Appendix A

Hydrant Testing Plan Memorandum

WEST YOST
Water. Engineered.

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MEMORANDUM

DATE:	December 9, 2021	Project No.: 936-60-21-10 SENT VIA: EMAIL
TO:	Greg Springman Trish Rice Steven Haney Dominic Valloni	
FROM:	Kambria Tiano, PE (CA) RCE #84129 Nick Szigeti, EIT (OR) #96476EI	
REVIEWED BY:	Sandrine Ganry, PE (OR) #80326PE	
SUBJECT:	Hydrant Testing Plan – City of Sweet Home Water Master Plan	

This memorandum summarizes the proposed hydrant testing and pressure data collection required to calibrate and validate the City of Sweet Home's (City) hydraulic model of the existing water system. West Yost's recommended program for hydrant flow testing is summarized below and provided for your review and comment. Details related to the hydrant testing program are discussed in this memorandum and organized as follows:

- Hydrant Testing Program Overview
- Personnel and Water System Data Requirements
- Testing Requirements and Procedure
- Summary of Hydrant Testing

Supplemental information pertinent to data collection in the field are provided in the following attachments:

- Attachment A: Hydrant Test Location Maps
- Attachment B: Hydrant Test Data Tables

Hydrant Testing Program Overview

Hydrant fire flow tests will be used to "spot-check" system pressures and verify that the City's hydraulic model accurately predicts fire flow conditions in the existing water system. These tests will help confirm that the hydraulic model can simulate observed fire flows and pressures with no valves closed within the water system.

The hydrant tests will also validate the pipeline roughness factors (C-factors) that have been assigned to pipelines in the City's hydraulic model. Though the hydrant testing program identified in this memorandum will not isolate and test specific pipelines of known diameter and material types, calibration of the hydraulic model against the observed fire flows will provide a confirmation that assigned pipeline C-factors are adequate under high flow conditions. Approximate pipeline C-factors were updated according to pipeline diameter and material type, as provided in the City's GIS pipeline shapefile or based on correspondence with City staff, during development of the City's Small Diameter Main Replacement Program. Pipeline roughness factors were assigned based on calibrated C-factors sourced from West Yost's C-factor database[1].

Each hydrant test requires that City staff record static pressures at the test and observation hydrants, fully open the test hydrant, record flow and residual pressure at the test hydrant, record residual pressures at nearby observation hydrants, and close the test hydrant. Flow testing procedure is discussed in further detail in *Testing Requirements and Procedure*, below.

Personnel and Water System Data Requirements

West Yost would like to request the following City personnel and system data to perform the recommended hydrant testing program:

- Four (4) City staff members to perform the following:
    - Setting up and flowing the test hydrant (1 City staff)
    - Reading and recording hydrant pressure and flow data (3 City staff)
    - Dechlorination at the flowing test hydrant
    - Directing and controlling traffic as necessary to accommodate the quantities of hydrant flow that will be discharged into the street and storm drainage system during each test
- Water system Supervisory Control and Data Acquisition (SCADA) data during the period that hydrant flow testing is performed that includes the following:
    - Tank levels (water surface elevations)
    - Booster pump station (including treatment plant) flows and pressures
    - Pressure regulating valve (PRV) flows and pressures
    - Data should be provided in one-minute intervals during hydrant testing days, if possible
- Water system facility operation settings, if not indicated in the SCADA data, including:
    - Pressure setpoints for PRV or VFD-equipped pumps

Testing Requirements and Procedure

West Yost would like the City to conduct 18 hydrant tests within the City's existing water service area. Table 1 lists the locations of the proposed tests, and each test location is illustrated on Figure 1. The selected tests are distributed throughout the existing water service area, and hydrant tests were selected based on proximity to pressure zone boundaries and water system facilities, surrounding pipeline characteristics (i.e., diameter, material, age), and regions with high elevations or remote (hydraulically distant from supply) locations. Detailed location maps of each hydrant test are provided in Attachment A.

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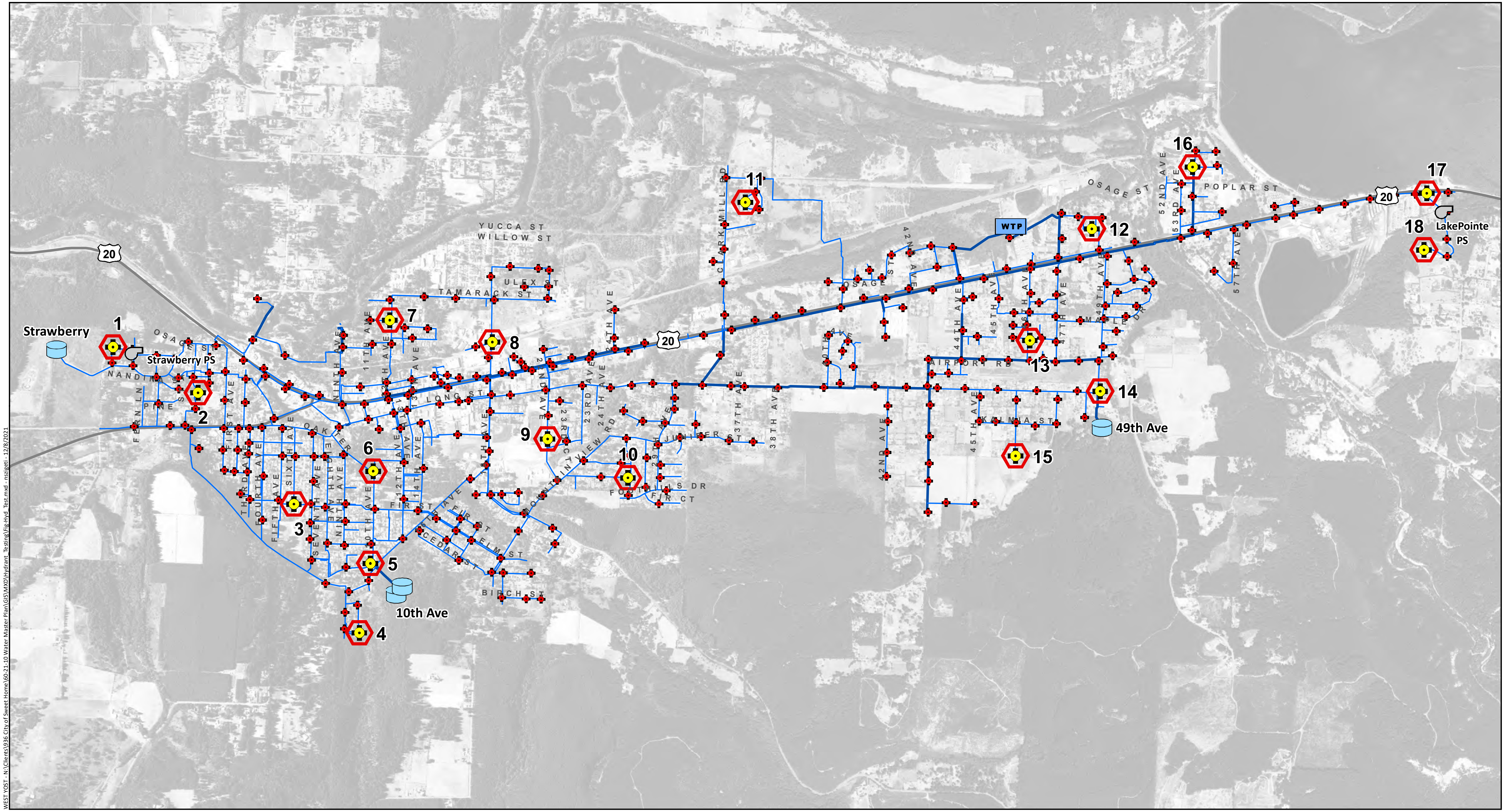
[1] West Yost's C-factor database summarizes results from over 330 uni-directional style hydrant tests. The database provides calibrated pipeline roughness factors for a variety of pipeline diameters and material types, including cast iron (over 50 hydrant tests), ductile iron (over 40 tests), and PVC (over 40 tests).

Table 1. Hydrant Test Locations

Hydrant Test No.	Approximate Location	Comments
1	1459 Strawberry Ridge	Strawberry Pressure Zone
2	1321 Sunset Lane	High elevation
3	610 Elm Street (across from Oak Heights Elementary)	High elevation **Be mindful of school drop off/ pick-up times for this location**
4	Corner at Taylor Creek Drive and Timber Street	High elevation; dead end
5	960 Alder Street (intersection of 10th Avenue and Alder Street)	Downstream of 10th Avenue tanks
6	745 10th Avenue	1950’s 10-inch cast iron
7	1806 12th Avenue	Isolated area
8	1621 18th Avenue (near railroad tracks)	1940’s 6-inch cast iron
9	951 22nd Avenue	1960’s-1970’s 6-inch ductile iron
10	778 27th Avenue	1970’s-2000’s 6 to 8-inch ductile iron
11	1941 37th Circle	1980’s-2000’s 8-inch ductile iron
12	4879 48th Loop	Near water treatment plant
13	1219 46th Avenue	8-inch PVC
14	1199 49th Avenue	Downstream of 49th Avenue tank
15	1083 46th Avenue (at bend in 46th Avenue)	1980’s 6 to 8-inch ductile iron
16	1702 54th Avenue	Isolated area
17	Intersection of Highway 20 and Riggs Hill Road	At end of long dead-end main
18	6309 LakePointe Way (in cul-de-sac)	LakePointe Pressure Zone



WTP Water Treatment Plant

Storage Tank

Pump Station

Test Hydrant

✚ Hydrants

Potable Water Pipelines

Less than 12-inch

12-inch and Greater

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Figure 1

Hydrant Test Location Overview

City of Sweet Home

Water Master Plan

Testing Procedure

Each test will involve maintaining flow from a single hydrant, while monitoring the residual pressure at two to three observation hydrants located near the flowing hydrant. The field-observed static and residual pressure readings will then be used to verify or calibrate the hydraulic model to observed conditions.

At least one (1) City staff member will be required at the flowing test hydrant and up to three (3) additional City personnel will be required in the field to measure static and residual pressures at the nearby observation hydrants (refer to Attachment A). Data will be recorded in the data log tables provided as Attachment B.

The general testing procedure at each of the test locations is outlined below and illustrated on Figure 2:

Step 1. Before the test, slowly open the test (flowing) hydrant and each observation hydrant to flush out possible accumulated sediments, and then close the hydrant valve before attaching the pressure gage. This allows sediments, which might damage the gage or cause faulty readings, to be flushed out from the hydrant.

Step 2. Attach the pressure gage to the hydrant with the gage's test cock valve **open**. Slowly open the hydrant and bleed off the gage with the gage's test cock until the hydrant is fully pressurized.

Step 3. Close the gage test cock valve, and then measure the static pressures at the designated test hydrant and each observation hydrant.

Step 4. Flow the designated test hydrant and measure the discharge flow and pressure. If system pressure at any hydrant approaches 20 pounds per square inch (psi), reduce flow from the test hydrant to maintain approximately 20 psi and note in the data log.

Step 5. Once the test hydrant flow and residual pressure have reached approximate equilibrium, measure the residual pressures at the designated test hydrant and at each observation hydrant while the test hydrant is flowing (directions should be provided via handheld radio from the City staff monitoring the test hydrant of when to record static and residual hydrant pressures).

Step 6. Continue monitoring pressure until flow and pressure has been recorded at all hydrants in the test. Record the static pressure and then detach the pressure gage. ***IMPORTANT**: Before closing the hydrant, be sure the gage's test cock valve is open and bleeding while the hydrant is being closed.*

It is anticipated that each test should take no more than thirty (30) minutes and that each hydrant will be flowing for no more than ten (10) minutes during a test.

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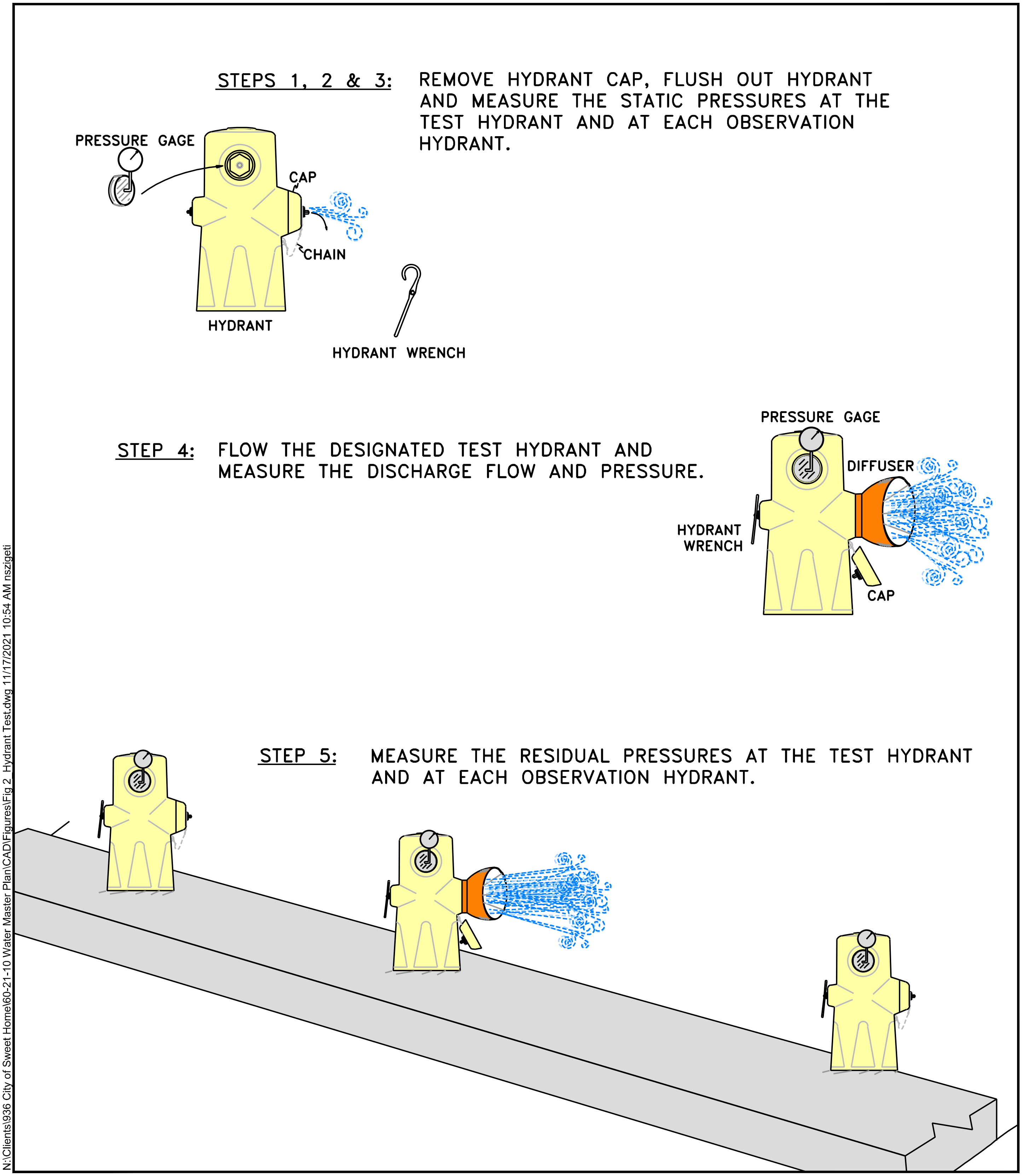

STEPS 1, 2 & 3: REMOVE HYDRANT CAP, FLUSH OUT HYDRANT AND MEASURE THE STATIC PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.

STEP 4: FLOW THE DESIGNATED TEST HYDRANT AND MEASURE THE DISCHARGE FLOW AND PRESSURE.

STEP 5: MEASURE THE RESIDUAL PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.

LEGEND

NOT TO SCALE

WEST YOST

Figure 2

Hydrant Test Procedure

City of Sweet Home
Water Master Plan

Testing Equipment and Responsibilities

The City will be responsible for providing the necessary equipment required to perform the hydrant testing procedure described in this memorandum. Required testing equipment includes:

- Hydrant wrenches (4 minimum)
- Hydrant pressure gages (4 minimum; 5-6 preferred in case of equipment failure)
- Hydrant diffuser with pitot assembly for measuring and directing hydrant flow (preferred) or hand-held flow meter
- Two-way portable communication for each of the testing personnel
- Dechlorination tablets for hydrant runoff

The City is also responsible for notifying other City staff and residents about the scheduled hydrant testing; obtaining any approvals that may be required, providing proper drainage of the hydrant flow, and providing equipment (e.g., dechlorination) and personnel for traffic control, if required.

West Yost requests that City operations staff review and inspect each of the proposed test locations before the testing date to identify any potential problems or hazards with the selected locations. Of particular concern is the potential for flooding landscaping, building basements, or creating hazardous traffic conditions. West Yost recommends that all drainage inlets/manholes be inspected near the testing sites to confirm proper drainage.

Summary of Hydrant Testing

Hydrant testing will be performed as described above and should be completed during typical weekday demand conditions (i.e., Tuesday through Thursday). The City is responsible for conducting the hydrant testing, recording pressure and flow results, and notifying other City staff and local residents/businesses about the hydrant testing, as needed.

Hydrant testing should be completed and results recorded (see Attachment B) and provided to West Yost by **Friday, January 14, 2022**. Completion of hydrant testing by this date will ensure the Water Master Plan project remains on-schedule.

West Yost is available for a conference call with City staff prior to the scheduled testing day, if desired, to review and finalize preparations for the hydrant testing. If any questions arise regarding the procedure or required equipment, please feel free to contact Kami Tiano at (925) 425-5625 or ktiano@westyost.com.

