PACKAGE 01
3 MG CULINARY WATER RESERVOIR
APPENDIX

Geotechnical Investigation

The Point Storage Reservoir Report

The Point Reservoir CFD

DFCM Project Number: 25406300

Final for Construction - February 18, 2025

Horrocks.

The POINT

Geotechnical Investigation
Water Storage Tanks

Final for Construction Submittal

Horrocks.

GEOTECHNICAL INVESTIGATION

THE POINT
WATER STORAGE TANKS

Draper, Utah

Prepared for:
Horrocks Engineers

October 2023

RB&G
ENGINEERING, INC.

202201-026-002

RB&G ENGINEERING, INC.

October 5, 2023

Horrocks Engineers
Attn:Dave Dillman, P.E.
2162 West Grove Parkway
Pleasant Grove, UT 84062

Re: The Point Water Storage Tanks – Geotechnical Investigation

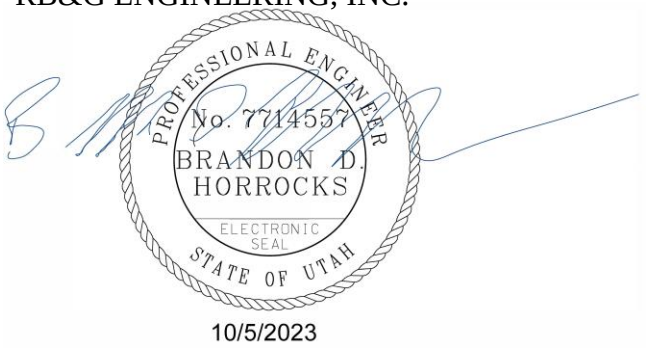
Dear Mr. Dillman:

A Geotechnical Investigation has been completed for The Point Water Storage Tanks project to be located in Draper, Utah. The results of this study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.



Brandon D. Horrocks, P.E., Principal

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GEOTECHNICAL INVESTIGATION

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GEOTECHNICAL INVESTIGATION

THE POINT
WATER STORAGE TANKS
DRAPER, UTAH

1 INTRODUCTION

This report outlines the results of a geotechnical investigation performed for two proposed water storage tanks to be located near the Fred House Training Academy in Draper, Utah as shown on the Vicinity Map and Site Plan, included as Figures 1 and 2. We understand that concrete tanks with storage capacities of about 7 million gallons (MG) and 3MG are being designed southwest and northeast of the Training Academy, respectively. Preliminary drawings provided to us show that the 7MG tank will have a footprint of about 280 feet by 180 feet and will be about 24 feet high. Preliminary drawings of the 3MG tank show that it will have a 150-foot wide square footprint with a height of about 24 feet. The water tanks are being designed as part of The Point project, which is the development at the location of the former Utah State Correctional Facility in Draper.

The purpose of this investigation was to determine the characteristics of the subsurface material at the site so that satisfactory substructures can be designed to support the proposed tank.

The information contained in the report is discussed under the following headings: 1) Introduction, 2) Geological and Existing Site Conditions, 3) Subsurface Soil and Water Conditions, and 4) Excavation and Fill Recommendations, and 5) Foundation Considerations and Recommendations.

2 GEOLOGICAL AND EXISTING SITE CONDITIONS

The proposed 3MG tank will replace two existing circular tanks that are within the proposed tank footprint. It is our understanding that the existing tanks are about 13.5 feet high. It is also our

understanding that some cracking and spalling has been observed within the tanks, but they have generally performed satisfactorily.

The surficial deposits at the site have been mapped as lacustrine gravel and sand deposits (Qlgp)[1]. There is a small splay of the Wasatch fault zone within the Traverse Mountains about 2.3 miles southeast of the project site. The main trace of the Salt Lake City segment of the fault zone is about 3 miles northeast of the site. Based on the available information it appears that the risk of fault rupture beneath the proposed tank foundations is low; however, there is significant risk of ground shaking at the site due to a rupture of one or more faults within the Wasatch fault zone. Seismic design recommendations are provided in Section 5.2 of this report.

The topography within the project area generally slopes downward towards the northwest at about 5%; however, the existing slope of the ground surface on the west side of the 7MG tank site slopes downwards at a rate of about 3H:1V (Horizontal:Vertical) for about 25 vertical feet. It appears that fill has been placed around the existing tanks within the northern portion of the site, artificially creating mounds. It is our understanding that the two existing tanks will be removed during construction of the 3MG tank. Vegetation at the site consists of grass and brush.

Groundwater was more than 45 feet below the ground surface at the time of the subsurface investigations (June 2023), and groundwater is unlikely to affect the construction or long term performance of the tank foundations.

Other than the information provided above, no conditions appear to exist at this site which would adversely affect foundation performance.

3 SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material at the site were evaluated by drilling eight borings to depths between 27 and 65 feet below the ground surface at the locations shown on Figure 2. Investigation field and laboratory testing procedures are described in the appendix. The boring logs and laboratory test results are also included in the appendix.

The boring numbers include the prefix “23-TANK” on the site plan and logs. The “23” indicates the year the drilling was performed, and “TANK” designates that the primary purpose of the test

[1] Biek, Robert F., 2005, Geologic map of the Jordan Narrows quadrangle, Salt Lake and Utah Counties, Utah. Utah Geologic Survey Map M-208. 1:24,000 scale.

hole was to investigate foundation conditions for the water storage tanks, differentiating from other geotechnical borings drilled for The Point project. The prefix will generally be omitted in this report for simplicity.

Overburden deposits consisting of sand and gravel materials with some clayey layers were encountered at the site. The thickness of the overburden varied between 8 and 21 feet below the ground surface, and was underlain by quartzite bedrock, most likely part of the Bingham Mine formation. The quartzite materials encountered in the test holes were highly fractured and broken, which is common for the Bingham Mine formation in the vicinity of the project area.

Laboratory classification tests were performed on 12 samples of the overburden soils and 3 samples of pulverized quartzite obtained from the borings. The results of the laboratory tests are summarized below:

Coarse-Grained Samples (<50% passing No. 200 sieve)

Soil Property	No. of Tests	Range	Average
Moisture Content (%)	8	2.1 – 20.7	10.7
Atterberg Limits, Non-Plastic Samples	7	non-plastic	n/a
Atterberg Limits, Plastic Samples **Liquid Limit** **Plasticity Index**	1	 24 6	 24 6
Gravel Content (%)	8	3 – 23	12
Sand Content (%)	8	57 – 79	73
Silt/Clay Content (%)	8	4 – 40	15
Electro-Chemical **pH** **Resistivity (ohm-cm)** **Chloride (mg/kg-dry)** **Sulfate (mg/kg-dry)**	1	 9.2 3,050 <11 <11	 9.2 3,050 <11 <11

Fine-Grained Samples

Soil Property	No. of Tests	Range	Average
Moisture Content (%)	4	6.5 – 26.6	20.3
Atterberg Limits, Non-Plastic Samples	1	non-plastic	n/a
Atterberg Limits, Plastic Samples **Liquid Limit** **Plasticity Index**	3	 21 - 26 2 - 4	 24 3
Gravel Content (%)	4	0 – 2	1
Sand Content (%)	4	12 – 34	82
Silt/Clay Content (%)	4	65 – 88	79

Pulverized Quartzite Samples

Property	No. of Tests	Range	Average
Moisture Content (%)	3	2.5 – 8.9	5.0
Atterberg Limits, Non-Plastic Samples	3	non-plastic	n/a
Gravel Content (%)	3	15 – 32	21
Sand Content (%)	3	55 – 73	66
Silt/Clay Content (%)	3	12 – 13	13
Electro-Chemical			
pH	2	9.2 – 9.5	9.4
Resistivity (ohm-cm)		800 – 3,500	2,150
Chloride (mg/kg-dry)		33 - 160	97
Sulfate (mg/kg-dry)		29 - 31	30

The results of electro-chemical tests performed on samples of the subsurface materials obtained from this site do not generally indicate potential for aggressive corrosion of steel or concrete in contact with the native soils. The exception is the resistivity value of 800 ohm-cm on one of the quartzite samples, which indicates a potential for aggressive corrosion of steel in contact with the soil.

The quartzite bedrock was cored using an HQ barrel in two of the test holes. The percent of the core runs recovered was between 0 and 30%, and the Rock Quality Designations (RQD) were 0% for all of the core runs.

Ground surface elevations at the boring locations were estimated based on topographic information provided to us. The approximate ground surface and top of quartzite elevations at each of the boring locations is as follows:

Boring	Approx. Ground Surface Elevation (ft)	Approx. Depth from Ground Surface to Top of Quartzite (ft)	Approx. Top of Quartzite Elevation (ft)
B1	4259	11	4248
B2	4253	16	4237
B3	4265	8	4257
B4	4254	8	4846
B5	4261	8	4853
B6	4254	21	4233
B7	4253	21	4232
B8	4252	18	4234

4 EXCAVATION AND FILL RECOMMENDATIONS

Based on preliminary design information provided to us, the 7MG tank floor elevation will be 20 to 35 feet below the existing ground surface, and the 3MG tank floor will be 10 to 20 feet below

the existing ground surface, neglecting the mounds of fill around the existing tanks. The tops of the tanks are planned to be below the existing ground surface elevation in most locations; however, the northwest corner of the 3MG tank may be up to about 4 feet above the existing ground surface.

We recommend that permanent excavations at this site be sloped 2H:1V, or flatter. Temporary excavations should comply with OSHA standards. Most of the soils at the site classify as Type B; however, some soil layers are Type C. Temporary excavations less than about 12 feet deep can generally be sloped 1H:1V; however, flattening the slopes to 1.5H:1V in localized areas where clean sandy deposits are present may be required. The subsurface profile at the site included layers of clean sandy soils having less than 10% passing a No. 200 sieve (i.e. Boring B1 between 7 and 11 feet, Boring B2 between 2 and 8 feet, and Boring B6 between 3 and 18 feet). The clean sandy soils have good strength characteristics when confined but are highly erodible and have little cohesion, which can result in shallow surficial sloughing. Assuming equipment access is maintained along excavations less than 12 feet deep, flattening excavations to mitigate surficial soughing can generally be performed as the issues develop.

Mitigating sloughing due to clean sandy layers within deep excavations can be difficult, depending on the ability to reach the clean sandy layers with equipment after the excavation is partially or fully complete. To reduce the risk of construction phase instability, we recommend that temporary excavations at this site more than 12 feet deep be sloped 1.5H:1V, or flatter, within the overburden deposits. The portions of temporary excavations that extend into the quartzite formation should be sloped 1H:1V, or flatter.

For project planning, we recommend it be assumed that the top of quartzite is 12 feet below the existing ground surface south of a line between Borings B4 and B5, and the top of quartzite slopes from 12 to 21 feet below the ground surface between Borings B1 and B6. At the 3MG tank, we recommend project planning assume the top of quartzite is 20 feet below the native ground surface. The native ground surface should be estimated based on surrounding topography where fill has been placed surrounding the two existing water tanks.

The quartzite at this site is expected to be rippable with a medium to large size excavator (CAT 320, or larger). It will be noted that hollow stem auger was advanced up to 42 feet into the quartzite during the subsurface investigations.

The materials at the bottom of the excavations for the 7MG tank are expected to be broken quartzite. The native materials at the foundation level for the 3MG tank will likely be quartzite;

however, there may be some areas where plastic silt (Boring B8) or other overburden soil is present at the bottom of the excavations.

Plastic fine grained soils left beneath foundations will be significantly more compressible than the quartzite formation. Consolidation of the plastic soils would result in differential settlement beneath the structure since minimal consolidation of the quartzite formation will occur. Where plastic soils are present at the foundation elevation, we recommend they be excavated and replaced with Structural Fill. The Geotechnical Engineer should be consulted if fine grained soils extend more than three feet below foundations.

We recommend that the bottom of the excavations be inspected by a representative of the Geotechnical Engineer prior to compaction of existing materials, placement of any fill, or placement of concrete to verify appropriate excavation of fine grained deposits and evaluate the quality of the quartzite. Although not expected in the quartzite formation, open joints or other features may require treatment to prevent migration of foundation soil particles, which would result in settlement.

We recommend that consideration be given to installing an underdrain beneath the tank foundations to monitor leakage. Constructing the underdrain could be performed by excavating 12 inches below the bottom of the floor slab, installing 6 inches of Structural Fill, then a non-woven geotextile fabric, then installing 6 inches of free draining gravel. 2-inch diameter perforated PVC pipes should be installed at about 15-foot spacing within the 6-inch thick free draining layer, and the perforated pipes should be connected to a solid collector pipe designed to carry the water to a discharge location. We recommend that the materials for the underdrain have the following properties:

Material	Recommended Properties
Structural Fill	• 3-inch minus granular soil • 70 – 100% passing ¾-inch sieve • 5 – 20% passing No. 200 sieve • Moisture conditioned ±2% from optimum moisture content • Placed in loose lifts ≤ 8 inches thick • Below foundations: Compacted to at least 95% of the maximum laboratory density determined by ASTM D1557 (Modified Proctor) • Adjacent to structures, but not below foundations: Compact to at least 90% of the maximum laboratory density
Geotextile Fabric	• Non-woven • Weight ≥ 8 oz/yd^2
Free Draining Gravel	• 1-inch minus rock • ≤ 5% passing No. 30 sieve • Placed in loose lifts ≤ 12 inches thick • Compacted with at least 3 passes of a vibratory compactor weighing at least 5 tons, or 5 passes of trench compactor weighing at least 1.5 tons

The quartzite at the bottom of excavations will likely break down to a gravelly soil. We recommend that the upper 8 inches of the quartzite at the bottom of excavations be scarified, moisture conditioned, and compacted to at least 95% of the maximum laboratory density determined by ASTM D1557.

The excavations should be backfilled with compacted Structural Fill, placed and compacted as shown in the table above. It is anticipated that the excavated quartzite, along with much of the granular overburden present at the site, will meet the requirements of Structural Fill. To ensure that compaction requirements are met, each lift should be tested. We recommend that at least one density test demonstrating compaction requirements are achieved be performed for each 2,500 ft^2 area of each lift. Testing should be performed in accordance with ASTM D6938 (nuclear method) or ASTM D1556 (sand cone method).

5 FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

5.1 FOUNDATION TYPES AND BEARING CAPACITIES

We recommend that foundations be located at least 30 inches below finished grade to provide frost protection and confinement of bearing soils. We also recommend that continuous footings be at least 2 feet wide and spot footings be at least 3 feet wide. We recommend that Type II or Type V cement be used for concrete at this site.

It is anticipated that the tank walls and roof will be supported using continuous and spot footings. The magnitude of the structural loads is not known as of the preparation of this report; however, it has been assumed that the column loads will not exceed 200 kips and that wall loads will not exceed 20 klf.

Assuming the foundation treatment described previously is performed, we recommend the following allowable bearing capacities:

Effective Footing Width, B' (ft)	Allowable Bearing Capacity (psf)
1.5	4,800
2	5,200
3	6,100
4	7,000
5	7,800

We recommend that a subgrade modulus of 150 pci be used for design at this site.

If the recommendations provided above are followed, we estimate that settlement of any foundation will not exceed one inch and differential settlement will not exceed L/480, which is equivalent to ½ inch over a distance of 20 feet. We consider this magnitude of settlement to be entirely satisfactory for the proposed structures. If desired for structural design, evaluations indicate that no more than ½ inch of total settlement and ¼ inch differential settlement will occur if the allowable bearing capacity is 5,000 psf for footings with effective widths of 4 feet to 6 feet, and 4,500 psf for effective widths of 8 to 10 feet. The allowable capacity for footings with effective widths of 2 and 3 feet is governed by shear, not settlement.

5.2 SEISMIC CONSIDERATIONS

Based on the results of field and laboratory tests, we have classified the site as Site Class C, as defined by ASCE 7-22 for seismic design. This site classification is consistent with the following description from ASCE7-22, "Softer and more highly fractured and weathered rock shall either be measured on site for shear wave velocity or classified as Site Class C."

The following multi-period spectrum has been calculated for seismic design at this site:

Multi-period response spectra based on ASCE 7-22

Period, T (s)	Design Sa (g)	MCE_R Sa (g)	Other Parameters	
0	0.5	0.75	Latitude	40.4839
0.01	0.5	0.75	Longitude	-111.8943
0.02	0.51	0.77	Site Class	C
0.03	0.56	0.84		
0.05	0.69	1.03	PGA_M	0.73
0.075	0.85	1.27		
0.1	0.97	1.45	S_S (g)	1.66
0.15	1.14	1.71		
0.2	1.24	1.86	S_1 (g)	0.55
0.25	1.23	1.85		
0.3	1.18	1.77	S_{MS} (g)	1.68
0.4	1.03	1.54		
0.5	0.9	1.35	S_{M1} (g)	0.77
0.75	0.68	1.02		
1	0.52	0.77	S_{DS} (g)	1.12

Multi-period response spectra based on ASCE 7-22

Period, T (s)	Design Sa (g)	MCE_R Sa (g)	Other Parameters	
1.5	0.32	0.48		
2	0.23	0.34	S_{D1} (g)	0.52
3	0.13	0.2		
4	0.087	0.13	T_L (s)	8
5	0.062	0.093		
7.5	0.03	0.044		
10	0.018	0.028		

The allowable soil bearing pressures recommended in Section 5.1 may be increased by one-third where seismic forces are included in the structural loads. If the frictional resistance of the foundations is used to resist seismic forces, we recommend a coefficient of friction of 0.45 be used to calculate the sliding resistance. See Section 5.3 below for recommendations related to resistance provided by passive earth pressures.

Since the static groundwater level is below 40 feet and the tanks will be supported on dense granular soils or bedrock, problems associated with liquefaction or lateral spread during a seismic event are unlikely at this site, and no special mitigation of these geologic hazards is required.

5.3 LATERAL EARTH PRESSURES

It is anticipated that the tanks will be partially or fully buried, which will result in lateral earth pressure against the tank walls. We are not aware of other planned earth retaining structures at this site. We recommend that the earth pressures be calculated using the following equation, along with the earth pressure coefficient outlined below:

$$P = \tfrac{1}{2}\, \gamma\, K\, H^2$$

Where P = total lateral force on wall, plf
K = earth pressure coefficient
γ = unit weight of soil (125 pcf)
H = height of retained soil against wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move during backfilling operations and the backfill material is granular soil, we recommend an active earth pressure coefficient of 0.28 be used in the above equation to calculate the lateral earth pressures. If the walls are restrained from any movement during backfilling (which

will likely be the case for the tank walls under static conditions) and the backfill material is granular soil, we recommend an at-rest earth pressure coefficient of 0.45 be used to calculate the lateral earth pressure. We recommend a passive earth pressure coefficient of 3.5 be used where the granular soil is used to restrain lateral movement.

The additional active earth pressure due to ground acceleration equal to two thirds of the MCE may be estimated using a coefficient of 0.31. The seismic ground motion will reduce the available passive resistance. This reduction may be accounted for as an earth pressure acting in the direction opposite the passive resistance, and computed using a coefficient of 0.8. The pressure diagrams for these forces may be roughly approximated as inverted triangles, such that the resultant forces of the seismic components act at heights of approximately 2H/3 above the base of the wall.

It should be recognized that the pressures calculated by the above equation are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

6 LIMITATIONS

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation.

It is recommended that a soils engineer observe the foundation excavations prior to placement of fill or footings. If, during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

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FIGURES

RB&G ENGINEERING, INC.

Figure 1 VICINITY MAP

The Point - Water Tanks

Draper, Salt Lake County, Utah

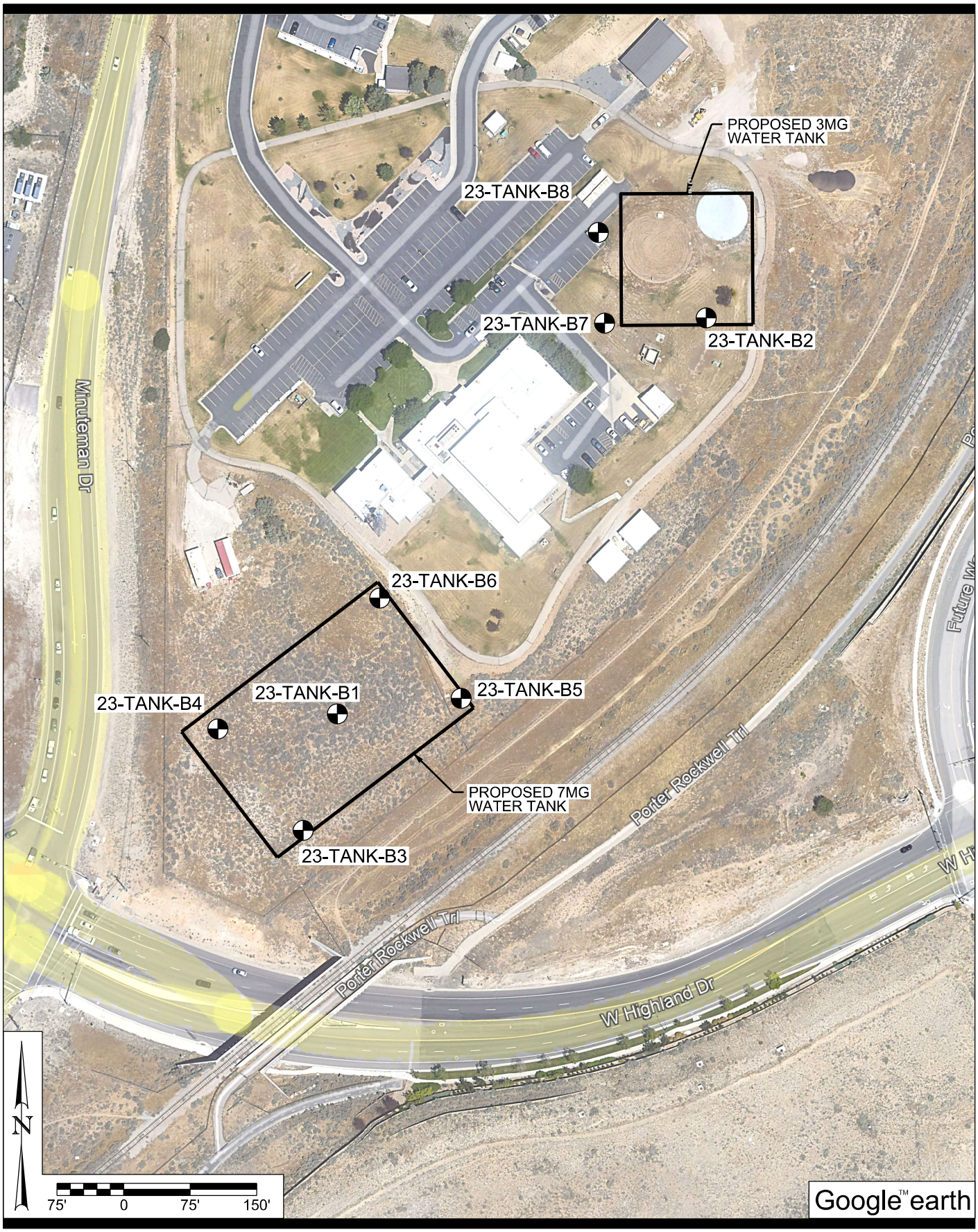

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Figure 2 SITE PLAN & TEST HOLE LOCATIONS

The Point - Water Tanks

Draper, Salt Lake County, Utah

APPENDIX

FIELD AND LABORATORY TESTING PROCEDURES

The subsurface investigation was performed using CME 55 and 75 rotary drill rigs. Borings were drilled with a tri-cone rock bit and HW casing, or with hollow stem auger. Water was used as the drilling fluid when drilling with a rock bit and casing.

Sampling was performed at three- to five-foot intervals within the depths investigated. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a height of 30 inches. The number of blows required to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of the cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with reasonable sample recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material.

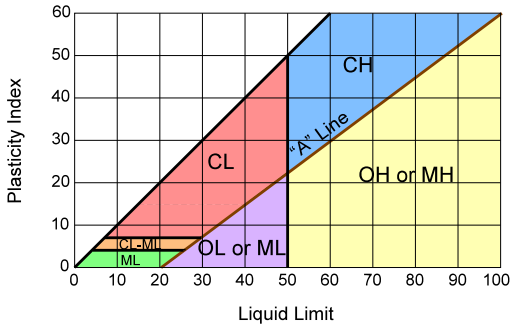
It will be noted that the sampling spoon was not driven through the full 18 inches at some sampling locations to the excessive number of blows required to advance the spoon. Where the sampling tube was not be driven through the full 18 inches, the number of blows required to drive the spoon through a given depth of penetration is shown on the boring log.

Continuous rock cores were obtained within bedrock deposits. The characteristics of the rock, including percent of core recovered and Rock Quality Designation (RQD) were logged in the field by an experienced engineer or geologist during the investigations. The RQD is the percentage of the length of a core run with intact rock pieces that are at least 4 inches long.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the boring logs. A description of the Unified Soil Classification System is presented in the appendix, and the meaning of the various symbols, shown on the logs, can be obtained from this figure.

Laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site included natural moisture content, Atterberg Limits, sieve analyses, pH, resistivity, chloride, and sulfate tests. Testing was performed following procedures outlined in the American Society for Testing and Materials (ASTM) standards.

Unified Soil Classification System

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
COARSE-GRAINED SOILS *more than half of material is larger than No. 200 sieve*	**Gravels** *more than half of coarse fraction is larger than No. 4 sieve size*	**Clean Gravels** *little or no fines*	**GW**		Well graded gravels, gravel-sand mixtures, little or no fines	*For laboratory classification of coarse-grained soils* Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fines (*fraction smaller than No. 200 sieve size*), coarse-grained soils are classified as follows: **Less than 5%** GW, GP, SW, SP **More than 12%** GM, GC, SM, SC **5% to 12%** Borderline cases requiring use of dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels With Fines *appreciable amount of fines*	**GM***	**d**	Silty gravels, poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				u				
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
	Sands *more than half of coarse fraction is smaller than No. 4 sieve size*	**Clean Sands** *little or no fines*	**SW**		Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with Fines *appreciable amount of fines*	**SM***	**d**	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
				u				
			SC		Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
FINE-GRAINED SOILS *more than half of material is smaller than No. 200 sieve*	**Silts and Clays** *liquid limit is less than 50*		**ML**		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	*For laboratory classification of fine-grained soils*  Plasticity Chart		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silt-clays of low plasticity			
	Silts and Clays *liquid limit is greater than 50*		**MH**		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
HIGHLY ORGANIC SOILS			**Pt**		Peat and other highly organic soils			

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay biner.)

DRILL HOLE LOG

BORING NO. 23-TANK-B1

SHEET 1 OF 1

PROJECT: THE POINT - WATER TANKS

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.482960° N, LONG: 111.895407° W

DATE STARTED: 6/7/23

DRILLING METHOD: 20-CME-55 / HW CASING TO 8.5', MUD ROTARY

DATE COMPLETED: 6/8/23

DRILLER: S.W., C.J.

GROUND ELEVATION: ~4259'

DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ 56.5' 6/27/23

LOGGED BY: J.N., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				18	6,7,4,(24)	SM	brown, sl. moist, med. dense — SILTY SAND W/GRAVEL, slightlyt plastic fines, organics								
4255	5			14	2,1,2,(7)	SP-SM (*A-1-b(0)*)	brown, moist, loose — SAND W/SILT, trace gravels		14.9		NP	10	79	11	
				14	2,4,11,(32)	SP-SM	brown, moist, dense								
4250	10			14	8,13,27,(71)	SP-SM (*A-1-b(0)*)	brown, moist, very dense — SAND W/SILT & GRAVEL		12.9		NP	18	73	9	Chem.
				0	50/3"	-	no recovery								
4245	15			0	50/3"	-	no recovery								
				0	70/4"	-	no recovery								
4240	20			6	130/6"	-	lt. brown, moist								
4235	25			3	80/3"	-	lt. brown, moist								
				2	50/2"	-	lt. brown, moist								
4230	30			0	50/1"	-	no recovery								
4225	35			2	60/2"	-	lt. brown, very moist — QUARTZITE, very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon								
4220	40			2	60/2"	-	lt. brown, very moist								
4215	45			1	60/1"	-	lt. brown, very moist								
4210	50			2	80/2"	-	gray, moist								
4205	55			0	70/2"	-	no recovery								
4200	60			1	60/2"	-	gray, moist								
4195	65			3	100/3"	-	gray, moist								
							BOTTOM OF HOLE								
4190															

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample
- Thin-Walled Tube Sample
- 2,3,2,(6) ← Blow Count per 6"
- $(N_1)_{60}$ Value
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)
- With Liners
- Pushed
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B2

PROJECT: THE POINT - WATER TANKS

SHEET 1 OF 1

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.484161° N, LONG: 111.893936° W

DATE STARTED: 6/8/23

DRILLING METHOD: 20-CME-55 / HW CASING TO 13.5', MUD ROTARY

DATE COMPLETED: 6/8/23

DRILLER: S.W., C.J.

GROUND ELEVATION: ~4253'

DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: J.N., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				14	4,6,8,(31)	SM	brown, moist, dense	SILTY SAND slightly plastic fines, organics, trace gravels								
4250				12	2,4,7,(26)	SP (*A-1-b(0)*)	brown, moist, med. dense			12.8		NP	23	73	4	
	5							SAND W/GRAVEL								
				13	6,9,9,(36)	SP	brown, moist, dense									
4245																
	10			13	7,9,10,(32)	ML (*A-4(0)*)	brown, moist, dense	SANDY SILT frequent sand pockets		22.7		NP	1	34	65	
4240				13	10,20,23,(67)	SM	lt. brown, moist, very dense	SILTY SAND W/GRAVEL								
	15			9	15,50/4"	SM -	lt. brown, moist, very dense lt. brown, moist	SILTY SAND								
4235				2	50/2"	-	lt. brown, moist									
	20			0	50/2"	-	no recovery	QUARTZITE very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon								
4230				0	55/2"	-	no recovery									
	25			0	60/2"	-	no recovery									
4225								BOTTOM OF HOLE								

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon

Split Spoon Sample: 2,3,2,(6) ← Blow Count per 6"; $(N_1)_{60}$ Value

* *T 0.45* ← Torvane (tsf); *PP 2.0* ← Pocket Penetrometer (tsf); With Liners

Thin-Walled Tube Sample: Pushed; *T 0.45* ← Torvane (tsf); *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B3

PROJECT: THE POINT - WATER TANKS

SHEET 1 OF 1

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.482606° N, LONG: 111.895541° W

DATE STARTED: 6/22/23

DRILLING METHOD: CME-75 / HOLLOW STEM AUGER

DATE COMPLETED: 6/22/23

DRILLER: DAVIS DRILLING

GROUND ELEVATION: ~4265'

DEPTH TO WATER - INITIAL: ▽ DRY'

AFTER 24 HOURS: ▼ N.M.

LOGGED BY: C.S., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				15	*PP 4.5* 4,9,10,(42)	CL SP-SM	lt. brown, dry LEAN CLAY brown, sl. moist, dense								
							SAND W/SILT								
4260	5			14	5,5,9,(32)	SP-SM (*A-1-a(0)*)	brown, moist, dense		2.9		NP	23	65	12	
4255	10			3	50/5"	-	brown, moist								
4250	15			2	50/3"	-	brown, moist								
4245	20			5	50/5"	-	brown, moist								
4240	25			3	50/3"	-	brown, moist								
4235	30			3	50/3"	-	QUARTZITE very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon yellow-brown, moist								
4230	35			2	50/3"	-	yellow-brown, moist								
4225	40			2	50/3"	-	yellow-brown, moist								
4220	45			2	50/2"	-	yellow-brown, moist								
						-	yellow-brown, moist								
4215	50			2	50/2"		BOTTOM OF HOLE								

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample
- Thin-Walled Tube Sample
- 2,3,2,(6) ← Blow Count per 6"
- $(N_1)_{60}$ Value
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)
- With Liners
- Pushed
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B4

PROJECT: THE POINT - WATER TANKS

SHEET 1 OF 1

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.482914° N, LONG: 111.895882° W

DATE STARTED: 6/22/23

DRILLING METHOD: CME-75 / HOLLOW STEM AUGER

DATE COMPLETED: 6/22/23

DRILLER: DAVIS DRILLING

GROUND ELEVATION: ~4254'

DEPTH TO WATER - INITIAL: ▽ DRY'

AFTER 24 HOURS: ▼ N.M.

LOGGED BY: C.S., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				12	*PP >4.5* 3,3,4,(15)	CL-ML SC-SM (*A-4(0)*)	brown, dry brown, sl. moist, med. dense SILTY CLAY W/SAND organics SILTY CLAYEY SAND		6.3	24	6	3	57	40	
4250	5			4	6,10,9,(44)	GP-GM	brown, moist, med. dense GRAVEL W/SILT & SAND thin cemented layers								
4245	10			9	11,18,50/2"	-	brown, moist		3.7		NP	16	71	13	
4240	15			1	50/2"	-	brown, moist								
4235	20			2	50/3"	-	brown-yellow, moist								
				2	50/3"	-	brown-yellow, moist								
4230	25			2	50/3"	-	brown-yellow, moist								
4225	30			3	50/3"	-	lt. brown, moist QUARTZITE very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon								
4220	35			1	50/2"	-	lt. brown, moist								
4215	40			4	50/5"	-	yellow-brown, moist								
4210	45			0	50/1"	-	no recovery								
4205	50			2	50/4"	-	lt. brown, moist								
4200							BOTTOM OF HOLE								

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample
- Thin-Walled Tube Sample
- 2,3,2,(6) ← Blow Count per 6"
- $(N_1)_{60}$ Value
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)
- With Liners
- Pushed
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B5

PROJECT: THE POINT - WATER TANKS

SHEET 1 OF 1

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.483007° N, LONG: 111.894913° W

DATE STARTED: 6/27/23

DRILLING METHOD: CME-75 / HOLLOW STEM AUGER

DATE COMPLETED: 6/27/23

DRILLER: DAVIS DRILLING

GROUND ELEVATION: ~4261'

DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4260															
				16	5,10,10,(44)	SM (*A-1-b(0)*)	brown, dry, dense — SILTY SAND organics in top 3"		2.1		NP	5	78	17	
	5														
4255				11	4,6,9,(35)	SM	lt. brown, sl. moist, dense — SILTY SAND W/GRAVEL								
	10			6	43,50/2"	-	lt. brown, dry		2.5		NP	32	55	13	
4250															
	15			3	50/3"	-	lt. brown, dry								
4245															
	20			3	50/3"	-	lt. brown, dry								
4240															
	25			5	50/6"	-	yellow, dry								
4235							QUARTZITE very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon								
	30			3	50/3"	-	lt. brown-yellow, dry								
4230															
	35			3	50/3"	-	lt. brown-yellow, dry								
4225															
	40			3	50/3"	-	lt. brown-yellow, dry								
4220															
	45			4	50/4"	-	yellow, dry								
4215															
	50			0	50/1"	-	no recovery								
4210							BOTTOM OF HOLE								

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon

Split Spoon Sample: 2,3,2,(6) ← Blow Count per 6"; $(N_1)_{60}$ Value

T 0.45 ← Torvane (tsf)

PP 2.0 ← Pocket Penetrometer (tsf)

With Liners

Thin-Walled Tube Sample — Pushed

T 0.45 ← Torvane (tsf)

PP 2.0 ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B6

SHEET 1 OF 1

PROJECT: THE POINT - WATER TANKS

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.483310° N, LONG: 111.895236° W

DATE STARTED: 6/27/23

DRILLING METHOD: 08-CME-55 / HWT CASING TO 20', HQ CORE

DATE COMPLETED: 6/28/23

DRILLER: T.K., N.M.

GROUND ELEVATION: ~4254'

DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: C.P., M.N.H, J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				11	7,10,15,(55)	CL-ML (*A-4(1)*)	gray, dry, very dense — SILTY CLAY W/SAND		6.5	21	4	2	19	79	
4250	5			16	3,5,7,(26)	SP-SM	brown, moist, med. dense — SAND W/SILT, clay ball at 6'								
4245	10			16	8,14,18,(51)	SP-SM (*A-1-b(0)*)	lt. brown, moist, very dense — SAND W/SILT, trace gravels		13.3		NP	11	79	10	
4240	15			11	21,30,50/4"	SP-SM	lt. brown, moist, very dense — SAND W/SILT & GRAVEL, possible cobbles, boulders								
4235	20			2	50/2"	GP-GM	yellow, moist, very dense — GRAVEL W/SILT & SAND, possible cobbles, boulders								
				12	Core *25,0*	-	brown-yellow, moist								
4230	25			16	Core *27,0*	-	yellow-brown, moist — QUARTZITE, very highly fractured & broken								
4225	30			4	50/4"	-	yellow-brown, moist								Chem.
				0	Core *0,0*	-	no recovery								
4220	35			2	50/2"	-	yellow-brown, moist								
							BOTTOM OF HOLE								
4215															

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample
- Core
- Thin-Walled Tube Sample

2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value

T 0.45 ← Torvane (tsf)

PP 2.0 ← Pocket Penetrometer (tsf)

Core 95,60 ← With Liners / Percent Recovery, R.Q.D.

Pushed *T 0.45* ← Torvane (tsf)

PP 2.0 ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B7

SHEET 1 OF 1

PROJECT: THE POINT - WATER TANKS

CLIENT: HORROCKS ENGINEERS

PROJECT NUMBER: 202201-026-2

LOCATION: LAT: 40.484145° N, LONG: 111.894340° W

DATE STARTED: 6/28/23

DRILLING METHOD: 08-CME-55 / HWT CASING TO 21', HQ CORE

DATE COMPLETED: 6/28/23

DRILLER: T.K., N.M.

GROUND ELEVATION: ~4253'

DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

LOGGED BY: C.P., M.N.H, J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4250	0			17	5,14,8,(49)	SC-SM	brown, sl. moist, dense SILTY CLAYEY SAND								
	5			15	6,9,14,(50)	ML (A-4(2))	brown to gray, wet, very stiff SILT W/SAND		26.6	26	4	0	17	83	
4245															
	10			17	7,10,24,(55)	ML SM	gray-yellow, wet red-brown, moist, very dense								
4240							SILTY SAND								
	15			14	11,19,23,(61)	SM (A-2-4(0))	white to lt. brown, moist, very dense		20.7		NP	5	79	16	
4235							SILTY SAND W/GRAVEL possible cobbles, boulders								
	20			1	50/3"	SM	white to lt. brown, moist, very dense								
4230				0	Core 0,0	-	no recovery								
	25			2	50/2"	-	gray, moist								
4225				18	Core 30,0	-	brown-gray, moist QUARTZITE very highly fractured & broken								Chem.
	30			2	50/4"	-	brown-gray, moist								
4220				0	Core 0,0	-	no recovery								
	35			1	50/1"	-	yellow, moist								
4215							BOTTOM OF HOLE								

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample
- Core
- Thin-Walled Tube Sample
- 2,3,2,(6) ← Blow Count per 6"
- $(N_1)_{60}$ Value
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)
- With Liners
- 95,60 ← Percent Recovery, R.Q.D.
- Pushed
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

DRILL HOLE LOG

BORING NO. 23-TANK-B8

SHEET 1 OF 1

PROJECT: THE POINT - WATER TANKS

CLIENT: HORROCKS ENGINEERS

LOCATION: LAT: 40.484419° N, LONG: 111.894365° W

DRILLING METHOD: CME-75 / HOLLOW STEM AUGER

DRILLER: DAVIS DRILLING

DEPTH TO WATER - INITIAL: ▽ 47.9' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 202201-026-2

DATE STARTED: 6/27/23

DATE COMPLETED: 6/27/23

GROUND ELEVATION: ~4252'

LOGGED BY: C.P., J.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4250	0														
				17	3,5,7,(26)	SC-SM	brown, sl. moist, med. dense — SILTY CLAYEY SAND; organics in top 6"								
	5			18	6,6,9,(35) *T 0.55*	SP-SM	brown, moist, dense — SAND W/SILT								
4245						CL-ML	gray, moist, stiff — SILTY CLAY W/SAND								
	10			18	3,7,7,(24) *T 0.65*	ML (*A-4(1)*)	gray to brown, sl. moist, stiff — SILT; plastic, sand lenses, trace sand		25.2	26	2	0	12	88	
4240															
	15			18	4,8,13,(30)	ML	lt. brown-gray, moist, very stiff								
4235															
	20			9	16,50/3"	-	lt. brown-gray, moist		8.9		NP	15	73	12	
4230															
	25			5	50/5"	-	yellow, sl. moist								
4225															
	30			3	50/3"	-	yellow-white, sl. moist								
4220															
	35			2	50/2"	-	lt. brown, dry — QUARTZITE; very highly fractured & broken, breaks to sand & gravel sizes when sampled with split spoon								
4215															
	40			5	50/5"	-	lt. brown, dry								
4210															
	45			3	50/3"	-	lt. brown, wet								
4205															
	50			2	50/2"	-	lt. brown, wet — BOTTOM OF HOLE								
4200															

DH_LOG_V8-2014-1 THE_POINT_WATERTANKS.GPJ US EVAL.GDT 9/29/23

RB&G ENGINEERING, INC.

LEGEND:

- 2" OD Split Spoon (SPT)
- 2.5" OD Split Spoon
- 3" OD Split Spoon
- Split Spoon Sample: 2,3,2,(6) ← Blow Count per 6"; $(N_1)_{60}$ Value
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)
- With Liners
- Thin-Walled Tube Sample: Pushed
- *T 0.45* ← Torvane (tsf)
- *PP 2.0* ← Pocket Penetrometer (tsf)

OTHER TESTS

UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
Chem. = pH, Resistivity, Sulfate, Chloride, Soluble Salts
Hyd. = Hydrometer
DC = Dispersive Clay

Laboratory Testing

RB&G ENGINEERING, INC.

Table 1

SUMMARY OF TEST DATA

PROJECT: The Point - Water Tanks
PROJECT NO.: 202201-026-2
LOCATION: see site plan
FEATURE: Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	IN-PLACE		UNCONFINED OR UU TRIAXIAL COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			PERCENT FINER THAN 0.005 mm	UNIFIED SOIL CLASSIFICATION SYSTEM / (AASHTO CLASSIFICATION)
		DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY		
OVERBURDEN SAMPLES												
	9-10.5		22.7				NP	1	34	65		ML (A-4 (0))
23-TANK-B6	0-1.5		6.5		21	17	4	2	19	79		CL-ML (A-4 (1))
23-TANK-B7	5-6.5		26.6		26	22	4	0	17	83		ML (A-4 (2))
23-TANK-B8	10-11.5		25.2		26	24	2	0	12	88		ML (A-4 (1))
		pH	Resistivity (ohm-cm)	Chloride (mg/kg-dry)	Sulfate (mg/kg-dry)							
23-TANK-B2	6 - 7.5	9.2	3050	<11	<11							
PULVERIZED QUARTZITE SAMPLES												
23-TANK-B4	10-11.5		3.7				NP	16	71	13		
23-TANK-B5	10-11.5		2.5				NP	32	55	13		
23-TANK-B8	20-21.5		8.9				NP	15	73	12		
		pH	Resistivity	Chloride (mg/kg-dry)	Sulfate (mg/kg-dry)							
23-TANK-B6	30-30.3	9.2	3500	33	31							
23-TANK-B7	26-27	9.5	800	160	29							

NP=Non-Plastic

The Point
Storage Reservoir Report

Final for Construction Submittal

Horrocks.

Horrocks.

THE POINT REDEVELOPMENT PROJECT STORAGE RESERVOIR REPORT

January 2024

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BACKGROUND INFORMATION

The Point Redevelopment Project (The Point) is a proposed mixed-use community in Draper, Utah. The community will be located at the former site of the Utah State Prison, just north of Point of the Mountain. This planned community will include housing, office space, retail, and industrial properties. The community, which encompasses approximately 606 acres (see Figure 1), will be supported by new roadways, utilities, and transit infrastructure. It is bordered by I-15 on the east and UPRR/UTA railroad lines on the west, by 14600 South on the south, and Bangerter Highway and commercial development on the north. The site slopes from east to west. Historically, there were several clusters of buildings along the north, east, and south of the property enclosed with tall, wired fencing, associated with the prison facilities. The majority of the property in the center and western edges of the project area are open fields. Demolition on the site was completed in October 2023 leaving the prison chapel among the open space. This proposed development will require a substantial amount of water to serve the future residents and municipal needs. This report will analyze the water storage demand for The Point.

EXISTING WATER STORAGE

The old prison site was served by a water connection from Jordan Valley Water Conservancy District (JVWCD). This water system was constructed in the 1950's, when there were less regulations then are required today. The old prison site was not connected to Draper City's system and had very little storage available. The Utah Division of Facilities Construction and Management (DFCM) owns property east of The Point site across I-15. DFCM owns the (2) existing reservoirs that are located on that property referred to as Fred House Academy's West and East Concrete Reservoirs, see Figure 1. Horrocks performed reservoir inspections to verify if they could be repurposed to supply culinary water for The Point.

EXISTING RESERVOIR INSPECTIONS

Reservoir inspections were performed in February 2023 on both existing reservoirs. Summaries are included in this section of the report. The reservoir inspection reports can be found in Appendix A. The Fred House Academy West Concrete Reservoir, with a capacity of 400,000 gallons, was constructed in the 1950s to serve the prison area. The Fred House Academy East Concrete Reservoir, with a capacity of 200,000 gallons, was built in the 1930s. It has not been in operation for an extended time. Because of the location and condition of these reservoirs, they are not suitable to provide fire protection or culinary distribution to the development.

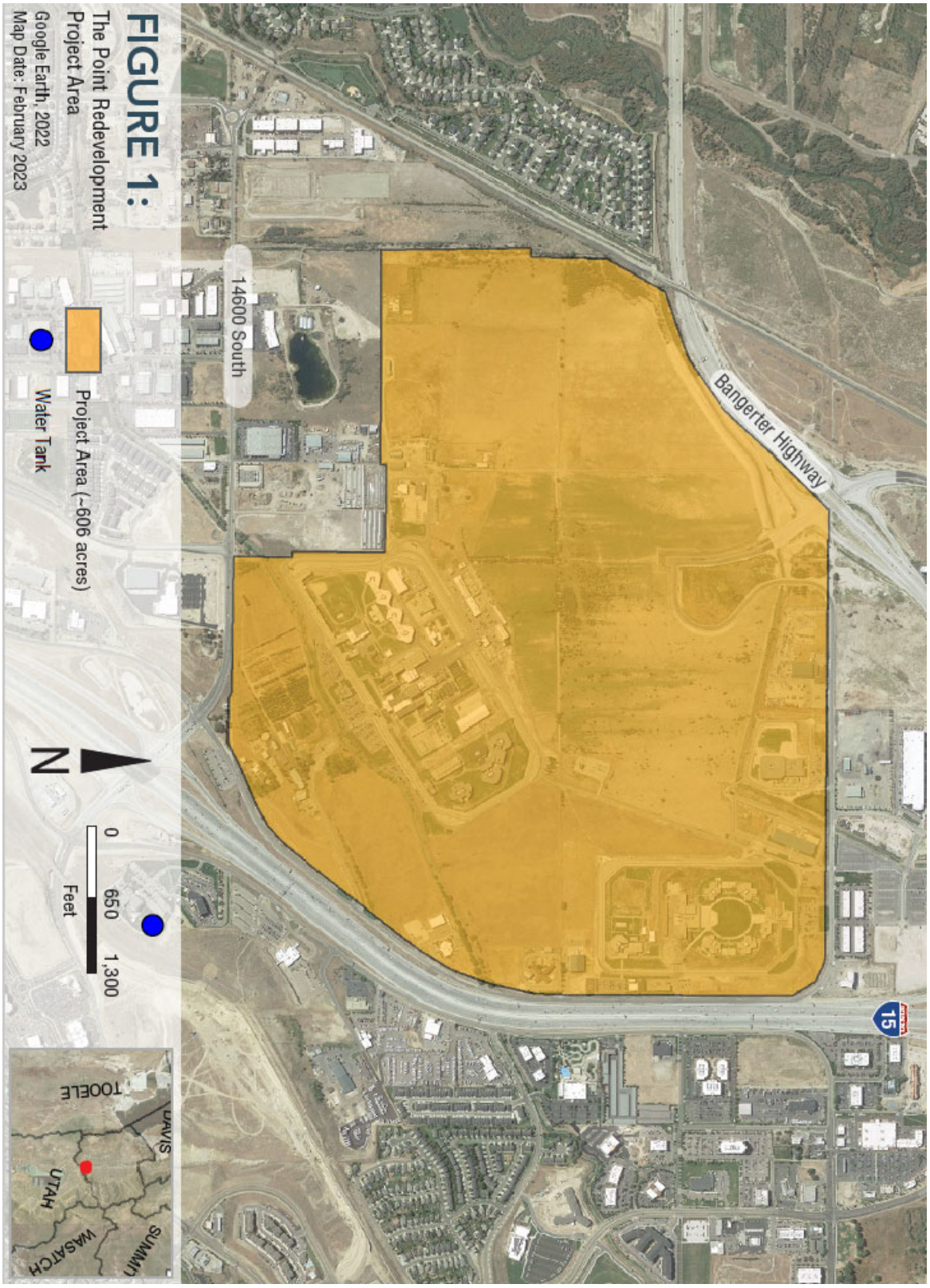

Figure 1: The Point Area Map

RESERVOIR #1 - FRED HOUSE ACADEMY WEST CONCRETE RESERVOIR INSPECTION

- Capacity – 400,000 gallons
- Diameter – 76 feet
- Height – 13.5 feet
- Construction Year – 1950s

Summary

Overall the reservoir was in good condition. As defined in the report, a condition of "good" indicated there were minor deficiencies noted and that the facility is functioning as designed. Minor repairs and ongoing maintenance are necessary to keep this facility functioning as intended. It is not too many years away from requiring more significant repairs.

Mechanical

The interior piping is functioning properly but showing signs of corrosion at the joints and bolted connections. This is the same for the inlet, outlet, overflow, and drain. The valves are corroding at the bolts on the bonnets and valve stems. The ladder is in good condition but requires a new coating.

Structural

The bottom slab appears to be in relatively good condition with no signs of new major cracks, spalling, or leakage. The columns appear to be in relatively good condition, with no new major cracks. Previously patched/wrapped cracks in the columns were observed, and the cracks appear not to have moved since the repairs took place. The walls are in relatively good condition with no new major cracking or spalling identified. Some rock pockets and minimal honeycombing locations were observed; however, the deficiencies have likely existed for the majority of the service life of the reservoir from the time of construction. The top slab is in relatively good condition. However, there are multiple locations with exposed and corroded rebar from spalling of the concrete or repair patch material. Some locations of spalling appeared to have been patched previously since in many of the locations, the spalled patch material could be found in chunks directly below the exposed rebar. All locations of exposed rebar were in the slab, rather than in the drop caps at the top of the columns. No new cracks in the slab were observed. The ladder at the main entrance is in good condition, however, multiple rungs have corroded such that the paint has delaminated and/or is flaking off.

The joint between the roof slab appears to be in fair working condition. The walls at the joint appear to have experienced multiple cracks around the entire circumference which have previously been patched and the sealant appears to have held with no new leakage observed. There was spalling observed at multiple locations around the circumference, however, it is unclear whether the spalling occurred recently or early in the service life of the reservoir. No new leakage was observed.

RESERVOIR #2 - FRED HOUSE ACADEMY EAST CONCRETE RESERVOIR INSPECTION

- Capacity – 200,000 gallons
- Diameter – 54 feet
- Height – 13.5 feet
- Construction Year – 1930s

Summary

Overall the reservoir was in fair condition. As defined in the report, a condition of "fair" indicated there were major deficiencies noted and that the item is in need of repairs to continue functioning as designed. Major structural and mechanical piping repairs would be necessary in order to place this facility back in service.

Mechanical

The piping would need to be replaced to place the reservoir back in service. This would include the inlet, outlet, drain, and overflow piping. Additional safety measures for reservoir access would have to be installed for safe ingress and egress. This would include larger access manways or hatches and ladder-ups. New telemetry conduit and equipment would be required. Upgraded air vents would also be required.

Structural

The bottom slab, walls, and ladder appear to be in relatively good condition with no signs or major cracks or leakage. The top slab columns are also in relatively good condition with no major cracking or spalling identified. Some rock pockets and non-uniform column sections were seen; however, the deficiencies have likely existed for the full life of the reservoir due to construction errors. The top slab is in poor condition. There are many locations with exposed and rusting rebar. Similar to the findings in a 2016 inspection, performed by Infinity Corrosion, the spalled concrete from the top slab were found in chunks on the floor slab. Chunks of spalled concrete were identified as falling from the column drop panels as well. In addition, a vast area of the roof slab shows signs of patchwork with some of the patching spalled, but not yet fallen to the floor. Long cracks were seen, and several translate almost completely across the top slab. The joint between the roof slab and the walls is leaking in many locations and the sealant appears to be failing around the majority of the reservoir. The general poor quality of this reservoir is likely due to age and lack of maintenance. It was last used a number of years ago.

WATER SYSTEM MINIMUM SIZING REQUIREMENTS AND RESULTS

In order to determine The Point's needs for a storage facility, Horrocks performed a minimum sizing analysis for the water system based on the State of Utah Division of Drinking Water's R309-510 requirements. These are to be used in the design of new systems and in the evaluation of water source, storage facility, and pipeline capacities. The system will be a stand-alone water system and will not be integrated into Draper's culinary water system. A secondary water system will be constructed so outdoor use is not included in the demand calculations. The Point's August 2023 Framework Plan and Land Use Program and Statistical Summary dated September 2023 was used to provide the projected land use characteristics for Phase 1 and build-out as well as using Utah State standards for typical water usage.

WATER DEMAND REQUIREMENTS AND RESULTS

Water demands were established for the system using the requirements in R309-510-7. The total base demand was calculated to be 15,748 ERCs (4,378 GPM) at build-out, which includes commercial demands which were converted to ERCs. Phase 1 demands were determined using multipliers based upon the base demand. It is estimated that the peak instantaneous demand for the system at build-out is 24.94 million gallons per day (MGD) and 6.47 for Phase 1. See Hydraulic Model Report in Appendix B for details on the analysis.

