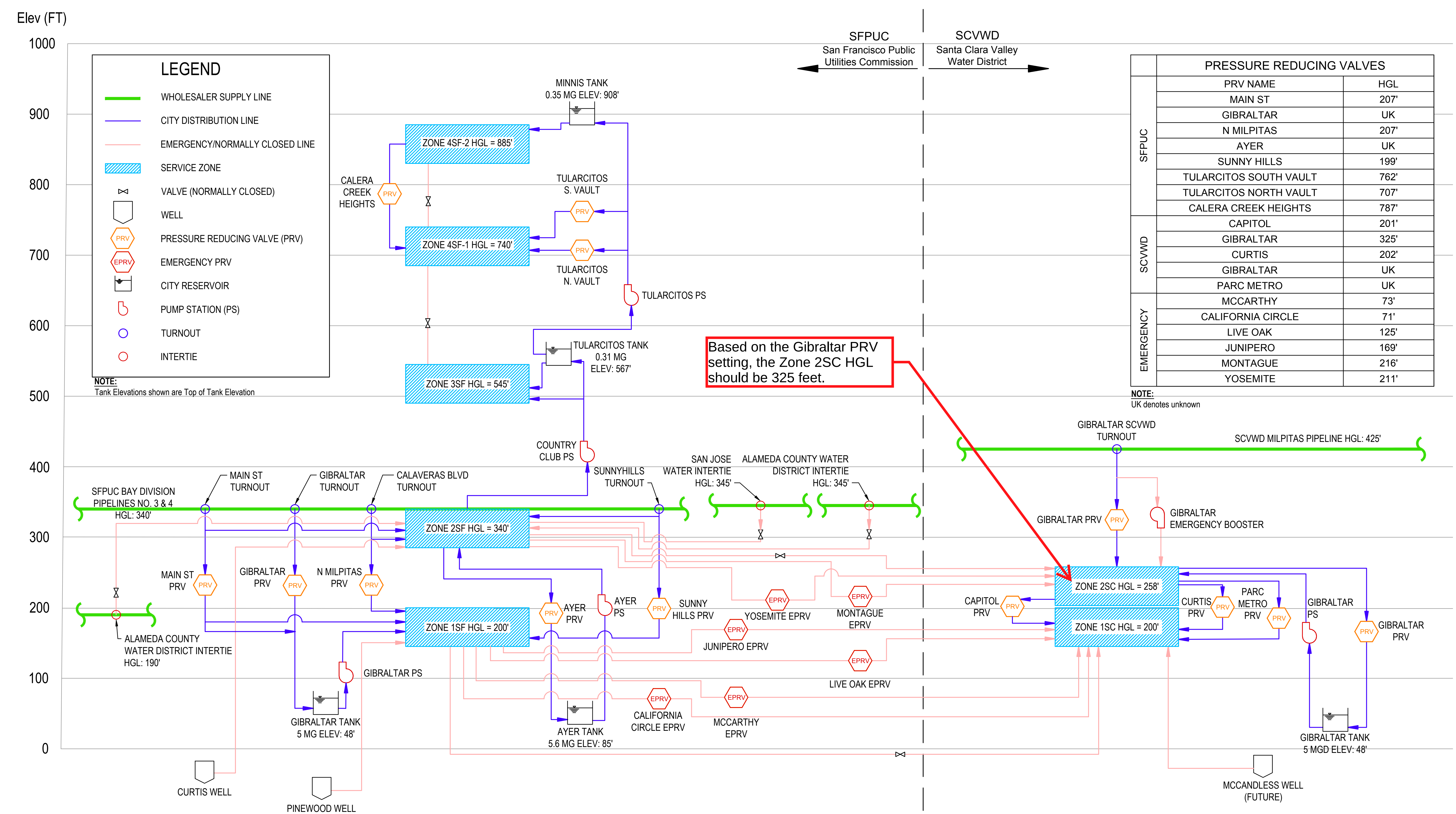
Appendix A

Water System Schematic Profile



	PRESSURE REDUCING VALVES	
	PRV NAME	HGL
SFPUC	MAIN ST	207'
	GIBRALTAR	UK
	N MILPITAS	207'
	AYER	UK
	SUNNY HILLS	199'
	TULARCITOS SOUTH VAULT	762'
	TULARCITOS NORTH VAULT	707'
	CALERA CREEK HEIGHTS	787'
SCVWD	CAPITOL	201'
	GIBRALTAR	325'
	CURTIS	202'
	GIBRALTAR	UK
	PARC METRO	UK
EMERGENCY	MCCARTHY	73'
	CALIFORNIA CIRCLE	71'
	LIVE OAK	125'
	JUNIPERO	169'
	MONTAGUE	216'
	YOSEMITE	211'

NOTE:
UK denotes unknown

HydroScience

City of Milpitas
Water Distribution System Plan
Schematic Profile

Appendix B

System Operations Narratives

City of Milpitas Distribution System Operation

General Description

WATER SUPPLY

The City of Milpitas receives water from two wholesale agencies, San Francisco Public Utilities Commission (SFPUC) and Valley Water (VW). Water from SFPUC is brought through the City by two transmission lines, Bay Division Pipelines 3 & 4, supplies Milpitas through 3 turnouts – Sunnyhills, Calaveras, and Main Street. Valley Water is brought to the City via the East Pipeline, and has one turnout at the City's Gibraltar Pump Station. There is an Intertie connection between Valley Water and SFPUC which runs from the end of the East Pipeline at Gibraltar Pump station and proceeds approximately 1,000 feet north the the SFPUC/VW Intertie Pump Station. Milpitas has a connection to this pipeline which can serve as an additional turnout to SFPUC, which we call the Intertie Turnout. When the SFPUC/VW Intertie is not in operation to transport water from SFPUC to VW or vice versa, the Intertie turnout is used by Milpitas to receive water from SFPUC, thus keeping the Intertie pipeline with fresh water in it.

The City also currently has one operational well, Pinewood Well, can be used to supply water to a portion of the City's zone 1SF distribution system. This well is currently premitted as a Standby Well, and thus can only be used for emergency operations only. An additional well, Curtis Well, has been drilled and developed, but there is no pump station and no connection to distribution system infrastructure. Curtis Well contains manganese and will require treatment. Possible infrastructure connections are to zones 1SC, 2SC and 2SF. In addition, a connection to Gibraltar Pump Station for blending purposes is also in consideration. A third well is in the planning stages now, McCandless Park Well. A test hole had been drilled and the above and below ground portions of the main well are in design with an anticipated completed date of sometime in 2022. This well will also require manganese removal treatment, and will serve zone 1SC.

Pressure Zones

Milpitas does not blend water from the two wholesalers that serve the City. As a result, Milpitas distinct areas that are served water from one or the other wholesaler, and they are designated by the letter codes SF and SC. Each wholesaler served area has two main pressure zones in the area of the City that resides on the valley floor. Zones are identified as low pressure or high pressure. Low pressure zones have a number designation of 1, and are regulated by pressure reducing valves to have a maximum pressure of about 80 psi in the zone. High pressure zones have a number designation of 2. The high pressure zone served by SF is not regulated and is set by the pressure supplied by SFPUC at the turnouts, which is typically between 130 and 140 psi. For the high pressure zone served by VW, it is set by a pressure reducing valve at Gibraltar Pump Station to between 135 and 140 psi. Valley Water is typically supplied from the East Pipeline at a pressure of 170 – 180 psi.

There are two additional pressure zones that cover the developed area of the hills in Milpitas which includes the Summit Pointe Golf and Country Club. This water system was originally called La Questa and is now commonly referred to as "The Hillside". Water is transported to these zones, designated 3 and 4a and 4b. These system will be described in more detail later in this document.

DISTRIBUTION SYSTEM OPERATION

VW System

The area of Milpitas which is served by Valley Water (formerly known as Santa Clara Valley Water District, or SCVWD) was carved out in the late 1980s to be served separately from the rest of the City's distribution system, which was formerly completely serviced by SFPUC. The area selected was primarily commercial/industrial. See the zone map for visual reference. Gibraltar Pump Station was constructed as part of this effort and has two 5 MG storage tanks, one designated for VW water and one for SFPUC water. The station is really 3 stations in one, and was intended to serve multiple purposes. For the distribution of VW water, the turnout connection to the East Pipeline was located on the station grounds. Water from the turnout goes through a revenue meter and vault, maintained by VW, and then goes through a Pressure Reducing Valve (PRV) to enter the City's zone 2SC distribution system. Water is also sent to the VW reservoir for storage directly from the turnout. Water from the reservoir can be pumped out of the reservoir and into zone 2SC by one of two pumping systems. When pumping from storage, flow from the turnout is generally halted. Once water enters zone 2SC, it is maintained at about 135 psi. There are three PRV stations that then take water from zone 2SC and reduce the pressure to send it to zone 1SC. Pressure in zone 1SC is maintained to have a maximum of about 80 psi as the highest pressure within the zone. The three PRVs that send water to zone 1SC are Curtis, Parc Metro and Capitol. The Curtis PRV is actually two PRVs in parallel, designated East and West.

In addition to the main PRVs that control pressure in zones 1SC and 2SC, there are also Emergency PRV stations. These are standby PRV stations that will only open and supply water if the pressure in zone they are supplying falls below a certain setpoint. For zone 2SC, there are two stations, Yosemite and Montague, that will allow water to pass from zone 2SF to zone 2SC if the pressure in zone 2SC falls below about 120 psi. For zone 1SC, there are 4 emergency PRV stations, Live Oak, McCarthy, California Circle, and Junipero. These stations will supply water from zone 1SF to zone 1SC if the pressure in zone 1SC falls below about 60 psi at the point of highest pressure. It is important to note that the emergency PRVs for both zones only flow in *one* direction, from the SF zones to the SC zones, and *not* in the opposite direction. The SC zones were intentionally set up to have higher pressures than the corresponding SF zones so that this system could work this way.

SFPUC System

The portion of the City supplied by water from SFPUC is primarily residential, with some commercial. Water is supplied to these zones from the 3 primary turnouts, Sunnyhills (called Washington by SFPUC), Calaveras, and Main Street (called Hammond by SFPUC). Each turnout has connections to the two Bay Division Pipelines, 3 and 4. There are two parallel revenue meters that supply a manifold to which the city connects for our supply. At the Sunnyhills and Main St. turnouts, there are two types of connections. Connections that go directly to zone 2SF are unregulated, fed directly at the pressure supplied by SFPUC. Connections that go to zone 1SF are fed through two parallel PRVs located within the turnout vault structure. At the Calaveras turnout, the connections are all to zone 2SF, and therefore unregulated. There is an associated PRV station a short distance away next to Milpitas City hall, called the Milpitas PRV station, that takes water from the Calaveras turnout and sends it to zone 1SF. This station has two PRVs in parallel, but one larger than the other. All turnout PRV stations with parallel PRVs operate in a lead/lag fashion, with one set to a slightly higher pressure setpoint than the other.

Water from zone 2SF supplies zone 3SF by acting as the supply to the first of two booster pumping stations, Country Club. Country Club booster pump station recieves water from zone 2SF as the suction supply that is then pumped into Zone 3SF. There is a 12" supply line that travels from the output of Country Club pump station up to the next station, Tularcitos, where it both supplies water to zone 3SF and fills the 310,000 gallon reservoir there. Both the pumps and the reservoir supply water to zone 3SF. The pumps at Country Club are activated by the level of the Tularcitos Reservoir. Then the level gets down to 15 feet the lead pump is turned on. Usually this is enough to start filling the reservoir, but if demand is high enough for the reservoir level to continue to fall to 14 feet, the lag pump will also turn on. Once the reservoir reaches 21.5 feet the pumps are shut off.

In the same manner, pumps at Tularcitos pull water from the reservoir and pump it into zone 4SFa and up to the Minnis Reservoir. Tularcitos pumps are controlled by the level of the Minnis Reservoir. Zone 4SF is broken into two subzones, a and b. Water from zone 4SFa feeds three PRVs called North Vault, South Vault, and Calera Creek Heights. Due to the elevation differences in zone 4, the PRVs are necessary to break the pressure midway in the zone. Zone 4SFa is unregulated, and the lower part of the zone, zone 4SFb is the portion regulated by the three PRV stations.

Each reservoir, Minnis and Tularcitos, has a nozzle type mixing system which uses a pump to circulate water from the tank through the pump and back in through the side of the tank and out a nozzle mounted inside which faces up at an angle to circulate the water both vertically and horizontally to avoid thermal and chemical stratification. Each also has a sampling pump and equipment for conducting water quality testing onsite.

Ayer Pump Station is located within zone 2SF and has 3 vertical turbine pumps and a 5.6 MG reservoir. The station has a single inlet/outlet which can be used to either fill the reservoir with water from zone 2SF or pump water into zone 2SF, but it cannot do both at the same time. Operation of this station is set up on a fill and pump basis, twice per day, pumping into the zone during morning and evening peak times, and filling from the zone during afternoon and overnight low demand periods.

Gibraltar Pump Station is located within zone 2SC, but also receives water from zone 1SF as well as the Intertie turnout. Gibraltar has a 5 MG reservoir and is also set up on a daily pump and fill cycle, pumping during morning and evening peak times to zone 1SF and filling during afternoon and overnight low demand periods from the Intertie turnout when not in use by SFPUC/VW, or from zone 1SF when the Intertie turnout is not available.

Pinewood Well is located in the southwest portion of the City in the neighborhood called The Pines and is in Pinewood Park. This well can produce about 1200 gallons per minute at an output pressure of about 70 psi. It is currently permitted as a Standby well and is need of further renovation, but it is eventually planned to be permitted as an active well and used to supplement the zone 1SF supply.

Curtis Well is located in Curtis Park, and has no pump station or connection to infrastructure yet. It was originally designed to provide emergency water supply to zone 2SF, but it's location facilitates a connection to both zones 1 & 2SC, as well as zone 2SF. In addition, a sleeve was put in crossing under the railroad tracks to allow a future line to connect the well to Gibraltar Pump Station for possible mixing or treatment to take place at Gibraltar. This would allow Curtis Well to run and blend water for pumping to zone 2SC or zone 1SF from Gibraltar.

INTERTIES

There are three inter-city interties. Two are with Alameda County Water District. The first one is located on Milmont drive at the border of Fremont and Milpitas. The second is on North Park Victoria, also at the border of Milpitas and Fremont. Both are manual interties, with significant pressure differences in the normal operating pressures of each system. Both interties have been used successfully to supply water from Milpitas to ACWD.

The third intertie is with San Jose, and is located on Landess Avenue. It is also manual. This intertie has no planned flushing points, and needs to be upgraded to allow routine operation and flushing.

City of Milpitas Water System Emergency Operations Scenarios

This document is a simplified overview of some of the possible emergency conditions that may arise and what changes to system operations are possible to mitigate the impacts of those conditions on the delivery of water to the City's water system customers. This is not a comprehensive how-to manual, as each emergency condition is unique, and the exact circumstances will dictate the actual actions to be taken. This document is intended as a guide to what is possible, and to help guide the responder to considering all possible actions in response to any specific emergency condition. The scenarios below are listed individually, but may occur in any combination, and each will have to be taken into consideration and weighed against the existing system conditions at the time.

SCENARIOS

1. Loss of Supply
    a. Loss of SFPUC Supply
    b. Loss of SCVWD (VW) Supply
    c. Loss of both SFPUC & VW Supply
    d. Loss of Well Supplies
2. Pump Station Issues
    a. Loss of PG&E power
        i. Ayer
        ii. Gibraltar
        iii. Hillside
        iv. Wells
    b. Loss of water supply
        i. Gibraltar
        ii. Ayer
        iii. Hillside

3. Distribution System Issues
    a. PRV Station loss/malfunction
    b. Zone interconnection
    c. Agency interconnection
    d. Contamination
    e. Fire suppression aid
    f. Main Line break
    g. Fire hydrant hit
    h. Construction shutdowns/tie-ins

1. Loss of Supply
    a. Loss of SFPUC supply

    The loss of SFPUC supply may can occur in three ways: Loss of a single turnout, a reduction in quantity from SFPUC, or the total loss of supply from SFPUC.

        i. Loss of a Turnout

        SFPUC water is supplied to the City by four turnouts: Sunny Hills, Calaveras, Main Street and the SFPUC/SCVWD Intertie (when available). The loss of a single turnout can be compensated by the other turnouts. Changes in flow patterns within the distribution system will occur which can result in lower pressures in the extremities of the system and dirty water in areas where the flow has reversed or increased. These changes are most significant in zone SF2. The use of Ayer pump station to support peak use times is recommended.

        ii. Reduction of Supply from SFPUC

        In the event SFPUC cannot meet demands there may be a reduction in supply. Here are the possible ways to add supply to zones SF1 and SF2:

            1. Pump from storage at Gibraltar and Ayer;
            2. Activate Pinewood Well to pump to zone SF1;
            3. (FUTURE) Activate Curtis Well to pump to either Gibraltar or zone SF2;
            4. Use water from SCVWD at Gibraltar to supply zone SF1 through the use of the Intertie turnout;
            5. Use water from SCVWD at Gibraltar to fill SFPUC reservoir and pump to zone SF1;
            6. Use water from SCVWD by opening isolation valves in zones SC1 and/or SC2;

7. Contact ACWD and/or SJ Muni to activate intercity interties for zones SF1 & 2 – significant pressure differences exist, and this is a last resort.

iii. Total loss of supply from SFPUC

In the unlikely event we lose all supply from SFPUC or are required to isolate from SFPUC, the options are similar to the partial loss scenario above but may require a combination of options. Pumping from storage is the most immediate remedy while the other options are set up. Storage will not last long and is dependent on the amount of water in storage at that moment and the time of year the outage occurs. If the outage will last more than a few days, use of Pinewood and (future) Curtis Wells may be significant, as SCVWD will likely be tasked to help provide water to SFPUC and their supply may also be limited.

b. Loss of SCVWD Supply

SCVWD water is only supplied to the City through a single turnout located at Gibraltar Pump Station. Loss of supply may occur as a reduction in available water or as a total loss.

i. Supply Reduction and Total Loss Options

1. Pump from storage at Gibraltar and use the VW turnout only to provide water to the SCVWD reservoir;
2. Use SF water from the SFPUC/VW Intertie directly from the Intertie turnout using the Intertie PRV into zone SC2 – pressure will be reduced to about 130 to 135 psi, max;
3. Use water from zone SF1 to provide water to the SCVWD reservoir either directly (pumping to zone

SF1 will not be possible in this configuration) or by floating the two reservoirs, while pumping to zone SC2.

c. Total Loss of both VW and SFPUC Supplies
    i. In the event both wholesale suppliers lose the ability to provide water to the City, the remaining supplies are limited to
        1. Storage at Ayer and Gibraltar;
        2. Pinewood, McCandless and Curtis Wells;
        3. Intercity Interties with ACWD and SJWC.
    ii. Pumping from storage would be the first recourse until the other two options are brought online. Ayer can supply water from the center of zone SF2. Gibraltar can provide water to zones SF1 and SC2.
    iii. Pinewood Well can pump to zone SF1 directly. Future options may allow it to pump to zone SC1.
    iv. McCandless Well, when completed, will be able to pump directly to zone SC1.
    v. Curtis Well, if completed, will be able to pump to any of the following:
        1. Gibraltar Pump Station, either or both reservoirs;
        2. Zone SF2;
        3. Zone SC2; or
        4. Zone SC1
    vi. Intercity Interties with ACWD can provide water to zones SF1 and SF 2 if ACWD has water to provide, along the City's north border.
    vii. An Intercity Intertie with SJWC can provide water to zone SF2 along the southeast border of the City if SJWC has water to provide and the zone pressure in our zone SF2 is low enough to accept water from SJWC.

d. Loss of Well Supplies
    i. Currently, the only well capable of supplying water to the City is Pinewood Well. It is currently permitted as

an Emergency Standby Well. Loss of this well would remove it from the options to provide water in the scenarios listed previously.

ii. Once all three of the City's wells are completed and brought into service as everyday supplies, the loss of supply from these wells would increase the amount of water the City would pull from its wholesale providers, which could have contract implications. In the event of an emergency, the loss of these wells as backup water supplies would eliminate the ability of the City to have an independent water supply under its control and eliminate this option as a means to provide water under any of the other emergency scenarios listed previously.

2. Pump Station Issues
    a. Loss of PG&E Power
        i. Ayer
            1. Ayer Pump Station is equipped with a 1,000 KW Caterpillar Genset which is capable of automatically starting and completely powering the station and all three pumps in the event of the loss of outside power.
            2. The station has a 1,000 gallon (900 gallon useable) above ground fuel storage tank that is capable of running the station for 24 hours before requiring refueling.
        ii. Gibraltar
            1. Gibraltar Pump Station is equipped with a 2.5 MW Genset which is capable of automatically starting and completely powering the pump station and all pumps in the event of the loss of outside power.
            2. The station has a 10,000 gallon (9,000 gallons useable) above ground fuel tank that is capable

of running the genset for 72 hours before refueling would be required.

3. The station also has 3 diesel powered pumps which can run independently with local controllers even if the station has no power. Pump 2 can be used to pump to zone SC2, pump 3 can be used to pump to zone SF1, and Pump 7 can be used as a booster to pump water directly from the SCVWD turnout into zone SC2.

iii. Hillside

1. All three Hillside stations are reliant on PG&E power for operation. All three do have a UPS battery emergency supply that will maintain power to the control panel and communications only.
2. Country Club and Tularcitos pump stations have a quick connect transfer switch mounted on the outside of the control building enclosures to be used with a portable trailer genset in the event of a power outage.
3. Country Club and Tularcitos also have pumper connections that can be used with either a trailer mounted portable pump or with a fire truck to act as emergency pumps and bypass the station to pump water to the next station. The City has a portable Paco trailer mounted pump with a capacity of approximately 1,000 gpm that can be used at either station.

iv. Wells

1. Pinewood well is not currently set up to easily take power from a portable generator set, nor does it have any installed backup power generator set. Loss of PG&E Utility power will render the well essentially inoperable and unable to serve water into the distribution system.