Attachment A

Hydrant Test Locations

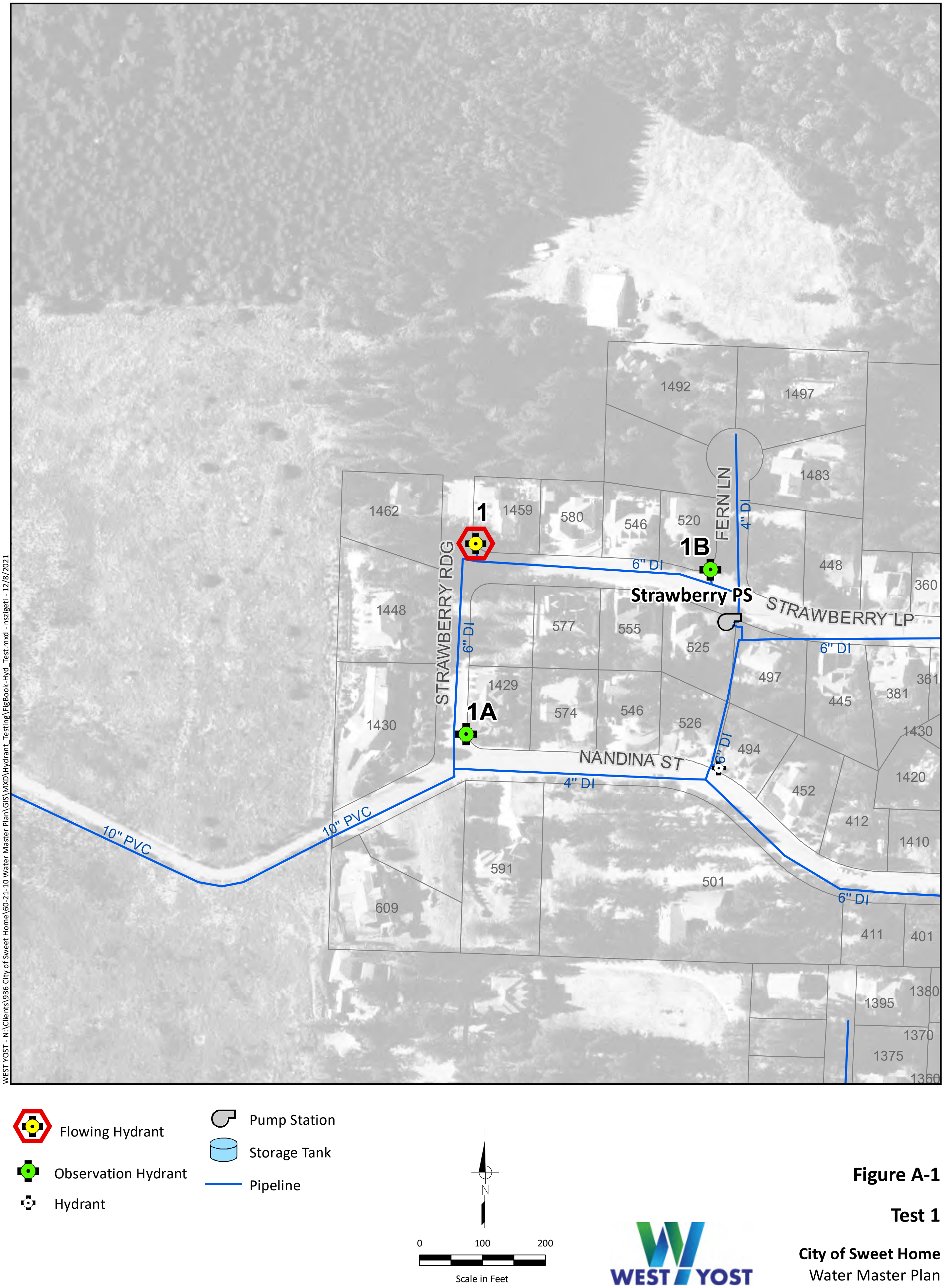

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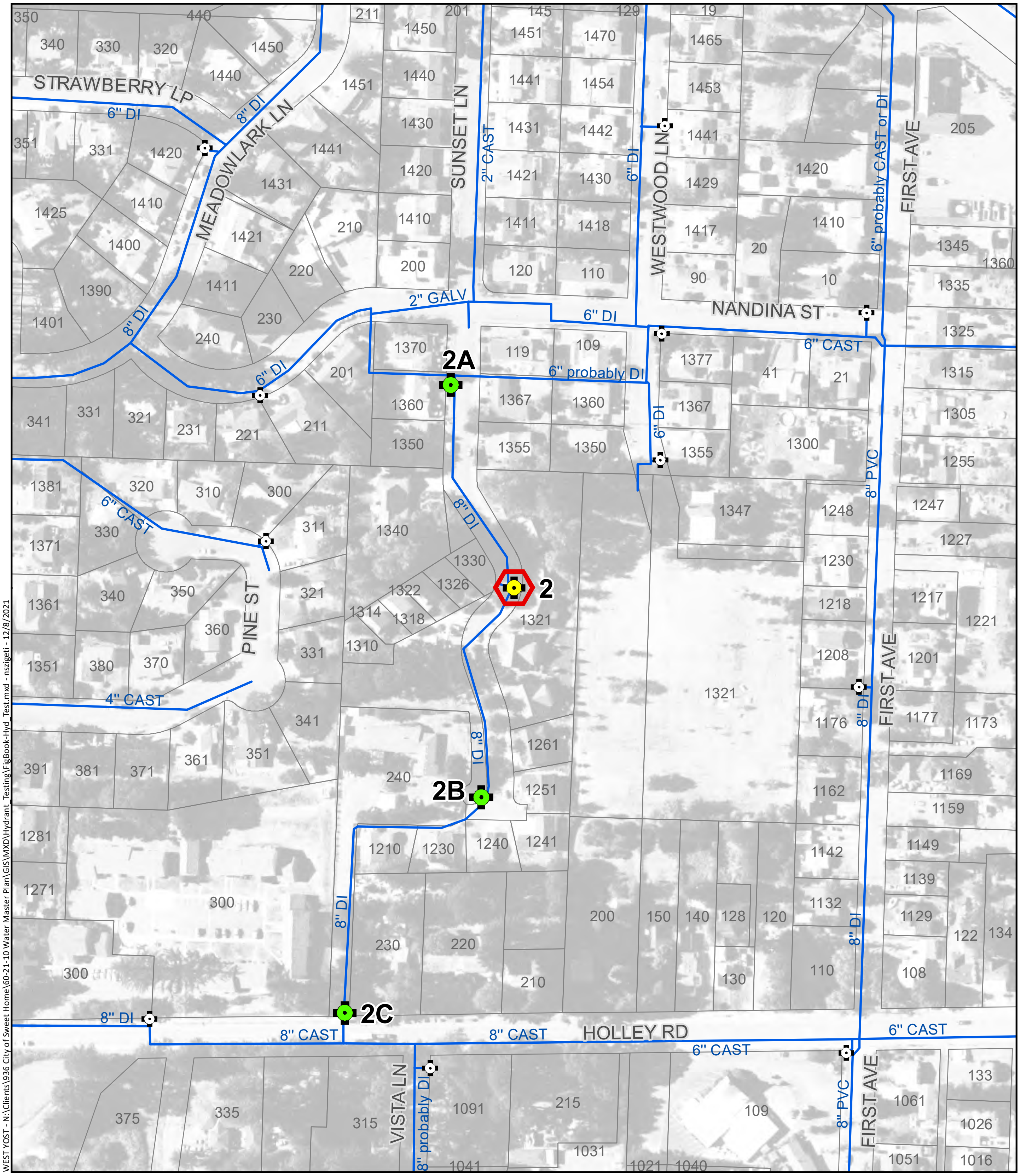
Figure A-1

Test 1

City of Sweet Home
Water Master Plan



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Flowing Hydrant

Observation Hydrant

Hydrant

Pump Station

Storage Tank

Pipeline

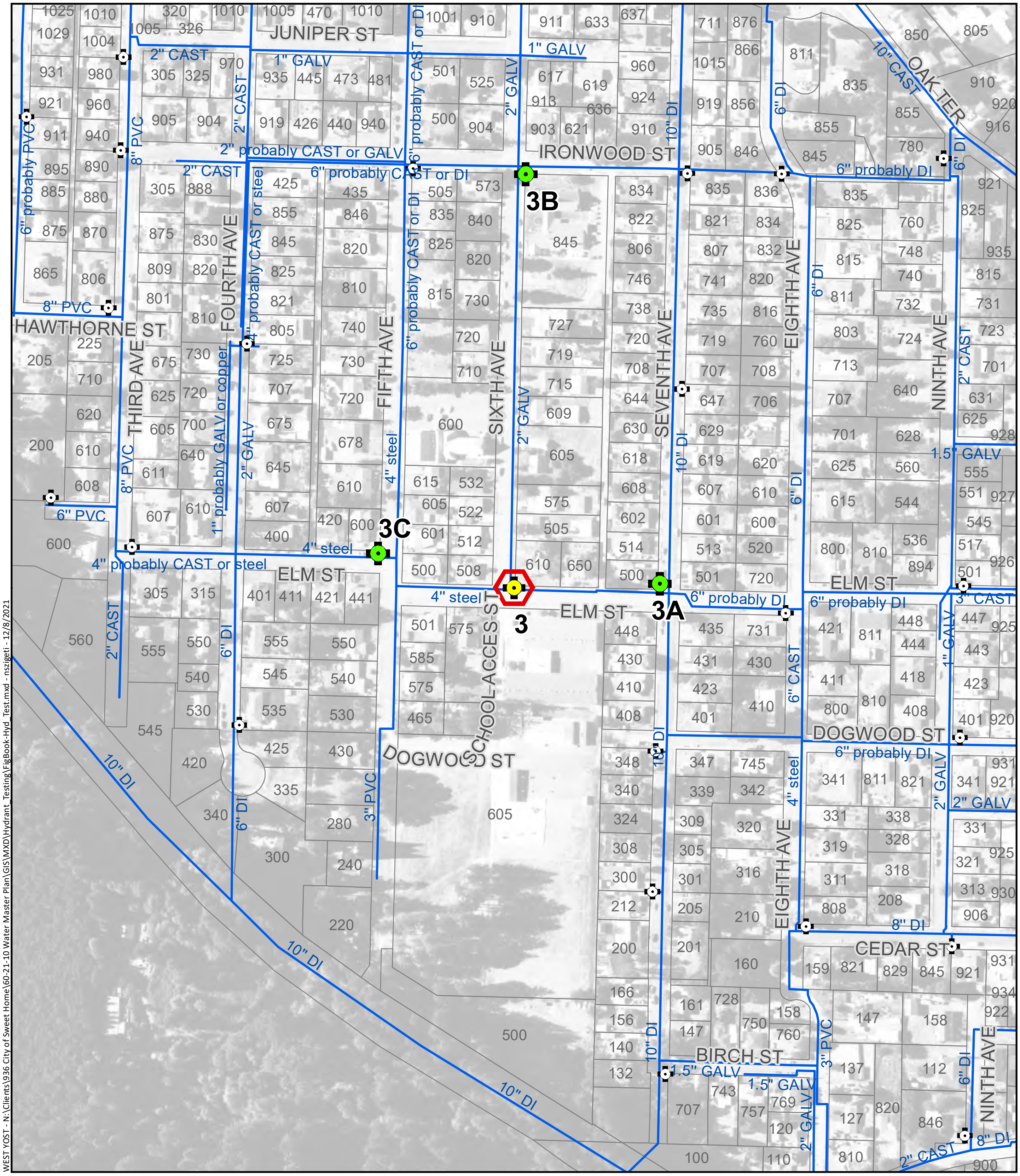
0 100 200

Scale in Feet

Figure A-2

Test 2

City of Sweet Home
Water Master Plan



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⬡	Flowing Hydrant
●	Observation Hydrant
⊕	Hydrant
	Pump Station
	Storage Tank
—	Pipeline

N

0 150 300

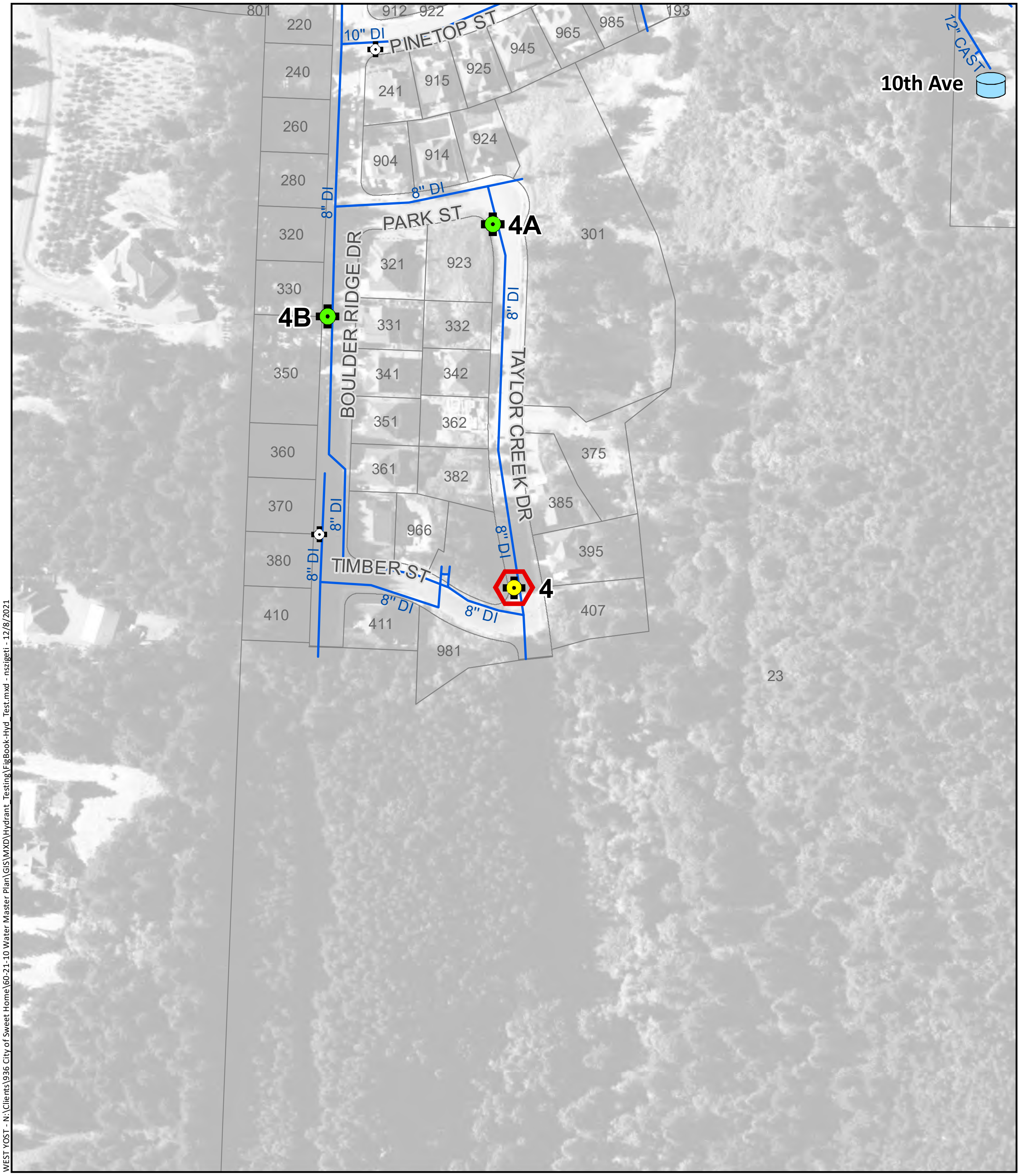
Scale in Feet

Figure A-3

Test 3

City of Sweet Home

Water Master Plan



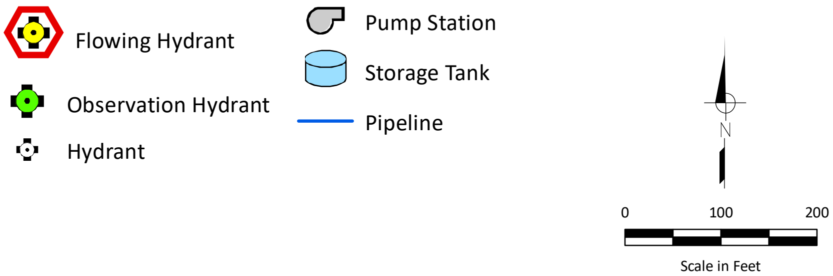


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Figure A-4

Test 4

City of Sweet Home
Water Master Plan

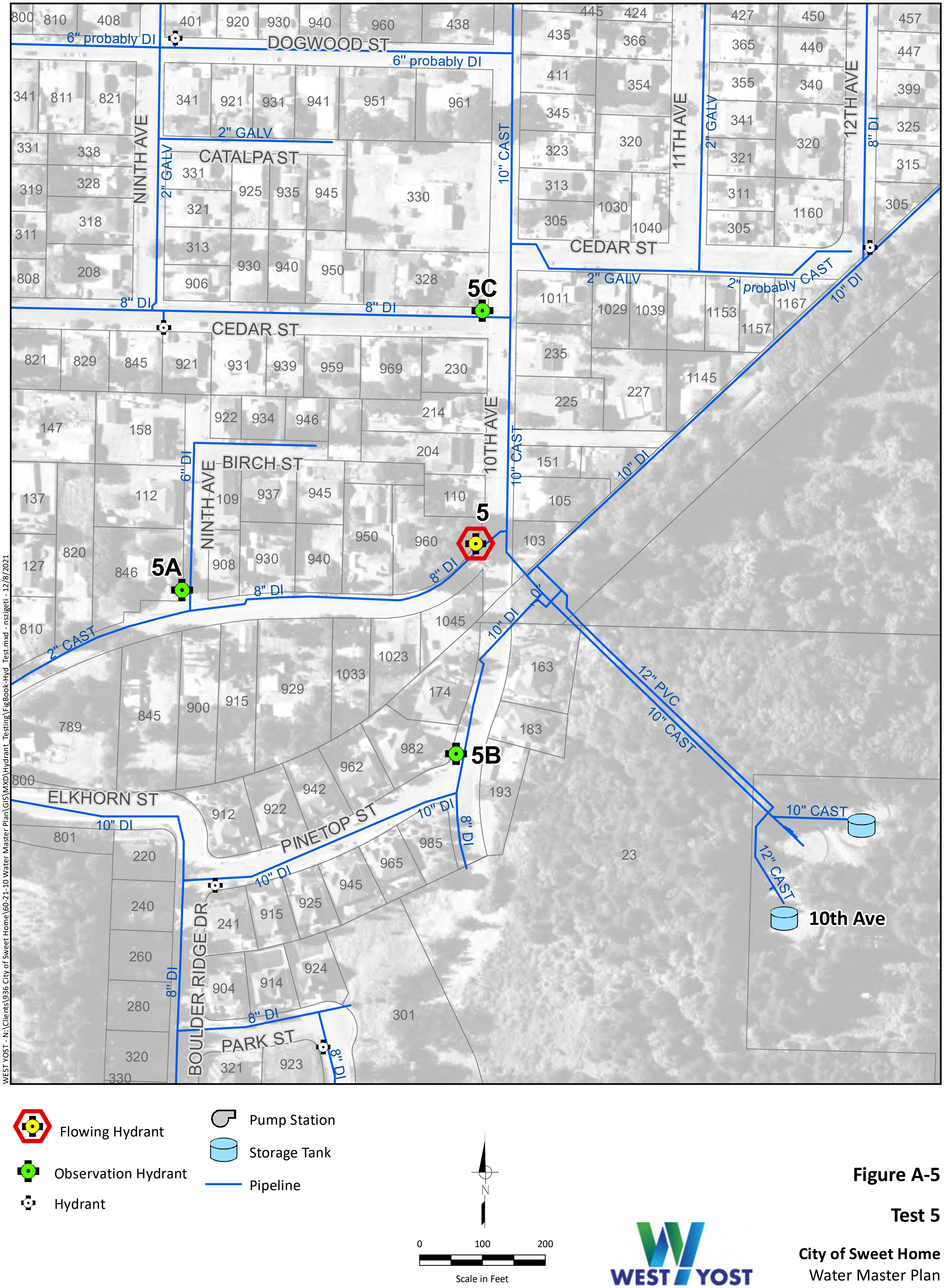

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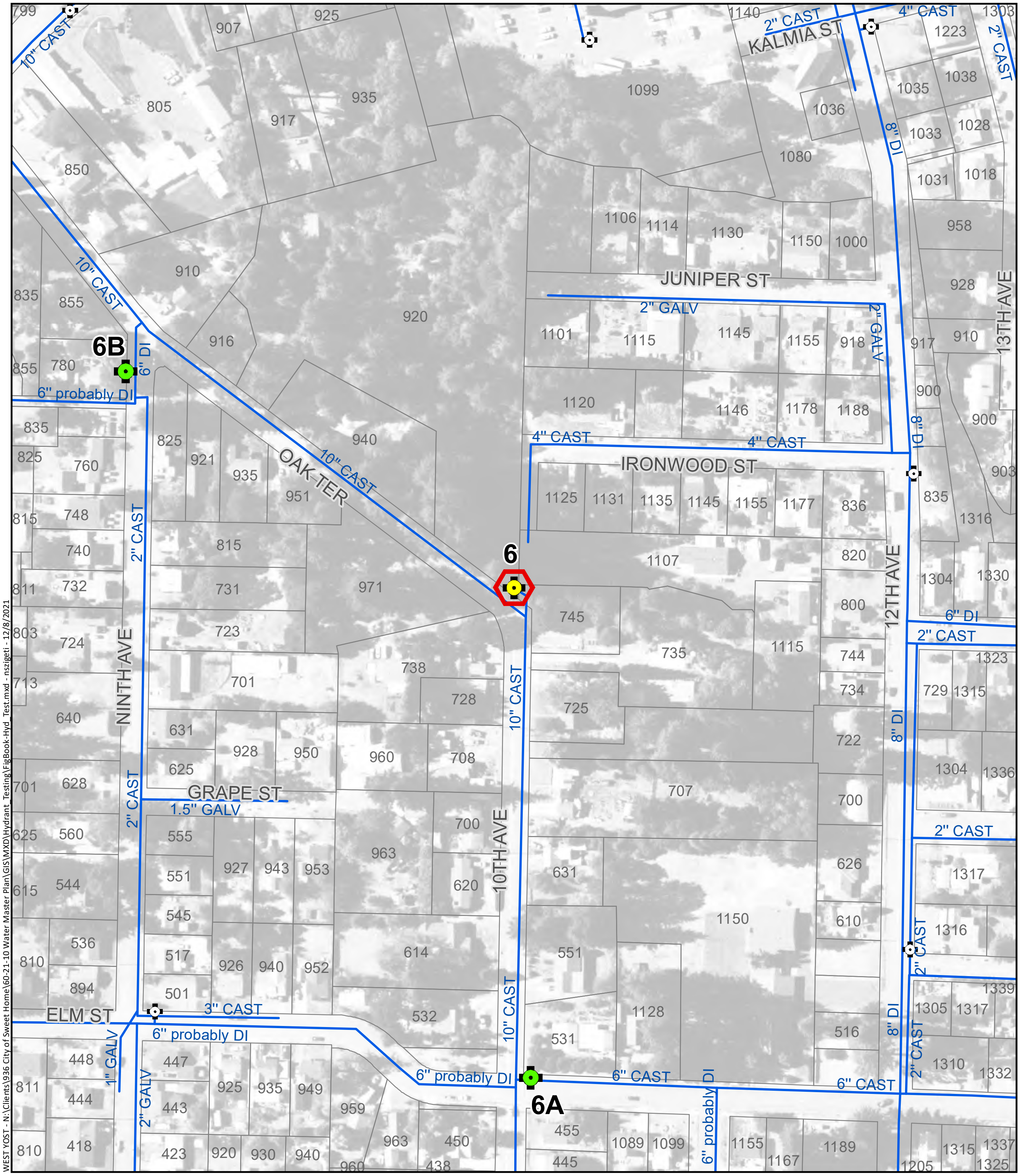
Figure A-5

