  
N.T.S.



**PRESSURE GAUGE DETAIL B**  
N.T.S.

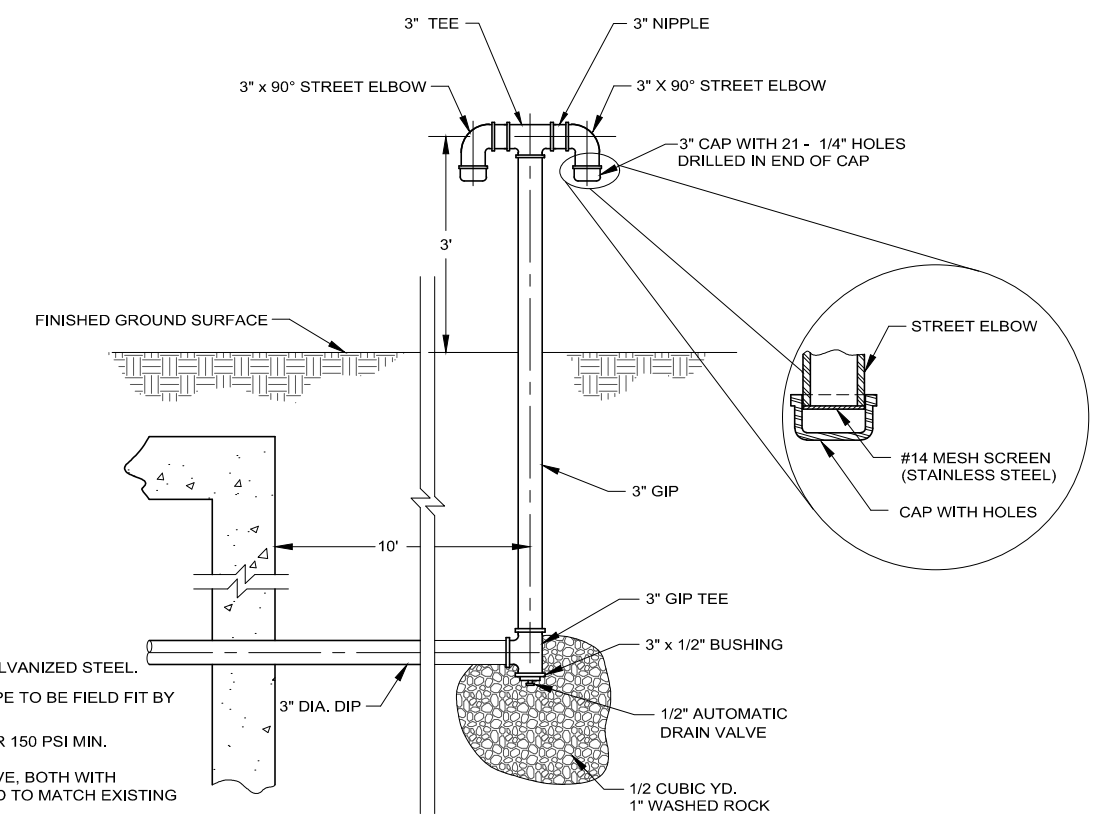
PRESSURE REDUCING STATION VALVE AND FITTING SCHEDULE			
NO.	DESCRIPTION	SIZE	JOINT
1.	REDUCER WITH MEGALUG RESTRAINT ON INFLOW SIDE	16" X 12"	MJ
2.	DUCTILE IRON PIPE	12"	-
3.	FLANGE COUPLING ADAPTER	12"	FLG X PE
4.	WALL PIECE WITH THRUST RING	12" X 2'-0"	FLG
5.	CROSS W/ 3/4" TAP	12" X 4"	FLG
6.	GATE VALVE (SEE TABLE NOTES)	12"	FLG
7.	NIPPLE	12"	FLG
8.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	12"	FLG
9.	SPOOL PIECE	12" X 1'-0"	FLG X PE
10.	TEE WITH 3/4" TAP	12" X 4"	FLG
11.	REDUCER	4" X 3"	FLG
12.	90° ELBOW	3"	FLG
13.	GATE VALVE (SEE TABLE NOTES)	3"	FLG
14.	PRESSURE REDUCING VALVE (CLA-VAL 90-01)	3"	FLG
15.	FLANGE COUPLING ADAPTER	3"	FLG X PE
16.	NIPPLE	3"	FLG X PE
17.	PRESSURE RELIEF VALVE (CLA-VAL 50-01)	3"	FLG
18.	COMPANION FLANGE	3"	FLG X THD
19.	GALVANIZED IRON PIPE	3"	THD
20.	PIPE SUPPORT (GRINNELL NO. 264 - 4 REQUIRED)	-	-
21.	FLOOR DRAIN	6" X 2"	-