STORAGE CAPACITY REQUIREMENTS AND RESULTS

- Water storage requirements for The Point are governed by the minimum requirements dictated by the State of Utah Division of Drinking Water in R309-510-8, as well as the International Fire Code. The requirements are listed below: Equalization Storage - 400 gallons of storage per indoor equivalent residential connection (ERC),
- Fire Suppression Storage – 4,000 gpm x 4 hours
  The proposed Project will consist of commercial and residential use. Some of the proposed commercial sites will consist of high-rise buildings. Due to the nature of the commercial development, fire flow demand will need to be higher than the typical fire flow requirements. Fire flow was determined to be 4,000 GPM maintained for four hours.
- Emergency Storage - Requirement amount is based on an assessment of risk and the degree of the system's dependability to meet the minimum requirements.

To meet the minimum requirements listed above, 8 million gallons of storage will be required at build-out as detailed below.

- Equalization Storage - 14,000 ERC's (Res., Comm., Edu., Ent., Shopping, Hotels, ect) x 400 gallons = 5,600,000 gallons

- Fire Suppression Storage – 4,000 gpm x 4 hours = 960,000 gallons
- Emergency Storage – 1,440,000 gallons, provides 4 hours of service at build-out if something were to happen to the supply line
- Total Required Storage – 8,000,000 gallons

Draper City has requested an additional 2 million gallons of storage for a total of 10 million gallons.

DISTRIBUTION SYSTEM SIZING RESULTS

A hydraulic water model using WaterGEMS was prepared to determine pipe sizing for the culinary water system. Two models were prepared to account for project phasing. One model shows Phase 1 scenarios while the second models the entire system. Both models resulted in three outputs for base, peak day w/fire flow, and peak instantaneous demand scenarios. For the purposes of the hydraulic model, one 10 MG water reservoir (as determined above) was considered and the base and peak instantaneous demands of 4,378 GPM and 17,323 GPM, respectively were used. It was designed to provide a peak flow of 24.94 million gallons per day (MGD). See Hydraulic Model Report in Appendix B for details on the analysis.

The results of the models show that the full storage capacity of 10 MG is not needed for Phase 1. Therefore, the water storage capacity was split into two reservoir, a 3 MG and 7 MG. Construction of the 3 MG reservoir will be built as part of Phase 1. The 7 MG reservoir will be built according to increases in demand as the site is developed. The two water storage reservoirs will be constructed southeast of I-15. Because the proposed reservoirs are considered the only source of water for the system, real world results may vary depending on data relevant to the connection points that tie The Point into the existing municipal water system. Site conditions are favorable for this system. Since the site slopes downhill to the northwest, system pressures will be the highest at points furthest away from the storage reservoirs.

For the distribution system, the pipe sizing is based on full build-out. However, Phase 1 will only be including the piping needed for that phase. The 3 MG reservoir will connect to a new 30-inch transmission line to be bored under I-15 to the site. This transmission line will connect to the onsite distribution system in South Loop Road. Figure 2 shows the proposed transmission line and distribution system for Phase 1 (backbone) and build-out. This transmission and distribution system will be a stand-alone water system and will not be integrated into Draper's culinary water system. Pipe material was determined based on pipe sizing. The 8- and 12-inch pipes were modeled as PVC and the 18-, 24- and 30-inch pipes were modeled as ductile iron. See Hydraulic Model Report in Appendix B for details on the analysis.

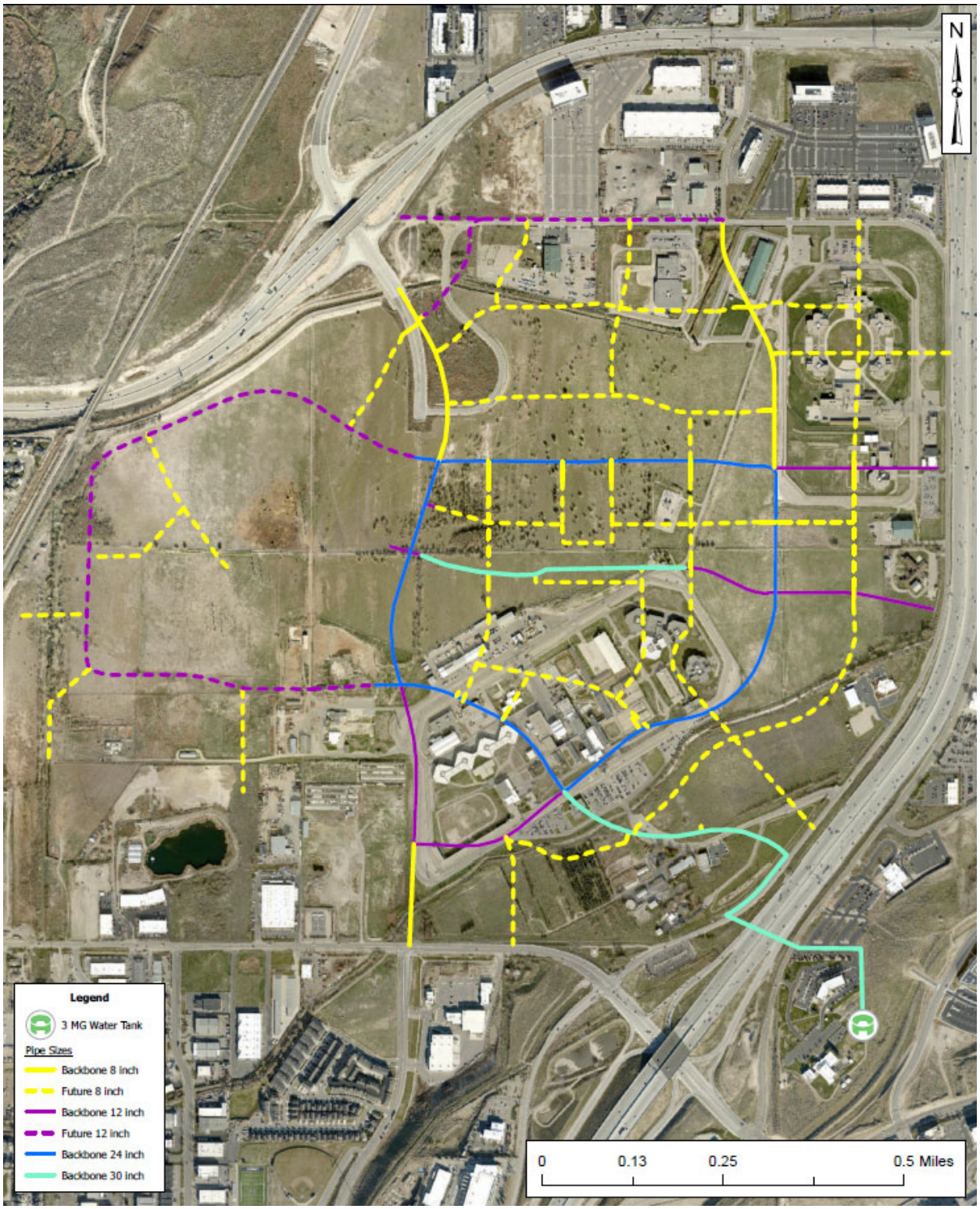

Figure 2: Proposed Culinary Water System Layout

RESERVOIR LOCATIONS

It is proposed that the reservoirs be located on the DFCM property east of I-15. This location is at the correct elevation to serve the site. By locating the reservoirs on this property, it will also save money as additional property will not need to be purchased. Figure 3 shows the 3 MG reservoir site layout. The future 7 MG reservoir would be located south in the storage area.

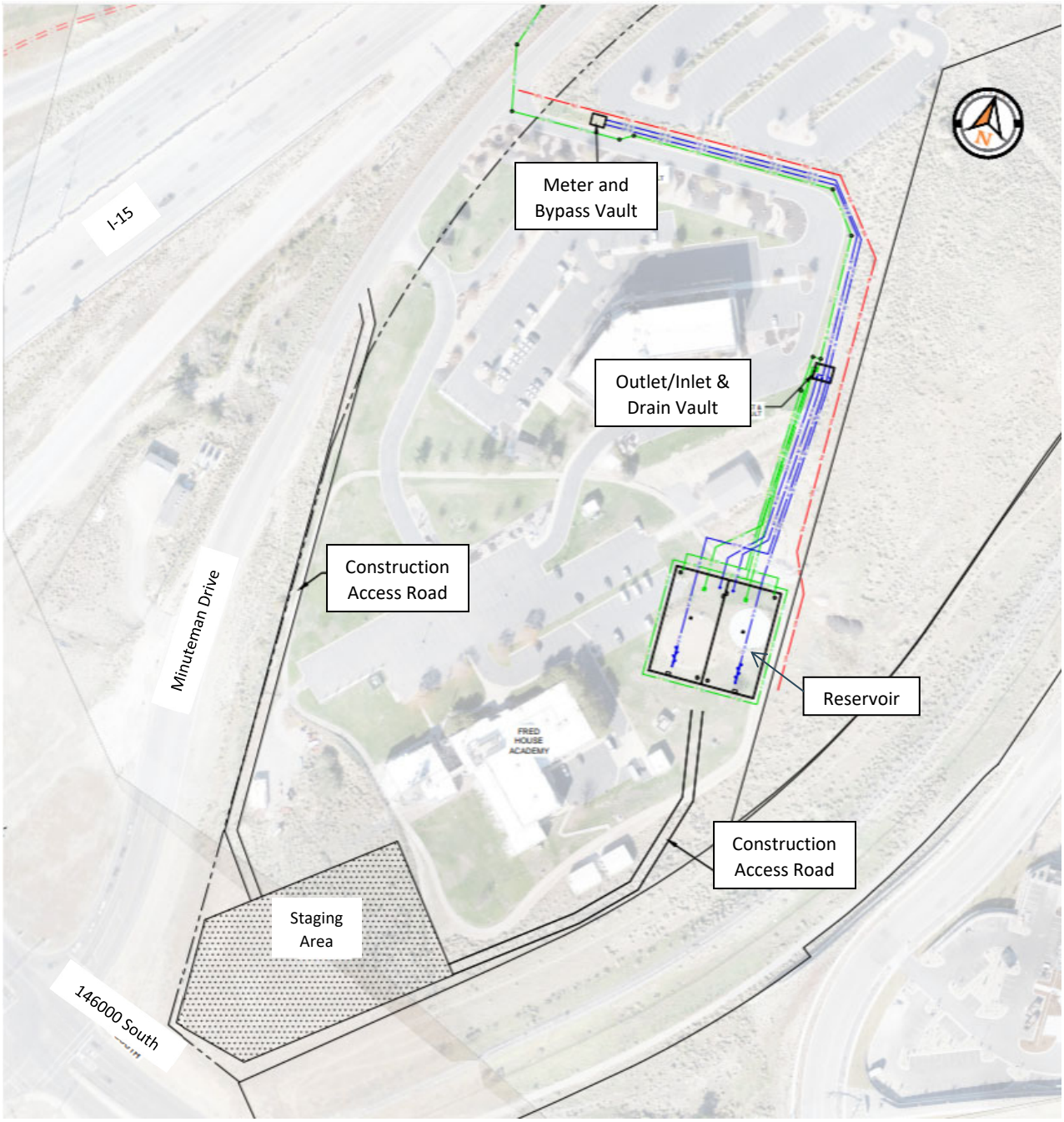

Figure 3: Proposed 3 MG Reservoir Location

VAULTS

Two vaults will be installed on the site. The first is the Meter and Bypass vault located just off Minuteman Drive on DFCM property between the Administration Building and the DMV parking lot. This vault will have the meter connecting JVWCD to Draper City. A bypass pipe is also being installed in this vault, this is meant to be used only when the entire reservoir needs to be taken out of service or offline for any reason.

The second vault is the Outlet/Inlet/Drain Combination vault. This vault houses the flow control valve for controlling the flow into the reservoir as well as inlet valves used to isolate each cell as needed. The outlet lines and valves are also in this vault, and they will be equipped with pressure transducers to read reservoir levels and provide signal to the flow control valve. Finally, the drain valves for each cell of the reservoir are located in this vault. These will be used to drain one cell or the other in order to maintain or clean as necessary.

DRAPER CITY

Horrocks coordinated with Draper City during the design process. They will be the owners of the reservoir after construction is completed.

Appendix A: Reservoir Inspections

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FRED HOUSE ACADEMY
WEST CONCRETE RESERVOIR INSPECTION

APRIL 2023

Reservoir Name: DFCM Fred House West Concrete Reservoir **Inspection Date**: February 18, 2023

Address: 14717 Minuteman Drive **Inspectors**: Kasey Chesnut

City: Draper, UT Daniel Mooney

Reservoir Information: Capacity: ~400,000 gal Dims: 76 (diameter) Ft. Height: 13.5 Ft.

Reservoir Type: ☐ Exposed ☐ Partially Buried ☒ Buried Constructed: 1950s Year

Roof Material/Constr: Concrete Coated: ☐ Yes ☒ No

Wall Material/Constr: Concrete Coated: ☐ Yes ☒ No

Floor Material/Constr: Concrete Coated: ☐ Yes ☒ No

Last Interior Recoat: N/A Year Last Exterior Recoat: N/A Year

DESCRIPTION OF MOST RECENT REPAIRS/REHABILITATION WORK

Signs of patchwork on the interior roof slab as well as many of the columns – no indication of when that was performed.

SITE OBSERVATIONS

The tank was constructed in the 1950's. It has a buried roof slab. Noticeable areas of patched cracking can be identified below the top slab coating. Both hatches are secure and the air vent is in working order. The access ladder is also in relatively good condition – the top few rungs are in need of a recoat.

STANDARDS

The inspection consisted of a visual observation of the concrete reservoir's interior and exterior components and coating system. The tank was empty for the inspection and all interior assessment data was recorded using photographs. Exterior assessment data was documented using photographs.

CONDITION OBSERVATIONS

Conditions noted during the field inspection are documented in the following pages and are supplemented with color photos at the end of the report. Condition ratings used to describe the inspection findings are annotated as follows:

Excellent:	No deficiencies noted.
Good:	Minor deficiencies noted. Item is functioning as designed.
Fair:	Major deficiencies noted. Item is in need of repairs to continue functioning as designed.
Poor:	Repair or replacement required immediately. Item may no longer function as designed.

CONTAMINATION, HEALTH & SAFETY

CONTAMINATION AND HEALTH

Air Vent(s) and Screen(s) -

- **Hatches** – Good - Secure, gaskets in good condition, consider recoating.
- **Exterior Overflow** – Good
- **Cathodic Covers** – N/A
- **Roof to Wall Joint** – Fair – previous patched cracks appear to be in-tact.
- **Roof Integrity** – Good – Minor cracking – showed signs of healing, spalling and rusting rebar identified in a few locations
- **Wall Integrity** – Good – minor cracks identified
- **Manway Integrity** – Good
- **Water Clarity** – N/A
- **Telemetry Penetration(s)** – Good

FACILITY SAFETY COMPLIANCE

- **External Ladder** – N/A
- **Safety Climb** – The access manway had a ladder-up installed which was in good condition.
- **Manway** – Good
- **Hatch** – Good – secure, gasket in good condition, no ladder-up installed.
- **Balcony & Railing** – N/A
- **Roof** – N/A buried.

INTERIOR RESERVOIR INSPECTION

INTERIOR RESERVOIR ROOF

- **Vent(s)** – Good – signs of corrosion from moisture in the pipe that drains onto ceiling.
- **Roof** – Good – Cracking, spalling and rusting rebar identified in a few locations
- **Protective Coating** – N/A

INTERIOR RESERVOIR WALLS

- **Wall to Roof Joint** – Good – no sealant noted, some repaired cracking noted.
- **Ring Panels** – N/A
- **Interior Ladder** – Good – some corrosion at the bolted connections, in need of a full recoat especially the top few rungs. Otherwise in functioning condition.
- **Cathodic Protection System** – N/A
- **Protective Coating** – N/A

INTERIOR RESERVOIR FLOOR

- **Perimeter Seam** – Good – minor cracking and no leaking observed
- **Floor Panels** - Good – minor cracking and no leaking observed

INTERIOR RESERVOIR PLUMBING COMPONENTS

- **Plumbing** – Good – in need of a recoat, consider replacing the valve nut.
- **Manways** – Good
- **Overflow** – Good

INTERIOR RESERVOIR SUPPORT COLUMNS

- **Column Structure(s)** – Good – Columns look good but some repaired cracking was observed near the top of some of the columns.

EXTERIOR RESERVOIR INSPECTION

EXTERIOR RESERVOIR ROOF

- **Vent(s)** - Good
- **Roof** – N/A - Buried
- **Access Hatch** – Good
- **Coating** – N/A - Buried

EXTERIOR RESERVOIR WALLS

- **Wall to Roof Joint** - Buried
- **Ladder** – N/A
- **Ring Panels** – N/A
- **Overflow** – Buried
- **Coating** – Buried

FOOTINGS / FOUNDATION

- **Footings / Foundation** – Buried
- **Anchor Bolts** – Buried

GENERAL TANK SECURITY

SECURITY

- **Fencing** – N/A
- **Ladders** – N/A
- **Perimeter** – Working buildings surrounding the tanks. No security or protection from the general public accessing the top of the tank. The tank is locked at the two hatches.
- **Vent (s)** – Good
- **Hatches** – Good, secure and safe.

SUMMARY

Overall the tank was in good condition.

Mechanical:

The interior piping is functioning properly but showing signs of corrosion at the joints and bolted connections. This is the same for the inlet, outlet, overflow, and drain. The valves are also corroding at the bolts on the bonnets and valve stems.

The ladder is in good condition but, as noted, requires a new coating.

Structural:

The bottom slab appears to be in relatively good condition with no signs of new major cracks, spalling, or leakage. The columns appeared to be in relatively good condition, with no new major cracks. Previously patched/wrapped cracks in the columns were observed, and the cracks appear not to have moved since the repairs took place. The walls are in relatively good condition with no new major cracking or spalling identified. Some rock pockets and minimal honeycombing locations were observed, however, the deficiencies have likely existed for the majority of the service life of the tank from the time of construction.

The top slab is in relatively good condition. However, there are multiple locations with exposed and corroded rebar from spalling of the concrete or repair patch material. Some locations of spalling appeared to have been patched previously since in many of the locations, the spalled patch material could be found in chunks directly below the exposed rebar. All locations of exposed rebar were in the slab, rather than in the drop caps at the top of the columns. No new cracks in the slab were observed.

The ladder at the main entrance is in good condition, however, multiple rungs have corroded such that the paint has delaminated and/or is flaking off.

The joint between the roof slab appears to be in fair working condition. The walls at the joint appear to have experienced multiple cracks around the entire circumference which have previously been patched and the sealant appears to have held with no new leakage observed. There was spalling observed at multiple locations around the circumference, however, it is unclear whether the spalling occurred recently or early in the service life of the tank and no new leakage was observed.

RECOMMENDATIONS AND COST ESTIMATES

Based on our inspection of the 400,000-gallon DFCM Fred House West Concrete Reservoir the following actions are recommended:

1. Repair of the spalling concrete and exposed rebar in the interior roof slab. Identify other areas of potential delaminations through further investigation of the roof slab.
2. All of the piping and ladder should be blasted or wire brushed and cleaned and then recoated. The nuts and bolts should also all be replaced.
3. Consider cathodic protection to protect the piping, valve stems, and ladder.

The following costs are provided as budgetary estimates for materials, labor, and equipment.

1. Repair of the spalling concrete and exposed rebar in the interior roof slab: $15,000
2. All of the piping and ladder should be blasted or wire brushed and cleaned and then recoated. The nuts and bolts should also all be replaced: $40,000-$50,000.
3. Consider cathodic protection to protect the piping, valve stems, and ladder: $5,000

(As a disinterested third-party inspector, Horrocks does not engage in the construction or rehabilitation of potable water storage facilities. Horrocks will, in its commitment to our client and upon request, identify to the client relevant entities that are professional reliable and best capable of completing the recommended work, or assist the client in research tips that will enable them to make a decision that best services the utility.)

APPENDIX A

Photographs

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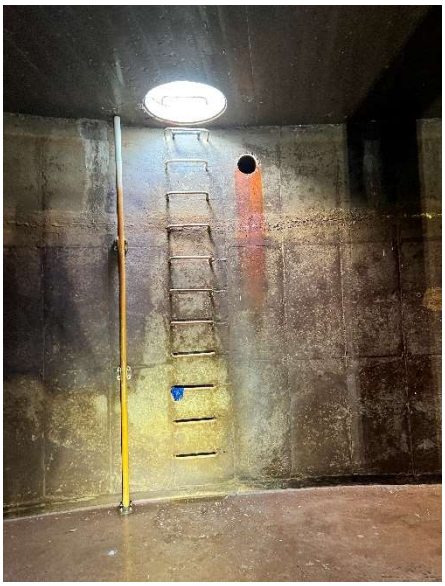
View of reservoir looking north east	Reservoir roof looking north
	
View of reservoir looking south – air vent	Exterior of the access manway and hatch

Access manway

Access manway and valve actuators

Manway – lid and ladder-up

Manway looking in – rungs in need of recoat

	
Access manway and ladder	Columns and access manway
	
Roof damage	Concrete on floor from roof damage

	
Roof joint	Column connection at roof
	
Overview of north of reservoir	Columns
	
Wall and roof	Ladder and signs of corrosion from piping, wall cracking

Patched wall cracks at roof joint and slab spall patches

Patched cracks at roof joint

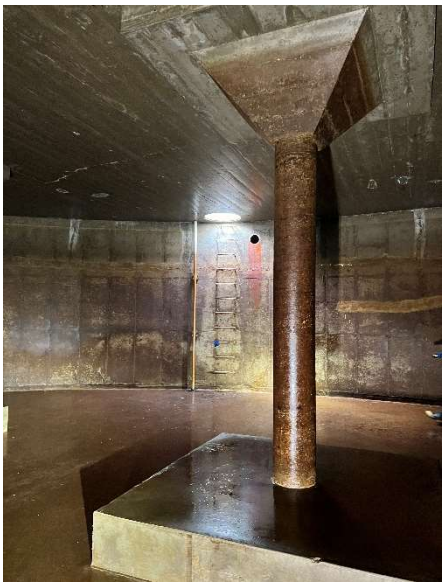
Floor joint

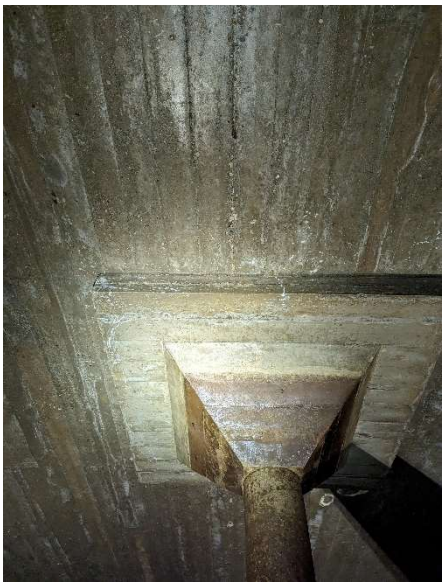
Overflow, valve stems, and access hatch

Overflow screen

Top of overflow

	
Wrapped column cracks	Wrapped column cracks
	
Wrapped column cracks	Wrapped column cracks

	
Column and drop cap	Column, footing and drop cap
	
Wrapped columns cracks	Column and drop cap

	
Column and drop cap	Column and drop cap
	
Column drop cap and lid slab	Lid slab

	
Column base	Floor
	
Floor	Floor joint…

	
Roof near access manway	Roof spalling patches
	
Roof spalling patches	Roof slab

	
New roof spalling	Roof spalling
	
Rood joint crack patches	Roof joint

	
Roof slab	Roof slab
	
Roof slab	Roof slab

	
Roof slab	Roof slab at column drop cap
	
Exterior roof	Exterior roof

	
Exterior roof	Exterior roof
	
Exterior roof	Exterior roof

	
Exterior roof	Exterior roof
	
Exterior roof	Exterior roof

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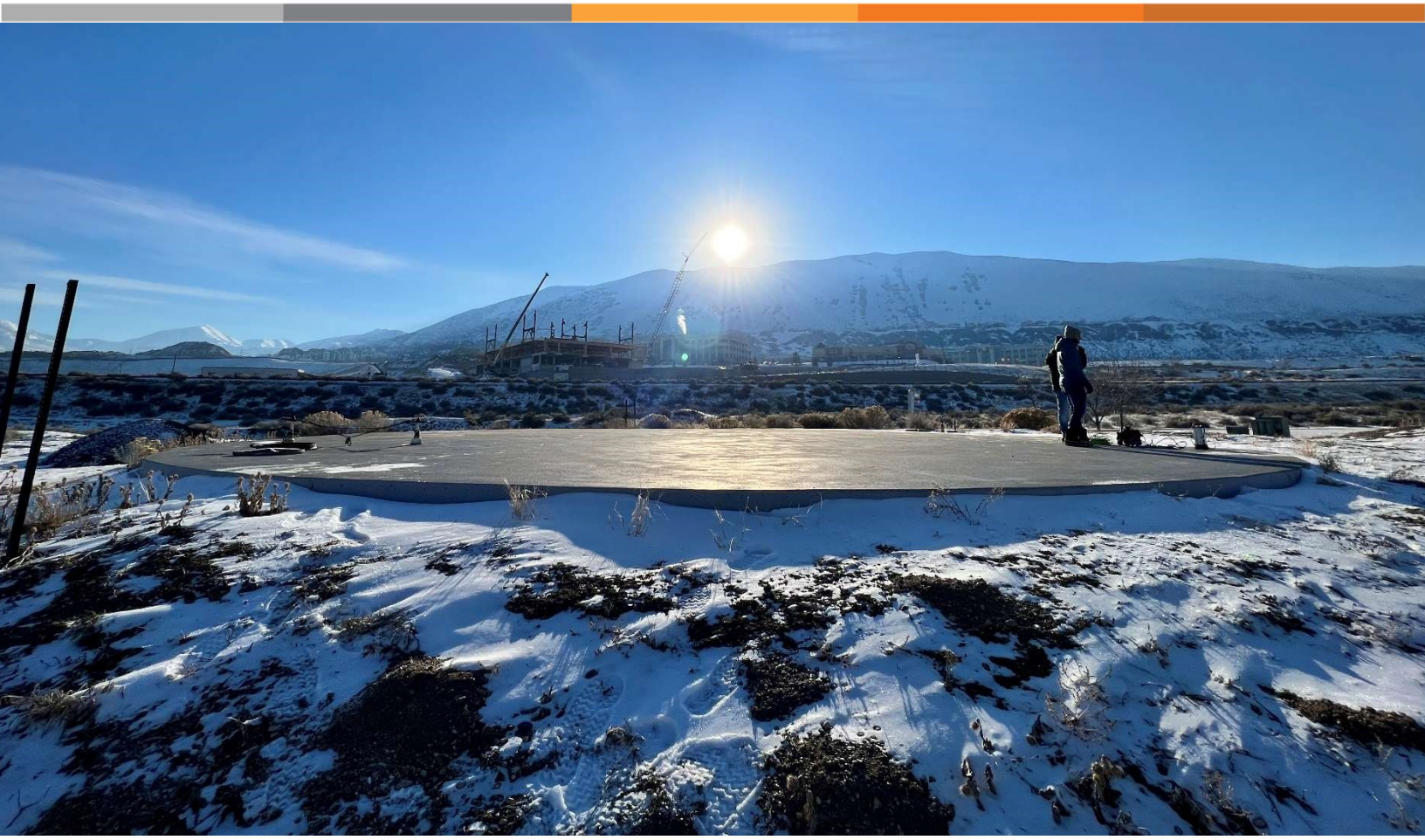

FRED HOUSE ACADEMY
EAST CONCRETE RESERVOIR INSPECTION

APRIL 2023

Reservoir Name: DFCM Fred House East Concrete Reservoir **Inspection Date**: February 1, 2023

Address: 14717 Minuteman Drive **Inspectors**: Kasey Chesnut

City: Draper, UT Brett Brady, Drew Geiger

Reservoir Information: Capacity: ~200,000 gal Dims: 54 (diameter) Ft. Height: 13.5 Ft.

Reservoir Type: ☐ Exposed ☒ Partially Buried ☐ Buried Constructed: 1930s Year

Roof Material/Constr: Concrete Coated: ☐ Yes ☒ No

Wall Material/Constr: Concrete Coated: ☐ Yes ☒ No

Floor Material/Constr: Concrete Coated: ☐ Yes ☒ No

Last Interior Recoat: N/A Year Last Exterior Recoat: N/A Year

DESCRIPTION OF MOST RECENT REPAIRS/REHABILITATION WORK

Signs of patchwork on the roof slab – no indication of when that was performed.

Exterior of roof slab coated following the August 2015 inspection by Infinity Corrosion. There was a follow-up inspection performed in June of 2016 to inspect the finished roof coating. During the 2016 inspection, spalling and exposed rebar were observed and noted in the report. The August 2015 and the June 2916 reports are both attached to this report.

SITE OBSERVATIONS

The tank was constructed in the 1930's. It has an exposed roof slab that has been recoated since the initial installation. Noticeable areas of patched cracking can be identified below the top slab coating. Both hatches and all valves are locked out. The access ladder is also in relatively good condition.

STANDARDS

The inspection consisted of a visual observation of the concrete reservoir's interior and exterior components and coating system. The tank has been empty for the inspection and all interior assessment data was recorded using photographs. The tank has been offline for an extended time. Exterior assessment data was documented using photographs.

CONDITION OBSERVATIONS

Conditions noted during the field inspection are documented in the following pages and are supplemented with color photos at the end of the report. Condition ratings used to describe the inspection findings are annotated as follows:

Excellent:	No deficiencies noted.
Good:	Minor deficiencies noted. Item is functioning as designed.
Fair:	Major deficiencies noted. Item is in need of repairs to continue functioning as designed.
Poor:	Repair or replacement required immediately. Item may no longer function as designed.

CONTAMINATION, HEALTH & SAFETY REPORT

CONTAMINATION AND HEALTH

Air Vent(s) and Screen(s)

- **Hatches** – Fair - Secure, gaskets need to be replaced.
- **Exterior Overflow** – Poor - Non functioning. Rusted closed
- **Cathodic Covers** – N/A
- **Roof to Wall Joint** – Poor – Leaking seen at this joint in many locations
- **Roof Integrity** – Poor – Cracking, spalling and rusting rebar identified in many locations
- **Wall Integrity** – Good – minor crack identified
- **Manway Integrity** – Good – very small access, should be upgraded if put back in service.
- **Water Clarity** – N/A
- **Telemetry Penetration(s)** – Poor - Conduit would need to be replaced.

FACILITY SAFETY COMPLIANCE

- **External Ladder** – N/A
- **Safety Climb** – Not installed
- **Manway** – Fair – tight access from a safetly perspective, no ladder-up
- **Hatch** – Good – secure from safety perspective.
- **Balcony & Railing** – N/A
- **Roof** – Fair – at grade.

INTERIOR RESERVOIR INSPECTION REPORT

INTERIOR RESERVOIR ROOF

- **Vent(s)** – N/A
- **Roof** – Poor – Cracking, spalling and rusting rebar identified in many locations
- **Protective Coating** – N/A

INTERIOR RESERVOIR WALLS

- **Wall to Roof Joint** – Poor – sealant has deteriorated and leakage was observed
- **Ring Panels** – N/A
- **Interior Ladder** – Good – some corrosion at the bolted connections. Otherwise functioning condition.
- **Cathodic Protection System** – N/A
- **Protective Coating** – N/A

INTERIOR RESERVOIR FLOOR

- **Perimeter Seam** – Good – minor cracking and no leaking observed
- **Floor Panels** - Good – minor cracking and no leaking observed

INTERIOR RESERVOIR PLUMBING COMPONENTS

- **Plumbing** – Poor – in need of replacement.
- **Manways** – Fair – accessible but not up to current standards.
- **Overflow** – Poor – in need of replacement.

INTERIOR RESERVOIR SUPPORT COLUMNS

- **Column Structure(s)** – Fair – Columns look good but some spaling and cracking observed in the column drop panels

EXTERIOR RESERVOIR INSPECTION REPORT

EXTERIOR RESERVOIR ROOF

- **Vent(s)** – Fair – would need new screens and coatings to be put back in service
- **Roof** – Fair – cracking and patching observed below
- **Access Hatch** – Fair – tight access and gasket failure.
- **Coating** – Good – coating appears to be relatively new

EXTERIOR RESERVOIR WALLS

- **Wall to Roof Joint** - Buried
- **Ladder** – N/A
- **Ring Panels** – N/A

- **Overflow** – Buried
- **Coating** – Buried

FOOTINGS / FOUNDATION

- **Footings / Foundation** – Buried
- **Anchor Bolts** – Buried

GENERAL TANK SECURITY

SECURITY

- **Fencing** – N/A
- **Ladders** – N/A
- **Perimeter** – Working buildings surrounding the tanks. No security or protection from the general public accessing the top of the tank. The tank is locked at the two hatches.
- **Vent (s)** – not in service. Would need to be replaced to use again.
- **Hatches** – Locked, need to be upsized and upgraded.

SUMMARY

Overall the tank was in fair condition.

Mechanical:

The piping would all need to be replaced in order to place the reservoir back in service. This would include the inlet, outlet, drain, and overflow piping. Additional safety measures for tank access should also be installed for safe ingress and egress. This would include larger access manways or hatches and ladder-ups. New telemetry conduit and equipment would be required. Upgraded air vents would also be required.

Structural:

The bottom slab, walls, and ladder appear to be in relatively good condition with no signs or major cracks or leakage. The top slab columns are also in relatively good condition with no major cracking or spalling identified. Some rock pockets and non-uniform column sections were seen, however, the deficiencies have likely existed for the full life of the tank due to construction errors.

The top slab is in poor condition. There are many locations with exposed and rusting rebar. Similar to the findings in the 2016 inspection the spalled concrete from the top slab were found in chunks on the floor slab. Chunks of spalled concrete were identified as falling from the column drop panels as well. In addition, a vast area of the roof slab shows signs of patchwork with some of the patching spalled, but not yet fallen to the floor. Long cracks were seen and several translate almost completely across the top slab.

The joint between the roof slab and the walls is leaking in many locations and the sealant appears to be failing around the majority of the tank. Likely to age and lack of maintenance, as this tank is out of service.

RECOMMENDATIONS AND COST ESTIMATES

Based on our inspection of the 200,000-gallon DFCM Fred House East Concrete Reservoir the following actions are recommended:

1. The top slab will require replacement or major repair.
2. It is recommended that the inlet, outlet, and overflow piping be replaced.
3. The existing roof vent pipe should be replaced and an additional vent pipe should be added opposite the existing vent.
4. Telemetry and necessary conduits will also need to be added.

Observations made during this inspection were also noted in the June 2016 inspection.

The following costs are provided as budgetary estimates for materials, labor, and equipment.

1. The top slab will require replacement or major repair: $100,000-$300,000
2. It is recommended that the inlet, outlet, and overflow piping be replaced: $60,000
3. The existing roof vent pipe should be replaced and an additional vent pipe should be added opposite the existing vent: $12,000
4. Telemetry and necessary conduits will also need to be added: $25,000-$30,000

(As a disinterested third-party inspector, Horrocks does not engage in the construction or rehabilitation of potable water storage facilities. Horrocks will, in its commitment to our client and upon request, identify to the client relevant entities that are professionally reliable and best capable of completing the recommended work, or assist the client in research tips that will enable them to make a decision that best services the utility.)

APPENDIX A

Photographs

Horrocks.

View of reservoir looking south east

Reservoir roof looking east

Access manway – broken seal

Valve actuators – locked

	
Ladder	View of columns
	
Columns and patchwork - looking east	Columns and patchwork - looking east
	
Roof damage	Concrete on floor from roof damage

	
Roof joint	Column connection at roof
	
Ladder corrosion	Base of ladder. Corrosion at bolts.
	
Roof spawling	Roof cracking and patches
	
Floor joint	Roof cracking

 	 
Roof joint (left) Cracking near column (right)	Internal Piping, overflow
	
Drain valve	Drain valve
	
Inlet	Inlet piping

	 
Ladder corrosion	Roof cracking
	
Roof damage	Roof damage
	
Roof damage - repair	Roof damage


Columns – concrete in good condition


Columns and general tank photos

Columns looking west

Roof damage

Roof damage

Wall / roof joint

Roof damage

Roof damage

Roof damage and repairs

Roof damage and repairs

Exterior roof

Exterior roof

Exterior roof

Exterior roof

APPENDIX B

Reports

April 2023

Horrocks.

Appendix B: Supporting Documents

The Point Redevelopment Project

Hydraulic Model Memo

January 2024

See Package 2B Technical Reports for updated December 2024 report

Horrocks.

DRAPER CITY

EXECUTIVE SUMMARY

This memo summarizes the modeling of a new drinking water system for The Point Redevelopment Project (The Point) which will serve new residential and commercial development to be located at and around the old Utah State Prison at *14425 Bitterbrush Ln S, Draper, UT 84020*, which is being demolished before site development. The development is set to occur using a phased approach. Phasing specifics are still to be determined. However, Figure 1 shown below breaks down the development into the initial Phase 1 installation and expected future phasing.

The source of culinary water supply for the new system will be two reservoirs, with a combined capacity of 10 Million Gallon (MG), located southeast of the site on the east side of I-15 (see Figure 1). A 3 MG reservoir will be built first and will supply water to The Point through a new 30-inch transmission line that will be bored under I-15. As demand requires, a 7 MG reservoir will be built and connected to the 3 MG reservoir. This system will not be connected to Draper's culinary water system per the City's request. For the purposes of the culinary model, the 10 MG water reservoir is considered the only source of water supplying the system. The proposed water system, including pipe sizing, is shown in Figure 1. Phase 1 pipelines are the backbone of the system and shown with solid lines. The base and peak demand for the proposed system is 4,378 GPM and 17,323 GPM respectively.

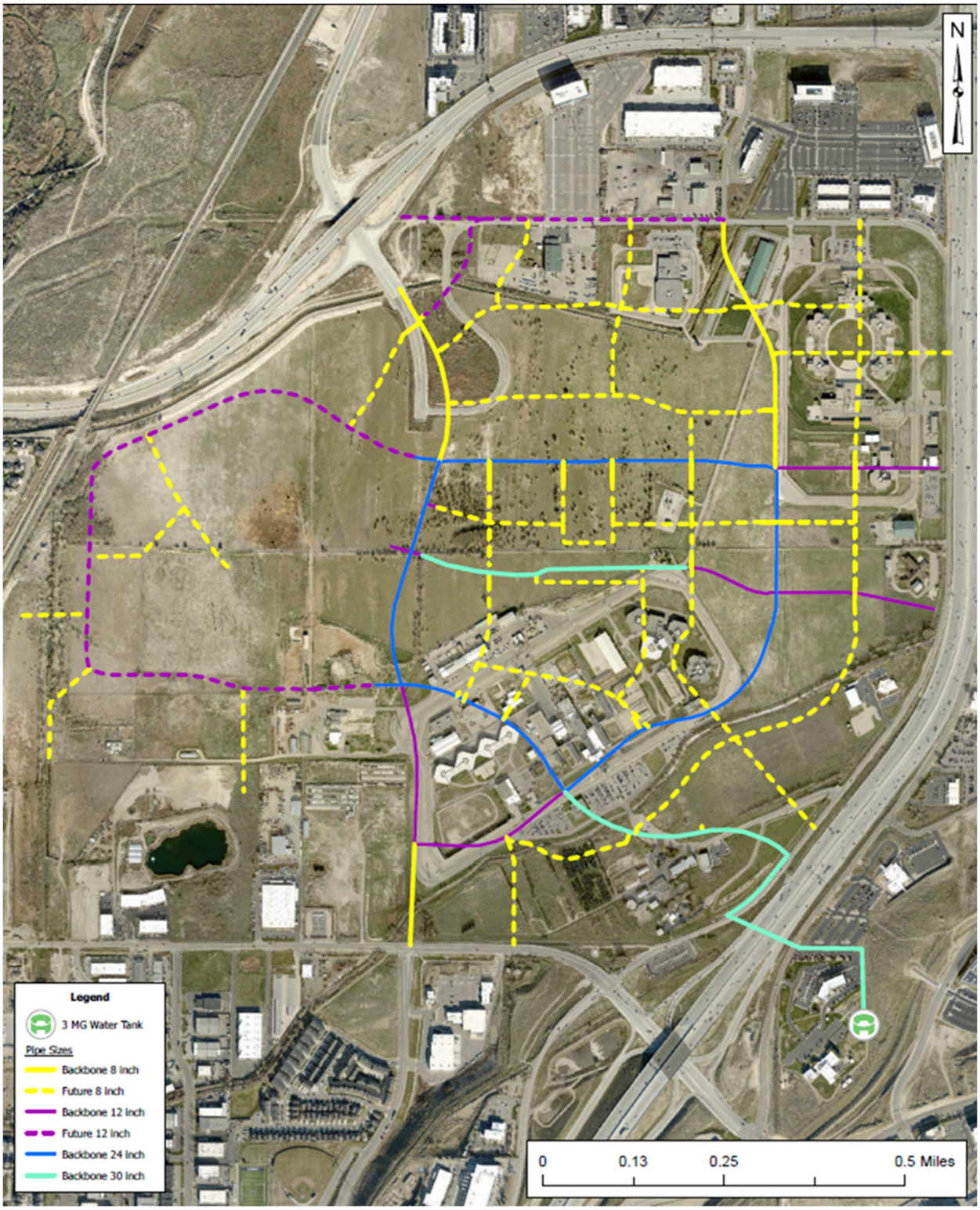

Figure 1: Proposed Culinary Water System by Pipe Size and Phasing

1.0 INTRODUCTION

The purpose of this report is to document the analysis for the distribution system sizing and the hydraulic model. In order to determine the pipeline sizing, Horrocks performed a minimum sizing analysis for the water system based on the State of Utah Division of Drinking Water's R309-510 requirements and using The Point's August 2023 Framework Plan and Land Use Program and Statistical Summary dated September 2023, which provide the projected land use characteristics for Phase 1 and build-out, and Utah State standards for typical water usage.

The new culinary water system for The Point will be designed to provide a peak flow of 24.94 million gallons per day (MGD). The new culinary water system will include two storage reservoirs (3 MG and 7 MG). The 3 MG reservoir will be built first during Phase 1 southeast of I-15. It will supply water to The Point through a 30-inch transmission line that will be bored under I-15. This transmission line will connect to the onsite distribution system in South Loop Road. As demand increases, a 7 MG reservoir will be constructed and tied into the 3 MG reservoir. This transmission and distribution system will be a stand-alone water system and will not be integrated into Draper City's culinary water system, per the city's request.

2.0 DEMAND CRITERIA

2.1 Water System Requirements For Utah

Water system sizing and storage requirements for The Point are governed by the minimum requirements dictated by the State of Utah Division of Drinking Water's R309-510, as well as the International Fire Code. They are to be used in the design of new systems and in the evaluation of water source, storage facility, and pipeline capacities. A secondary water system will be constructed so outdoor use is not included in the demand calculations.

2.2 Water Demand – Source Sizing

Water demands were established for the system using the requirements outlined in R309-510-7 as listed below.

- Water system's source capacity can meet the peak day demand.
- Water system's source capacity can provide one year's supply of water, which is the average yearly demand.

Table 510-1 under R390-510 indicates the following and is calculated for The Point as shown in Table 1:

- Peak Day Demand: 800 gallon per day (gpd)/connection for residential or Equivalent Residential Connection (ERC)
- Average Yearly Demand: 146,000 gal/connection or ERC

ERC Evaluation

Water demand was established using the projected land use characteristics for demands under Phase 1 and build-out. See Table 1 for a summary of the ERCs calculations. The total base demand for build-out was calculated to be 15,748 ERCs. Subsequent demand scenarios were determined using multipliers based upon the base demand scenario. Commercial demands were converted to ERCs and then totaled together for each phase.

Fire Flow Requirements

The proposed project will consist of commercial and residential use. Some of the commercial sites proposed will consist of high-rise buildings. Due to the nature of the commercial development, fire flow demand will need to be higher than the typical fire flow requirements. Fire flow was determined to be 4,000 GPM maintained for four hours.

Water Demand Summary

Table 1 summarizes the water demand criteria based on Equivalent Residential Units (1 ERC = 400 gallons per day [GPD]) and gallons per minute (GPM). The total base demand was calculated to be 15,748 ERCs (4,378 GPM) at build-out, which includes commercial demands which were converted to ERCs. Phase 1 demands were determined using multipliers based upon the base demand. It is estimated that the peak instantaneous demand for the system at build-out is 24.94 million gallons per day (MGD) and 6.47 MGD for Phase 1. Table 2 identifies the ERC calculations broken out.

Table 1: Summary of Demands for Phase 1 and All Phases Combined.

Demand	ERC	GPM	MGD
Build-out			
Base	15,748	4,378	6.3
Peak Day w/ Fire	31,496	8,756	12.61
Peak Instantaneous	62,312	17,323	24.94
Phase 1			
Base	4,085	1,136	1.64
Peak Day w/ Fire	8,170	2,271	3.27
Peak Instantaneous	16,164	4,494	6.47

Table 2: ERC Calculations for Phase 1 and at Build-out.

	Phase 1	Build-out	Unit
Residential			
Residential ERC	3,381	9,292	
Residential Use Ave	400	400	gpd
Residential GPD	1,352,551	3,716,736	gpd
Commercial			
Employees	7,969	61,610	People
GPD/employee	25	25	gpd
Commercial GPD	199,225	1,540,261	gpd
ERC's	498.06	3,850.65	ERC
Retail			
Employees	1,973	3,069	People
GPD/employee	11	11	gpd
Retail GPD	21,703	33,757	gpd
ERC's	54	84	ERC
Hotel			
Employees	75	75	People
GPD/employee	11	11	gpd
Rooms	548	548	Rooms
GPD/room	150	150	gpd
Hotel GPD	82,200	82,200	gpd
ERC's	206	206	ERC
Fire Flow			
4000 gpm/4 hrs	960,000	960,000	gallons
ERC's	2,400	2,400	ERC
Emergency Storage			
Emergency Storage	1,440,000	1,440,000	gallons
ERC's	3,600	3,600	ERC
Additional Draper Storage			
Draper Storage	2,000,000	2,000,000	gallons
ERC's	5,000	5,000	ERC

2.3 Storage Sizing

Water storage sizing was determined for the system as a stand-alone system not connected to other water sources and using the requirements in R309-510-8. The reservoir capacity includes equalization storage, fire suppression storage, and emergency storage for a total required storage of 8 MG. Draper City requested an additional 2 MG for a total of 10 MG. See Table 3 for a summary. The results of the models show that the full storage capacity of 10 MG is not needed for Phase 1. Therefore, the water storage capacity was split into two reservoirs, a 3 MG

and 7 MG. Construction of the 3 MG reservoir will be built as part of Phase 1. The 7 MG reservoir will be built according to increases in demand as the site is developed. The two water storage reservoirs will be constructed southeast of I-15. See The Storage Reservoir Report in the Appendix for more details.

Table 3: Storage Calculations for Phase 1 and at Build-out.

	Phase 1	Build-out	Unit
Equalization Storage			
400 gallons/ERC	1,751,200	5,600,000	gallons
	4.378	14,000	ERC
Fire Flow			
4000 gpm/4 hrs	960,000	960,000	gallons
Emergency Storage			
Emergency Storage	1,440,000	1,440,000	gallons
Additional Draper Storage			
Draper Storage	2,000,000	2,000,000	gallons

3.0 METHODOLOGY AND ANALYSIS

3.1 Hydraulic Model Used

Horrocks created the hydraulic computer model using WaterGEMS to determine pipe sizing for the proposed culinary water system. The program uses the Hazen-Williams equation to calculate flow rates and head-loss through the system. Horrocks performed several modeling evaluations of the proposed system. The hydraulic computer model was used to analyze multiple water use scenarios including base, peak day with fire flow, and peak instantaneous.

Two models were constructed to account for demands under Project phasing. Both models used a single 10 MG tank to supply water. One model shows Phase 1 scenarios while the second models the entire system at build-out demand for the entire system. Storage demand was also considered in Tables 1 and 2 but was not included as a model input.

3.2 Hydraulic Model Input

Distribution system sizing requirements

R309-105-9 provides the minimum requirements for a water system. It states that pressures must be above 20 psi during normal operation of the water system. Systems must maintain the following minimum dynamic water pressures at all locations within the system.

- 30 psi in all areas of the system during peak instantaneous usage,
- 20 psi in all areas of the water system during maximum day usage with imposed fire flows,
- 4,000 gpm fire flow for 4 hours maximum for residential apartment complexes, and
- Adequate fire flows for all other buildings according to IFC standards.

Since output data is in GPM and model input is in ERCs, the model calculations referenced ERC conversion factors. Each demand scenario used unique conversion factors to account for changes in demand. The conversion factors are summarized below on Table 3. It is estimated that the peak demand for the system is 24.94 MGD at build-out as shown on Table 1.

Table 3: Conversion Factors (ERC to GPM)

Demand Scenario	Conversion Factor
Base	0.278
Peak Day w/ Fire Flow	0.556
Peak Instantaneous	1.1

3.4 Model Results and Distribution System

Both models resulted in three outputs for base, peak day w/fire flow, and peak instantaneous demand scenarios. See Figures A-1 through A-6 in the Appendix for the model output results. Site conditions are favorable for this system. Since the site slopes downhill to the northwest, system pressures will be the highest at points furthest away from the storage reservoir.

For the distribution system, the pipe sizing is based on full build-out. However, Phase 1 will only be including the piping needed for that phase. Pipeline geometry relevant to the model includes all the proposed pipes shown in Figure 1. The system backbone will be built during Phase 1 includes a new 30-inch transmission line connected to the 3 MG reservoir. From the reservoir, the 30-inch line enters a vault north of the reservoir and will cross I-15 via a boring. It will then tee into the existing 24-inch line, continuing into the development. The 30-inch line reduces to 24-inches at the intersection of South Loop Road and 200 West. This 24-inch loop continues around the perimeter of Phase 1.

Pipe material was determined based on pipe sizing. The 8- and 12-inch pipes were modeled as PVC and the 18-, 24- and 30-inch pipes were modeled as ductile iron.