2. McCandless Well is being designed with a quick connect backup power transfer connection switch similar to the Hillside pump stations and should be operable to at least serve water on an emergency basis.
3. Curtis Well will likely be designed to the same standard as McCandless and able to use a portable generator as backup power to serve water on an emergency basis.

b. Loss of Water Supply
   i. Gibraltar
      1. Gibraltar Pump Station has three water supply sources:
         a. 42" pipeline from VW, known as the Milpitas Pipeline or the East Pipeline;
         b. 24" distribution line from Zone 1SF which can draw water from Main Street Turnout PRVs and Milpitas PRV (the Zone 1SF connection to the Calaveras Turnout);
         c. 10" connection to the VW/SFPUC Intertie which we call the Intertie Turnout, and normally draws SF water and is closed when VW is using the Intertie to send water to SFPUC.
      2. Virtually any of these supplies can be used to support the loss of any other supply through the use of valving at the pump station and/or the use of the two reservoirs onsite. The pump station was designed with versatility in mind, both in the manner and number of pump installations and in the use of valves and bypass pipelines. There are too many combinations possible to list them out individually. Here we will list the general possibilities – the Operator is encouraged to

carefully examine the potential water pathways for each situation to arrive at the best possible solution and to ensure no harm will be done.

3. Loss of the 42” VW supply:
    a. Intertie supply can be used through the Intertie PRV by setting to its highest pressure setpoint and closing the normally open connection to Zone 1SF and then opening the normally closed connection to Zone 2SC - PRV will support about 130 – 135 psi, so zone will run at a slightly lower pressure - the SF reservoir cannot be filled while in this mode;
    b. Booster or Peak Shaving pumps can be used to supply water from storage by using a Flow Through setup to supply the reservoir from Zone 1SF – Pumps can be run in conjunction with the Intertie PRV by setting the pumps to the same pressure as the PRV or the pumps can run in lead at a higher pressure with the Intertie PRV acting as a backup supply. Pumps 3 and 4 cannot be used to pump water from the SF reservoir while supplying water to the SC reservoir from zone 1SF.
    c. The 30” suction lines from the two 5 MG reservoirs can be linked together by opening valve BFV 101 between pumps 2 and 3. The level between the two reservoirs should be as close to the same as possible – the larger the difference between them, the higher the water velocity will be as valve BFV 101 is opened and the levels begin to equalize. This

method allows filling to occur through the SF reservoir from either zone 1SF or the Intertie PRV.

4. Loss of 24" zone 1SF line supply:
    a. Use the Intertie supply to fill reservoir and supply zone 1SF directly. Do not run pump 4 or 3 at the same time as filling the reservoir from zone 1SF, water will only recirculate and not supply the zone.
    b. Use the SC reservoir by opening valve BFV 101 to equalize the SC and SF reservoirs. See 2.b.i.3.c. above for caveats about opening valve BFV 101.
    c. Use the zone 2SC supply by closing valve BFV 020 and then opening valve BFV 021A to fill the SF reservoir from zone 2SC and use pump 4 and/or 3 to supply zone 1SF. This CANNOT be used to directly supply zone 1SF from zone 2SC due to the higher pressure.
5. Loss of 10" VW/SFPUC Intertie supply
    a. This supply is normally only used when the Intertie is not being used to send water from VW to SFPUC or vice versa. Normal configuration sends SFPUC water through this connection to our zone 1SF. Loss of this supply is made up from the 18" connection to zone 1SF which draws water through the distribution system from the low pressure supply PRV at Main St turnout and/or the Milpitas PRV, which is a nearly direct connection to the Calaveras Turnout.
    b. If it is not possible to fill the SF reservoir through the distribution system connection

to zone 1SF, there is a normally closed connection to zone 2SC which can be used to fill the SF reservoir. Since this is a high pressure zone, it cannot be used to directly supply zone 1SF – this must be done through use of pumps 3 and/or 4.

c. An additional method to use VW water to supply zone 1SF is to open the 30" isolation valve between the two reservoirs so they are both filled from the VW supply and use pumps 3 and/or 4 to send water to zone 1SF.

ii. Ayer

1. Ayer is supplied solely from zone 2SF. The station currently has a single inlet/outlet design, so water can only flow one way into or out of the station at any given time, meaning the station can pump out water or fill the reservoir, but cannot do both at the same time.
2. Calaveras Turnout is the main source of supply to Ayer pump station via large mains that come directly east on Calaveras Blvd from the Calaveras Blvd turnout and valve lot.
3. Loss of supply to Ayer would only occur if there were a loss of the pipeline that supplies the station from Calaveras Blvd, or if that segment of line was not in operation. There is no alternative supply for Ayer in either of those events, and Ayer would not be able to pump water out to the system, regardless of the quantity of water in storage.
4. A CIP project to provide a secondary pipeline connection from zone 2SF to the station has been proposed, but is not currently in design or under construction.

iii. Hillside

1. The Hillside, or La Questa, water system has only a single supply source – zone 2SF. Water is supplied from system pressure in zone 2SF to Country Club Pump Station. CCPS then pumps water into zone 3SF through a 12 inch transmission and distribution line via 2 250 gpm submersible vertical turbine pumps. This line both supplies the zone and delivers water to a 350,000 gallon reservoir (Tularcitos) at the top of the zone. This reservoir provides gravity pressure to the zone when the pumps are not in use.
2. There is no alternative source of supply if water cannot be delivered from zone 2SF to CCPS. If CCPS experiences failure that results in neither of the 2 pumps being able to pump water, then a backup potable water trailer pump must be brought in to act as the pump station. This pump would hook up to a fire hydrant at the pump station that would provide water from zone 2SF to the suction side of the trailer pump, and then the discharge line from the trailer pump would be connected to a special pumper connection designed for this purpose to provide water to zone 3SF. If the trailer pump is not available for some reason, a fire engine pumper can also be used.
3. Tularcitos reservoir and pump station is the next step in the Hillside water system. Tularcitos Pump station is nearly identical to CCPS in that it has 2 250 gpm submersible vertical turbine pumps that send water from zone 3SF and/or the Tularcitos Reservoir and deliver it into a 12 inch combination distribution/transmission line that

serves zone 4SFa and Minnis Reservoir. Minnis Reservoir provides gravity head and flow for zones 4SFa and 4SFb.

4. Loss of the pumps at Tularcitos would result in the loss of water supply to Minnis and zones 4SFa&b. Use of a trailer pump would be needed to replace the function of those pumps, similar to CCPS. Supply would come from a connection on the Tularcitos Reservoir, and discharge would be connected to a special pumper connection, similar to CCPS, to supply water to zone 4SFa and Minnis Reservoir.
5. Loss of the Tularcitos Reservoir would result in the loss of gravity supplied water to zone 3SF. There are two ways to compensate for this reservoir being out of service.
    a. At CCPS there is a pressure relief valve located in a vault with a manhole cover between the fenced pump station and Country Club Drive. This pressure relief valve is specifically there to enable the CCPS pumps to be run constantly to supply water to zone 3SF at a constant pressure. The pumps at CCPS are single speed pumps and cannot be ramped up and down to respond to demand changes in the zone to maintain a constant pressure. Instead, the relief valve will open at a set pressure to relieve the excess discharge from the pumps back into zone 2SF. This is not a perfect solution because the water discharged back into zone 2SF simply returns to the suction side of the CCPS pumps, thus running in a circle, and will result in the water being heated

and boiled by the pumps if not relieved. The solution to this is to use hoses to run a constant flow from hose bib connections on the discharge of each pump to the storm drain so that a minimal flow of new water is always coming into the pumps to keep them cool.

b. The other method to replace the supply from Tularcitos Reservoir is to use a combination pressure relief valve/pressure reducing valve located at Tularcitos Pump Station. There is a double leaf hatch covered vault with this valve located within. This valve has dual pilot valve systems installed on it, and normally uses the pilot valve system that is configured to run the valve as a pressure relief valve. This pilot system must be shut down, and the pilot valve system on the other side opened to configure the valve as a pressure reducing valve. This valve is connected to zone 4SFa and zone 3SF. As a relief valve it opens to relieve excess pressure from zone 4SFa to zone 3SF. As a pressure reducing valve, it opens to maintain use water from zone 4SFa/Minnis Reservoir to maintain a set pressure in zone 3SF, thus doing what Tularcitos reservoir was doing. This is the preferred method to use when Tularcitos Reservoir is not in service to maintain pressure in zone 3SF.
c. Getting water from zone 3SF to zone 4SFa/Minnis when Tularcitos Reservoir is not in service is different depending on

which method you are using to maintain pressure in zone 3SF. If telemetry is still working between Minnis and Tularcitos, the pumps at Tularcitos will cycle according to the level in Minnis reservoir and can be left to run on their own if using the CC pump method in a. above. The pumps at CC will supply water to the pumps at Tularcitos. Only one pump at Tularcitos should be used in auto to fill Minnis so that the capacity of the CC pumps are not exceeded. If using the pressure reducing valve method in b. above to maintain zone 3SF pressure, the pumps at CC and at Tularcitos will need to be run manually and at the same time. The level at Minnis will need to be monitored, and the pumps both shut down at the same time.

6. Loss of the Minnis Reservoir will result in the loss of gravity pressure and flow for zones 4SFa&b. This is compensated by using the combination relief and pressure reducing valve at Tularcitos in a manner similar to using the relief valve at CC when Tularcitos Reservoir is offline. With the combo valve operating on the pressure relief pilot system the pumps can be used to maintain the pressure in the system. Similar to the CC method, hoses need to be connected to the hose bibs on the discharge side of the pumps in order to keep a minimum flow through the pump and prevent the water from recirculating through the pump and overheating/boiling. See 5.a above.

3. Distribution System Issues
    a. PRV Station Loss/Malfunction
        i. Pressure Reducing Stations take water from a higher zone and feed it into a subsequent zone at a lower pressure. They are both a source of supply and pressure regulator. When I PRV fails, it will usually show signs before having a catastrophic failure. The regulated pressure will begin to increase and become more difficult to control to the desired set point. A gradually rising pressure on the regulated downstream side of the PRV can be a sign that the valves main diaphragm has a pinhole in it and needs to be replaced. It can also be a sign that the pilot valve is failing. If a PRV has failed or needs to be taken out of service the valve can usually be isolated by closing the up and down stream line valves and allowing the lag PRV to take over the load, assuming there is a lag PRV – most stations are configured with lead/lag parallel valves, but not all of them (Capital Ave and Parc Metro, for instance). If a valve does not have a parallel lead/lag to take over, the system balance may need to be adjusted by checking the other PRV stations and making minor pressure setpoint changes. Since possible flow direction changes may occur in the distribution system, this may result in dirty water calls and the need for flushing/NO-DES use to respond to the water flow changes.
    b. EPRV Station Loss Malfunction
        i. The EPRV stations are single PRVs set to allow water to move from SF zones into corresponding SC zones in the event that pressure falls in the SC zone below the minimum setpoint of the EPRV. When this happens, the EPRV will open and allow water to flow from the SF zone to the SC zone and will try to regulate the SC zone toe the EPRV setpoint pressure. Malfunction of an

EPRV will not result in overpressure of any zone, since the served zone is normally higher than the supplying zone, and water cannot flow in reverse through a PRV, even if it has failed. Loss of the function of this station only results in the loss of protection for the served zone in the event that zone incurs a pressure reduction. Zone isolation valves can be opened to directly supply water from the SF zone to the SC zone if needed as an alternative to the EPRV.

c. Zone Interconnection
    i. There are 44 zone isolation valves throughout the City. These are valves that were closed when the City went from being solely supplied by SFPUC to being supplied by both SFPUC and SCVWD (VW). There valves were marked by using large G12 valve boxes and painting them red. The are only to be opened in the event a zone has a supply failure that results in the loss of supply and pressure and all other means of supplying the zone are not available. Opening of these valves will need to be accompanied by flushing of the lines up and downstream and there will likely be dirty/stagnant water.

d. Agency Interconnection
    i. Milpitas has 3 intercity interties, two with ACWD and one with SJWC. Similar to the zone isolation valves, use of these valves is a last resort emergency response measure. Pressures are not the same between the separate agencies, and use must be coordinated between both agencies before opening the valves.
    ii. Connections with ACWD are located with one in zone 1SF on Milmont and one in 2SF on Churchill. The connection with SJWC is located in zone 2SF at the south end of the zone on Landess Ave.

Appendix C

Hydrant Testing and HPR Placement Plan

MEMORANDUM

DATE:	March 9, 2020	Project No.: 270-60-19-16 SENT VIA: EMAIL
TO:	Harris Siddiqui, PE, City of Milpitas Glen Campi, City of Milpitas	
FROM:	Roger Chu, PE, RCE #87591	
REVIEWED BY:	Amy Kwong, PE, RCE #73213	
SUBJECT:	City of Milpitas – 2020 Water Master Plan Update – Hydrant Testing and HPR Placement Plan	

This memorandum summarizes the proposed hydrant testing and pressure data collection procedures required to calibrate the City of Milpitas's (City) potable water system hydraulic model. West Yost Associates' (West Yost) recommended plan for hydrant testing and hydrant pressure recorder (HPR) placement is provided for your review and comment, as summarized in the following sections:

- Hydrant Testing
- Hydrant Pressure Recorder Placement
- Summary of Hydrant Testing and HPR Placement Plan

It is recommended the City shares this plan with the appropriate parties (e.g., water operations and/or Fire Department staff), so they are aware of the equipment being used or installed at the proposed testing/pressure monitoring locations. Field pressure monitoring is scheduled to occur beginning March 10 through March 18 (monitoring period), and hydrant testing is scheduled for March 11, 2020.

HYDRANT TESTING

The purpose of hydrant testing is to confirm the assignment of roughness factors (C-factors) to pipelines in the City's hydraulic model. West Yost will use data collected though hydrant testing to ensure the assigned pipeline C-factors are appropriate and representative of actual field conditions. Hydrant tests were selected based on the combination of pipeline material type, diameter, and age that represents the majority of the City's water distribution system.

Details related to hydrant testing are presented in the following sections:

- Personnel and System Data Requirements
- Hydrant Testing Schedule
- Testing Requirements and Procedure
- City's Responsibilities

Personnel and System Data Requirements

West Yost would like to request the following City personnel and system data to accomplish the recommended hydrant testing under West Yost's direction:

- Three (3) to five (5) City staff members (with vehicles) that will be available during regular working hours to assist with, but not limited to the following:
  - Closing and re-opening valves, as needed, before and after hydrant testing
  - Reading and recording hydrant pressure data
  - Flowing the test hydrant and de-chlorination
  - Directing and controlling traffic and hydrant flows (i.e., to the nearest drainage inlet) to ensure safety
  - Public outreach and interface, as needed
- System information during the monitoring period that includes the following:
  - Available SCADA and telemetry data from all water distribution system facilities:
    - Turnout flows and pressures
    - Reservoir levels [feet]
    - Booster Pump Station information (pump operational status, speed settings, discharge pressures [psi], and flow rate [gpm])
    - Pressure Reducing Valve information (upstream pressure [psi], downstream pressure [psi], and flow rate [gpm], if available)

Hydrant Testing Schedule

West Yost requests that hydrant testing be scheduled from **7:30 AM to 4:30 PM on March 11, 2020**. West Yost will meet with the City staff before hydrant testing at the City's Public Works Department, located at 1265 North Milpitas Boulevard, to conduct a brief field coordination meeting to review hydrant testing procedure and protocol (i.e., where to go and what to do). West Yost will also use this coordination meeting to distribute pressure gauges necessary to complete hydrant testing (hydrant wrenches to be provided by City staff). In addition, West Yost will also discuss with City staff what order they prefer to conduct tests (i.e., avoid school traffic or commuter traffic, etc.) and to review hydrant tests that may present challenges.

Testing Requirements and Procedure

West Yost plans to conduct up to ten (10) hydrant tests within the City's water system. Figure 1 shows the proposed hydrant test locations. In addition, four (4) alternative hydrant tests have been identified. If any of the primary test locations are unable to be completed, an alternative location may be used. Table A-1 in Attachment A lists the proposed test locations. Details regarding each of the proposed tests (e.g., flowing hydrant, observation hydrants, closed valves, etc.) is also provided in Attachment A (Figures A-1 through A-14).

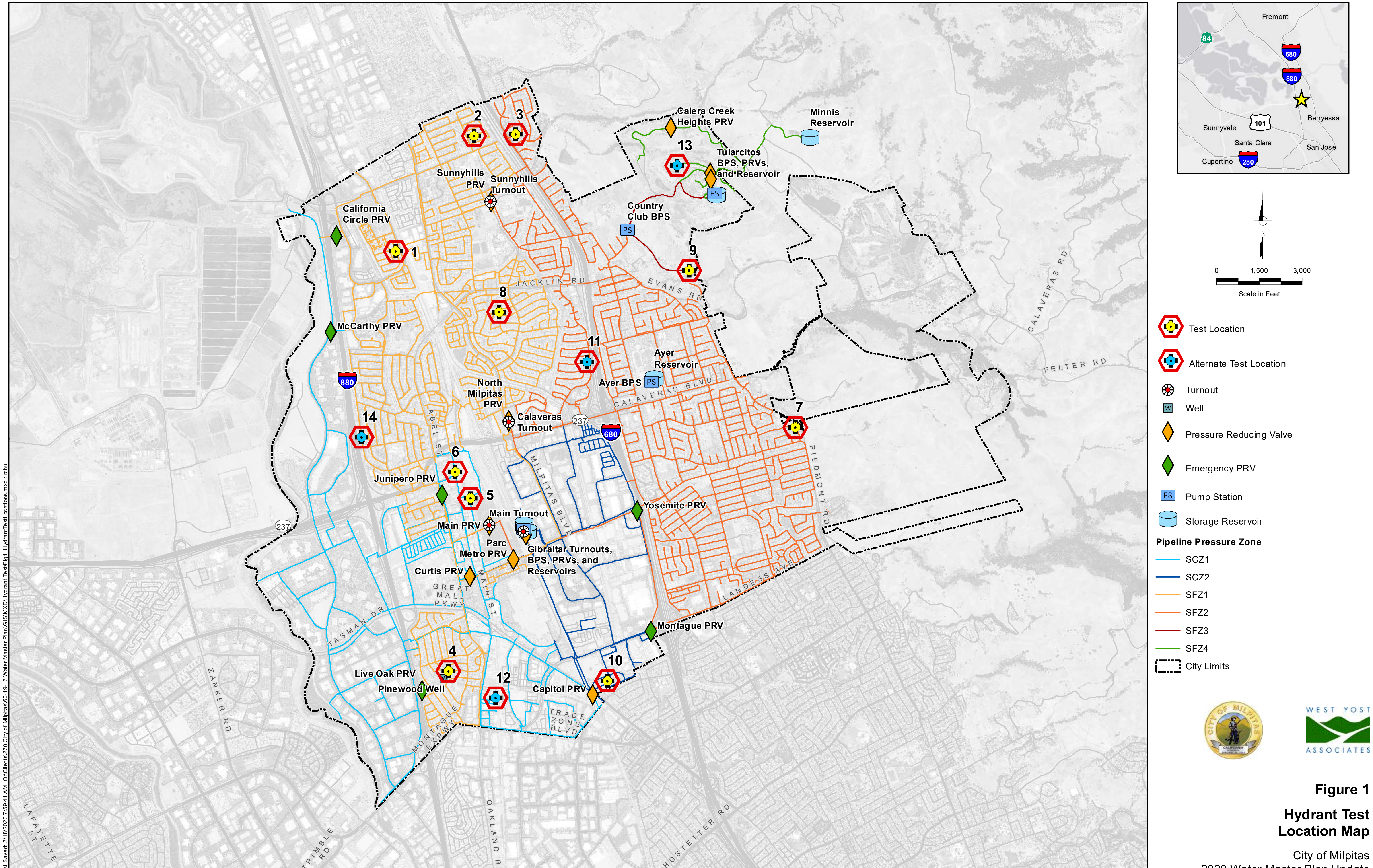


Figure 1

Hydrant Test Location Map

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Each hydrant test will involve maintaining flow from a single hydrant while monitoring the residual pressure at two (2) to four (4) observation hydrants located near the flowing hydrant. The field-observed static and residual pressure readings will then be used to confirm pipeline C-factors to calibrate the hydraulic model to observed conditions. Hydrant test locations have been selected to isolate pipelines of a particular material type, diameter, and age. Some tests will require City staff members to close one (1) or more isolation valves prior to the test and then re-open these isolation valves following the test.

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

Step 1. Before attaching the pressure gauge, flush the test (flowing) hydrant and each observation hydrant to remove sediments, which might damage the gauge or cause faulty readings.

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

Step 3. Close the gauge 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.

Step 5. Measure the residual pressures at the designated test hydrant and at each observation hydrant while the test hydrant is flowing.