TABLE UNLESS OTHERWISE SPECIFIED, ALL PIPE AND FITTINGS ARE DIP CLASS 53.  
 NOTES: ALL FLANGES ARE ANSI CLASS 125.  
 PROVIDE MEGALUG RESTRAINT ON ALL MJ FITTINGS.  
 PROVIDE BRONZE OR STAINLESS STEEL BOLTS FOR ALL CONNECTIONS WITHIN VAULT.  
 MUELLER RESILIENT SEAT, CLOW RESILIENT WEDGE OR EAST JORDAN GATE VALVE.



**SECTION 1**  
N.T.S.

- NOTES:
1. ALL PIPE ABOVE GROUND TO BE GALVANIZED STEEL.
  2. LOCATION OF PRESSURE RELIEF PIPE TO BE FIELD FIT BY ENGINEER.
  3. PROVIDE THRUST WALL DESIGN FOR 150 PSI MIN. OPERATING PRESSURE. PROVIDE REDUCER OR SOLID SLEEVE, BOTH WITH MEGALUG RESTRAINT, AS REQUIRED TO MATCH EXISTING PIPE CONDITIONS.
  4. VAULT DIMENSIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY. H-20 MIN. LOADING REQUIRED. PROVIDE SHOP DRAWINGS FOR ENGINEERS APPROVAL PRIOR TO CONSTRUCTION.



**PRESSURE RELIEF PIPE A**  
N.T.S.



**12" PRESSURE REDUCING VALVE WITH 3" BYPASS**

## **Cover Collar for Water Valve Box**

### **1. GENERAL**

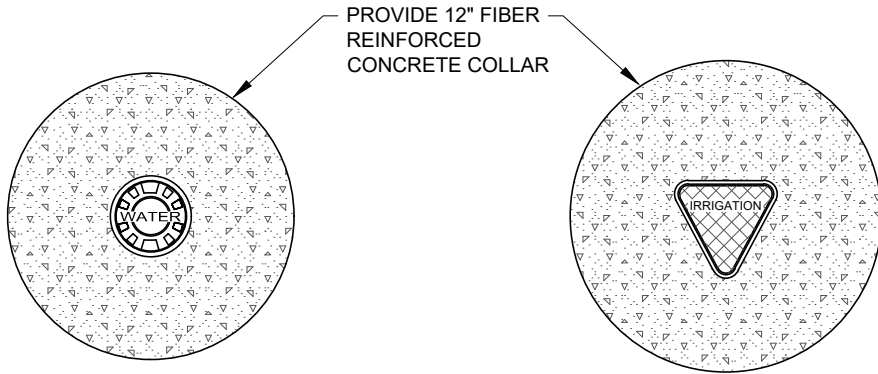
- A. In a pavement surface, fill an annular space around a frame and cover casting with fiber reinforced concrete.

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Fiber Reinforced Type II Portland Cement Concrete (PCC) shall have the following characteristics:
  - i. 4,000 psi min. compressive strength at 28 days.
  - ii. 6 sack minimum of cement per cubic yard.
  - iii. Maximum water - cement ratio of 0.45.
  - iv. Air entrainment at 6% +/- 1.5%
  - v. Slump 1-4 inches.
  - vi. Polypropylene or cellulose fibers shall be added to the PCC at 1.5 lbs. per cubic yard, or as per manufacturers recommendations for driving surfaces.
- C. Concrete Curing Agent: Type ID Class A (clear with fugitive dye), membrane forming compound, APWA Section 03 39 00.