APPENDIX:

RESULTS FOR EACH DEMAND SCENARIO (ALL PHASES)

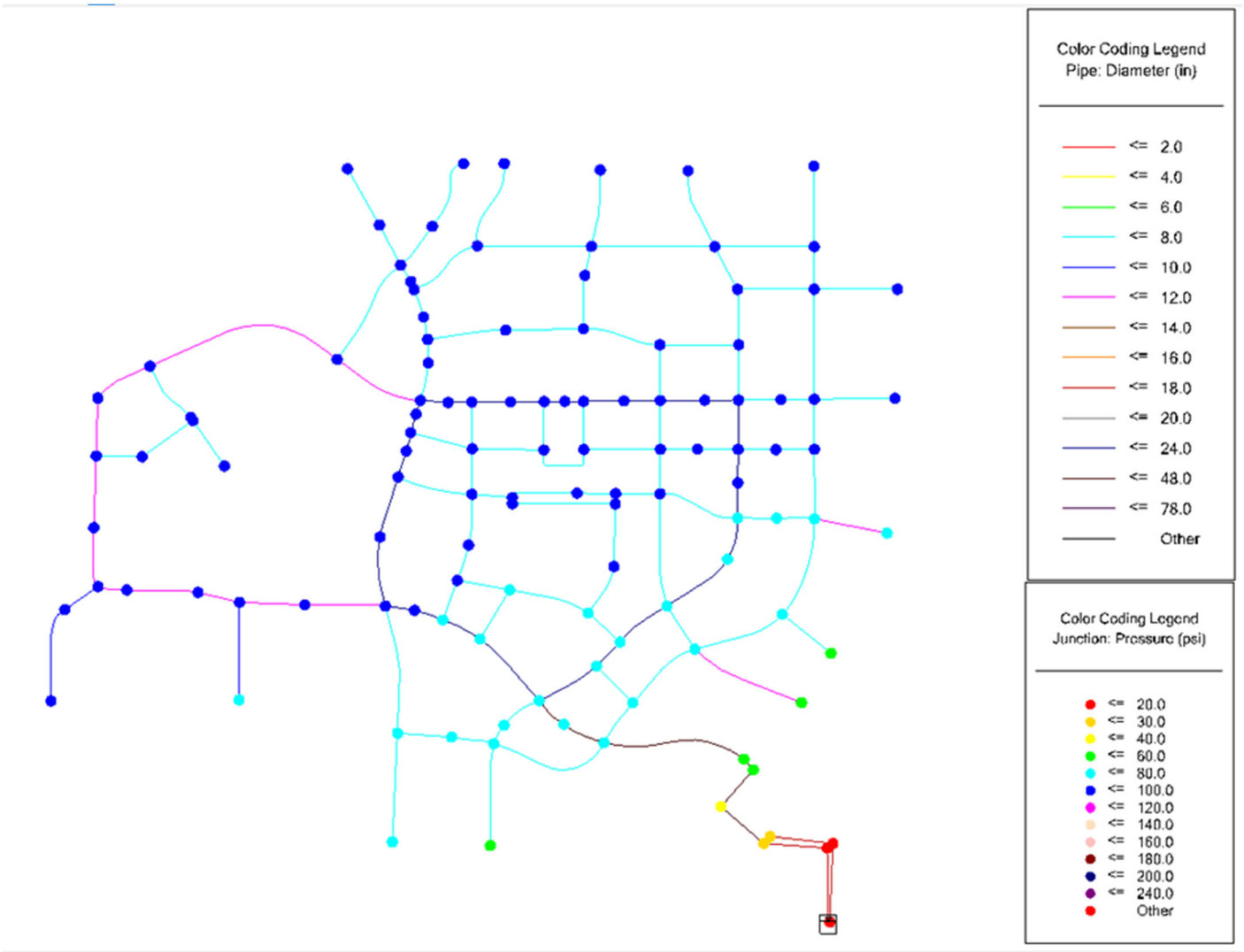

Figure A-1: Base Scenario - All Phases

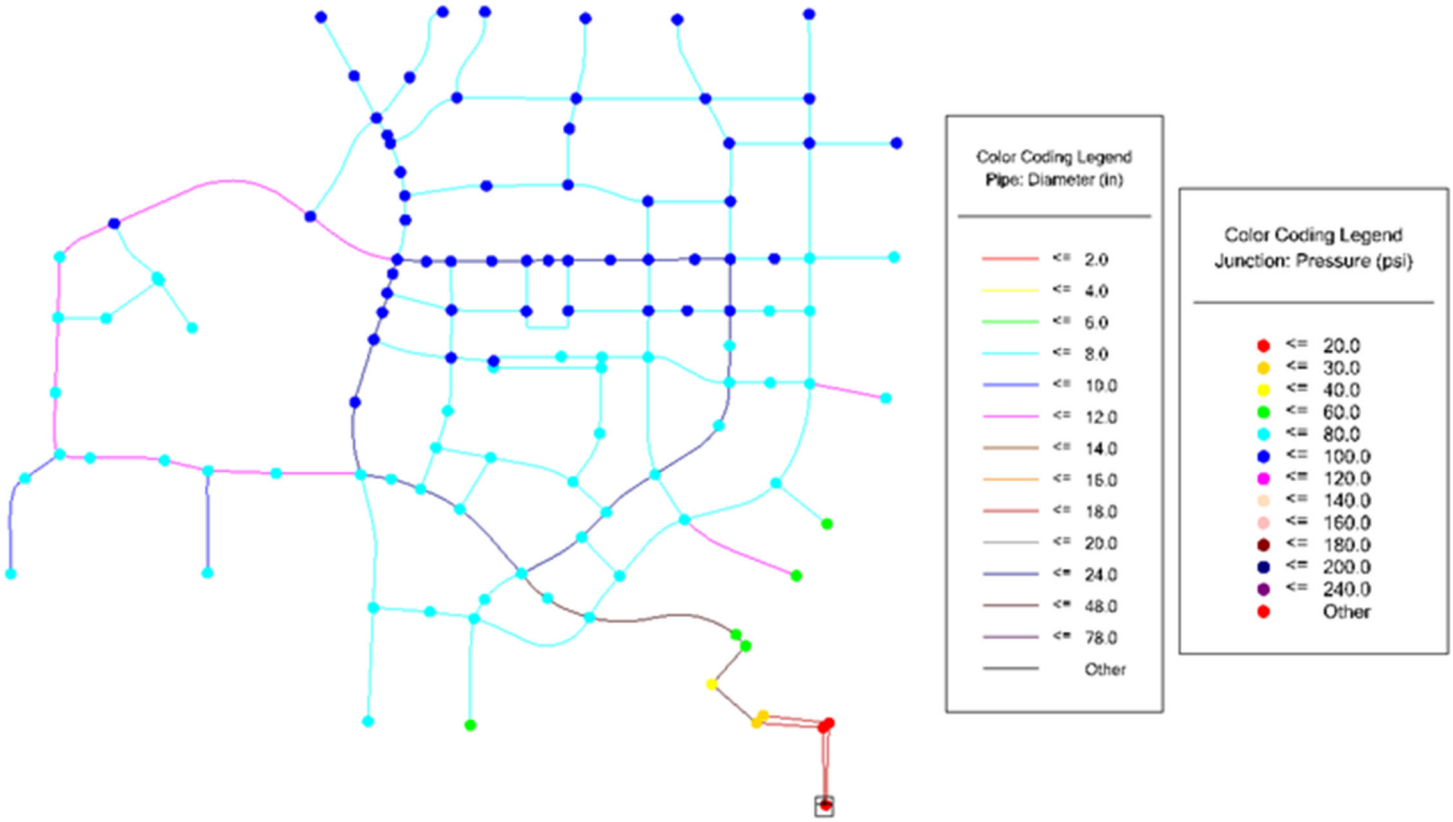

Figure A-2: Peak Day w/ Fire scenario - All Phases

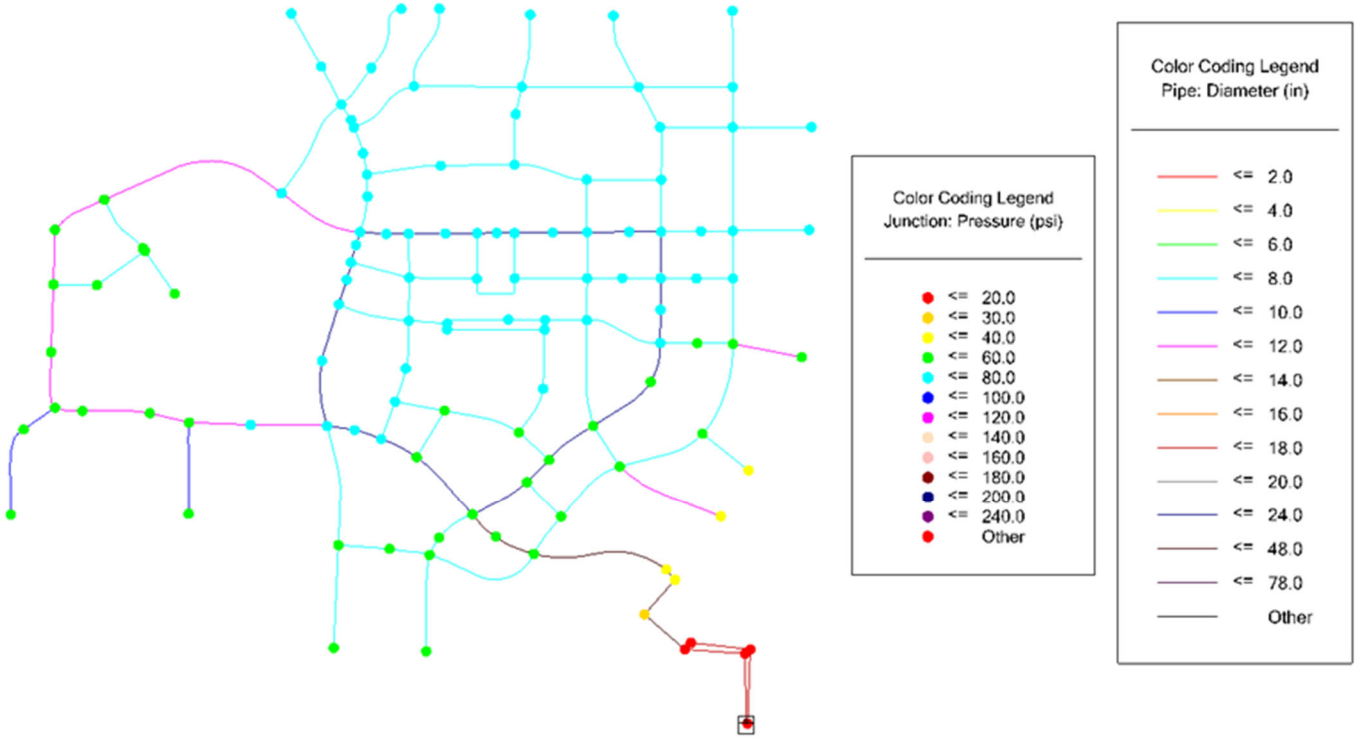

Figure A-3: Peak Instantaneous Results for all Phases

PHASE 1 DEMAND SCENARIOS

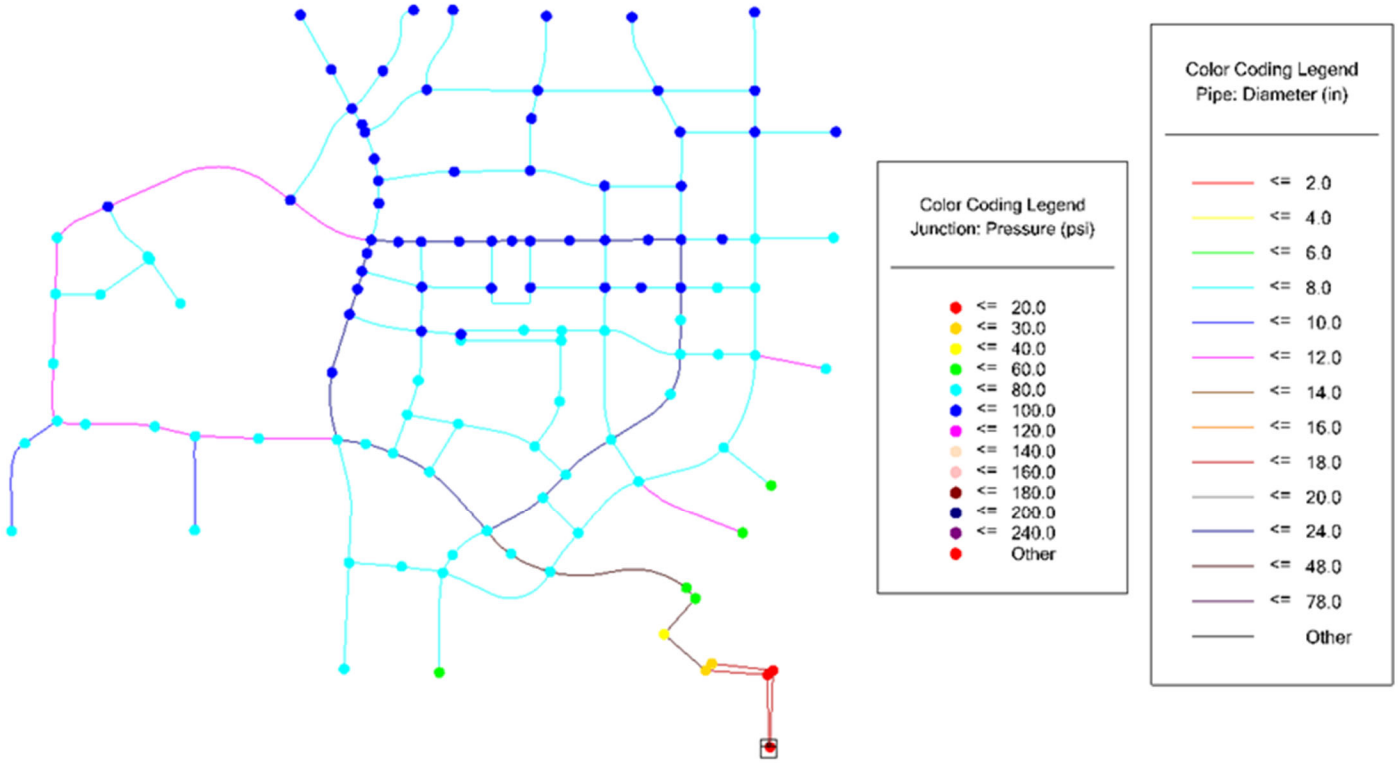

Figure A-4: Base Demand Scenario for Phase 1

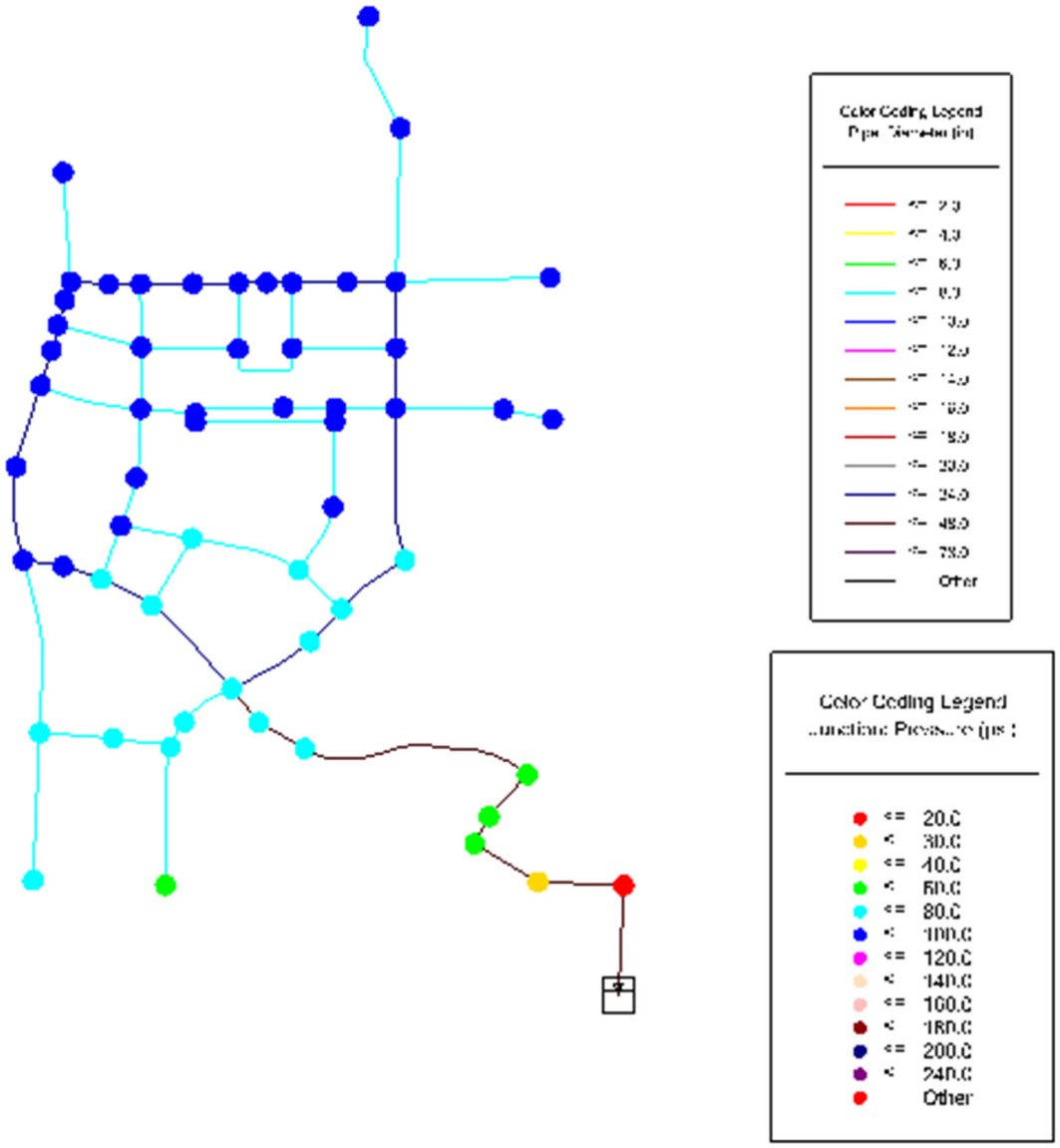

Figure A-5: Peak day w/ Fire Flow Phase 1 Scenario

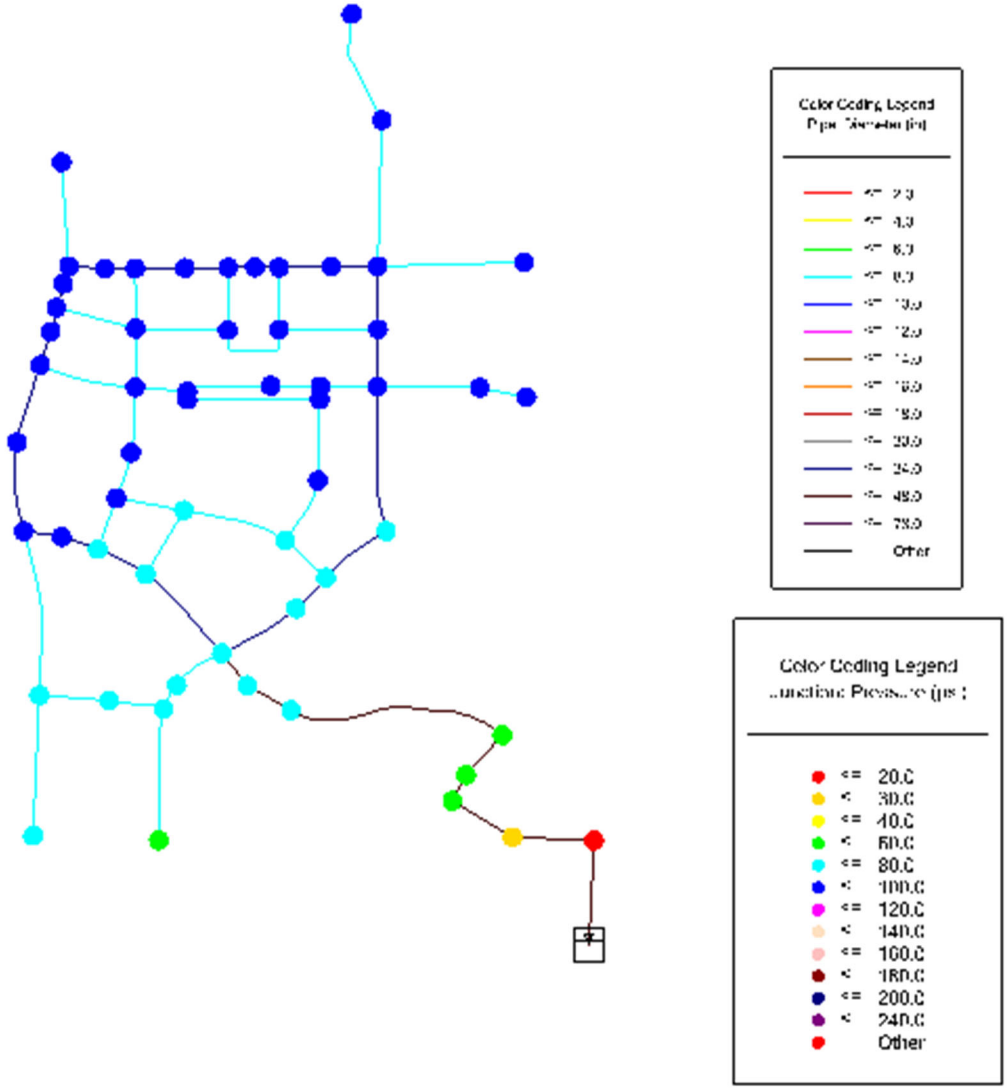

Figure A-6: Peak Instantaneous Demand for Phase 1

Appendix C: Utah Division of Drinking Water Rules

R309. Environmental Quality, Drinking Water.

R309-510. Facility Design and Operation: Minimum Sizing Requirements.

R309-510-1. Purpose.

This rule specifies the minimum requirements for the sizing of public drinking water facilities such as sources (and their associated treatment facilities), storage tanks, and pipelines. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-510-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-510-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-510-4. General.

(1) This rule provides minimum quantities and flow rates that shall be used in the design of new systems and in the evaluation of water source, storage facility, and pipeline capacities, unless a public water system has obtained a capacity reduction per R309-510-5. Water demand may vary significantly depending on water system size, type, land use, urbanization, location, precipitation, etc. Therefore, public water systems may submit system-specific water use data to justify alternative sizing requirements in accordance with R309-510-5.

(2) When designing a public water system, the sizing requirements for indoor water use, irrigation, and fire suppression (as required by the local fire code official) shall be included as appropriate.

(3) Local authorities may impose more stringent design requirements on public water systems than the minimum sizing requirements of this rule.

(4) Public water systems shall consider daily, weekly, monthly, seasonal, and yearly variations of source capacity and system demand and shall verify that the capacities of drinking water facilities are sufficiently sized.

(5) The Director may modify the sizing requirements based on the unique nature and use of a water system.

R309-510-5. Reduction of Sizing Requirements.

(1) Water systems that want to use system-specific design criteria that are below the state's minimum sizing requirements may submit a request for a reduction to the Director. Each request shall include supporting information justifying the reduction in source, storage, or pipeline sizing.

(2) Depending on the reduction being sought, the supporting information may include actual water use data representing peak day demand, average day demand for indoor and irrigation uses, fire flow requirements established by the local fire code official, etc. Each reduction request and supporting information will be reviewed on a case-by-case basis because of the wide variety of factors to be considered, such as water system configuration and size, built-in redundancy, water user type, safety factors, method and quality of data collected, water losses, reliability of the source, etc.

(3) Prior to collecting or compiling water use data for a reduction request, a public water system shall consult with the Division of Drinking Water to identify the information needed for a reduction request and to establish a data collection protocol.

(4) The data submitted for a source reduction request shall be sufficient to account for daily, seasonal, and yearly variations in source and demand.

(5) If data justifying a reduction are accepted by the Director, the sizing requirements may be reduced. The requirements shall not be less than the 90th percentile of acceptable readings.

(6) If a reduction is granted on the basis of limited water use, enforceable water use restrictions must be in place, shall be consistently enforced by the water system or local authority, and shall be accepted by the Director.

(7) The Director may re-evaluate any reduction if the nature or use of the water system changes.

R309-510-6. Water Conservation.

Drinking water systems shall use the water resources of the state efficiently. The minimum sizing requirements of this rule are based on typical water consumption patterns in the State of Utah. Where legally-enforceable water conservation measures exist, the sizing requirements in this rule may be reduced on a case-by-case basis by the Director.

R309-510-7. Source Sizing.

(1) Peak Day Demand and Average Yearly Demand.

Sources shall legally and physically meet water demands under two conditions:

(a) The water system's source capacity shall be able to meet the anticipated water demand on the day of highest water consumption, which is the peak day demand.

(b) The water system's source capacity shall also be able to provide one year's supply of water, which is the average yearly demand.

(2) Indoor Water Use.

Tables 510-1 and 510-2 shall be used as the minimum sizing requirements for peak day demand and average yearly demand for indoor water use unless a public water system has obtained a reduction per R309-510-5.

TABLE 510-1

Source Demand for Indoor Use

Type of Connection	Peak Day Demand	Average Yearly Demand
Year-round use		
Residential	800 gpd/conn	146,000 gal./conn
Equivalent Residential Connection (ERC)	800 gpd/ERC	146,000 gal./ERC
Seasonal/Non-residential use		
Modern Recreation Camp	60 gpd/person	(See Note 1)
Semi-Developed Camp		
a. with pit privies	5 gpd/person	(See Note 1)
b. with flush toilets	20 gpd/person	(See Note 1)
Hotel, Motel, and Resort	150 gpd/unit	(See Note 1)
Labor Camp	50 gpd/person	(See Note 1)
Recreational Vehicle Park	100 gpd/pad	(See Note 1)
Roadway Rest Stop	7 gpd/vehicle	(See Note 1)
Recreational Home Development (i.e., developments with limited water use) (See Note 2)	400 gpd/conn	(See Note 1)

NOTES FOR TABLE 510-1:

Note 1. Average yearly demand shall be calculated by multiplying the number of days in the designated water system operating period by the peak day demand unless a reduction has been granted in accordance with R309-510-5.

Note 2. To be considered a Recreational Home Development (i.e., developments with limited water use) as listed in Table 510-1, dwellings shall not have more than 8 plumbing fixture units,in accordance with the state-adopted plumbing code, and shall not be larger than 1,000 square feet. For a new not-yet-constructed development to be considered as a development with limited water use, it must have enforceable restrictions in place that are enforced by the water system or local authority and are accepted by the Director.

TABLE 510-2

Source Demand for Indoor Use - Individual Establishments (Note 1)

Type of Establishment	Peak Day Demand (gpd) (Notes 2 and 3)
Airports	
a. per passenger	3
b. per employee	15
Boarding Houses	
a. for each resident boarder and employee	50
b. for each nonresident boarders	10
Bowling Alleys, per alley	
a. with snack bar	100
b. with no snack bar	85
Churches, per person	5
Country Clubs	
a. per resident member	100
b. per nonresident member present	25
c. per employee	15
Dentist's Office	
a. per chair	200
b. per staff member	35
Doctor's Office	

a. per patient	10
b. per staff member	35
Fairgrounds, per person	1
Fire Stations, per person	
a. with full-time employees and food prep.	70
b. with no full-time employees and no food prep.	5
Gyms	
a. per participant	25
b. per spectator	4
Hairdresser	
a. per chair	50
b. per operator	35
Hospitals, per bed space	250
Industrial Buildings, per 8 hour shift, per employee (exclusive of industrial waste)	
a. with showers	35
b. with no showers	15
Launderette, per washer	580
Movie Theaters	
a. auditorium, per seat	5
b. drive-in, per car space	10
Nursing Homes, per bed space	280
Office Buildings and Business Establishments, per shift, per employee (sanitary wastes only)	
a. with cafeteria	25
b. with no cafeteria	15
Picnic Parks, per person (toilet wastes only)	5
Restaurants	
a. ordinary restaurants (not 24 hour service)	35 per seat
b. 24 hour service	50 per seat
c. single service customer utensils only	2 per customer
d. or, per customer served (includes toilet and kitchen wastes)	10
Rooming House, per person	40
Schools, per person	
a. boarding	75
b. day, without cafeteria, gym or showers	15
c. day, with cafeteria, but no gym or showers	20
d. day, with cafeteria, gym and showers	25
Service Stations	
a. per vehicle served, or	10
b. per gas pump	250
Skating Rink, Dance Halls, etc., per person	
a. no kitchen wastes	10
b. Additional for kitchen wastes	3
Ski Areas, per person (no kitchen wastes)	10
Stores	
a. per public toilet room	500
b. per employee	11
Swimming Pools and Bathhouses, per person (Note 4)	10
Taverns, Bars, Cocktail Lounges, per seat	20
Visitor Centers, per visitor	5

NOTES FOR TABLE 510-2:

Note 1. When more than one use will occur, the multiple uses shall be considered in determining total demand. Small industrial plants maintaining a cafeteria or showers and club houses or motels maintaining swimming pools or laundries are typical examples of multiple uses. Uses other than those listed above shall be considered in relation to established demands from known or similar installations.

Note 2. Source capacity must at least equal the peak day demand of the system. Determine this by assuming the facility is used to its maximum, e.g., the physical capacity of the facility.

Note 3. To determine the average day demand for establishments listed in Table 510-2, divide the peak day demand by 2, unless alternative data are accepted by the Director.

Note 4. Or Peak Day Demand = 20 x (Water Area (ft^2)/30) + Deck Area (ft^2)

(3) Irrigation Use.

If a water system provides water for irrigation, Table 510-3 shall be used to determine the peak day demand and average yearly demand for irrigation water use. The following procedure shall be used:

(a) Determine the location of the water system on the map entitled Irrigated Crop Consumptive Use Zones and Normal Annual Effective Precipitation, Utah as prepared by the Soil Conservation Service (available from the Division). Find the numbered zone, one through six, in which the water system is located (if located in an area described "non-arable" find nearest numbered zone).

(b) Determine the net number of acres which may be irrigated.

(c) Refer to Table 510-3, which assumes direct application of water to vegetation, to determine peak day demand and average yearly demand for irrigation use.

(d) Consider water losses due to factors such as evaporation, irrigation delivery method, overwatering, pipe leaks, etc. Apply a safety factor to the irrigation demand in the design accordingly.

TABLE 510-3

Source Demand for Irrigation

Map Zone	Peak Day Demand (gpm/irrigated acre)	Average Yearly Demand (AF/irrigated acre) (Note 1)
1	2.26	1.17
2	2.80	1.23
3	3.39	1.66
4	3.96	1.87
5	4.52	2.69
6	4.90	3.26

NOTE FOR TABLE 510-3:
Note 1. The average yearly demand for irrigation water use (in acre-feet per irrigated acre) is based on 213 days of irrigation, e.g., April 1 to October 31.

(4) Variations in Source Yield.

(a) Water systems shall consider that flow from sources may vary seasonally and yearly. Where flow varies, the number of service connections supported by a source shall be based on the minimum seasonal flow rate compared to the corresponding seasonal demand.

(b) Where source capacity is limited by the capacity of treatment facilities, the maximum number of service connections shall be determined using the treatment plant design capacity instead of the source capacity.

R309-510-8. Storage Sizing.

(1) General.

Each public water system, or storage facility serving connections within a specific area, shall provide:

(a) equalization storage volume, to satisfy average day demands for water for indoor use and irrigation use,

(b) fire flow storage volume, if the water system is equipped with fire hydrants intended to provide fire suppression water or as required by the local fire code official, and

(c) emergency storage, if deemed appropriate by the water supplier or the Director.

(2) Equalization Storage.

(a) All public drinking water systems shall provide equalization storage. The amount of equalization storage varies with the nature of the water system, the extent of irrigation use, and the location and configuration of the water system.

(b) Table 510-4 lists required equalization storage for indoor use. Storage requirements for non-community systems not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

TABLE 510-4

Storage Volume for Indoor Use

Type	Volume Required (gallons)
Community Systems	
Residential;	
per single resident service connection	400
Non-Residential;	
per Equivalent Residential Connection (ERC)	400
Non-Community Systems	
Modern Recreation Camp; per person	30
Semi-Developed Camp; per person	
a. with Pit Privies	2.5
b. with Flush Toilets	10
Hotel, Motel and Resort; per unit	75
Labor Camp; per unit	25
Recreational Vehicle Park; per pad	50

Roadway Rest Stop; per vehicle	3.5
Recreational Home Development (i.e., developments with limited water use); per connection (See Note 2 in Table 510-1)	400

(c) Where a drinking water system provides water for irrigation use, Table 510-5 shall be used to determine the minimum equalization storage volumes for irrigation. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in R309-510-7(3).

TABLE 510-5

Storage Volume for Irrigation Use

Map Zone	Volume Required (gallons/irrigated acre)
1	1,782
2	1,873
3	2,528
4	2,848
5	4,081
6	4,964

(3) Fire Flow Storage.

(a) Fire flow storage shall be provided if fire flow is required by the local fire code official or if fire hydrants intended for fire flow are installed.

(b) Water systems shall consult with the local fire code official regarding needed fire flows in the area under consideration. The fire flow information shall be provided to the Division during the plan review process.

(c) When direction from the local fire code official is not available, the water system shall use Appendix B of the International Fire Code, 2015 edition, for guidance. Unless otherwise approved by the local fire code official, the fire flow and fire flow duration shall not be less than 1,000 gallons per minute for 60 minutes.

(4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability. The Director may require emergency storage when it is warranted to protect public health and welfare.

R309-510-9. Distribution System Sizing.

(1) General Requirements.

The distribution system shall be designed to ensure adequate flow and that minimum water pressures as required in R309-105-9 exist at all points within the distribution system.

(2) Peak Instantaneous Demand for Indoor Water Use.

(a) Large or complex water systems may determine peak instantaneous demand using hydraulic modeling. The hydraulic model must either apply an instantaneous peaking factor to account for peak instantaneous demand or use actual peak instantaneous water flow data.

(b) Alternatively, the peak instantaneous demand for a single pipeline shall be calculated for indoor use using the following equation:

$Q = 10.8 \times N^{0.64}$

where N equals the total number of ERC's, and Q equals the total flow (gpm) delivered to the total connections served by that pipeline.

(c) For Recreational Vehicle Parks, the peak instantaneous flow for indoor use shall be based on the following:

TABLE 510-6

Peak Instantaneous Demand for Indoor Water Use for Recreational Vehicle Parks

Number of Connections	Formula
0 to 59	$Q = 4N$
60 to 239	$Q = 80 + 20N^{0.5}$
240 or greater	$Q = 1.6N$

NOTES FOR TABLE 510-6:

Q is total peak instantaneous demand (gpm). N is the maximum number of connections. However, if the only water use is via service buildings, the peak instantaneous demand shall be calculated for the number of plumbing fixture units as presented in the state-adopted plumbing code.

(d) For small non-community water systems, the peak instantaneous demand for indoor water use shall be calculated on a per-building basis for the number of plumbing fixture units as presented in the state-adopted plumbing code.

(3) Peak Instantaneous Demand for Irrigation Use.

Peak instantaneous demand for irrigation use is given in Table 510-7. The procedure for determining the map zone and irrigated acreage for using Table 510-7 is outlined in R309-510-7(3).

TABLE 510-7

Peak Instantaneous Demand for Irrigation Use

Map Zone	Peak Instantaneous Demand (gpm/irrigated acre)
1	4.52
2	5.60
3	6.78
4	7.92
5	9.04
6	9.80

(4) Fire Flow.

(a) Distribution systems shall be designed to deliver needed fire flow if fire flow is required by the local fire code official or if fire hydrants intended for fire flow are provided. The distribution system shall be sized to provide minimum pressures as required by R309-105-9 to all points in the distribution system when needed fire flows are imposed during peak day demand in the distribution system.

(b) The water system shall consult with the local fire code official regarding needed fire flow in the area under consideration. The fire flow information shall be provided to the Division during the plan review process.

(c) If direction from the local fire code official is not available, the water system shall use Appendix B of the International Fire Code, 2015 edition, for guidance. Unless otherwise approved by the local fire code official, the fire flow and fire flow duration shall not be less than 1,000 gallons per minute for 60 minutes.

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R309. Environmental Quality, Drinking Water.
R309-511. Hydraulic Modeling Requirements.
R309-511-1. Purpose.

The purpose of this rule is to ensure that the increased water demand created by new construction will not adversely affect existing or new water users. This will be accomplished by requiring the public water system or its agent to evaluate the water delivery system using a hydraulic model and by certifying to the Director that the project will not adversely impact the system. It is intended that the public water system or its agent will use the findings of the hydraulic model to design improvements providing satisfactory service to both existing and new water users. This rule requires the public water system or its agent to certify that the design meets minimum flow requirements of R309-510 and pressure requirements as set forth in rule R309-105-9.

R309-511-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-511-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

"The public water system or its agent" is the individual responsible for signing the certification and preparing the Hydraulic Modeling Design Elements Report. This individual shall be a registered professional engineer, licensed to practice in the State of Utah.

R309-511-4. General.

(1) Rule Applicability.

(a) This rule applies to public drinking water systems categorized as community water systems as defined by rule R309-100-4(2), and to non-transient non-community water systems that have system demands higher than required by R309-510 or with demands for fire suppression. All public drinking water systems are still required to comply with R309-550-5 with respect to water main design, which may require a hydraulic analysis. Submission of the Hydraulic Model Report, as defined in R309-511-7 and 8, is not required for projects meeting one of the following criteria:

(i) public drinking water projects that will not result in negative hydraulic impact, such as, but not limited to;

(A) addition of new sources in accordance with R309-515;

(B) adding disinfection, fluoridation, or other treatment facilities that do not adversely impact flow, pressure or water quality;

(C) storage tank repair or recoating;

(D) water main additions with no expansion of service (e.g., looping lines);

(E) adding transmission lines to storage or sources without adding service connections;

(F) adding pump station(s) from source or storage upstream of distribution service connections; or,

(G) public drinking water projects that have negligible hydraulic impact as determined by the Director.

(ii) public drinking water projects that are a part of a planned phase of a master plan previously approved by the Director per R309-500-6(3)(a);

(iii) the water system maintains and updates a hydraulic model of the system, and has designated a professional engineer responsible for overseeing the hydraulic analysis in meeting the requirements of R309-511 in writing to the Director; or,

(iv) the water system has a means that is deemed acceptable by the Director to gather real-time data indicative of hydraulic conditions in model scenarios of R309-511-5(9), and the real-time data show the system is capable of meeting the flow and pressure requirements for the additional demands placed on the existing system.

(b) Professional Engineer's certification of the hydraulic modeling results, as defined in R309-511-4(2)(c) and R309-511-6(1), shall be part of the submission of plans for any public drinking water project as defined in R309-500-5(1) except for the projects listed under R309-511-4(1)(a)(i).

(c) A public water system must clearly identify the reason in the plan submittal if it wishes to demonstrate that R309-511 does not apply to a new construction project. In some cases, supporting documentation may be needed.

(d) If there are existing deficiencies in the water system, the Director may allow a new construction project to proceed in accordance with the plan review requirements in R309-500 through 550 as long as the public water system demonstrates that the new construction project is located in a hydraulically separated area and does not adversely impact the existing deficiencies, or does not create new deficiencies within the water system.

(2) Rule Elements.

The public water system or its agent, in connection with the submission of plans and specifications to the Director, shall perform the following:

(a) conduct a hydraulic modeling evaluation consistent with the requirements as set forth in this rule and R309-510. This model shall include either the entire public drinking water system or the specific areas affected by the new construction if hydraulically separated areas exist within the water system;

(b) calibrate the model using field measurements and observations;

(c) certify in writing to the Director that the design complies with the sizing requirements of R309-510 and the minimum water pressures of R309-105-9;

(d) prepare and submit a Hydraulic Model Design Elements Report (see R309-511-7); and,

(f) prepare a System Capacity and Expansion Report if required (see R309-511-8).

R309-511-5. Requirements for the Hydraulic Model.

The following minimum requirements must be incorporated into hydraulic models that are constructed to meet these requirements:

(1) include at least 80 percent of the total pipe lengths in the distribution system affected by the proposed project;

(2) account for 100 percent of the flow in the distribution system affected by the proposed project. Water demand allocation must account for at least 80 percent of the flow delivered by the distribution system affected by the proposed project if customer usage in the system is metered;

(3) include all 8-inch diameter and larger pipes. Pipes smaller than 8-inch diameter shall also be included if they connect pressure zones, storage facilities, major demand areas, pumps, and control valves, or if they are known or expected to be significant conveyers of water such as fire suppression demand. Model piping does not need to include service lateral piping;

(4) include all pipes serving areas at higher elevations, dead ends, remote areas of a distribution system, and areas with known under-sized pipelines;

(5) include all storage facilities and accompanying controls or settings applied to govern the open/closed status of the facility that reflect standard operations;

(6) if applicable, include all pump stations, drivers (constant or variable speed), and accompanying controls or settings applied to govern their on/off/speed status that reflect various operating conditions and drivers;

(7) include all control valves or other system features that could significantly affect the flow of water through the distribution system (e.g., interconnections with other systems and pressure reducing valves between pressure zones) reflecting various operating conditions;

(8) impose peak day and peak instantaneous demands to the water system's facilities. These demands may be peak day and peak instantaneous demands per R309-510, the reduced demand approved by the Director per R309-510-5, or the demands experienced by the water system that are higher than the values listed in R309-510. This may require multiple model simulations to account for the varying water demand conditions. In some cases, extended period simulations are needed to evaluate changes in operating conditions over time. This will depend on the complexity of the water system, extent of anticipated fire event and nature of the new expansion;

(9) calibrate the model to adequately represent the actual field conditions using field measurements and observations;

(10) if fire hydrants are connected to the distribution system, account for fire suppression requirements specified by local fire authority or use the default values stated in R309-510-9(4). For significant fire suppression demand, extended simulations must contain the run time for the period of the anticipated fire event. In some cases, a steady-state model may be sufficient for residential fire suppression demand; and,

(11) account for outdoor use, such as irrigation, if the drinking water system supplies water for outdoor use.

R309-511-6. Elements of the Public Water System or Its Agent's Certification.

(1) The public water system or its agent's certification.

The Director relies upon the professional judgment of the registered professional engineer who certifies that the hydraulic analysis and evaluation have been done properly and that the flow and pressure requirements have been met. The public water system or its agent shall, after a thorough review, submit a document to the Director certifying that the following requirements have been met:

(a) the hydraulic model requirements as set forth in rule R309-511-5;

(b) the appropriate demand requirements as specified in this rule and rule R309-510 have been used to evaluate various operating conditions of the public drinking water system;

(c) the hydraulic model predicts that new construction will not result in any service connection within the new expansion area not meeting the minimum distribution system pressures as specified in R309-105-9;

(d) the hydraulic model predicts that new construction will not decrease the pressures within the existing water system such that the minimum distribution system pressures are not met, as specified in R309-105-9;

(e) the calibration methodology is described and the model is sufficiently accurate to represent conditions likely to be experienced in the water delivery system; and,

(f) identify the hydraulic modeling method, and if computer software was used, the software name and version used.

(2) The format of the public water system or its agent's submission.

The public water system or its agent shall submit to the Director the following documentation:

(a) the certification as required in R309-511-6(1). The certification shall be signed, dated, and stamped by a registered professional engineer, licensed to practice in the State of Utah;

(b) a Hydraulic Model Design Elements Report (see R309-511-7). The document shall be signed, dated, and stamped by a registered professional engineer, licensed to practice in the State of Utah; and,

(c) for community public water systems, the water system management shall certify that they have received a copy of input and output data for the hydraulic model with the simulation showing the worst case results in terms of water system pressure and flow.

(3) The submission of supporting documentation.

The public water system or its agent shall submit a System Capacity and Expansion Report (see R309-511-8) if requested by the Director. The document shall be signed, dated, and stamped by a registered professional engineer, licensed to practice in the State of Utah.

R309-511-7. Hydraulic Model Design Elements Report.

The public water system or its agent shall prepare a Hydraulic Model Design Elements Report along with, and in support of, the certification stated in R309-511-6(1). The Hydraulic Model Design Elements Report shall contain, but is not limited to, the following elements:

(1) if the public drinking water system provides water for outdoor use, the report must describe the criteria used to estimate this demand. If the irrigation demand map in R309-510-7(3) is not used, the report shall provide justification for the alternative demands used in the model. If the irrigation demands are based on the map in R309-510-7(3) the report must identify the irrigation zone number, a statement and/or map of how the irrigated acreage is spatially distributed, and the total estimated irrigated acreage. The indicated irrigation demands must be used in the model simulations;

(2) the total number of connections served by the water system including existing connections and anticipated new connections served by the water system after completion of the construction of the project;

(3) the total number of equivalent residential connections (ERC) including both existing connections as well as anticipated new connections associated with the project. The number of ERCs must include high as well as low-volume water users. The determination of the ERCs shall be based on flow requirements using the anticipated demand as outlined in R309-510, or based on alternative sources of information that are deemed acceptable by the Director;

(4) the methodology used for calculating demand and allocating it to the model; a summary of pipe length by diameter; a hydraulic schematic of the distribution piping showing pressure zones, general pipe connectivity between facilities and pressure zones, storage, elevation and sources; and a list or ranges of values of the friction coefficient used in the hydraulic model according to pipe material and condition in the system. All coefficients of friction used in the hydraulic analysis shall be consistent with standard practices;

(5) a statement stating either "yes fire hydrants exist or will exist within the system" or "there are no fire hydrants connected to the system and there is no plan to add fire hydrants with this project." Either statement will require the identification of the local fire authority's name, address, and contact information, as well as the fire flow quantity and duration if required;

(6) the locations of the lowest pressures within the distribution system, and areas identified by the hydraulic model as not meeting each scenario of the minimum pressure requirements in R309-105-9; and,

(7) calibration method and quantitative summary of the calibration results (e.g., comparison tables, graphs).

R309-511-8. System Capacity and Expansion Report.

The public water system or its agent may be required to prepare a System Capacity and Expansion Report along with a Hydraulic Model Design Elements Report, as specified above, in support of the certification. It is intended that the System Capacity and Expansion Report be prepared, maintained, and used by the public water system's management to make informed decisions about its capability to provide water service to future customers and need only be submitted to the Division if requested by the Director. The System Capacity and Expansion Report shall consist of the elements described in R309-110-4 under the definition of "Master Plan" and shall be updated if significant growth or changes to the water system have occurred.

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R309. Environmental Quality, Drinking Water.

R309-545. Facility Design and Operation: Drinking Water Storage Tanks.

R309-545-1. Purpose.

The purpose of this rule is to provide specific requirements for public drinking water storage tanks. It is intended to be applied in conjunction with other rules, specifically R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that facilities are reliably capable of supplying water in adequate quantities, which consistently meeting applicable drinking water quality requirements and not posing a threat to general public health.

R309-545-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-545-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-545-4. General.

Storage for drinking water shall be provided as an integral part of each public drinking water system unless an exception to the rule is approved by the Director. Pipeline volume in transmission or distribution lines shall not be considered part of any storage volumes.

R309-545-5. Size of Tank(s).

Storage tanks shall be sized in accordance with the required minimums of R309-510.

R309-545-6. Tank Material and Structural Adequacy.

(1) Materials.

The materials used in drinking water storage tanks shall provide stability and durability as well as protect the quality of the stored water. Steel tanks shall be constructed from new, previously unused, plates and designed in accordance with AWWA Standard D100-11.

(2) Structural Design.

The structural design of drinking water storage tanks shall be sufficient for the environment in which they are located.

R309-545-7. Location of Tanks.

(1) Pressure Considerations.

The location of the tank and the design of the water system shall be such that the minimum working pressure in the distribution system shall meet the minimum pressures as required in R309-105-9.

(2) Connections.

Tanks shall be located at an elevation where present and anticipated connections can be adequately served. System connections shall be placed at elevations such that minimum pressures, as required in R309-105-9, will be continuously maintained.

(3) Sewer Proximity.

Sewers, and similar sources of possible contamination shall be kept at least 50 horizontal feet from the tank.

(4) Standing Surface Water.

The area surrounding a ground-level or buried drinking water storage tank shall be graded in a manner that will prevent surface water from standing within 50 horizontal feet of the tank.

(5) Ability to Isolate.

Drinking water storage tanks shall be designed and located so that they can be isolated from the distribution system. Storage tanks shall be capable of being drained for cleaning or maintenance. Where possible, tanks shall be designed with the ability to be isolated without loss of pressure or service in the distribution system.

(6) Earthquake and Landslide Risks.

Potential geologic hazards shall be taken into account in selecting a tank location. Earthquake and landslide risks shall be evaluated.

(7) Security.

The site location and design of a drinking water storage tank shall take into consideration security issues and potential for vandalism.

R309-545-8. Tank Elevation and Burial.

(1) Flood Elevation.

The bottom of a ground-level or buried drinking water storage tank shall be located at least 3 feet above the 100-year flood level or the highest known maximum flood elevation, whichever is higher.

(2) Ground Water.

When the bottom of a drinking water storage tank will be placed below the normal ground surface, it shall be placed above the local ground water table.

(3) Covered Roof.

When the roof of a drinking water storage tank will be covered by earth, the roof shall be sloped to drain toward the outside edge of the tank.

R309-545-9. Tank Roof and Sidewalls.

(1) Protection From Contamination.

All drinking water storage tanks shall have suitable watertight roofs and sidewalls that shall also exclude birds, animals, insects, and excessive dust.

(2) Openings.

Openings in the roof and sidewalls shall be kept to a minimum and shall comply with the following:

(a) Any pipes running through the roof or sidewall of a metal drinking water storage tank shall be welded, or properly gasketed. In new concrete tanks, these pipes shall be connected to standard wall castings with seepage rings that have been poured in place. Vent pipes, in addition to seepage rings, shall have raised concrete curbs that direct water away from the vent pipe and are formed as a single pour with the roof deck. Roof drains or any other pipes, which may contain water of lesser quality than drinking water, shall not penetrate the roof, walls, or floor of a drinking water storage tank.

(b) Openings in a storage tank roof or top, designated to accommodate control apparatus or pump columns, shall be welded, gasketed, or curbed and sleeved as above, and shall have additional proper shielding to prevent vandalism.

(3) Adjacent Compartments.

Drinking water shall not be stored or conveyed in a compartment adjacent to wastewater when the two compartments are separated by a single wall.

(4) Roof Drainage.

The roof of all storage tanks shall be designed for drainage to eliminate water ponding. Parapets, or similar structures, which would tend to hold water and snow, shall not be allowed/permitted unless adequate waterproofing and drainage are provided. Downspout or roof drain pipes shall not enter or pass through the tank.

R309-545-10. Internal Features.

The following shall apply to internal features of drinking water storage tanks:

(1) Drains.

(a) A means shall be provided for the draining of drinking water storage tanks.

(b) Where possible, the drain shall be separate from the outlet pipeline. If a tank drain line is provided, it shall be sloped for complete drainage.

(c) The drain shall not discharge to a sanitary sewer.

(d) If local authority allows discharge to a storm drain, the drain discharge shall have a physical clearance of at least 12 inches between the discharge end of the pipe and the overflow rim of the receiving basin.

(2) Internal Catwalks.

Internal catwalks, if provided and located over the drinking water, shall have a solid floor with raised edges. The edges and floor shall be designed so that shoe scrapings or dirt will not fall into the drinking water.

(3) Inlet and Outlet.

(a) To minimize potential sediment in the flow from the tank, the outlet pipes from all tanks shall be located in a manner to provide a silt trap prior to discharge into the distribution system.

(b) Inlet and outlet pipes shall be configured to provide mixing and circulation.

(4) Tank Floor.

The floor of the storage tank shall be sloped to permit complete drainage of the structure.

R309-545-11. Internal Surfaces and Coatings.

(1) ANSI/NSF Standard 61 Certification.

All interior surfaces and coatings shall comply with ANSI/NSF Standard 61 or other standards approved by the Director. This requirement applies to any pipes and fittings, protective materials (e.g., paints, coatings, concrete admixtures, concrete release agents, or concrete sealers), joining and sealing materials (e.g., adhesives, caulks, gaskets, primers and sealants) and mechanical devices (e.g., electrical wire, switches, sensors, valves, or submersible pumps) that may come into contact with the drinking water.

(2) Curing Procedures and Volatile Organic Compounds.

(a) Proper curing procedures shall be followed per manufacturer's directions, including curing time, temperature, and forced air ventilation. Drinking water shall not be introduced into the tank until proper curing has occurred.

(b) It shall be the responsibility of the water system to assure that no tastes, odors, toxins, or contaminantsthat result in MCL exceedances, are imparted to the water as a result of tank coating or repair.

(c) Prior to placing a drinking water storage tank in service, cleaning, disinfection, and flushing procedures shall be completed.

(d) Prior to placing a drinking water storage tank in service, an analysis for volatile organic compounds from water contained therein may be required to verify compliance with drinking water maximum contaminant levels.

R309-545-12. Steel Tanks.

(1) Paints.

Proper protection shall be given to all metal surfaces, both internal and external, by paints or other protective coatings. Internal coatings shall comply with R309-545-11.

(2) Cathodic Protection.

If installed, internal cathodic protection shall be designed, installed and maintained by personnel trained in corrosion engineering.

R309-545-13. Tank Overflow.

All water storage tanks shall be provided with an overflow that discharges at an elevation between 12 and 24 inches above the ground surface or the rim of the receiving basin. The discharge shall be directed away from the tank and shall not cause erosion.

(1) Diameter.

Overflow pipes shall be of sufficient capacity to permit waste of water in excess of the filling rate.

(2) Slope.

Overflow pipes shall be sloped for complete drainage.

(3) Screen.

Overflow pipes shall be screened with No. 4 mesh non-corrodible screen installed at a location least susceptible to damage by vandalism.

(4) Visible Discharge.

Overflow pipes shall be located so that any discharge is visible.

(5) Cross Connections.

Overflow pipes shall not be connected to, or discharge into, any sanitary sewer system.

R309-545-14. Access Openings.

Drinking water storage tanks shall be designed with reasonably convenient access to the interior for cleaning and maintenance.

(1) Height.

There shall be at least one opening above the level of the overflow, which shall be framed at least 4 inches above the surface of the roof at the opening; or if on a buried tank, shall be elevated at least 18 inches above any earthen cover over the tank. The frame shall be securely fastened and sealed to the tank roof to prevent any liquid contaminant entering the tank. Concrete drinking water storage tanks shall have raised curbs around access openings, formed and poured continuous with the pouring of the roof, and sloped to direct water away from the frame.

(2) Shoebox Lid.

The frame of any access opening shall be provided with a close-fitting, solid shoebox type cover that extends down around the frame at least 2 inches and is furnished with a gasket(s) between the lid and frame. The horizontal surface of the tank lid shall not have any openings, cracks, or penetrations, such as a lock, key hole, or bolted handle that would allow contaminants to enter the tank.

(3) Locking Device.

The lid to any access opening shall have a locking device.

R309-545-15. Venting.

Drinking water storage tanks shall be vented. The air venting capacity shall exceed the water inflow and the water outflow of the tank. Overflows shall not be considered or used as vents. Vents provided on drinking water storage tanks shall:

(1) Inverted Vent.

Be downturned a minimum of 2 inches below any opening and shielded to prevent the entrance of contaminants.

(2) Open Venting.

On buried structures, the end of the vent discharge shall be a minimum of 24 inches above the earthen covering.

(3) Blockage.

Be located and sized to avoid blockage during winter conditions.

(4) Screen.

Be fitted with No. 14 mesh or finer non-corrodible screen.

(5) Screen Protector.

Vents that are 6-inch diameter or greater shall be fitted with additional heavy gage screen or substantial covering, which will protect the No. 14 mesh screen against vandalism or damage.

R309-545-16. Freezing Prevention.

All drinking water storage tanks and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which may interfere with proper functioning.

R309-545-17. Level Controls.

Adequate level control devices shall be provided to maintain water levels in storage tanks.

R309-545-18. Safety.

(1) Utah OSHA.

The safety of employees shall be considered in the design of the storage tanks. Ladders, ladder guards, platform railings, and safely located entrance hatches shall be provided where applicable. As a minimum, safety practices shall conform to pertinent laws and regulations of the Utah Occupational Safety and Health Division.

(2) Ladders.

Ladders having an unbroken length in excess of 20 feet shall be provided with appropriate safety features, such as a safety cage, a safety harness, platforms, etc.

(3) Requirements for Elevated Tanks.

Elevated tanks shall have railings or handholds provided to access the water compartment safely.

R309-545-19. Disinfection.

Drinking water storage tanks shall be disinfected before being put into service for the first time and after being entered. The tank shall be cleaned of all refuse and shall then be washed with drinking water prior to adding the disinfectant. AWWA Standard C652-11 shall be followed for tank disinfection.

Upon completing any of the three methods for storage tank chlorination, as outlined in AWWA C652-11, the water system must properly dispose of residual super-chlorinated waters in the outlet pipes. Other super-chlorinated waters, which are not to be ultimately diluted and delivered into the distribution system, shall also be properly disposed. Chlorinated water discharged from the storage tank shall be disposed of in conformance with R317 of the Utah Administrative Code.

R309-545-20. Tank Standards.

The plans and specifications shall incorporate the applicable portions of the following standards:

(1) AWWA Standards.

(a) C652-11, Disinfection of Water-Storage Facilities.

(b) D100-11, Welded Carbon Steel Tanks for Water Storage.

(c) D102-11, Coating Steel Water-Storage Tanks.

(d) D103-09, Factory-Coated Bolted Carbon Steel Tanks for Water Storage.

(e) D104-11, Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Tanks.

(f) D110-13, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

(g) D115-06, Tendon-Prestressed Concrete Water Tanks.

(h) D120-09, Thermosetting Fiberglass-Reinforced Plastic Tanks.

(i) D130-11, Geomembrane Materials for Potable Water Applications.

(2) NSF International Standards.

(a) NSF 60, Drinking Water Treatment Chemicals - Health Effects.

(b) NSF 61, Drinking Water System Components - Health Effects.

(3) Utah OSHA.

Applicable standards of the Utah Occupational Safety and Health Division shall be adhered to.

R309-545-21. Operation and Maintenance of Storage Tanks.

(1) Inspection and Cleaning.