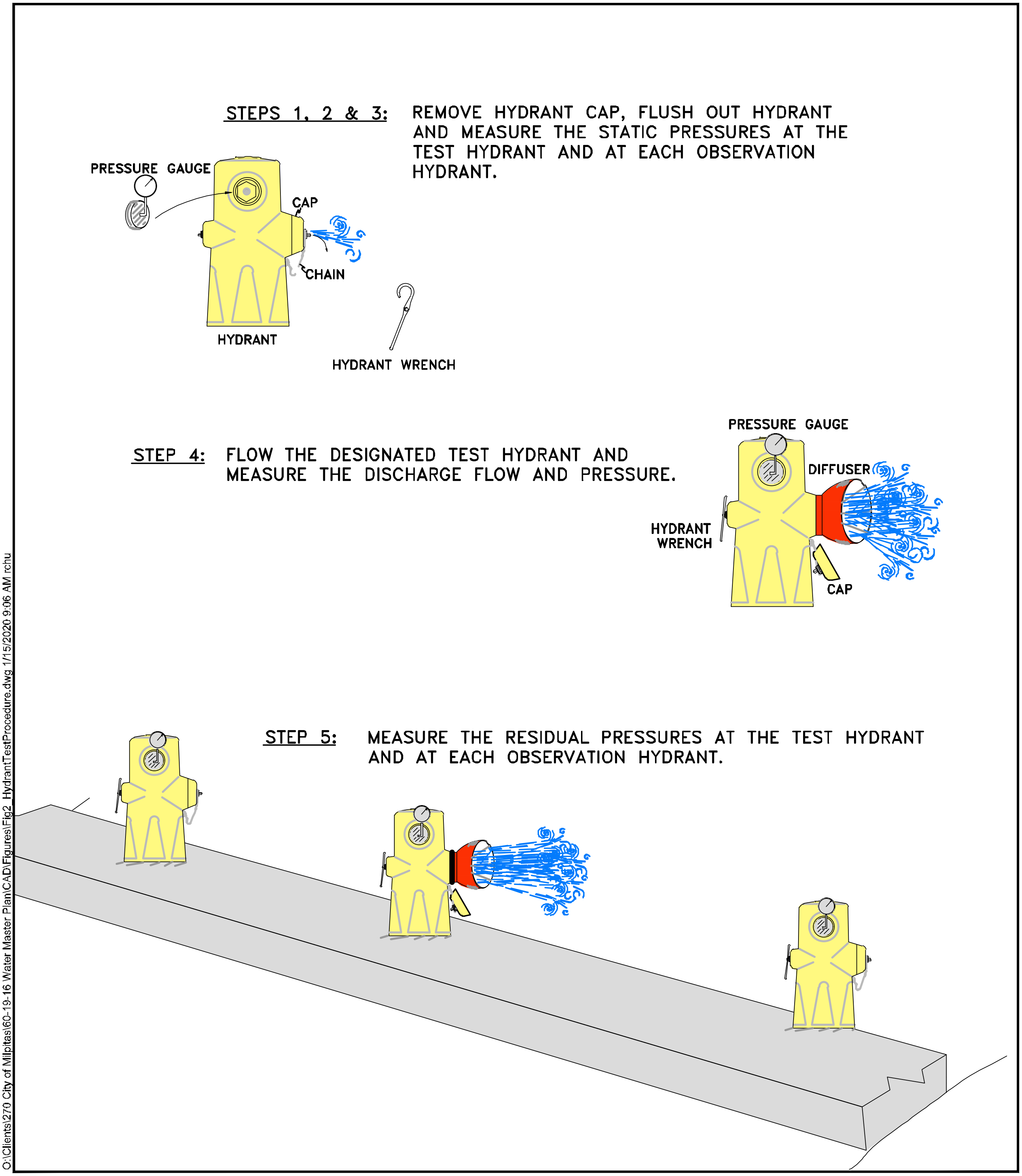
Step 6. Continue monitoring pressure until the "all clear" is given by a West Yost employee. Record the static pressure and then detach the pressure gauge. ***IMPORTANT:*** *Before closing the hydrant, be sure the gauge's test cock valve is open and bleeding while the hydrant is being closed.*

At least one (1) City staff member will be required at the flowing test hydrant and up to two (2) additional City personnel will be required in the field to assist with the opening and closing of valves (refer to Attachment A). West Yost will provide three (3) staff members to direct, oversee, and assist in the field data collection work effort.

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

Testing Equipment

West Yost will provide a 4.5-inch diameter Swivel Piezo Diffuser and pressure gauges during the hydrant testing program. It is our recommendation that the 4.5-inch diameter Swivel Piezo Diffuser be used for all proposed hydrant tests. For any hydrant test where is it not possible to use this type of diffuser due to drainage or traffic control issues, an alternative method will need to be further evaluated and confirmed before the day of field testing.



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Note:
1. Figure is not to scale.

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Figure 2

Hydrant Test Procedure

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City's Responsibilities

The City will be responsible for providing the following hydrant testing equipment:

1. Vehicles
2. Hydrant wrenches
3. Equipment for closing valves and controlling traffic
4. De-chlorination equipment[1]
5. Two-way portable communication for each testing personnel

The City is also responsible for notifying residents, and other City staff and departments (i.e., Fire Department) about the scheduled hydrant testing, obtaining approvals that may be required, and providing proper drainage of the hydrant flow.

West Yost requests that the City 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 concern is the potential for flooding landscaping or building basements or creating hazardous traffic conditions. West Yost recommends that all drainage inlets/manholes be inspected near the testing site to confirm proper drainage. Additionally, the City should check the location and status of hydrants and valves that will be operated during hydrant testing. Detailed figures, which illustrate the flowing hydrant, observation hydrants, and valves to be closed, are provided in Attachment A.

HYDRANT PRESSURE RECORDER PLACEMENT

Placement of HPRs at key hydrants within the City's water system allows West Yost to verify pressures simulated in the City's hydraulic model. West Yost has identified twenty (20) hydrants to monitor water system pressures with HPRs. The selected HPR locations are typically downstream of water supply facilities (e.g., turnouts, booster pump stations, and pressure reducing valves).

West Yost is proposing to install the twenty (20) HPRs on March 10, 2020 to collect pressure information for a total of one (1) week. West Yost plans to attach the HPRs to the 2.5-inch port on specified hydrants and lock them in place with a padlock. After the seven-day monitoring period is complete, West Yost will remove the HPRs from their locations (March 18, 2020) and download and review the collected data. Figure 3 shows the general location of each HPR. Table B-1 (in Attachment B), describes the approximate location of each HPR and the water supply facility being monitored. Attachment B also includes detailed figures showing the specific location of each hydrant selected for HPR placement (Figures B-1 through B-20). West Yost requests that City staff review and inspect each of the proposed HPR placement locations before the placement date to identify any potential problems with the selected locations.

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[1] Handling of water released from each hydrant test will need to comply with City Operations procedures and be consistent with the City's NPDES permit for planned releases from hydrant tests.

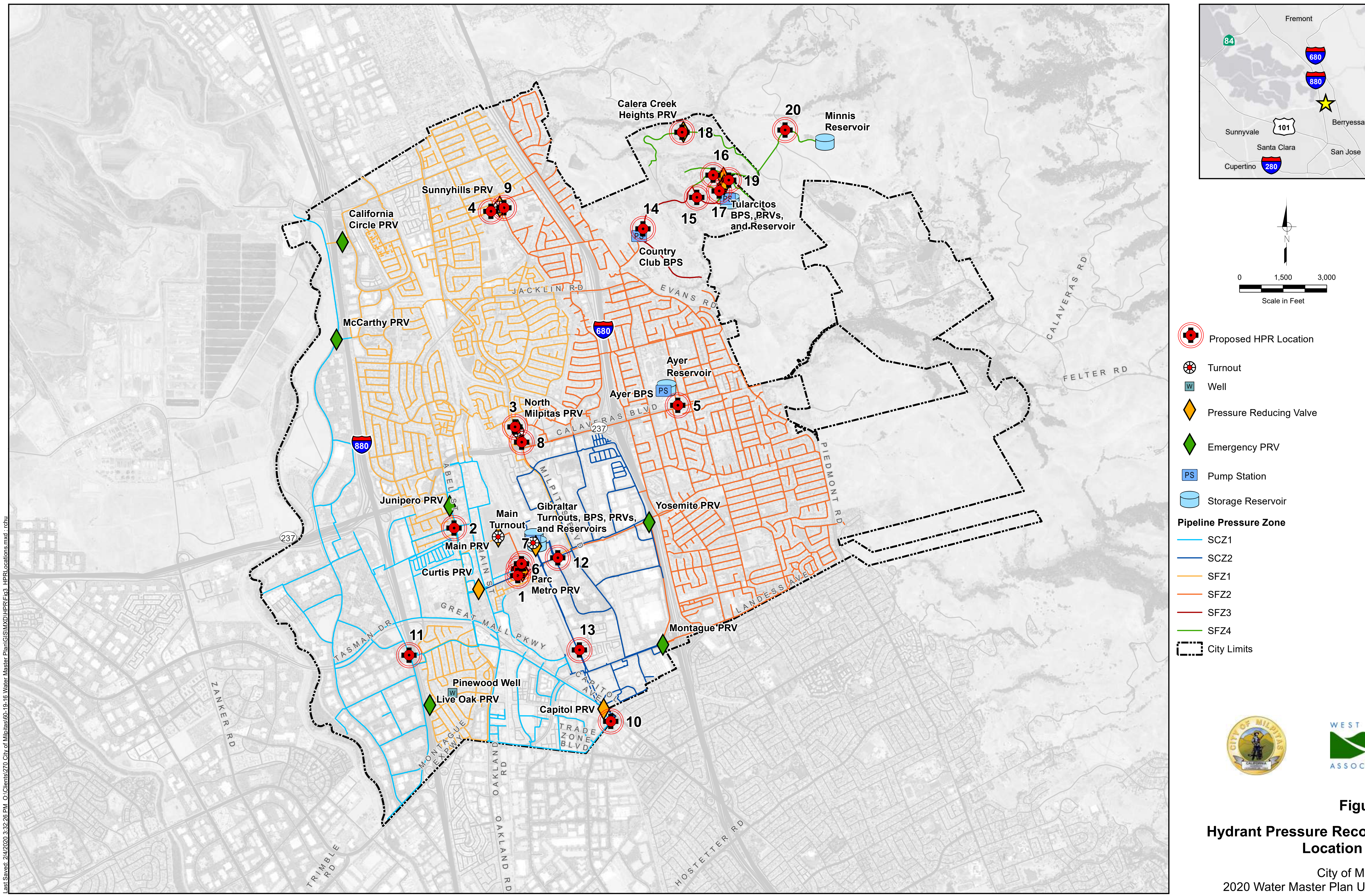

Figure 3

Hydrant Pressure Recorder Location Map

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It is important for City staff to coordinate with the Fire Department and any other appropriate parties regarding the HPR locations and duration of monitoring. This will help reduce the chance of inadvertently shutting off a hydrant with an HPR installed and may also reduce the risk of an HPR being removed or tampered with. *Each HPR is equipped with a padlock and a set of keys will be provided to the City staff. However, in case of an emergency, the Fire Department can break the lock to remove the HPR.* If an HPR is required to be removed during a non-emergency, or if the associated hydrant needs to be shut off, West Yost requests that the Fire Department inform City staff and that City staff will then coordinate with West Yost.

SUMMARY OF HYDRANT TESTING AND HPR PLACEMENT PLAN

Hydrant testing will be performed as described above beginning at 7:30 AM on Wednesday, March 11, 2020. West Yost proposes to install HPRs on Tuesday, March 10, 2020 and remove them on Wednesday, March 18, 2020. The locations and associated detailed location maps of the designated hydrants for testing and HPR placement are presented in Attachments A and B, respectively.

West Yost requests a conference call with City staff on Wednesday, March 4, approximately one week before the scheduled testing day, to review and finalize preparations for the hydrant testing and HPR placement. An Outlook meeting request will be sent to City staff to finalize a suitable meeting date and time.

Please feel free to contact Roger Chu at (925) 425-5631 or Amy Kwong at (925) 461-6788 if you have any questions or comments.

ATTACHMENT A

Table A-1. Hydrant Test Locations[a]							
Test No.	Pipeline Material	Installation Decade	Pipeline Diameter, Inches	Location	Pressure Zone	No. of Closed Valves	Comments
1	PVC	1990s	8	Along Elkwood Drive	SF1	1	-
2	AC	1960s	6	Along Gosser Street	SF1	1	-
3	AC	1980s	6	Along Stirling Drive and Stratford Drive	SF2	2	-
4	AC	1960s	6	Along Greentree Way	SF1	3	-
5	PVC	1980s	8	Along Hammond Way	SC1	1	-
6	AC	UNK[b]	8	Along Main Street	SC1	2	-
7	AC	1970s	8	Along Lacey Drive	SF2	1	-
8	AC	1970s	6	Along Clauser Drive	SF1	3	-
9	AC	1980s	8	Along Calaveras Ridge Drive	SF3	0	-
10	DI	2000s	8	Within Crossing at Montague Apartments	SC2	1	-
11	AC	1980s	6	Along Las Lomas Drive and Pacheco Drive	SF2	1	Alternate
12	PVC	2000s	8	Along Costa Street and Mihalakis Street	SC1	2	Alternate
13	AC	1980s	8	Along Pebble Beach Court	SF4-1	0	Alternate
14	AC	1960s	8	Along Heath Street	SF1	2	Alternate

(a) 10 test locations and 4 alternate test locations, if time permits.
(b) UNK = unknown

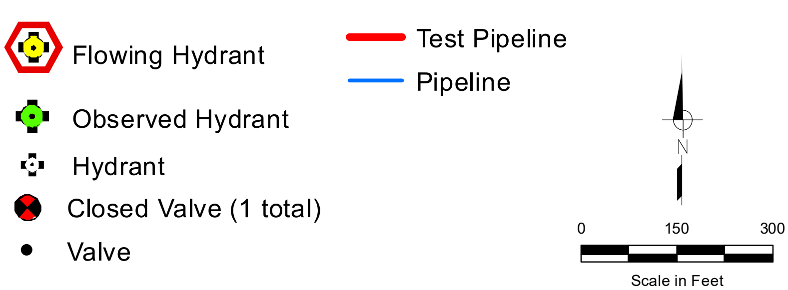

Figure A-1

Test 1 - Zone SF1
(8-inch PVC - 1990s)

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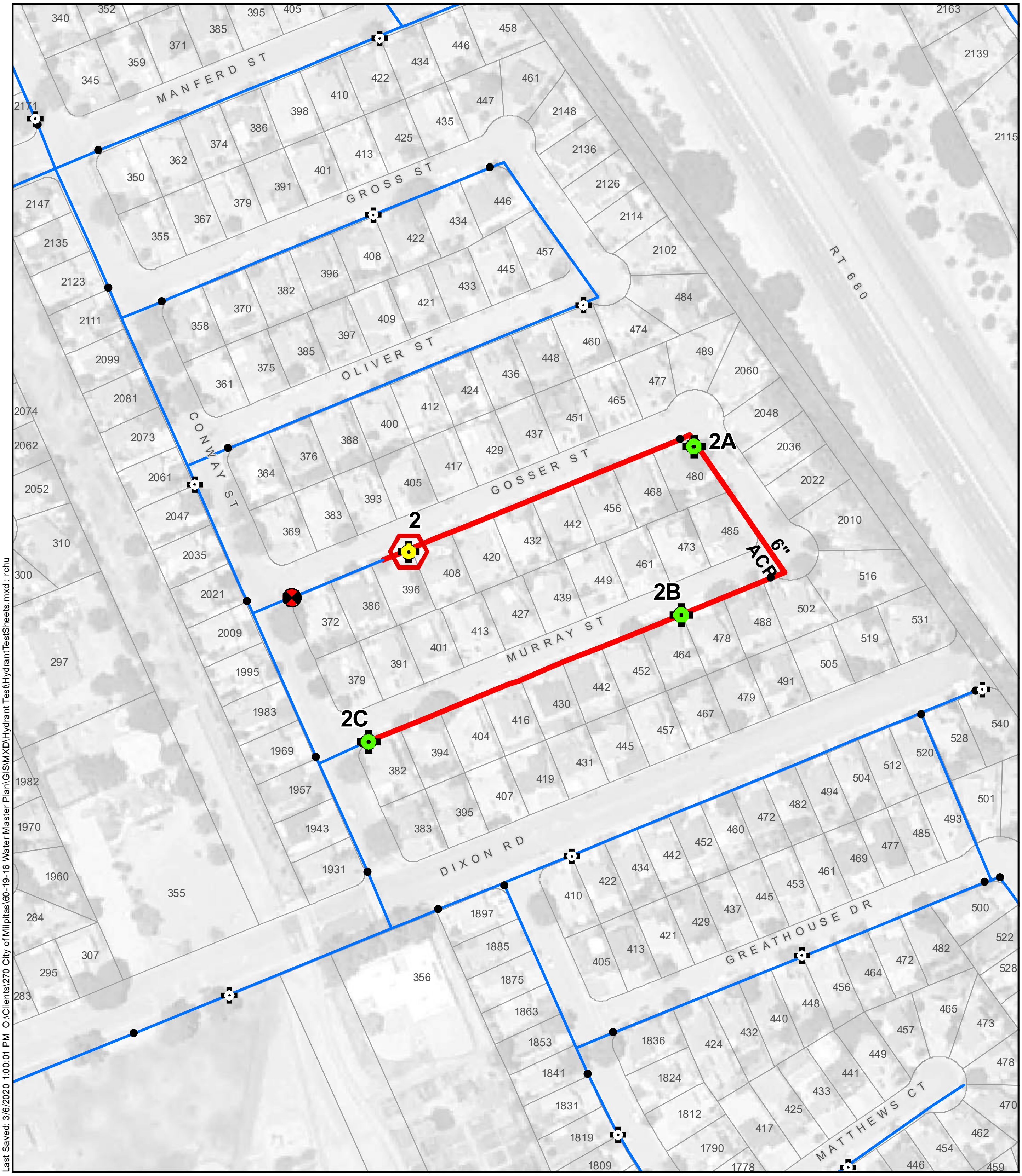

Flowing Hydrant

Observed Hydrant

Hydrant

Closed Valve (1 total)

Valve

Test Pipeline

Pipeline

N

0 100 200

Scale in Feet

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Figure A-2

Test 2 - Zone SF1
(6-inch AC - 1960s)

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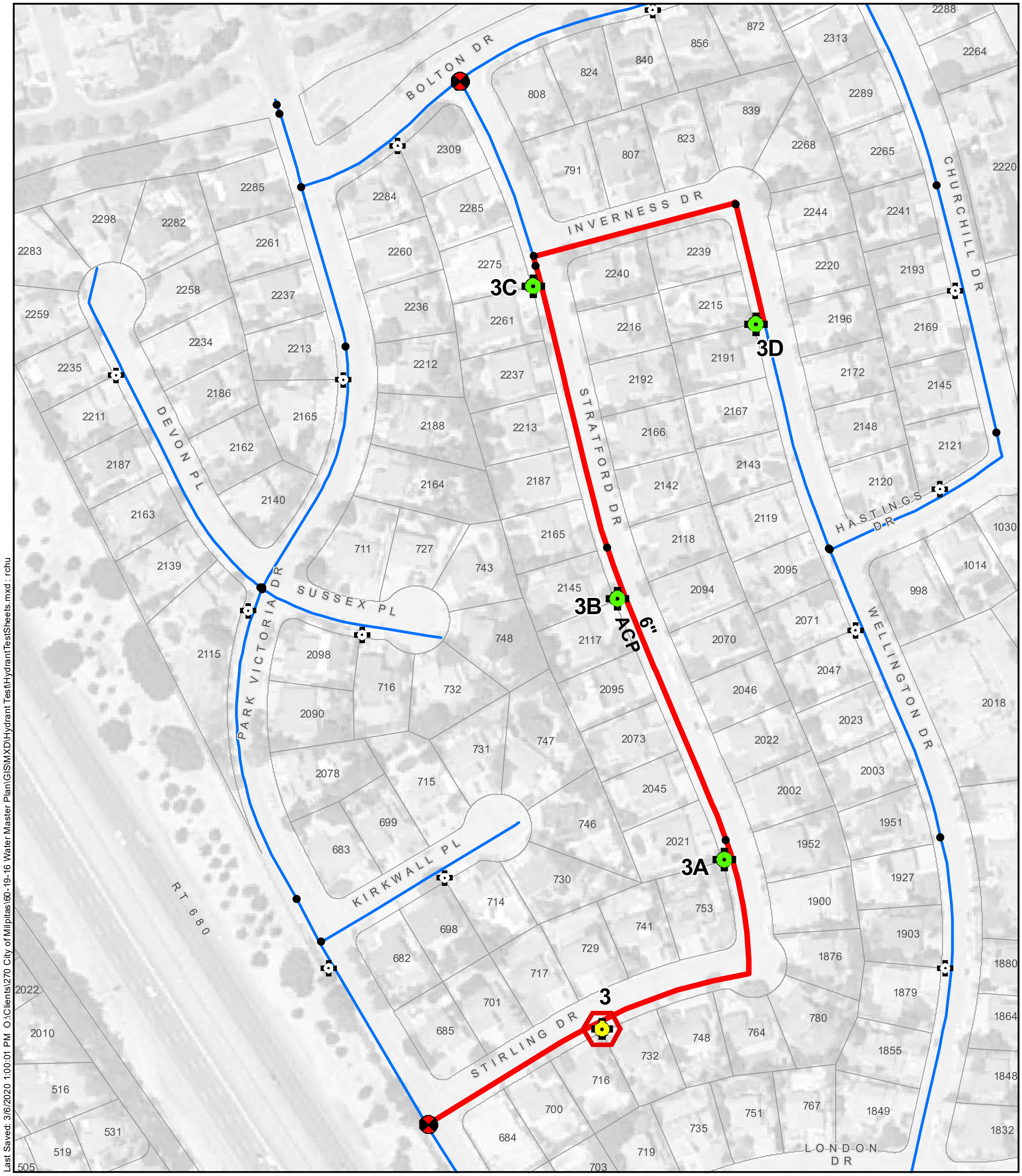

Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (2 total)
Valve

Test Pipeline
Pipeline

N

0 100 200
Scale in Feet

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Figure A-3

Test 3 - Zone SF2
(6-inch AC - 1980s)