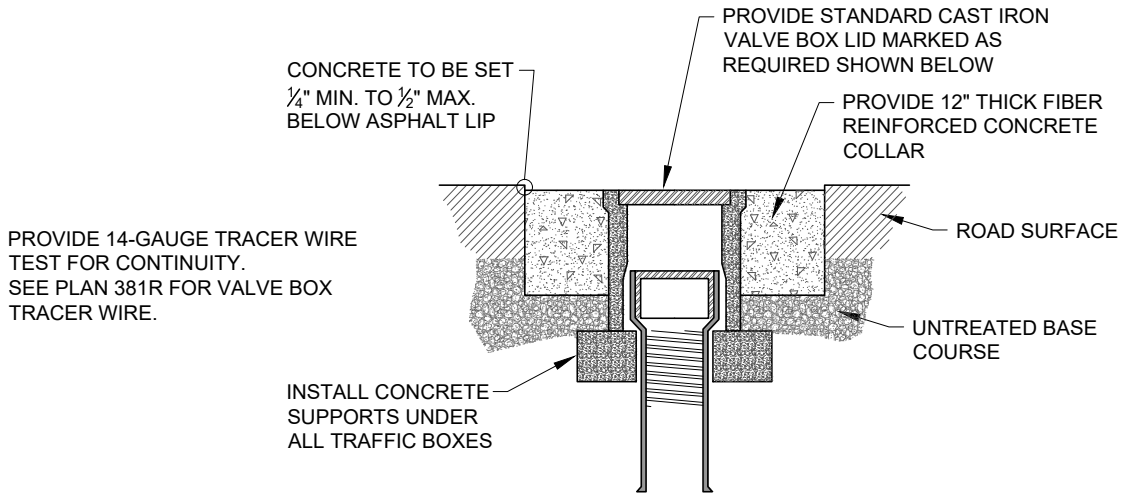
### **3. EXECUTION**

- A. Base Course and Backfill Placement: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.
- B. Pavement Preparation: Provide a neat vertical and concentric joint between concrete collar and existing bituminous concrete surface. Clean edges of all dirt, oil, and loose debris.
- C. Provide steel plates to cover all collars until sufficient strength is reached for traffic loading.



CULINARY WATER PLAN

IRRIGATION WATER PLAN



PROVIDE 14-GAUGE TRACER WIRE  
TEST FOR CONTINUITY.  
SEE PLAN 381R FOR VALVE BOX  
TRACER WIRE.



STANDARD CAST IRON  
LID MARKINGS

**COVER COLLAR FOR WATER  
VALVE BOXES**

## ***Air Release Assembly***

### **1. GENERAL**

- A. This drawing detail is applicable to water main piping less than 16-inches diameter.
- B. PCCP, steel, MLAC and other water main pipe materials will require special detail or design drawings. Submit the design and detail drawings and materials to the ENGINEER for review before installation.
- C. Installation in areas of high ground water or potential for water entering the vent pipe will require a special design to be provided by the ENGINEER.
- D. Before backfilling around the assembly, secure inspection of installation by ENGINEER.

### **2. PRODUCTS**

- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Drain Gravel: Sewer rock, ASTM size no. 3 (2" to 1") or equal, APWA Section 31 05 13.
- C. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- D. Concrete: Class 4000, APWA Section 03 30 04R.
- E. Manhole: Riser, ASTM C478.
- F. Reinforcement: Deformed, steel, ASTM A615. Give bars an epoxy coating at least 15 mils thick. Minimum stress yield strength of steel tie-down bars is 70,000 ksi.
- G. Small Fittings: Brass. Do not use galvanized materials.
- H. PVC Pipe and Fittings: Schedule 40, APWA Section 33 05 07R.
- I. Water Tight Wall Seal: Waterproof, compressible.

### **3. EXECUTION**

- A. Base Course and Backfill Placement: **When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**
- B. Apply tape wrap to the exterior of all buried steel **or galvanized** pipe per AWWA C209.
- C. Concrete Placement: APWA Section 03 30 10. Provide 1/2-inch radius edges. Apply a broom finish. Apply a curing agent.
- D. Service saddle is required on all PVC and AC pipe taps unless specified otherwise. Ductile iron and cast iron pipe may be direct tapped.
- E. Seal manhole joints water-tight and ground flush with interior wall.
- F. Follow applicable AWWA and NSF standards when connecting piping.
- G. If diameter of air relief valve is greater than 2-inches, provide piping to match its diameter from water main connection to open to air.