Tanks that are entered for inspection or cleaning shall be disinfected in accordance with AWWA Standard C652-11 prior to being returned to service.

(2) Recoating or Repairing.

Any substance used to recoat or repair the interior of a drinking water storage tank shall be certified to conform to ANSI/NSF Standard 61. If the tank is not drained for recoating or repairing, any substance or material used to repair the interior coatings or cracks shall be suitable for underwater application, as indicated by the manufacturer, as well as comply with both ANSI/NSF Standards 60 and 61. Recoating of the interior of a drinking water tank shall comply with the plan review requirements of R309-500-5(1)(c)(i).

(3) Seasonal Use.

Water storage tanks which are operated seasonally shall be flushed and disinfected in accordance with AWWA Standard C652-11 prior to each season's use. Certification of proper disinfection shall be obtained by the water system and kept on file. During the non-use period, care shall be taken to see that openings to the water storage tank (those which are normally closed and sealed during normal use) are closed and secured.

KEY: drinking water, storage tanks, access, overflow and drains
Date of Enactment or Last Substantive Amendment: November 10, 2014
Notice of Continuation: March 12, 2020
Authorizing, and Implemented or Interpreted Law: 19-4-104

R309. Environmental Quality, Drinking Water.
R309-550. Facility Design and Operation: Transmission and Distribution Pipelines.
R309-550-1. Purpose.

The purpose of this rule is to provide specific requirements for the design and installation of transmission and distribution pipelines which deliver drinking water to facilities of public drinking water systems or to consumers. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that facilities are reliably capable of supplying water in adequate quantities, consistently meeting applicable drinking water quality requirements, and not posing a threat to general public health.

R309-550-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-550-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-550-4. General.

Transmission and distribution pipelines shall be designed, constructed and operated to convey adequate quantities of water at ample pressure, while maintaining water quality.

R309-550-5. Water Main Design.

(1) Distribution System Pressure.

(a) The distribution system shall be designed to maintain minimum pressures as required in R309-105-9 at points of connection, under all conditions of flow.

(b) When static pressure exceeds 150 psi in new distribution water lines, pressure reducing devices shall be provided on mains in the distribution system where service connections exist.

(2) Design Flow Rates.

Flow rates used when designing or analyzing distribution systems shall meet the minimum requirements in R309-510.

(3) Hydraulic Analysis.

(a) All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements.

(b) Where improvements will upgrade more than 50% of an existing distribution system, or where a new distribution system is proposed, a hydraulic analysis of the entire system shall be prepared and submitted for review prior to plan approval.

(c) Some projects require a hydraulic model. The Division may require submission of a hydraulic modeling report and/or certification, as outlined in R309-511, prior to plan approval.

(4) Minimum Water Main Size.

For water mains not connected to fire hydrants, the minimum line size shall be 4 inches in diameter, unless they serve picnic sites, parks, semi-developed camps, primitive camps, or roadway rest-stops. Minimum water main size, serving a fire hydrant lateral, shall be 8 inches in diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by 6-inch lines.

(5) Fire Protection.

When a public water system is required to provide water for fire flow by the local fire code official, or if the system has installed fire hydrants on existing distribution mains for that purpose:

(a) The design of the distribution system shall be consistent with the fire flow requirements as determined by the local fire code official.

(b) The location of fire hydrants shall be consistent with the requirements of the State-adopted fire code and as determined by the local fire code official.

(c) The pipe network design shall permit fire flows to be met at representative locations while minimum pressures, as required in R309-105-9, are maintained at all times and at all points in the distribution system.

(d) Fire hydrant laterals shall be a minimum of 6 inches in diameter.

(6) Geologic Considerations.

The character of the soil through which water mains are to be laid shall be considered. Special design and burial techniques shall be employed for Community Water Systems in areas of geologic hazard (e.g., slide zones, fault zones, river crossings, etc.)

(7) Dead Ends.

(a) To provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.

(b) Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 fps in the water main being flushed. No flushing device shall be directly connected to a sewer.

(8) Isolation Valves.

Sufficient number of valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial districts and at not more than one block or

800 foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed one mile.

(9) Corrosive Soils and Waters.

Consideration shall be given to the materials to be used when corrosive soils or waters will be encountered.

(10) Special Precautions in Areas of Contamination.

Where distribution systems are installed in areas of contamination:

(a) pipe and joint materials which are not susceptible to contamination, such as permeation by organic compounds, shall be used; and,

(b) non-permeable materials shall be used for all portions of the system including water mains, service connections, and hydrant leads.

(11) Water Mains and Other Sources of Contamination.

Caution shall be exercised when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The Division shall be contacted to establish specific design requirements prior to locating water mains near a source of contamination.

R309-550-6. Component Materials and Design.

(1) ANSI/NSF Standard for Health Effects.

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, Drinking Water System Components - Health Effects. To permit field-verification of this certification, all components shall be appropriately stamped with the NSF logo.

(2) Asbestos and Lead.

(a) The use of asbestos cement pipe shall not be allowed.

(b) Pipes and pipe fittings installed after January 4, 2014, shall be "lead free" in accordance with Section 1417 of the Federal Safe Drinking Water Act. They shall be certified as meeting ANSI/NSF 372 or Annex G of ANSI/NSF 61.

(3) 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.

(4) Used Materials.

Only materials that have been used previously for conveying drinking water may be reused. Used materials shall meet the above standards, be thoroughly cleaned, and be restored to their original condition.

(5) Fire Hydrants.

(a) Hydrant drains shall not be connected to, or located within, 10 feet of sanitary sewers. Where possible, hydrant drains shall not be located within 10 feet of storm drains.

(b) Auxiliary valves shall be installed in all hydrant leads.

(c) Hydrant drains shall be installed with a gravel packet or dry well unless the natural soils will provide adequate drainage.

(6) Air Relief Valves and Blow-Offs.

(a) At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves.

(b) The open end of the air relief vent pipe from automatic valves shall be provided with a #14 mesh, non-corrodible screen and a downward elbow, and where possible, be extended to at least one foot above grade. Alternatively, the open end of the pipe may be extended to as little as one foot above the top of the pipe if the valve's chamber is not subject to flooding, or if it meets the requirements of (7) Chamber Drainage.

(c) Blow-offs or air relief valves shall not be connected directly to a sewer.

(d) Adequate number of hydrants or blow-offs shall be provided to allow periodic flushing and cleaning of water lines.

(e) The air relief valve shall be installed in a manner to prevent it from freezing. A shut-off valve shall be provided to permit servicing of an air relief valve.

(7) Chamber Drainage.

(a) Chambers, pits, or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system, shall not be connected directly to a storm drain or sanitary sewer.

(b) Chambers shall be provided with a drain to daylight, if possible. Where this is not possible, underground gravel-filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage. Sump pumps may also be considered if a drain to daylight or absorption pit is not feasible.

(8) Control Valve Stations

(a) Pressure Reducing Valves (PRVs)

(i) Isolation Valves shall be installed on both sides of the pressure reducing valve.

(ii) Where variable flow conditions will be encountered, consideration shall be given to providing parallel PRV lines to accomidate low and high flow conditions.

(b) Backflow Devices

Installation of Backflow devices shall conform to the State-adopted plumbing code.

(c) Meters

Meter installation shall conform to the State-adopted plumbing code and local jurisdictional standards.

R309-550-7. Separation of Water Mains and Transmission Lines from Sewers.

(1) Basic Separation Standards.

(a) The horizontal distance between water lines and sanitary sewer lines shall be at least 10 feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e. from the nearest edges of the facilities).

(b) Water mains and sewer lines shall not be installed in the same trench.

(c) Where local conditions make it impossible to install water or sewer lines at separation distances required by subsection (a), the sewer pipes are in good condition, and there is not high groundwater in the area, it may be acceptable if the design includes a minimum horizontal separation of 6 feet and a minimum vertical clearance of 18 inches with the waterline being above. In order to determine whether the design is acceptable, the following information shall be submitted as part of the plans for review.

(i) reason for not meeting the minimum separation standard;

(ii) location where the water and sewer line separation is not being met;

(iii) horizontal and vertical clearance that will be achieved;

(iv) sewer line information including pipe material, condition, size, age, type of joints, thickness or pressure class, whether the pipe is pressurized or not, etc.;

(v) water line information including pipe material, condition, size, age, type of joints, thickness or pressure class, etc.;

(vi) ground water and soil conditions; and,

(vii) any mitigation efforts.

(d) If the basic separation standards as outlined in subsections (a) though (c) above cannot be met, an exception to the rule can be applied for with additional mitigation measures to protect public health, in accordance with R309-105-6(2)(b).

(3) Special Provisions.

The following special provisions apply to all situations:

(a) The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist.

(b) All water transmission lines that may become unpressurized shall not be installed within 20 feet of sewer lines.

(c) In the installation of water mains or sewer lines, measures shall be taken to prevent or minimize disturbances of the existing line.

(d) Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist or where the minimum separation distances cannot be met. These conditions may be due to soil type, groundwater, and/or the nature of the fluid conveyed in the conduit, such as a septic sewage which produces corrosive hydrogen sulfide.

(e) Sewer Force Mains

(i) When a new sewer force main crosses under an existing water main, all portions of the sewer force main within 10 feet (horizontally) of the water main shall be enclosed in a continuous sleeve.

(ii) When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

(4) Water Service Laterals Crossing Sewer Mains and Laterals.

Water service laterals shall conform to all requirements given herein for the separation of water and sewer lines.

R309-550-8. Installation of Water Mains.

(1) Standards.

The specifications shall incorporate the provisions of the manufacturer's recommended installation procedures or the following applicable standards:

(a) For ductile iron pipe, AWWA Standard C600-10, Installation of Ductile Iron Water Mains and Their Appurtenances;

(b) For PVC pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe and AWWA Manual of Practice M23, 2003;

(c) For HDPE pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and AWWA Manual of Practice M55, 2006; and,

(d) For Steel pipe, AWWA Standard C604-11, Installation of Buried Steel Water Pipe- 4 inch and Larger.

(2) Bedding.

A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones larger than the backfill materials described below shall be removed for a depth of at least 6 inches below the bottom of the pipe.

(3) Backfill.

Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. The material and backfill zones shall be as specified by the standards referenced in Subsection (1), above. As a minimum:

(a) for plastic pipe, backfill material with a maximum particle size of 3/4 inch shall be used to surround the pipe; and,

(b) for ductile iron pipe, backfill material shall contain no stones larger than 2 inches.

(4) Dropping Pipe into Trench.

Under no circumstances shall the pipe or accessories be dropped into the trench.

(5) Burial Cover.

All water mains shall be covered with sufficient earth or other insulation to prevent freezing, unless they are part of a non-community system that can be shut-down and drained during winter months when temperatures are below freezing.

(6) Thrust Blocking.

All tees, bends, plugs, and hydrants shall be provided with thrust blocking, anchoring, tie rods, or restraint joints designed to prevent movement. Restraints shall be sized to withstand the forces experienced.

(7) Pressure and Leakage Testing.

All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600-10.

(8) Surface Water Crossings.

(a) Above Water Crossings

The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

(b) Underwater Crossings

(i) A minimum cover of 2 feet or greater, as local conditions may dictate, shall be provided over the pipe.

(ii) When crossing water courses that are greater than 15 feet in width, the following shall be provided:

(A) Pipe with joints shall be of special construction, having restrained joints for joints within the surface water course and flexible restrained joints at both edges of the water course.

(B) Isolating valves shall be provided on both sides of the water crossing at locations not subject to high ground water or flooding, so that the section can be isolated for testing or repair.

(C) A means shall be provided, such as a sampling tap, not subject to flooding, to allow for representative water quality testing on the upstream and downstream side of the crossing.

(D) A means shall be provided to pressure test the underground water crossing pipe.

(9) Sealing Pipe Ends During Construction.

The open ends of all pipelines under construction shall be covered and effectively sealed at the end of the day's work.

(10) Disinfecting Water Lines.

All new water mains or appurtenances shall be disinfected in accordance with AWWA Standard C651-05 or a method approved by the Director. The specifications shall include detailed procedures for the adequate flushing, disinfection and microbiological testing of all water mains. On all new and extensive distribution system construction, evidence of satisfactory disinfection shall be provided to the Division. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with drinking water. A standard heterotrophic plate count is advisable. The use of water for public drinking water purposes shall not commence until the bacteriologic tests indicate the water is free from contamination.

R309-550-9. Cross Connections and Interconnections.

(1) Physical Cross Connections.

There shall be no physical cross connections between the distribution system and pipe, pumps, hydrants, or tanks that may be contaminated from any source, including pressurized irrigation.

(2) Recycled Water.

Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the drinking water supply.

(3) System Interconnects.

The interconnections between different drinking water systems shall be reviewed and approved by the Director.

R309-550-10. Water Hauling.

Proposals for water hauling shall be submitted to, and approved by, the Director.

(1) Community Water Systems.

Water hauling is not an acceptable permanent source for drinking water distribution in Community Water Systems.

(2) Non-Community Systems.

The Director may allow water hauling for Non-Community Public Water Systems by special approval if:

(a) consumers can not otherwise be supplied with good quality drinking water; or,

(b) the nature of the development, or ground conditions, are such that the placement of a pipe distribution system is not justified.

(3) Emergencies.

Water hauling may be a temporary means of providing drinking water in an emergency. Water systems shall notify the Division as soon as possible of such emergencies.

R309-550-11. Service Connections and Plumbing.

(1) Service Taps.

Service taps shall not jeopardize the quality of the system's water.

(2) Plumbing.

(a) Water services and plumbing shall conform to the State-adopted Plumbing Code.

(b) Pipes and pipe fittings installed after January 4, 2014, shall be "lead-free" in accordance with Section 1417 of the federal Safe Drinking Water Act. They shall be certified meeting the ANSI/NSF 372 or Annex G of ANSI/NSF 61.

(3) Individual Home Booster Pumps.

Individual booster pumps shall not be allowed for individual service from the public water supply mains. Exceptions to the rule may be granted by the Director if it can be shown that the granting of such an exception will not jeopardize the public health.

(4) Service Lines.

(a) Service lines shall be capped until connected for service.

(b) The portion of the service line under the control of the water system is considered to be part of the distribution system.

(5) Service Meters and Building Service Line.

Connections between the service meter and the home shall be in accordance with the State-adopted Plumbing Code.

R309-550-12. Transmission Lines.

(1) Unpressurized Flows.

Transmission lines shall conform to all applicable requirements in this rule. Transmission line design shall minimize unpressurized flows.

(2) Proximity to Concentrated Sources of Pollution.

A water system shall not install an unpressurized transmission line less than 20 feet from a concentrated source of pollution (e.g., septic tanks and drain fields, garbage dumps, pit privies, sewer lines, feed lots, etc.). Furthermore, unpressurized transmission lines shall not be placed in boggy areas or areas subject to the ponding of water.

R309-550-13. Operation and Maintenance.

(1) Disinfection After Line Repair.

The disinfection procedures of Section 4.7, AWWA Standard C651-05 shall be followed if a water main is cut or repaired.

(2) Cross Connections.

The water system shall not allow a connection that may jeopardize water quality. Cross connections shall be eliminated by physical separation, an air gap, or an approved and properly operating backflow prevention assembly.

The water system shall have an ongoing cross connection control program in compliance with R309-105-12.

(3) ANSI/NSF Standards.

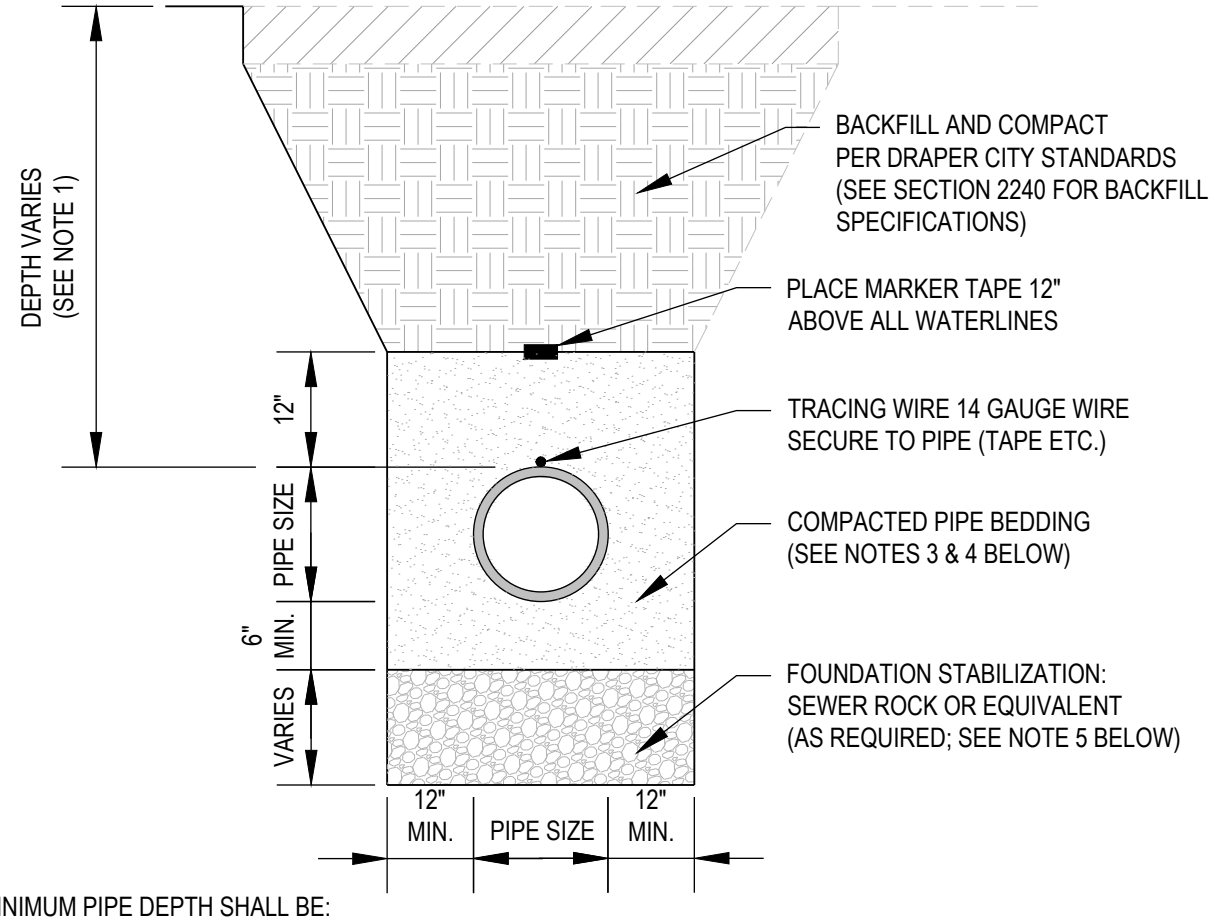
All pipe and fittings used in routine operation and maintenance shall be ANSI-certified as meeting NSF Standard 61 or Standard 14.

(4) Seasonal Operation.

Water systems operated seasonally shall be disinfected and flushed according to AWWA Standard C651-05 for pipelines and AWWA Standard C652-11 for storage facilities prior to each season's use. A satisfactory bacteriologic sample shall be obtained prior to use. During the non-use period, care shall be taken to close all openings into the system.

KEY: drinking water, transmission and distribution pipelines, connections, water hauling
Date of Enactment or Last Substantive Amendment: September 10, 2015
Notice of Continuation: March 12, 2020
Authorizing, and Implemented or Interpreted Law: 19-4-104

Appendix D: Draper City Standards



1. MINIMUM PIPE DEPTH SHALL BE:
   48" WHEN ELEVATION IS BELOW 5200 FEET
   60" WHEN ELEVATION IS 5200 FEET
   * MAXIMUM PIPE DEPTH SHALL BE 60", OR 2' BELOW STRUCTURAL SECTION OF ROADS

2. STANDARD PIPE MATERIALS
   DIA. ≤ 10" D.I. OR C900 PVC PIPE
   DIA. > 10" D.I. PIPE
   D.I. = CLASS 52 DUCTILE IRON PIPE
   C900 = CLASS 305 C900 PVC PIPE (DR-14)

3. PIPE BEDDING SHALL BE: SAND

4. CONTRACTOR SHALL COMPACT BEDDING MATERIAL TO A MIN. 95% OF THE MAXIMUM DRY DENSITY PER CURRENT ASTM D-1557.

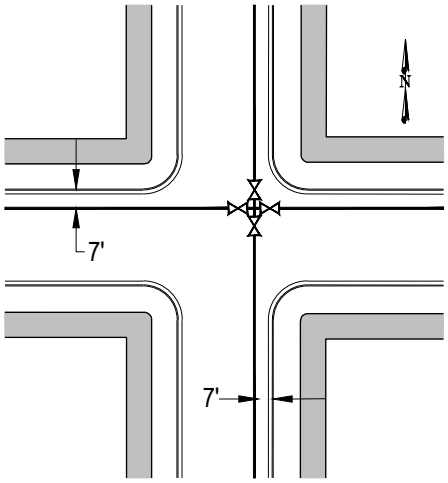
5. SEE SECTION 2220-3.02 FOR TRENCH EXCAVATION AND STABILIZATION SPECIFICATIONS.

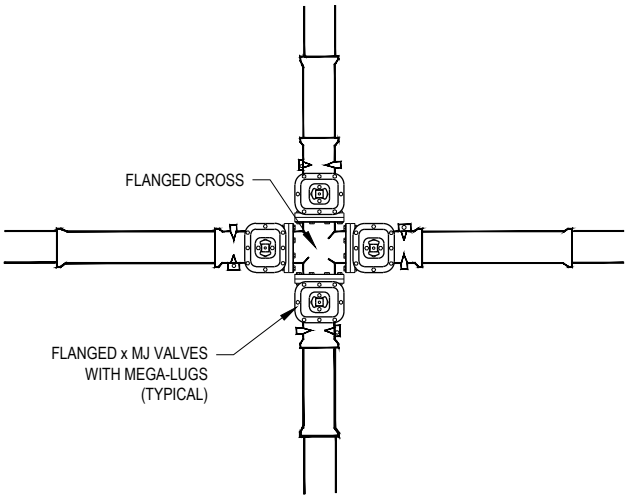
NO.	AUTHORIZED BY	REVISIONS	DATE
1	APPROVED		XXX 08

DRAPER CITY

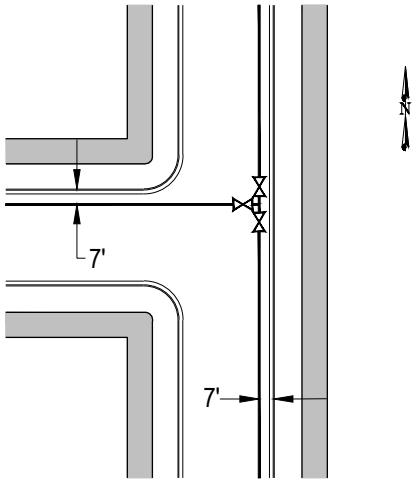
TYPICAL WATERLINE PIPE ZONE

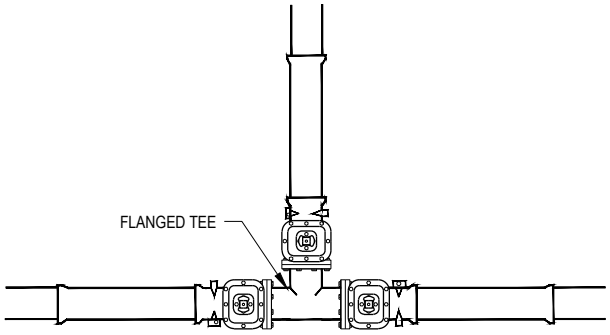
3010





CROSS-TYPICAL CONNECTIONS





TEE-TYPICAL CONNECTIONS

NOTES:

1. VALVES SHALL GENERALLY BE LOCATED ON EACH BRANCH OF WATER MAIN INTERSECTIONS. WHERE RELATIVELY SHORT LINES LESS THAN 500 FEET IN LENGTH ARE INVOLVED, ONE OF THE TWO VALVES BETWEEN INTERSECTIONS MAY BE OMITTED AT THE DIRECTION OF THE CITY ENGINEER. .

2. SEE DWG NO.s 3080, 3085, & 3090 FOR ANCHOR BLOCK AND THRUST BLOCK DETAILS.

3. SEE DWG NO. 3040 FOR VALVE BOX DETAILS.

4. REFER TO SECTIONS 3.4 'MAIN LINE FITTINGS' AND SECTION 7.1 'INSTALLATION OF VALVES AND FITTING' FOR INFORMATION CONCERNING THE INSTALLATION AND WRAPPING OF BOLTED CONNECTIONS.

5. ALL WATER LINES SHALL BE INSTALLED ON NORTH AND EAST SIDES OF THE STREET AND SHALL BE LOCATED 7' OFFSET FROM TBC.

6.. TEES AND CROSSES SHALL BE FLANGED ONLY WHEN DIRECTLY CONNECTED TO VALVES. OTHERWISE ALL TEES AND CROSSES SHALL BE MJ WITH THRUST RESTRAINT. (MEGA-LUGS AND THRUST BLOCKS).

7. ALL BUTTERFLY GEAR/OPERATOR ASSEMBLY TO BE ON NORTH OR EAST SIDE OF WATER LINE.

NO.	AUTHORIZED BY	REVISIONS	DATE			
1	APPROVED		XXXX. 08	DRAPER CITY	WATER MAIN CONNECTIONS AT INTERSECTIONS	3035

NOTES

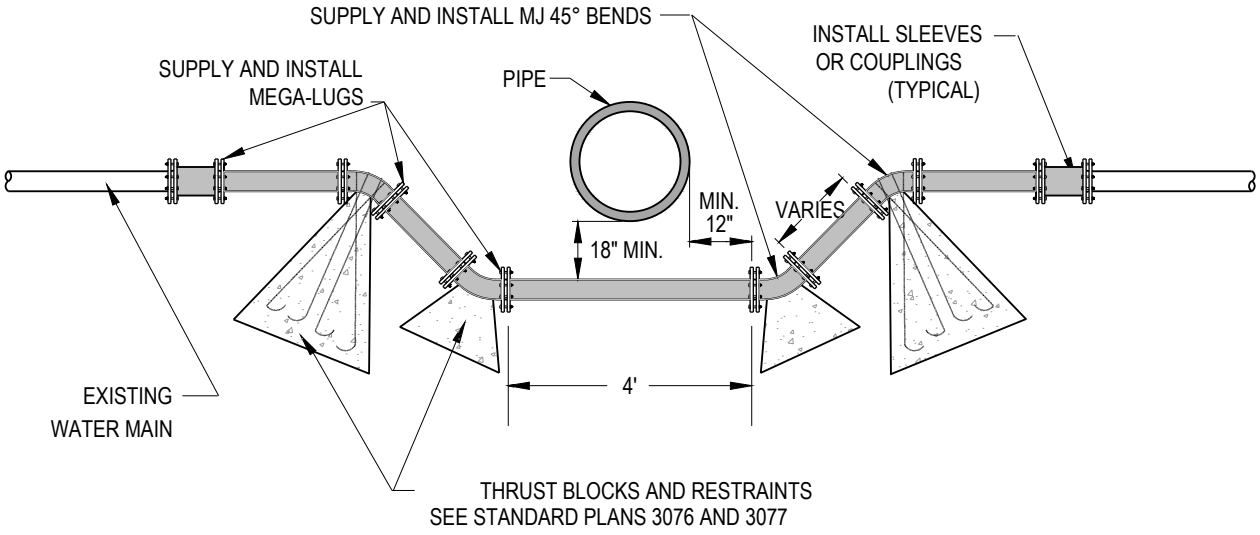
1. INSPECTION: INSPECTION OF INSTALLATION BY ENGINEER REQIURED BEFORE BACKFILLING TRENCH.

2. BACK FILL: INSTALL BACK FILL IN LIFTS NOT EXCEEDING 8" BEFORE COMPACTION. COMPACT EACH LIFT TO A MIN. DRY DENSITY OF 95% MODIFIED PROCTOR ASTM D-1557.

3. PROVIDE DUCTILE IRON PIPE AND FITTINGS WITH MEGA LUGS ACCORDING TO AWWA M-11 SPECIFICATIONS.

4. REFER TO ENGINEER'S SPECIFICATIONS FOR AIR/VAC REQUIREMENTS.

5. GREASE ALL NUTS & BOLTS WITH POLY FM GREASE AND POLY-WRAP. COMPLETE LOOP USING 8 MIL THICK POLY WRAP.



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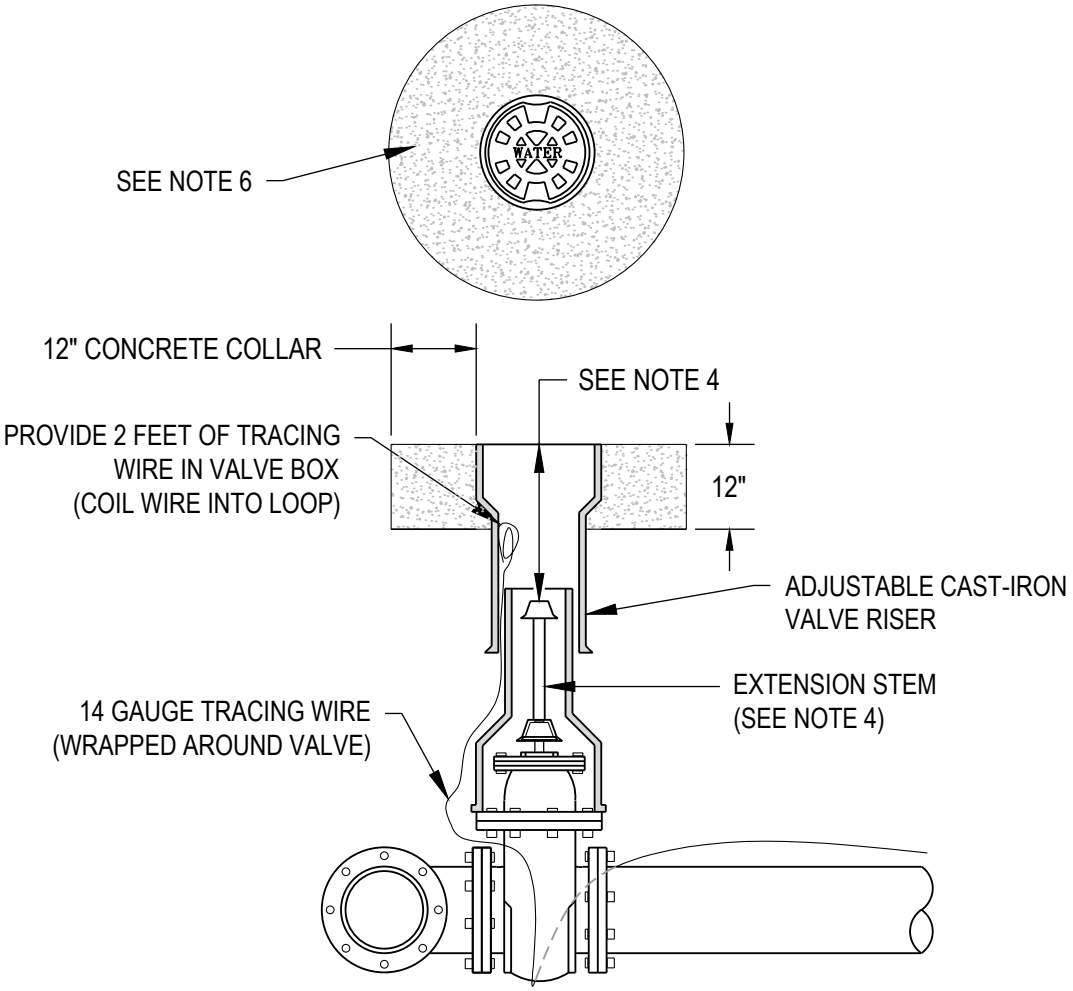
DRAPER CITY

TYPICAL WATERLINE LOOP

WT-3037



1. INSPECTION OF INSTALLATION BY ENGINEER REQUIRED PRIOR TO BACKFILLING.

2. APPLY POLY F.M. GREASE TO ALL NUTS & BOLTS AND WRAP WITH 8 MIL. THICK POLYWRAP

3. GATE VALVE SHALL BE AMERICAN SERIES 2500 OR CLOW C509 RESILIENT WEDGE OR EQUIVALENT FOR ALL WATER LINES 10" AND BELOW. WATERLINE 12" AND ABOVE SHALL BE CLOW 4500 CLASS 150-B BUTTERFLY VALVES OR EQUIVALENT.

4. PROVIDE EXTENSION STEM AS NEEDED. EXTENSION SHALL BE 48" MIN. TO 60" MAX. FROM SURFACE.

5. VALVE BOX SHALL BE D&L M-8040 THRU M-8064 OR EQUIVALENT.

6. FURNISH AND INSTALL 12" CONCRETE COLLAR. (REFER TO SECTION 3000 FOR CONCRETE SPECIFICATIONS).

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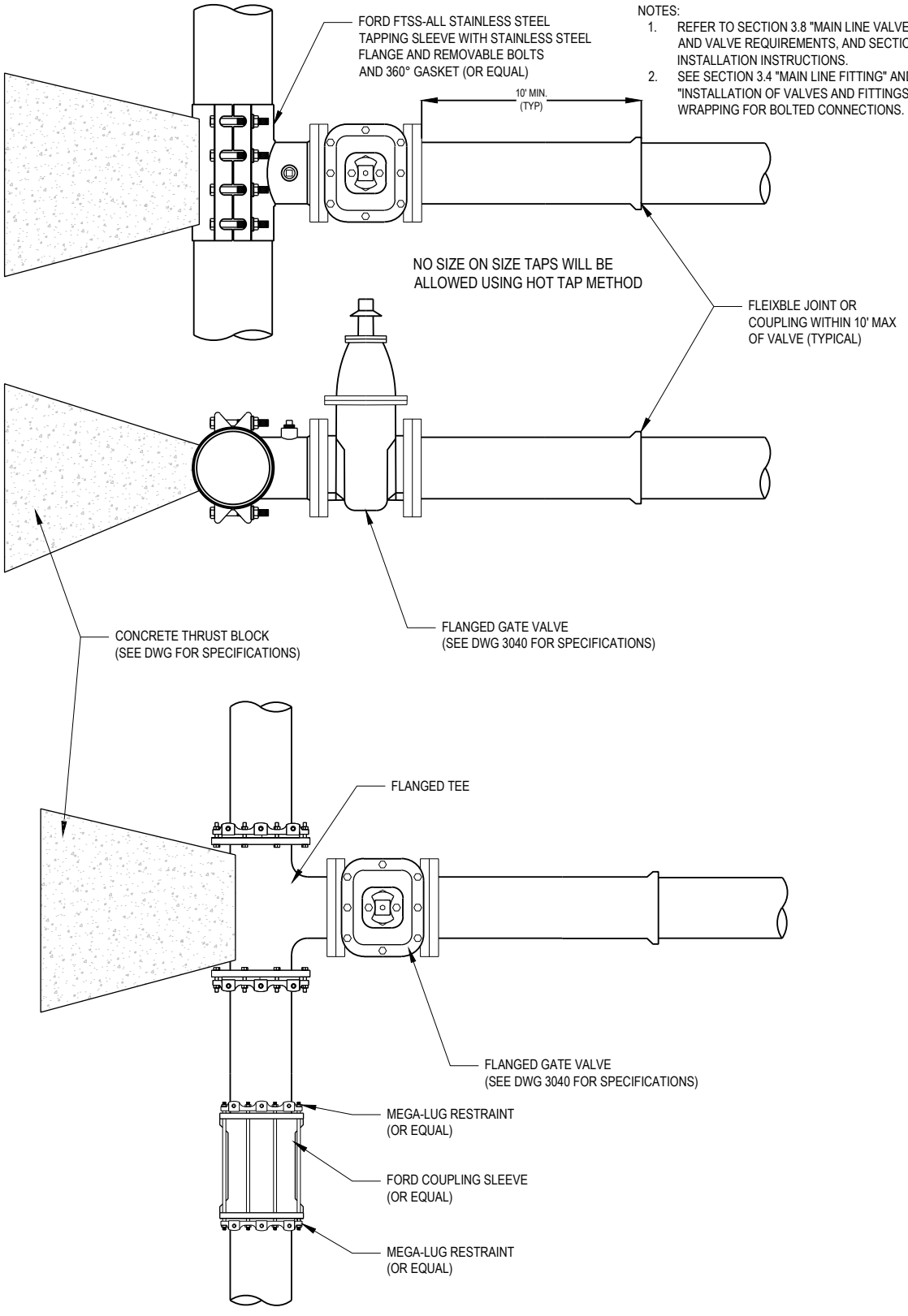
DRAPER CITY

VALVE BOX INSTALLATION

3040



NOTES:

1. REFER TO SECTION 3.8 "MAIN LINE VALVES" FOR TAPPING SLEEVE AND VALVE REQUIREMENTS, AND SECTION 7.9 "HOT TAPPING" FOR INSTALLATION INSTRUCTIONS.
2. SEE SECTION 3.4 "MAIN LINE FITTING" AND SECTION 7.11 "INSTALLATION OF VALVES AND FITTINGS" FOR INSTALLATION AND WRAPPING FOR BOLTED CONNECTIONS.

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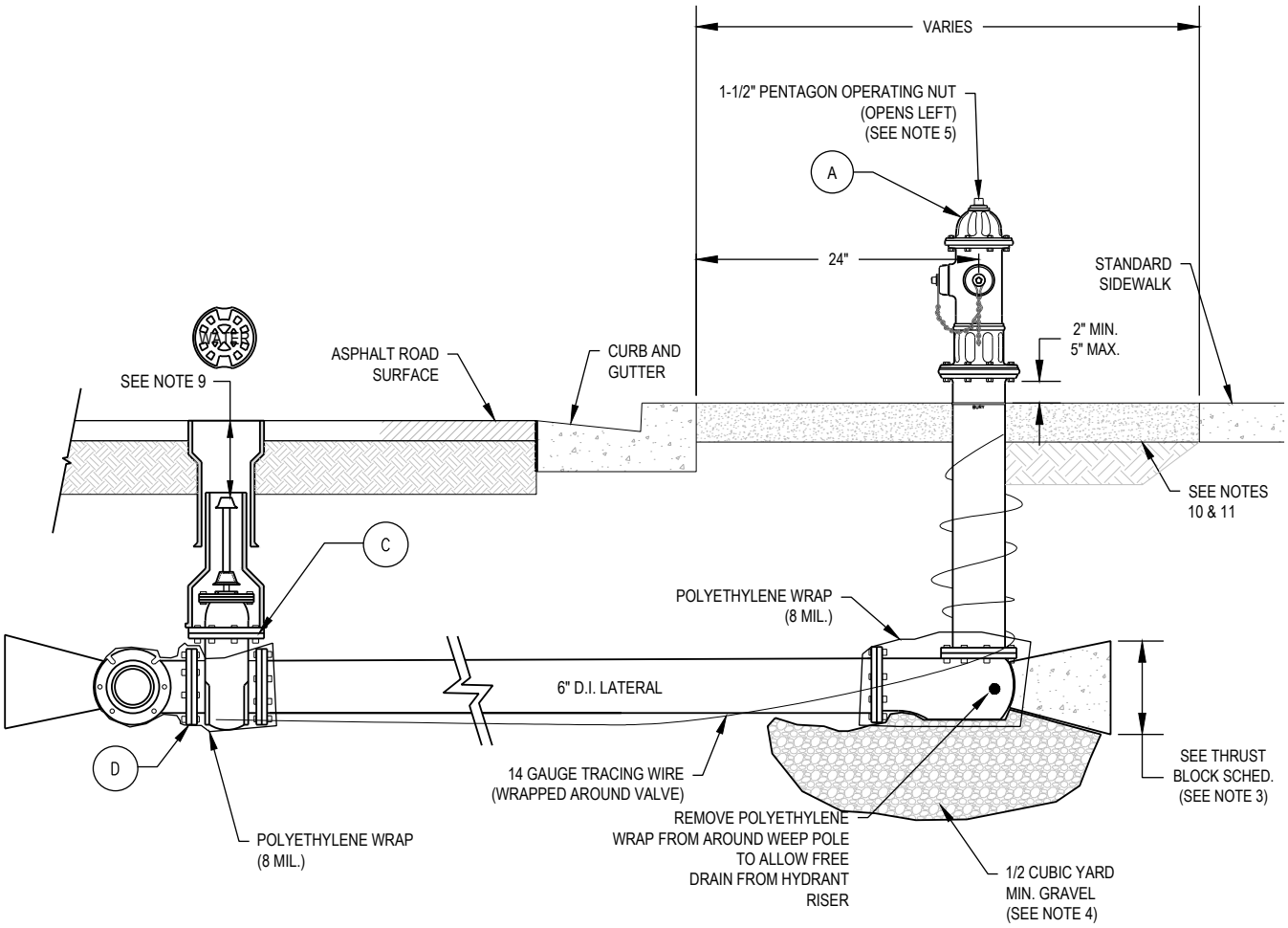
DRAPER CITY

MAIN LINE TIE-IN

WT-3045



1. INSPECTION OF INSTALLATION BY ENGINEER REQUIRED BEFORE BACKFILLING TRENCH.
2. IF NOT IN SERVICE, HYDRANT MUST BE TAGGED, "NOT IN SERVICE".
3. SEE THRUST BLOCK STANDARD DRAWING. THRUST BLOCK SHALL NOT COVER DRAIN HOLE.
4. PROVIDE 1/2 CUBIC YARD MIN. OF 3/4" CLEAN CRUSHED ROCK AROUND DRAIN HOLE AT BASE OF HYDRANT. PLACE MIRIFIED FABRIC UNDER ROCK TO MINIMIZE SILTING.
5. POINT THE 4-1/2" STEAMER NOZZLE TO THE STREET.
6. PLACE FIRE HYDRANTS SO SIDEWALK FLANGE IS 2" MIN. OR 5" MAX. ABOVE GRADE.
7. APPLY POLY F.M. GREASE TO ALL BURIED NUTS AND BOLTS.
8. NUT EXTENDED TO 48" TO 60" MAX. FROM SURFACE.
9. PROVIDE A FLAT (2% SLOPE MAX.) 4 FOOT DIAMETER CLEAR WORKING SPACE AROUND HYDRANT.
10. PROVIDE A 5'X5'X5" THICK CONCRETE PAD WITH 6" COMPACTED ROAD BASE; OR AS PER CITY ENGINEER (SEE SECTION 3000 FOR CONCRETE SPECIFICATIONS).
11. VALVE CANNOT BE LOCATED WITHIN CURB & GUTTER.
12. NO WATER SERVICE CONNECTIONS SHALL BE ALLOWED ON FIRE LINES.
13. EXTERIOR FINISH OF HYDRANT SHALL BE IN LIKE NEW CONDITION.

LEGEND		
No.	ITEM	DESCRIPTION
A	FIRE HYDRANT	RED IN COLOR, FLANGED, WATEROUS PACER, CLOW MEDALLION (SEE NOTE 16)
B	2 PC CAST IRON VALVE BOX	NUT RISER MAY BE REQUIRED
C	GATE VALVE WITH 2" X 2" OPERATING NUT	PER DRAPER CITY STANDARDS DWG. 3040
D	M.J. OR M.J. X FLG. TEE	

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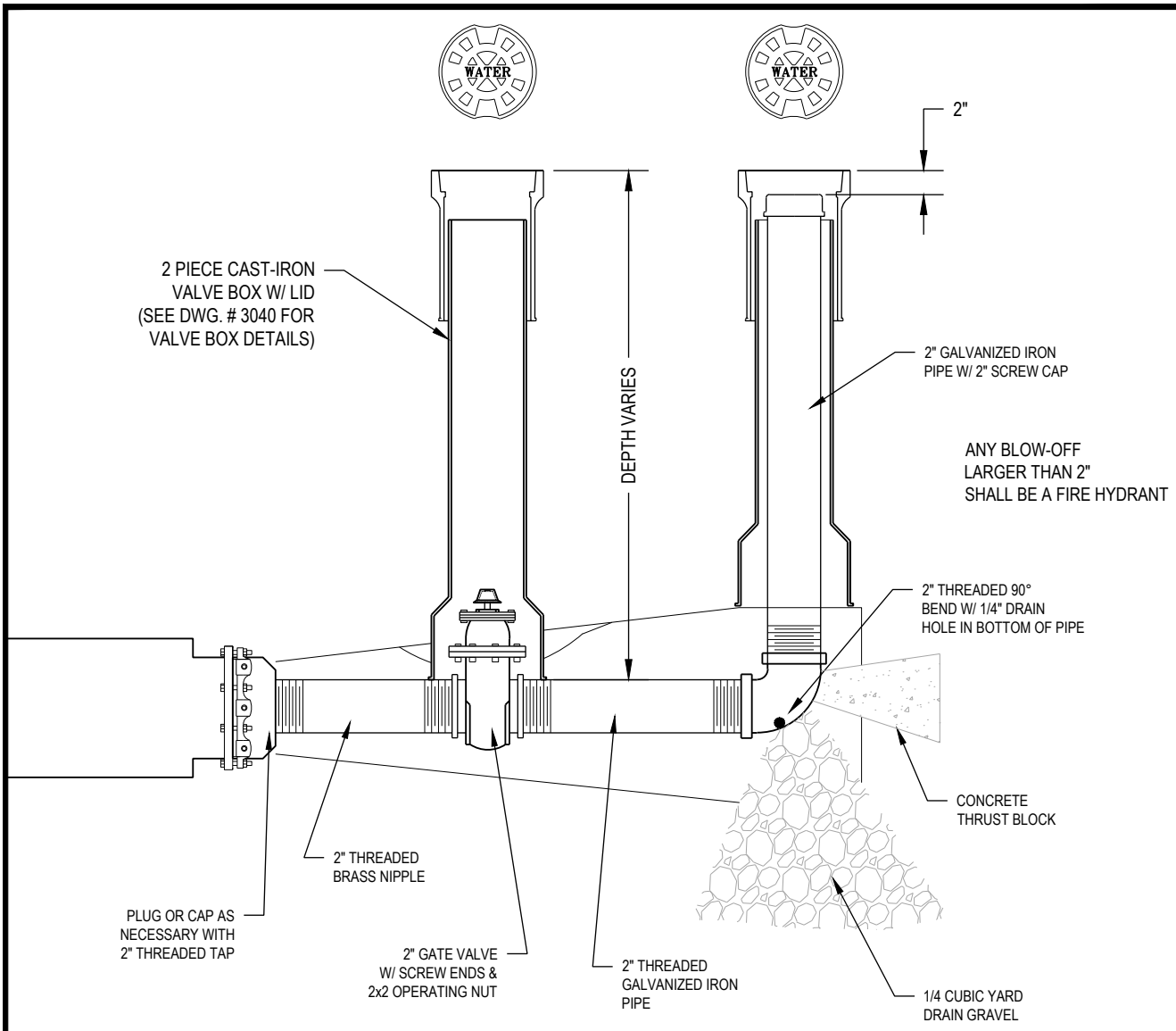
FIRE HYDRANT W/VALVE IN PARK STRIP

3056



1. CONCRETE: 2000 P.S.I. SEE THRUST BLOCK DWG. FOR DETAILS. POUR CONCRETE AGAINST UNDISTURBED SOIL.
2. TAPE: APPLY TAPE WRAP TO THE EXTERIOR OF ALL GALVANIZED PIPE PER AWWA C209. APPLY POLY F.M. GREASE TO ALL NUTS AND BOLTS AND WRAP WITH 8 MIL. THICK POLY WRAP
3. WATERMAINS 12" AND LARGER WILL REQUIRE SPECIAL WASHOUT ASSEMBLY APPROVED BY CITY ENGINEER.
4. DRAINAGE: AFTER INSTALLATION OF WASHOUT ASSEMBLY, VERIFY VALVE RISER DRAINS TO GRAVEL.
5. INSPECTION: PRIOR TO BACKFILLING, SECURE INSPECTION OF INSTALLATION BY ENGINEER.
6. BACKFILL: SEE SECTION 2240 FOR SPECIFICATIONS
7. BLOW-OFF MUST BE SIZED TO LINE.
8. IF EXPECTED DEVELOPMENT IS 24 UNITS OR PERMANENT, THIS MUST BE FIRE HYDRANT.
9. IF FUTURE DEVELOPMENT HAS NOT BEEN APPROVED FOR CONSTRUCTION PRIOR TO START OF WARRANTY PERIOD THEN FIRE HYDRANT WASHOUT SHALL BE REPLACED WITH A PERMANENT FIRE HYDRANT.

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DRAPER CITY

2" WASHOUT & BLOW-OFF

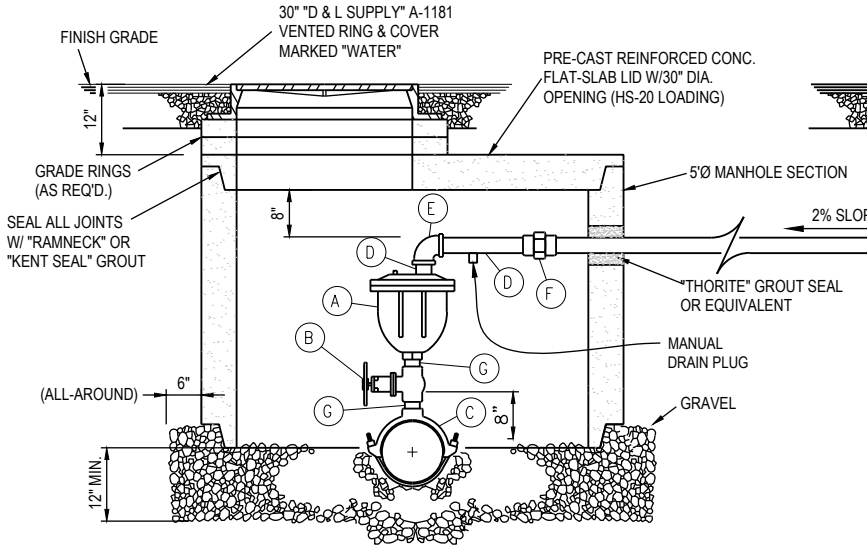
3060

PIPE & FITTING SCHEDULE

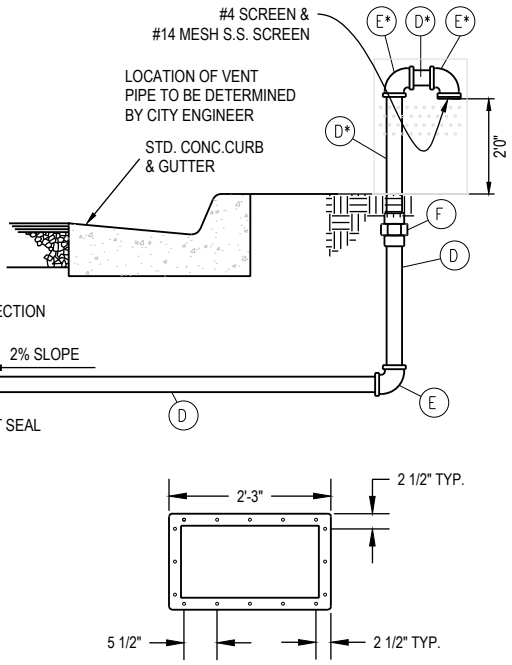
NO.	DESCRIPTION	FITTING
A	2" HEAVY-DUTY COMBINATION AIR/VACUUM RELIEF VALVE "APCO" CAV MODEL S-145C OR APPROVED EQUAL**	THR.
B	2" GATE VALVE OR BALL VALVE	THR.
C	2" BRASS DOUBLE STRAP SERVICE SADDLE	-
D	2" GALV. STEEL PIPE OR SCH. 80 PVC	THR.
E	2" GALV. STEEL 90° ELBOW OR SCH 80 PVC	THR.
F	2" GALV. STEEL UNION OR SCH 80 PVC	THR.
G	2" BRASS PIPE	THR.

* ALL VENT PIPING MUST BE GALV. STEEL ABOVE GROUND.