Test 5

City of Sweet Home
Water Master Plan



Flowing Hydrant

Observation Hydrant

Hydrant

Pump Station

Storage Tank

Pipeline

N

0 100 200

Scale in Feet

Figure A-6

Test 6

City of Sweet Home

Water Master Plan

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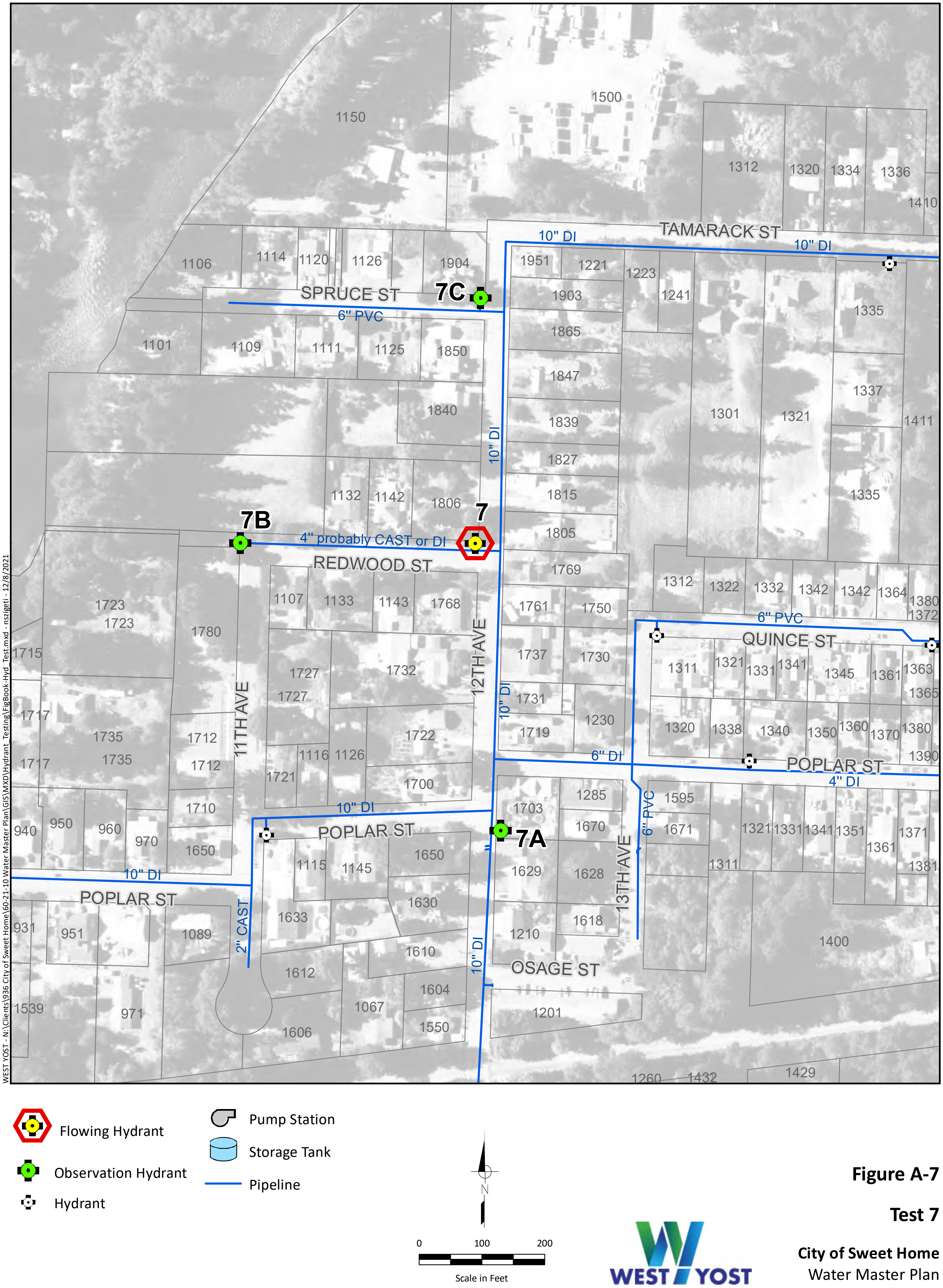

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Figure A-7

Test 7

City of Sweet Home
Water Master Plan

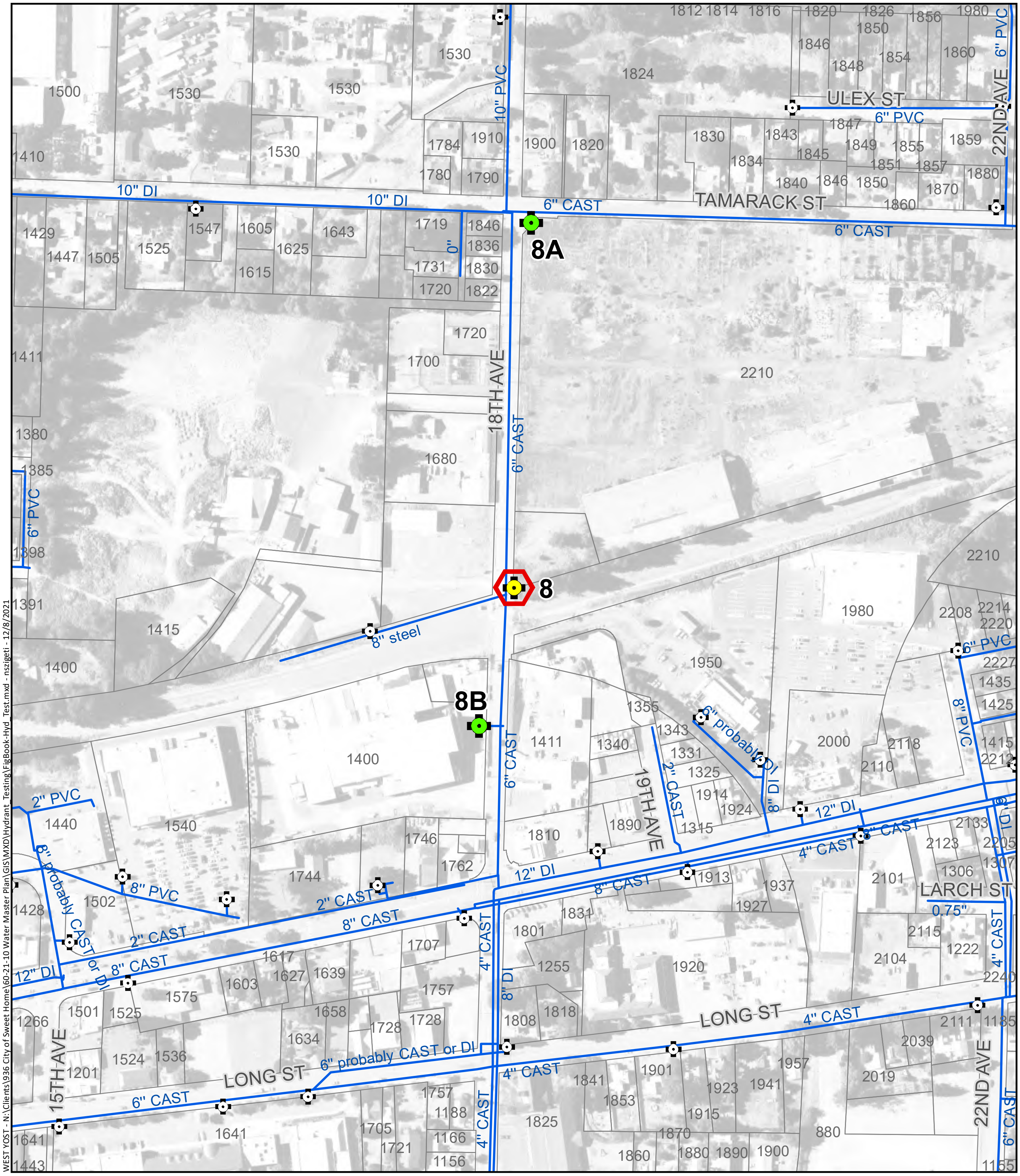

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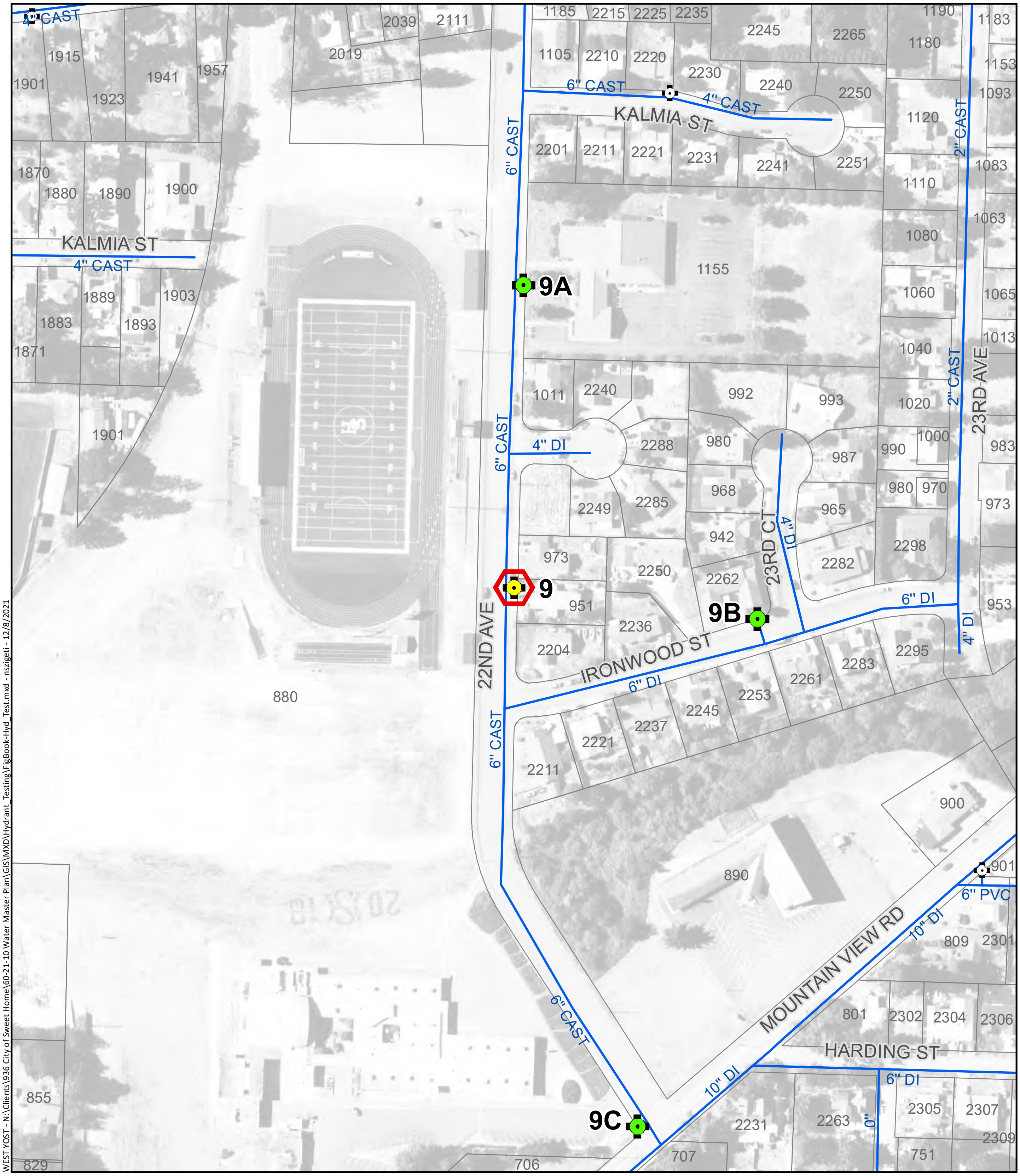
Figure A-8

Test 8

City of Sweet Home
Water Master Plan



🔴 Flowing Hydrant

🟢 Observation Hydrant

⊕ Hydrant

Pump Station

Storage Tank

— Pipeline

N

0 100 200

Scale in Feet

WEST YOST

Figure A-9

Test 9

City of Sweet Home

Water Master Plan

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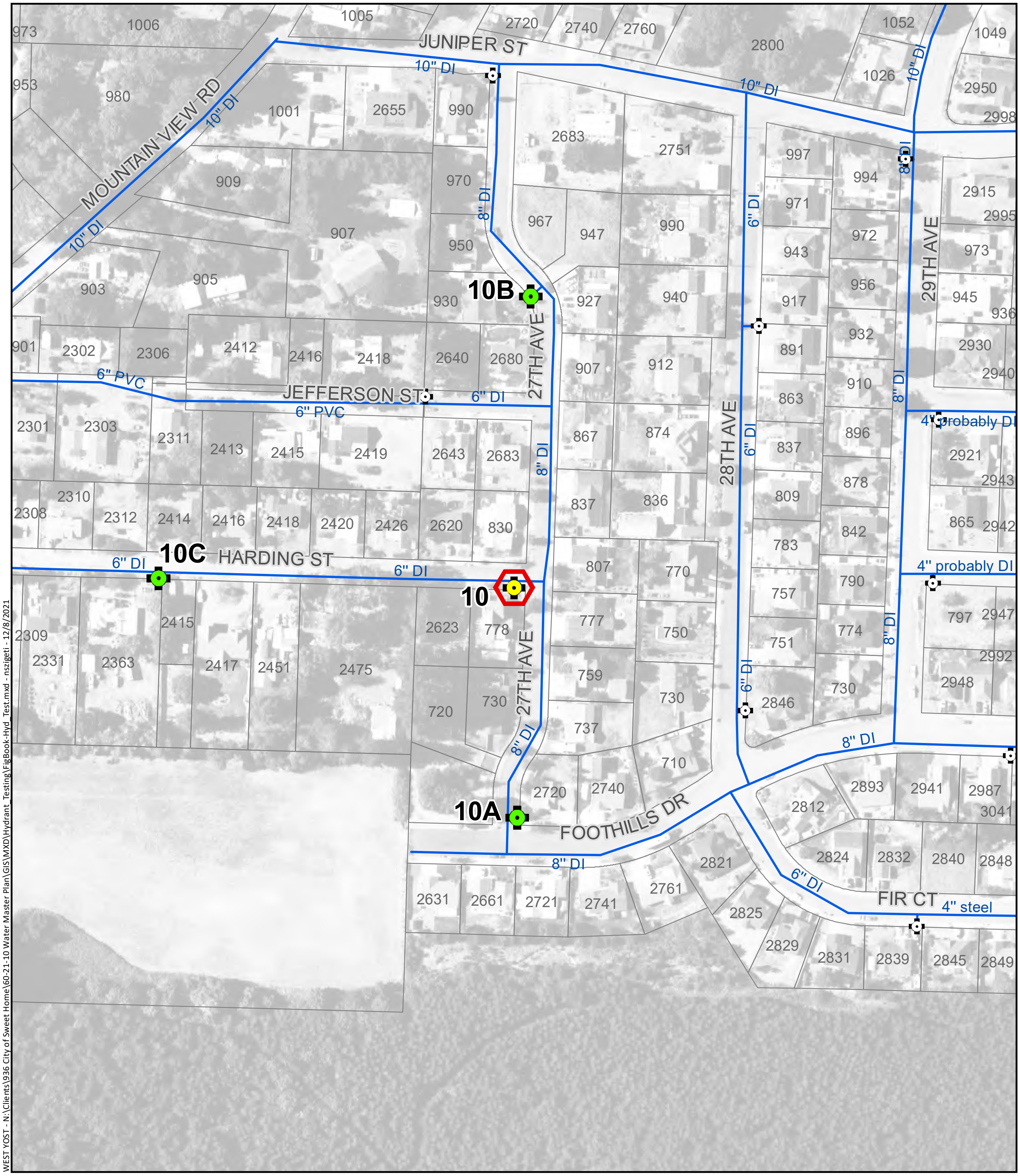

⬣ Flowing Hydrant

● Observation Hydrant

⊙ Hydrant

Pump Station

Storage Tank

— Pipeline

N

0 100 200

Scale in Feet

WEST YOST

Figure A-10

Test 10

City of Sweet Home

Water Master Plan

🔴 Flowing Hydrant

🟢 Observation Hydrant

⊙ Hydrant

Pump Station

Storage Tank

— Pipeline

N

0 100 200

Scale in Feet

WEST YOST

Figure A-11

Test 11

City of Sweet Home
Water Master Plan

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- Flowing Hydrant
- Observation Hydrant
- Hydrant
- Pump Station
- Storage Tank
- Pipeline

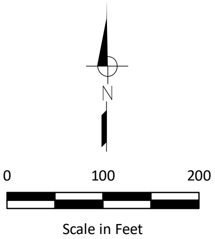
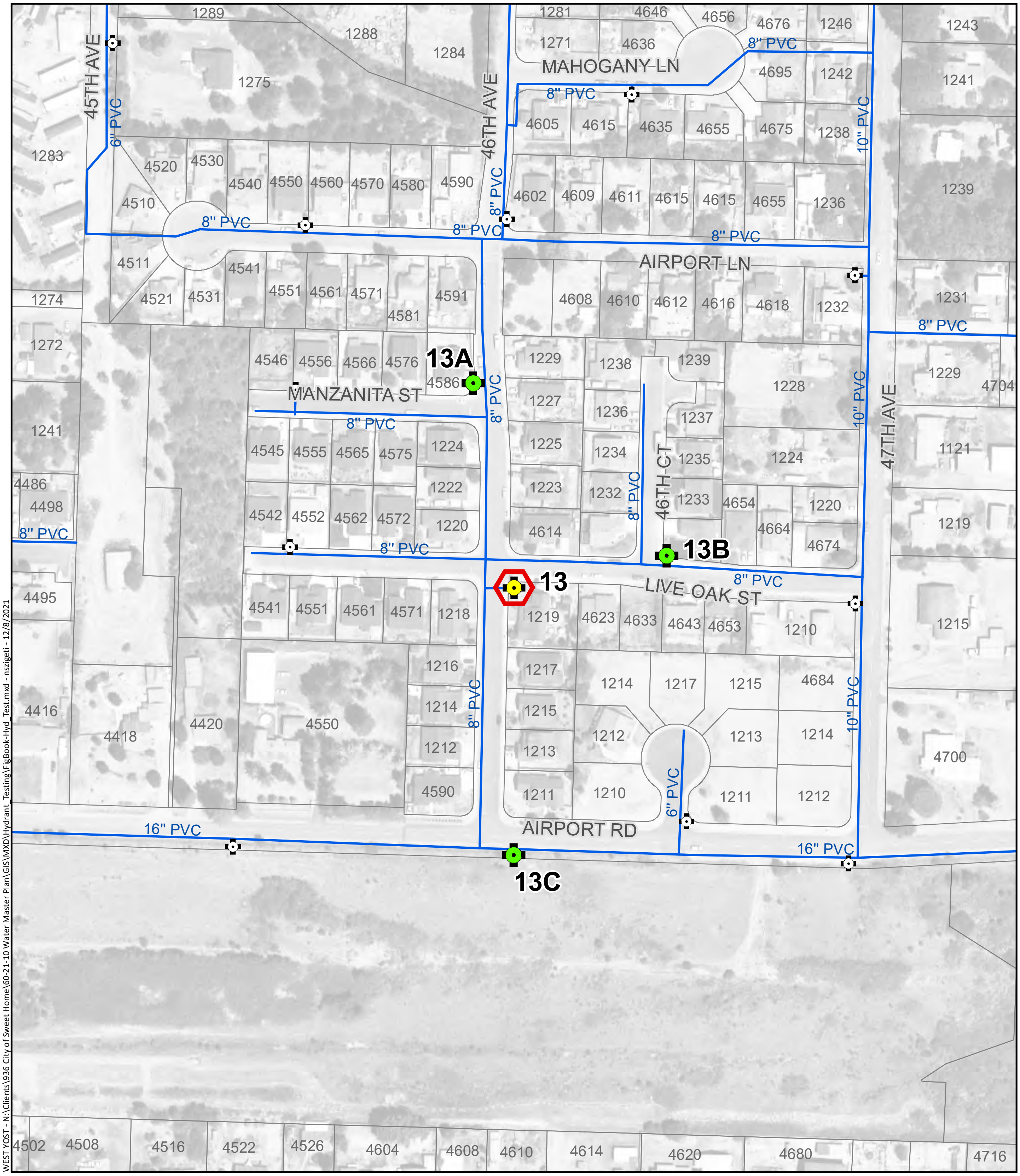