## ***Hot Tap Detail***

### **1. GENERAL**

- A. Additional water system requirements are specified in APWA Section 33 11 00R - Water Distribution and Transmission, 33 12 16R - Water Valves, and 33 12 19R - Hydrants.
- B. Before backfilling, secure inspection of installation by Public Works.

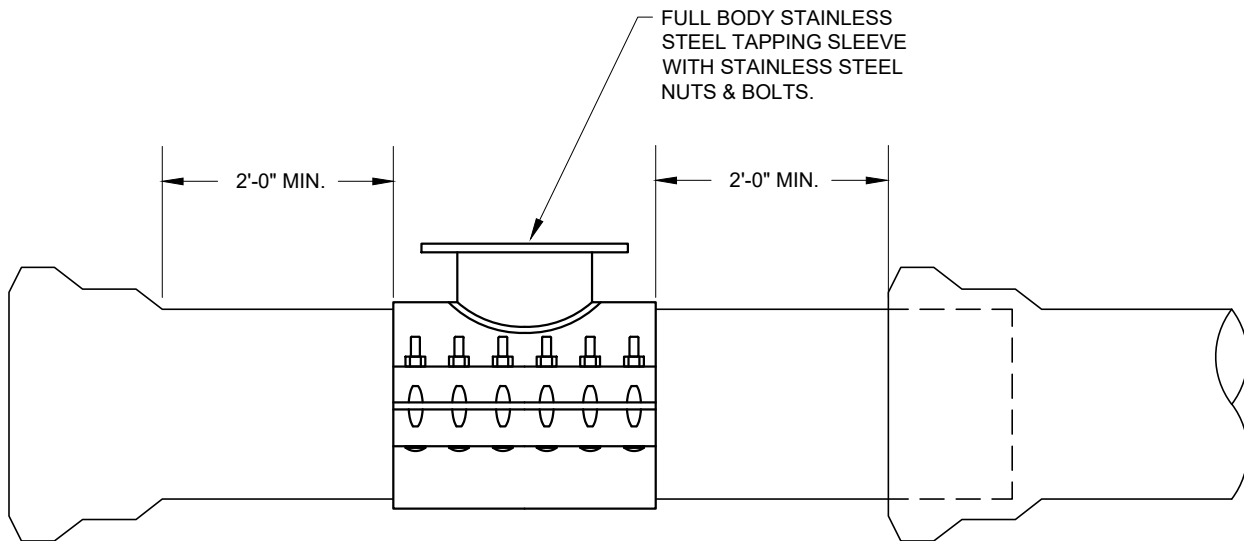
### **2. PRODUCTS**

- A. Hot Tap: Full body stainless steel tapping sleeve with stainless steel nuts & bolts.
- B. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- C. Piping: Match existing pipe, fittings, coupling sizes and materials.
- D. Thrust Blocks: Concrete Class 4000, APWA Section 03 30 04R.
- E. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- F. Grease: Non-oxide poly-FM.

### **3. EXECUTION**

- A. Hot Tap:
  - 1) Apply grease to all buried metal surfaces. Wrap with polyethylene sheet and tape wrap.
- B. Valves: See Section 33 12 16R.
- C. Valve Boxes. Salvage any C.I.S.T. valve boxes and reuse. Adjust to grade as necessary on relocated hydrant.
- D. Thrust Blocks: Required. Before pouring concrete, wrap pipe system plastic sheet to prevent bonding of concrete to pipe system.
- E. Base Course and Backfill Placement: When no density compactive effort is specified, compact trench backfill to 95% or greater relative to a standard proctor density, and base course compaction to 95% or greater relative to a modified proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.
- F. Surface Restoration:
  - 1) Landscaped Surface: Rake to match existing grade. Replace vegetation to match pre-construction conditions. Follow APWA Section 32 92 00 (turf or grass) or APWA Section 32 93 13 (ground cover) requirements.
  - 2) Paved Surface: Do not install bituminous concrete or Portland cement concrete surfacing until trench compaction is acceptable to ENGINEER. Follow APWA Section 33 05 25 (bituminous concrete surfacing), or APWA Section 33 05 25 (concrete surfacing).