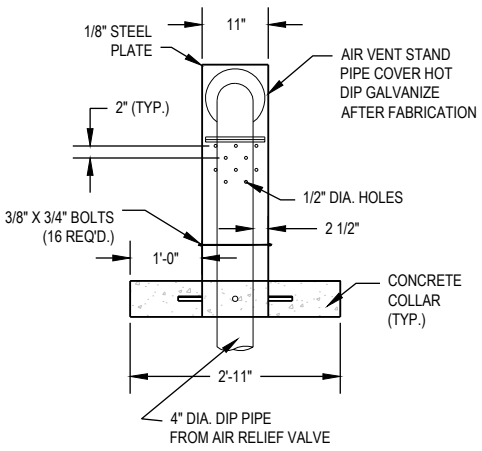
** SOME AREAS REQUIRE LARGER VALVE PER CITY ENGINEER

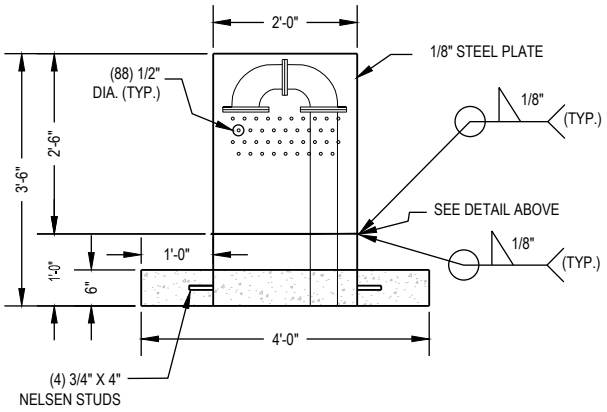


AIR/VACUUM RELIEF STATION



AIR VENT STAND PIPE





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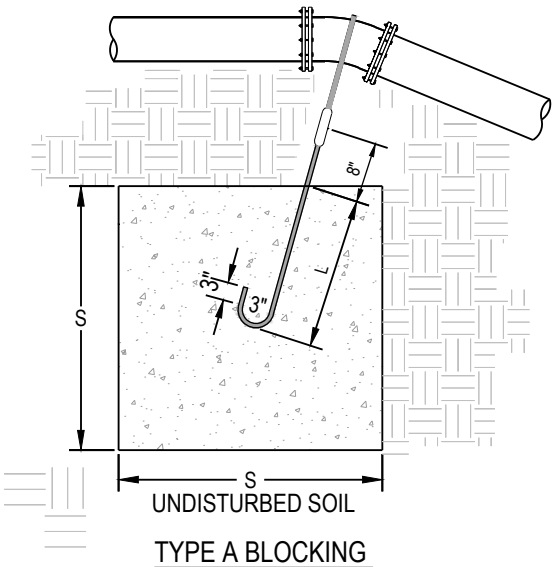
DRAPER CITY

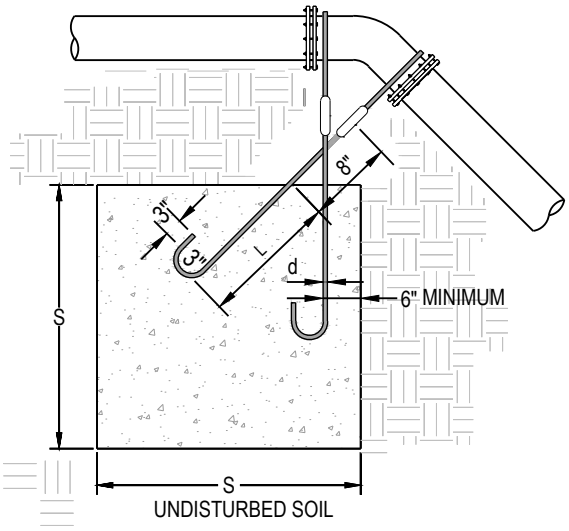
COMBINATION AIR RELEASE & VACUUM VALVE

3075



TYPE A BLOCKING

FOR 11 1/4° - 22 1/2° VERTICAL BENDS



TYPE B BLOCKING

FOR 45° VERTICAL BENDS

TYPE A BLOCKING
FOR 11 1/4° - 22 1/2° VERT. BENDS

	VB		S	d	L
PIPE SIZE NOMIN. DIAMETER - INCH	VERTICAL BEND DEGREES	NO.OF CU FT. OF CONC. BLOCKING	SIDE OF CUBE FEET	DIAMETER OF SHACK OR REBAR RODS - INCH	DEPTH OF RODS IN CONCRETE (FEET).
4"	11 1/4°	8	2.0	5/8"	1.5
	22 1/2°	15.6	2.5	#4	2.0
6"	11 1/4°	15.6	2.5	#4	2.0
	22 1/2°	34.3	3.25	#4	
8"	11 1/4°	27	3.0	#4	2.0
	22 1/2°	64	4.0	#4	
12"	11 1/4°	64	4.0	#4	2.0
	22 1/2°	125	5.0	#4	3.0
16"	11 1/4°	107	4.25	#5	3.0
	22 1/2°	216	6.0	#5	4.0
20"	11 1/4°	138	5.17	#5	3.5
	22 1/2°	334	6.94	#5	4.0
24"	11 1/4°	240	6.22	#5	4.0
	22 1/2°	476	7.81	#5	4.0
30"	11 1/4°	369	7.17	#5	4.0
	22 1/2°	733	9.02	#5	4.0

TYPE B BLOCKING
FOR 45° VERTICAL BENDS

	VB		S	d	L
PIPE SIZE NOMIN. DIAMETER - INCH	VERTICAL BEND DEGREES	NO.OF CU FT. OF CONC. BLOCKING	SIDE OF CUBE FEET	DIAMETER OF SHACK OR REBAR RODS - INCH	DEPTH OF RODS IN CONCRETE FEET.
4"	45°	1	3.0	5/8" #4	2.0
6"		2.37	4.0	5/8" #4	2.5
8"		3.97	4.75	5/8" #4	2.0
12"		9.04	6.25	5/8" #4	4.0
16"		17.24	7.75	#5 #5	4.0
20"		26.52	5.17	#5 #5	4.0
24"		37.82	10.07	#5 #5	4.0
30"		58.26	11.63	#5 #5	4.0

SEE NOTES ON SHEET 3 FOR CLARIFICATION

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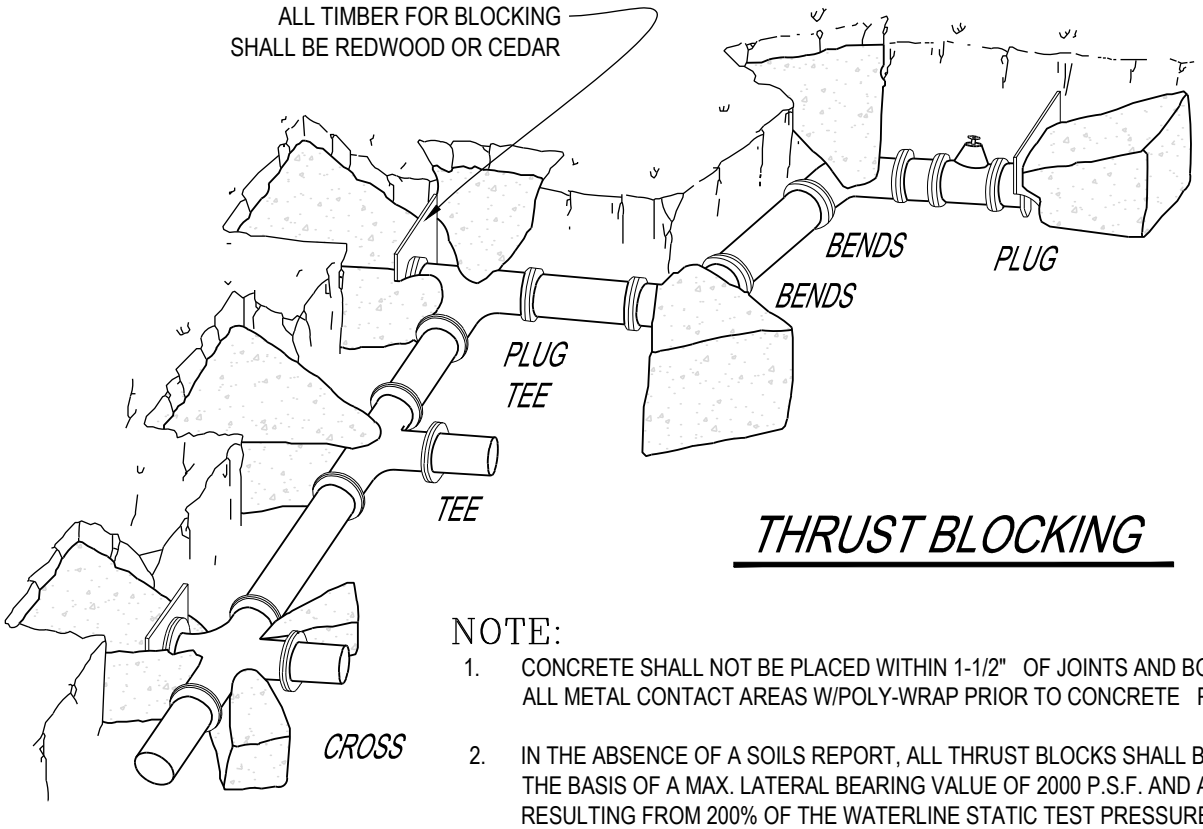
1	APPROVED		SEPT. 04

DRAPER CITY

TIE-DOWN & CONCRETE THRUST RESTRAINTS

3077
10F3



THRUST BLOCKING

NOTE:

1. CONCRETE SHALL NOT BE PLACED WITHIN 1-1/2" OF JOINTS AND BOLTS. COVER ALL METAL CONTACT AREAS W/POLY-WRAP PRIOR TO CONCRETE PLACEMENT.
2. IN THE ABSENCE OF A SOILS REPORT, ALL THRUST BLOCKS SHALL BE SIZED ON THE BASIS OF A MAX. LATERAL BEARING VALUE OF 2000 P.S.F. AND A THRUST RESULTING FROM 200% OF THE WATERLINE STATIC TEST PRESSURE.
3. THRUST BLOCKS ARE REQ'D. AT ALL BENDS OF 22-1/2" OR MORE.

MINIMUM BEARING AREA IN SQ. FT.	SIZE OF PIPE								
	4"	6"	8"	12"	14"	16"	20"	24"	30"
TEES, VALVES DEAD ENDS	2	4	6.5	14	19	24	27	53	81
90° BENDS	3	5.5	9.5	20	26.5	34	52	74	114
45° BENDS	2	3	5	11	14.5	18.5	28.5	41	62
22 1/2° BENDS	2	1.5	2.75	5.5	7.5	9.5	14.5	21	32
11 1/4° BENDS	2	1	1.5	3	4	6	16	53	16

SEE SHEET 3 FOR ADDITIONAL NOTES

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1	APPROVED		SEPT. 04

DRAPER CITY

TIE-DOWN & CONCRETE THRUST RESTRAINTS

3077
20F3

NOTES

1. ALL WORK MUST BE INSPECTED AND APPROVED BY ENGINEER PRIOR TO BACK FILLING

2. THRUST BLOCKS OR RESTRAINTS MUST BE POURED AGAINST UNDISTURBED SOIL

3. CONCRETE MUST HAVE A MINIMUM OF 2,000 P.S.I. COMPRESSIVE STRENGTH IN 28 DAYS

4. CONCRETE MUST BE ALLOWED TO CURE FOR 5 DAYS PRIOR TO PRESSURIZING WATER LINES OR HAVE ADDITIONAL APPROVED THRUST RESTRAINTS INSTALLED PRIOR TO PRESSURIZATION OF THE WATER LINE

5. ALL PIPE JOINTS TO BE LEFT ACCESSIBLE.

6. REINFORCING STEEL BARS TO BE EPOXY COATED A MINIMUM OF 15 MIL THICK

7. ALL EXPOSED METAL SURFACES TO BE COATED WITH POLY FM GREASE AND WRAPPED WITH AT LEAST 8 MIL THICK POLYETHYLENE SHEETING OR TUBING, AS PER MANUFACTURER INSTRUCTIONS

8. THRUST DESIGN FOR PIPE SIZES OR CONFIGURATIONS NOT SHOWN REQUIRE SPECIAL DESIGN

9. BEARING AREAS, VOLUMES, AND SPECIAL THRUST BLOCKING OR RESTRAINING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER THIS STANDARD

10. RESTRAINT SIZING ASSUMES A MAXIMUM OPERATING PRESSURE OF 150 PSI TEST PRESSURES OF 200 P.S.I., AND A MINIMUM 2,000 POUND SOIL BEARING STRESS. OPERATING PRESSURES IN EXCESS OF 150 PSI. OR SOILS WITH LESS THAN 2,000 POUNDS BEARING STRESS WILL REQUIRE A SPECIAL DESIGN

11. MINIMUM YIELD STRENGTH OF STEEL TIE DOWNS TO BE 70,000 PSI.

12. INSTALL APPROPRIATE SIZED THRUST BLOCKING ON ALL BLIND FLANGES, MJ PLUGS, AND CAPS

13. LOCKING RESTRAINT DEVICES SHALL BE USED IN CONJUNCTION WITH CONCRETE THRUST BLOCKING.

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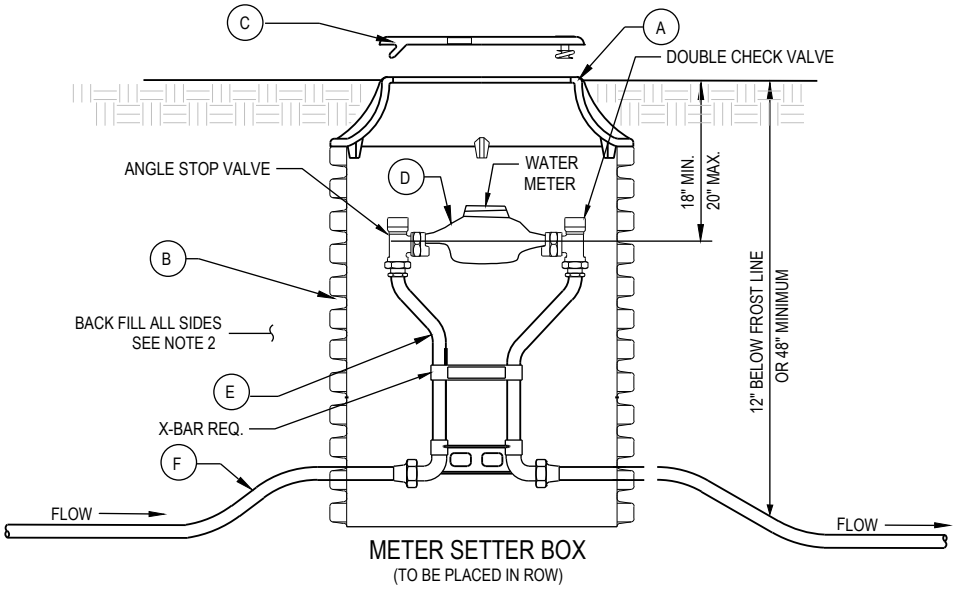
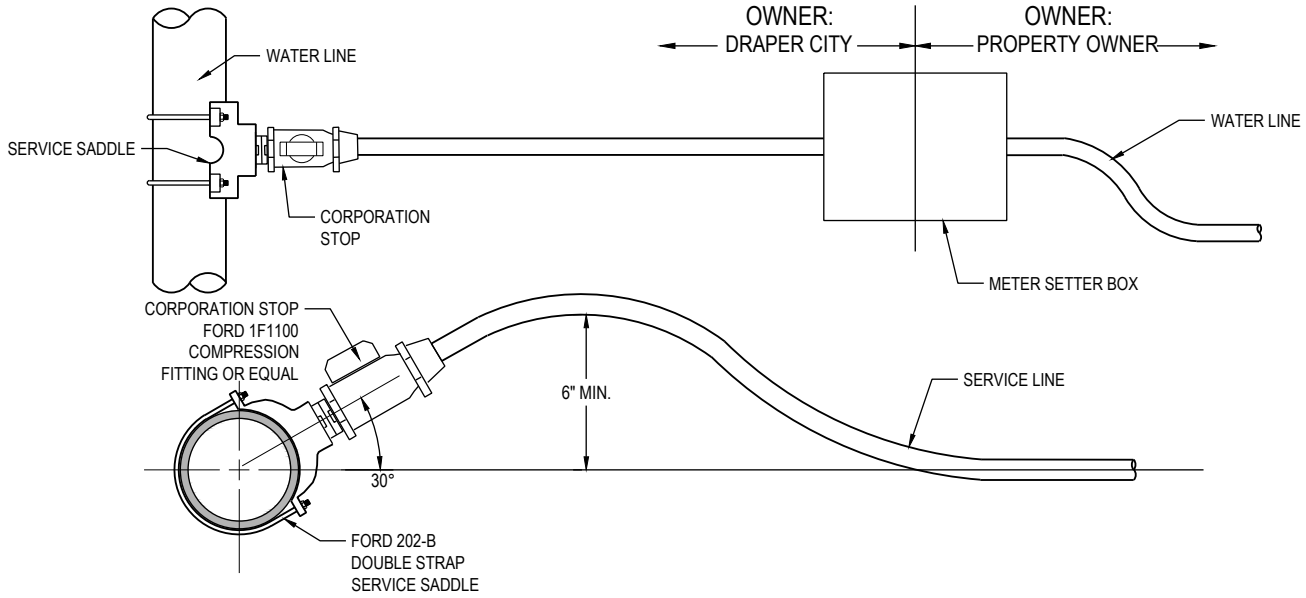


METER SETTER BOX
(TO BE PLACED IN ROW)



LEGEND			
No.	*	ITEM	DESCRIPTION
A		CAST IRON RING (grass)	D & L 2244 OR EQUAL
B		METER BOX (21" X 36")	ADS METER BOX WHITE IN COLOR OR EQUAL CORRUGATED, SMOOTH WALLED INSIDE } IN PARKSTRIP**
C		2" TAP IN LID FOR RADIO READ SENSOR OF METER	L2240- D & L OR EQUAL (SEE NOTE 10 FOR TRAFFIC RATED LID)
D	*	METER	PROVIDED BY CITY
E		1" METER YOKE W/ DOUBLE CHECK IN SETTER	FORD VBHC 74-18W
F		COPPER PIPE (TYPE K - SOFT) OR 1" POLY PIPE (CTS)	

* HDPE TRAFFIC RATED BOX OR EQUIVALENT
21 X 36 HANCOR METER TILE OR EQUAL (METER BOX)

** ALL OTHER AREAS REQUIRE APPROVAL OF CITY ENGINEER W/ TRAFFIC RATED BOX & LID

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DRAPER CITY

METER SETTER & METER BOX 1-INCH SERVICE

3098
10F2

NOTES

1. INSPECTION: PRIOR TO BACK FILLING AROUND METER BOX AND TAPS, SECURE INSPECTION OF INSTALLATION BY CITY ENGINEER.

2. BACK FILL: BACK FILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO DRY DENSITY OF 95% PER ASTM D-1557 (SEE SECTION 2240 FOR SPECIFICATIONS).

3. PLACEMENT: ALL METERS ARE TO BE INSTALLED IN THE PARK STRIP (PUBLIC ROW) AND MUST BE PLACED WITHIN 1' OF PROPERTY LINE WITH 2 BOXES ADJACENT TO COMMON PROPERTY LINE.

4. ALL METER SETTERS MUST HAVE BACK FLOW PREVENTERS.

5. METER BOX MUST BE FREE OF DEBRIS AND WATER, AND BE FREE OF ALL DEFECTS. METER BOXES THAT ARE CRACKED, CHIPPED, BROKEN, OR DEFORMED WILL NOT BE ACCEPTED.

6. METER SETTER MUST BE 18"-20" BELOW LID.

7. BRASS CORPORATION STOPS: FORD CORPORATION STOP OR EQUAL.

8. COMPRESSION FITTINGS ARE TO BE MUELLAR 110 OR EQUAL.

9. COMPRESSION FITTINGS FOR POLY PIPE REQUIRE INSERTS.

10. TRAFFIC LID SHALL BE H & D SUPPLY "MTU-9021" WITH 2" KNOCK OUT OR EQUAL.

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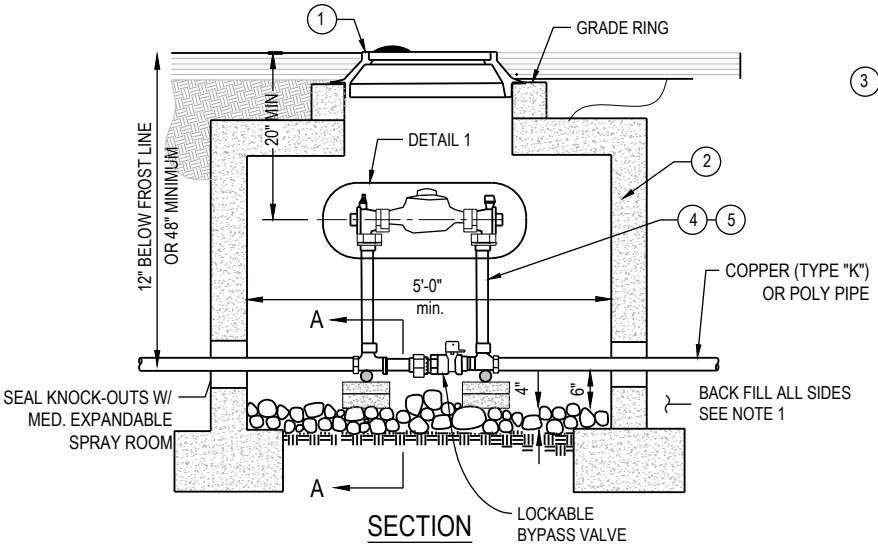
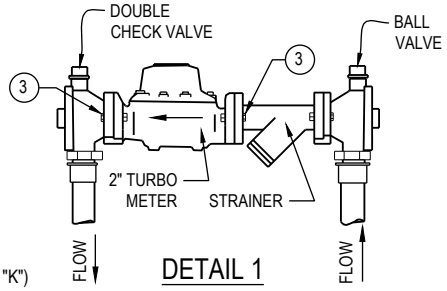
DRAPER CITY

METER SETTER & METER BOX 1-INCH SERVICE

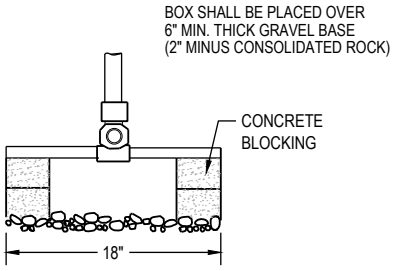
3098
2OF2



SECTION



DETAIL 1



SECTION "A-A"

LEGEND: SERVICE METER		
No.	ITEM	DESCRIPTION
1	CAST IRON COVER (grass) DUCT. IRON COVER (traffic)	W/2" TAP FOR RADIO READ SENSOR OF METER
2	CONCRETE BOX, 5' X 5' INSIDE DIM. WITH KNOCK-OUTS AND FOOTINGS	H-20 TRAFFIC RATED
3	METER BOLTS	
4	1 1/2" CUSTOM SETTER	WITH LOCKABLE BYPASS
5	2" CUSTOM SETTER	WITH LOCKABLE BYPASS

LEGEND: SERVICE TAP		
No.	ITEM	DESCRIPTION
A	CONCRETE TRAFFIC BOX	
B	2-PC. CAST IRON VALVE BOX WITH LID	
C	CORPORATION STOP	
D	COMPRESSION FITTING	
E *	SERVICE SADDLE CLAMP	DOUBLE BANDED BRASS
F **	COPPER (TYPE "K") OR POLY PIPE (CTS) AWWA C-901	

* "E" IS REQUIRED ON D.I.P. WATER MAIN

** ALL POLY PIPE REQUIRES 14 Ga. TRACER WIRE

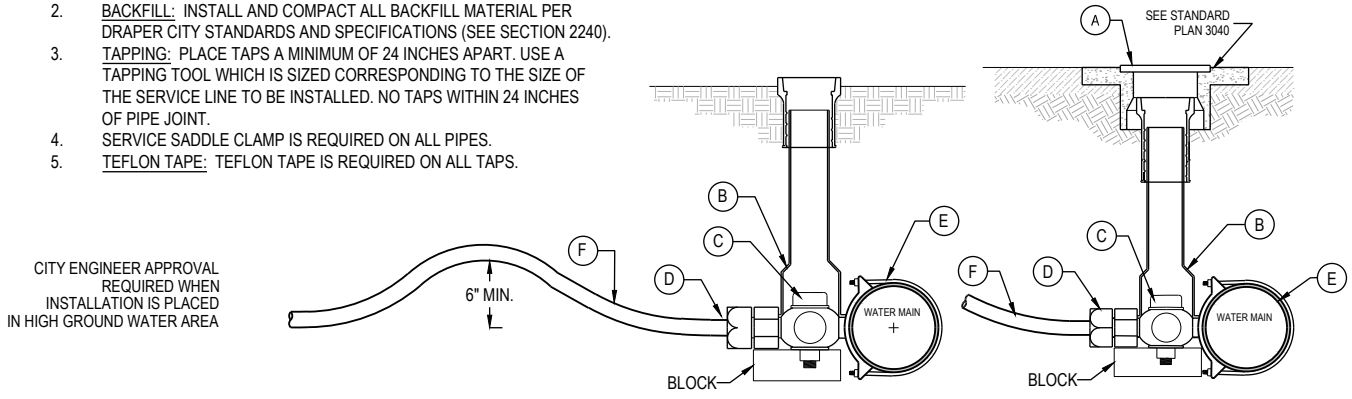
NOTES FOR SERVICE LINE AND METER

1. INSPECTION: PRIOR TO BACKFLLING AROUND THE METER BOX, SECURE INSPECTION BY CITY ENGINEER.
2. BACKFILL: INSTALL AND COMPACT ALL BACKFILL MATERIAL PER DRAPER CITY STANDARDS AND SPECIFICATIONS. IN 8" COMPACTED LIFTS. COMPACT LIFTS TO A MINIMUM 95% DENSITY (SEE SECTION 2240).
3. METER: DRAPER CITY WILL PROVIDE AND INSTALL METER.
4. PIPE: INSTALL CTS PIPE OR COPPER (TYPE "K") TO PROPERTY LINE.
5. PLACEMENT: DO NOT INSTALL METER BOX UNDER DRIVEWAY APPROACHES, SIDEWALKS, OR CURB & GUTTER. IN NEW CONSTRUCTION, INSTALL METER NEAR CENTER OF LOT IN PARKSTRIP

NOTES FOR SERVICE TAPS

1. INSPECTION: PRIOR TO BACKIFLLING AROUND THE METER BOX, SECURE INSPECTION BY CITY ENGINEER.
2. BACKFILL: INSTALL AND COMPACT ALL BACKFILL MATERIAL PER DRAPER CITY STANDARDS AND SPECIFICATIONS (SEE SECTION 2240).
3. TAPPING: PLACE TAPS A MINIMUM OF 24 INCHES APART. USE A TAPPING TOOL WHICH IS SIZED CORRESPONDING TO THE SIZE OF THE SERVICE LINE TO BE INSTALLED. NO TAPS WITHIN 24 INCHES OF PIPE JOINT.
4. SERVICE SADDLE CLAMP IS REQUIRED ON ALL PIPES.
5. TEFLON TAPE: TEFLON TAPE IS REQUIRED ON ALL TAPS.

NOTE: ALL FITTINGS SHALL BE COMPRESSION FITTINGS WITH INSERTS USED FOR POLY PIPE



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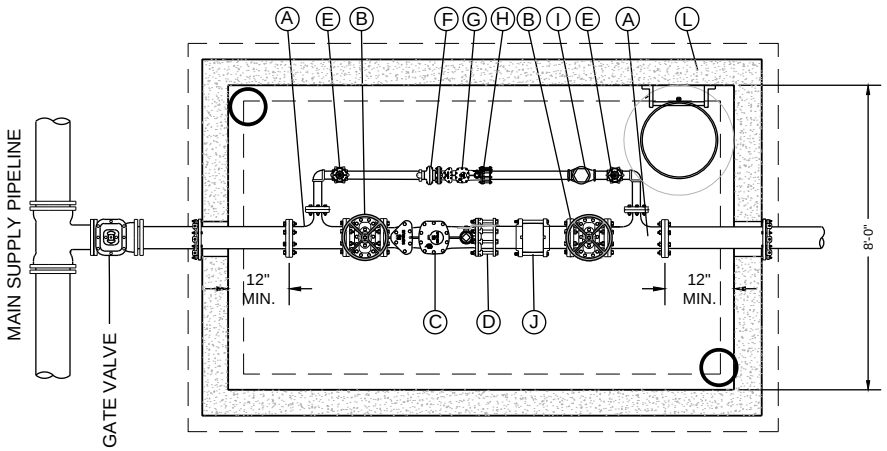
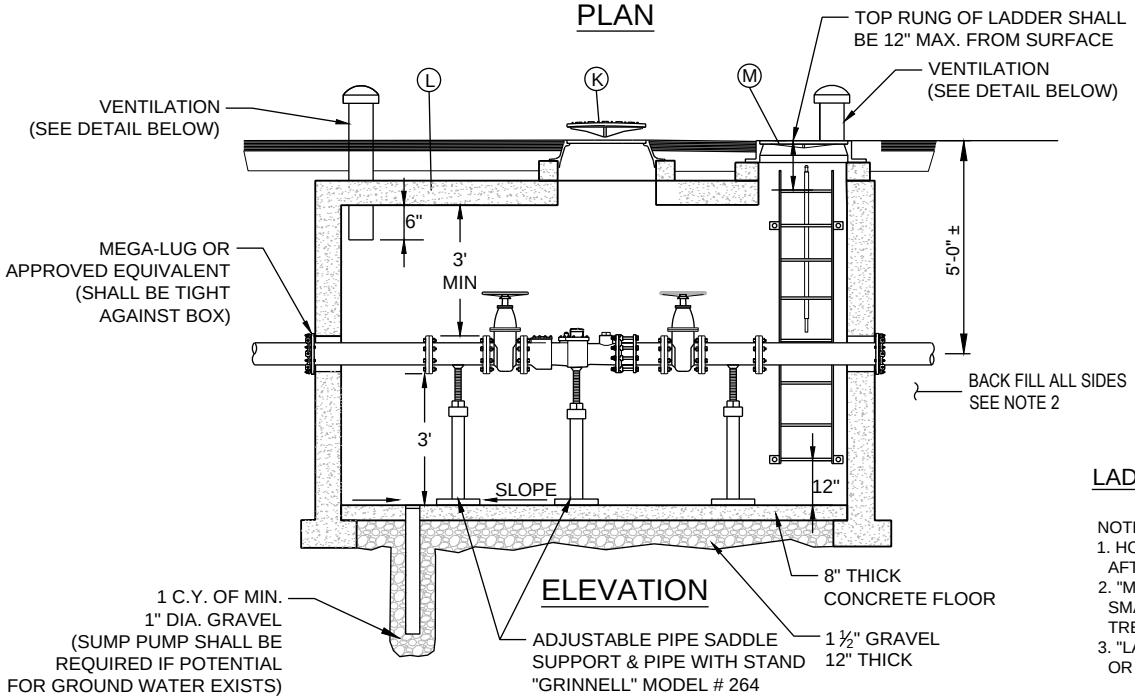
DRAPER CITY

METER SETTER AND METER BOX 1-1/2-INCH & 2-INCH SERVICE

3101



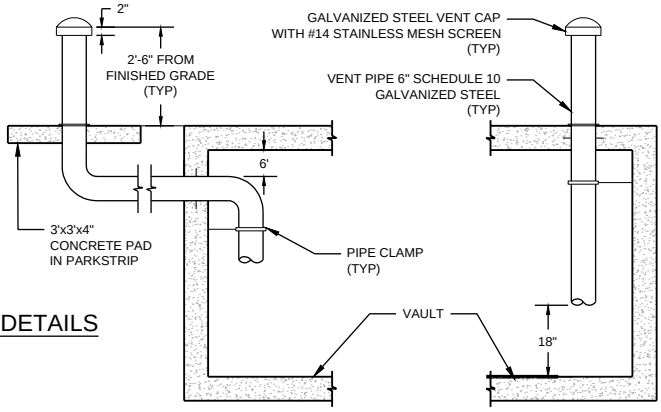
PLAN



ELEVATION

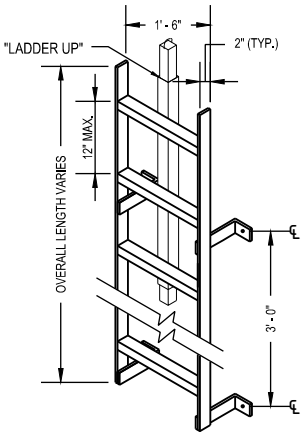
LADDER NOTES

NOTE:
1. HOT DIP GALVANIZE AFTER FABRICATION
2. "McNICHOLS" SMALL HOLE TRACTION TREAD OR APPROVED EQUAL
3. "LADDERUP SAFETY POST" OR APPROVED EQUAL



VENT PIPE DETAILS

LADDER DETAIL



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1	APPROVED		SEPT. 04

DRAPER CITY

4" TO 8" METER WITH 2" BYPASS

3118
10F2

NOTES

1. PRIOR TO BACK FILLING AROUND CONCRETE BOX, SECURE INSPECTION OF INSTALLATION BY ENGINEER.

2. INSTALL BACK FILL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT EACH LIFT TO DRY DENSITY OF 96% ± 2% OPTIMUM MOISTURE.

3. PROVIDE BRASS FITTINGS AND NIPPLES IF NOT SPECIFIED OTHERWISE. DO NOT USE GALVANIZED MATERIALS.

4. ALL PIPING SHALL BE DUCTILE IRON CLASS 55 AND SHALL BE PAINTED AS PER AWWA STANDARD C210-97.

5. CONCRETE METER BOX SHALL BE H-20 TRAFFIC LOADING RATED.

6. ALLOW 1" CLEARANCE AROUND WATERLINE WHERE LINE PASSES CONCRETE WALLS. SEAL OPENING WITH COMPRESSIBLE SEAL.

7. INSTALL VALVE WITH VALVE BOX ADJACENT TO MAIN.

8. GREASE MEGA-LUGS USING POLY F.M. GREASE AND WRAP WITH 8 MIL THICK POLYWRAP.

9. 10" AND LARGER METERS SHALL BE ENGINEERED AND SUBMITTED TO CITY FOR APPROVAL BY CITY ENGINEER.

LEGEND			
ITEM		DESCRIPTION	PART NUMBER
Ⓐ		FLANGED TEE	
Ⓑ		GATE VALVE W/ HANDWHEEL	
Ⓒ		SENSUS METER	SENSUS OMNI C2 W/ RADIO READ FOR COMMERCIAL APPLICATIONS SENSUS OMNI F2 W/ RADIO READ FOR MASTER METER APPLICATIONS
Ⓓ		FLANGED COUPLING ADAPTER	
Ⓔ		2" GATE VALVE	
Ⓕ		2" LOK-PAK TYPE OF METER FLANGE	
Ⓖ		SENSUS METER	SENSUS OMNI T2 W/ RADIO READ
Ⓗ		2" FLANGED COUPLING ADAPTER	
Ⓘ		2" CHECK VALVE	
Ⓙ		VAL-MATIC CHECK VALVE	SEE SPECIFICATIONS FOR REQUIRED VALVE SPACING FROM METER
Ⓚ		36" MANHOLE RING AND COVER	
Ⓛ		CONCRETE BOX (SEE NOTE 5)	TO BE SIZED PER APPLICATION AND PIPE SIZE
Ⓜ		24" MANHOLE RING AND COVER	

NO.	AUTHORIZED BY	REVISIONS	DATE
1	APPROVED		SEPT. 04

DRAPER CITY

4" TO 8" METER WITH 2" BYPASS

3118
20F2

The Point
Hydraulic Model Memo - Updated

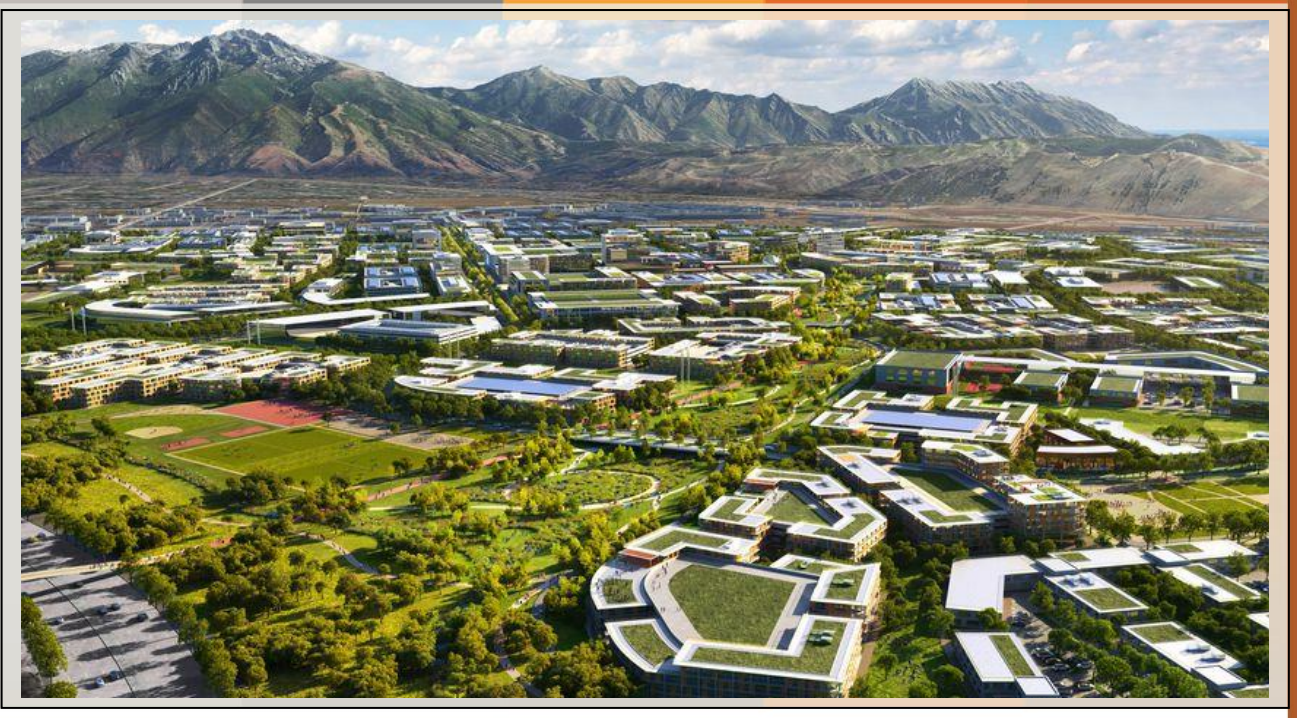
Final for Construction Submittal

Horrocks.

The Point Redevelopment Project

Hydraulic Model Memo

February 2025



Horrocks.

DRAPER CITY

EXECUTIVE SUMMARY

This memo summarizes the modeling of a new drinking water system for The Point Redevelopment Project (The Point) which will serve new residential and commercial development to be located at and around the old Utah State Prison at *14425 Bitterbrush Ln S, Draper, UT 84020*, which is being demolished before site development. The development is set to occur using a phased approach. Figure 1 below shows piping layout for buildout.

The source of culinary water supply for the new system will be two reservoirs, with a combined capacity of 9 million gallon (MG), located southeast of the site on the east side of I-15 (see Figure 1). A 3 MG reservoir will be built first and will supply water to The Point through a new 30-inch transmission line that will be bored under I-15. As demand requires, a 6 MG reservoir will be built and connected to the 3 MG reservoir. This system will be connected to Draper's culinary water system at two points along the existing 24" waterline that runs underneath Pony express Rd. The proposed water system, including pipe sizing, is shown in Figure 1. Phase 1 pipelines are the backbone of the system and shown with solid lines. The average daily demand and peak day demand for the proposed system is 3,270 GPM and 6,540 GPM respectively.

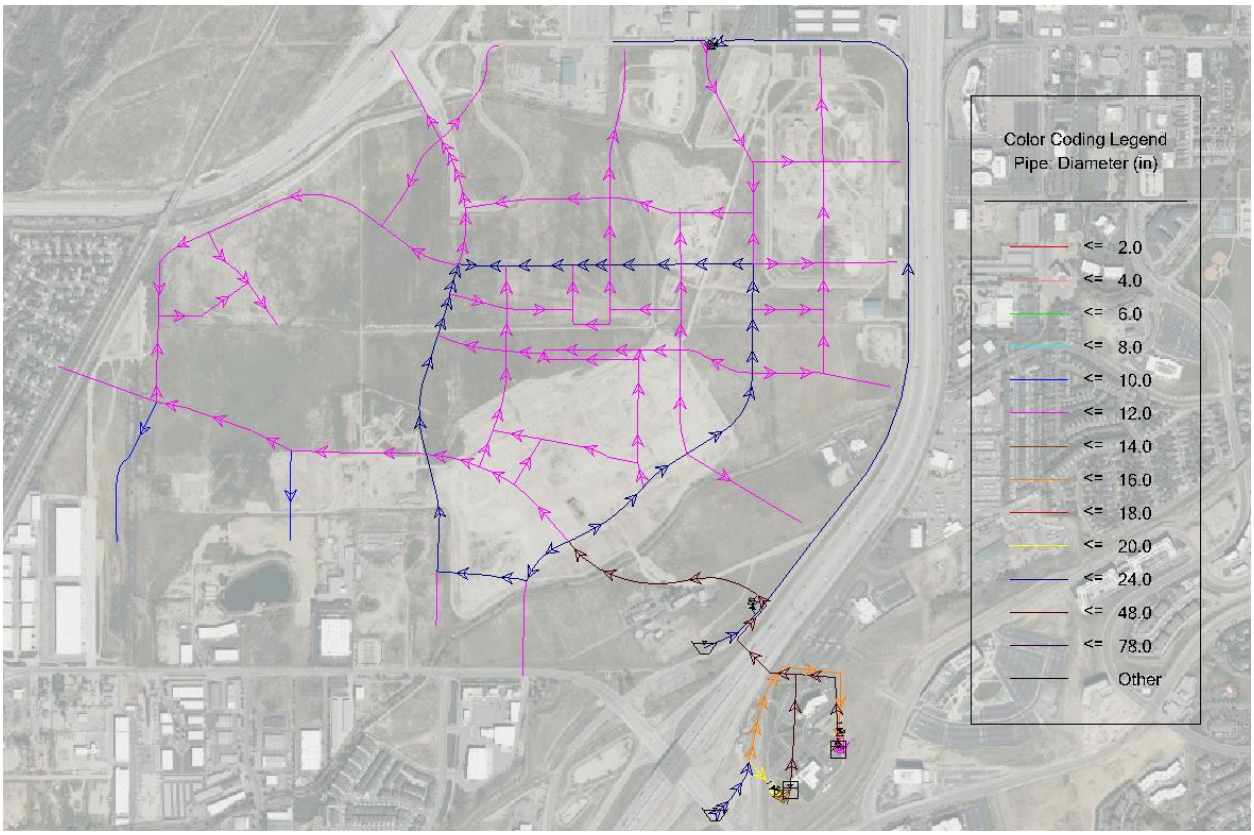


Figure 1: Proposed Culinary Water System by Pipe Size.

1.0 INTRODUCTION

The purpose of this report is to document the analysis for the distribution system sizing and the hydraulic model. In order to determine the pipeline sizing, Horrocks performed a minimum sizing analysis for the water system based on the State of Utah Division of Drinking Water's R309-510 requirements and using The Point's August 2023 Framework Plan and Land Use Program and Statistical Summary dated September 2023, which provide the projected land use characteristics for Phase 1 and build-out, and Utah State standards for typical water usage.

The new culinary water system for The Point will be designed to provide a peak instantaneous flow of 18.8 million gallons per day (MGD). The new culinary water system will include two storage reservoirs (3 MG and 6MG). The 3 MG reservoir will be built first during Phase 1 southeast of I-15. It will supply water to The Point through a 30-inch transmission line that will be bored under I-15. This transmission line will connect to the onsite distribution system in South Loop Road. As demand increases, a 6 MG reservoir will be constructed and tied into the 3 MG reservoir. This transmission and distribution system will operate as a stand-alone water system but will connect to the existing Draper City distribution system via PRVs at the North end and South end of the development.

2.0 DEMAND CRITERIA

2.1 Water System Requirements For Utah

Water system sizing and storage requirements for The Point are governed by the minimum requirements dictated by the State of Utah Division of Drinking Water's R309-510, as well as the International Fire Code. They are to be used in the design of new systems and in the evaluation of water source, storage facility, and pipeline capacities. A separate secondary water system will be constructed so outdoor use is not included in the demand calculations.

2.2 Water Demand – Source Sizing

Water demands were established for the system using the requirements outlined in R309-510-7 as listed below.

- Water system's source capacity can meet the peak day demand.
- Water system's source capacity can provide one year's supply of water, which is the average yearly demand.

Table 510-1 under R390-510 indicates the following and is calculated for The Point as shown in Table 1:

- Peak Day Demand: 800 gallon per day (gpd)/connection for residential or Equivalent Residential Connection (ERC)
- Average Yearly Demand: 146,000 gal/connection or ERC

ERC Evaluation

Water demand was established using the projected land use characteristics for demands under Phase 1 and build-out. See Table 1 for a summary of the ERCs calculations. The total average daily demand for build-out was calculated to be 11,772 ERCs or 3,270 GPM. Subsequent demand scenarios were determined using multipliers based upon the average daily demand

scenario (see Table 3). Commercial demands were converted to ERCs and then totaled together for each phase.

Fire Flow Requirements

The proposed project will consist of commercial and residential use. Some of the commercial sites proposed will consist of high-rise buildings. Due to the nature of the commercial development, fire flow demand will need to be higher than the typical fire flow requirements. Fire flow was determined to be a conservative 4,000 GPM maintained for four hours.

Water Demand Summary

Table 1 summarizes the water demand criteria based on Equivalent Residential Units (1 ERC = 400 gallons per day [GPD]) and gallons per minute (GPM). The total average daily demand was calculated to be 3,270 GPM at build-out, which includes commercial demands which were converted to ERCs.

Phase 1 demands were determined using multipliers based upon the average daily demand. It is estimated that the peak instantaneous demand for the system at build-out is 18.8 million gallons per day (MGD) and 6.47 MGD for phase 1. Table 2 identifies the ERC calculations broken out.

Table 1: Summary of Demands for Phase 1 and All Phases Combined.

Demand	ERC	GPM	MGD
Build-out			
Average Daily Demand	11,772	3,270	4.7
Peak Day w/ Fire		6,540	9.4
Peak Instantaneous		13,080	18.8
Phase 1			
Average Daily Demand	4,085	1,150	1.64
Peak Day w/ Fire		2,271	3.27
Peak Instantaneous		4,494	6.47

Table 2: ERC Calculations for Build-out.

Residential		
Residential ERC	7,904	
Residential Use Ave	400	gpd
Residential GPD	3,161,600	gpd
Commercial		
Employees	57,280	
GPD/employee	25	gpd
Commercial GPD	1,432,000	gpd
ERC's	3,580.00	
Retail		
Employees	3,002	
GPD/employee	11	gpd
Retail GPD	33,022	gpd
ERC's	83	
Hotel		
Employees	75	
GPD/employee	11	gpd
Rooms	548	
GPD/room	150	gpd
Hotel GPD	82,200.00	gpd
ERC's	206	
Fire Flow		
4000 gpm/4 hrs	960,000.00	gallons
ERC's	2,400.00	
Emergency Storage		
Emergency Storage GPD	1,440,000	gallons
ERC's	3,600	
Additional Draper Storage		
Draper Storage	2,000,000.00	gallons
ERC's	5,000	

2.3 Storage Sizing

The Point Reservoirs One and Two are circular concrete tanks that will service the development. The total volume will be 9.108 million gallons. Water storage sizing was determined for the system as a stand-alone system not connected to other water sources and using the requirements in R309-510-8. The reservoir capacity includes equalization storage, fire suppression storage, and emergency storage for a total required storage of 7 MG. Draper City requested an additional 2 MG of storage for a total of 9 MG. See Tables 2 & 3 for a summary. The results of the models show that the full storage capacity of 9 MG is not needed until full buildout. Tanks will be constructed according to project phasing. Therefore, the water storage

capacity was split into two reservoirs, a 3 MG tank and a 6 MG tank. Construction of the 3 MG reservoir will be built as part of Phase 1. The 6 MG reservoir will be built according to increases in demand as the site is developed. The two water storage reservoirs will be constructed southeast of I-15.The tank elevations are 4,632' minimum and 4,652' maximum. The emergency overflow will be at the maximum elevation of 4,652'.

Equalization storage is 14,000 ERCs (Res., Comm., Edu., Shopping, Hotels, Etc.) multiplied by 400 gallons giving 5,600,000 gallons.

Table 3: Storage Calculations for Phase 1.

Phase 1		
Residential		
Residential ERC	3,381	ERC
Residential Use Ave	400	gpd
Residential GPD	1,352,551	gpd
Commercial		
Employees	7,969	People
GPD/employee	25	gpd
Commercial GPD	199,225	gpd
ERC's	498.06	ERC
Retail		
Employees	1,973	People
GPD/employee	11	gpd
Retail GPD	21,703	gpd
ERC's	54	ERC
Hotel		
Employees	75	People
GPD/employee	11	gpd
Rooms	548	Rooms
GPD/room	150	gpd
Hotel GPD	82,200.00	gpd
ERC's	206	ERC
Fire Flow		
4000 gpm/4 hrs	960,000.00	gallons
ERC's	2,400.00	ERC
Emergency Storage		
Emergency Storage GPD	1,440,000	gallons
ERC's	3,600	ERC
Additional Draper Storage		
Draper Storage	2,000,000.00	gallons
ERC's	5,000	ERC

3.0 METHODOLOGY AND ANALYSIS

3.1 Hydraulic Model Used

Horrocks created the hydraulic computer model using WaterGEMS to determine pipe sizing for the proposed culinary water system. The program uses the Hazen-Williams equation to calculate flow rates and head-loss through the system. Horrocks performed several modeling evaluations of the proposed system. The hydraulic computer model was used to analyze multiple water use scenarios including average daily demand, peak day with fire flow, and peak instantaneous. Phase 1 scenarios account for demands under project phasing.

3.2 Model Scenarios

The scenarios that were modeled were done so in accordance with state standards and rules. Each scenario represents a specific worst-case scenario. Modeled scenarios are as follows:

- Average Daily Demand
  - Average Daily Demand Extended Period Simulation
  - Buildout Age Analysis
- Peak Day with Fire
  - Peak Day With Fire (fire flow at 2000gpm)
- Peak Instantaneous
- Peak Day
  - Peak Day EPS
- Year 2027 Phase 1
  - Year 2027 Phase 1- Age Analysis (Tank @1MG)
  - Year 2027 Phase 1- Age Analysis (Tank @0.5MG)

3.3 Hydraulic Model Input

Model inputs include demand, the pipe network, system storage, flow control valve settings, the existing Draper City water line, proposed PRV's and model scenarios. System demand was distributed evenly throughout the model. The demand was distributed in this way because there still remains some uncertainty in the population distribution throughout the network.

Demand was not placed on transmission lines or dead-end junctions, only on the interior junctions where development is expected to occur.

Friction coefficients range from 130-140, consistent with standard practices and according to pipe materials. The coefficients are 130 for PVC pipes and 140 for ductile iron pipes.

Elevation inputs for the storage tanks are 4632' minimum and 4652' maximum. An overflow device will be installed inside the tank at 4,652'. The exact tank setting depends on the scenario. Initial tank settings for steady state scenarios are 4633', while EPS scenarios are initially set at 4651'. The Easternmost tank has a volume of 3MG (servicing phase 1) and the Westernmost tank has a volume of 6MG. The 6 MG tank will be brought online as development outpaces the ability of the 3 MG to service the development.

Flow control valve settings vary depending on the scenario (i.e. time of year) but range from 3000GPM (average) to 5500GPM (Peak day). Flow control valves are set to turn on when the tank reaches 13' and to turn off once the tanks are full at 20'.

PRV's were placed at the two locations where the proposed network will interconnect with Draper City's existing distribution network. These PRV's will need to be set to a hydraulic grade of 4632' to avoid the backflow of Draper City's water into the proposed system.

Distribution system sizing requirements

R309-105-9 provides the minimum requirements for a water system. It states that pressures must be above 20 psi during normal operation of the water system. Systems must maintain the following minimum dynamic water pressures at all locations within the system.

- 30 psi in all areas of the system during peak instantaneous usage,
- 20 psi in all areas of the water system during maximum day usage with imposed fire flows,
- 4,000 gpm fire flow for 4 hours maximum for residential apartment complexes, and
- Adequate fire flows for all other buildings according to IFC standards.

Local jurisdictions have required that the system meet pressures higher than the minimum mentioned above. Modeled pressures in non-transmission line pipes typically range from 80-100psi during average use and peak usage. Local requirements are as follows:

- 50 psi minimum in all areas of the system during peak instantaneous usage.

Since output data is in GPM and model input is in ERCs, the model calculations referenced ERC conversion factors. Each demand scenario used unique conversion factors to account for changes in demand. The conversion factors are summarized below on Table 3. It is estimated that the peak demand for the system is 18.8 MGD at build-out as shown on Table 1.

A diurnal demand pattern was applied to all EPS scenarios (including water age). Since the system doesn't exist yet, no real-world data exists. Thus, the demand pattern was assumed, with peaking factors of 2.0 applied at 8am and 6pm. Please see Table A-1 and Figure A-12 in the appendix.

Table 3: Conversion Factors (ERC to GPM)

Demand Scenario	Conversion Factor
Average Daily Demand	0.278
Peak Day w/ Fire Flow	0.556
Peak Instantaneous	1.1

3.4 Model Results and Distribution System

Model results are within reasonable expectations. See Figures A-1 through A-11 in the Appendix for the model output results. Site conditions are favorable for this system. Pressure

requirements are met for all junctions across all scenarios except along the transmission line and along the modeled existing Draper City 24" waterline. The low pressures along the existing 24" line are due to conservative assumptions about Draper City's pressures (hydraulic grade was assumed to be 4,697.13') and the low pressures along the transmission line are nominal. Overall, the system was modeled conservatively, and results meet the requirements set in R309-105-9, and by local jurisdictions, and are as follows:

- **Average Daily Demand**-Low pressures (less than 20PSI) only exist on the transmission line near the tanks. Service pressures range from 60PSI to 100PSI. Pipe Velocities range from 0.5FPS to 2FPS.
    - **Average Daily Demand EPS-** Tanks and flow control valves operate nominally within the ranges set on the flow control valves, and pressures and velocities are within standards. This EPS scenario had a period of 720 hours.
    - **Buildout age Analysis**- Age throughout the network ranges from 60 hours to 80 hours. Larger ages occur at the dead end junctions in the model, which is to be expected as no demand has been placed on those junctions. Throughout the service area the age is around 70 hours. This EPS scenario had a period of 720 hours.
- **Peak Day with Fire (Fire Flow @ 4000GPM)-** Pressures and velocities for the peak day with fire scenario are within nominal ranges. Available fire flow ranges from 1800GPM to 4500GPM. Only one dead end junction is unable to meet minimum fire flow conditions, which is expected due to the nature of dead-end junctions. Other than the failing dead end junction fire flow ranges from 4000GPM to 4500GPM.
    - **Peak Day with fire (fire flow @ 2000GPM)-**This scenario was created to ensure that minimum fire flow conditions are met. All junctions except for the failing dead-end junction meet the minimum 2000GPM fire flow conditions.
- **Peak Instantaneous-** Pressures and velocities for the peak instantaneous steady state scenario are within acceptable ranges. Velocities range from 0.5FPS to 4FPS, and pressures range from 50Psi to 100psi. Generally, pressures are above 60psi.
- **Peak Day-** Results for the peak day scenario are nominal. Pressures range from 70PSI to 100PSI and velocities within the service network range from 0.28 FPS to 2 FPS. The flow control valves in this scenario are set to the highest setting of 3500GPM, giving a velocity of 5 FPS in the transmission line.
    - **Peak Day EPS-** Pressures and velocities for the peak day EPS scenario are within acceptable ranges. Velocity within the transmission lines is highest in this scenario. To sufficiently meet the demands the FCV supplying the 6MG tank has a setting of 5500GPM. The increased loading results in 6FPS through the first portion of the transmission line and around 5 FPS through the remaining portions of the mainline. Pressures through the network range from 80PSI to 120PSI. This EPS scenario had a period of 720 hours.
- **Year 2027 Phase 1-** Pressures and velocities are nominal for the initial build phase of development.
    - **Year 2027 Phase 1- Age Analysis (Tank @ 1MG)-** Maximum age for this scenario is 166 hours (6.9 Days). This EPS scenario had a period of 720 hours.