Figure A-12

Test 12

City of Sweet Home
Water Master Plan



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Flowing Hydrant

Observation Hydrant

Hydrant

Pump Station

Storage Tank

Pipeline

N

0 100 200

Scale in Feet

WEST YOST

Figure A-13

Test 13

City of Sweet Home
Water Master Plan

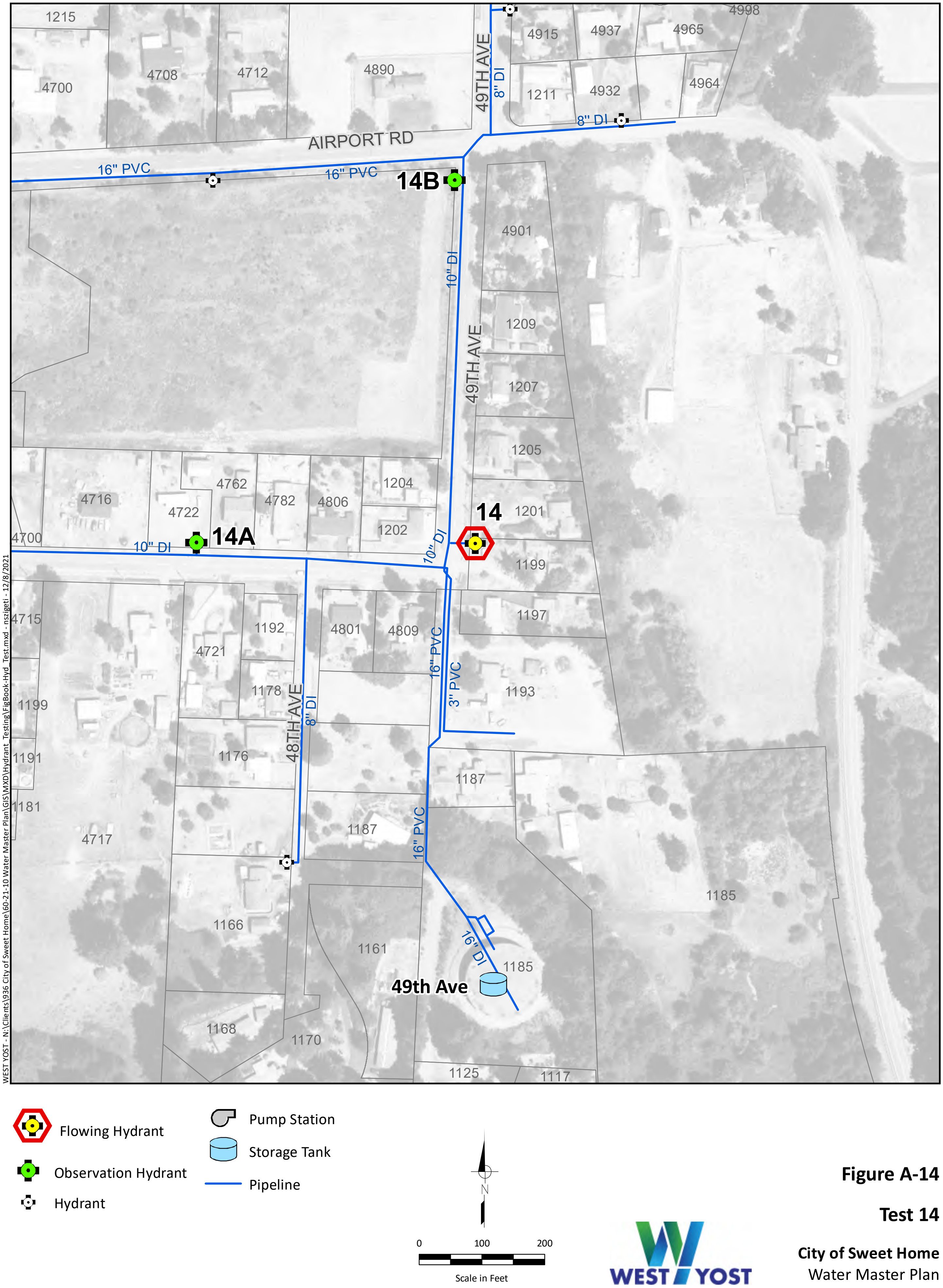

Figure A-14

Test 14

City of Sweet Home
Water Master Plan

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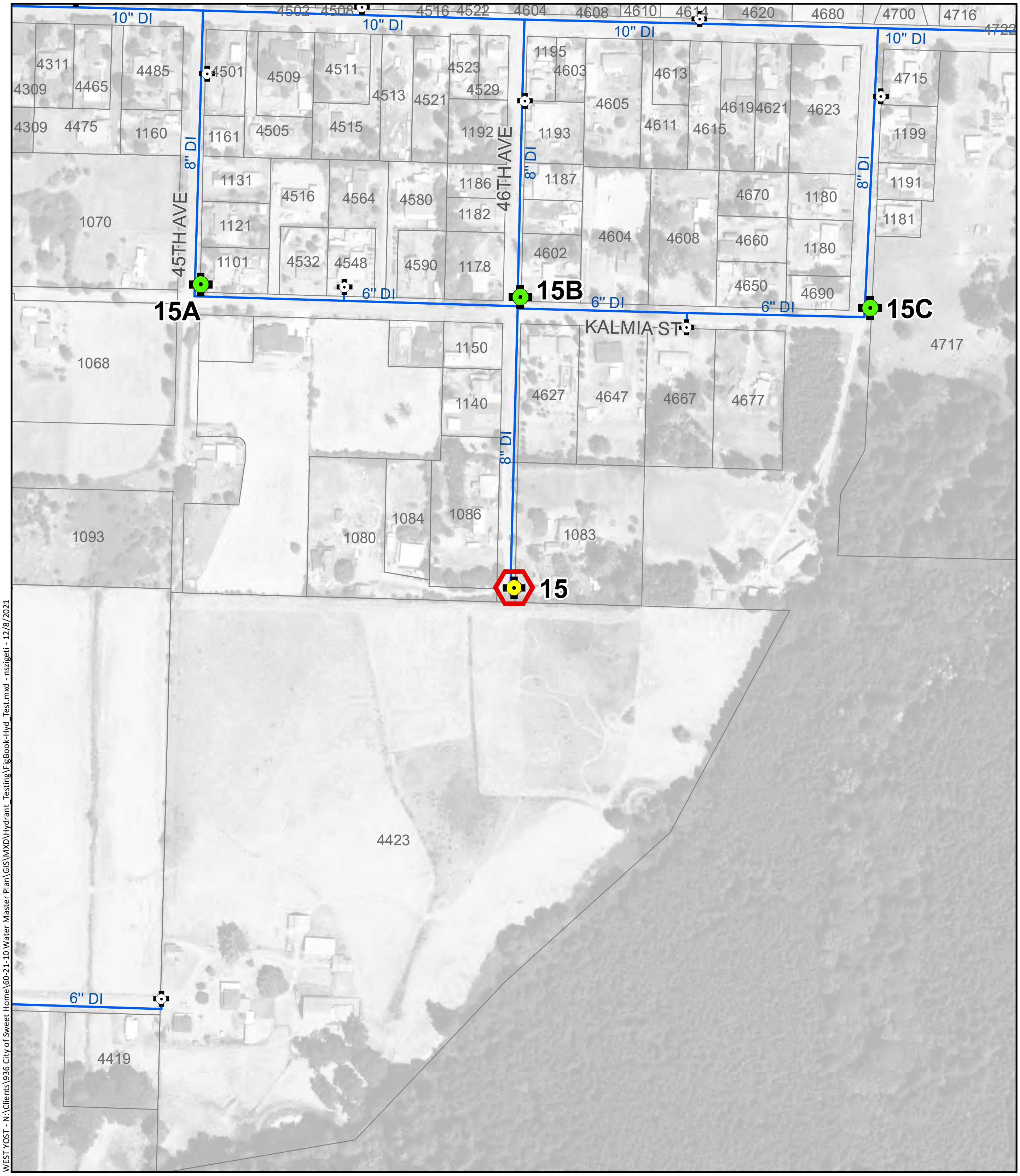


Flowing Hydrant

Observation Hydrant

Hydrant

Pump Station

Storage Tank

Pipeline

N

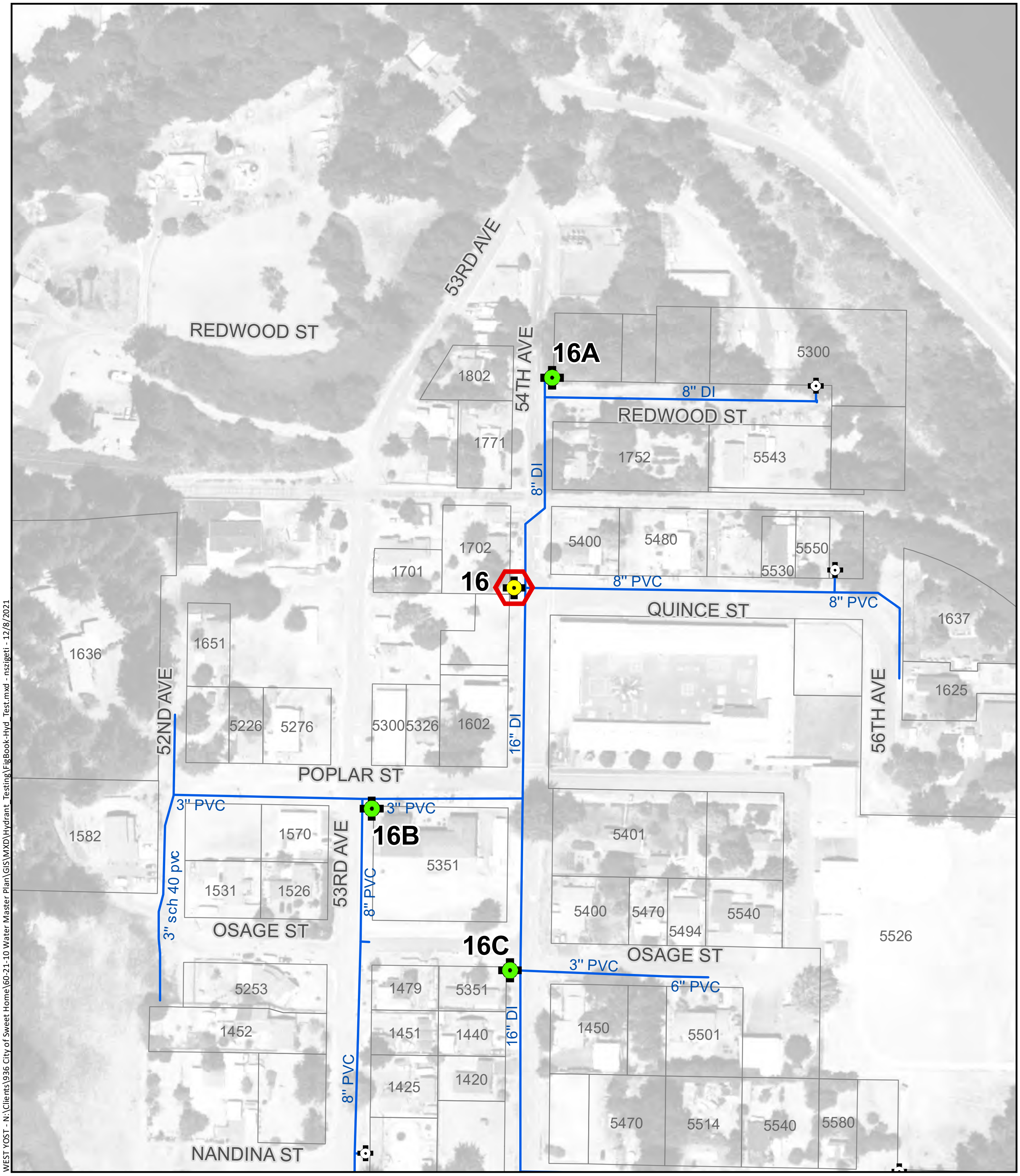
0 150 300

Scale in Feet

Figure A-15

Test 15

City of Sweet Home
Water Master Plan



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- Flowing Hydrant
- Observation Hydrant
- Hydrant
- Pump Station
- Storage Tank
- Pipeline

N

0 100 200

Scale in Feet

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Figure A-16

Test 16

City of Sweet Home

Water Master Plan

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Flowing Hydrant

Observation Hydrant

Hydrant

Pump Station

Storage Tank

Pipeline

N

0 250 500

Scale in Feet

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Figure A-17

Test 17

City of Sweet Home

Water Master Plan

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Figure A-18

Test 18

City of Sweet Home
Water Master Plan

Attachment B

Hydrant Test Data Logs

Table B-1. Data Log - Flowing Hydrant

Hydrant Test No.	Date	Time Recorded	Hydrant Static Pressure, psi (note ±psi, if varies)	Hydrant Residual Pressure, psi (note ±psi, if varies)	Hydrant Flow, gpm (note ±gpm, if varies)	Comments / Notable Test Anomalies
1						
2						
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11						
12						
13						
14						
15						
16						
17						
18						

Table B-2. Data Log - Monitoring Hydrant A

Hydrant Test No.	Monitoring Hydrant No.	Date	Time Recorded	Hydrant Static Pressure, psi (note ±psi, if varies)	Hydrant Residual Pressure, psi (note ±psi, if varies)	Comments / Notable Test Anomalies
1						
2						
3						
4						
5						
6						
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12						
13						
14						
15						
16						
17						
18						

Table B-2. Data Log - Monitoring Hydrant B

Hydrant Test No.	Monitoring Hydrant No.	Date	Time Recorded	Hydrant Static Pressure, psi (note ±psi, if varies)	Hydrant Residual Pressure, psi (note ±psi, if varies)	Comments / Notable Test Anomalies
1						
2						
3						
4						
5						
6						
7						
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12						
13						
14						
15						
16						
17						
18						

Table B-2. Data Log - Monitoring Hydrant C

Hydrant Test No.	Monitoring Hydrant No.	Date	Time Recorded	Hydrant Static Pressure, psi (note ±psi, if varies)	Hydrant Residual Pressure, psi (note ±psi, if varies)	Comments / Notable Test Anomalies
1						
2						
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Appendix B

Geotechnical Seismic Risks and Hazards Mapping

Technical Memorandum

To:	Sandrine Ganry West Yost	Project:	Sweet Home Water Master Plan
From:	Wolfe Lang, PE Delve Underground	cc:	
Prepared by:	Luke Ferguson, PE Delve Underground	Job No.:	6342.0
Date:	May 31, 2023		
Subject:	Seismic Hazards Evaluation - FINAL		

1.0 Introduction

The City of Sweet Home (City) is currently conducting a seismic resiliency study for their water system. A key required component of the study is understanding the seismic hazards present in the service area. The City has contracted West Yost to provide professional services for the resiliency study. West Yost has retained Delve Underground to conduct a seismic hazards assessment. The primary purpose of this task is to broadly identify the seismic hazard potentials, namely the strong ground shaking potential and seismic permanent ground deformation (PGD) in the Sweet Home service area. This task includes creating seismic hazard maps.

This memorandum presents the results of our evaluation. The following tasks were completed in accordance with our scope of work:

1. Review of available local geologic information;
2. Review of DOGAMI seismic hazard maps for a magnitude 9.0 Cascadia Subduction Zone (CSZ) event;
3. Review of available geotechnical boring and well log information to verify DOGAMI seismic hazard maps;
4. Development of estimates of seismic hazards in the project area, including strong ground shaking, liquefaction-induced settlement, lateral spreading displacement, and seismic landslide slope instability.
5. Development of hazard maps illustrating these hazards in relation to the Sweet Home service area;
6. Development of site response spectral acceleration values for a maximum considered earthquake (MCE_R) and a CSZ seismic event;
7. Development of this memorandum summarizing the results of our evaluations.

2.0 Data Review

Delve Underground performed a background information review and reviewed available existing geotechnical data from various previous projects within the Sweet Home service area. Existing geotechnical data sources consisted mainly of well logs. Limited subsurface information was provided by the City at the 49th Ave Reservoir and the Strawberry Reservoir.

3.0 Geologic and Seismic Setting

3.1 Geologic Setting

The Sweet Home service area is located in the foothills of the Western Cascades, a north-south trending physiographic region that stretches from northern California to British Columbia, tucked between the Willamette Valley to the west and the younger High Cascades to the east. The Western Cascades in Oregon were formed by a series of volcanic events from approximately 35 to 17 million years ago. The region is marked by densely forested hills dissected by the region's many rivers (Madin, 1990; Schlicker and Deacon, 1967; Wilson, 1998; Popowski, 1996).

The Paleogene structural basement of this region of the Western Cascades is composed of non-marine volcaniclastic sedimentary rocks, tuff, basaltic andesite, andesite, and dacite of the Late Eocene to Oligocene Fisher Formation. The Fisher Formation is overlain by basalt lavas, ash-flow tuff, tuff, and non-marine sedimentary rocks of the Little Butte Volcanic Series. A subducting plate below the Eocene shoreline resulted in a volcanic chain that produced the volcanic activity responsible for the Fisher Formation and the Little Butte Volcanic Series. As the angle of the subducting plate shifted, the volcanic activity gradually shifted east of the region.

Over the span of geologic time, Quaternary sedimentary deposits of alluvium, colluvium, landslide deposits, and terrace deposits have accumulated on the volcanic rock surfaces and in the valleys formed by the rivers. The sediments consist primarily of unconsolidated gravel and sand, with lenses of silt and clay.

3.2 Seismic Setting

The Pacific Northwest is located near an active tectonic plate boundary. Off the northwest coast the Juan de Fuca oceanic plate is subducting beneath the North American crustal plate. This tectonic regime has resulted in seismicity in the project area occurring from three primary sources:

- Shallow crustal faults within the North American plate;
- CSZ intraplate faults within the subducting Juan de Fuca plate; and
- CSZ megathrust events generated along the boundary between the subducting Juan de Fuca plate and the overriding North American plate.

Among these three sources, CSZ megathrust events are considered as having the most hazard potential due to the anticipated magnitude and duration of associated ground shaking. Recent studies indicate that the CSZ can potentially generate large earthquakes with magnitudes ranging from 8.0 to 9.2 depending on rupture length. The recurrence intervals for CSZ events are estimated at approximately 500 years for the mega-magnitude full rupture events (magnitude 9.0 to 9.2) and 200 to 300 years for the large-magnitude partial rupture events (magnitude 8.0 to 8.5). Additionally, current research indicates a probability of future occurrence because the region is "past due" based on historic and prehistoric recurrence intervals documented in ocean sediments. For example, over the next 50 years, the CSZ earthquake has an estimated probability of occurrence off the Oregon Coast on the order of 16 to 22 percent (Goldfinger et. al., 2016).