APPROVED TAPPING SLEEVES:  
ROMAC "SST III", JCM 432, & MUELLER H-304SS  
(OR APPROVED EQUAL)



NOTES:

1. TAPPING SLEEVE SHALL NOT BE INSTALLED CLOSER THAN 2'-0" MIN. FROM THE BACK OF THE BELL, OR ANY FITTING OR JOINT.
2. NO HOT TAP SHALL BE PERFORMED WITHOUT PRIOR COORDINATION WITH TOOEELE CITY WATER DEPARTMENT.

## ***Pressurized Irrigation Water and Potable Water Interface***

### **1. GENERAL**

- A. The catch basin valve and pump size must match the minimum discharge rate from the potable water system when indoor demands are also being expected from the system.

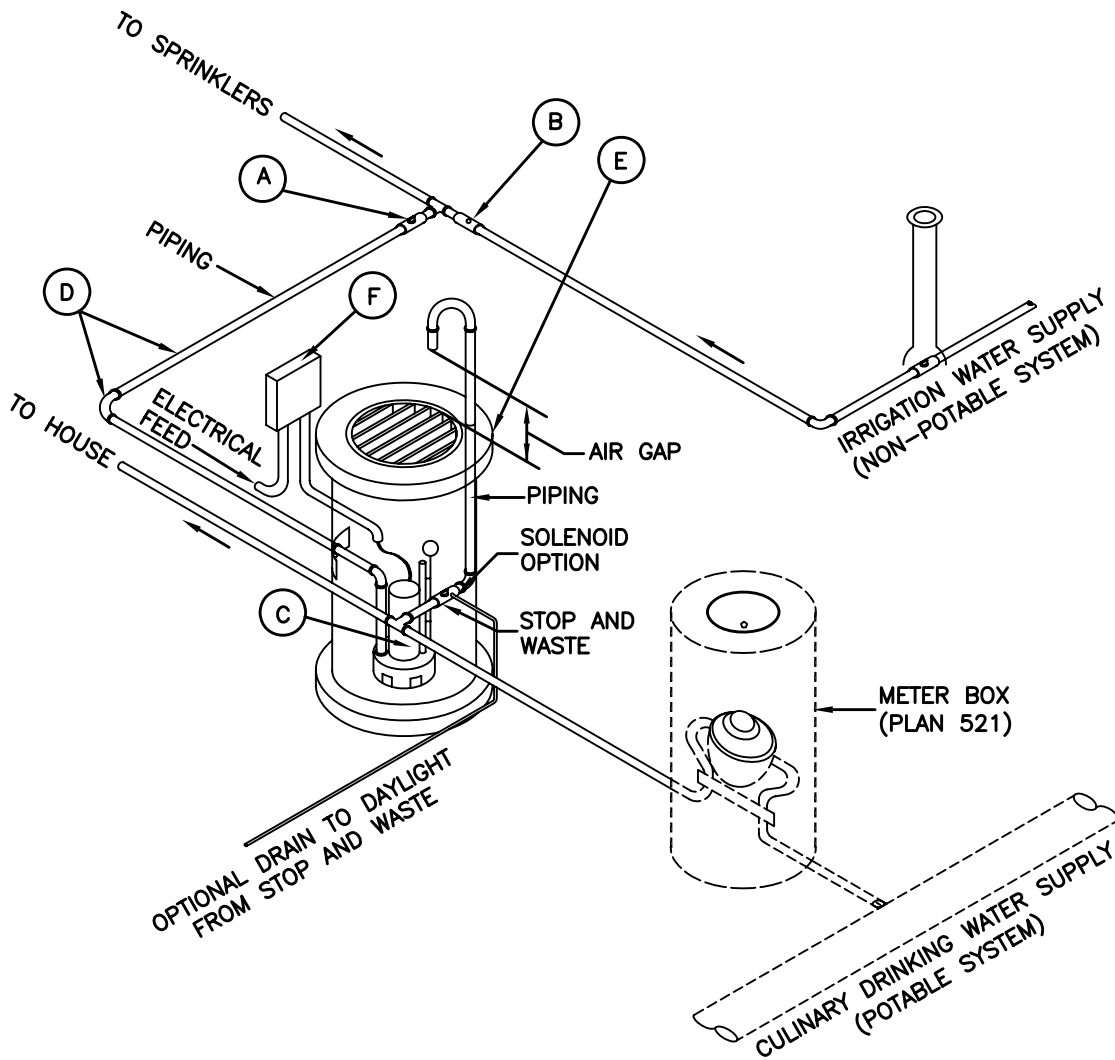
### **2. PRODUCTS**

- A. All parts of the potable water system from the stop and waste valve to the air gap drop leg above the catch basin are to be copper or galvanized iron only.
- B. Below ground parts on the non-potable water system may be made of PVC or polyethylene at the agency's discretion.