- **Year 2027 Phase 1- Age Analysis (Tank @ 0.5MG)-** Maximum age for this scenario is 116 hours (4.83 days). This EPS scenario had a period of 720 hours.

APPENDIX:

RESULTS FOR EACH DEMAND SCENARIO (ALL PHASES)

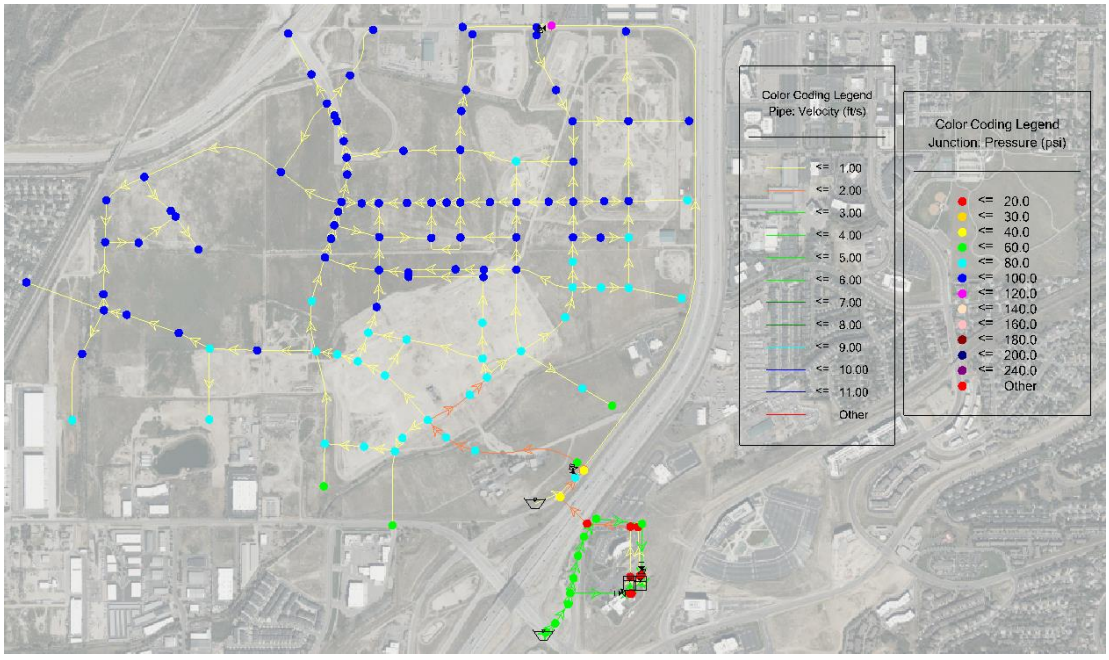


Figure A-1: Average Daily Demand Scenario

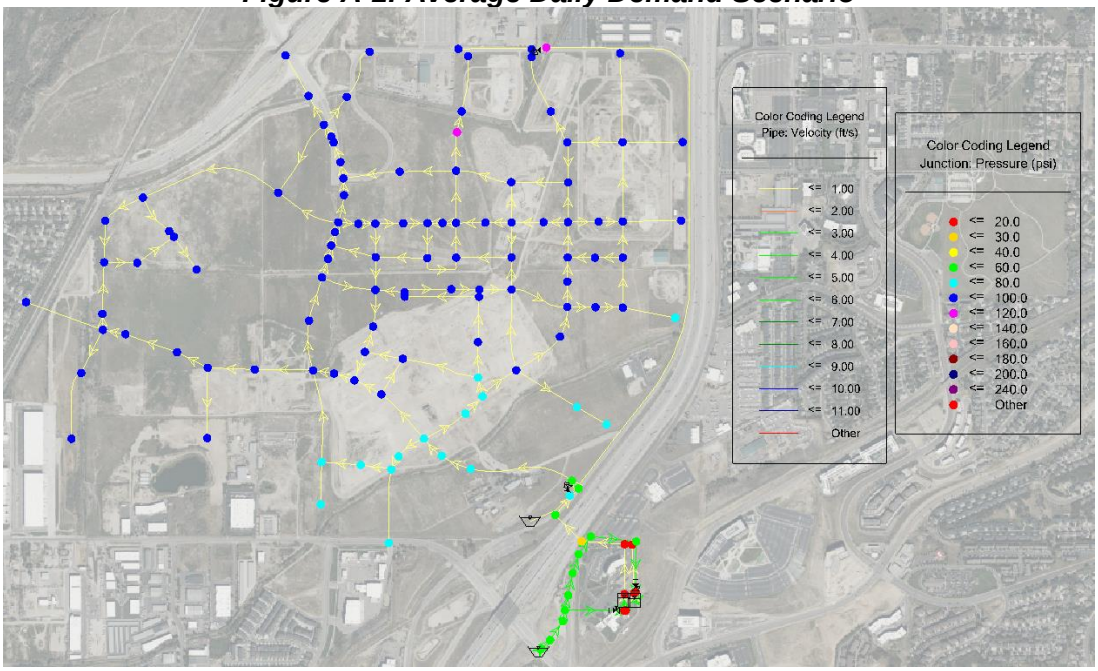


Figure A-2: Average Daily Demand EPS scenario

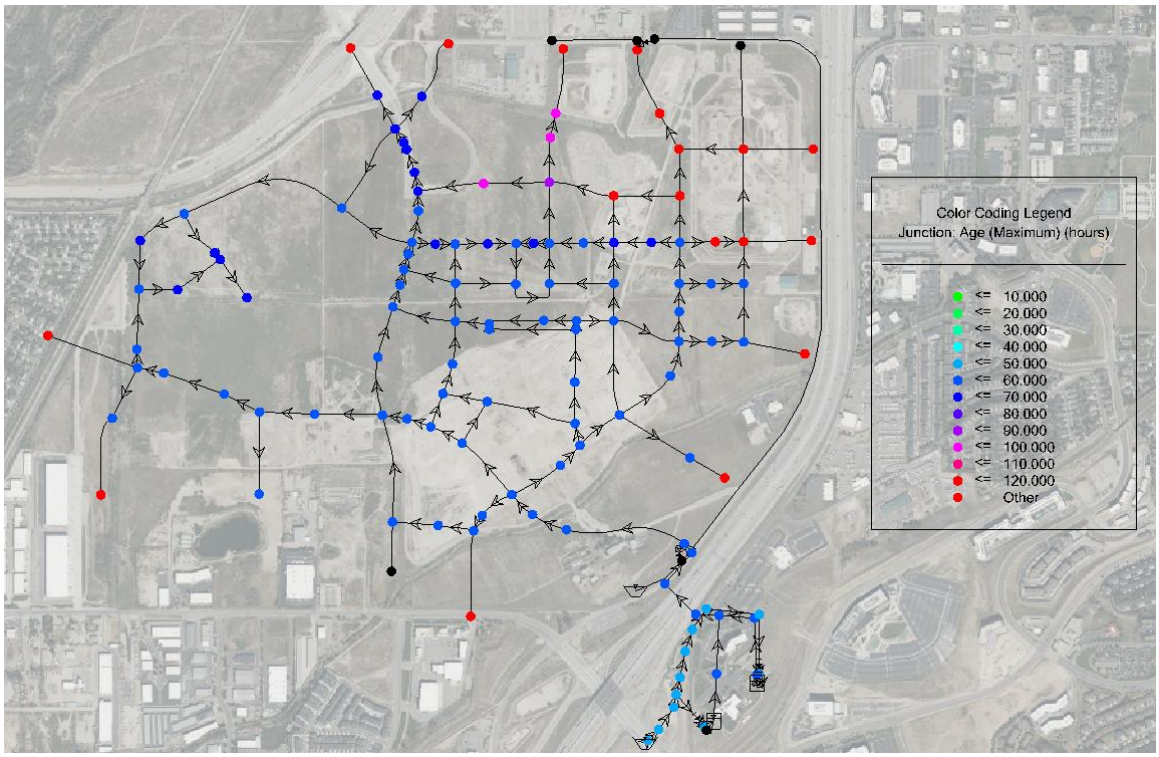


Figure A-3: Buildout Age Analysis

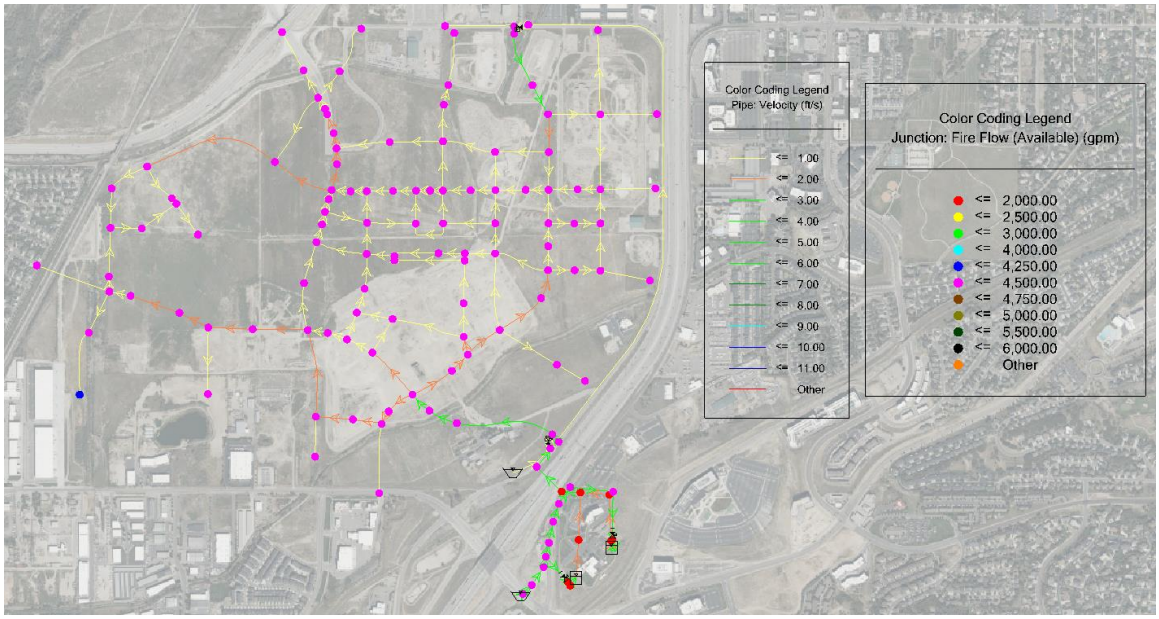
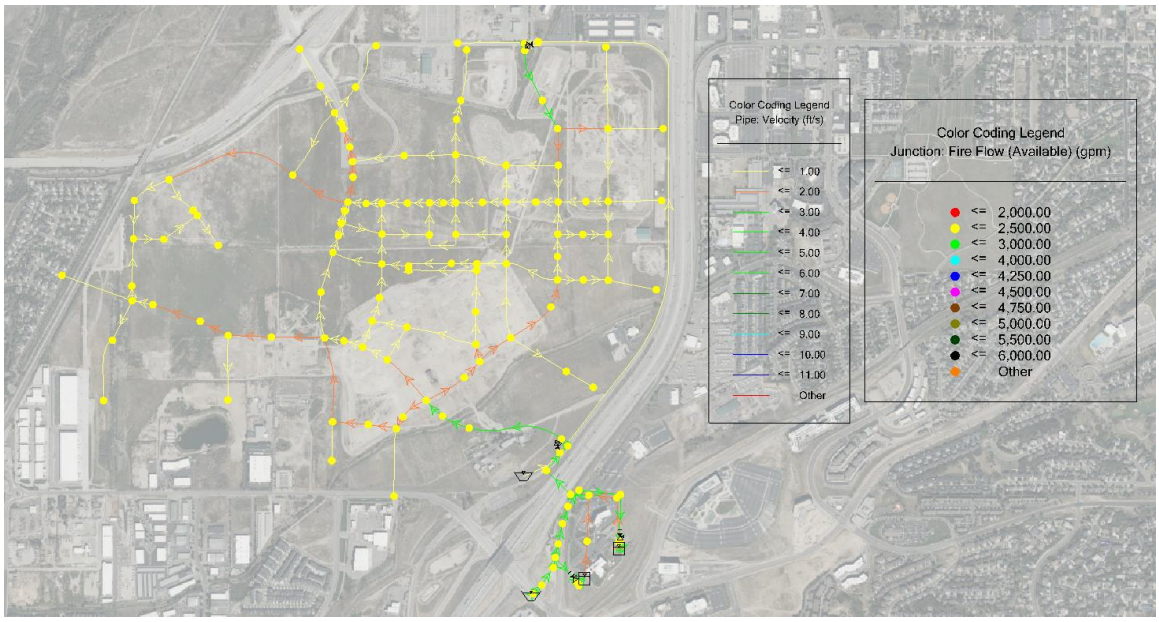
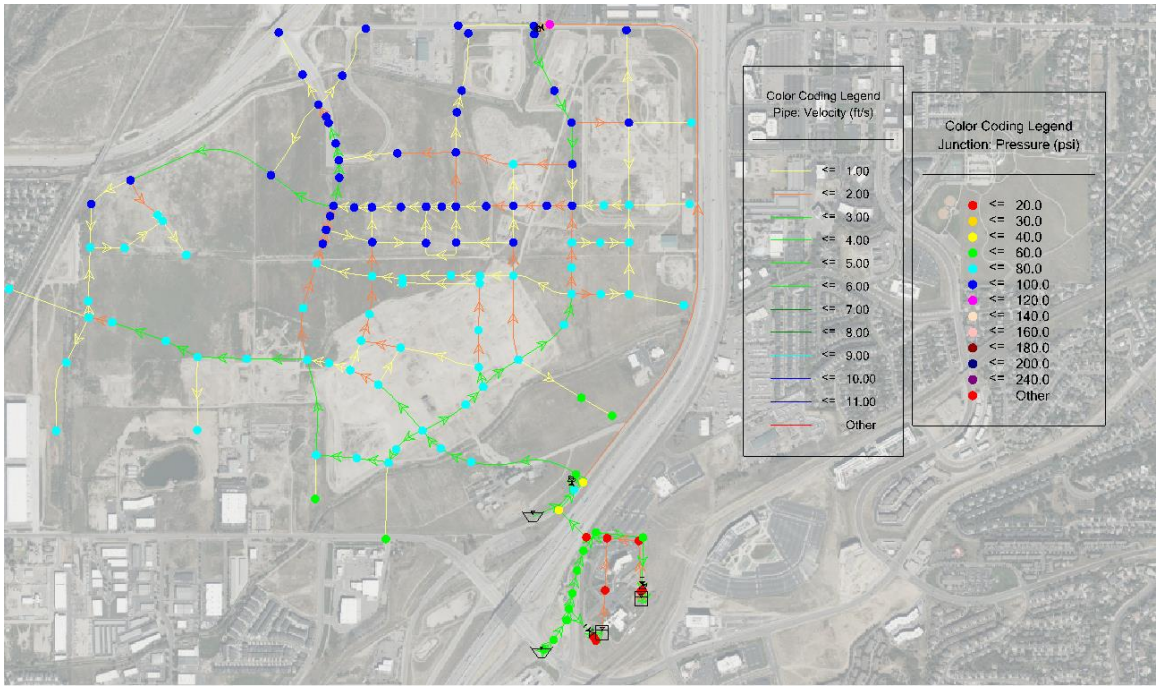


Figure A-4: Peak Day With Fire



A-5: Peak Day with Fire at 2000gpm flow



A-6: Peak Instantaneous

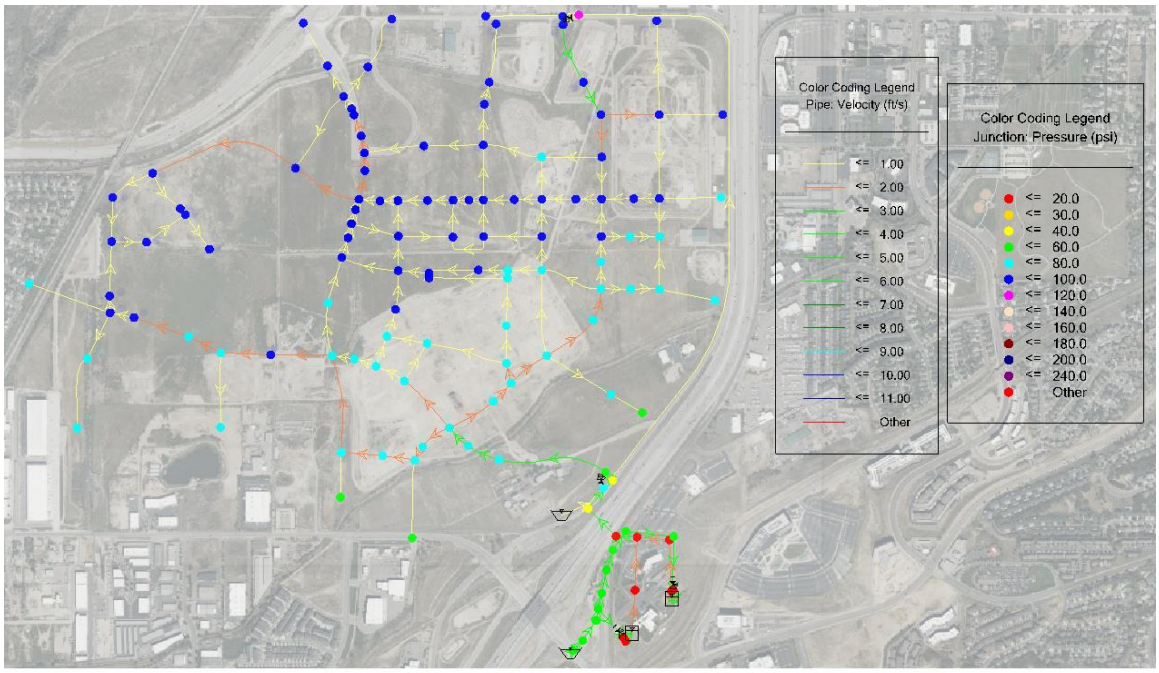


Figure A-7: Peak Day

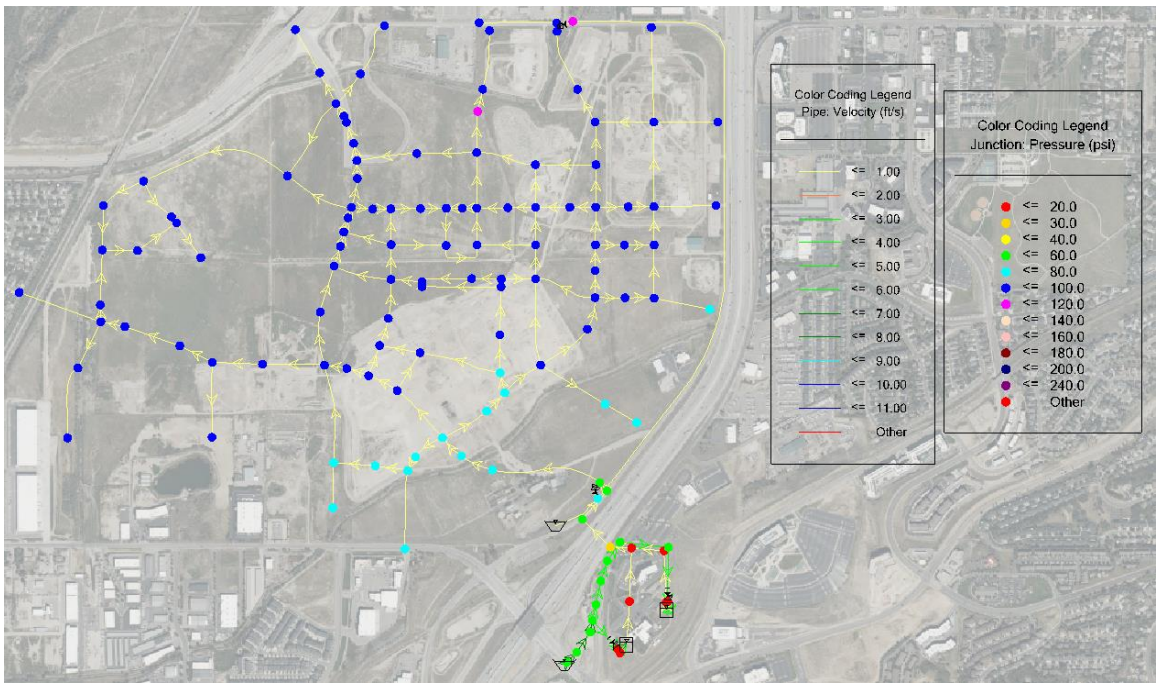


Figure A-8: Peak Day EPS

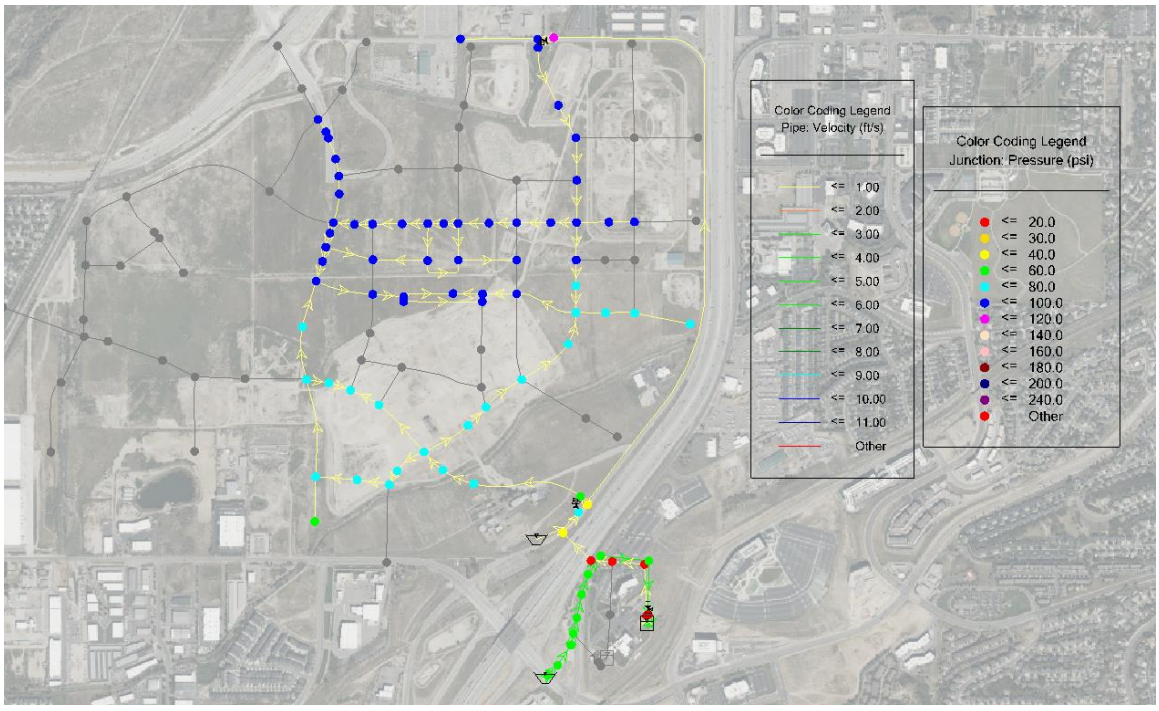


Figure A-9: Year 2027 Phase 1

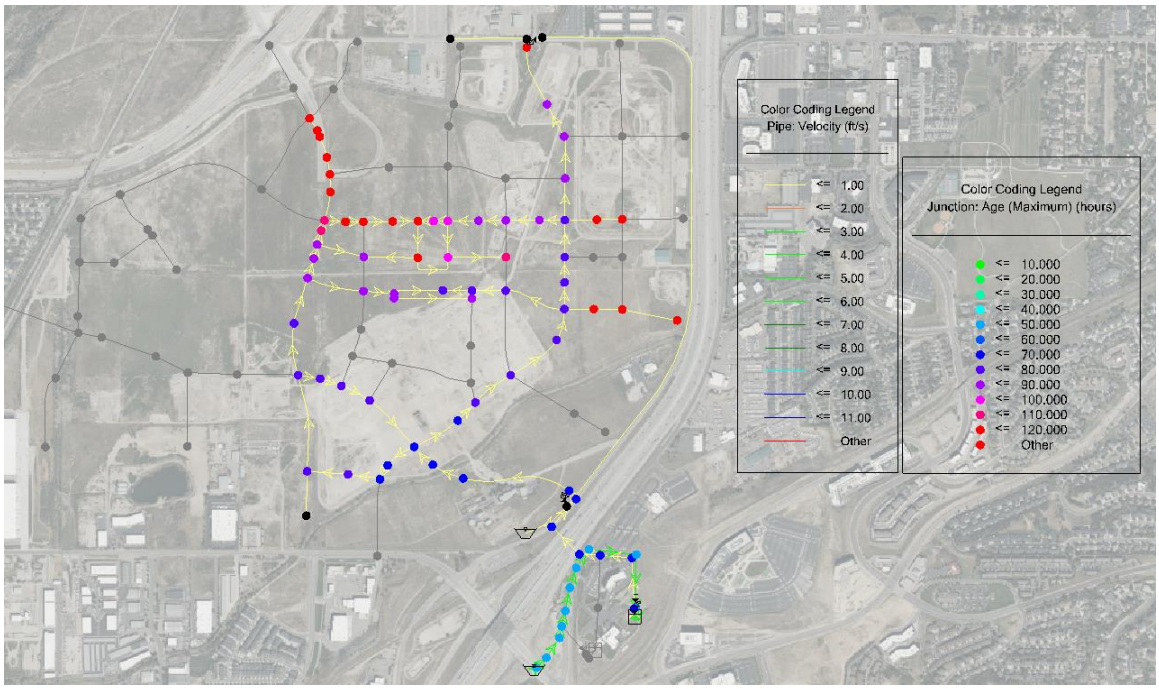


Figure A-10: Year 2027 Phase 1- Age analysis (Tank @1MG)

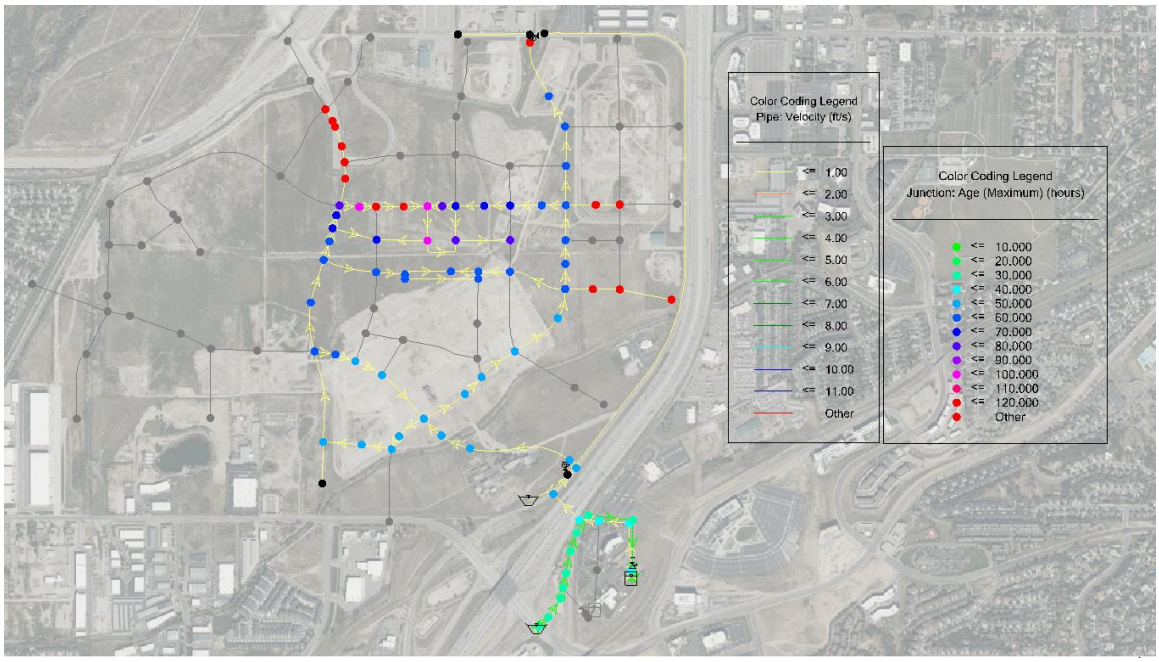


Figure A-11: Year 2027 Phase 1- Age Analysis (Tank @0.5MG)

Time from Start (hours)	Multiplier
1	0.17
2	0.25
3	0.45
4	0.8
5	1
6	1.56
7	1.7
8	2
9	1.7
10	1.56
11	1.4
12	0.85
13	0.75
14	0.6
15	0.48
16	0.53
17	1
18	1.59
19	2
20	1.6
21	1.2
22	0.45
23	0.19
24	0.17

Table 1A: The diurnal demand pattern used for EPS analysis.

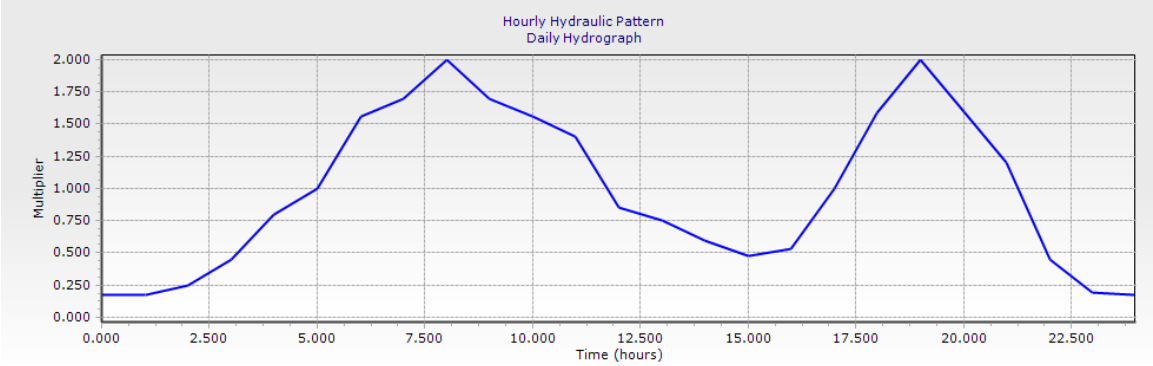


Figure A-12: Diurnal use pattern applied to demand in the EPS scenario.

The Point Reservoir CFD

Final for Construction Submittal

Horrocks.

Horrocks Point Reservoir CFD

Nathan Huber

06/28/2024

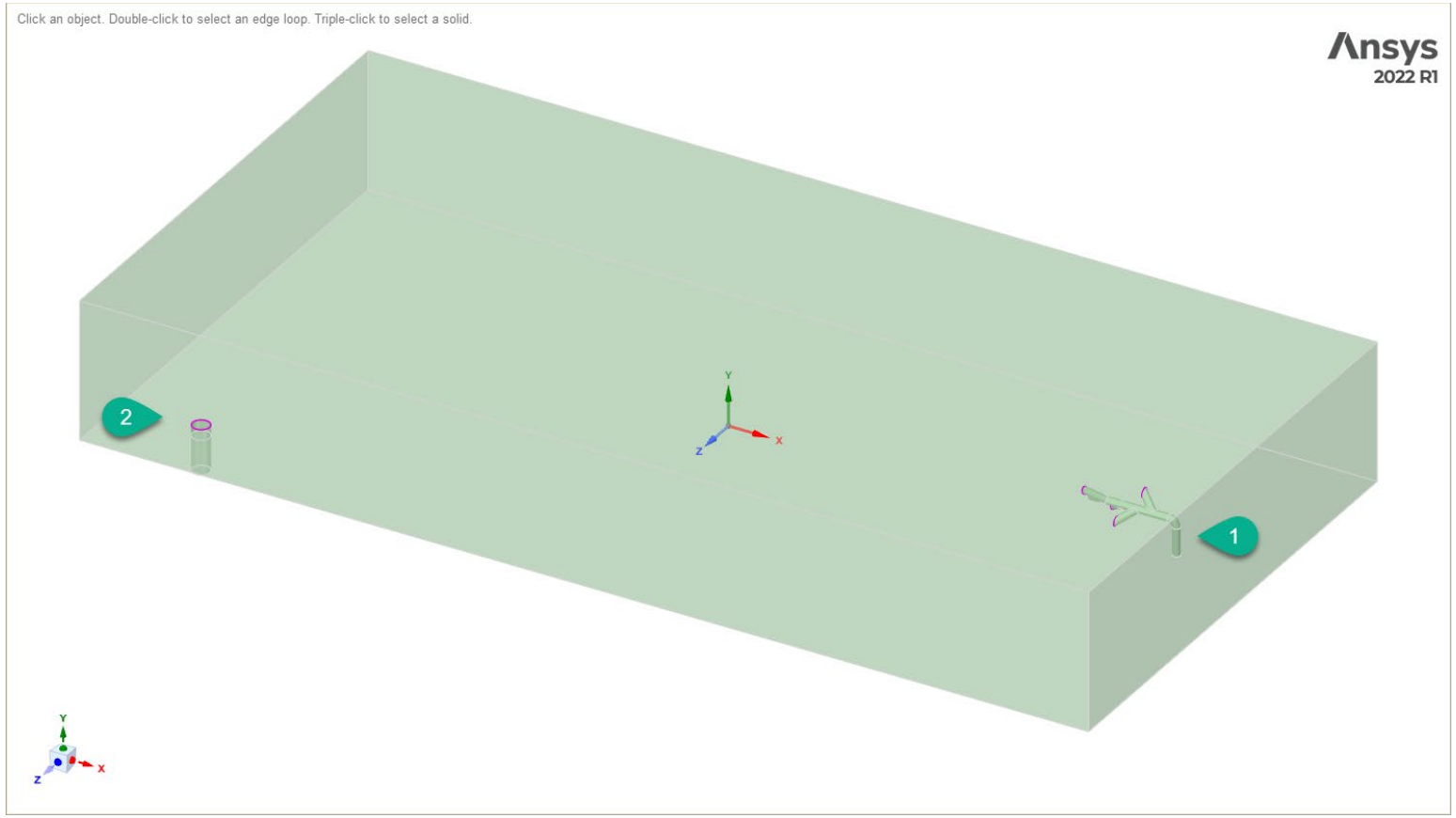
Updated 07/24/2024

Scope

- PADT is completing a basic CFD of the Point Reservoir for Horrocks
- The analysis will be steady state, water only, with a prescribed water height which will be simplified as a slip wall.
- Velocity contours in the reservoir are a key result to review with the customer.

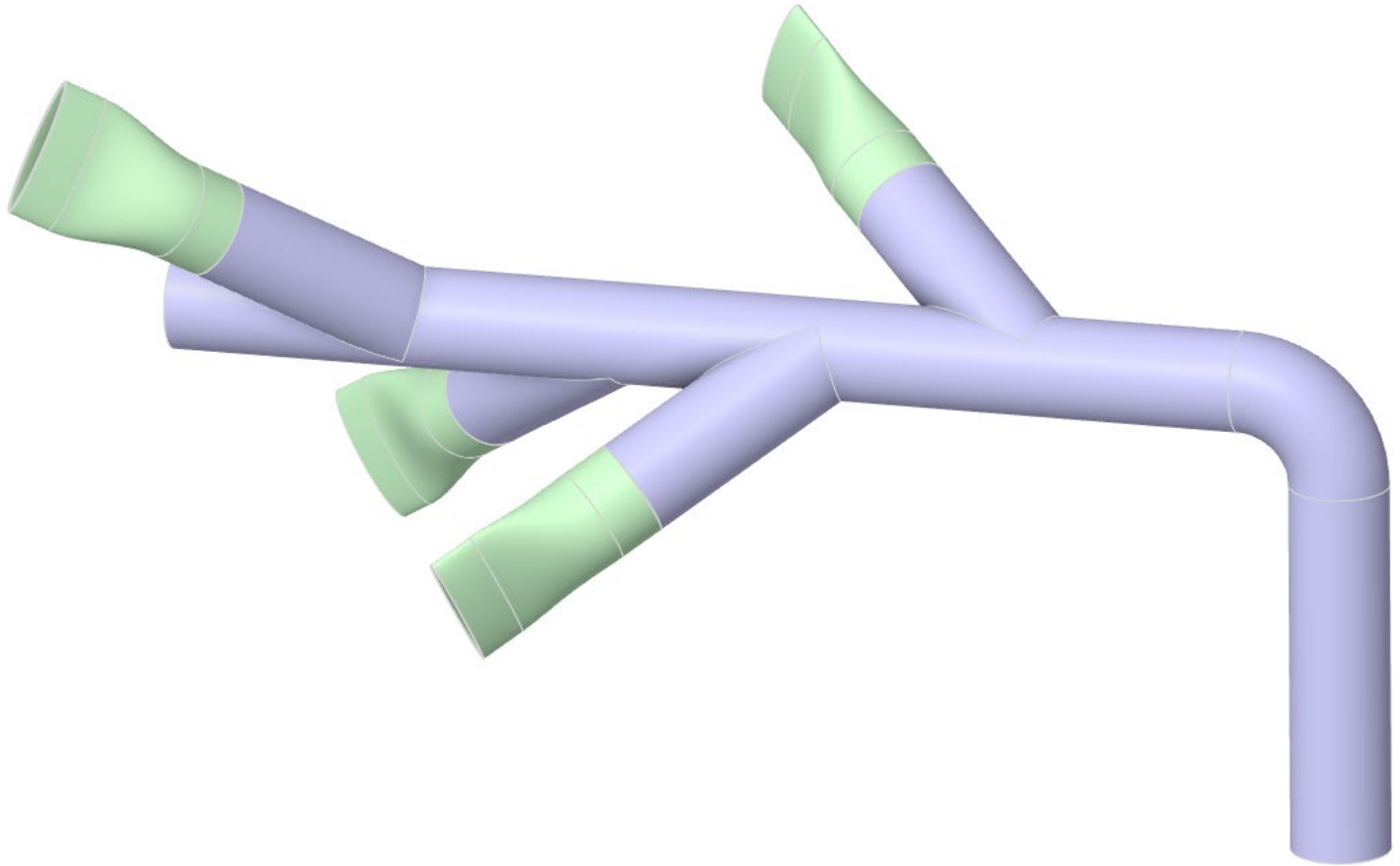
Geometry creation

1. Inlet header
2. Outlet



Geometry creation

- Header with fixed check valve geometry approximation



Analysis setup

- Water height
  - 20 feet
- Inlet
  - Massflow inlet
  - 601 GPM = 37.85 kg/s
- Outlet
  - Pressure outlet
  - Target massflow of the inlet flowrate
- Fluid
  - Fluent default water
  - 998.2 kg/m3

Analysis Cases

1. Check valves 100% open, matching the wye ID
   - 601 GPM from the header inlet, flow through wyes a result
2. No check valves
   - 25% of 601 GPM prescribed at each wye
3. Check valves included, fixed shape
   - 25% of 601 GPM prescribed at each wye
4. Check valves included, fixed shape
   - 601 GPM from the header inlet, flow through wyes and check valves a result

Assumptions/Comments

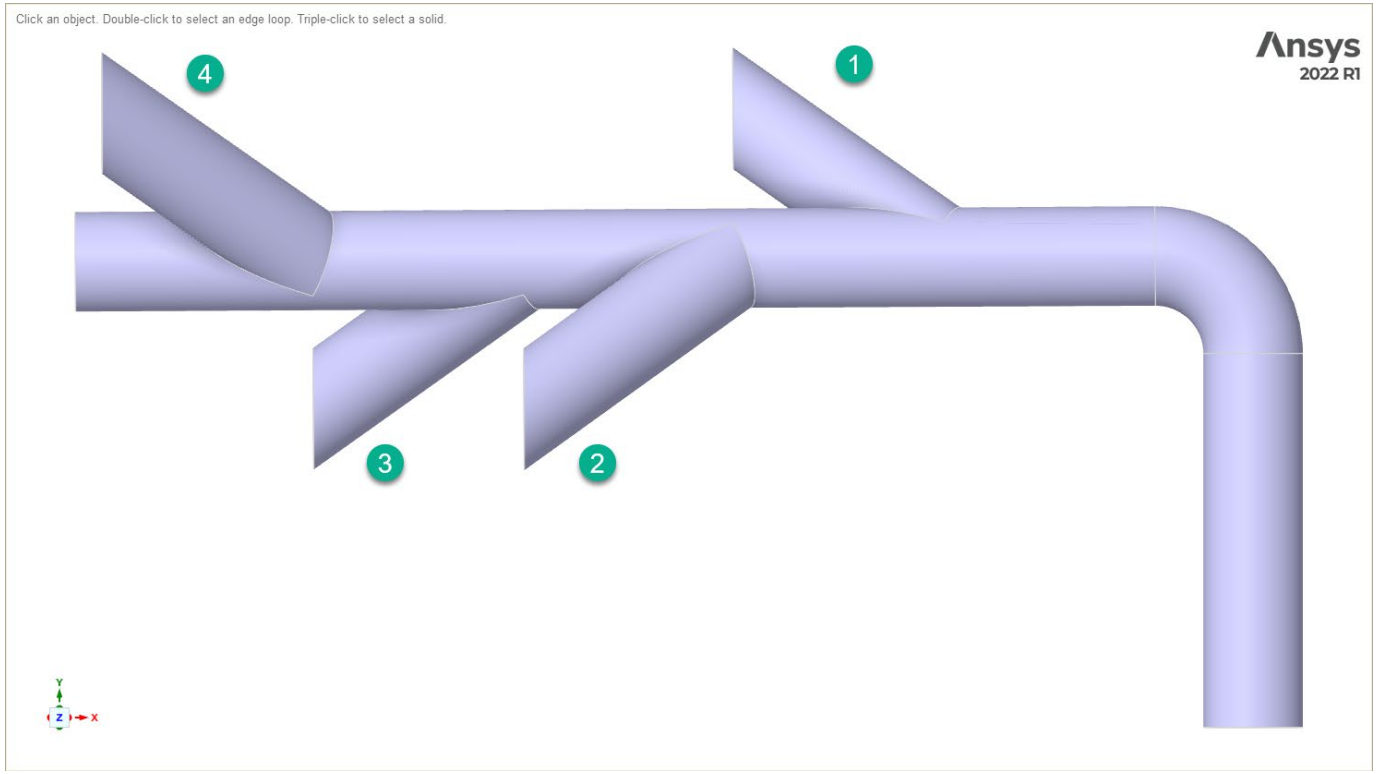
- The true functionality of the check valves with regard to pressure drop and volume flow is unknown. The fixed check valve geometry is an approximation.
- The check valves may alter flow distribution through the wyes as they deform, which is not modeled here.

Results

Flow through Wyes

	Mass Flow [kg/s]			
Case	Wye 01	Wye 02	Wye 03	Wye 04
1	2.30	0.70	10.72	23.84
2	9.46	9.46	9.46	9.46
3	9.46	9.46	9.46	9.46
4	6.11	8.95	10.65	12.01

	Mass Flow [% of total]			
Case	Wye 01	Wye 02	Wye 03	Wye 04
1	6%	2%	29%	63%
2	25%	25%	25%	25%
3	25%	25%	25%	25%
4	16%	24%	28%	32%

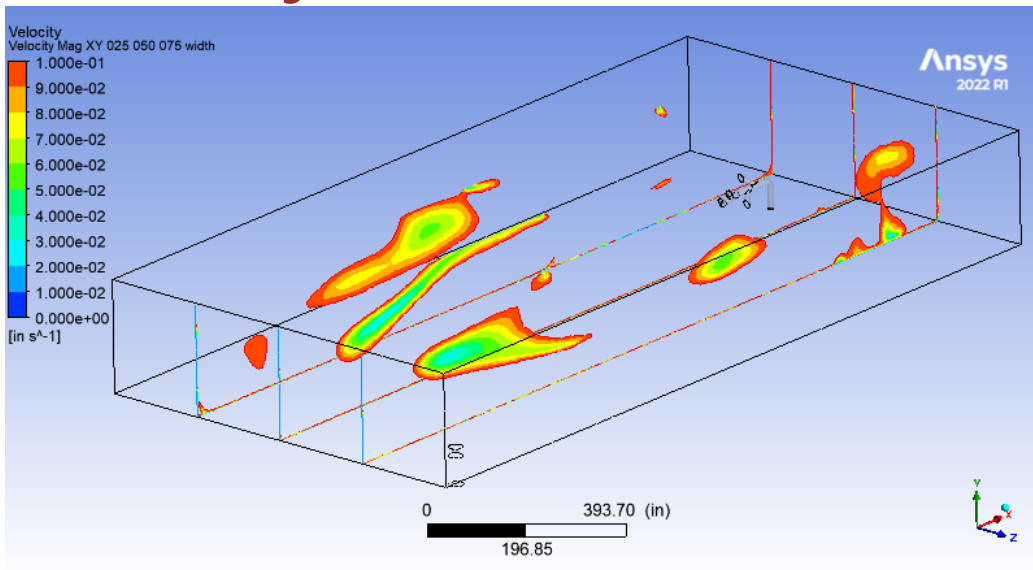


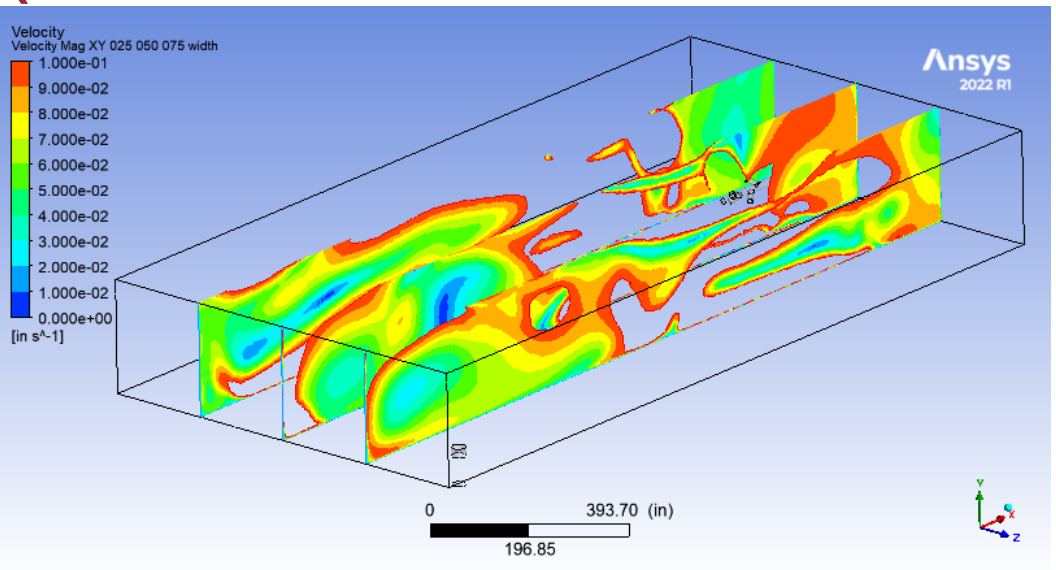
Results Information

- Results in this section are in in/s units
- Velocity contour plots show regions that are 0 in/s to 0.1 in/s
- Iso-surfaces are created where velocity = 0.5 in/s
  - Inside this surface is higher velocity, outside is lower velocity
  - The iso-surface is colored by depth, otherwise it would be a solid blue and can be hard to understand
- Iso-volumes are created where velocity is <0.1 in/s and <0.05in/s
- Streamlines are released from the inlet
  - Pay no attention to qty of streamlines which varies due to geometry.