4.0 Subsurface Conditions

The subsurface within the project area is dominated by the following geologic units:

- **Alluvium**: Consists of unconsolidated gravel, sand, silt, and clay deposited along active stream channels and their adjoining flood plains and is Holocene in age.
- **Colluvium**: Consists of an unconsolidated mixture of soil and rock fragments that have been transported downslope by precipitation and gravity via surficial erosion. This unit is present mainly on and at the base of steep slopes.
- **Landslide Deposits**: Consists of unconsolidated mixed masses of rock and soil deposited by gravity-driven mass-wasting processes such as slumps, landslides, debris flows, etc. Individual slide masses can form large complexes resulting from long-term landslide activity.
- **Mixed Grain Sediments**: Consists primarily of unconsolidated deposits of gravel and sand, with some silt and clay, and is considered to be Pleistocene-aged based on stratigraphy.
- **Coarse Grained Sediments**: Consists primarily of gravel with minor sand and silt deposited by steeper gradient streams draining the Western Cascades. This unit is assigned a Holocene age based on location near active stream channels.
- **Sedimentary Rock**: Consists primarily of Tertiary-aged sandstones and conglomerates, including sedimentary rock units of volcaniclastic origin.
- **Volcanic Rock**: Consists primarily of Tertiary-aged basalt and diabase associated with Western Cascade and Little Butte volcanic activity.

A geology map of the Sweet Home service area is shown in Figure 1.

5.0 Geotechnical Seismic Hazards

Seismic hazards include strong ground shaking, liquefaction settlement, lateral spreading, and seismic-induced landslides. These hazards have the potential to damage facilities (i.e., treatment plant, pipelines, reservoirs, pump stations) through either permanent ground deformation or intense shaking. Our analysis of these seismic hazards is based on information provided from existing geotechnical explorations, historic well logs, DOGAMI hazard maps created for the Oregon Resilience Plan (ORP) (Madin and Burns, 2013), and our knowledge of the geotechnical conditions of the area. In our seismic analyses we assumed a magnitude 9.0 earthquake and a bedrock peak ground acceleration of 0.13 g to represent the effects of a CSZ seismic event in the project area.

Geotechnical information contained in logs and reports studied for this project was analyzed for potential seismic hazards and compared to seismic hazards mapped by DOGAMI. Where appropriate, DOGAMI mapped hazards were modified and improved to incorporate results of the analysis of local geotechnical information. Of note, existing geotechnical information in the project area is sparse, with quality subsurface information available mainly only at reservoir, water treatment, and wastewater treatment sites. Subsurface conditions could not be confirmed where subsurface investigations are not available.

5.1 Ground Shaking (Peak Ground Velocity)

To assess the hazard potential of ground shaking in the project area we reviewed the peak ground velocity (PGV) map published by DOGAMI for the ORP in the event of a M9 CSZ earthquake (Madin and Burns, 2013).

The estimated ground shaking intensity (PGV) depends on earthquake magnitude, distance to fault rupture, and the subsurface materials present at the site. Generally, in the Sweet Home service area the PGV values are estimated to range between 5 and 10 inches per second. The PGV hazard map for the Sweet Home service area is shown in Figure 2.

5.2 Liquefaction

Liquefaction is a phenomenon affecting saturated, granular soils in which cyclic, rapid shearing from an earthquake results in a drastic loss of shear strength and a transformation from a granular solid mass to a viscous, heavy fluid mass. The results of soil liquefaction include loss of shear strength, loss of soil materials through sand boils, flotation of buried chambers/pipes, and post liquefaction settlement.

To evaluate the hazard potential of soil liquefaction in the project area, we reviewed liquefaction hazard maps published by DOGAMI for the ORP, modified as discussed in Section 5.0, in the event of a M9 CSZ earthquake. Where geotechnical data was available, we conducted site specific analyses based on the subsurface conditions shown in previous geotechnical explorations using the latest SPT-based liquefaction susceptibility and settlement assessment procedures (Boulanger and Idriss, 2014; Idriss and Boulanger, 2008). Based on our evaluation, liquefaction is not a significant hazard across the majority of the Sweet Home service area. Coarse gravels overlying shallow bedrock provide subsurface conditions that are not conducive to liquefaction. At the wastewater treatment plant existing geotechnical investigations show isolated pockets of unconsolidated fill soils that have the potential to liquefy. These fill pockets are discontinuous and not expected to present a significant hazard to existing water system facilities. The Sweet Home service area liquefaction hazard map is shown in Figure 3.

5.3 Lateral Spreading

Liquefaction can result in progressive horizontal deformation of the ground known as lateral spreading. The lateral movement of liquefied soil breaks the non-liquefied soil crust into blocks that progressively move downslope or toward a free face in response to earthquake generated ground accelerations. Seismic movement incrementally pushes these blocks downslope as seismic accelerations overcome the strength of the liquefied soil column. The potential for and magnitude of lateral spreading depends on the liquefaction potential of the soil, the magnitude and duration of earthquake ground accelerations, the site topography, and the post-liquefaction strength of the soil.

To assess the hazard potential of lateral spreading in the project area, we reviewed a lateral spreading hazard map published by DOGAMI for the ORP, modified as discussed in Section 5.0, in the event of a M9 CSZ earthquake. Based on our evaluation, lateral spreading is not expected to be a hazard in the Sweet Home service area. Therefore, a lateral spreading hazard map is not included as part of this memorandum.

5.4 Seismic Landslides

Earthquake induced landslides can occur on slopes due to the inertial force from an earthquake adding load to a slope. The ground movement due to landslides can be extremely large and damaging to pipelines and other structures. To assess the hazard potential of landslides in the project area, we reviewed a landslide hazard map published by DOGAMI for the Sweet Home area, and modified it based on reviewed geotechnical data, site topography, and the location of mapped historic and prehistoric landslide deposits.

Generally, the seismic landslide hazard for the study area is low due to its relative flatness. However, seismic landslide hazard is present in isolated areas where steeper slopes are present along the southern boundary of the service area. Specifically, there is a potential for seismic landslides at steep slopes adjacent to the 10th Avenue and 49th Avenue reservoirs. Seismic landslide PGD up to 4 feet may occur in these areas. The seismic landslide hazard map of the service area is shown in Figure 5, with the hazard quantified by estimated seismic landslide induced PGD. Mapped existing landslide deposits are also shown.

6.0 Spectral Accelerations

Seismic spectral acceleration parameters for PGA_M, S_{M1}, and S_{MS} were estimated for the project area by Delve Underground for both a MCE_R and a CSZ earthquake. The MCE_R roughly corresponds to a seismic event with a 2,475-year recurrence interval and the CSZ roughly corresponds to a seismic event with a 475-year recurrence interval.

Spectral accelerations for the MCE_R event were determined in a probabilistic manner using the hazard tool published online by ASCE 7, which draws its spectral acceleration values from the ASCE 7-22 building code. A Risk Category of III was assumed for the Sweet Home water system.

Spectral accelerations for the CSZ event were determined in a deterministic manner using the NGA-Subduction Ground Motion Characterization Tool (Mazzoni, 2020) in conjunction with the online United States Geologic Survey (USGS) Unified Hazard Tool. This tool provides a range of estimated spectral accelerations based on the magnitude and rupture distance of a specific earthquake event. A magnitude of 9.0 and a rupture distance of 87 km were assumed. The 50th percentile values are presented in this study.

These spectral acceleration parameters are dependent on the seismic site class of the soil at the site. To assess the seismic site classes present in the project area, we reviewed a site class map published by DOGAMI for the Sweet Home area, and modified it based on reviewed geotechnical data. Estimated spectral accelerations for a CSZ event are shown in Figure 5 and estimated spectral accelerations in an MCE_R event are provided in Figure 6. These values are also presented in Table 1.

Table 1. Spectral Accelerations

Site Class	CSZ Event			MCE_R Event		
	PGA_M (g)	S_{M1} (g)	S_{MS} (g)	PGA_M (g)	S_{M1} (g)	S_{MS} (g)
B	0.14	0.14	0.27	0.30	0.28	0.58
C	0.21	0.23	0.40	0.38	0.44	0.83
D	0.27	0.50	0.38	0.42	0.69	0.95

7.0 Conclusions

The majority of the Sweet Home service area is not located within a seismic hazard zone. The subsurface is dominated by coarse gravels and shallow bedrock, without significant deposits of liquefiable soils. Therefore, the liquefaction and lateral spreading hazard in the service area is low. Certain areas of unconsolidated fill materials, such as those present at the wastewater treatment plant, are liquefiable. However, these fill materials are discontinuous and not expected to pose a significant hazard to the Sweet Home water system. It is important to note that available subsurface information in the service area is limited and subsurface conditions could not be confirmed where existing geotechnical information was not available.

There is a seismic landslide hazard present on slopes along the southern boundary of the service area, including at the 10th Avenue and 49th Avenue reservoir sites. Delve Underground recommends that site specific slope stability analyses, including additional subsurface investigations, be performed at both the 10th Avenue and 49th Avenue reservoirs to determine the level of seismic landslide hazard present at those sites.

8.0 Limitations

This Seismic Hazards Technical Memorandum has been prepared for the Sweet Home Water Master Plan project, located in Sweet Home, Linn County, Oregon. This report contains a compilation of information from previous studies, projects, and published literature. The professional judgements and characterizations presented herein are based on this information. Delve Underground is not responsible for errors and omissions that might appear in studies reported by others.

The scope of our geotechnical services has not included an environmental evaluation regarding the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below the site.

This report has been completed within the limitations of the West Yost Associates, Inc. approved scope of work, schedule, and budget. The services rendered have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same area. Delve Underground is not responsible for the use of this report for anything other than the Sweet Home Water Master Plan project.

DELVE UNDERGROUND

Luke Ferguson, P.E.
Project Engineer

Yuxin "Wolfe Lang", P.E., G.E.
Principal Engineer

9.0 References

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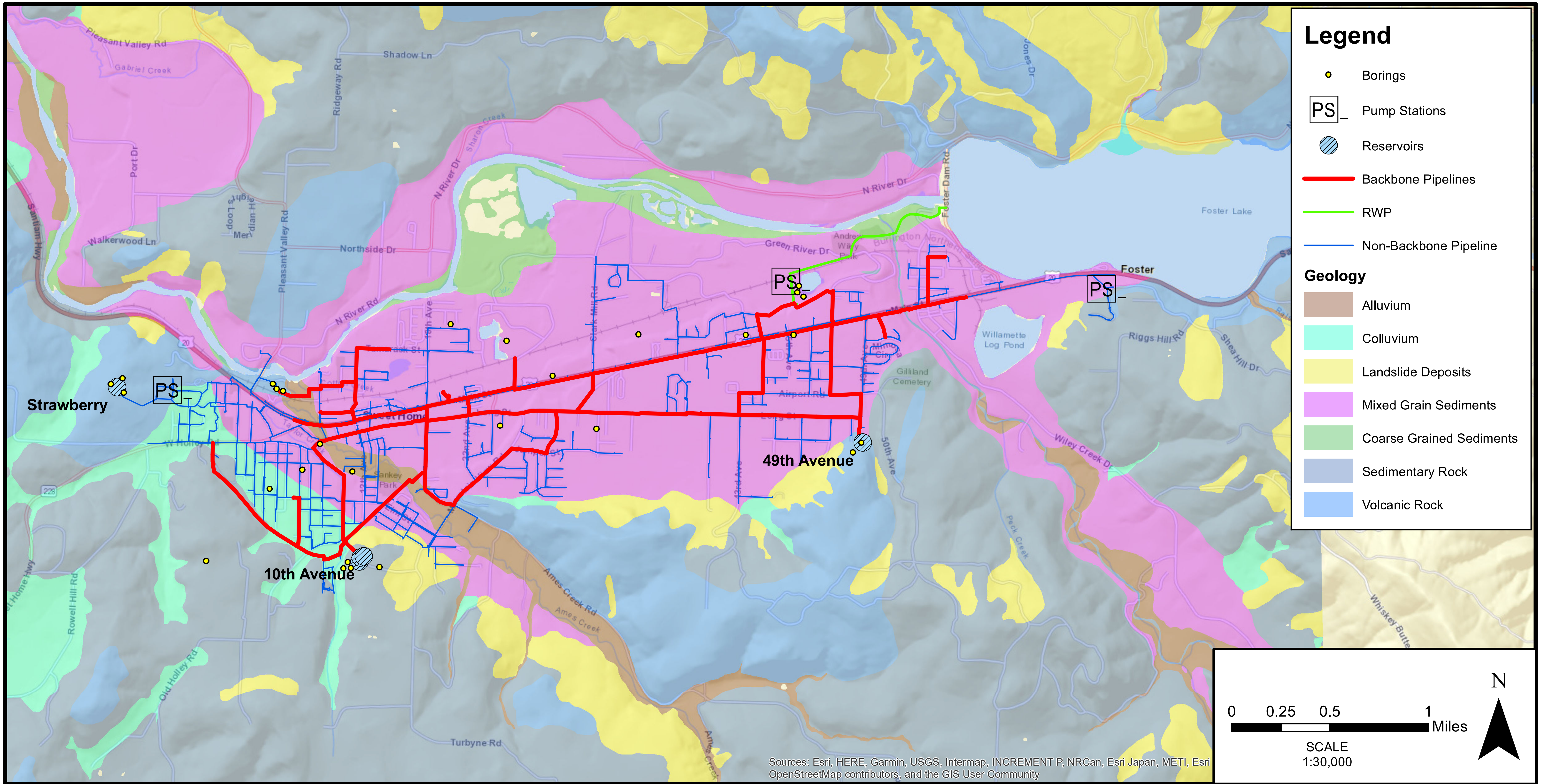
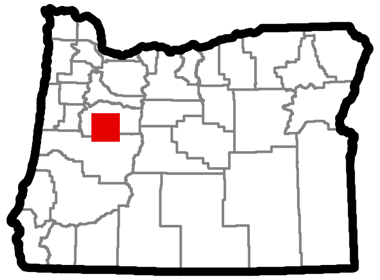
Figures



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri OpenStreetMap contributors, and the GIS User Community



DELVE underground

CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

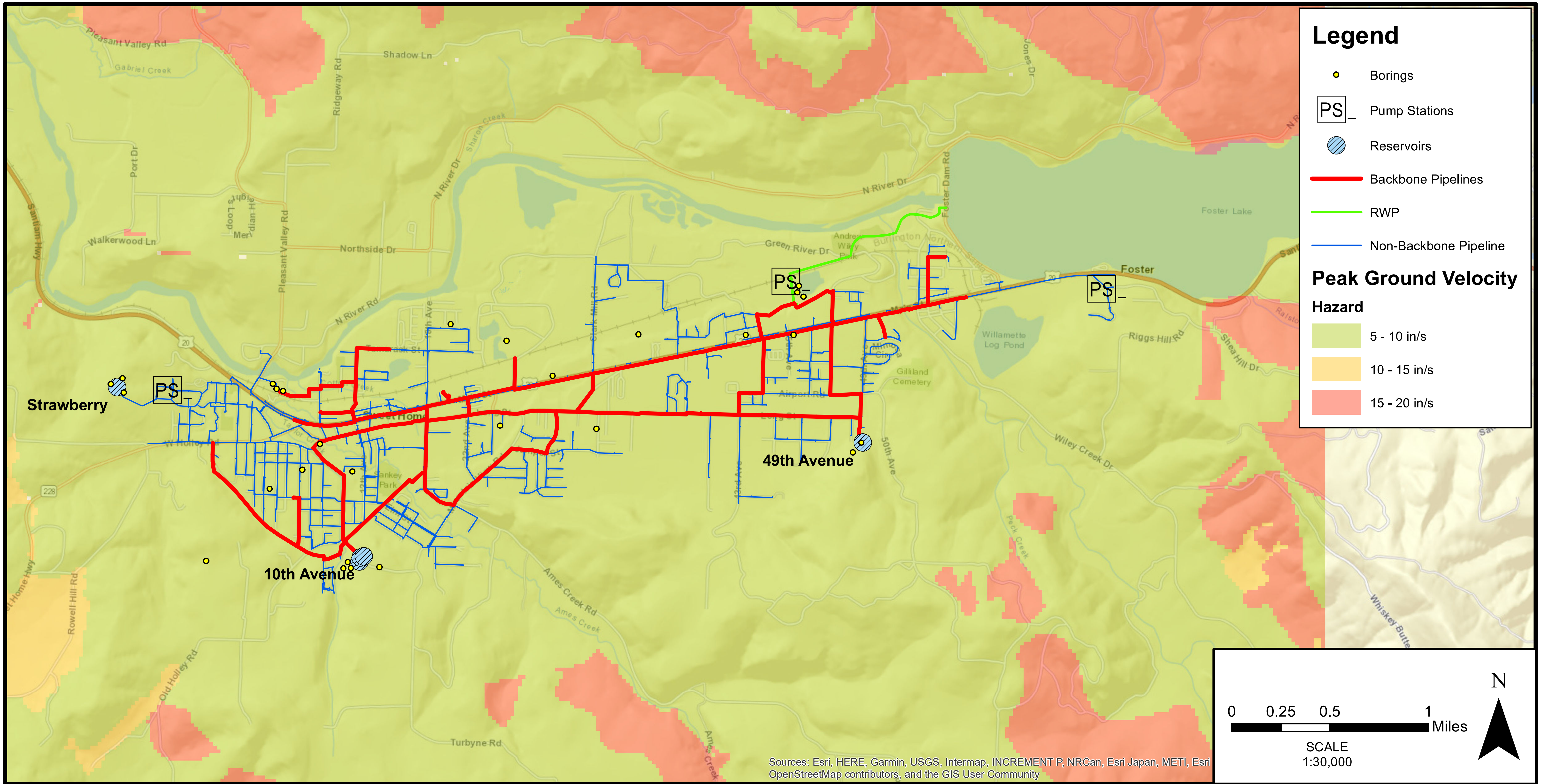
SEISMIC HAZARDS TECHNICAL MEMORANDUM
GEOLOGY MAP

MAY
2023

FIGURE
1

NOTES:
GEOLOGY MAP ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri
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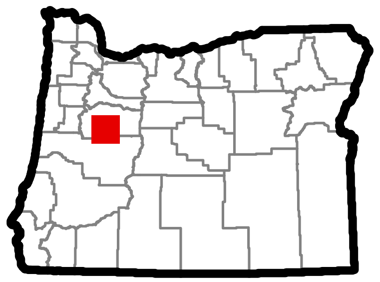

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CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

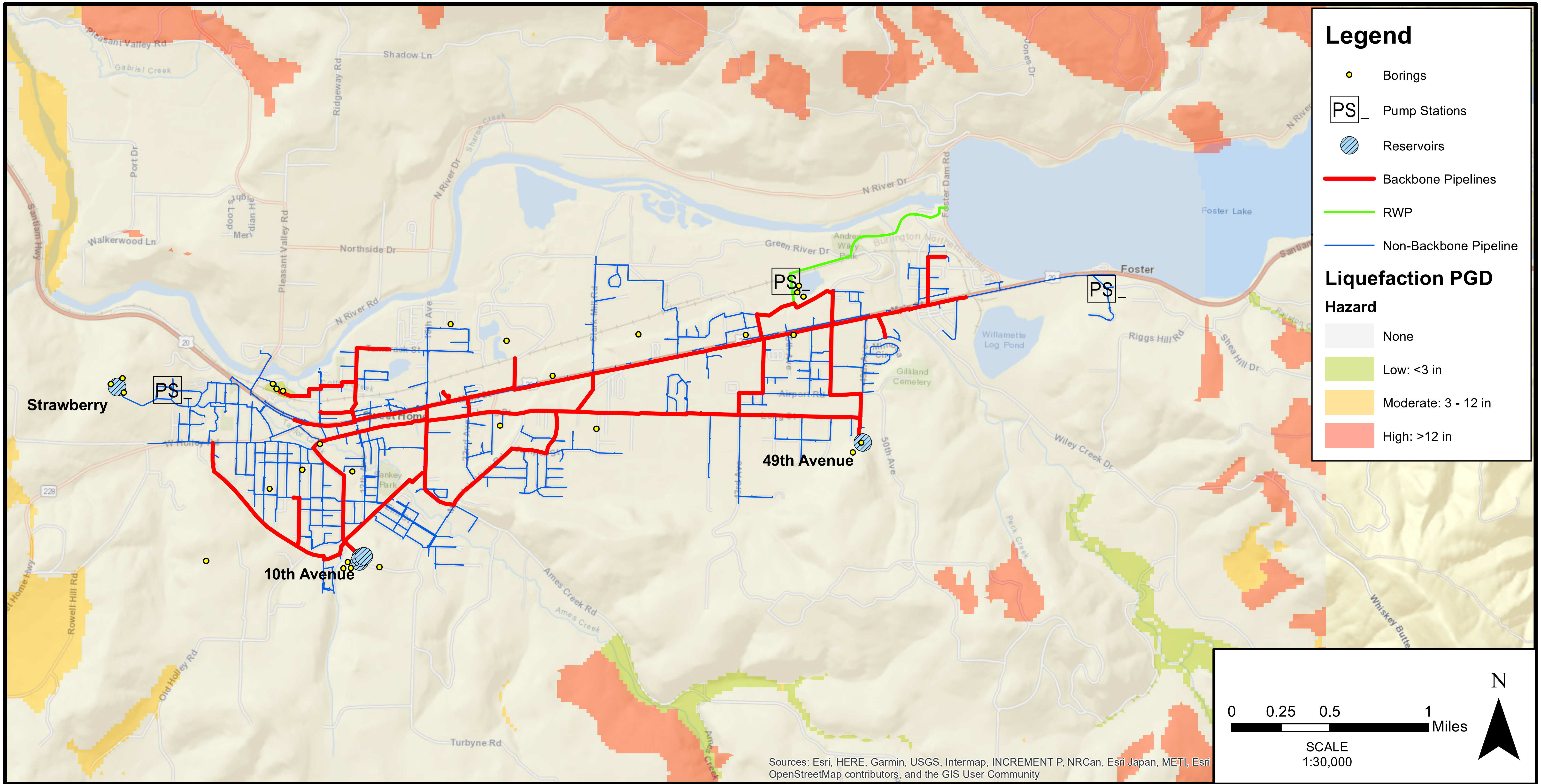
SEISMIC HAZARDS TECHNICAL MEMORANDUM
PEAK GROUND VELOCITY MAP

MAY
2023

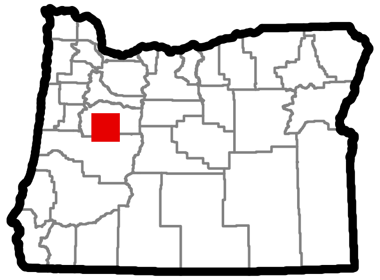
NOTES:
PEAK GROUND VELOCITY MAP ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.