### **3. EXECUTION**

- A. Air gap. An air gap of at least two pipe diameters must exist between the maximum overflow lip of the catch basin and the end of the down-turned discharge pipe.
- B. Stop and Waste Valve: Locate the valve in an area where subsurface ground water will not accumulate or attach a drain pipe to the drain hole and drain to daylight with a non-corrodible #14 mesh screen over the end.
- C. Catch Basin: The ground surrounding the catch basin must slope away from the catch basin (basin cannot be located where flooding could result in a water level higher than the maximum overflow lip of the catch basin).
- D. Stand Pipes: Provide draining and freeze protection.
- E. Solenoid Valve: A solenoid operated valve may be installed at this point provided the valve and housing are not constructed of plastic (must be brass or ferrous metal).
- F. Galvanized Pipe: Apply tape wrap to the exterior of all galvanized pipe per AWWA C209.

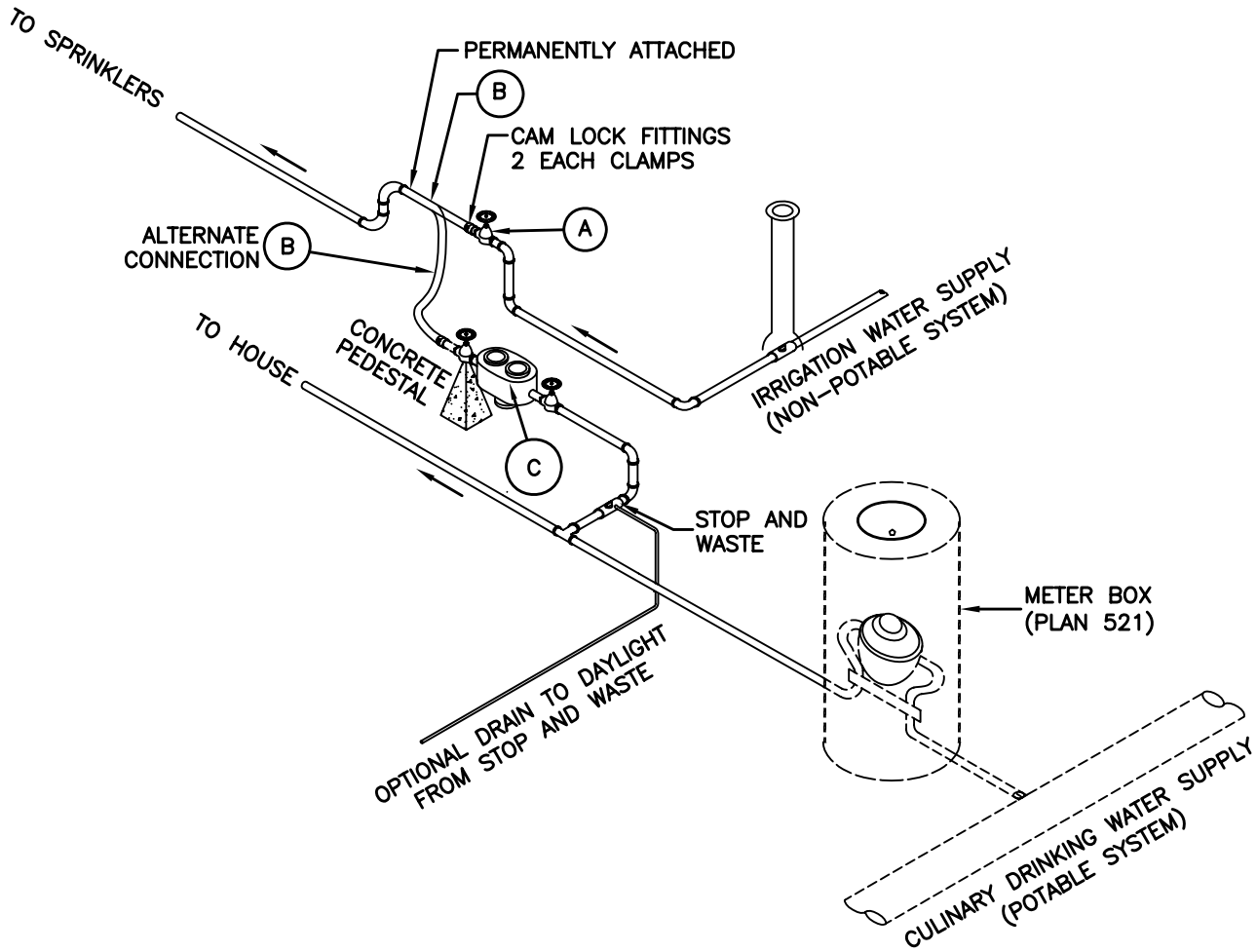
# TYPE A - PUMP INTERCONNECT



**SHOWN FOR CONCEPTUAL USE ONLY. REQUIRES SPECIAL DESIGN AND CITY APPROVAL PRIOR TO UTILIZATION.**

LEGEND		
No.	ITEM	DESCRIPTION
A	CONTROL VALVE	NOTE 1A
B	CHECK VALVE	SIZE TO MATCH EXISTING PIPE
C	SUBMERSIBLE PUMP WITH FLOAT OPERATED CUT-OUT SWITCH	NOTE 1A