Velocity Contour Plots (25%, 50%, 75% Width)

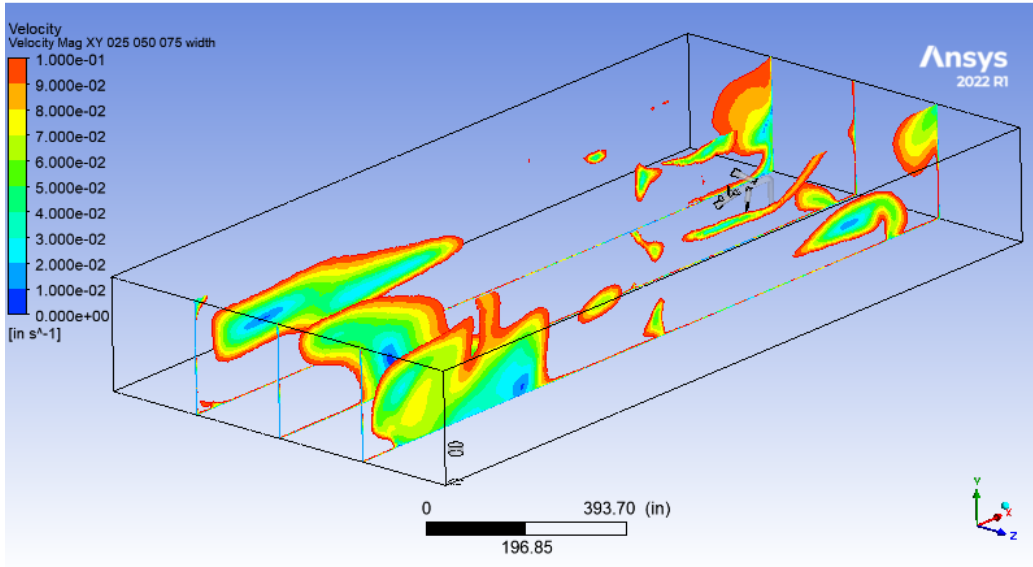
Case 1

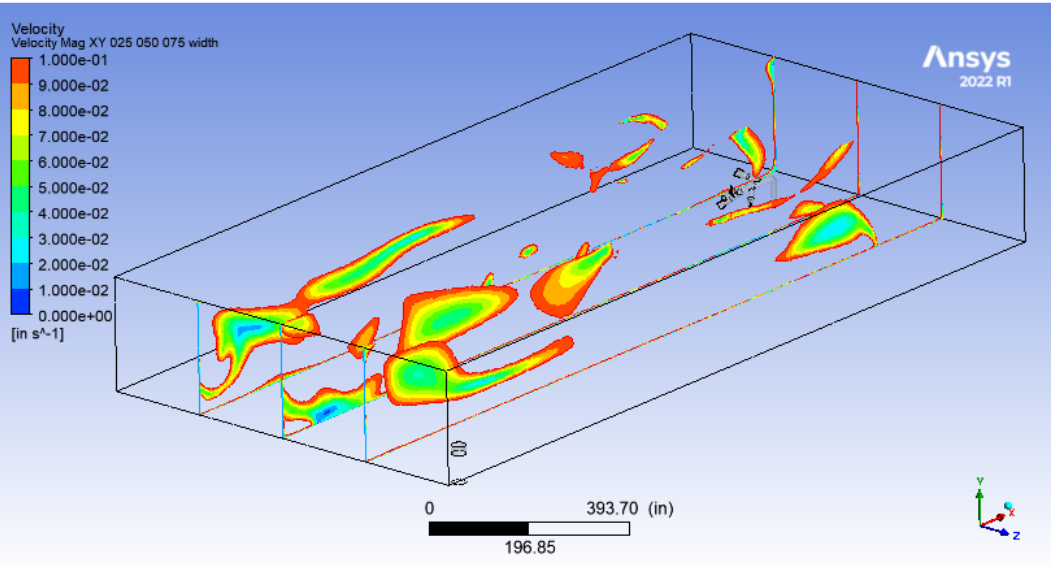




Case 2

Case 3

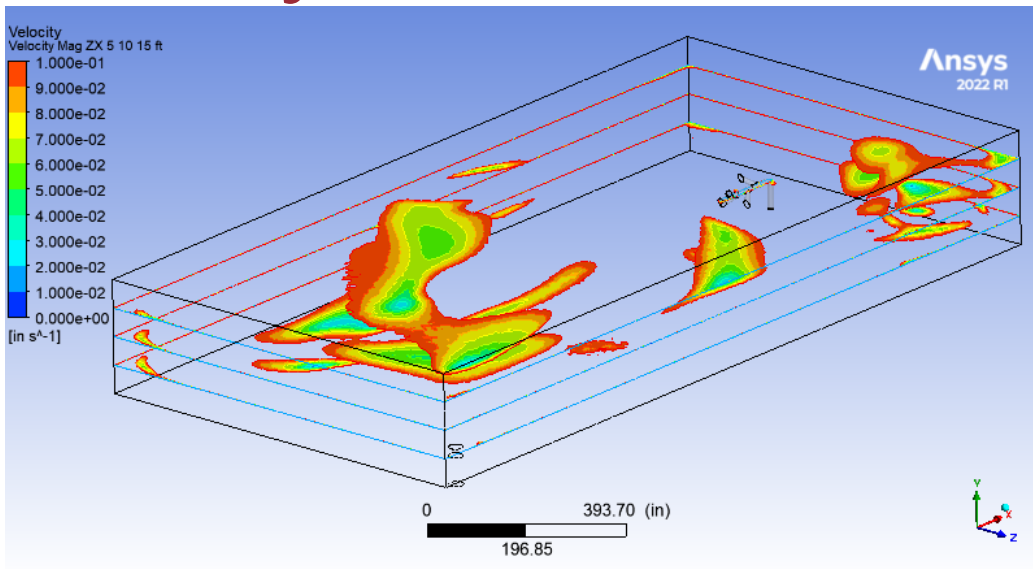


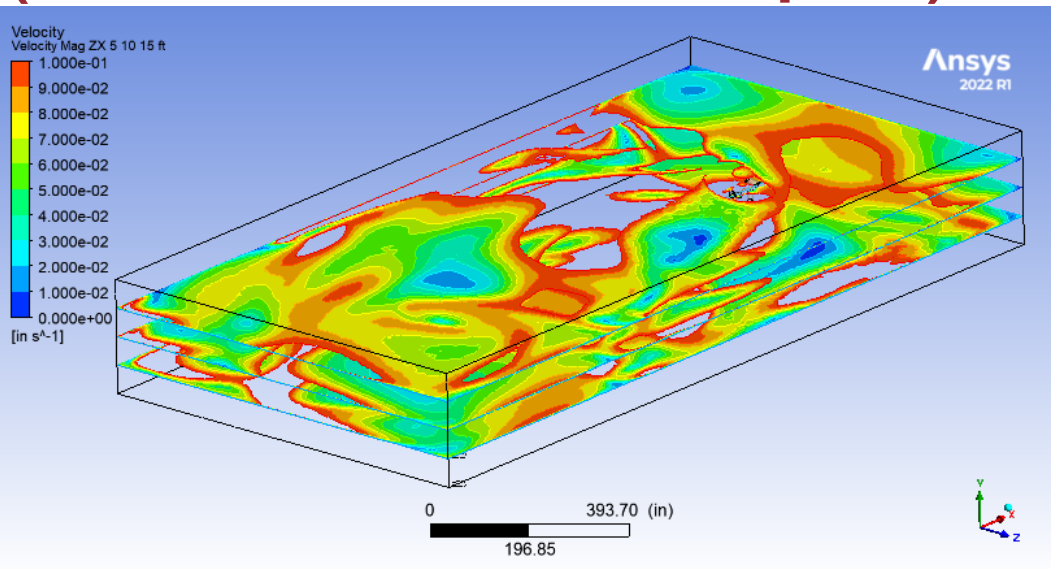


Case 4

Velocity Contour Plots (5ft, 10ft, 15ft depth)

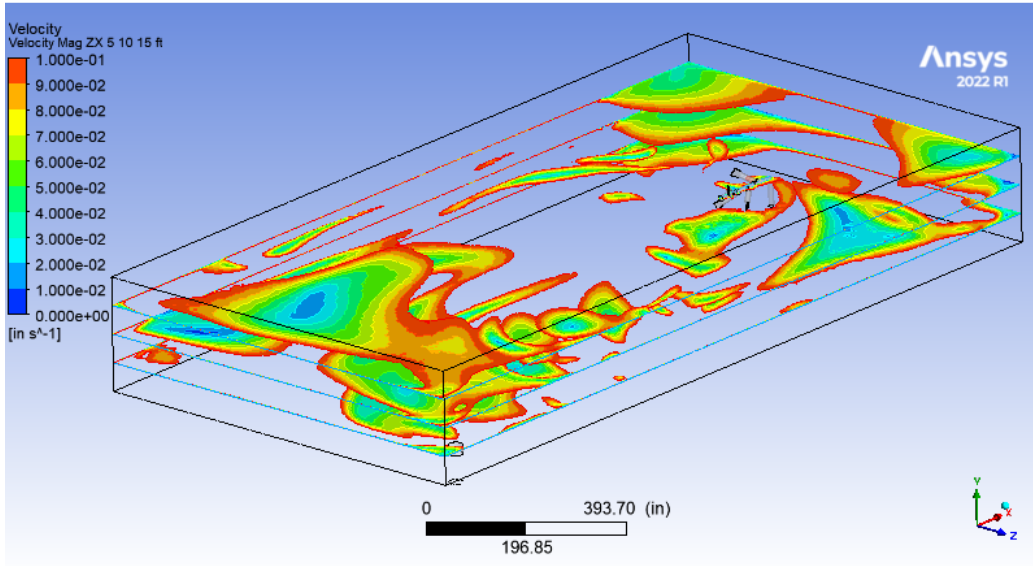
Case 1

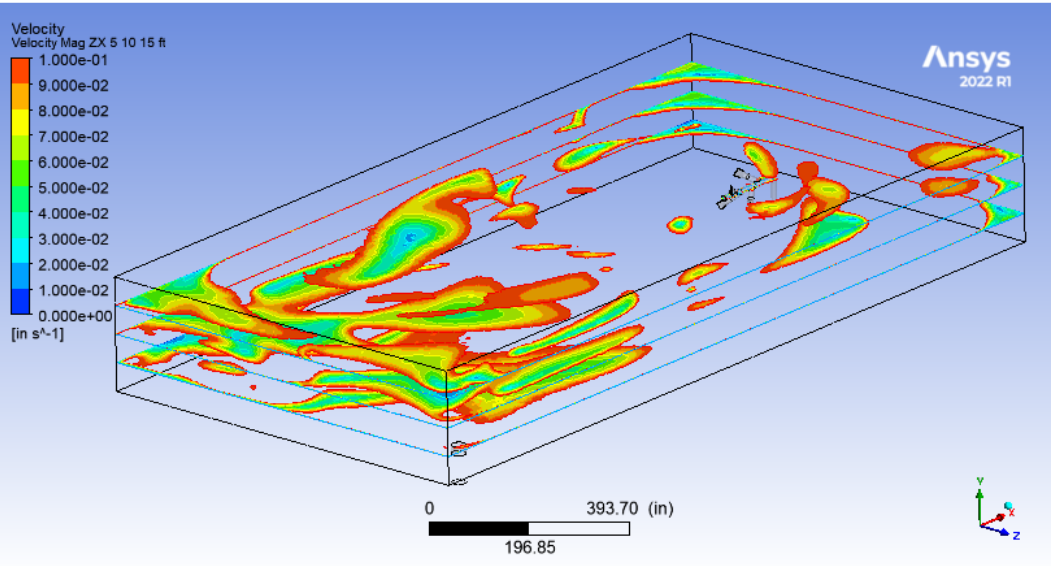




Case 2

Case 3

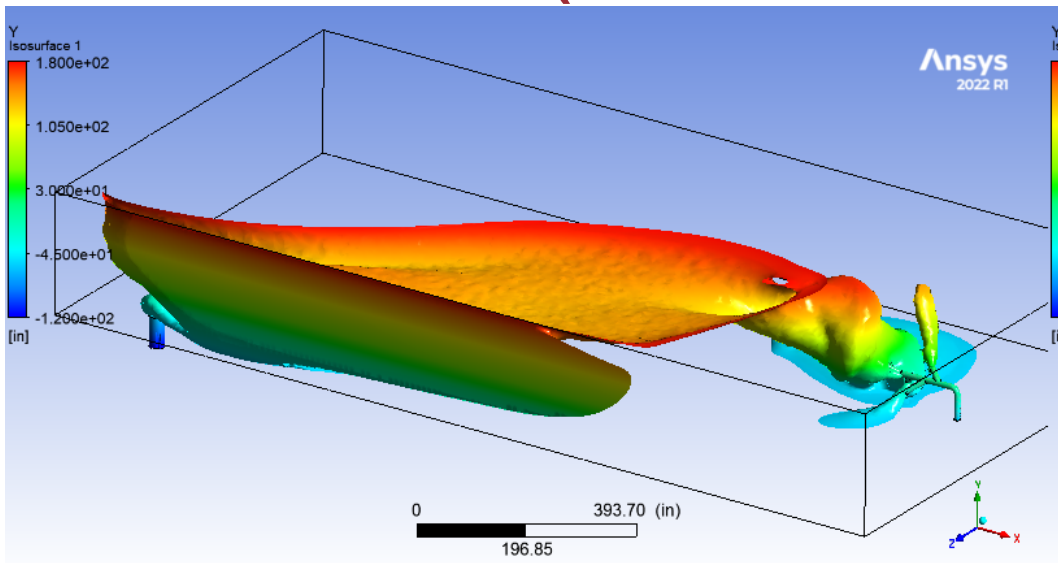


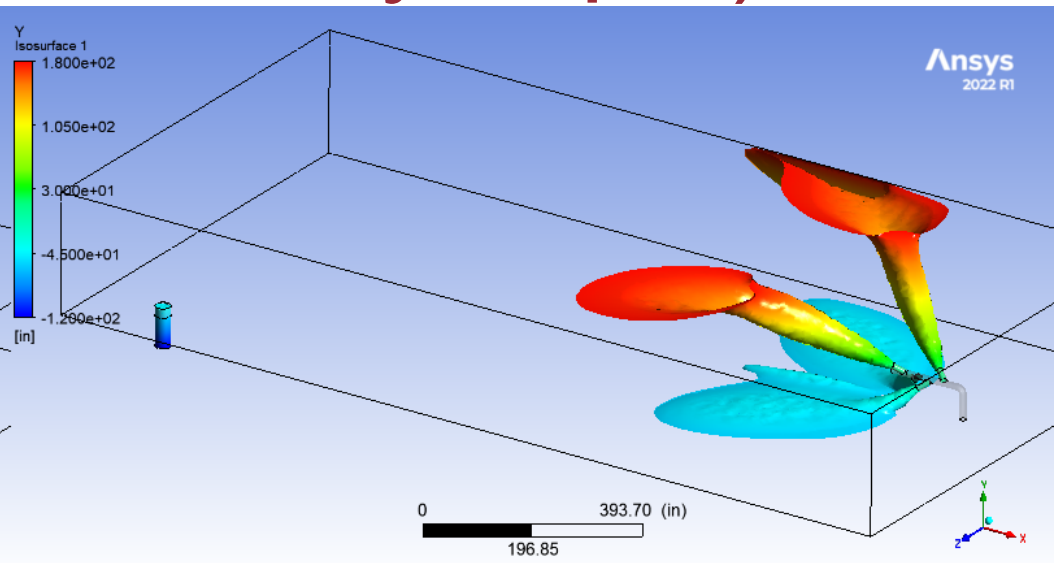


Case 4

Iso-Surface (0.5 in/s, colored by depth)

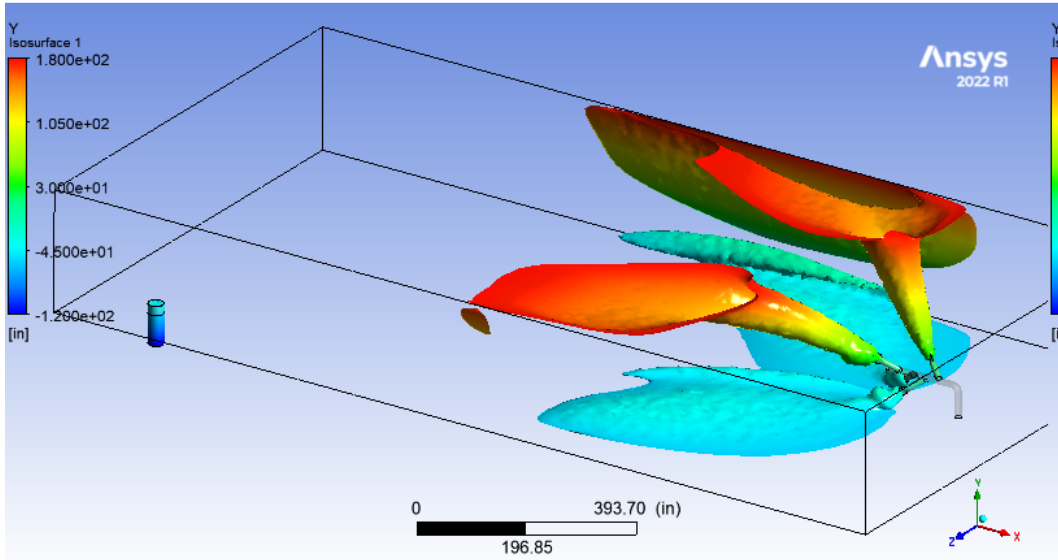
Case 1

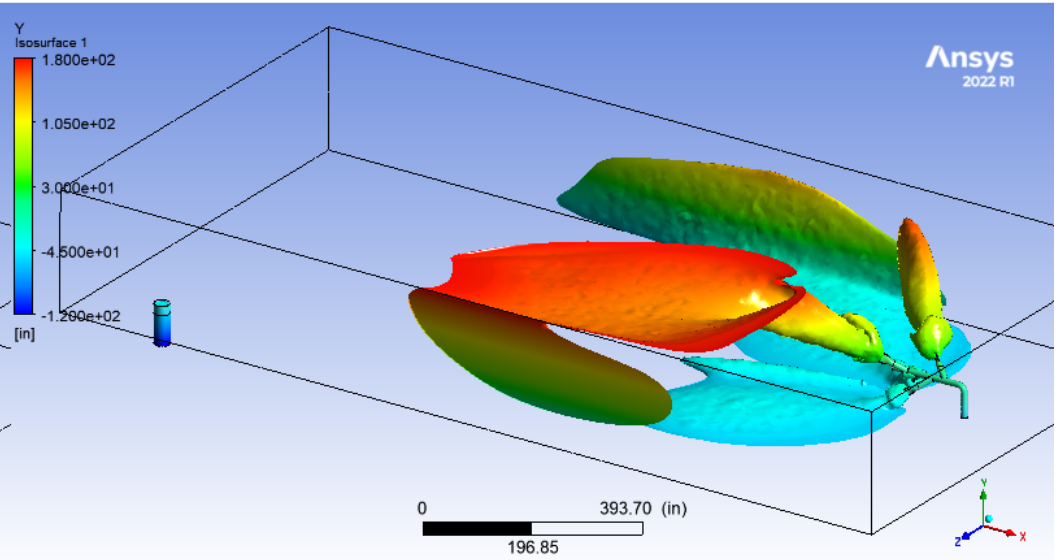




Case 2

Case 3

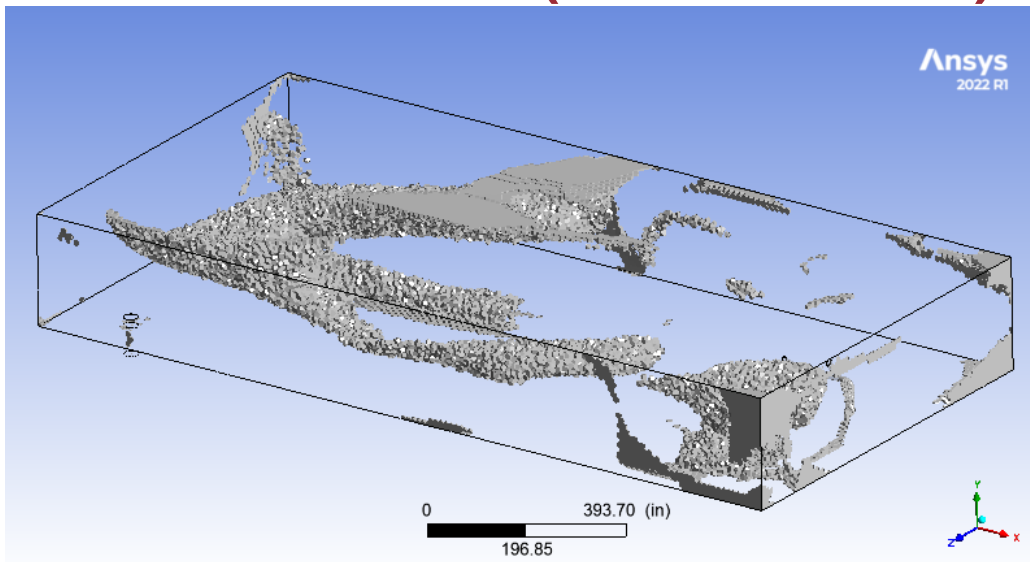


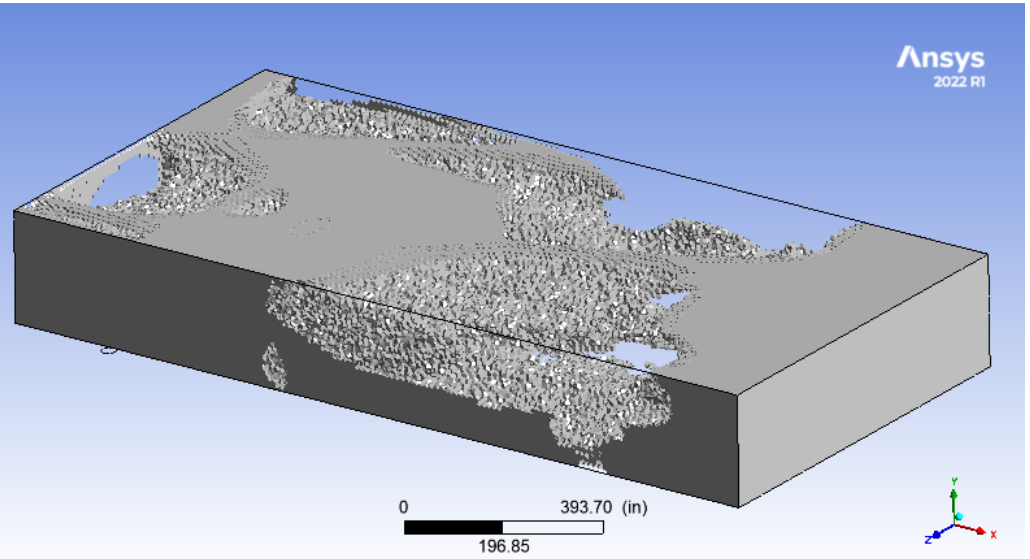


Case 4

Iso-Volume (<0.1 in/s)

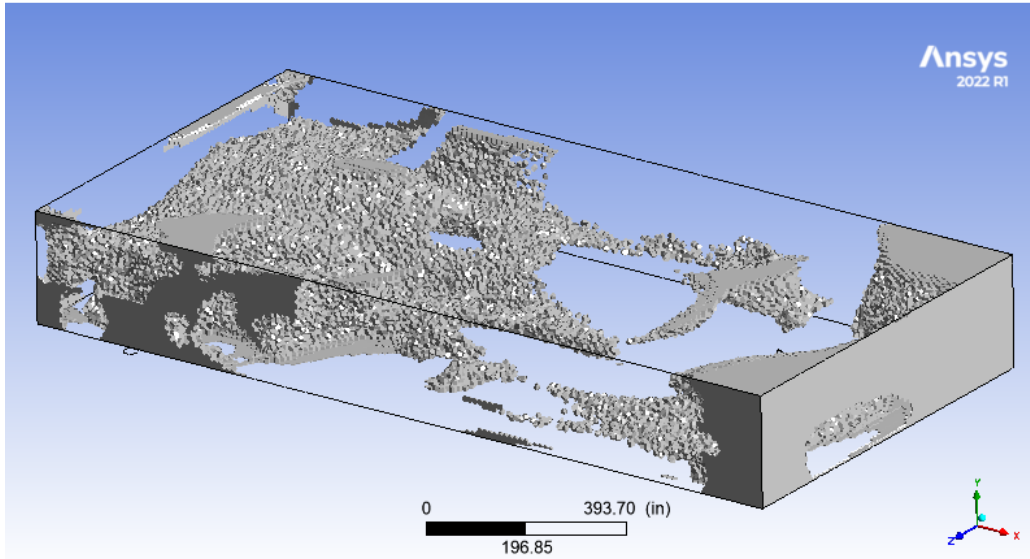
Case 1

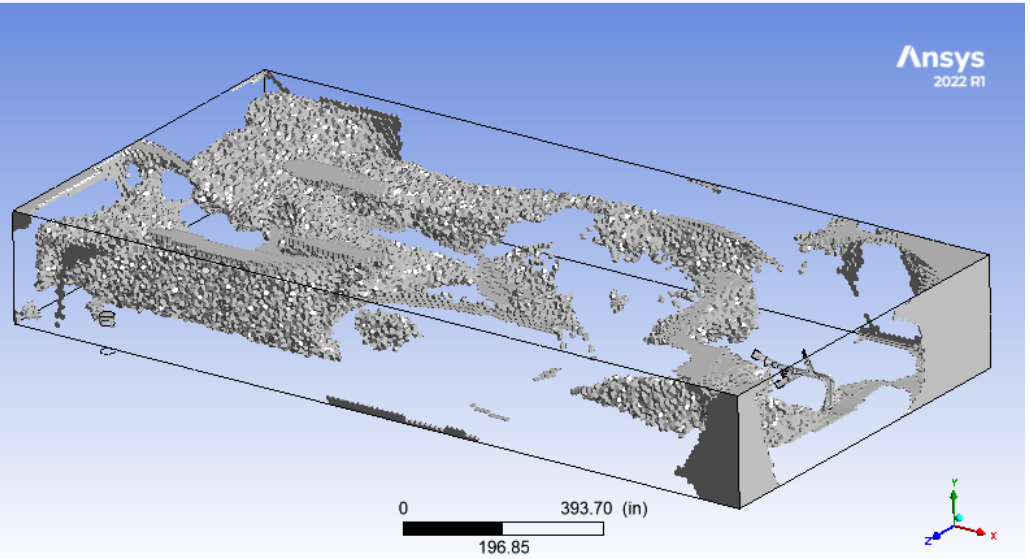




Case 2

Case 3

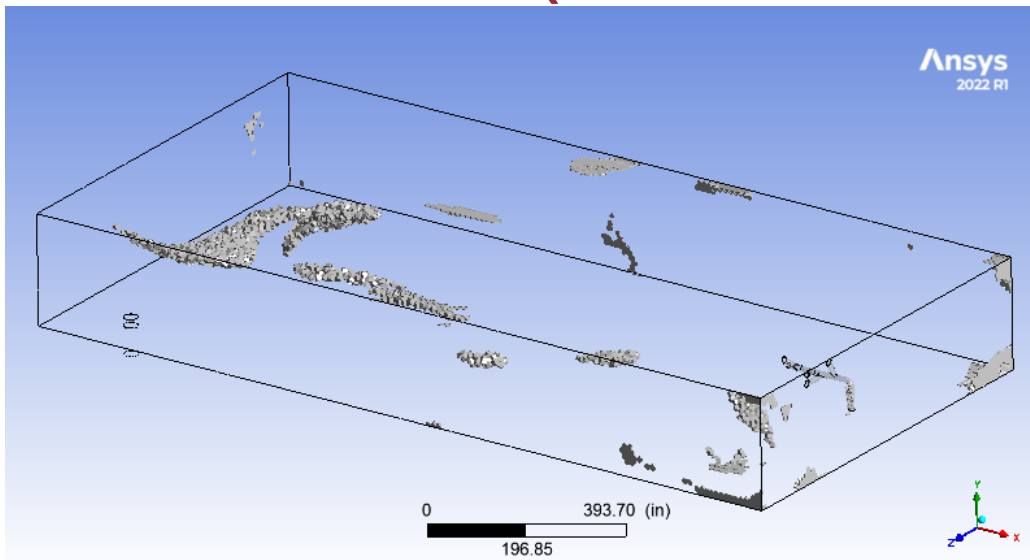


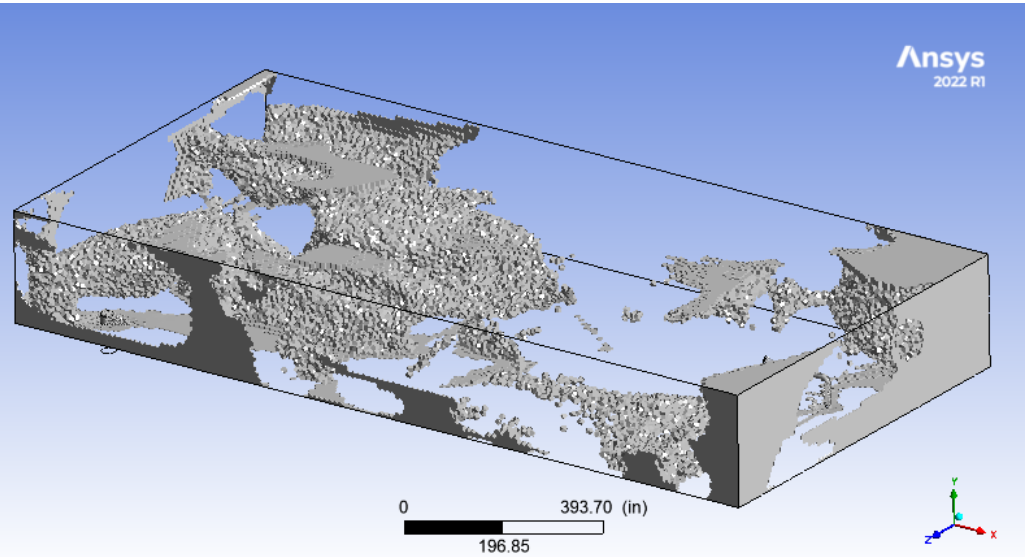


Case 4

Iso-Volume (<0.05 in/s)

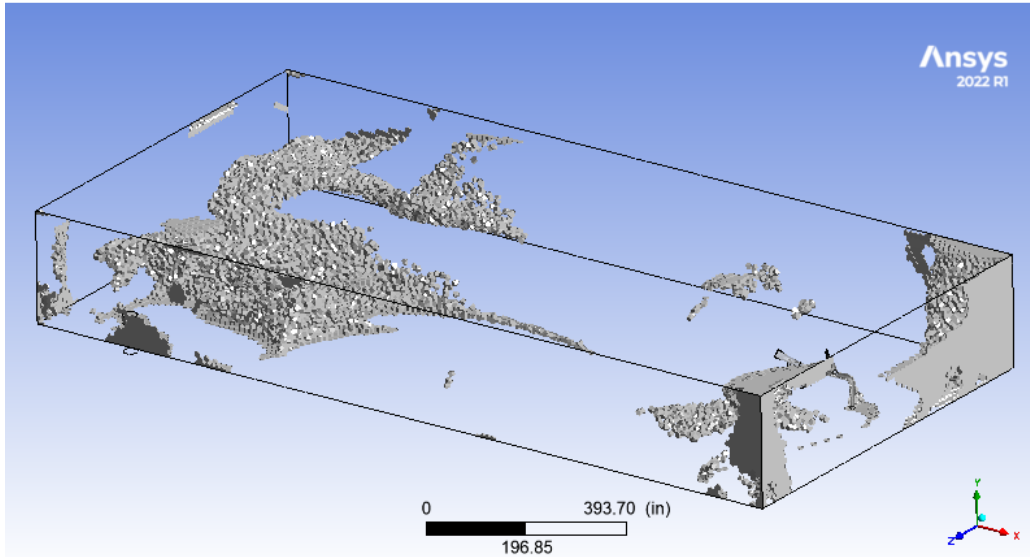
Case 1

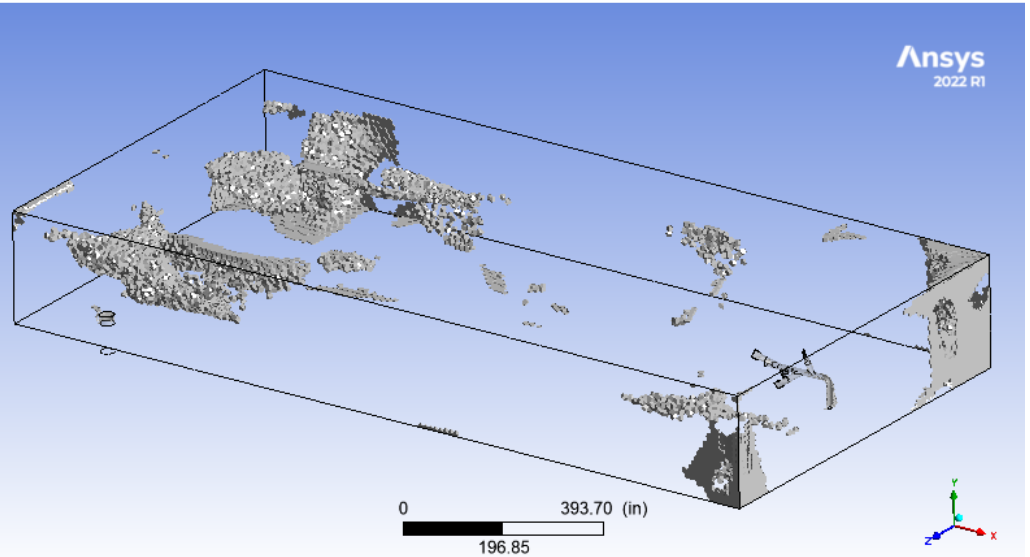




Case 2

Case 3

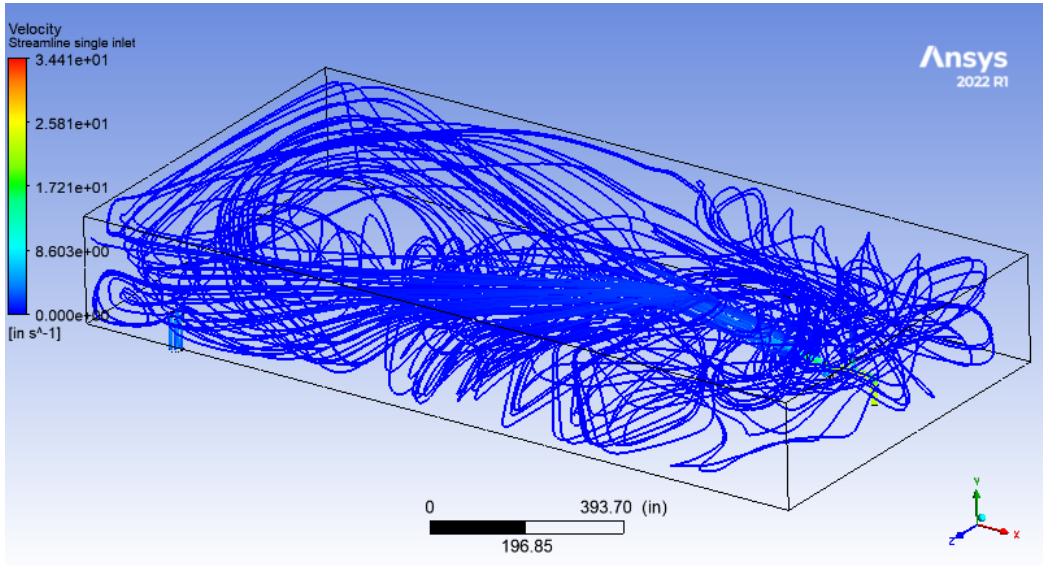




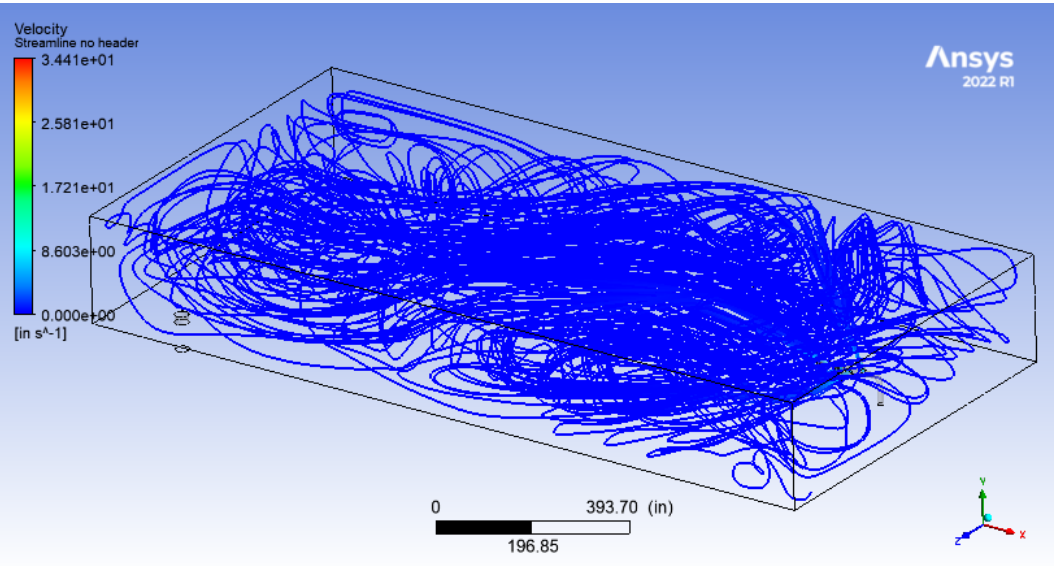
Case 4

Streamlines

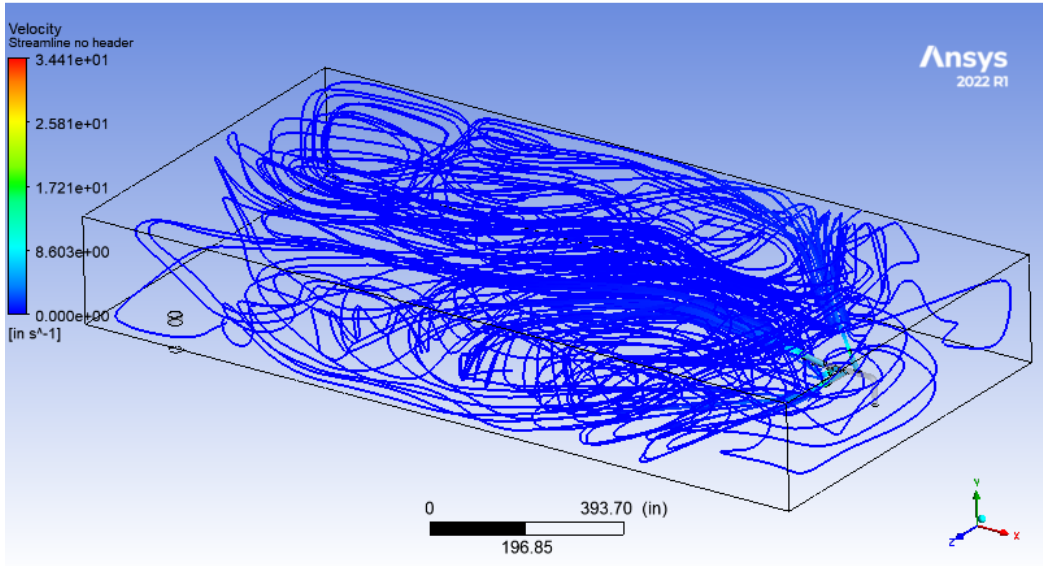
Case 1



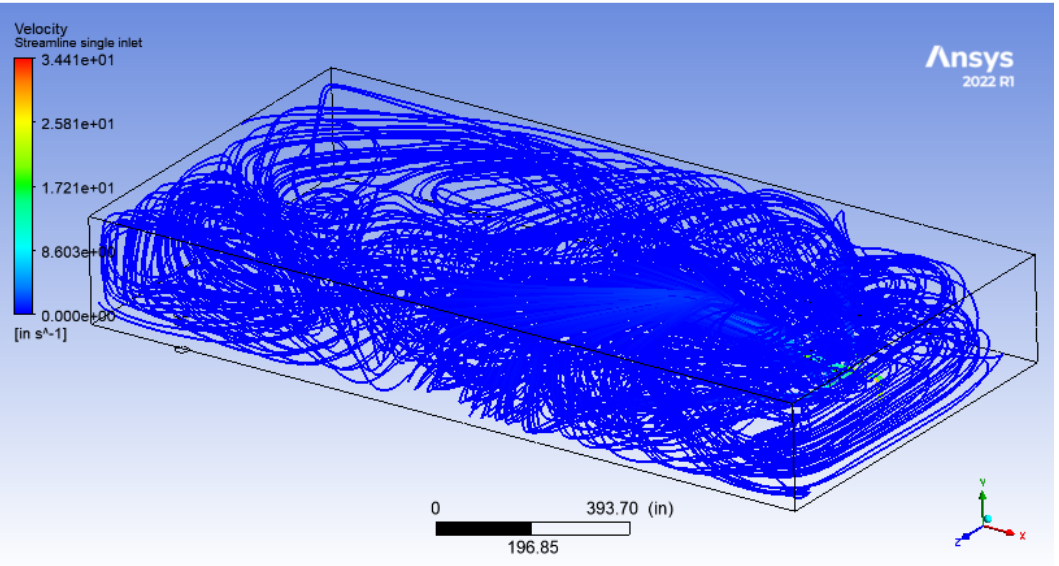
Case 2



Case 3



Case 4

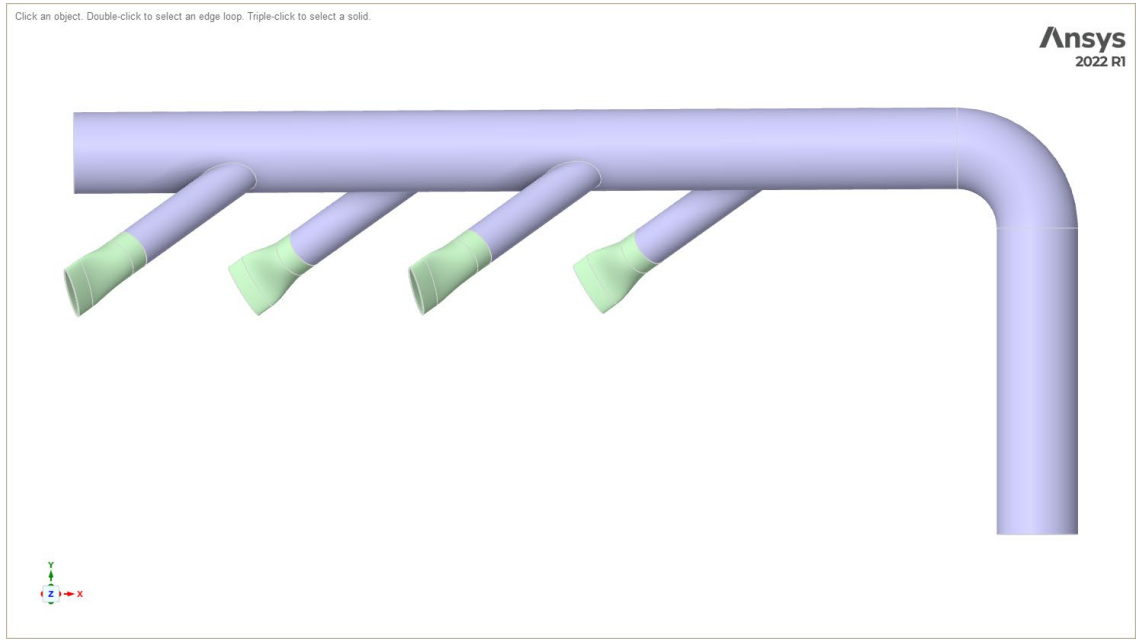


6in Wyes, Pointing Down

Case 5

Case 5 - 6in Iteration

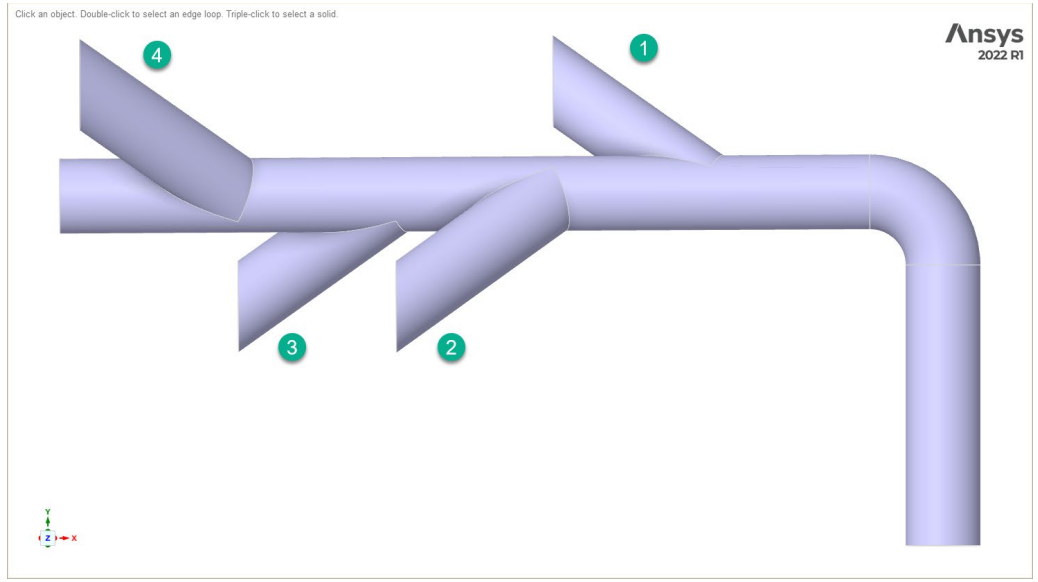
- Horrocks Requested an iteration with 6in wyes, with all 4 pointing downward
- Check valves included, fixed shape scaled down from 12in shape
  - 601 GPM from the header inlet, flow through wyes and check valves a result

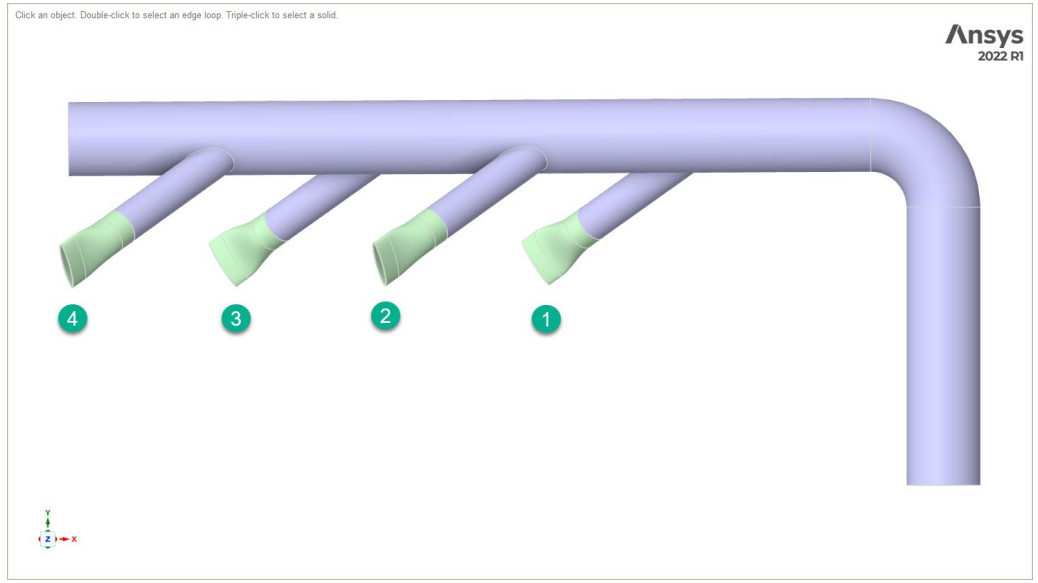


Flow through Wyes

	Mass Flow [kg/s]			
Case	Wye 01	Wye 02	Wye 03	Wye 04
1	2.30	0.70	10.72	23.84
2	9.46	9.46	9.46	9.46
3	9.46	9.46	9.46	9.46
4	6.11	8.95	10.65	12.01
5	9.53	9.50	9.34	9.37

	Mass Flow [% of total]			
Case	Wye 01	Wye 02	Wye 03	Wye 04
1	6%	2%	29%	63%
2	25%	25%	25%	25%
3	25%	25%	25%	25%
4	16%	24%	28%	32%
5	25.27%	25.20%	24.76%	24.84%



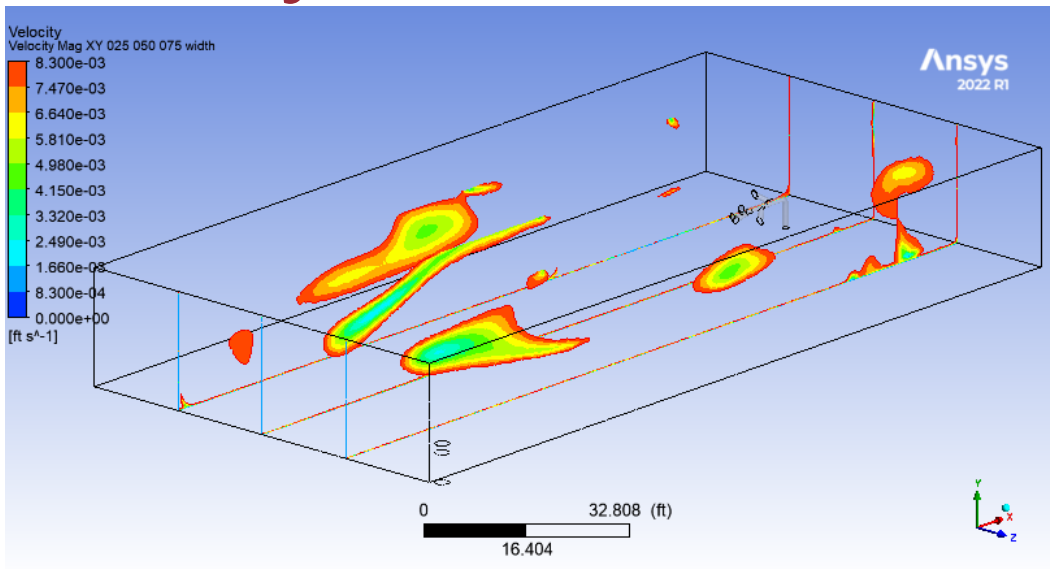


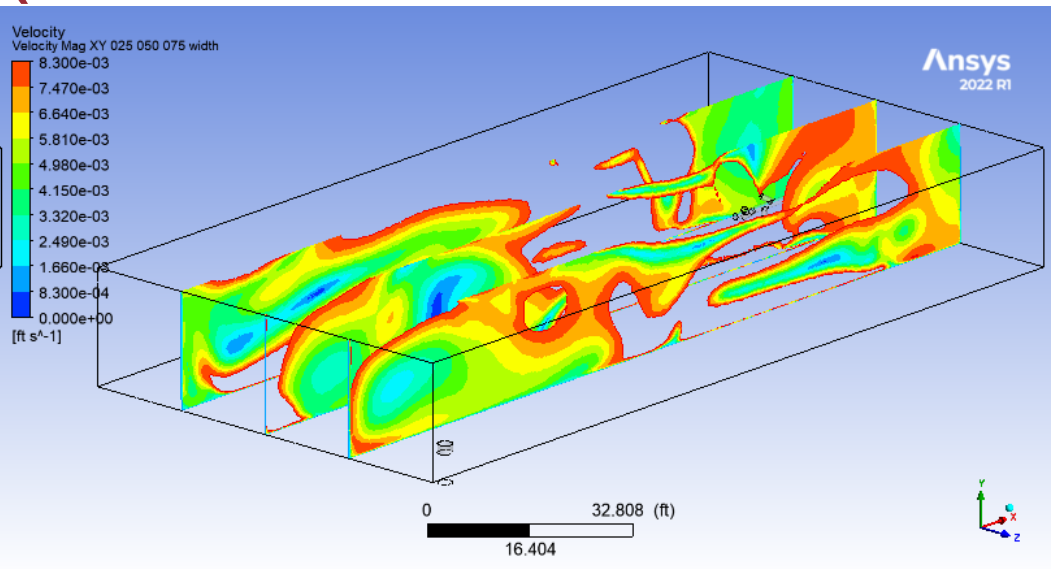
Results Information

- Results in this section are in ft/s units
- Velocity contour plots show regions that are 0 ft/s to 0.0083 ft/s
  - (0 in/s to 0.1 in/s)
- Iso-surfaces are created where velocity = 0.0417 ft/s (0.5 in/s)
  - Inside this surface is higher velocity, outside is lower velocity
  - The iso-surface is colored by depth, otherwise it would be a solid blue and can be hard to understand
- Iso-volumes are created where velocity is <0.0083 ft/s and <0.00417 ft/s
  - <0.1 in/s and <0.05in/s
- Streamlines are released from the inlet
  - Pay no attention to qty of streamlines which varies due to geometry.