FIGURE
2



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri OpenStreetMap contributors, and the GIS User Community



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CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

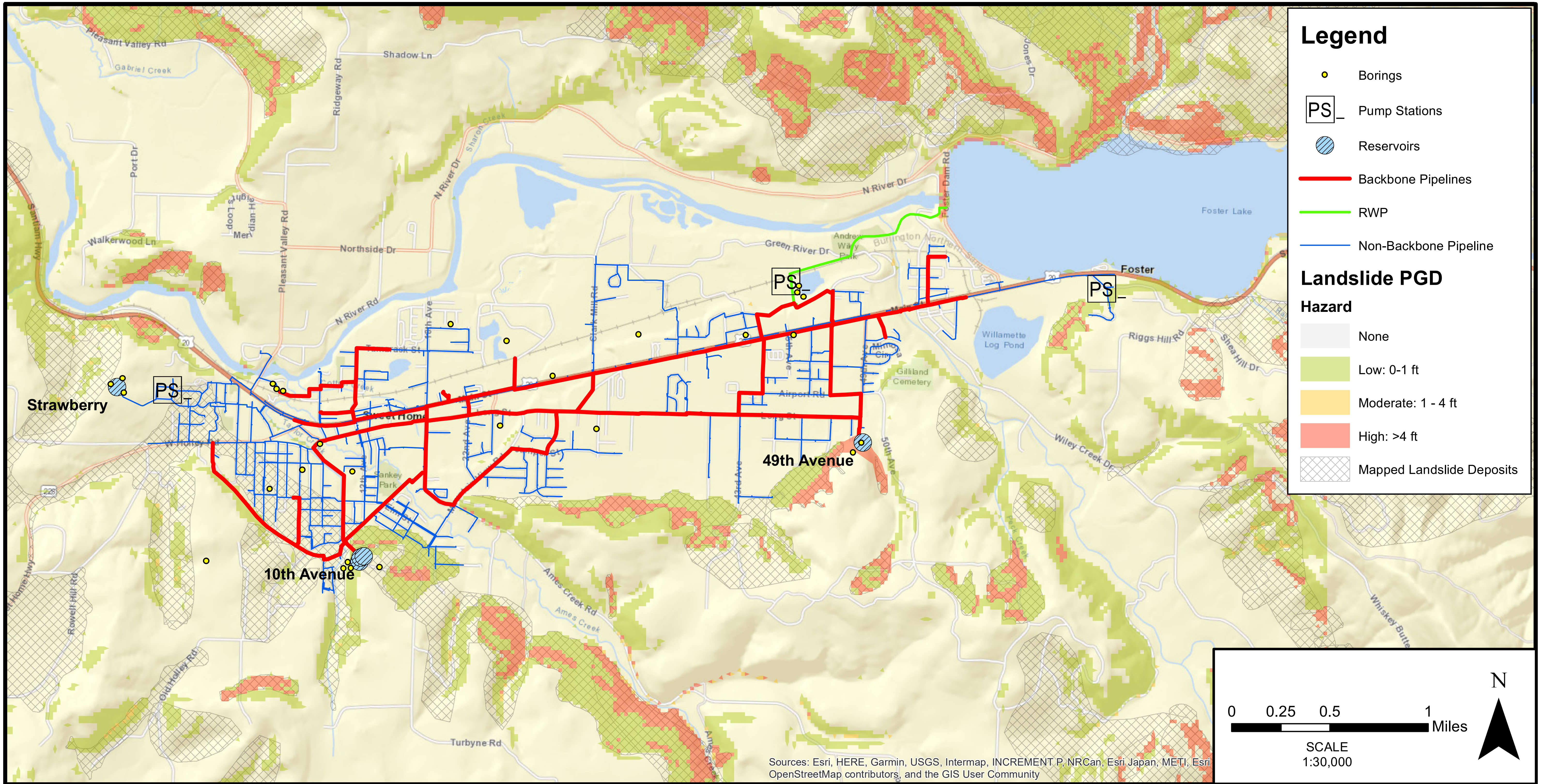
SEISMIC HAZARDS TECHNICAL MEMORANDUM
LIQUEFACTION SETTLEMENT MAP

MAY
2023

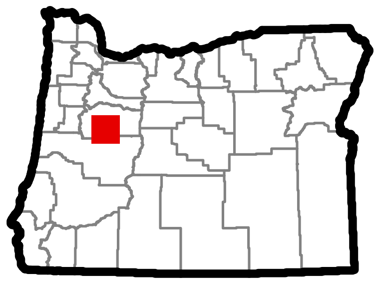
FIGURE
3

NOTES:
LIQUEFACTION SETTLEMENT MAP ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06 AND SITE OBSERVATIONS.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri OpenStreetMap contributors, and the GIS User Community



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CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

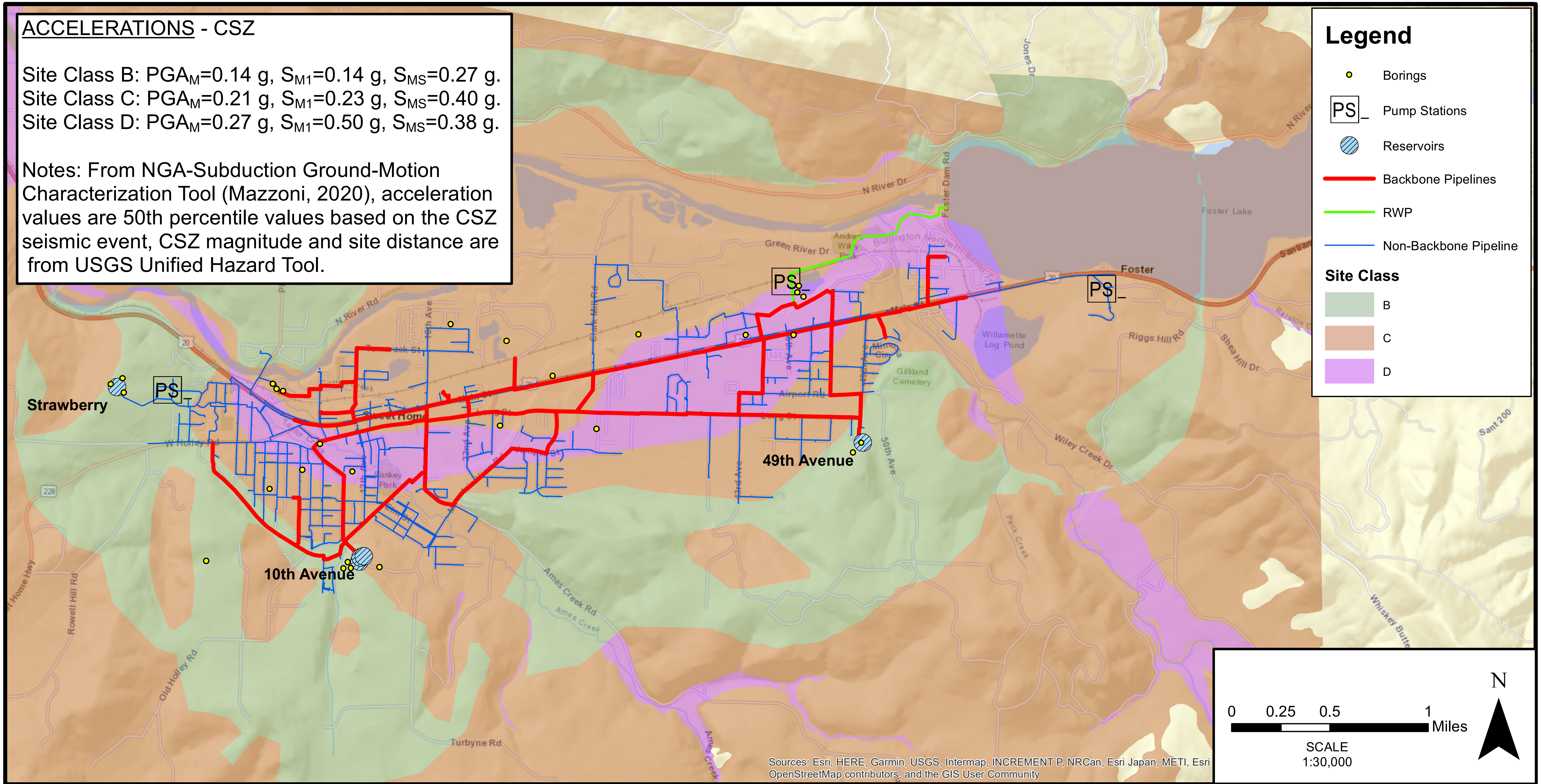
SEISMIC HAZARDS TECHNICAL MEMORANDUM
SEISMIC LANDSLIDE MAP

MAY
2023

NOTES:
SEISMIC LANDSLIDE MAP ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06 AND SITE OBSERVATIONS.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.

FIGURE
4

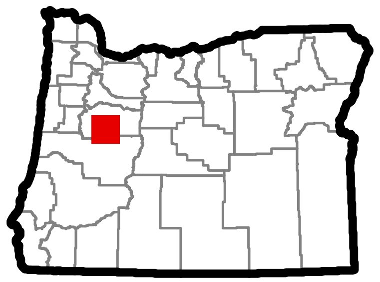


ACCELERATIONS - CSZ

Site Class B: PGA_M=0.14 g, S_{M1}=0.14 g, S_{MS}=0.27 g.
Site Class C: PGA_M=0.21 g, S_{M1}=0.23 g, S_{MS}=0.40 g.
Site Class D: PGA_M=0.27 g, S_{M1}=0.50 g, S_{MS}=0.38 g.

Notes: From NGA-Subduction Ground-Motion Characterization Tool (Mazzoni, 2020), acceleration values are 50th percentile values based on the CSZ seismic event, CSZ magnitude and site distance are from USGS Unified Hazard Tool.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri OpenStreetMap contributors, and the GIS User Community



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CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

SEISMIC HAZARDS TECHNICAL MEMORANDUM
SPECTRAL ACCELERATIONS - CSZ

MAY
2023

FIGURE
5

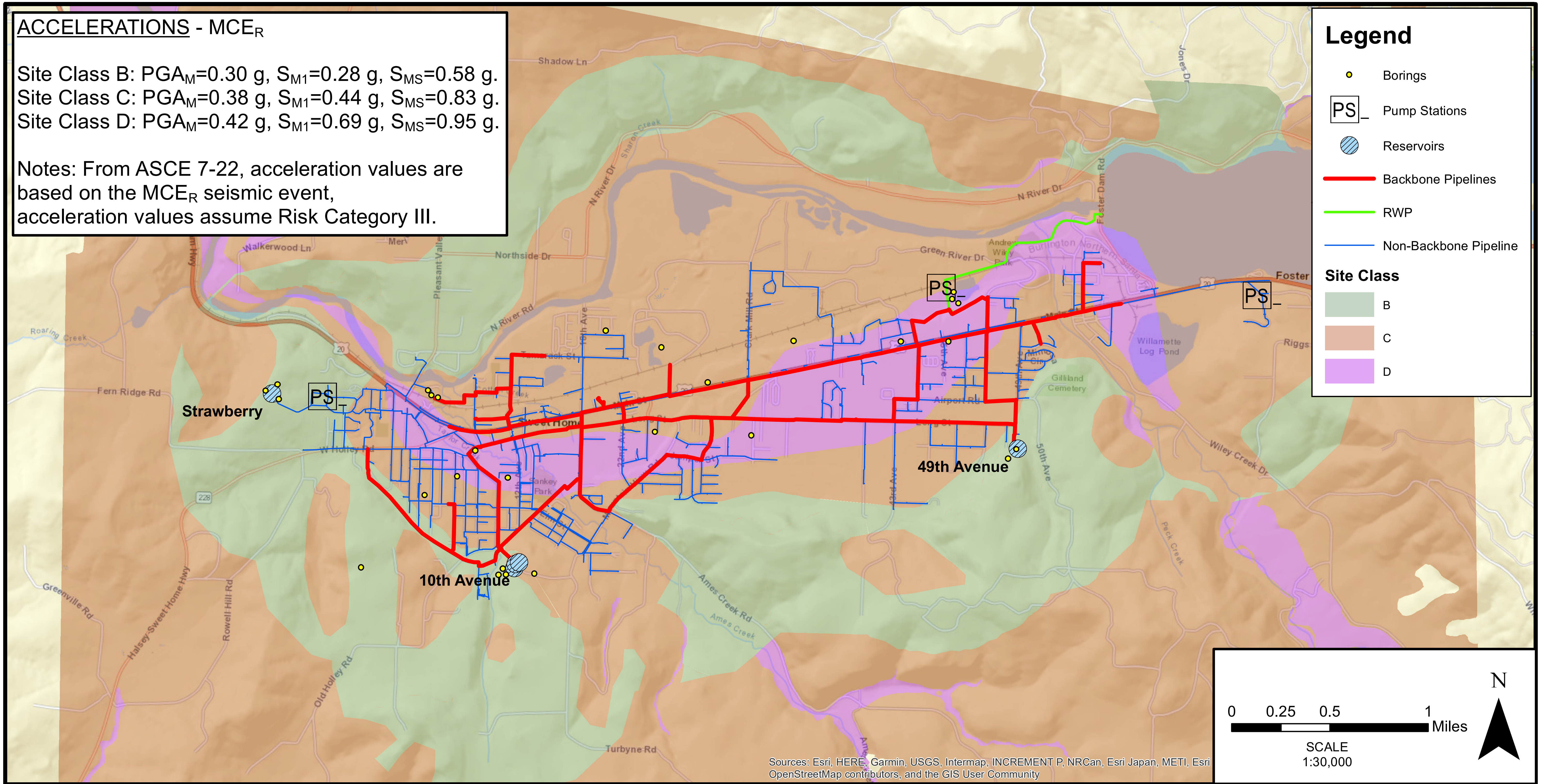
NOTES:
SPECTRAL ACCELERATIONS - CSZ ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06, USGS UHS, AND MAZZONI, 2020.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.

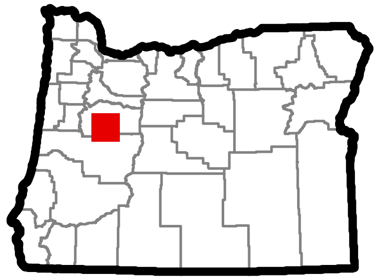
<u>ACCELERATIONS</u> - MCE_R

Site Class B: PGA_M=0.30 g, S_{M1}=0.28 g, S_{MS}=0.58 g.
Site Class C: PGA_M=0.38 g, S_{M1}=0.44 g, S_{MS}=0.83 g.
Site Class D: PGA_M=0.42 g, S_{M1}=0.69 g, S_{MS}=0.95 g.

Notes: From ASCE 7-22, acceleration values are based on the MCE_R seismic event, acceleration values assume Risk Category III.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri OpenStreetMap contributors, and the GIS User Community



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CITY OF SWEET HOME WATER SYSTEM EVALUATION
LINN COUNTY, OREGON

SEISMIC HAZARDS TECHNICAL MEMORANDUM
SPECTRAL ACCELERATIONS - MCE_R

MAY
2023

FIGURE
6

NOTES:
SPECTRAL ACCELERATIONS - MCE_R ESTIMATES SHOWN ARE BASED ON DATA FROM EXISTING BORINGS AND DOGAMI OPEN FILE REPORT O-13-06 AND ASCE 7-22.

AREAS OUTSIDE OF EXISTING BORINGS HAVE NOT BEEN VERIFIED.

Appendix C

Structural Seismic Resiliency Evaluation

ACE ENGINEERING LLC
professional structural engineering
commercial . residential . industrial

po box 231 . ashland . oregon 97520
541.552.1417 . ace-engineeringllc.com

STRUCTURAL
TECHNICAL MEMORANDUM

DATE: **June 1, 2023**

TO: **WEST YOST**

ATTENTION: **SANDRINE GANRY**

PROJECT: **2021-33, CITY OF SWEET HOME, OREGON, WATER MASTER PLAN**

SUBJECT: **ASCE/SEI 41-17 SEISMIC EVALUATION OF EXISTING STRUCTURES**

1.0 Introduction

The City of Sweet Home, Oregon (City) is currently conducting a Water Master Plan (WMP) for their water treatment and distribution system. The City has retained West Yost to perform the WMP. West Yost retained ACE Engineering LLC to perform the structural portion of the WMP.

The primary purpose of the structural portion of the WMP is to broadly identify the potential structural and seismic deficiencies of each significant structure in the water treatment and distribution system. This memorandum presents the results of the structural evaluation. The following tasks were completed as the structural scope of work:

1. Review existing documentation of each structure that was made available by the City.
2. Review Seismic Hazards Evaluation prepared by McMillen Jacobs Associates, April 27, 2022.
3. Site observation of each significant structure in the water treatment and distribution system on June 13 and 14, 2022.
4. Abbreviated description of the structural system of each significant structure in the water treatment and distribution system.
5. Complete ASCE/SEI 41-17 Tier 1 Checklists, Quick Checks, and Evaluations.
6. Abbreviated summary of findings and identification of shortcomings of each significant structure in the water treatment and distribution system.

2.0 Documentation Review

The City provided original design drawings for each of the significant structures in the water treatment and distribution system. The drawings include:

1. Raw Water Intake (2007).
2. Raw Water Pump Station (2008)
3. Water Treatment Building (2008)
4. Water Treatment Pond (2008)
5. Lake Pointe Pump Station (2016)
6. Strawberry Pump Station (2001)
7. Strawberry Reservoir (2001)
8. Strawberry Reservoir Vault (2001)
9. 10th Avenue Reservoir 300k Inactive (1938)
10. 10th Avenue Reservoir 700k (1951)
11. 10th Avenue Reservoir 1.5M (1969)
12. 49th Avenue Reservoir (1993)

A review of the structural drawings and details that were provided by the City was performed. The Geotechnical engineers at McMillen Jacobs Associates provided their Technical Memorandum for Seismic Hazards Evaluation for each site occupied by the water distribution system. A review of the Seismic Hazards Evaluation was performed.

3.0 Site Observation

Each significant structure of the water treatment and distribution system was observed on June 13 & 14, 2022. Steve Haney, Utilities Manager, of the City of Sweet Home was present during the site observations. The existing structures were observed for compliance with the original design drawings and details. Deviations from the original design documents were noted. Signs for structural deficiencies or distress were a primary focus and any signs were noted.

4.0 Structure Summaries

4.1 Raw Water Intake

The Raw Water Intake structure is located on Foster Reservoir Dam. The intake structure consists of a slab on grade with CMU block walls supporting a wood framed roof. The structure was built in 2007 and is in good condition. There is no rain gutter on the back side of the mono-sloped roof which as contributed to some minor exposure or scour on the downhill side of the building.