D	ELBOWS, TEES & PIPE AS REQ'D	SCREWED OR FLANGED (OR BRAZED ABOVE GROUND ONLY)
E	CATCH BASIN	NOTE 1A
F	ELECTRICAL BOX AND CONDUIT	PER ELECTRICAL CODE

# TYPE B- BACKFLOW PREVENTER INTERCONNECT



LEGEND		
No.	ITEM	DESCRIPTION
(A)	VALVE	BALL, RESILIENT SEAT, GATE OR ACCEPTABLE ALTERNATE
(B)	FLEXIBLE DISCHARGE HOSE	100 PSI WORKING PRESSURE 400 PSI BUST PRESSURE
(C)	REDUCED PRESSURE BACK-FLOW PREVENTER (RPBP DEVICE)	SHUTOFF VALVES & TEST COCKS ARE INCLUDED
(D)	ELBOWS AND TEES	SCREWED, FLANGED, (OR BRAZED ABOVE GROUND ONLY)

## **Reduced Pressure Principal Assembly Station**

### **1. GENERAL**

- A. Test the **Reduced Pressure Principal Assembly Station** within 10 days of installation by a licensed backflow device tester and report results to ENGINEER.
- B. Tester is to assure CONTRACTOR and ENGINEER that the backflow preventer system meets the Utah Safe Drinking Water Act.

### **2. PRODUCTS**

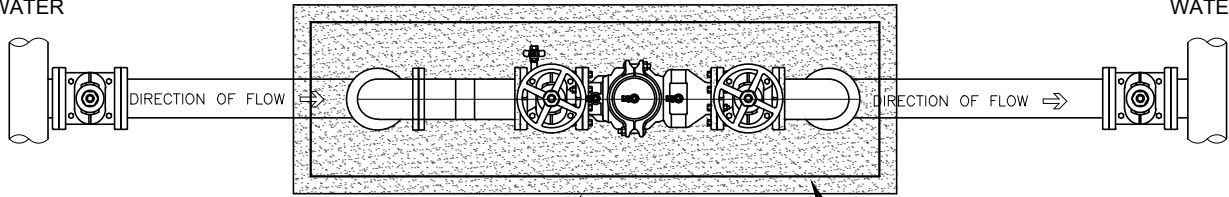
- A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
- B. Backfill: Common fill, APWA Section 31 05 13. Maximum particle size 2-inches.
- C. Concrete: Class 4000, APWA Section 03 30 04**R**.
- D. Concrete Curing Agent: Clear membrane forming compound with fugitive dye (Type ID Class A), APWA Section 03 39 00.
- E. Paint: Epoxy based. Color to be selected by ENGINEER.