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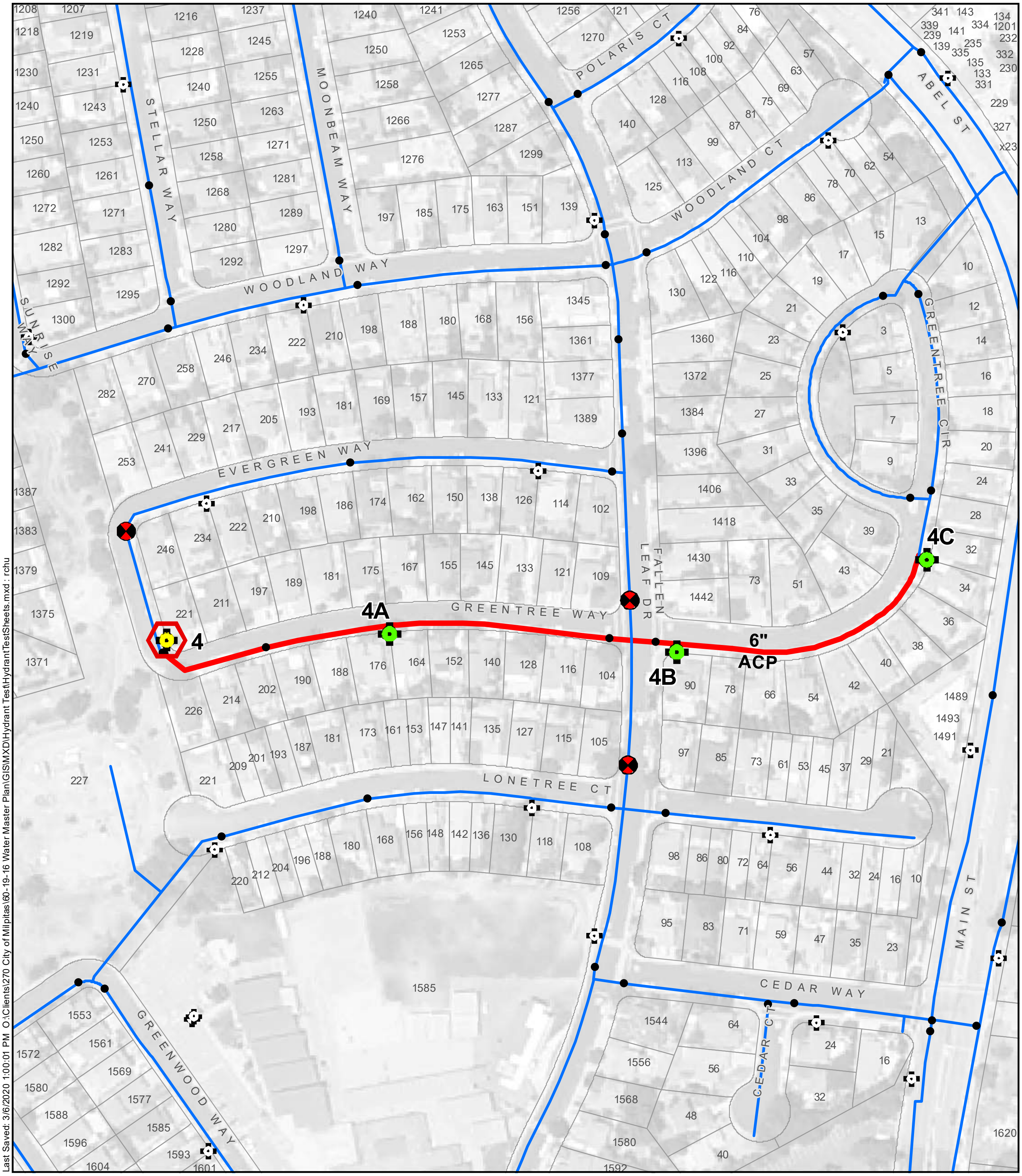

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Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (3 total)
Valve
Test Pipeline
Pipeline

0 100 200
Scale in Feet

Figure A-4

Test 4 - Zone SF1
(6-inch AC - 1960s)

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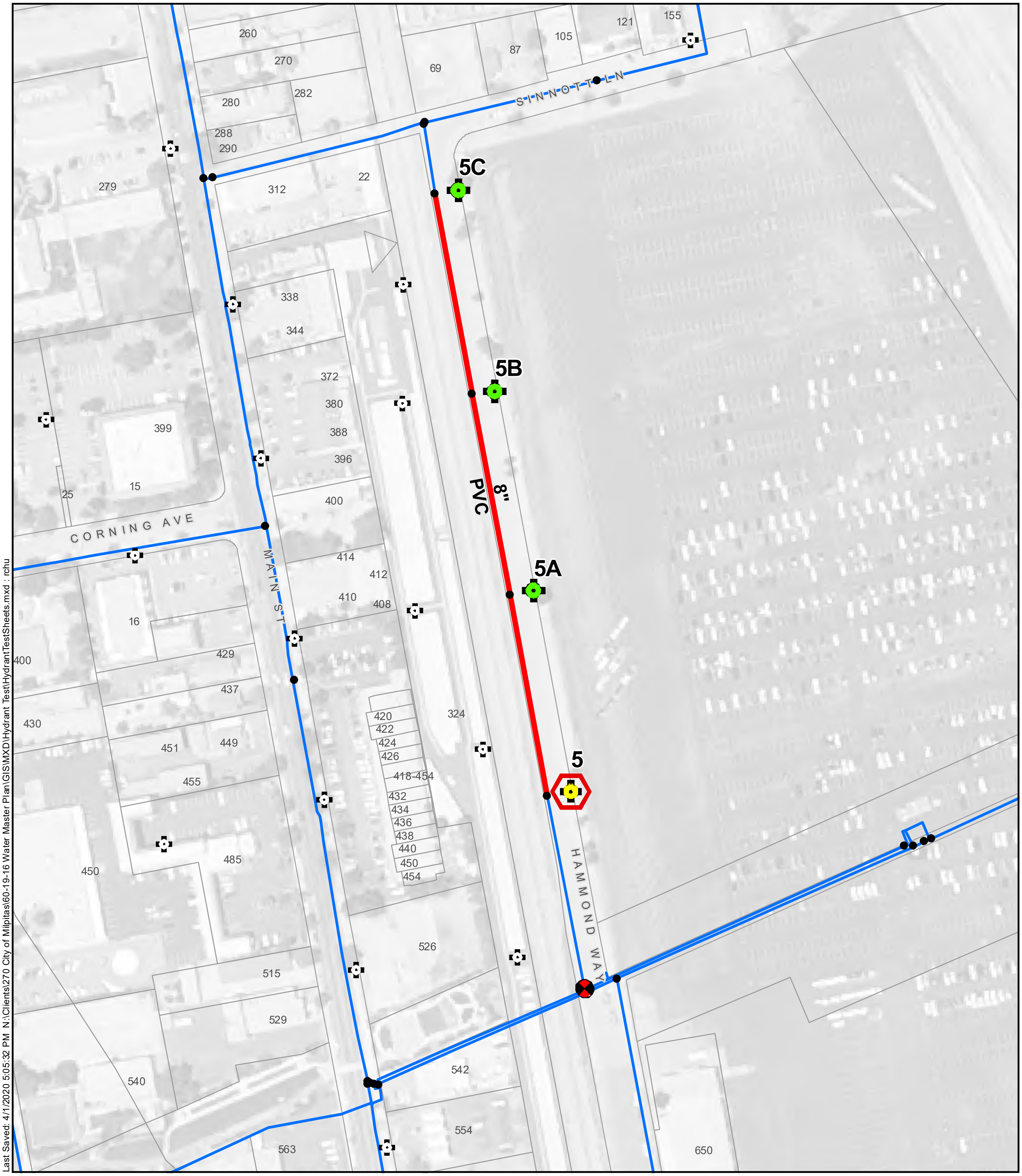

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Flowing Hydrant

Observed Hydrant

Hydrant

Closed Valve (1 total)

Valve

Test Pipeline

Pipeline

N

0 100 200

Scale in Feet

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Figure A-5

Test 5 - Zone SC1
(8-inch PVC - 1980s)

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Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (2 total)
Valve
Test Pipeline
Pipeline

0 75 150
Scale in Feet

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Figure A-6

Test 6 - Zone SC1 (8-inch AC - UNK)

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Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (1 total)
Valve
Test Pipeline
Pipeline

N

0 150 300
Scale in Feet

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Figure A-7

Test 7 - Zone SF2
(8-inch AC - 1970s)

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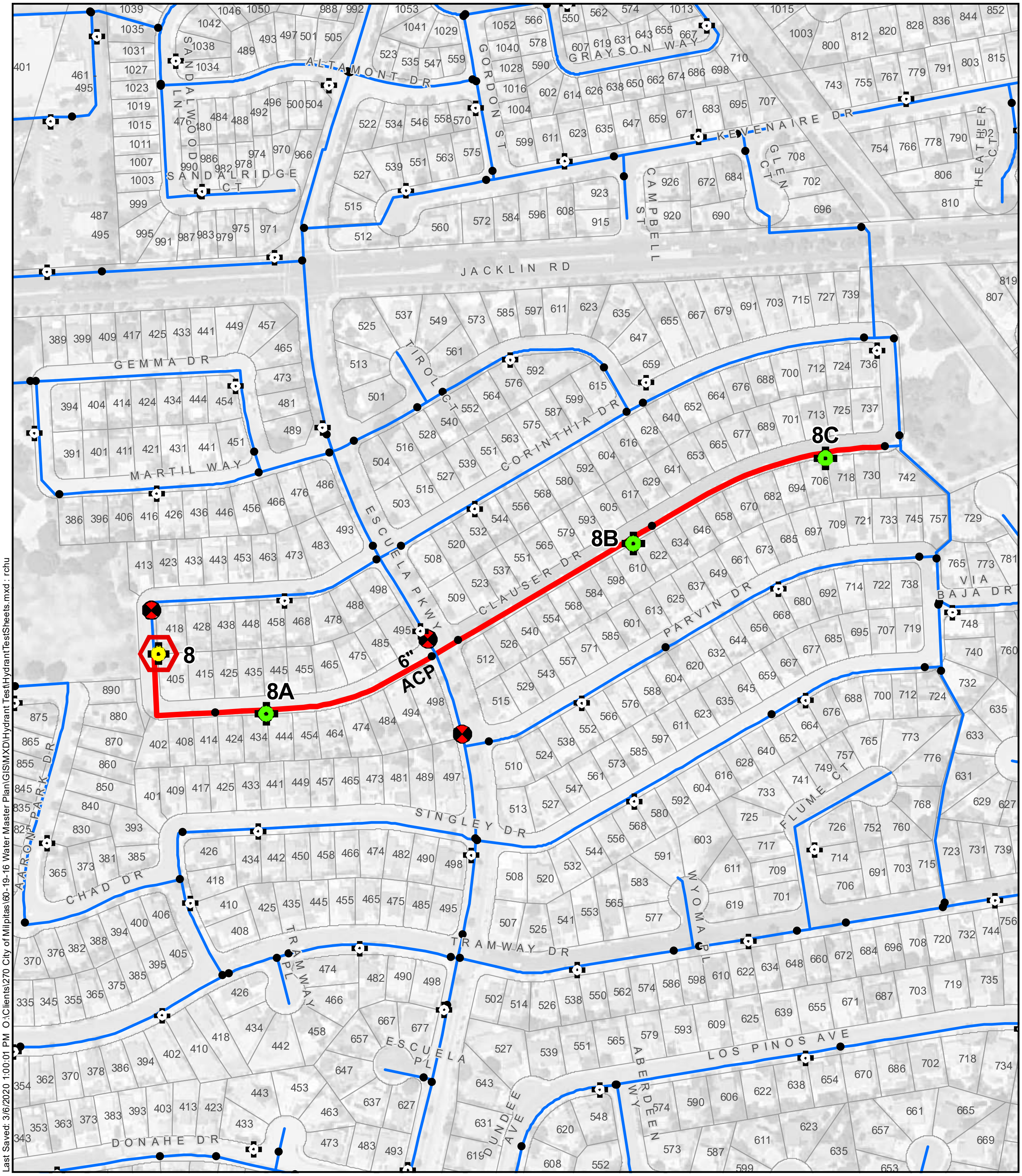

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Flowing Hydrant

Observed Hydrant

Hydrant

Closed Valve (3 total)

Valve

Test Pipeline

Pipeline

N

0 150 300

Scale in Feet

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Figure A-8

Test 8 - Zone SF1 (6-inch AC - 1970s)

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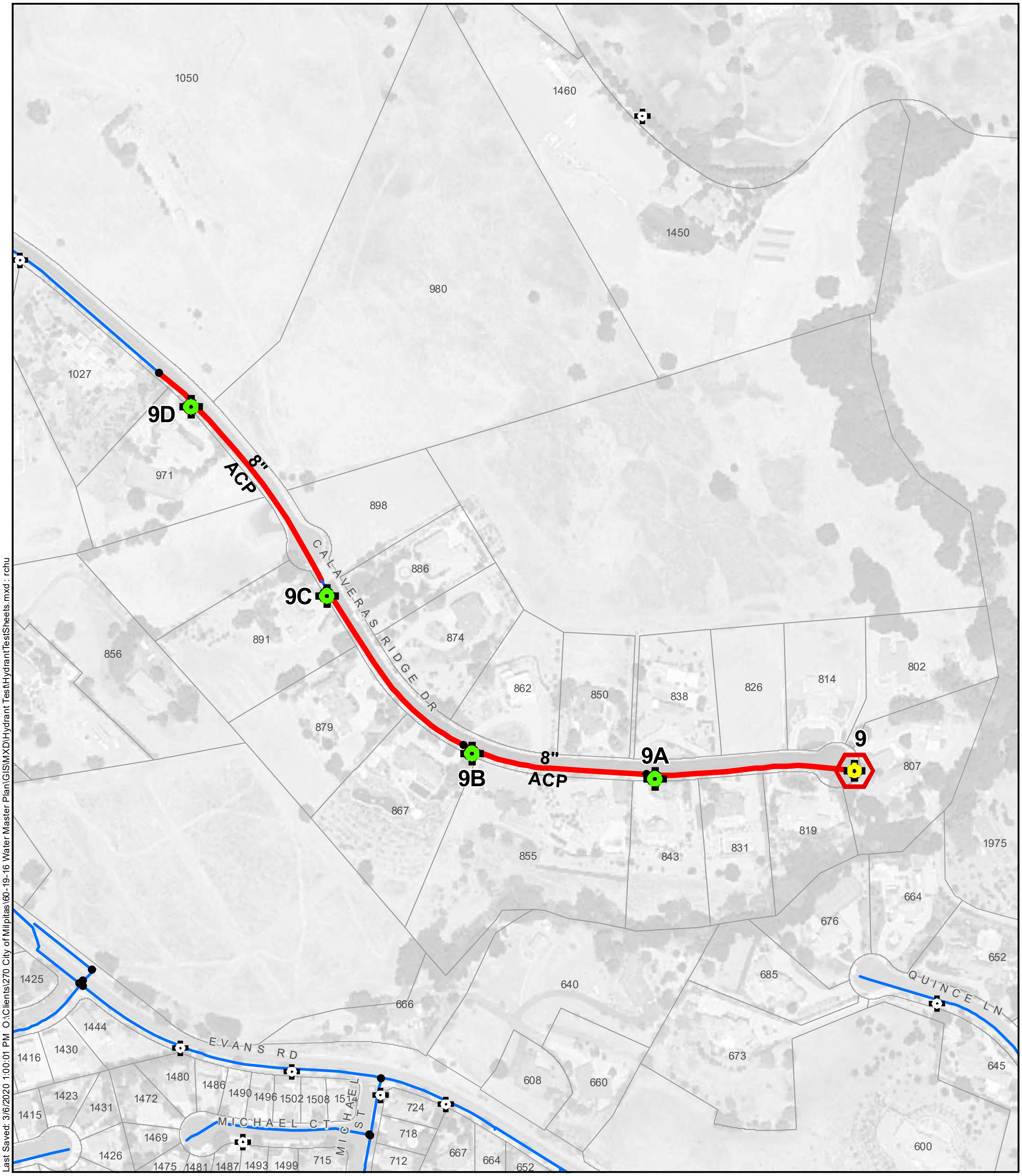

Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (0 total)
Valve
Test Pipeline
Pipeline

N

0 150 300
Scale in Feet

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Figure A-9

Test 9 - Zone SF3
(8-inch AC - 1980s)

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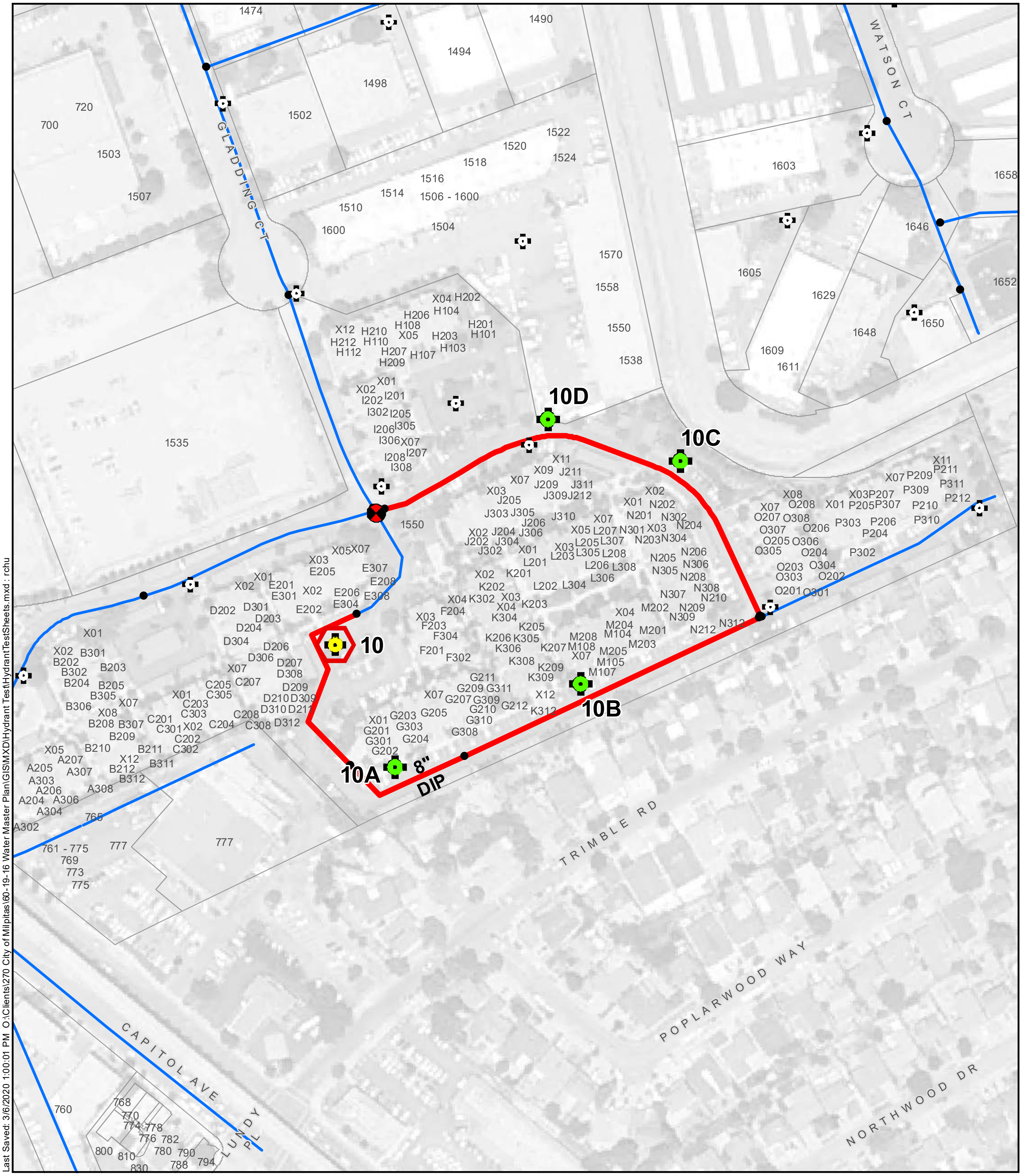

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Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (1 total)
Valve
Test Pipeline
Pipeline

0 100 200
Scale in Feet

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Figure A-10

Test 10 - Zone SC2
(8-inch DI - 2000s)

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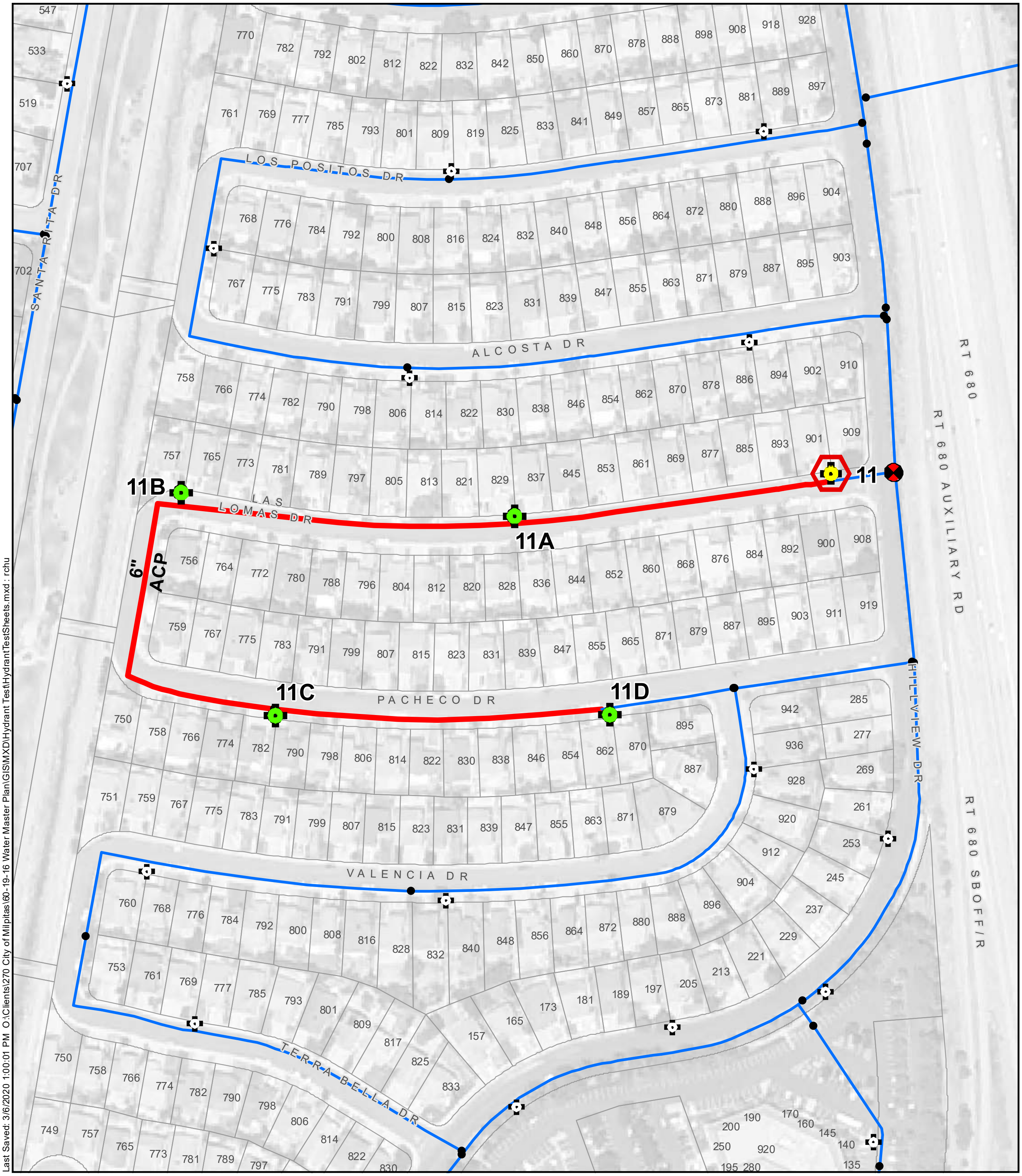