4.2 Raw Water Pump Station

The Raw Water Pump Station is located north of the Water Treatment Plant. The pump station consists of a concrete wet well with a CMU block pump house above approximately 8 feet of the east end. Approximately 16 feet of the pump house consists of a slab on grade with 8 feet being an elevated slab over the wet well. The CMU block walls support a wood framed truss roof. The structure was built in 2008 and is in good condition.

4.3 Water Treatment Building

The Water Treatment Building has a concrete clear well with a concrete slab top below a portion of the building. The remainder of the main floor consists of a slab on grade. The south side of the building is embedded into the hillside and the soil is retained by a concrete retaining wall. The remainder of the perimeter walls were constructed with 10” CMU block. The building is framed by Pre-Engineered Metal Building steel frames with light gauge metal roof purlins. The west portion of the building contains a wood framed mezzanine that contains offices, an IT room, a laboratory, and a meeting room.

The structure was built in 2008 and is in good condition despite some issues. Steven pointed out some insulation that became saturated when condensation building up on the underside of the metal roof. Rust and corrosion was observed near the base of most of the steel columns.

4.4 Water Treatment Pond

The Water Treatment Pond just north of the Water Treatment Building. The Water Treatment Pond is a concrete structure that was built in 2008 and is in good condition.

4.5 Lake Pointe Pump Station

The Lake Pointe Pump Station structure is located on the east side of town just off of Hwy 20 near Foster Reservoir. The pump station consists of a slab on grade with CMU block walls supporting wood framed roof trusses. The structure was built in 2016 and is in good condition.

4.6 Strawberry Pump Station

The Strawberry Pump Station consists of a plastic cover bolted to a concrete pad on grade. The plastic cover protects the pump & electrical panels from weather. The pump station was installed in 2001 and is in good condition.

4.7 Strawberry Reservoir

The Strawberry Reservoir is a bolted steel tank on a concrete foundation on grade that was built in 2001. Steven pointed out that several of the nuts for the anchor bolts are loose. Other than tightening the anchor nuts, the structure is in good condition.

4.8 Strawberry Reservoir Vault

The Strawberry Reservoir has an accessory structure on site. The vault structure consists of a slab on grade with CMU block walls supporting a grating floor and a wood framed roof. The structure was built in 2001 and is in fair condition. Mold, rust and corrosion was observed on the interior of the structure. A fan intended to provide ventilation does not appear to operate properly, if at all.

4.9 10th Avenue Reservoir 300k

The 300k gallon reservoir at 10th Avenue is inactive and is not providing service to the water distribution system. The existing reservoir consists of a concrete slab on grade with concrete walls and a concrete lid. The original drawings from 1938 show a wood framed lid, so at some point the structure was retrofitted. The reservoir is in fair condition.

4.10 10th Avenue Reservoir 700k

The 700k gallon reservoir at 10th Avenue consists of a concrete slab on grade with concrete walls and a concrete lid. The walls have been coated with shotcrete at some point. It is unlikely that the original structure was constructed using shotcrete in 1951. The shotcrete coating may have been used to seal cracks and protect the existing concrete walls, but that is speculation. For a structure originally built in 1951 it is in good condition.

4.11 10th Avenue Reservoir 1.5M

The 1.5M gallon reservoir at 10th Avenue consists of a concrete slab on grade with concrete walls and a concrete lid. Similar to the 700k reservoir, the walls of the 1.5M reservoir have a shotcrete finish. It is possible that the original structure was constructed using shotcrete in 1969. It is also possible that the shotcrete coating may have been used to seal cracks and protect the existing concrete walls, but that is speculation. For a structure originally built in 1969 it is in good condition.

4.12 49th Avenue Reservoir 2.0M

The 2.0M gallon reservoir at 49th Avenue consists of a concrete slab on grade with concrete walls and a concrete lid. Similar to the two previously mentioned reservoirs, the walls of the 2.0M reservoir have a shotcrete finish. It is possible that the original structure was constructed using shotcrete in 1993. It is also possible that the shotcrete coating may have been used to seal cracks and protect the existing concrete walls, but that is speculation. For a structure originally built in 1993 it is in good condition.

5.0 ASCE/SEI 41-17 Tier 1 Checklists, Quick Checks, and Evaluations

The Tier 1 level of the American Society of Civil Engineer's "Seismic Evaluation of Existing Buildings – ASCE 41-17" guideline was used to evaluate each structure. The purpose of a Tier 1 evaluation is to provide "Quick Checks" to evaluate a structure and determine deficiencies related to the lateral resisting elements.

It is the intent of the evaluation to determine the structural deficiencies of each structure as compared to current prescribed loading and detailing requirements for lateral (wind/seismic) loading to a performance level of "Immediate Occupancy" per ASCE 41-17 section 2.3.1.1. The level of performance is defined per ASCE 41-17 as:

"Structural Performance Level S-1, Immediate Occupancy, is defined as the postearthquake damage state in which a structure remains safe to occupy and essentially retains its preearthquake strength and stiffness."

The commentary to ASCE 41-17 section 2.3.1.1 describes the level of performance as:

"Only very limited structural damage has occurred. The basic vertical- and lateral-force-resisting systems of the building retain almost all of the preearthquake strength and stiffness. The risk of life-threatening injury as a result of structural damage is very low, and although some minor structural repairs might be appropriate, these repairs would generally not be required before reoccupancy. Continued use of the building is not limited by its structural condition but might be limited by damage or disruption to nonstructural elements of the building, furnishings, or equipment and availability of external utility services."

ASCE 41-17 requires that a seismic hazard level is determined. In order to obtain a performance level of "Immediate Occupancy" the seismic hazard shall be BSE-1E as defined in section 2.4.1.4 and C2.4.1.4. The BSE-1E hazard level earthquake has a 20% chance of recurring every 50 years. This design level earthquake has a similar rate of occurrence and magnitude as the current state adopted building codes. A 25% reduction in force is recommended by the State of Oregon for seismic rehabilitation grants. The City of Portland City Code for the evaluation and rehabilitation of existing buildings contains similar recommendations. It is likely that this level of earthquake hazard provides an appropriate level of performance for these facilities.

Lateral force resisting systems work in conjunction with gravity framing systems. The existing gravity framing system was also observed for structural distress during the site observation.

ASCE 41-17 requires that non-structural items retain their position during earthquake shaking for structures in order to obtain a performance level of "Immediate Occupancy". Non-structural items include utilities, fixtures, equipment, finishes and furnishings.

The ASCE 41-17 checklists for each structure are included in Appendix A for reference.

6.0 Seismic Rehabilitation Recommendations

The following items summarize the findings and recommendations for structural improvements for each structure. The recommendations are required to resolve structural deficiencies and maintain the load bearing system of each structure. A complete load bearing system that is capable of resisting building code load combinations is important to the continuing performance of each structure.

6.1 Raw Water Intake

The Raw Water Intake structure is considered a Reinforced Masonry Bearing Walls with Flexible Diaphragm (RM1) structure. No deficiencies were found in the checklists for the Raw Water Intake structure. The only non-structural deficiency found during the site observation is:

- Lack of rain gutter on the back side of the roof contributing to some minor exposure or scour on the downhill side of the building.

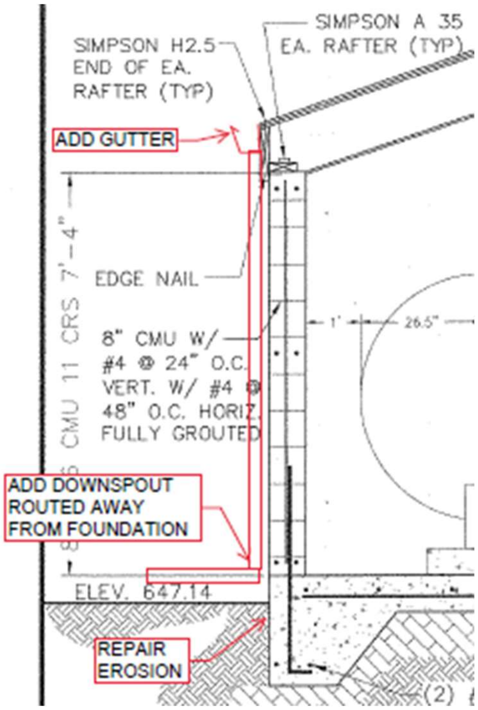

Figure 6.1 Raw Water Intake

6.2 Raw Water Pump Station

The Raw Water Pump Station is considered a Reinforced Masonry Bearing Walls with Flexible Diaphragm (RM1) structure. No deficiencies were found in the checklists, document review and site observation for the Raw Water Pump Station structure.

6.3 Water Treatment Building

The Water Treatment Building is considered a Reinforced Masonry Bearing Walls with Flexible Diaphragm (RM1) structure in the east-west direction and a Metal Building Frame (S3) in the north-south direction. The noncompliant items discovered in the checklists and site observation include:

- REDUNDANCY: The mezzanine is open to the east toward the filters making it a 3 sided diaphragm. No shear walls are provided for lateral resistance of the mezzanine diaphragm along the east side.
- PROPORTIONS: The height to thickness ratio of the masonry walls exceed the recommended limits.
- OPENINGS AT EXTERIOR MASONRY WALLS: The stair opening in the mezzanine diaphragm is adjacent to the exterior masonry wall and exceeds the recommended limits.
- PLAN IRREGULARITIES: The stair opening in the mezzanine diaphragm is considered a plan irregularity. There is a lack of tensile capacity around the stair opening in the mezzanine diaphragm.
- UNBLOCKED DIAPHRAGMS: The mezzanine diaphragm was not noted to have blocking at the plywood panel edges. The unblocked diaphragm exceeds allowable limits and aspect ratios when subject to east-west lateral loading.
- SUSPENDED CONTENTS: Several items are suspended from the structure and are free to swing or move but may damage themselves or adjoining components.
- TALL NARROW EQUIPMENT: There are several pieces of equipment more than 6 feet tall that should be anchored to the floor or adjacent walls.
- CONDUIT COUPLINGS: Conduit greater than 2.5 inches should have flexible couplings.
- The condensation buildup above the insulation should be addressed to prevent further failure of the insulation.
- The rust and corrosion around the base of the steel columns should be treated, repaired and properly coated to prevent further deterioration.

Fig 6.3.1 Open Mezzanine Lacks Redundancy

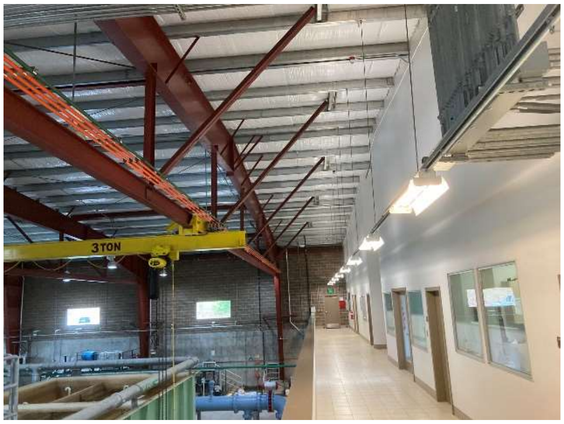

Figure 6.3.2 Lights & Conduits at Egress

Figure 6.3.3 Corrosion at Steel Columns

Figure 6.3.4 Tanks without Restraints

6.4 Water Treatment Pond

The Water Treatment Pond is considered a Concrete Shear Wall (C2) structure. No deficiencies were found in the checklists, document review and site observation for the Water Treatment Pond structure.

6.5 Lake Pointe Pump Station

The Lake Pointe Pump Station is considered a Reinforced Masonry Bearing Walls with Flexible Diaphragm (RM1) structure. No deficiencies were found in the checklists, document review and site observation for the Lake Pointe Pump Station structure.

6.6 Strawberry Pump Station

The Strawberry Pump Station is an unclassified structure. No deficiencies were found in the checklists, document review and site observation.

6.7 Strawberry Reservoir

The Strawberry Reservoir is considered a Steel Plate Shear Wall (S6) structure. No deficiencies were found in the checklists, document review. The only item to be addressed from the site observation is:

- Tighten the nuts of the existing anchor bolts.

Figure 6.7 Strawberry Reservoir Anchor Bolts

6.8 Strawberry Reservoir Vault

The Strawberry Reservoir is considered a Reinforced Masonry Bearing Walls with Flexible Diaphragm (RM1) structure. No deficiencies were found in the checklists, document review. The items to be addressed from the site observation include:

- Repair the fan or provide adequate ventilation to prevent future build up of mold, rust and corrosion
- Clean and repair the mold, rust and corrosion to original condition.

Figure 6.8.1 Strawberry Vault

Figure 6.8.2 Strawberry Vault Corrosion

6.9 10th Avenue Reservoir 300k

The 300k gallon reservoir at 10th Avenue is considered a Concrete Shear Wall (C2) structure. No deficiencies were found in the checklists, document review and site observation.

6.10 10th Avenue Reservoir 700k

The 700k gallon reservoir at 10th Avenue is considered a Concrete Shear Wall (C2) structure. No deficiencies were found in the checklists, document review and site observation.

6.11 10th Avenue Reservoir 1.5M

The 1.5M gallon reservoir at 10th Avenue is considered a Concrete Shear Wall (C2) structure. The noncompliant items discovered in the checklists and site observation include:

- REINFORCING STEEL: The amount of vertical reinforcing steel bars in the existing concrete walls is less than the recommended amount.
- WALL THICKNESS: The perimeter wall thickness exceeds the recommended limit for the unsupported height of the reservoir.

6.12 49th Avenue Reservoir 2.0M

The 2.0M gallon reservoir at 49th Avenue is considered a Concrete Shear Wall (C2) structure. The only noncompliant item discovered in the checklists and site observation include:

- WALL THICKNESS: The perimeter wall thickness exceeds the recommended limit for the unsupported height of the reservoir.

Figure 6.12 49th Avenue Reservoir 2.0M Wall

6.13 General nonstructural items.

It is recommended that City staff review the Nonstructural Checklist and consider the items at each facility for compliance with the best practices for storing items and equipment. Some conditions to consider include:

- FIRE SUPPRESSION PIPING: Make sure piping is anchored and braced in accordance with current NFPA standards. Consider anchoring and bracing all piping in all facilities.
- HAZARDOUS MATERIAL STORAGE: Some chemicals used in the treatment process or used during regular cleaning and maintenance processes may be considered hazardous when spilled. Items storing these chemicals should be restrained to prevent displacement, tipping or falling.
- HAZARDOUS MATERIAL DISTRIBUTION: Natural gas piping should anchored or braced adequately to prevent damage that might allow the hazardous material to release.
- SHUTOFF VALVES: Piping containing hazardous material, including natural gas, should have shutoff valves or other devices to prevent spills or leaks.
- FLEXIBLE COUPLINGS: Hazardous material, ductwork and piping, including natural gas piping, should have flexible couplings.
- LIGHT FIXTURES LENSE COVERS: Make sure lens covers on light fixtures are attached with safety devices and add safety devices if necessary.
- INDUSTRIAL STORAGE RACKS: Industrial storage racks or similar items that are more than 12 feet high should be anchored to the floor.
- TALL NARROW CABINETS: Cabinets, lockers, bookshelves, etc. more than 6 feet high and with height-to-depth ratios exceeding 3:1 should anchored to the floor or wall.
- FALL-PRONE CONTENTS: Equipment, stored items weighing more than 20 pounds and more than 4 feet above the floor should be braced or restrained.
- FALL-PRONE EQUIPMENT: Equipment weighing more than 20 pounds and more than 4 feet above the floor should be braced or restrained.
- IN-LINE EQUIPMENT: Equipment installed in line with a duct or piping system, with an operating weight more than 75 pounds should be laterally braced independent of the duct or piping system.
- TALL NARROW EQUIPMENT: Equipment, tanks, etc. more than 6 feet high and with height-to-depth ratios exceeding 3:1 should anchored to the floor or wall.
- SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing should be free to swing or move with the structure without damaging itself or adjoining components.
- HEAVY EQUIPMENT: Floor supported or platform supported equipment weighing more than 400 pounds should be anchored to the structure.
- CONDUIT COUPLINGS: Conduit greater than 2.5 inches should have flexible couplings.
- FLEXIBLE COUPLINGS: Fluid and gas piping should have flexible couplings.
- FLUID AND GAS PIPING: Fluid and gas piping should be anchored and braced to the structure to limit spills or leaks.

Based on previous experience and observations at site the buildings may contain some form of hazardous material. These materials will need to be dealt with on a case-by-case basis as they are encountered during the project.

7.0 Conclusions

The majority of the Sweet Home water treatment and distribution system is in reasonable structural condition. Maintenance and structural upgrades should be part of the City’s operating plan. Replacement of aging structures should also be included in the City’s long term plan regardless of physical condition.

8.0 Limitations

This Structural Technical Memorandum has been prepared for the City of Sweet Home Water Master Plan. The conclusions and recommendations in this memorandum were derived from the professional review of documentation that was provided by the City of Sweet Home, West Yost, published literature and limited site observations. ACE Engineering is not responsible for errors and omissions that might exist in documents and construction performed by others.

This report has been completed within the limitation of the West Yost approved scope of work. The services provided have been performed in a manner consistent with the level of competency presently maintained by other practicing professional engineers in the same type of work in the community of the project for the professional and technical soundness, accuracy, and adequacy of the work. ACE Engineering is not responsible for the use of this report for anything other than the Sweet Home Water Master Plan.