Velocity Contour Plots (25%, 50%, 75% Width)

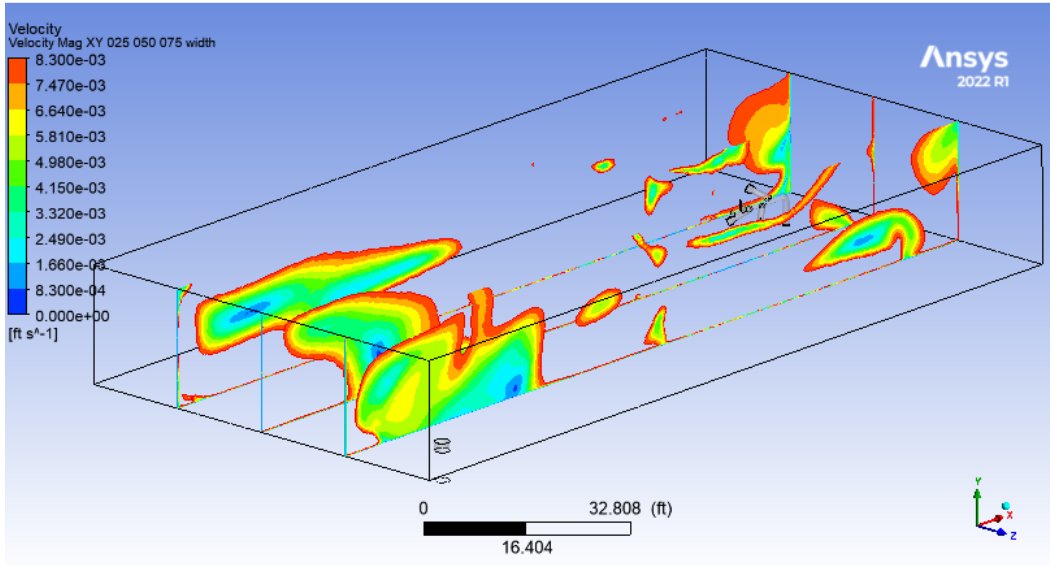
Case 1

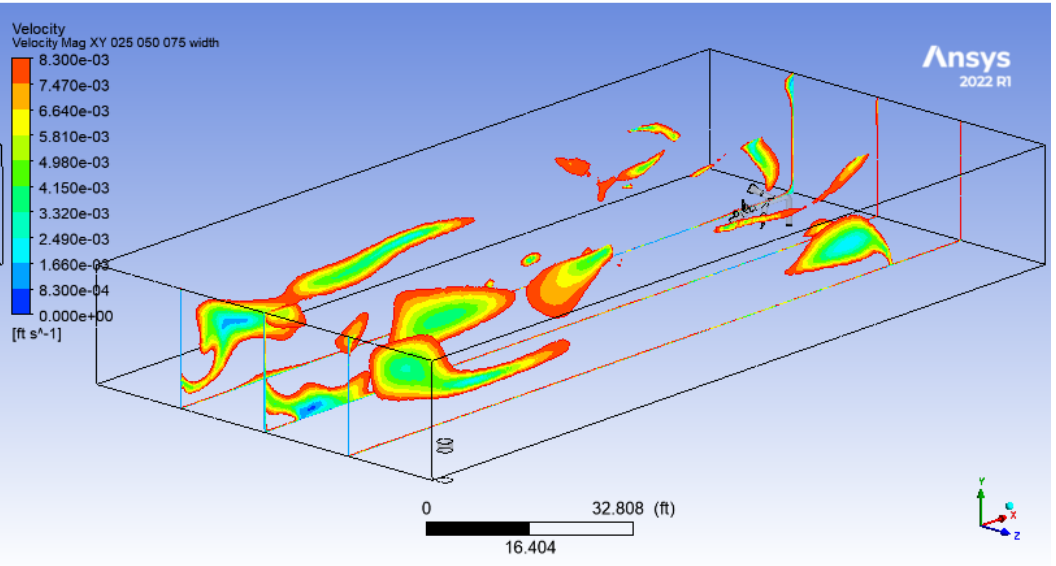




Case 2

Case 3

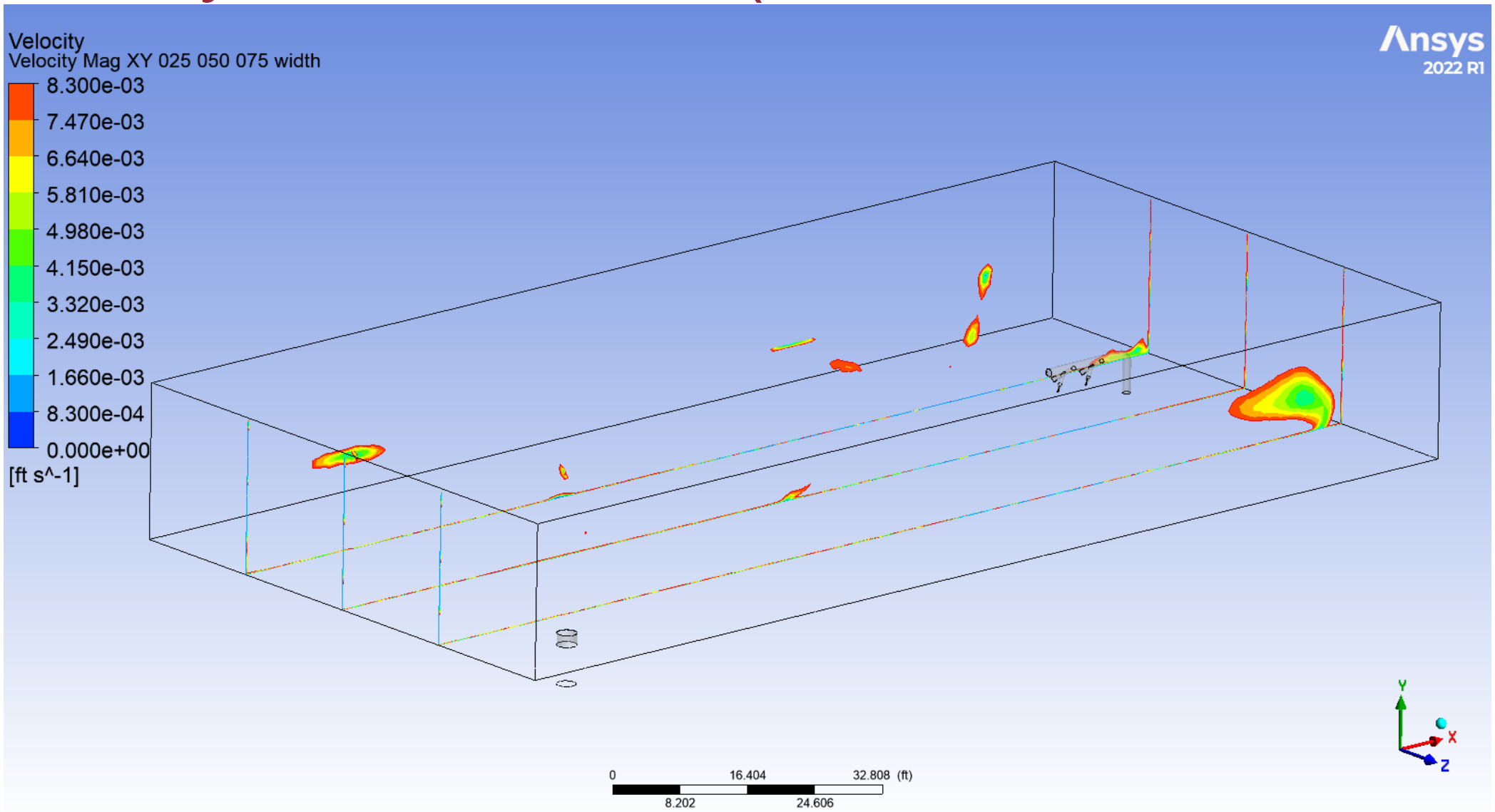




Case 4

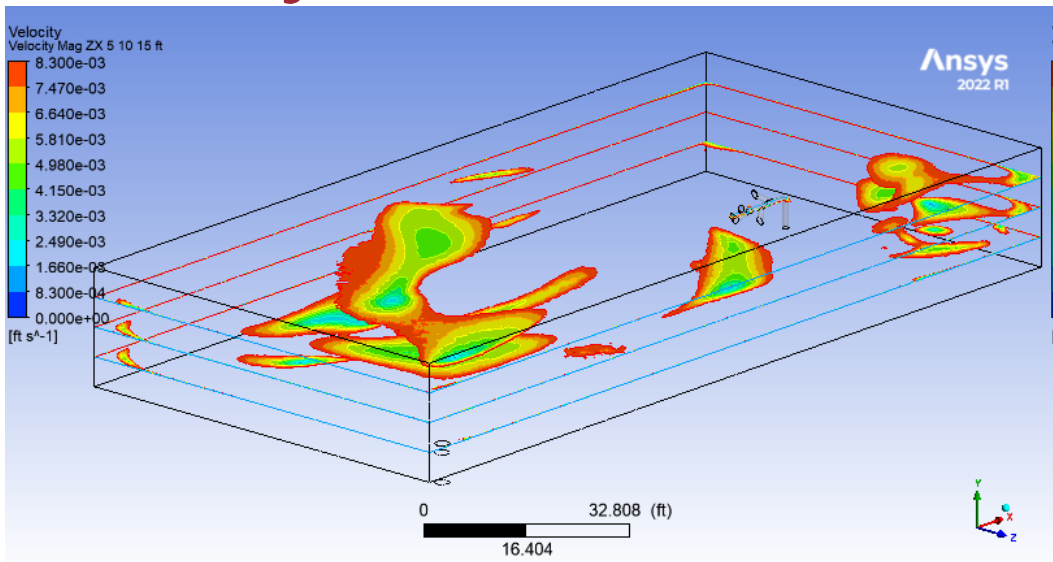
Velocity Contour Plots (25%, 50%, 75% Width)

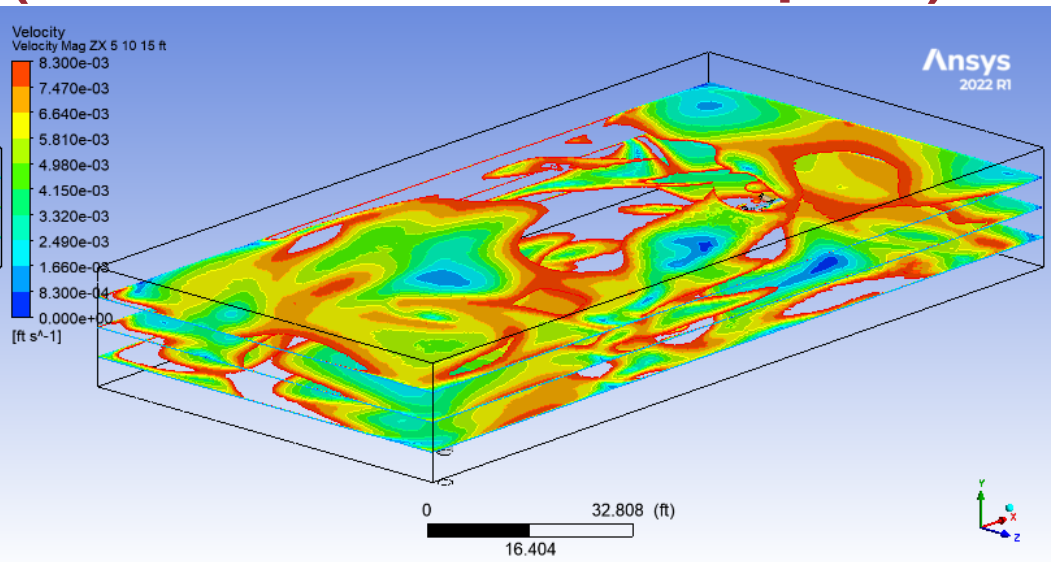
Case 5



Velocity Contour Plots (5ft, 10ft, 15ft depth)

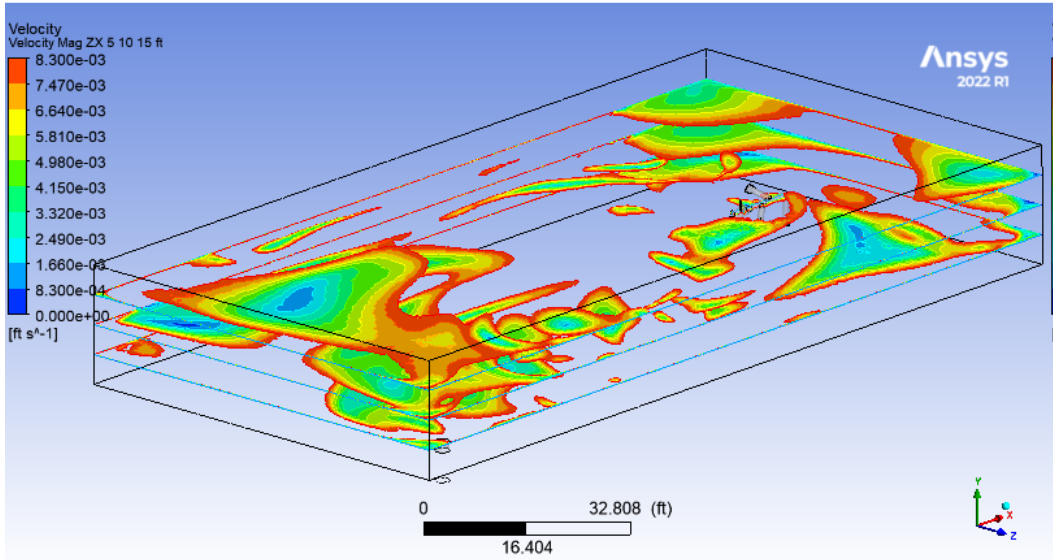
Case 1

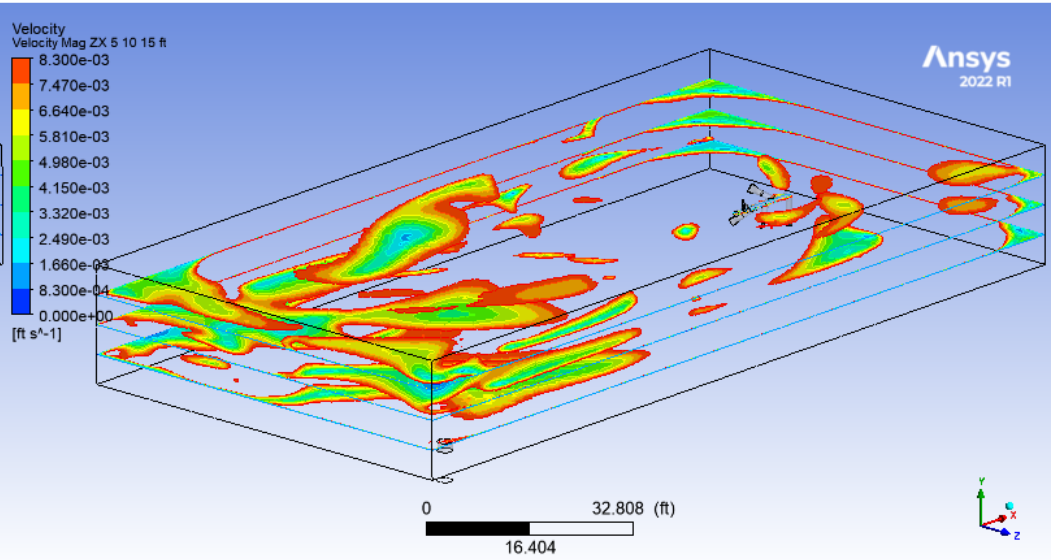




Case 2

Case 3

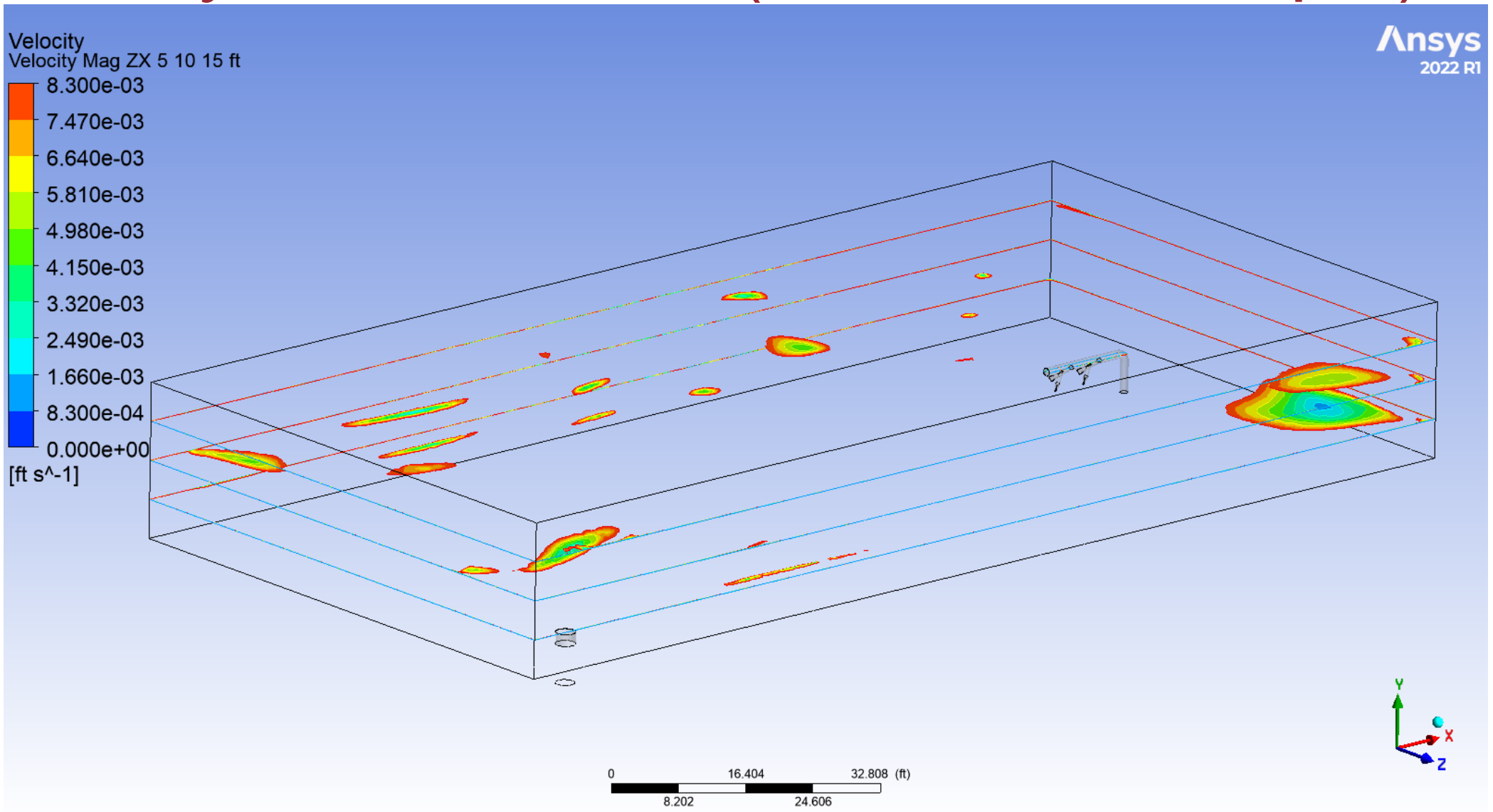




Case 4

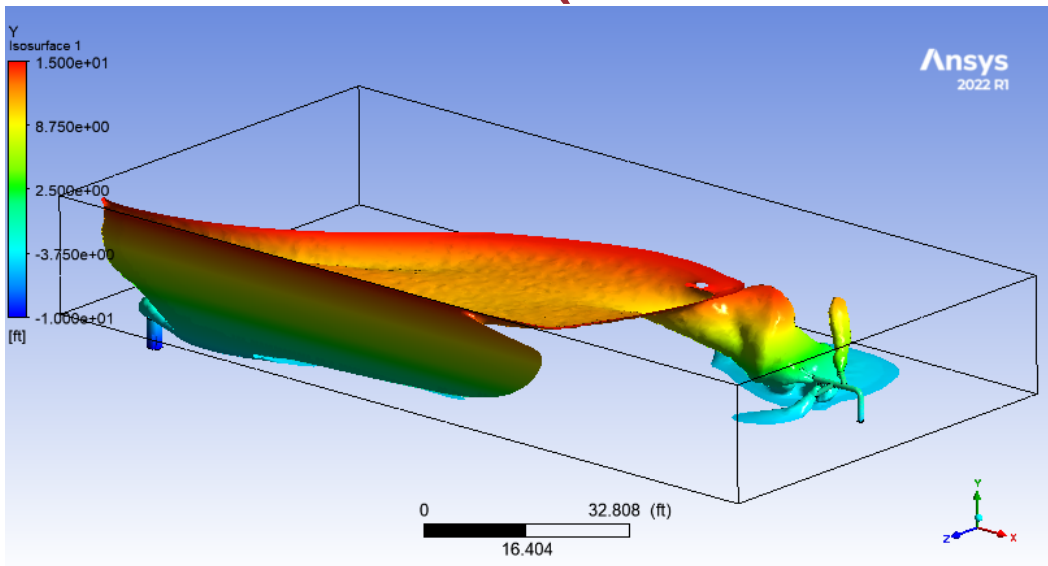
Velocity Contour Plots (5ft, 10ft, 15ft depth)

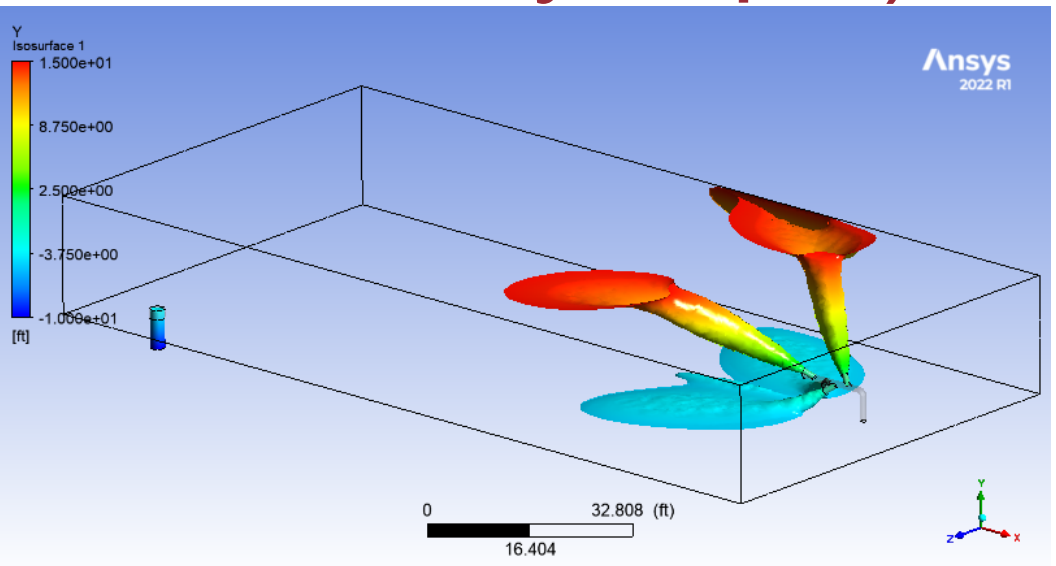
Case 5



Iso-Surface (0.0417 ft/s, colored by depth)

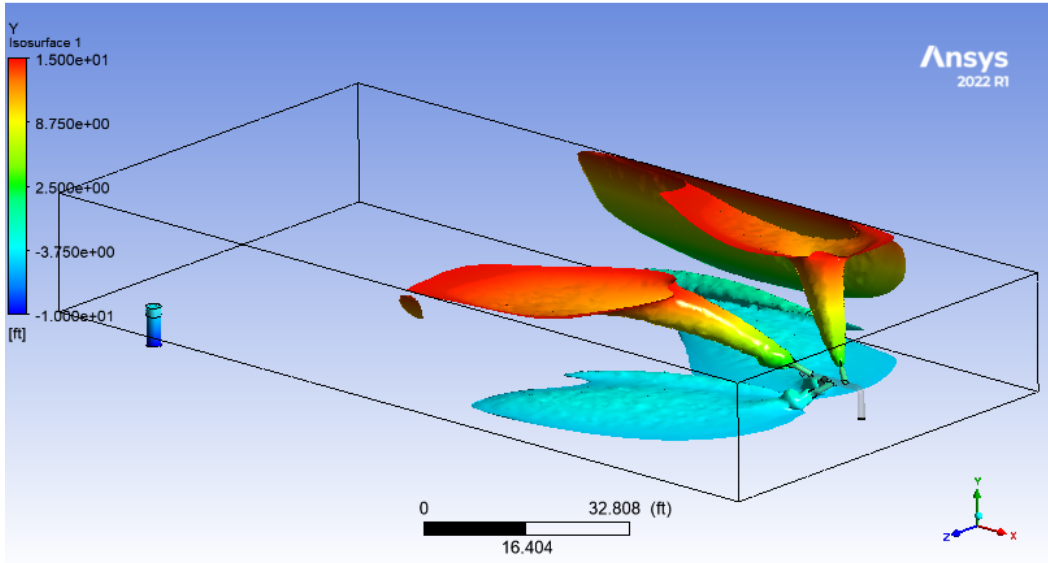
Case 1

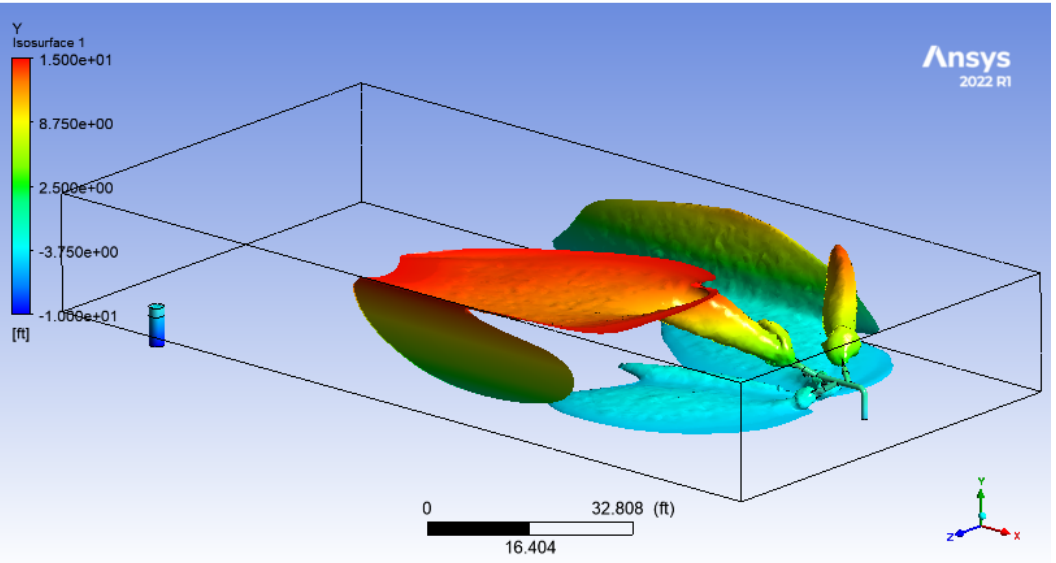




Case 2

Case 3

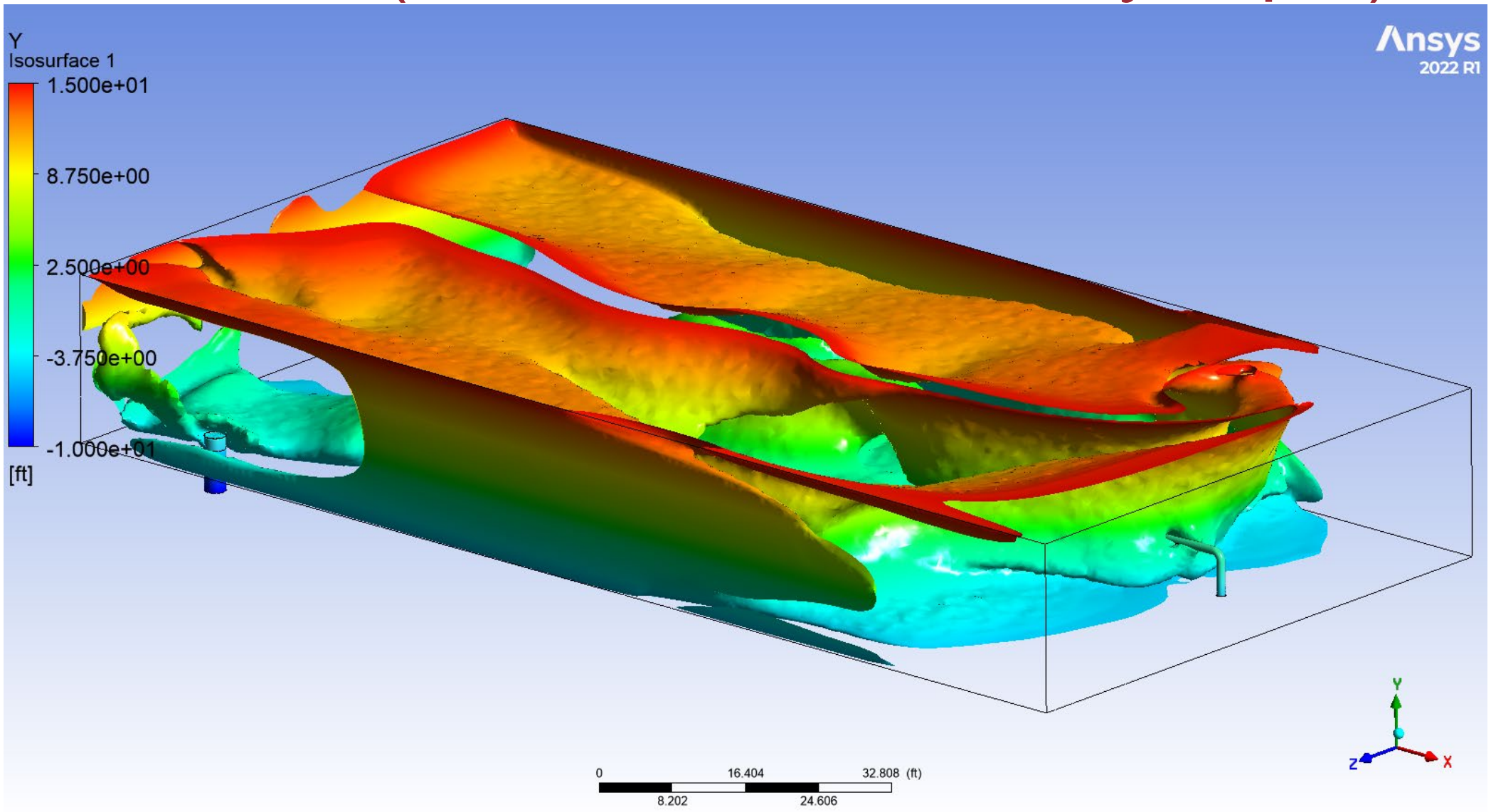




Case 4

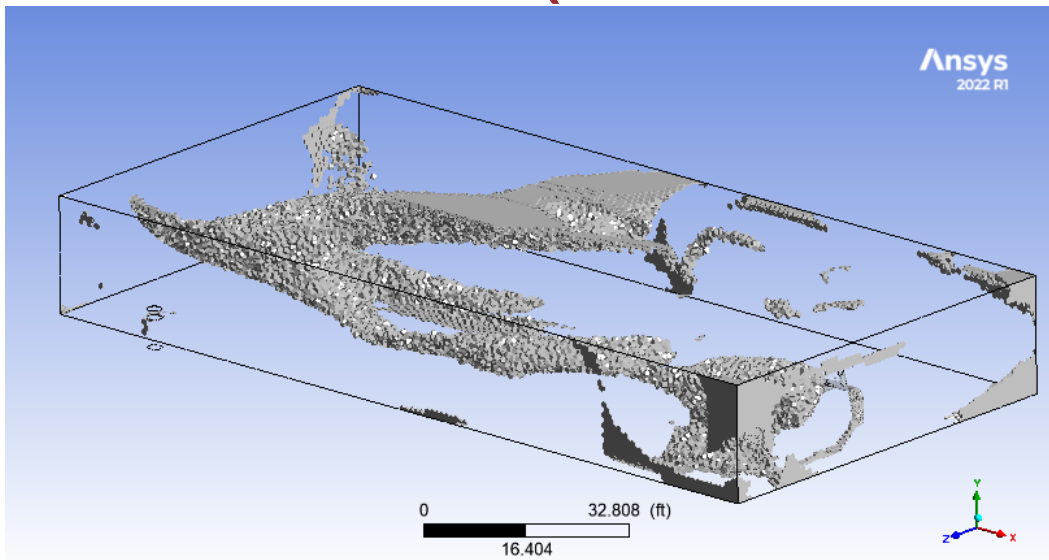
Iso-Surface (0.0417 ft/s, colored by depth)

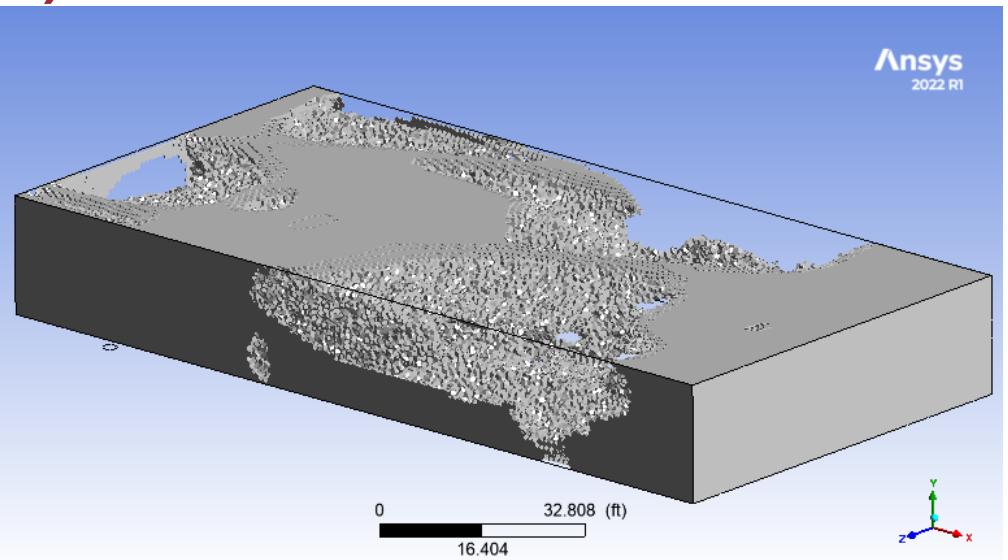
Case 5



Iso-Volume (<0.0083 ft/s)

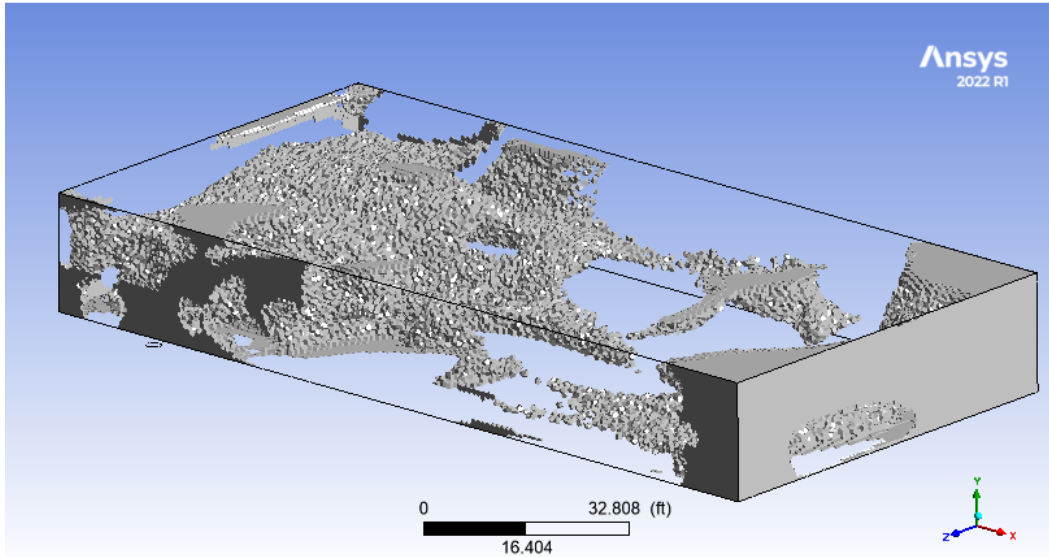
Case 1

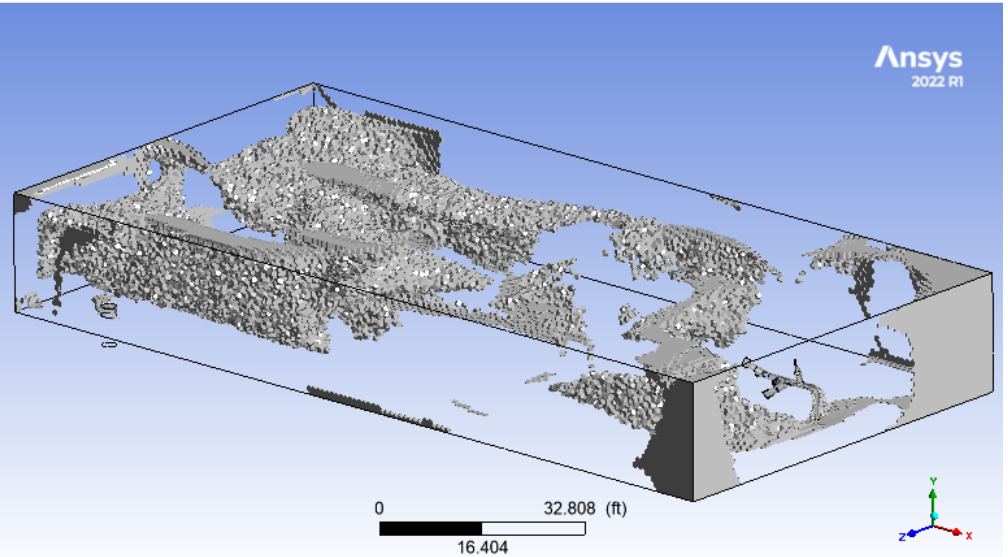




Case 2

Case 3

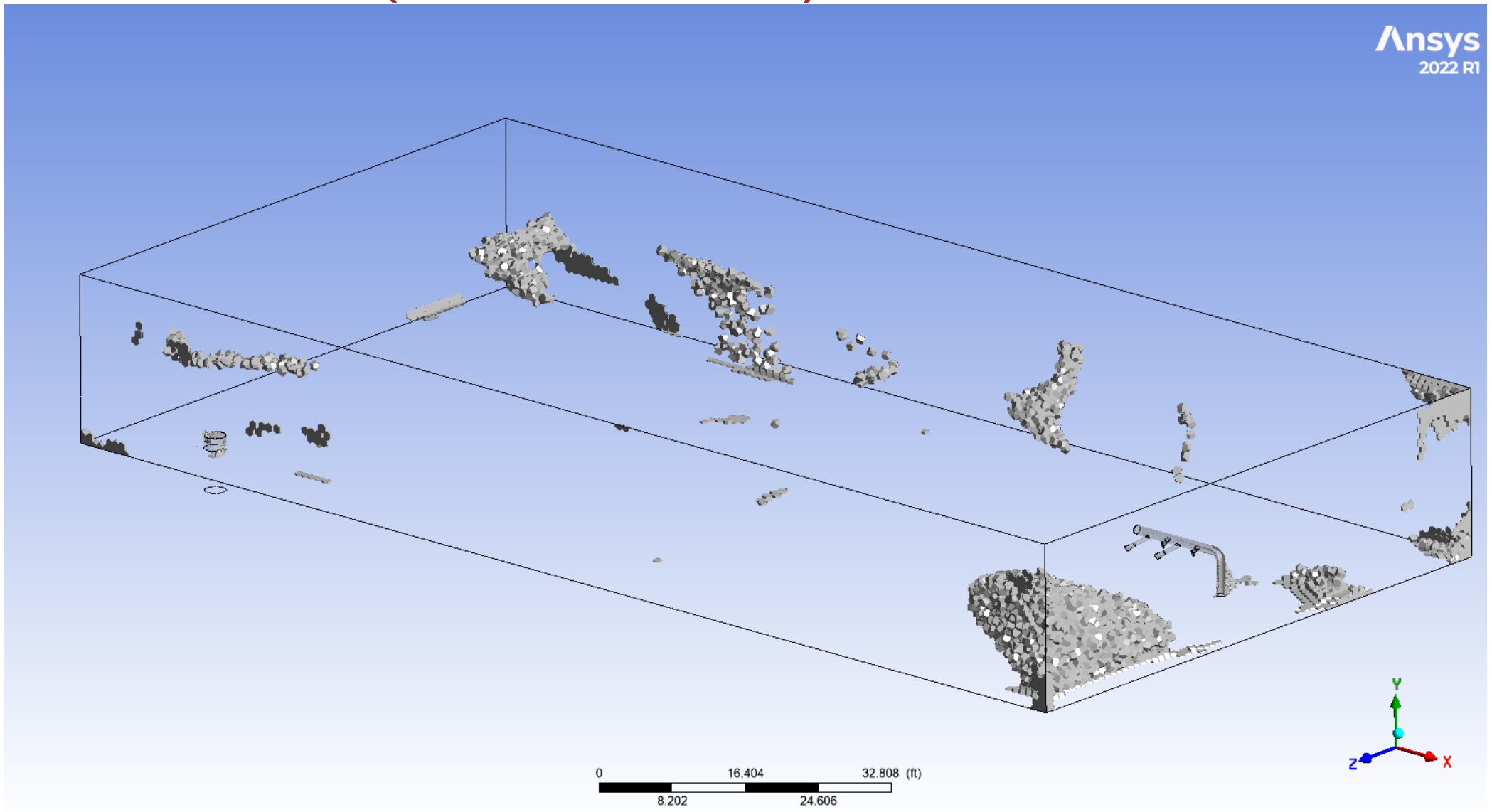




Case 4

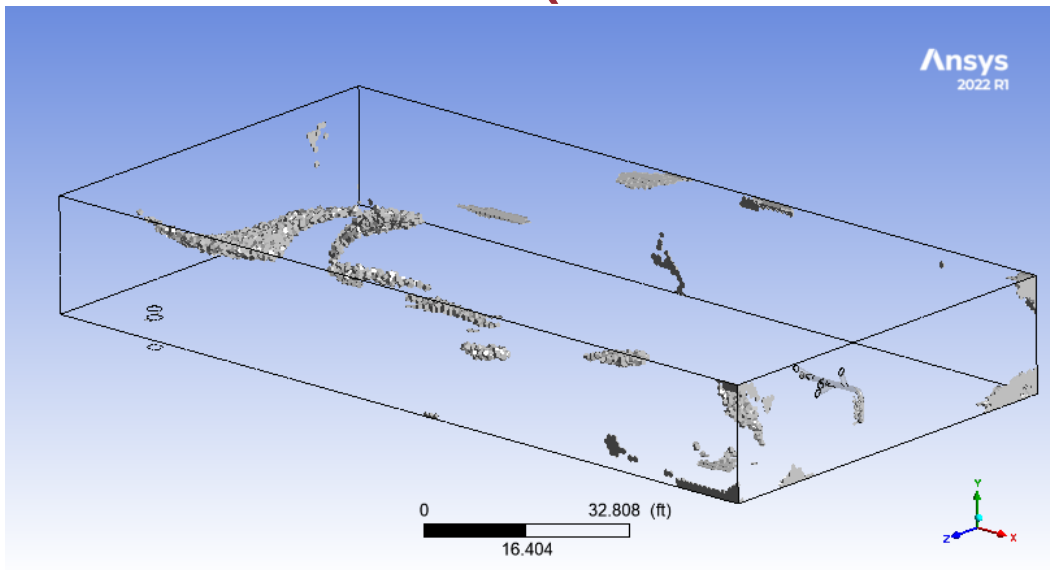
Iso-Volume (<0.0083 ft/s)

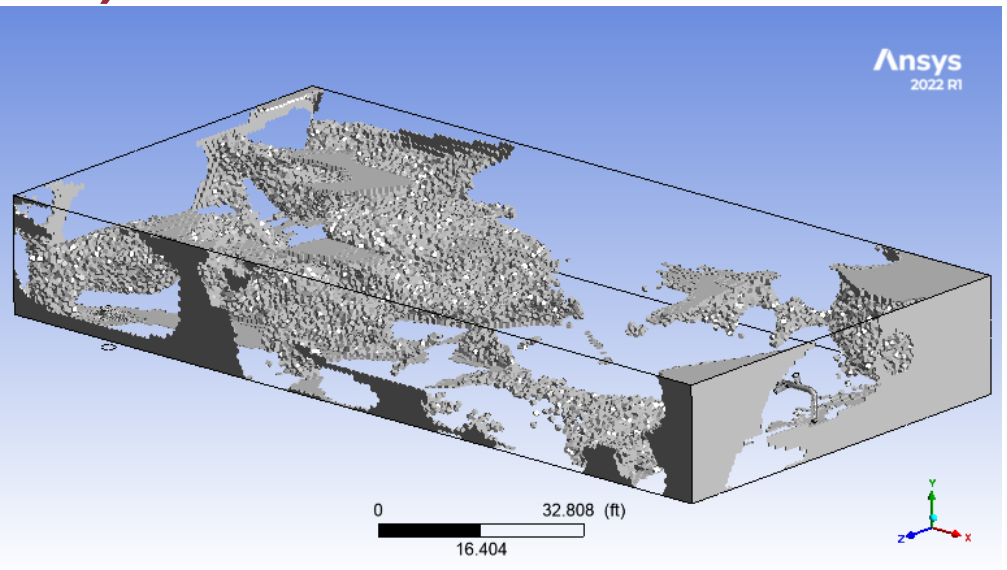
Case 5



Iso-Volume (<0.00417 ft/s)

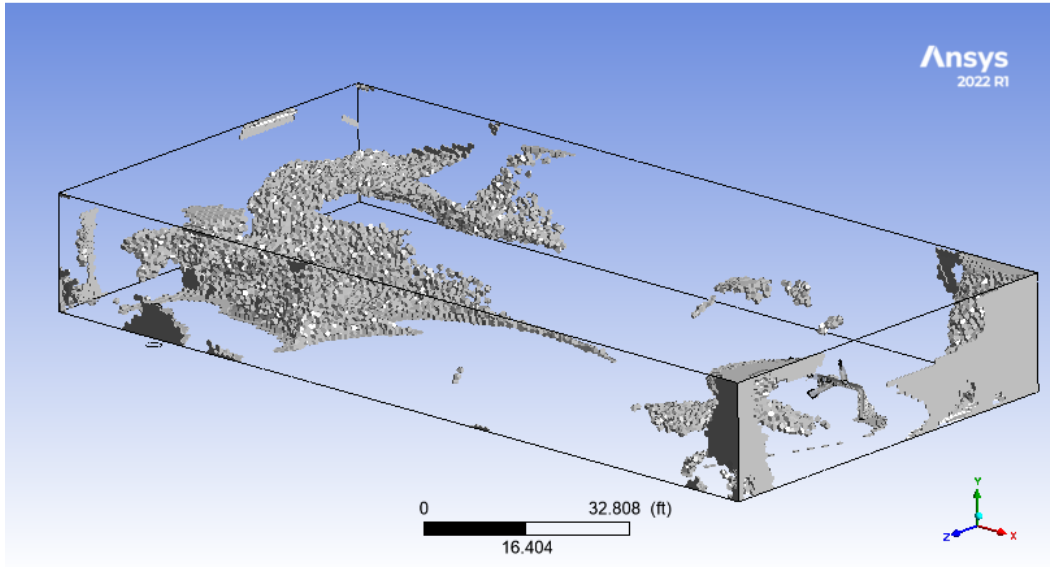
Case 1

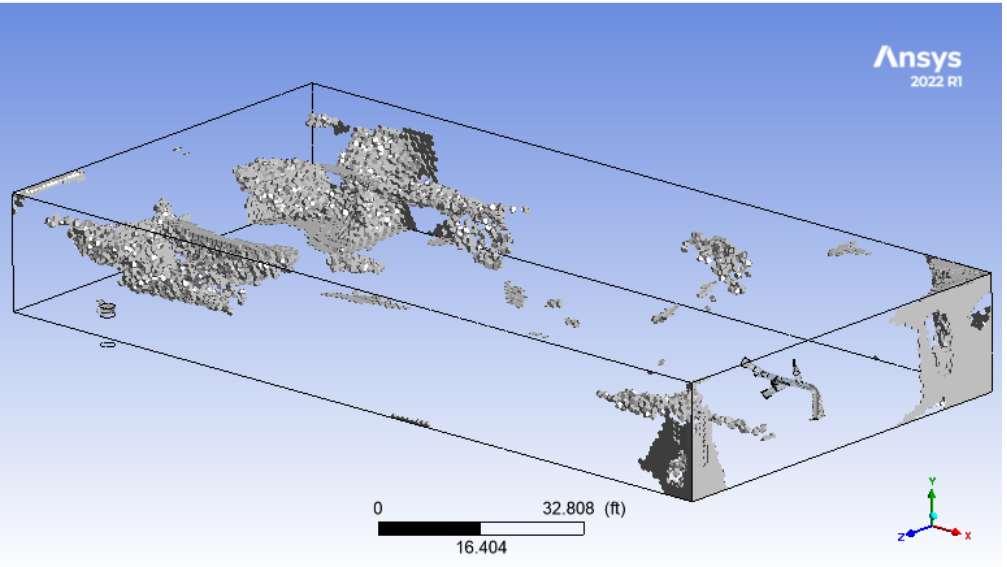




Case 2

Case 3

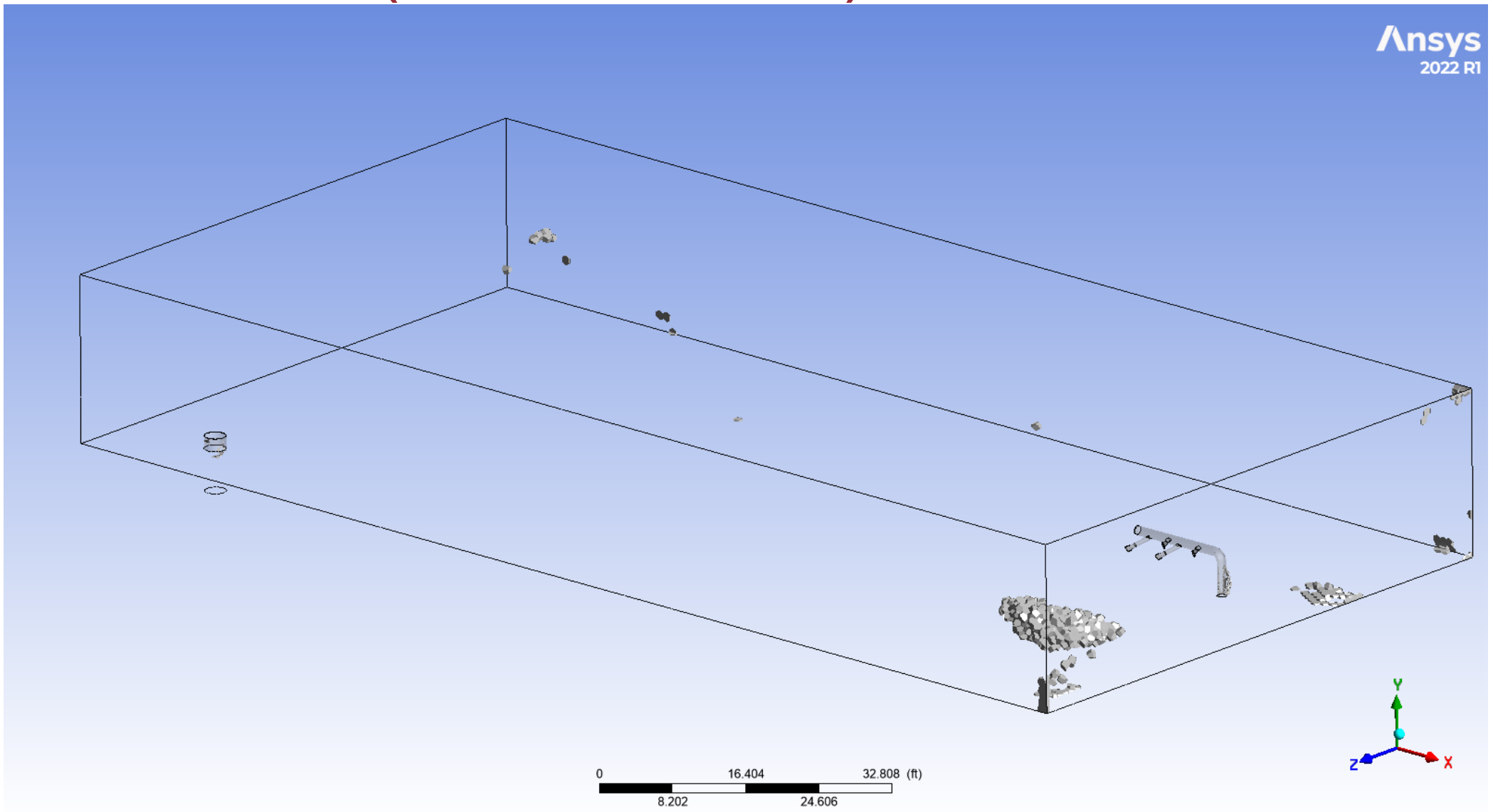




Case 4

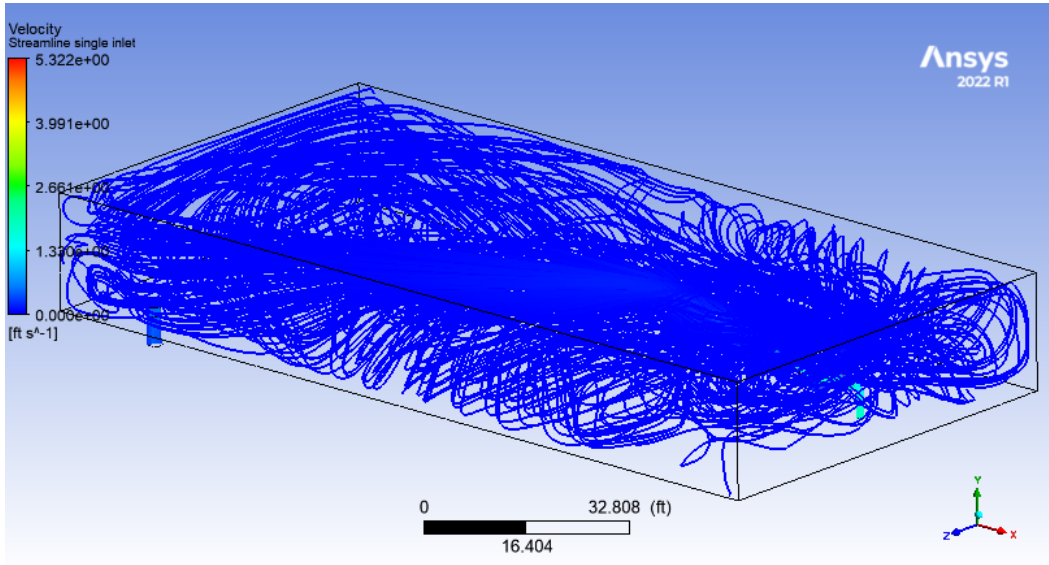
Iso-Volume (<0.00417 ft/s)

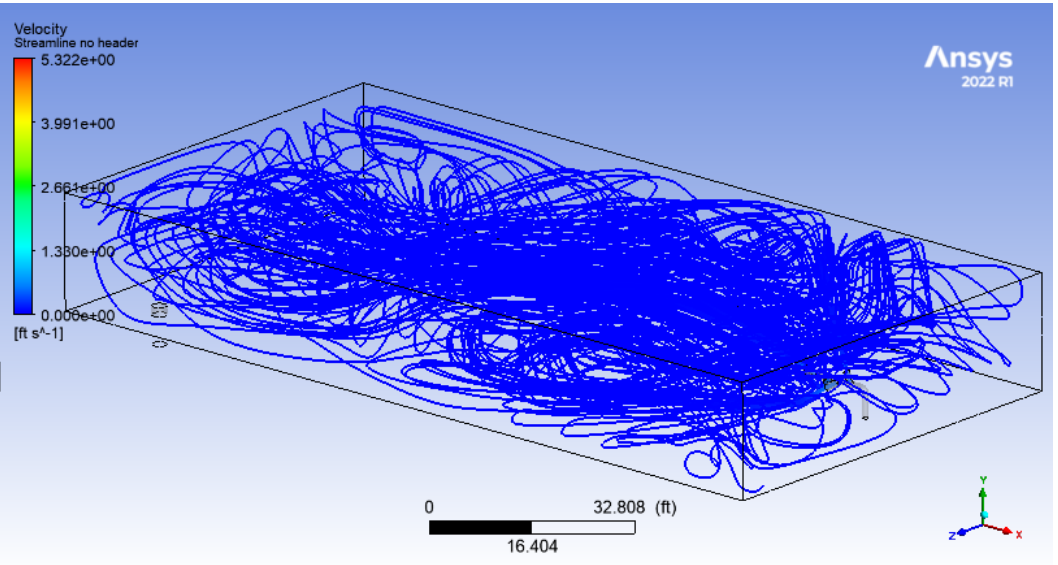
Case 5



Streamlines

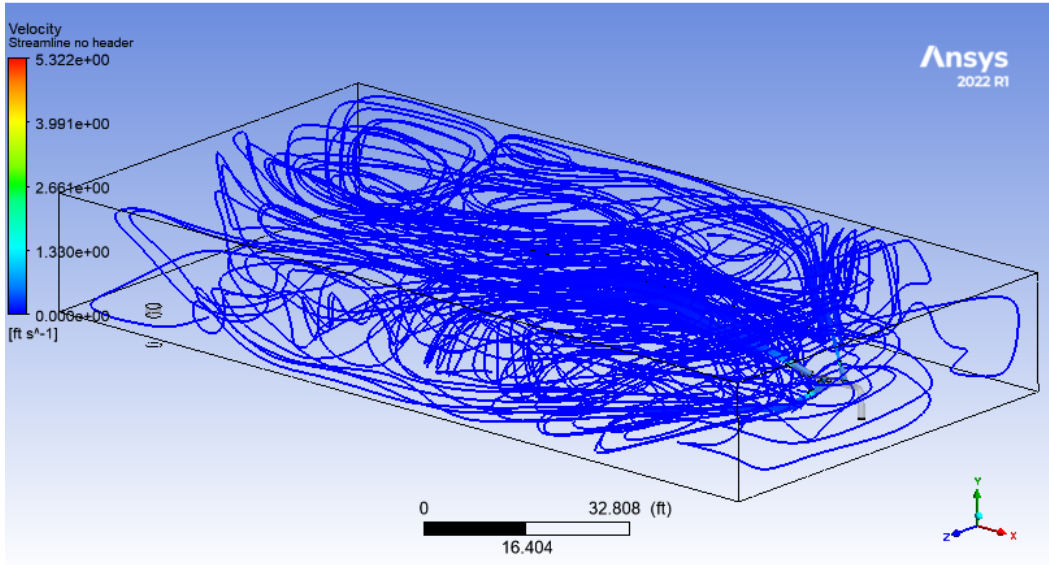
Case 1

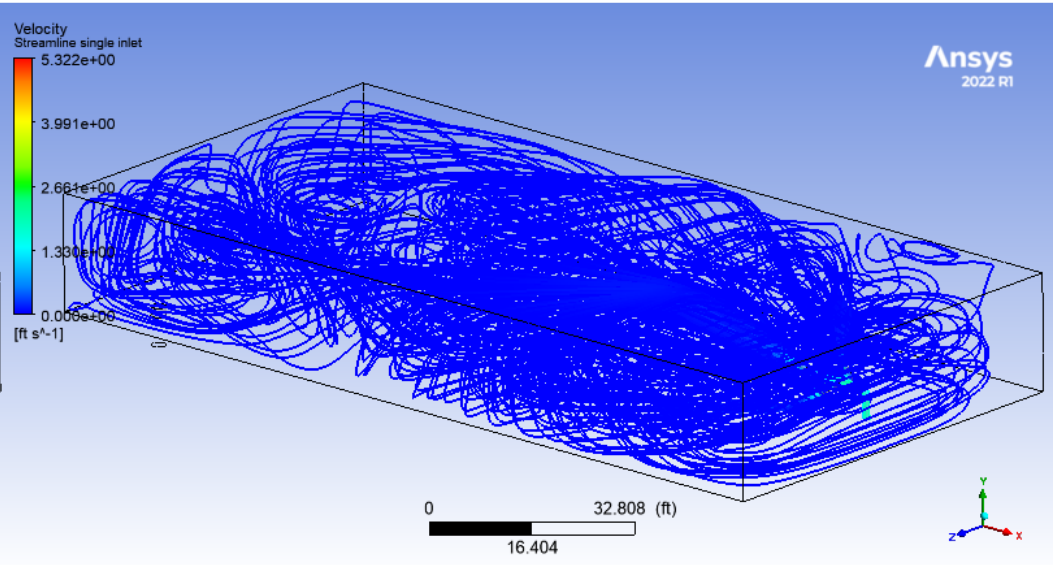




Case 2

Case 3





Case 4

Streamlines

Case 5