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Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (1 total)
Valve

Test Pipeline
Pipeline

N

0 100 200
Scale in Feet

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Figure A-11

Alternate Test 11
Zone SF2
(6-inch AC - 1980s)

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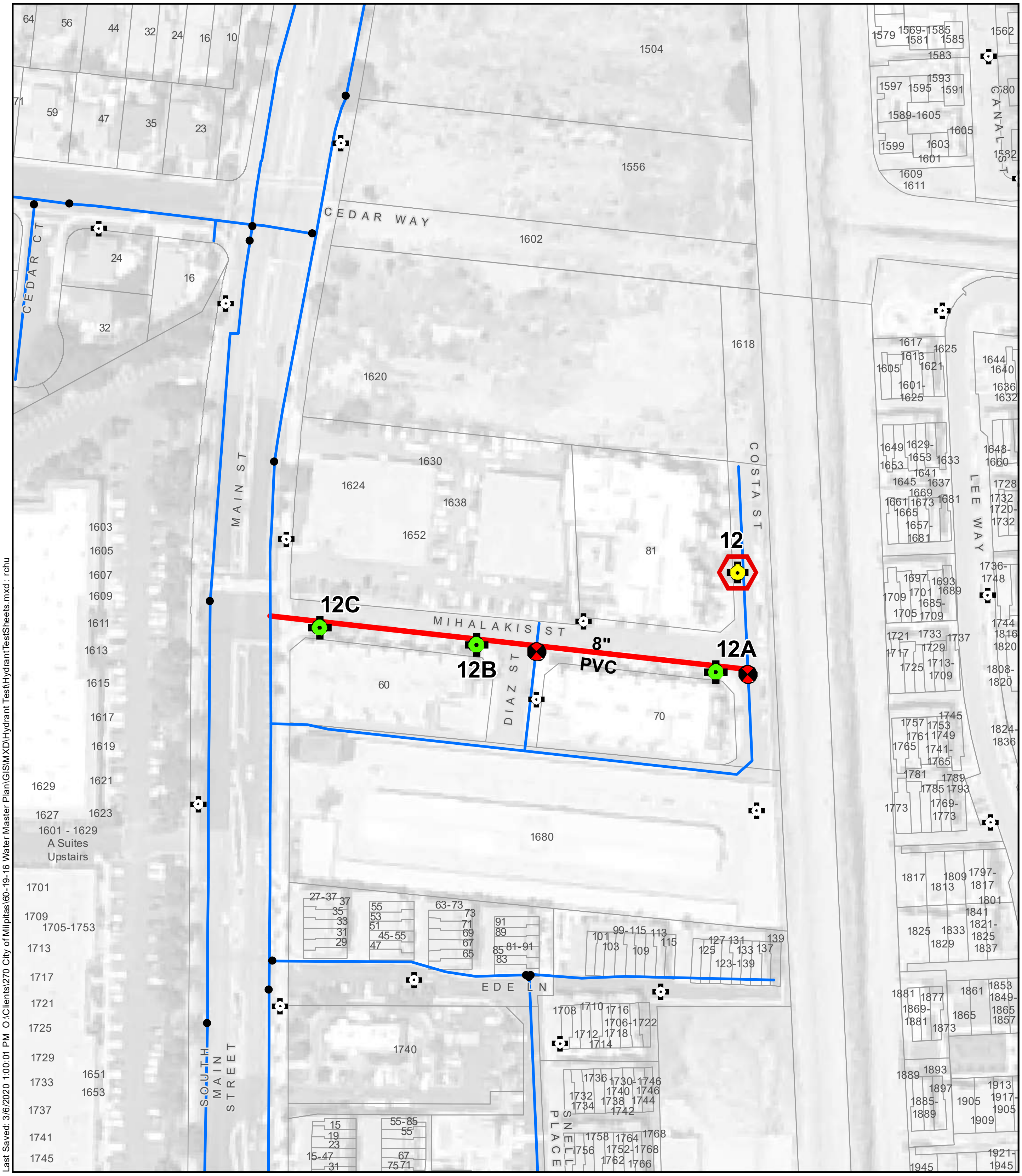

Flowing Hydrant

Observed Hydrant

Hydrant

Closed Valve (2 total)

Valve

Test Pipeline

Pipeline

N

0 75 150

Scale in Feet

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Figure A-12

Alternate Test 12
Zone SC1
(8-inch PVC - 2000s)

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Flowing Hydrant

Observed Hydrant

Hydrant

Closed Valve (0 total)

Valve

Test Pipeline

Pipeline

N

0 100 200

Scale in Feet

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Figure A-13

Alternate Test 13
Zone SF4-1
(8-inch AC - 1980s)

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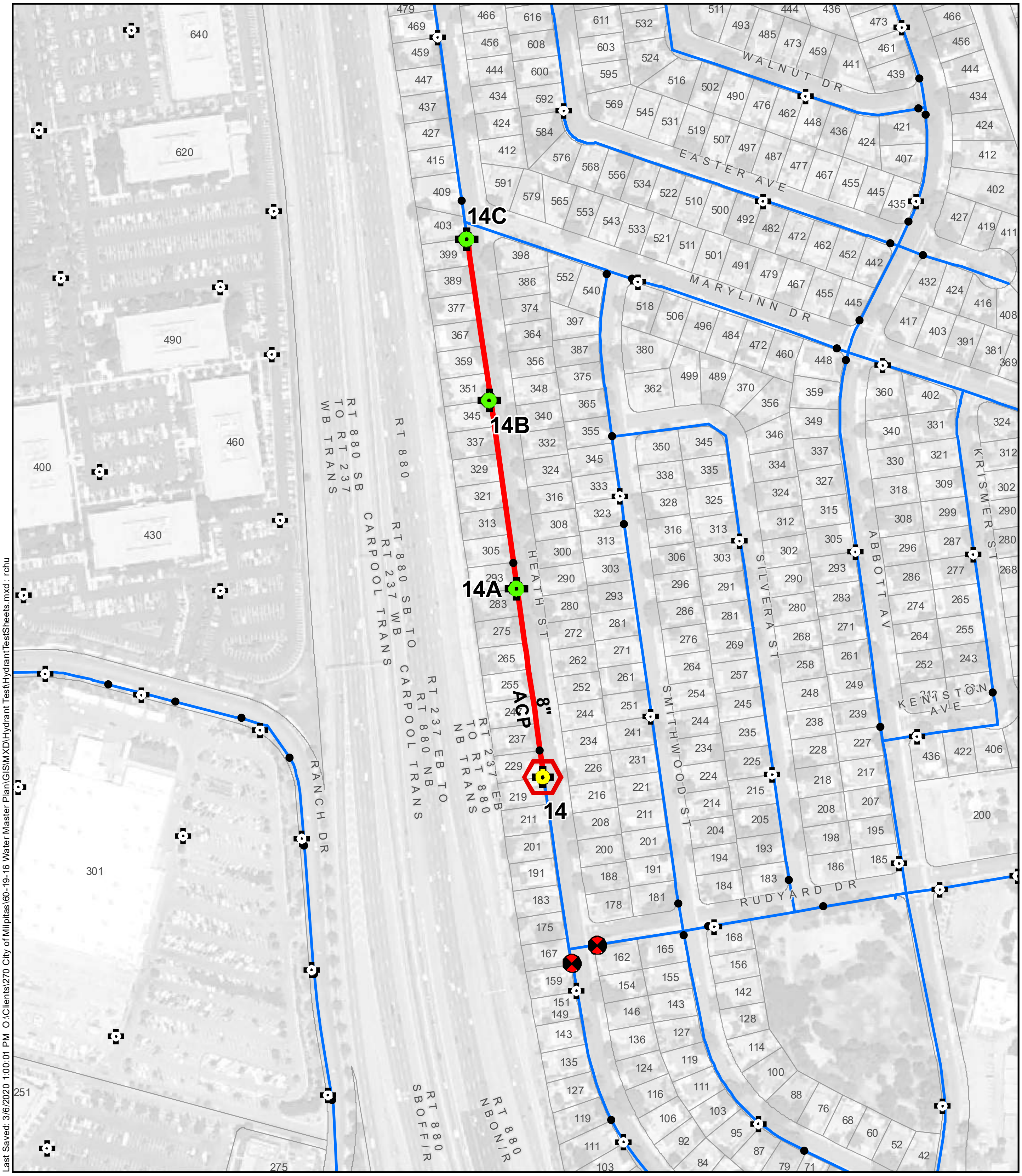

Flowing Hydrant
Observed Hydrant
Hydrant
Closed Valve (2 total)
Valve
Test Pipeline
Pipeline

N

0 150 300
Scale in Feet

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Figure A-14

Alternate Test 14
Zone SF1
(8-inch AC - 1960s)

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ATTACHMENT B

Table B-1. Hydrant Pressure Recorder Locations

HPR No.	Pressure Zone	Facility Monitored	Location
1	SF1	Gibraltar BPS	Near 819 E Curtis Ave
2	SF1	Main St PRV	SW corner of Corning Avenue and Abel Street
3	SF1	N Milpitas PRV	Near 70 N Milpitas Boulevard
4	SF1	Sunnyhills PRV	Near 361 Washington Drive
5	SF2	Ayer BPS	Near 1439 E Calaveras Boulevard
6	SC1	Parc Metro PRV	Near 232 Parc Place Drive
7	SF2	Main St Turnout	Near 271 Parc Place Drive
8	SF2	Calaveras Turnout	NE corner of N Milpitas Boulevard and E Calaveras Boulevard
9	SF2	Sunnyhills Turnout	Near 1589 Washington Drive
10	SC1	Capitol PRV	Lundy Pl near 880 E Capitol Avenue
11	SC1	Curtis PRV	Near 1189 Barber Lane
12	SC2	Gibraltar PRV	Intersection of Gibraltar Court and Gibraltar/Yosemite Drive
13	SC2	Gibraltar BPS	Piper Dr between Garden Street and Meridian Place
14	SF3	Country Club BPS	Country Club Drive, north of BPS
15	SF3	Tularcitos Tank	Near 1251 Tularcitos Drive
16	SF4-1	Tularcitos N PRV	Near 1772 Country Club Drive
17	SF4-1	Tularcitos S PRV	Near 1870 Saint Andrews Court
18	SF4-1	Calera Creek Heights PRV	Near 1631 Calera Creek Heights Drive
19	SF4-2	Tularcitos BPS	Near 1490 Tularcitos Drive
20	SF4-2	Minnis Tank	Near intersection of Monument Peak Road and Downing Road (Launch Site Road?)

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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

0 100 200
Scale in Feet

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Figure B-1

Hydrant Pressure Recorder Locations

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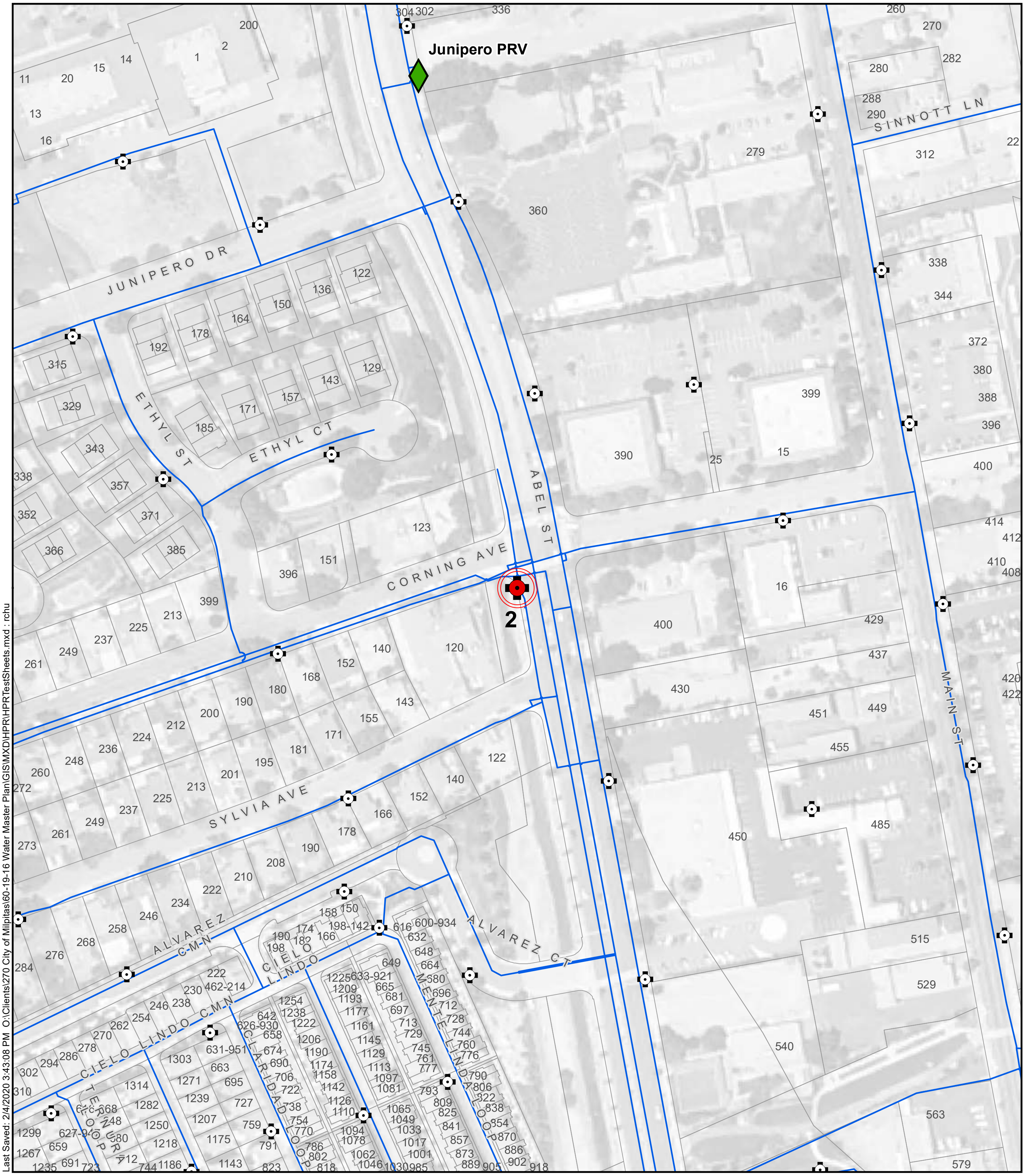

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Proposed HPR Location
Hydrant
Turnout
PS Pump Station
Storage Reservoir
W Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

0 100 200
Scale in Feet

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Figure B-2

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-3

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
PS Pump Station
Storage Reservoir
W Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-4

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

Proposed HPR Location

Hydrant

Turnout

Pump Station

Storage Reservoir

Well

Pressure Reducing Valve

Emergency PRV

Pipeline

N

0 100 200

Scale in Feet

WEST YOST ASSOCIATES

Figure B-5

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location

Hydrant

Turnout

PS Pump Station

Storage Reservoir

W Well

Pressure Reducing Valve

Emergency PRV

Pipeline

N

0 100 200

Scale in Feet

CITY OF MILPITAS

WEST YOST ASSOCIATES

Figure B-6

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location

Hydrant

Turnout

PS Pump Station

Storage Reservoir

W Well

Pressure Reducing Valve

Emergency PRV

Pipeline

0 100 200

Scale in Feet

N

WEST YOST ASSOCIATES

Figure B-7

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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- Proposed HPR Location
- Hydrant
- Turnout
- Pump Station
- Storage Reservoir
- Well
- Pressure Reducing Valve
- Emergency PRV
- Pipeline

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-8

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

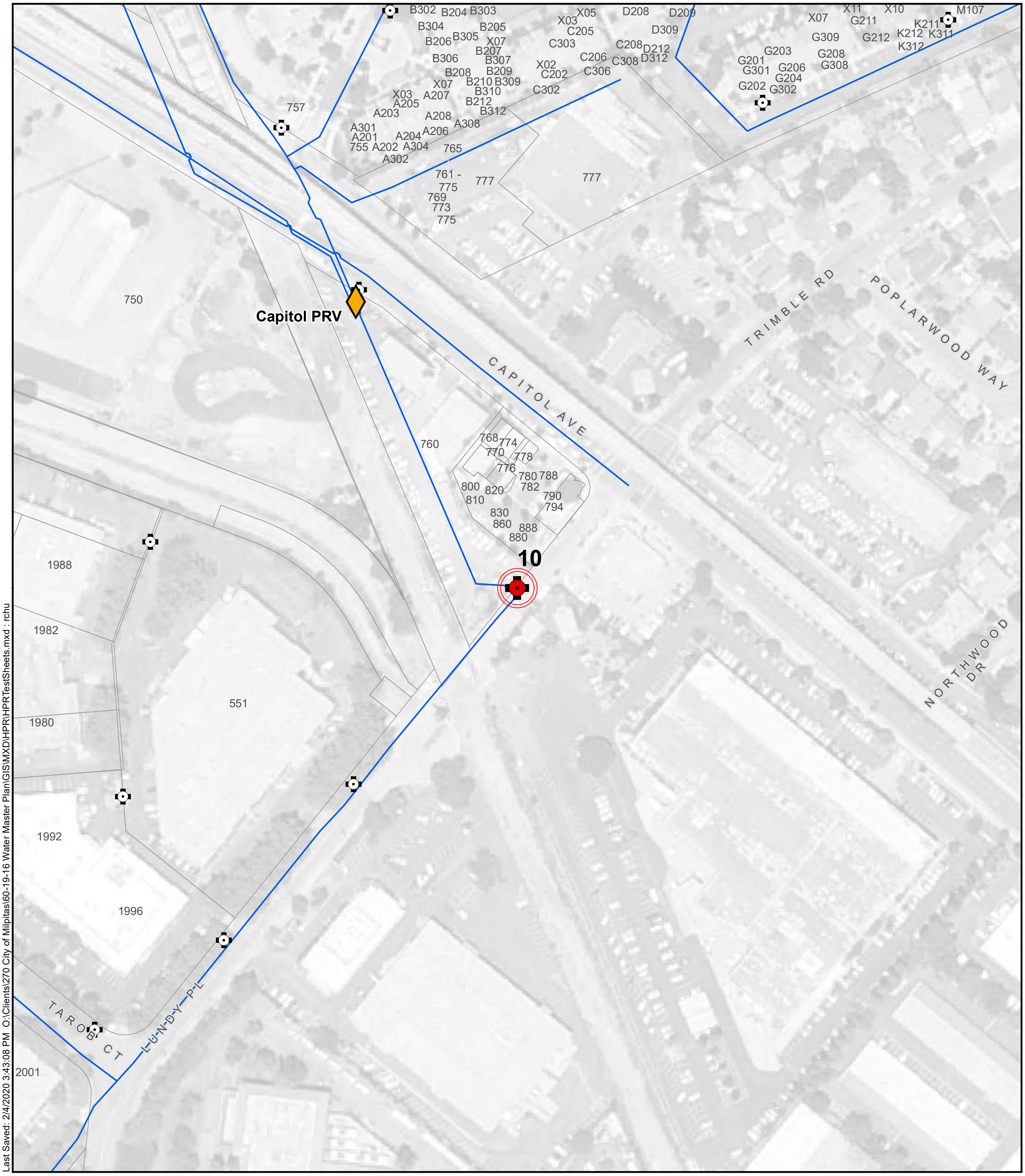
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-9