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APPENDIX A - **ASCE/SEI 41-17 CHECKLISTS**

Table 17-3. Immediate Occupancy Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Building System—General			
[✓ C] NC N/A U	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1
C NC [✓ N/A] U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.5% of the height of the shorter building in low seismicity, 1.0% in moderate seismicity, and 3.0% in high seismicity.	5.4.1.2	A.2.1.2
C [✓ NC] N/A U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure.	5.4.1.3	A.2.1.3
Building System—Building Configuration			
C NC [✓ N/A] U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above.	5.4.2.1	A.2.2.2
C NC [✓ N/A] U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above.	5.4.2.2	A.2.2.3
[✓ C] NC N/A U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	5.4.2.3	A.2.2.4
[✓ C] NC N/A U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines.	5.4.2.4	A.2.2.5
[✓ C] NC N/A U	MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered.	5.4.2.5	A.2.2.6

continues

Table 17-3 *(Continued)*. Immediate Occupancy Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension.	5.4.2.6	A.2.2.7
Low Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Geologic Site Hazards			
[✓ C] NC N/A U	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building.	5.4.3.1	A.6.1.1
[✓ C] NC N/A U	SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure.	5.4.3.1	A.6.1.2
[✓ C] NC N/A U	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated.	5.4.3.1	A.6.1.3
Moderate and High Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)			
Foundation Configuration			
[✓ C] NC N/A U	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$.	5.4.3.3	A.6.2.1
[✓ C] NC N/A U	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C.	5.4.3.4	A.6.2.2

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

FOSTER DAM RAW WATER INTAKE STRUCTURE

Table 17-35. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.^{2} (4.83 MPa).	5.5.3.1.1	A.3.2.4.1
[✓ C] NC N/A U	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls.	5.5.3.1.3	A.3.2.4.2
Connections			
[✓ C] NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1

continues

Table 17-35 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
[✓ C] NC N/A U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1
Stiff Diaphragms			
C NC [✓ N/A] U	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab.	5.6.4	A.4.5.1
C NC [✓ N/A] U	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements.	5.7.2	A.5.2.3
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides.	5.5.3.1.5	A.3.2.4.3
[✓ C] NC N/A U	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30.	5.5.3.1.2	A.3.2.4.4
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft (1.2 m) long.	5.6.1.3	A.4.1.6
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
C NC [✓ N/A] U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
[✓ C] NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
[✓ C] NC N/A U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
[✓ C] NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
[✓ C] NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
[✓ C] NC N/A U	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors.	5.7.1.2	A.5.1.4

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

WATER TREATMENT PLANT RAW WATER INTAKE

Table 17-35. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.^{2} (4.83 MPa).	5.5.3.1.1	A.3.2.4.1
[✓ C] NC N/A U	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls.	5.5.3.1.3	A.3.2.4.2
Connections			
[✓ C] NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1

continues

Table 17-35 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
[✓ C] NC N/A U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1
Stiff Diaphragms			
C NC [✓ N/A] U	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab.	5.6.4	A.4.5.1
C NC [✓ N/A] U	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements.	5.7.2	A.5.2.3
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides.	5.5.3.1.5	A.3.2.4.3
[✓ C] NC N/A U	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30.	5.5.3.1.2	A.3.2.4.4
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft (1.2 m) long.	5.6.1.3	A.4.1.6
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
C NC [✓ N/A] U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
[✓ C] NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
[✓ C] NC N/A U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
[✓ C] NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
[✓ C] NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
[✓ C] NC N/A U	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors.	5.7.1.2	A.5.1.4

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

WATER TREATMENT PLANT

Table 17-35. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
C [✓ NC] N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. MEZZANINE	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.^{2} (4.83 MPa).	5.5.3.1.1	A.3.2.4.1
[✓ C] NC N/A U	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls.	5.5.3.1.3	A.3.2.4.2
Connections			
C [✓ NC] N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C [✓ NC] N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1

continues

Table 17-35 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
[✓ C] NC N/A U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1
Stiff Diaphragms			
C NC [✓ N/A] U	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab.	5.6.4	A.4.5.1
C NC [✓ N/A] U	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements.	5.7.2	A.5.2.3
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides.	5.5.3.1.5	A.3.2.4.3
C [✓ NC] N/A U	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30. 35.8	5.5.3.1.2	A.3.2.4.4
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
C [✓ NC] N/A U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft (1.2 m) long.	5.6.1.3 MEZZANINE	A.4.1.6
C [✓ NC] N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
C NC [✓ N/A] U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
[✓ C] NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
[✓ C] NC N/A U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C [✓ NC] N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2 MEZZANINE	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
[✓ C] NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
[✓ C] NC N/A U	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors.	5.7.1.2	A.5.1.4

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

WATER TREATMENT PLANT

Table 17-13. Immediate Occupancy Checklist for Building Type S3

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low and Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	BRACE AXIAL STRESS CHECK: The axial stress in the diagonals, calculated using the Quick Check procedure of Section 4.4.3.4, is less than 0.50F_y.	5.5.4.1	A.3.3.1.2
[✓ C] NC N/A U	FLEXURAL STRESS CHECK: The average flexural stress in the moment-frame columns and beams, calculated using the Quick Check procedure of Section 4.4.3.9, is less than F_y.	5.5.2.1.2	A.3.1.3.3
Connections			
[✓ C] NC N/A U	TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel moment frames.	5.7.2	A.5.2.2
[✓ C] NC N/A U	STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation.	5.7.3.1	A.5.3.1
Moderate Seismicity (Complete the Following Items in Addition to the Items for Very Low and Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the elastic moment (F_yS) of the adjoining members.	5.5.2.2.1	A.3.1.3.4
Diaphragms			
C NC [✓ N/A] U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7

continues

Table 17-13 *(Continued)*. Immediate Occupancy Checklist for Building Type S3

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
C NC [✓ N/A] U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
[✓ C] NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	ROOF PANELS: Where considered as diaphragm elements for lateral resistance, metal, plastic, or cementitious roof panels are positively attached to the roof framing to resist seismic forces.	5.7.5	A.5.5.1
C NC [✓ N/A] U	WALL PANELS: Where considered as shear elements for lateral resistance, metal, fiberglass, or cementitious wall panels are positively attached to the framing and foundation to resist seismic forces.	5.7.5	A.5.5.2
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	MOMENT-RESISTING CONNECTIONS: All moment connections are able to develop the strength of the adjoining members or panel zones.	5.5.2.2.1	A.3.1.3.4
[✓ C] NC N/A U	COMPACT MEMBERS: All frame elements meet compact section requirements in accordance with AISC 360, Table B4.1.	5.5.2.2.4	A.3.1.3.8
C NC [✓ N/A] U	BEAM PENETRATIONS: All openings in frame-beam webs are less than one quarter of the beam depth and are located in the center half of the beams.	5.5.2.2.5	A.3.1.3.9
[✓ C] NC N/A U	OUT-OF-PLANE BRACING: Beam–column joints are braced out of plane.	5.5.2.2.7	A.3.1.3.11
[✓ C] NC N/A U	BOTTOM FLANGE BRACING: The bottom flanges of beams are braced out of plane.	5.5.2.2.8	A.3.1.3.12
Connections			
[✓ C] NC N/A U	TRANSFER TO STEEL FRAMES: Diaphragms are connected for transfer of seismic forces to the steel moment frames, and the connections are able to develop the lesser of the strength of the frames or the diaphragms.	5.7.2	A.5.2.2
[✓ C] NC N/A U	STEEL COLUMNS: The columns in seismic-force-resisting frames are anchored to the building foundation, and the anchorage is able to develop the least of the following: the tensile capacity of the column, the tensile capacity of the lowest level column splice (if any), or the uplift capacity of the foundation.	5.7.3.1	A.5.3.1
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the seismic forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

LAKE POINT PUMP STATION

Table 17-35. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than 70 lb/in.^{2} (4.83 MPa).	5.5.3.1.1	A.3.2.4.1
[✓ C] NC N/A U	REINFORCING STEEL: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls.	5.5.3.1.3	A.3.2.4.2
Connections			
[✓ C] NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.	5.7.1.3	A.5.1.2
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1

continues

Table 17-35 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types RM1 and RM2

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
[✓ C] NC N/A U	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support.	5.7.4.1	A.5.4.1
Stiff Diaphragms			
C NC [✓ N/A] U	TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab.	5.6.4	A.4.5.1
C NC [✓ N/A] U	TOPPING SLAB TO WALLS OR FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements.	5.7.2	A.5.2.3
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	REINFORCING AT WALL OPENINGS: All wall openings that interrupt rebar have trim reinforcing on all sides.	5.5.3.1.5	A.3.2.4.3
[✓ C] NC N/A U	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than 30.	5.5.3.1.2	A.3.2.4.4
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft (1.2 m) long.	5.6.1.3	A.4.1.6
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
C NC [✓ N/A] U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
[✓ C] NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
[✓ C] NC N/A U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
[✓ C] NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
[✓ C] NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
[✓ C] NC N/A U	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors.	5.7.1.2	A.5.1.4

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

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Table 17-24. Collapse Prevention Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low and Moderate Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
C NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction.	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation.	5.7.3.4	A.5.3.5
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning.	5.5.3.2.1	A.3.2.2.3
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length.	5.6.1.3	A.4.1.4
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A [✓ U]	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
C NC N/A [✓ U]	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
[✓ C] NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC [✓ N/A] U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than 8d_b.	5.5.3.2.2	A.3.2.2.5
C NC [✓ N/A] U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
C [✓ NC] N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
[✓ C] NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
[✓ C] NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
[✓ C] NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC [✓ N/A] U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5
C NC [✓ N/A] U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
[✓ C] NC N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
[✓ C] NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

10TH STREET RESERVOIR - 1951 TANK

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
[✓ C] NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
[✓ C] NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC [✓ N/A] U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5
C NC [✓ N/A] U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
[✓ C] NC N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
[✓ C] NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

10TH STREET RESERVOIR - 1969 TANK

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
C [✓ NC] N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
[✓ C] NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC [✓ N/A] U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5
C NC [✓ N/A] U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
C [✓ NC] N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
[✓ C] NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

49TH STREET RESERVOIR

Table 17-25. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Very Low Seismicity			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
[✓ C] NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
[✓ C] NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
[✓ C] NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (457 mm).	5.5.3.1.3	A.3.2.2.2
Connections			
C NC [✓ N/A] U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
[✓ C] NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms.	5.7.2	A.5.2.1
[✓ C] NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation.	5.7.3.4	A.5.3.5
Foundation System			
C NC [✓ N/A] U	DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil.		A.6.2.3
[✓ C] NC N/A U	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story.		A.6.2.4
Low, Moderate, and High Seismicity (Complete the Following Items in Addition to the Items for Very Low Seismicity)			
Seismic-Force-Resisting System			
[✓ C] NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items in Table 17-23: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOKS.	5.5.2.5.2	A.3.1.6.2
[✓ C] NC N/A U	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC [✓ N/A] U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall.	5.5.3.2.1	A.3.2.2.3
[✓ C] NC N/A U	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered.	5.5.3.1.4	A.3.2.2.4
C NC [✓ N/A] U	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.	5.5.3.2.2	A.3.2.2.5
C NC [✓ N/A] U	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall.	5.5.3.1.5	A.3.2.2.6
C [✓ NC] N/A U	WALL THICKNESS: Thicknesses of bearing walls are not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (101 mm).	5.5.3.1.2	A.3.2.2.7

continues

Table 17-25 *(Continued)*. Immediate Occupancy Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Diaphragms (Stiff or Flexible)			
[✓ C] NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
[✓ C] NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length.	5.6.1.3	A.4.1.4
[✓ C] NC N/A U	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities.	5.6.1.4	A.4.1.7
[✓ C] NC N/A U	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension.	5.6.1.5	A.4.1.8
Flexible Diaphragms			
C NC [✓ N/A] U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC [✓ N/A] U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC [✓ N/A] U	SPANS: All wood diaphragms with spans greater than 12 ft (3.6 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC [✓ N/A] U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft (9.2 m) and aspect ratios less than or equal to 3-to-1.	5.6.2	A.4.2.3
C NC [✓ N/A] U	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft (12.2 m) and have aspect ratios less than 4-to-1.	5.6.3	A.4.3.1
C NC [✓ N/A] U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC [✓ N/A] U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-38. Nonstructural Checklist

Status	Evaluation Statement^{a,b}	Tier 2 Reference	Commentary Reference
Life Safety Systems			
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13.	13.7.4	A.7.13.1
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13.	13.7.4	A.7.13.2
[✓ C] NC N/A U	**HR—not required; LS—LMH; PR—LMH**. EMERGENCY POWER: Equipment used to power or control Life Safety systems is anchored or braced.	13.7.7	A.7.12.1
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints.	13.7.6	A.7.14.1
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13.	13.7.4	A.7.13.3
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—LMH**. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced.	13.7.9	A.7.3.1
Hazardous Materials			
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers.	13.7.1	A.7.12.2
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods.	13.8.3	A.7.15.1
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release.	13.7.3 13.7.5	A.7.13.4
[✓ C] NC N/A U	**HR—MH; LS—MH; PR—MH**. SHUTOFF VALVES: Piping containing hazardous material, including natural gas, has shutoff valves or other devices to limit spills or leaks.	13.7.3 13.7.5	A.7.13.3
[✓ C] NC N/A U	**HR—LMH; LS—LMH; PR—LMH**. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, have flexible couplings.	13.7.3 13.7.5	A.7.15.4
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements.	13.7.3 13.7.5 13.7.6	A.7.13.6
Partitions			
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft (3.0 m) in Low or Moderate Seismicity, or at most 6 ft (1.8 m) in High Seismicity.	13.6.2	A.7.1.1
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system.	13.6.2	A.7.2.1
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005.	13.6.2	A.7.1.2
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—MH**. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system.	13.6.2	A.7.2.1
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints.	13.6.2	A.7.1.3

continues

Table 17-38 *(Continued)*. Nonstructural Checklist

Status	Evaluation Statement^{a,b}	Tier 2 Reference	Commentary Reference
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft (1.8 m).	13.6.2	A.7.1.4
Ceilings			
C NC [✓ N/A] U	**HR—H; LS—MH; PR—LMH**. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft^2 (1.1 m^2) of area.	13.6.4	A.7.2.3
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—LMH**. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft^2 (1.1 m^2) of area.	13.6.4	A.7.2.3
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—MH**. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) and ceilings of smaller areas that are not surrounded by restraining partitions are laterally restrained at a spacing no greater than 12 ft (3.6 m) with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression.	13.6.4	A.7.2.2
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—MH**. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in. (13 mm); in High Seismicity, 3/4 in. (19 mm).	13.6.4	A.7.2.4
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures.	13.6.4	A.7.2.5
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft^2 (13.4 m^2) are supported by closure angles or channels not less than 2 in. (51 mm) wide.	13.6.4	A.7.2.6
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2,500 ft^2 (232.3 m^2) and has a ratio of long-to-short dimension no more than 4-to-1.	13.6.4	A.7.2.7
Light Fixtures			
[✓ C] NC N/A U	**HR—not required; LS—MH; PR—MH**. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture.	13.6.4 13.7.9	A.7.3.2
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft. Unbraced suspended fixtures are free to allow a 360-degree range of motion at an angle not less than 45 degrees from horizontal without contacting adjacent components. Alternatively, if rigidly supported and/or braced, they are free to move with the structure to which they are attached without damaging adjoining components. Additionally, the connection to the structure is capable of accommodating the movement without failure.	13.7.9	A.7.3.3
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. LENS COVERS: Lens covers on light fixtures are attached with safety devices.	13.7.9	A.7.3.4
Cladding and Glazing			
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft^2 (0.48 kN/m^2) are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft (1.8 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft (1.2 m)	13.6.1	A.7.4.1

continues

Table 17-38 *(Continued)*. Nonstructural Checklist

Status	Evaluation Statement^{a,b}	Tier 2 Reference	Commentary Reference
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. CLADDING ISOLATION: For steel or concrete moment-frame buildings, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less.	13.6.1	A.7.4.3
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio by the use of rods attached to framing with oversize holes or slotted holes of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02, and the rods have a length-to-diameter ratio of 4.0 or less.	13.6.1	A.7.4.4
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. THREADED RODS: Threaded rods for panel connections detailed to accommodate drift by bending of the rod have a length-to-diameter ratio greater than 0.06 times the story height in inches for Life Safety in Moderate Seismicity and 0.12 times the story height in inches for Life Safety in High Seismicity and Position Retention in any seismicity.	13.6.1	A.7.4.9
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. PANEL CONNECTIONS: Cladding panels are anchored out of plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections.	13.6.1.4	A.7.4.5
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel.	13.6.1.4	A.7.4.6
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—MH**. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel.	13.6.1.4	A.7.4.7
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes more than 16 ft^2 (1.5 m^2) in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked.	13.6.1.5	A.7.4.8
Masonry Veneer			
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft^2 (0.25 m^2), and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in. (914 mm); for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (610 mm).	13.6.1.2	A.7.5.1
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor.	13.6.1.2	A.7.5.2
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing.	13.6.1.2	A.7.5.3
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup.	13.6.1.1 13.6.1.2	A.7.7.2
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. STUD TRACKS: For veneer with cold-formed steel stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. (610 mm) on center.	13.6.1.1 13.6.1.2	A.7.6.1

continues

Table 17-38 *(Continued)*. Nonstructural Checklist

Status	Evaluation Statement^{a,b}	Tier 2 Reference	Commentary Reference
C NC [✓ N/A] U	**HR—not required; LS—MH; PR—MH**. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof.	13.6.1.1 13.6.1.2	A.7.7.1
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing.	13.6.1.2	A.7.5.6
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. OPENINGS: For veneer with cold-formed-steel stud backup, steel studs frame window and door openings.	13.6.1.1 13.6.1.2	A.7.6.2
Parapets, Cornices, Ornamentation, and Appendages			
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5.	13.6.5	A.7.8.1
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft (3.0 m); for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft (1.8 m).	13.6.6	A.7.8.2
C NC [✓ N/A] U	**HR—H; LS—MH; PR—LMH**. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement.	13.6.5	A.7.8.3
C NC [✓ N/A] U	**HR—MH; LS—MH; PR—LMH**. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft (1.8 m). This evaluation statement item does not apply to parapets or cornices covered by other evaluation statements.	13.6.6	A.7.8.4
Masonry Chimneys			
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney.	13.6.7	A.7.9.1
C NC [✓ N/A] U	**HR—LMH; LS—LMH; PR—LMH**. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof.	13.6.7	A.7.9.2
Stairs			
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out of plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1.	13.6.2 13.6.8	A.7.10.1
C NC [✓ N/A] U	**HR—not required; LS—LMH; PR—LMH**. STAIR DETAILS: The connection between the stairs and the structure does not rely on post-installed anchors in concrete or masonry, and the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.4.3.1 for moment-frame structures or 0.5 in. for all other structures without including any lateral stiffness contribution from the stairs.	13.6.8	A.7.10.2
Contents and Furnishings			
C NC [✓ N/A] U	**HR—LMH; LS—MH; PR—MH**. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/RMI MH 16.1 as modified by ASCE 7, Chapter 15.	13.8.1	A.7.11.1

continues

Table 17-38 *(Continued)*. Nonstructural Checklist

Status	Evaluation Statement^{a,b}	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	**HR—not required; LS—H; PR—MH**. TALL NARROW CONTENTS: Contents more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other.	13.8.2	A.7.11.2
[✓ C] NC N/A U	**HR—not required; LS—H; PR—H**. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level are braced or otherwise restrained.	13.8.2	A.7.11.3
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. ACCESS FLOORS: Access floors more than 9 in. (229 mm) high are braced.	13.6.10	A.7.11.4
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—MH**. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor.	13.7.7 13.6.10	A.7.11.5
C [✓ NC] N/A U	**HR—not required; LS—not required; PR—H**. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components.	13.8.2	A.7.11.6
Mechanical and Electrical Equipment			
[✓ C] NC N/A U	**HR—not required; LS—H; PR—H**. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb (9.1 kg) whose center of mass is more than 4 ft (1.2 m) above the adjacent floor level, and which is not in-line equipment, is braced.	13.7.1 13.7.7	A.7.12.4
[✓ C] NC N/A U	**HR—not required; LS—H; PR—H**. IN-LINE EQUIPMENT: Equipment installed in line with a duct or piping system, with an operating weight more than 75 lb (34.0 kg), is supported and laterally braced independent of the duct or piping system.	13.7.1	A.7.12.5
C [✓ NC] N/A U	**HR—not required; LS—H; PR—MH**. TALL NARROW EQUIPMENT: Equipment more than 6 ft (1.8 m) high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls.	13.7.1 13.7.7	A.7.12.6
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—MH**. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01.	13.6.9	A.7.12.7
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components.	13.7.1 13.7.7	A.7.12.8
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning.	13.7.1	A.7.12.9
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb (181.4 kg) is anchored to the structure.	13.7.1 13.7.7	A.7.12.10
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure.	13.7.7	A.7.12.11
C [✓ NC] N/A U	**HR—not required; LS—not required; PR—H**. CONDUIT COUPLINGS: Conduit greater than 2.5 in. (64 mm) trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections.	13.7.8	A.7.12.12
Piping			
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings.	13.7.3 13.7.5	A.7.13.2

continues

Table 17-38 *(Continued)*. Nonstructural Checklist

Status	Evaluation Statement[a,b]	Tier 2 Reference	Commentary Reference
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks.	13.7.3 13.7.5	A.7.13.4
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. (64 mm) in diameter are restrained.	13.7.3 13.7.5	A.7.13.5
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements.	13.7.3 13.7.5	A.7.13.6
Ducts			
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. DUCT BRACING: Rectangular ductwork larger than 6 ft^2 (0.56 m^2) in cross-sectional area and round ducts larger than 28 in. (711 mm) in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft (9.2 m). The maximum spacing of longitudinal bracing does not exceed 60 ft (18.3 m).	13.7.6	A.7.14.2
[✓ C] NC N/A U	**HR—not required; LS—not required; PR—H**. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit.	13.7.6	A.7.14.3
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements.	13.7.6	A.7.14.4
Elevators			
C NC [✓ N/A] U	**HR—not required; LS—H; PR—H**. RETAINER GUARDS: Sheaves and drums have cable retainer guards.	13.7.11	A.7.16.1
C NC [✓ N/A] U	**HR—not required; LS—H; PR—H**. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight.	13.7.11	A.7.16.2
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored.	13.7.11	A.7.16.3
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min (0.30 m/min) or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations.	13.7.11	A.7.16.4
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking.	13.7.11	A.7.16.5
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1.	13.7.11	A.7.16.6
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1.	13.7.11	A.7.16.7
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces.	13.7.11	A.7.16.8
C NC [✓ N/A] U	**HR—not required; LS—not required; PR—H**. GO-SLOW ELEVATORS: The building has a go-slow elevator system.	13.7.11	A.7.16.9

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

[a] Performance Level: HR = Hazards Reduced, LS = Life Safety, and PR = Position Retention.

[b] Level of Seismicity: L = Low, M = Moderate, and H = High.