### **3. EXECUTION**

- A. Install per plumbing code. It must not be susceptible to flooding and must be accessible at all times for testing, repair, inspection, etc.
- B. Install backfill around concrete box. **When no density compactive effort is specified, compact backfill to 95% or greater relative to a standard proctor density. Maximum lift thickness before compaction is 8-inches. See APWA Section 31 23 26R.**
- C. Except machined surfaces, coat all items in atmosphere with epoxy paint.
- D. Concrete placement, APWA Section 03 30 10**R**. Provide 1/2-inch radius on edges. Apply a broom finish. Apply a curing agent.

CULINARY WATER

SECONDARY WATER



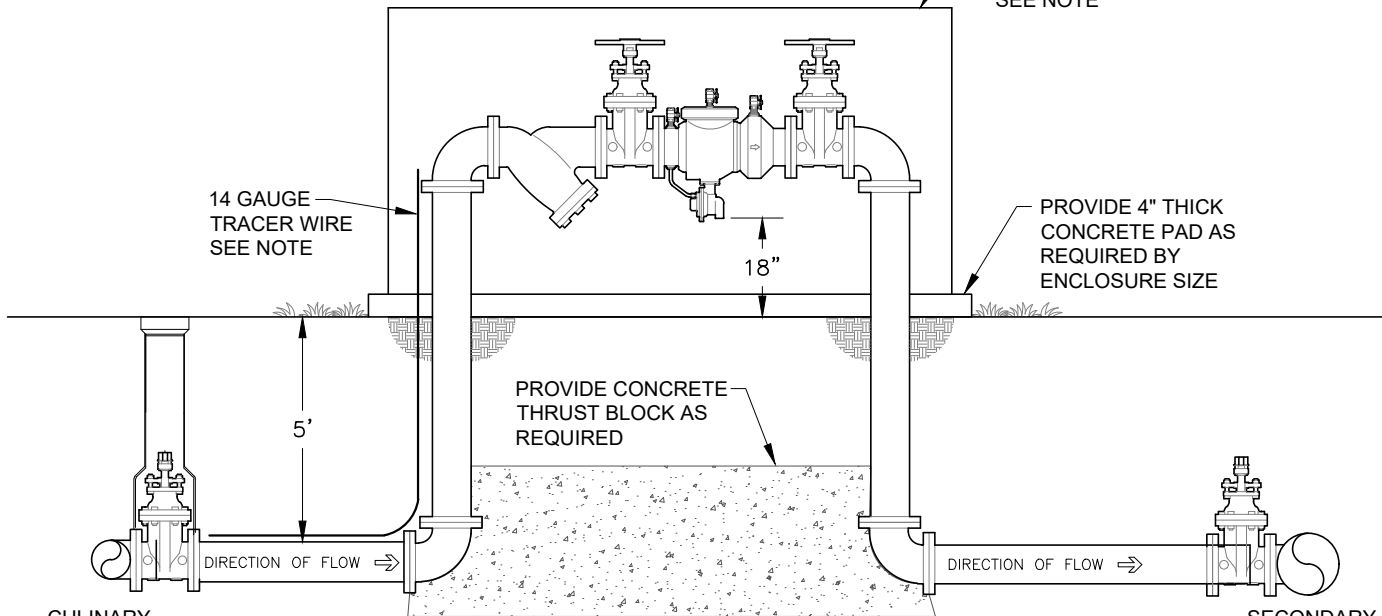
PROVIDE 4" THICK CONCRETE PAD AS REQUIRED BY ENCLOSURE SIZE

PROVIDE LOCKING PROTECTIVE SOLID ENCLOSURE

PROVIDE LOCKING PROTECTIVE SOLID ENCLOSURE SEE NOTE

14 GAUGE TRACER WIRE SEE NOTE

PROVIDE 4" THICK CONCRETE PAD AS REQUIRED BY ENCLOSURE SIZE



PROVIDE CONCRETE THRUST BLOCK AS REQUIRED

**NOTE:**

PROVIDE 14-GAUGE TRACER WIRE AND BRING INTO PROTECTIVE SOLID CLOSURE. TEST FOR CONTINUITY. SEE PLAN 381R FOR TRACER WIRE.

WILKINS MODEL 375, FEBCO LF860  
(OR APPROVED EQUAL)  
REDUCED PRESSURE PRINCIPLE  
ASSEMBLY

# REDUCED PRESSURE PRINCIPAL ASSEMBLY STATION

Plan No.  
**631 R**

1/2023