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



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Proposed HPR Location

Hydrant

Turnout

Pump Station

Storage Reservoir

Well

Pressure Reducing Valve

Emergency PRV

Pipeline

0 100 200

Scale in Feet

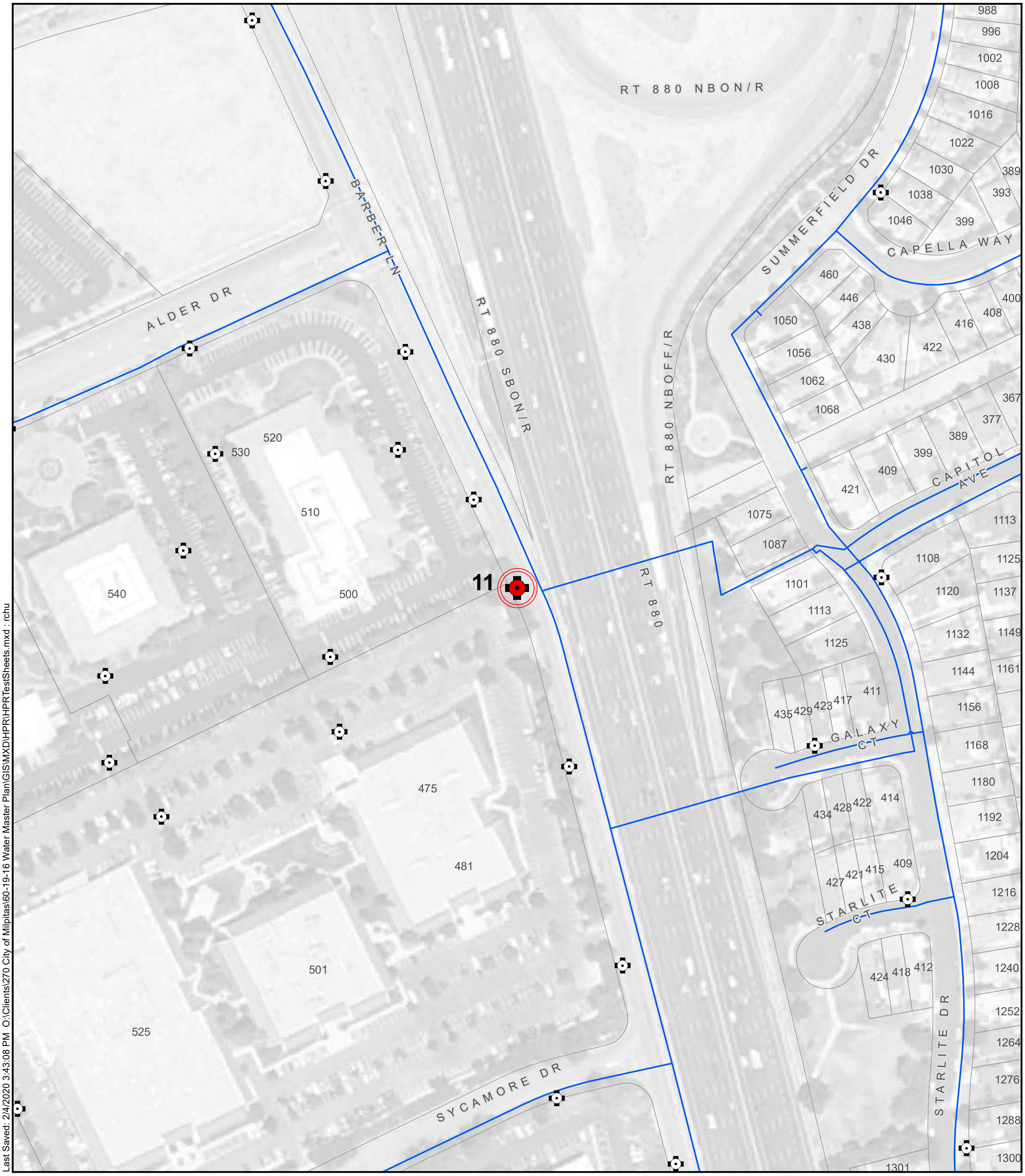
N

WEST YOST ASSOCIATES

Figure B-10

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-11

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
PS Pump Station
Storage Reservoir
W Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

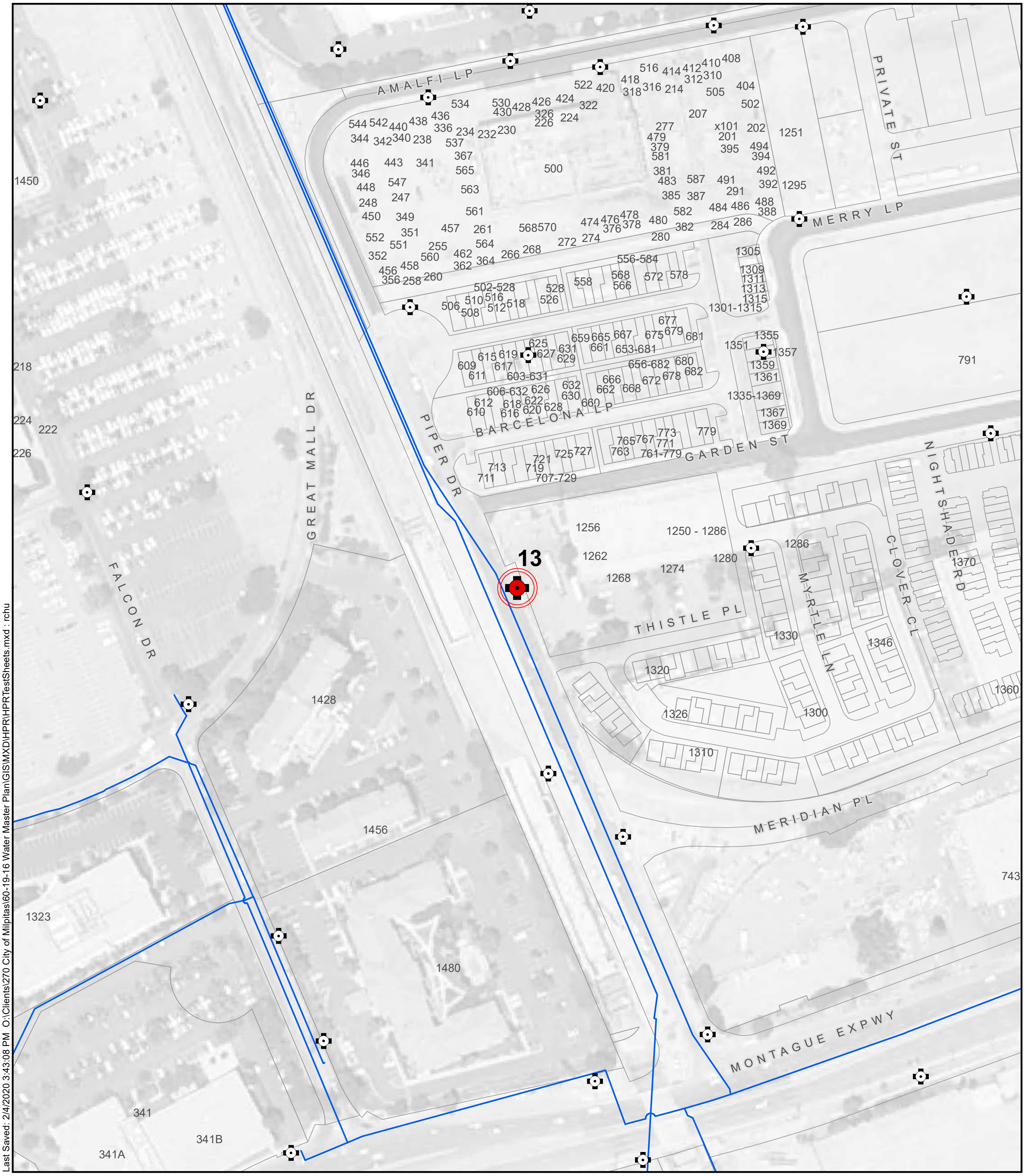
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-12

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



- Proposed HPR Location
- Hydrant
- Turnout
- PS Pump Station
- Storage Reservoir
- W Well
- Pressure Reducing Valve
- Emergency PRV
- Pipeline

N

0 100 200

Scale in Feet

CITY OF MILPITAS

WEST YOST ASSOCIATES

Figure B-13

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-14

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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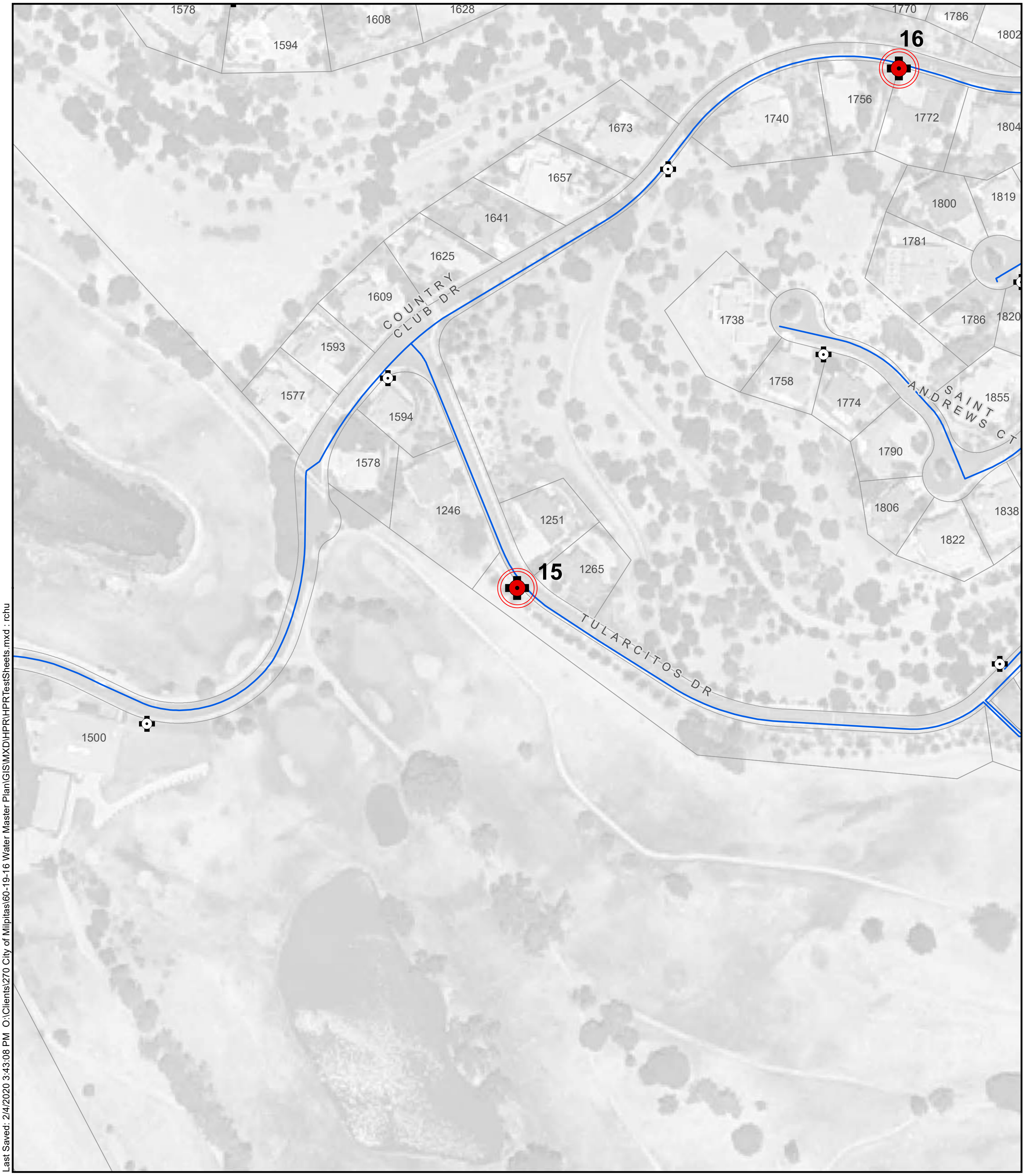

Proposed HPR Location

Hydrant

Turnout

PS Pump Station

Storage Reservoir

W Well

Pressure Reducing Valve

Emergency PRV

Pipeline

N

0 100 200

Scale in Feet

WEST YOST ASSOCIATES

Figure B-15

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
PS Pump Station
Storage Reservoir
W Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

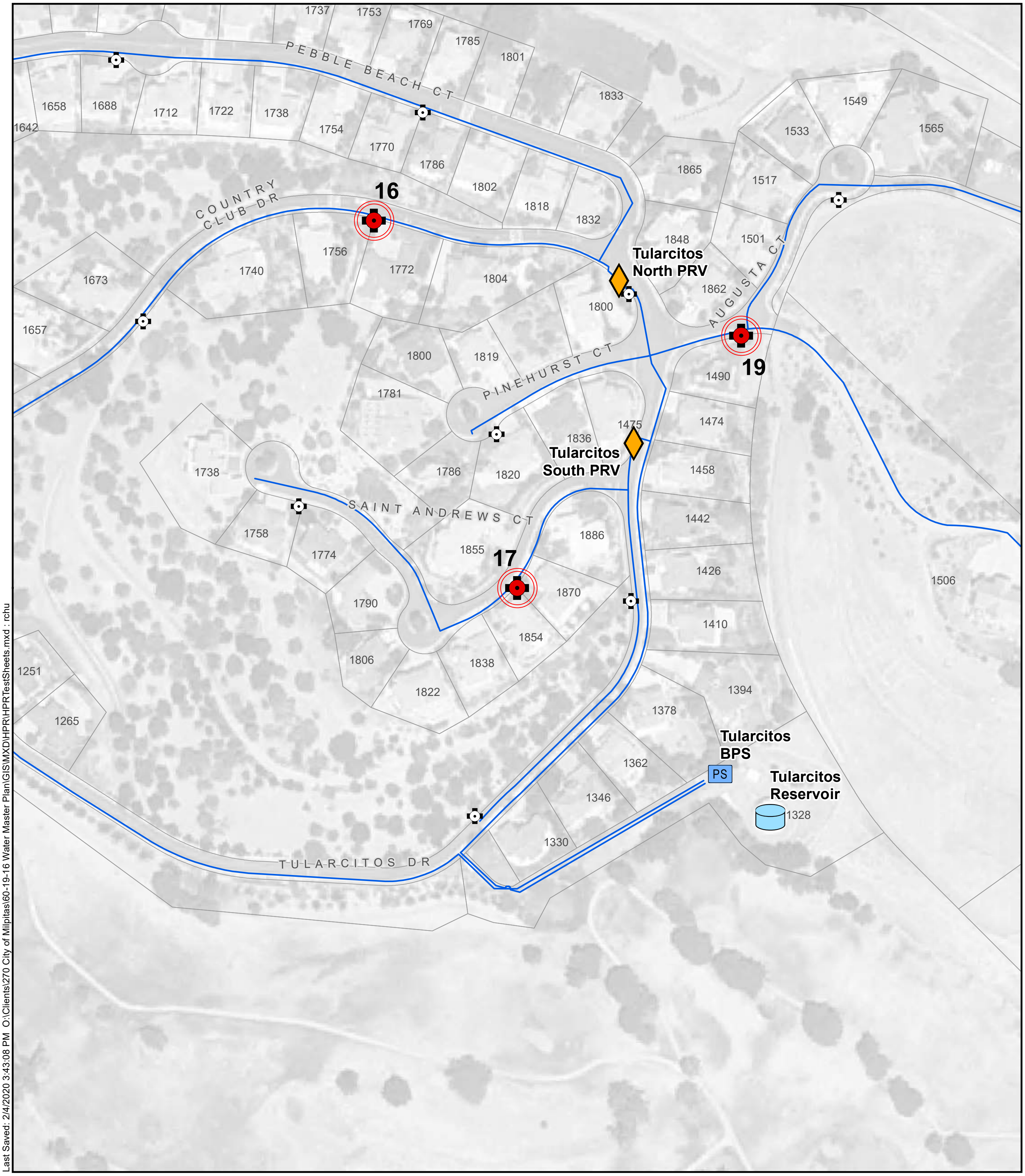
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-16

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

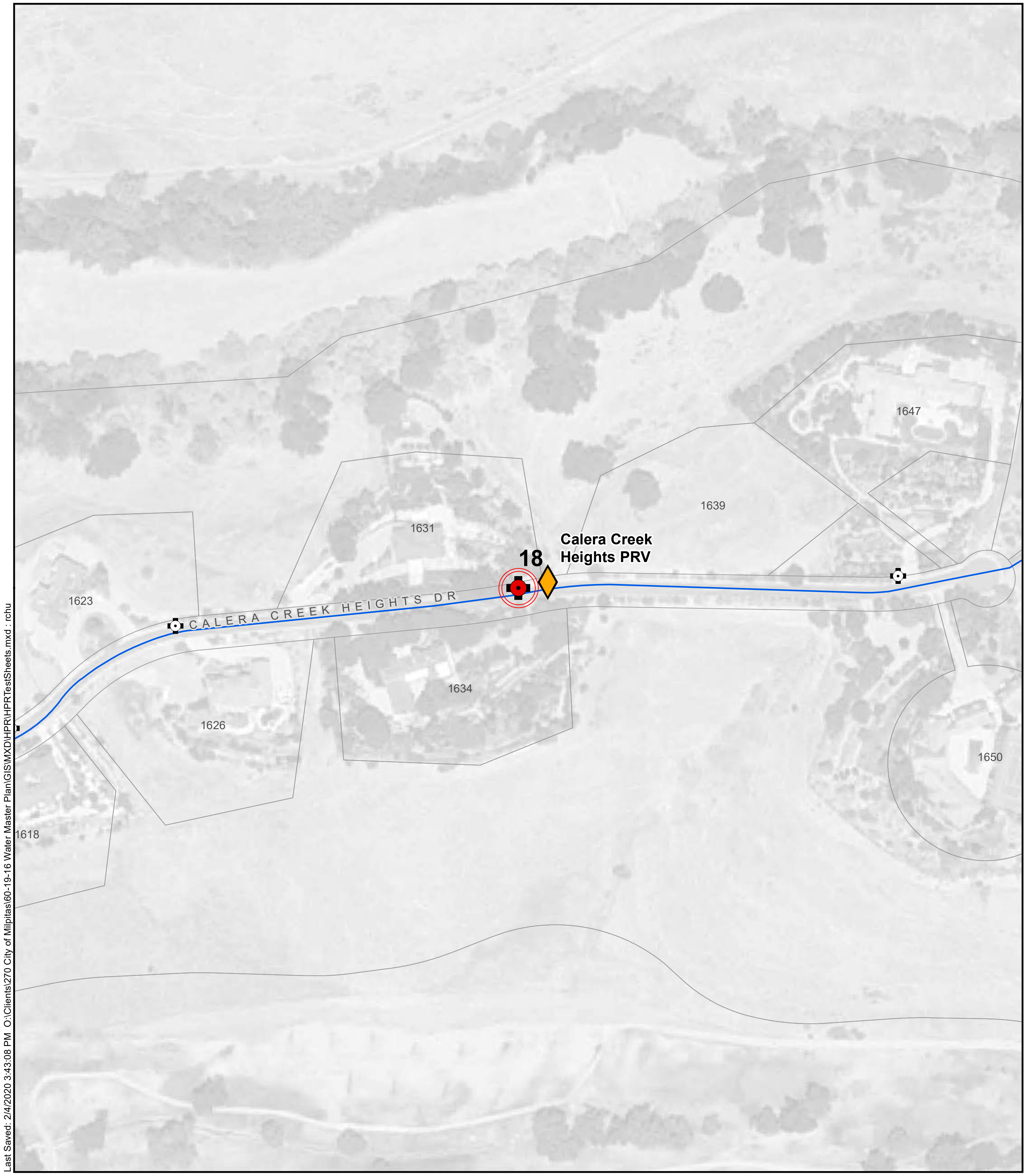
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-17

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

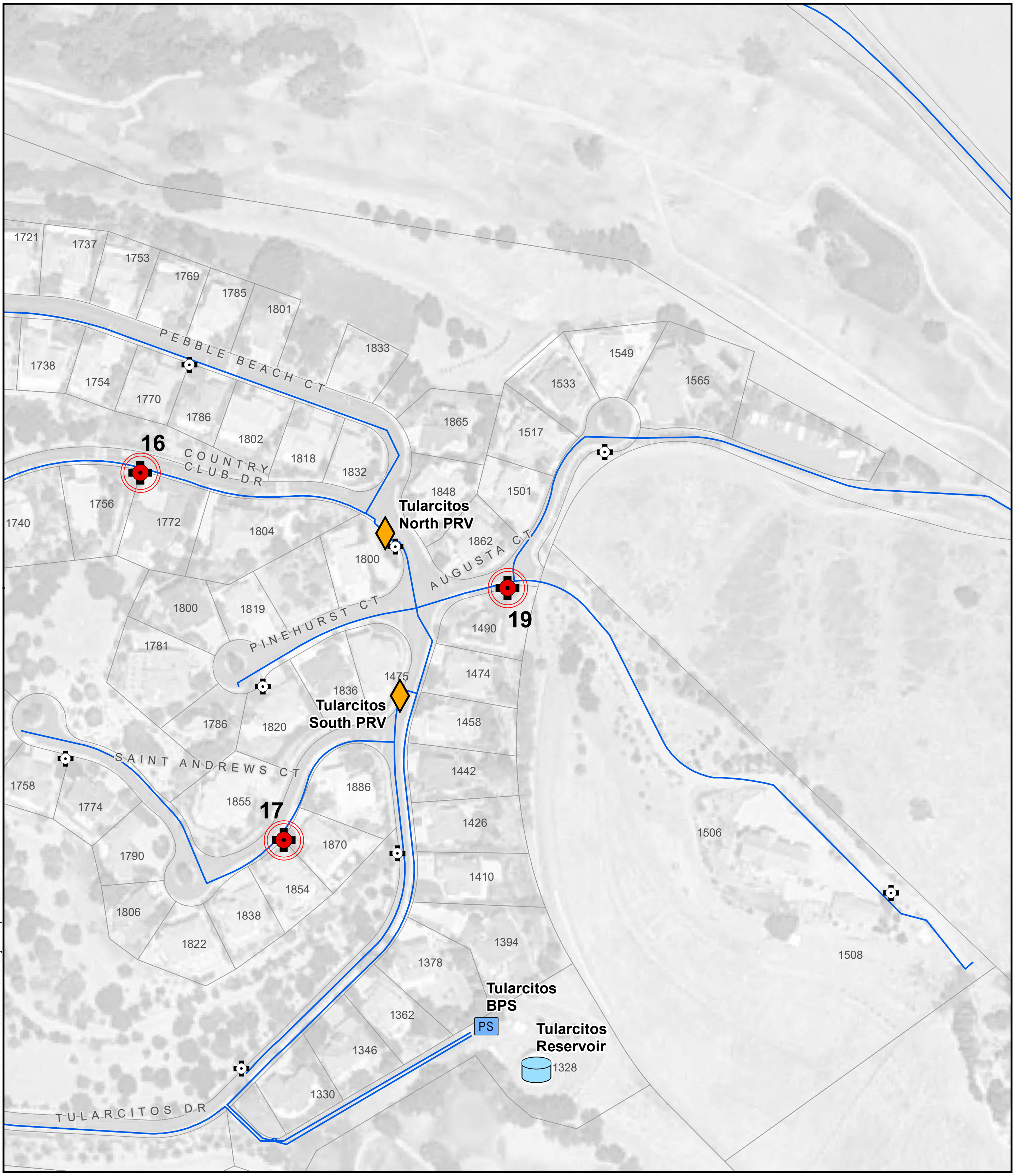
0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-18

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update



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Proposed HPR Location
Hydrant
Turnout
Pump Station
Storage Reservoir
Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-19

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

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Proposed HPR Location
Hydrant
Turnout
PS Pump Station
Storage Reservoir
W Well
Pressure Reducing Valve
Emergency PRV
Pipeline

N

0 100 200
Scale in Feet

WEST YOST ASSOCIATES

Figure B-20

Hydrant Pressure Recorder Locations

City of Milpitas
2020 Water Master Plan Update

Appendix D

Water Utility Condition Assessment

TECHNICAL MEMORANDUM | OCTOBER 2020

2020 Water Master Plan
Water Utility Condition Assessment

PREPARED FOR

City of Milpitas

PREPARED BY

WEST YOST
Water. Engineered.

2020 Water Master Plan
Water Utility Condition Assessment

Prepared for

City of Milpitas

Project No. 270-60-19-16

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Michael Zacharia, PE	10-30-20 Date	Anne Girtz, PE	10-30-20 Date

QA/QC Review: Elizabeth Drayer PE	10-30-20 Date

WEST YOST
Water. Engineered.

TECHNICAL MEMORANDUM | OCTOBER

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2020 Water Master Plan
Water Utility Condition Assessment

This Technical Memorandum (TM) summarizes the condition assessment that was performed of the City of Milpitas's (City) water utility assets under Task 3 – Water Utility Asset Condition Assessment of the 2020 Water Master Plan Update (Master Plan). This TM presents assessment methodologies, asset valuations, likelihood and consequence of failure factors, and risk scores as summarized in the following sections:

1.0 Scope of Work

2.0 Review of Existing Information

3.0 Asset Replacement Cost and Current Valuation

4.0 Risk Assessment Framework

5.0 Likelihood of Failure Methodology

6.0 Consequence of Failure Methodology

7.0 Risk Assessment

8.0 Conclusions

1.0 SCOPE OF WORK

The scope of this assessment includes:

- Preparing an estimate of remaining useful life and replacement cost of assets;
- Developing a risk policy consisting of likelihood of failure (LOF) factors, consequence of failure (COF) factors, and interpretation of both LOF and COF to define risk; and
- Performing a desktop risk analysis of utility assets.

Each asset was evaluated according to the risk policy, resulting in risk scores for each water system asset. Risk scores and corresponding risk action thresholds can be used for decision making including selection and prioritization of asset renewal or replacement efforts. The analysis results will be used to inform the Task 7 Rehabilitation and Replacement Study of the Master Plan.

The standardized evaluation process established in the risk policy can be used in future assessments of condition, risk, and valuation of water system assets. The policy framework was developed so that risk factor definitions are commensurate across assets from other City utilities and can be applied to other departments. Should new data become available to support additional or refined risk factors (e.g. pipe break data with failure cause, condition assessment data, etc.), these can be developed within the risk framework proposed herein.

2.0 REVIEW OF EXISTING INFORMATION

This section describes the existing information upon which the assessments were based, and any data processing required prior to undertaking the assessments.

2.1 Asset Data and Asset Registry

The City provided two data sources containing water system asset information: a master inventory spreadsheet and a GIS database.

The master inventory spreadsheet contained information on water facilities including wells, pump stations, reservoirs, PRVs, turnouts, interties, and isolation valves. In addition to facility data, the spreadsheet contained information on select individual assets at each facility (e.g., for a pump station, the pump size(s), manufacturer, model, and other attributes were provided).

The City's existing GIS database was outdated and was updated by HydroScience as part of their work on the City's Sewer Master Plan (being completed concurrently). The updated database contained geospatial and attribute information for horizontal water assets including pipelines, valves, backflow preventers, blow off assemblies, hydrants, and meters.

The master spreadsheet and GIS database were compiled to create an asset registry of all City water system assets. Upon comparison of the two data sources provided by the City, it was observed that several assets were present in both databases. Duplicate entries included: isolation valves (40), PRVs (18), and reservoirs (5). To reconcile the duplicates, a coordinate comparison was performed in GIS to identify duplicate isolation valves; and visual inspection in GIS was performed to identify duplicate PRVs and reservoirs. Duplicates were removed from the respective database prior to compiling the asset registry. The asset registry facilitated the condition and risk assessment discussed herein and provides a database for the City to track and manage their assets moving forward. This database is provided as a separate deliverable which consists of an Excel spreadsheet titled *Asset Registry and Risk Results.xlsx* and may be used to refresh the City's CMMS database.

The final asset registry contained 35,260 entries, consisting of 35,173 horizonal assets and 87 vertical assets. The breakdown of assets by type is presented in Table 1.

Table 1. Asset Registry – Count of Asset Types

Asset Type	Count
Horizontal Assets	
Pipelines	9,575 pipe segments (183 miles)
Hydrants	2,906
Valves	6,341
Meters	16,351
Total Horizontal Assets	**35,173**
Vertical Assets	
Fuel Tank	3
Engine	4
Generator	3
Motor	10
PLC	2
PRV	23
Pump	19
Reservoir	5
Turnouts and Interties	7
VFD	9
Well	2
Total Vertical Assets	**87**

2.2 2002 Utility Depreciation Study

A Utility Depreciation Study (Schaaf and Wheeler) was performed in 2002. The study included the following:

- An inventory of all City water system assets;
- Replacement costs for those elements; and
- A timetable for replacement of water system elements based on anticipated remaining useful life estimates.

This replacement cost analysis assumed unit costs based on a March 2003 ENR Construction Cost Index. Table 2 presents the resulting replacement costs from the 2002 study for the City's water system assets in 2002 dollars.

Table 2. Water System Replacement Costs, 2002 Utility Depreciation Study (2002 Dollars)

Asset Type	Replacement Cost Million dollars
Pipelines	131
Valves and Couplings	8.9
ACP Disposal	80.6
Storage Tanks	13.4
Pump Stations	10.6
Wells	1.1
Total	**$245.6**

2.3 2018 Soil Corrosivity Study

In 2018, the City commissioned a soil corrosivity study (JDH Corrosion Consultants, Inc.) to develop a comprehensive database related to corrosion potential of the soils throughout the City. The assessment was focused on water pipelines made of asbestos cement (AC), ductile iron, cast iron, dielectric coated steel, and mortar coated steel materials. Based on in-situ soil resistance measurements and a review of previous soil evaluations, strategies were developed for long-term corrosion control of AC and metallic pipelines.

3.0 ASSET REPLACEMENT COST AND CURRENT VALUATION

Asset replacement cost and current valuation estimates are asset management best practices that can afford utility agencies improved decision making. This information provides agencies more accurate and integrated information about their assets, and allows more productive relationships with governing authorities, ratepayers, and other stakeholders because they can provide better information in a more transparent way.

Asset Replacement Cost estimates can be used to guide rehabilitation and replacement budgeting. Typically, investment in replacement should cover at a minimum, the deprecation of the assets.

Asset Current Valuation estimates are required to support transactions (public-private partnerships, outright sale, etc.), insurance coverage or claims, and rates cases.

3.1 Water System Asset Replacement Cost

A water system asset replacement cost estimate was developed which represents the cost to replace the entire system in-kind, at current construction and design standards. Costs were developed based on a combination of data supplied by manufacturers, published industry standard cost data and curves, construction costs for similar facilities built by other public agencies, and construction costs previously estimated by West Yost for similar facilities with similar construction cost indexes. Details on cost estimating assumptions are provided in a separate appendix of the Water Master Plan.

A summary of the water system replacement costs is presented in Table 3a. Detailed replacement costs are provided in the *Asset Registry and Risk Results* Excel workbook.

Table 3a. Water System Replacement Costs (2020 Dollars)

Facility Type	Replacement Cost Million dollars
Pipelines	148.4
Valves	4.7
Hydrants	36.2
Meters	6.9
Storage Tanks	46.6
Pump Stations	27.6
Wells	7.2
PRVs	5.9
Turnouts and Interties	4.4
Total	**$287.9**

3.2 Water System Current Valuation

Using the 2020 replacement cost estimate presented in Table 3a, a current water system valuation was prepared using asset useful life estimates (discussed in detail in the Asset Useful Life section) and assuming a straight-line value reduction or depreciation. A straight-line depreciation assumes that the value of an existing asset is reduced gradually over its useful life in a linear relationship. For example, a pipe with 50 percent remaining useful life is valued at 50 percent of its total new replacement cost value. The water system asset valuation estimates the value of individual assets only, not the inherent value of the water system as a whole.

The 2020 water system asset valuation assuming straight-line depreciation is presented in Table 3b. Detailed asset valuation costs are provided in the *Asset Registry and Risk Results* Excel workbook.

Table 3b. Water System Asset Valuation (2020 Dollars)

Facility Type	Asset Valuation, Million dollars
Pipelines	43.5
Valves	1.2
Hydrants	9.1
Meters	0.7
Storage Tanks	16.1
Pump Stations	2.8
Wells	2.0
PRVs	1.5
Turnouts and Interties	1.1
Total	**$78.0**

4.0 RISK ASSESSMENT FRAMEWORK

Understanding the *risk* of each water system asset can help water utilities to prioritize highest-risk assets for renewal or replacement, allowing limited resources to be allocated most effectively. The two components of risk include:

- **Likelihood of Failure (LOF)**, which estimates the probability that a failure will occur in an asset by meeting the end of its physical, design, service, or economic useful life; and
- **Consequence of Failure (COF)**, which estimates the impacts of asset failure expressed either qualitatively or quantitatively, being a loss, injury, or disadvantage from a social, economic, environmental, or regulatory standpoint.

Risk is then estimated using the conventional risk equation:

Risk = LOF x COF

The following sections present the LOF and COF methodology that was developed for the City's water system assets, and then calculates asset risk using the risk equation.

5.0 LIKELIHOOD OF FAILURE METHODOLOGY

A desktop assessment was performed on existing water utility assets to estimate the LOF of each asset. For this assessment, asset failure is defined by the asset's inability to perform as intended or needed in its application. The primary failure mode utilized for this assessment was physical mortality, which is defined as physical deterioration due to age, usage, or acts of nature. Operational efficiency failure was also evaluated to consider the reduction in pipeline asset performance due to pipe roughness. Supplemental asset data such as failure history and asset condition assessment can also be used to evaluate LOF. This data was not available at the time this analysis was performed.

For each asset type, one or more LOF factors were developed for each failure mode, as presented in Table 4a.

Table 4a. Asset Failure Modes and LOF Factors

Failure Mode	Failure Description	LOF Factor
Physical Mortality	The percent of useful life remaining considers that older assets are more likely to fail than newer ones due to the age of materials and wear from repeated use.	Remaining Useful Life (for pipelines, considering pipe material, pipe diameter, and soil conditions)
	Pipelines that operate at higher working pressures can undergo stress cycles and cause higher failure rates in older pipelines.	Operating Pressure[a]
Operational Efficiency Failure	The accumulation of corrosion byproducts and suspended particles on the inside wall of aged pipes can increase pipe roughness and reduce pipe diameter, thereby increasing operational costs to overcome to greater hydraulic losses.	Pipe Roughness[a] (change in Hazen-Williams C-Factor)

(a) LOF Factor only applicable to pipelines

LOF ratings were assigned for each factor using standard definitions presented in Table 4b. Ratings and definitions range from 1 – indicating that an asset is in good condition and asset failure is "unlikely", to 4 – indicating that asset is in poor condition and asset failure is "very likely". Finally, each asset was evaluated under each applicable LOF factor to develop an overall LOF rating.

Table 4b. LOF Definition and Ratings

	LOF Rating			
	1	2	3	4
LOF Definition	Unlikely	Possible	Likely	Very Likely

The following sections describe the development of each LOF factor utilized in the assessment.

5.1 Asset Useful Life Defined

Asset useful life is generally considered to be the time that an asset provides valued service, after which it does not meet its intended service level. End of life is not necessarily indicative of catastrophic failure, and in most cases an asset can still hold functionality when it has reached the end of its useful life. Absent quantifiable condition or performance data, the assumption is that the older the asset, the greater likelihood it will fail.

Municipal water system assets vary by type, manufacture, design, construction, and quality. They have different characteristics in how they operate and, consequently, will have different profiles of how they perform and ultimately fail. Asset useful life expectancies are documented by the American Water Works Association and Water Environment Research Foundation (WERF) in addition to other notable industry associations. Useful life values presented here are nominal and consistent with the water utility industry and are not specific to any geographic region.

5.1.1 Non-Pipeline Useful Life

Table 5a presents a summary of useful life by asset type which were used for the assessment of the City's vertical and non-pipeline horizontal water utility assets. Pipeline assets are discussed separately in the following section.

Table 5a. Useful Life by Asset Type

Asset Type	Useful Life, years
Vertical Assets	
Fuel Tank	15
Engine	15
Generator	15
Motor	25
PLC	15
PRV	25
Pump	25
Reservoir	50
Turnouts and Interties	30
VFD	10
Well	50
Non-Pipeline Horizontal Assets	
Hydrants	50
Meters	15
Valves	50

5.1.2 Pipeline Useful Life

Pipeline useful life can vary significantly based on pipe size, material, and environmental conditions. The City's 2018 soil corrosivity study indicated that the City's AC pipe was more susceptible to failure in clay soils due to the pipe stresses associated with contraction and expansion of the soil. Smaller diameter AC pipes were especially susceptible to failure due to their relatively low resistance to soil movement. The report recommended a range of AC pipe useful lives based on pipe diameter. The investigation also mapped soil corrosivity and found that soils throughout the City were "severely" to "moderately" corrosive to metallic pipes (cast iron, ductile iron, steel).

Table 5b presents the useful lives for pipelines based on industry standards and the JDH report. It includes a base useful life (not considering soil conditions) and an effective useful life for AC pipe in clayey soils and metallic pipes in corrosive soils. Reinforced concrete pipe was considered vulnerable to corrosive soils due to the potential for exposed reinforcement steel.

Table 5b. Useful Life – Pipelines

Pipe Material	Diameter, Inches	Base Useful Life, years	Effective Useful Life, years			
			Clay Soils	Moderately Corrosive Soils	Corrosive Soils	Severely Corrosive Soils
Asbestos Cement	4-10	30	24	-	-	-
	12+	90	72	-	-	-
Polyvinyl Chloride	all	70	-	-	-	-
Concrete Cylinder	all	75	-	68	64	60
Cast Iron	all	100	-	90	85	80
Ductile Iron	all	100	-	90	85	80
Steel	all	95	-	86	81	76

5.1.3 Asset Remaining Useful Life Defined

The asset useful life estimates discussed above were used to calculate the remaining useful life (RUL) of each asset with the following formulas:

RUL = Asset Useful Life – Asset Age

RUL (%) = (Asset Useful Life – Asset Age) / Asset Useful Life

5.1.4 Estimation of LOF based on Remaining Useful Life

Decay curves can be used to illustrate the progression of asset degradation (decay) over an asset's useful life. The curves in Figure 1 were developed by WERF[1] and represent empirical failure patterns at several

[1] WERF SIMPLE (Sustainable Infrastructure Management Program Learning)

polynomial rates that may be experienced in the water industry. For this assessment, Late Decay 2 curve was selected as the indicator of likelihood of failure based on the following assumptions:

- Once municipal assets are beyond the point of early mortality, only a gradual decline in asset condition is expected to occur for much of the asset life. Early mortality is characterized by asset failure very soon after the asset is commissioned and in service. The occurrence of early mortality is often associated with manufacturing and installation issues.
- Late Decay Curve 2 provides only a 30 percent reduction in asset condition for the first two-thirds of the asset life. This is considered a nominal reduction in condition for a major milestone in the asset lifecycle and represents a suitable objective for asset performance.
- Late Decay Curve 2 provides a progression that is not significantly steep in terms of asset degradation over the final, remaining, one-third lifecycle.

Figure 1 also shows how Late Decay Curve 2 is used to correlate asset remaining useful life with the LOF rating (e.g. for an asset with a % RUL of 30 percent, the LOF rating is 2).

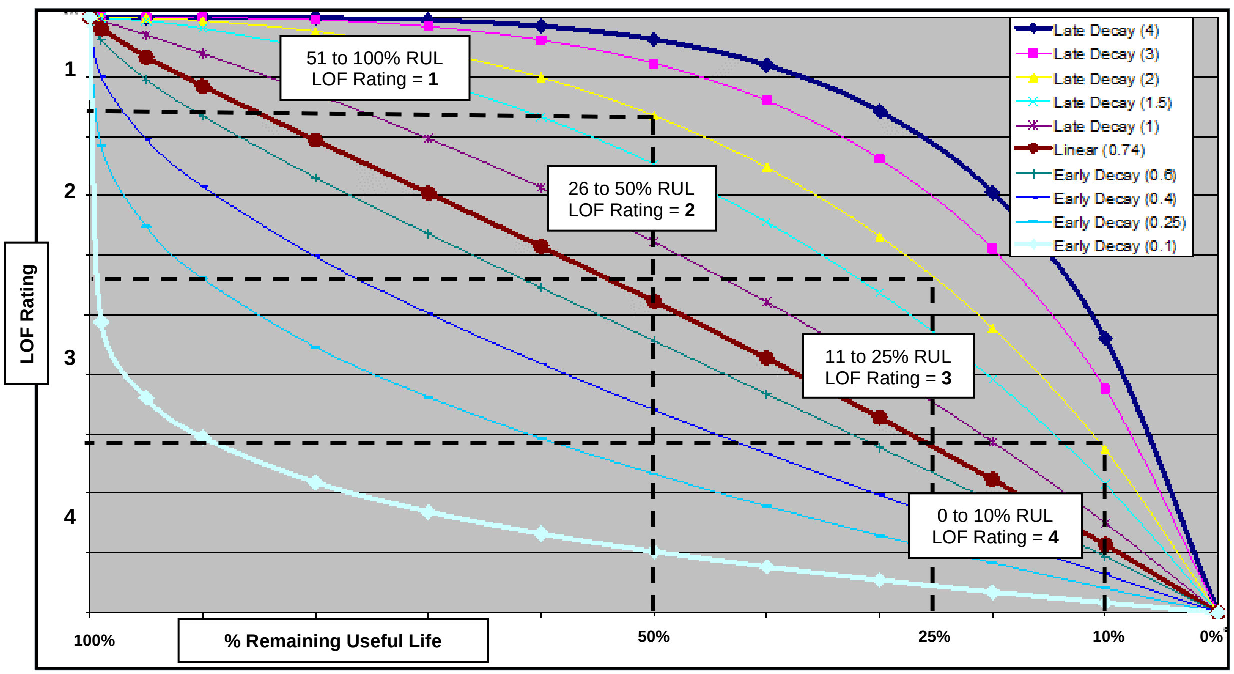


Figure 1. Percent Remaining Useful Life and LOF Rating

Several assets in the City databases were missing age or installation dates. These assets were assigned an LOF rating based on the following assumptions:

- AC pipe was assigned a rating of 4 under the assumption that AC pipe was not installed after the mid-1980s (and therefore the % RUL would be zero). 19 miles (894 pipe segments) of AC pipe had an unknown age/installation date.
- Remaining assets of unknown age were assigned a rating of 3 to account for the generally higher risk associated with unknown asset age and condition.

5.2 Pipeline Hydraulic Conditions

Pipeline conditions from the hydraulic model were considered to evaluate LOF factors of pipe roughness (operational efficiency failure mode) and operational pressure (physical mortality failure mode).

5.2.1 Pipe Roughness

Hydrant testing was performed over a portion of the distribution system to determine calibrated pipeline roughness, or C-Factors (see Task 4 of the Master Plan, presented in Chapter 6). Calibrated C-Factors from the hydraulic model were used to determine the reduction in C-Factor when compared to the C-Factor of a brand-new pipe of the same material. The result of the C-Factor comparison is presented in Table 6.

Table 6. Pipe Roughness: C-Factor Comparison

Pipe Material	Pipe Sizes	New Pipe C-Factor	Calibrated C-Factor	Percent of New C-Factor
Asbestos Cement	Diameter ≤ 8 inches	140	110	79%
	Diameter > 8 inches		120	86%
Polyvinyl Chloride	Diameter ≤ 8 inches	150	130	87%
	Diameter > 8 inches		140	93%
Concrete Cylinder	Diameter > 8 inches	140	130	93%
Cast Iron	Diameter ≤ 8 inches	130	100	77%
	Diameter > 8 inches		110	85%
Ductile Iron	Diameter ≤ 8 inches	140	130	93%
	Diameter > 8 inches		140	100%
Steel	Diameter ≤ 8 inches	140	120	86%
	Diameter > 8 inches		130	93%

5.2.2 Operating Pressure

Operating pressure was obtained from the calibrated hydraulic model under an average day scenario, with system pumps operating. Pipeline assets were evaluated for high operating pressure as an influence to increased LOF. Through discussions with the City, pipeline assets operating continually in excess of 135 psi regardless of design class were considered to be at higher risk of failure or increased LOF.

5.3 Supplemental Condition Data

Supplemental condition data typically consists of focused condition assessment studies of assets and facilities to determine condition based on an established set of metrics and criteria. Such assessments should be performed at intervals generally less than the asset's useful life to confirm condition and status on the useful life curve. Maintenance records may also capture details from asset failure and problems. This information can be used to document type and frequency of failures that serve as an indication of asset condition and be used in the future to develop additional LOF factors.

5.4 Likelihood of Failure Evaluation

Assets were evaluated under each applicable LOF factor to develop an overall LOF rating. Pipeline assets were assessed based on the criteria outlined above consisting of RUL and operating pressure. Non-pipeline assets considered only RUL alone. Since these criteria are baseline and easy to assess they serve as the *fixed* LOF criteria.

Given the availability of supplemental data, the other criteria were incorporated as *modifiers* to the LOF assessment. LOF scores were subjected to the other criteria as potential modifiers that could increase the LOF rating if additional data were available. These modifiers include pipeline roughness, failure history from maintenance or other failure data, and focused condition assessment activities.

Both fixed and modifier LOF factors were assigned a weight based on the relative importance of each factor. For the fixed LOF factors, RUL is weighted to represent 80 percent of the total rating, while operating pressure represents 20 percent of the total rating. The maximum possible weighted rating for the fixed LOF factors is 4. LOF modifiers are only evaluated if the fixed LOF rating is less than 4. LOF modifiers can increase the overall rating up to 1 additional score, resulting in a total possible LOF rating of 4. Table 7 presents the LOF criteria and rating definitions.

Table 7. LOF Factor and Ratings – Water System Assets

Factor	LOF Rating and Definition				Weight	Max Possible Rating
	1 Unlikely	2 Possible	3 Likely	4 Very Likely		
Fixed LOF Factors						
Remaining Useful Life (RUL)	51 to 100% RUL	26 to 50% RUL	11 to 25% RUL; Non-AC pipe asset with unknown age	0 to 10% RUL; AC pipe asset with unknown age	80%	3.2 (Pipelines) 4.0 (All other assets)
Operating Pressure[a]	<84 psi	85 psi to 99 psi	100 psi to 1 34 psi	>135 psi	20%	0.8
					Maximum Rating	**4.0**
LOF Modifiers						
Pipe Roughness[a]	85% to 100% of new C-Factor Rating	75% to 84% of new C-Factor Rating	65% to 74% of new C-Factor Rating	<64% of new C-Factor Rating	2.5%	0.10
Failure History	<2	3 to 5	6 to 9	>10	10%	0.40
Condition Assessment	New	Used	Worn	Pending Failure	12.5%	0.50
					Maximum Modifier	**1.0**
					Total Possible LOF Rating	**4.0**

(a) Factor only applicable to pipelines

5.5 Asset LOF Results

Table 8 presents the LOF rating results as a percent of total assets by type (i.e. for hydrants, 8 percent of all hydrants were evaluated to have a LOF rating of 1 and 17 percent of all hydrants have a LOF rating of 2, etc.). Individual asset LOF results are provided in the *Asset Registry and Risk Results* Excel workbook.

Table 8. Asset LOF Results, Percent of Total Assets by Type

	LOF Rating, total assets by type, percent			
	1	2	3	4
Horizontal Assets				
Pipelines[(a)]	25	18	20	37
Hydrants	8	17	75	0
Meters	0	3	22	75
Valves	16	23	61	0
Vertical Assets				
Fuel Tank	0	0	33	67
Engine	0	0	0	100
Generator	0	0	67	33
Motor	0	0	30	70
PLC	0	0	50	50
PRV	0	4	87	9
Pump	0	0	16	84
Reservoir	0	60	40	0
Turnouts and Interties	0	0	100	0
VFD	0	0	22	78
Well	50	0	50	0

(a) Pipeline results are shown as percent of total pipeline length, not pipe segments.

5.6 Facility LOF Results

The previous section describes the method for assigning an LOF rating for each asset. For vertical assets, multiple assets can constitute a larger facility; for example, the Ayer Pump Station facility includes a pump, motor, generator, fuel tank, PLC, and VFD. LOF can also be estimated at the facility level by considering the LOF of individual components within that facility. LOF was estimated for Milpitas water system facilities by averaging the associated component LOFs, weighted based on the individual component value. The applied weighting considers the fact that assets of a lower value should have a lesser impact on the overall facility LOF, whereas assets with a higher value should have a greater impact on the overall facility LOF.

$$\text{Facility LOF} = \frac{\sum_{i=1}^{n} Component\ LOF \times Compnent\ Value\ (\$)}{Total\ Facility\ Value\ (\$)}$$

Table 9 presents the LOF rating results for each facility on the same 1 to 4 scale, rounded to the nearest tenth.

Table 9. Facility LOF Results

Facility	LOF Rating
Curtis Well	1.7
Gibraltar Reservoir (SC)	2.0
Gibraltar Reservoir (SF)	2.0
Minnis Reservoir	2.0
ACWD Intertie	2.4
SJWC Intertie	2.4
Calera Creek Heights PRV	2.4
Capitol PRV	2.4
Main PRV	2.4
Milpitas PRV	2.4
Sunnyhills PRV	2.4
Curtis PRV	2.5
SCVWD Intertie	3.0
Gibraltar Turnout	3.0
Calaveras Turnout	3.0
Sunnyhills Turnout	3.0
Main Street Turnout	3.0
Abel PRV	3.0
Gibraltar PRV	3.0
Live Oak PRV	3.0
McCarthy PRV	3.0
Montague PRV	3.0
North Vault PRV	3.0
Sinclair PRV	3.0
South Vault PRV	3.0
Ayer Reservoir	3.0
Tularcitos Reservoir	3.0
Country Club Pump Station	3.2
Tularcitos Pump Station	3.2
Pinewood Well	3.4
Ayer Pump Station	3.6
Gibraltar Pump Station	3.7

6.0 CONSEQUENCE OF FAILURE METHODOLOGY

Consequence of failure (COF) rates the severity of consequences should an asset fail. Consequences typically include system performance impacts; economic or social impacts to the City, residents, or the community; safety impacts; and local or regional environmental impacts.

COF factors were developed in collaboration with City staff to reflect both City Council Core Goals and Priority Areas.

6.1 Consequence of Failure Framework

The Milpitas City Council has adopted a series of goals and priority areas that identify critical elements important to the City in the services it provides. These Goals and Priority Areas are outlined in the City's 2020 fiscal budget as shown below.

Core Goals	Priority Areas
• Superior Customer Service • Integrity and Accountability • Recognition and Celebration • Open Communication • Trust and Respect	• Public Safety • Transportation and Transit • Neighborhoods and Housing • Governance and Administration • Environment • Economic Development and Job Growth • Community Wellness and Open Space

Council objectives such as these can typically align with the critical objectives of a utility's performance and can therefore be related to asset performance and the consequence of an asset failing. A COF framework was developed based on the Council Goals and Priority Areas. Each goal and priority area were evaluated for applicability to asset COF and, for those that could be developed, were categorized, measured, and rating definitions developed. Every objective except for: Recognition and Celebration; Open Communication; Neighborhoods and Housing; and Community Wellness and Open Space were developed into factors within the COF framework. Table 10 presents the COF framework and eight proposed COF factors.

Table 10. COF Framework

Council Goals and Priority Areas	Category	COF Factor	Rating and Metric			
			1 Negligible	2 Minimal	3 Moderate	4 Severe
Superior Customer Service	Reliable, High Quality Customer Service in General	(1) Water Service Interruptions	Negligible Impact to Water Service	Water pressure below 30 psi	Interruption of Water Service Over Localized Area	Interruption of Water Service Over Large Area
Integrity and Accountability Trust and Respect	Public Perception/Response	(2) Magnitude and Method of Public Response	No Public Response	May result in telephone calls	May Result in Social Media Coverage	May Result in Local or Greater Media Coverage or Public Comment
Public Safety	Health and Safety of Public and City Employees	(3) Severity of Injury or Illness	No Health or Safety Impact	Minor Injury, First Aid	Injury, Medical Attention	Severe Injury or Loss of Life
Environment	Compliance with Environmental Regulations or other Water Quality Concern	(4) State and Federal Regulatory Violations or Public Response	No Impact	Reportable violation, no enforcement action	May Result in Strong Warning or Fine	Non-compliance resulting in administrative or consent order
Transportation and Transit	Public Transit Service	(5) Public Transit Service Interruptions	No Impact	Minor Detours	Bus Service is impacted >15% to sensitive groups/locations	Community Access to BART is Interrupted Requires Coordination with Outside Agencies i.e., County, CalTrans, VTA, etc.
Economic Development and Job Growth	Economic Impacts	(6) Local Business Impact	No Impact	Localized Short-term Business Impact, no Adverse Impact on Economic Vitality		Long-term or Area-wide Economic Impact, Adverse Impact to Economic Vitality
Governance and Administration	Utility Operations	(7) Response Time to Restore an Asset	Recovery measured in days	Recovery could require up to Two (2) weeks	Recovery Could Require up to One (1) Month	Recovery Requires Greater Than One (1) Month
		(8) Restoration Costs or Impact on Utility Rates	Can be absorbed within fiscal budget without adjustment	Could impact multiple budget objects	May Require Council Action	May Impact Reserves

6.2 Consequence of Failure Rating Defined

The COF framework presented in Table 10 was further developed into a model to assess COF for both horizontal and vertical assets by defining rating interpretations for all factors. Interpretations were developed into metrics such that COF ratings could easily be assigned with asset characteristics or geospatial data, avoiding manual evaluation of individual assets. For horizontal assets, this included assessment based on pipe size, street classification, land use, and hydraulic modeling. For vertical assets this included similar assessment criteria along with asset type.

COF ratings were assigned for each factor using standard definitions presented in Table 11. Ratings range from 1 – indicating the consequence of asset failure would be “negligible”, to 4 – indicating the consequence of asset failure would be “severe”. Tables 11 and 12 present the COF factors, metrics, and ratings for horizontal and vertical assets, respectively.

Table 11. COF Definition and Ratings

	LOF Rating			
	1	2	3	4
COF Definition	Negligible	Minimal	Moderate	Severe

Table 12. COF Factors and Ratings – Horizontal Assets (Pipes, Valves, Hydrants, Meters)

Factor	Description	Data Source	Rating and Metric			
			1 Negligible	2 Minimal	3 Moderate	4 Severe
(1) Water Service Interruption	Asset failure may cause interruptions to water service	GIS Pipe Diameter(c); GIS Meter Size	Pipes ≤8-inch	Pipes 10 to 12-inch; All Other Meters	Pipes 14 to 18-inch; Meters 6 to 8-inch	Pipes >18-inch
(2) Magnitude and Method of Public Response	Asset failure may cause a loss in public confidence	GIS Pipe Diameter(c); Critical Facilities(a)	-	Pipes ≤8-inch; All Other Meters	Pipes 10 to 12-inch; Meters 6 to 8-inch	Pipes >14-inch within 500 feet of a Critical Facility
(3) Severity of Injury or Illness	Asset failure may cause injury or illness to public or utility operations staff	GIS Pipe Diameter(c)	Pipes ≤8-inch; All Other Meters	Pipes 10 to 12-inch; Meters 6 to 8-inch	Pipes 14 to 18-inch	Pipes >18-inch
(4) State and Federal Regulatory Violations or Public Response	Asset failure may result in violation of state or federal environmental regulations	Asset Type	All Valves; All Meters	All Pipes; All Hydrants	-	-
(5) Public Transit Service Interruptions	Asset failure may cause an impedance to public and private transportation function	GIS Road Speed; GIS Land Use; BART stations; and Sensitive Groups/Locations(b)	Streets with speeds up to 25 mph	Streets with speeds from 30-50 mph in Residential LU	Streets with speeds from 30-50 mph in Non-Residential LU; or Adjacent to a Sensitive Group/ Location	Highways, Highway crossings, or Within 100-feet of BART station
(6) Local Business Impact	Asset failure may have a negative impact to the City economy	GIS Land Use (LU)	All Other LU Types	-	LU types including PF, RRMU, M	LU types including TWC, VHDMU, GNC, RSC, INP, MFG, PAO
(7) Response Time to Restore an Asset	The City's ability to respond depends on the location of the asset	GIS Road Speed	Streets with speeds up to 25 mph	Streets with speeds from 30-50 mph in Residential LU	Streets with Speeds from 30-50 mph in Non-Residential LU	Highways or Highway Crossings
(8) Restoration Costs or Impact to Utility Rates	The asset failure may have an impact to utility fiscal performance	GIS Pipe Diameter(c)	Pipes ≤12-inch; All Meters	Pipes 14 to 16-inch	Pipes 18 to 24-inch	Pipes >24-iinch or Highway Crossings

(a) Critical Facilities include Schools, Fire Stations, and Hazardous Pipelines.
(b) Sensitive Groups/Locations include Fire Stations and Schools.
(c) Hydrants were assigned the rating of adjacent/service pipeline; Valves were assigned the rating of connecting pipeline.

Table 13. COF Factors and Ratings – Vertical Assets

Factor	Description	Data Source	Rating and Metric			
			1 Negligible	2 Minimal	3 Moderate	4 Severe
(1) Water Service Interruption	Asset failure may cause interruptions to water service	Asset Type	-	-	PRVs	Interties, Turnouts, Reservoirs, Pumping Stations, Wells, Emergency PRVs
(2) Magnitude and Method of Public Response	Asset failure may cause a loss in public confidence	Asset Type	-	-	-	Interties, Turnouts, Reservoirs, Pumping Stations, Wells, PRVs
(3) Severity of Injury or Illness	Asset failure may cause injury or illness to public or utility operations staff	Asset Type	-	-	PRVs	Interties, Turnouts, Reservoirs, Pumping Stations, Wells, Emergency PRVs
(4) State and Federal Regulatory Violations or Public Response	Asset failure may result in violation of state or federal environmental regulations	Asset Type and location	All Others	-	Wells	Wells within 50-feet to a surface water source and Surface Water Interties
(5) Public Transit Service Interruptions	Asset failure may cause an impedance to public and private transportation function	GIS Road Speed; GIS Land Use; BART stations; and Sensitive Groups/Locations[b]	Streets with speeds up to 25 mph	Streets with speeds from 30-50 mph in Residential LU	Streets with speeds from 30-50 mph in Non-Residential LU; or Adjacent to a Sensitive Group/ Location	Highways, Highway crossings, or Within 100-feet of BART station
(6) Local Business Impact	Asset failure may have a negative impact to the City economy	GIS Land Use	All Other LU Types	-	LU types including PF, RRMU, M	LU types including TWC, VHDMU, GNC, RSC, INP, MFG, PAO
(7) Response Time to Restore an Asset	The City's ability to respond depends on the location of the asset	Asset Type	-	PRVs, Interties	Turnouts	Reservoirs, Pumping Stations, Wells
(8) Restoration Costs or Impact to Utility Rates	The asset failure may have an impact to utility fiscal performance	Asset Type	PRVs, Interties	Turnouts	-	Reservoirs, Pumping Stations, Wells

(a) Sensitive Groups/Locations include Fire Stations and Schools

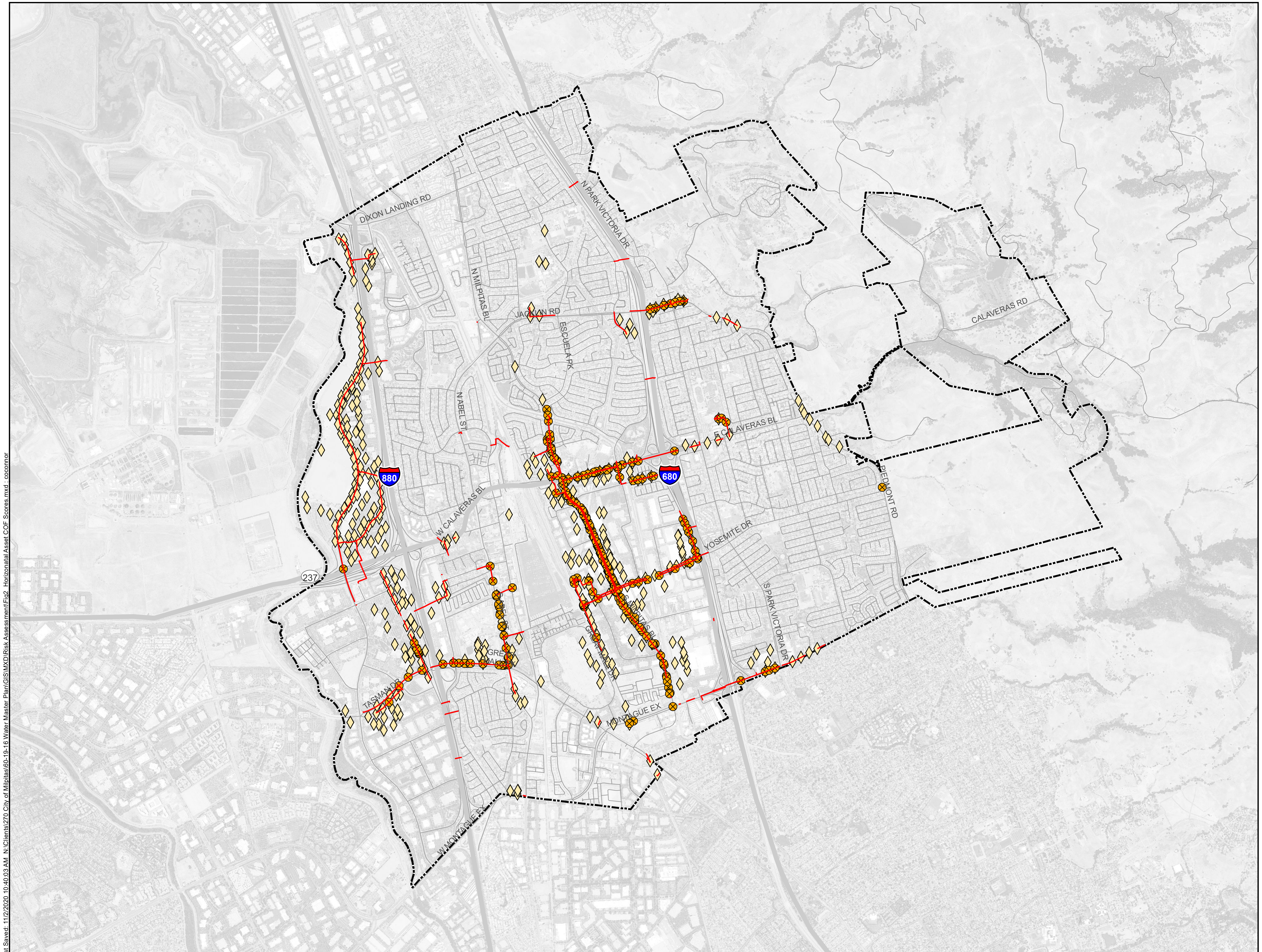
6.3 Horizontal Asset COF Results

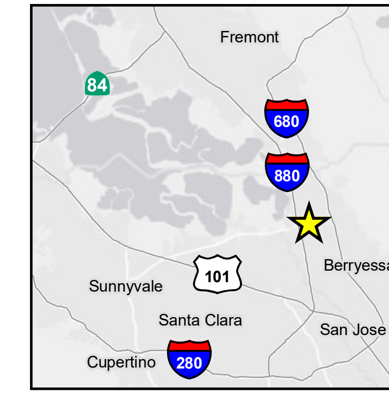
The eight asset COF ratings were averaged to obtain an overall COF rating on the 1 to 4 scale. Table 14 presents the COF rating results for horizontal assets, summarized by percent of total asset type (i.e. for hydrants, 32 percent of all hydrants were evaluated to have a COF rating of 1). Horizontal assets with a moderate (3) COF rating are shown spatially in Figure 2. Individual asset COF results are provided in the *Asset Registry and Risk Results* Excel workbook.

Table 14. Horizontal Asset COF Results, Percent of Total Asset by Type

Horizontal Assets	COF Rating, percent			
	1	2	3	4
Pipelines[a]	45	46	9	0
Hydrants	32	53	15	0
Meters	100	0	0	0
Valves	43	52	5	0

(a) Pipeline results are shown as percent of total pipeline length.





N

0 1,500 3,000
Scale in Feet

Valves
Hydrants
Pipelines
City Limits

WEST YOST

Figure 2

Existing Horizontal Assets with COF Score ≥ 3

City of Milpitas
2020 Water Master Plan Update

Last Saved: 11/2/2020 10:40:03 AM N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Risk Assessment\Fig2 Horizontal Asset COF Scores.mxd : coconnor

6.4 Facility COF Results

For vertical assets, COF ratings were assigned at the facility level (i.e. pump station, reservoir, well, etc.), with all facility components inheriting the COF rating of its parent facility. Table 15 presents the overall COF rating results for each facility on the same 1 to 4 scale, rounded to the nearest decimal.

Table 15. Facility COF Results

Facility	COF Rating
Live Oak PRV	2.0
Main PRV	2.0
North Vault PRV	2.0
South Vault PRV	2.0
Calera Creek Heights PRV	2.0
SCVWD Intertie	2.3
SJWC Intertie	2.3
Abel PRV	2.3
Gibraltar PRV	2.4
McCarthy PRV	2.4
Sinclair PRV	2.4
Sunnyhills PRV	2.4
Milpitas PRV	2.5
Main Street Turnout	2.5
ACWD Intertie	2.6
Capitol PRV	2.6
Curtis PRV	2.6
Montague PRV	2.6
Calaveras Turnout	2.8
Sunnyhills Turnout	2.8
Country Club Pump Station	2.9
Tularcitos Pump Station	2.9
Minnis Reservoir	2.9
Tularcitos Reservoir	2.9
Gibraltar Turnout	2.9
Ayer Reservoir	3.1
Gibraltar Pump Station	3.3
Gibraltar Reservoir (SC)	3.3
Gibraltar Reservoir (SF)	3.3
Curtis Well	3.3
Pinewood Well	3.3
Ayer Pump Station	3.4

7.0 RISK ASSESSMENT

Risk combines both LOF and COF to determine the resulting level of risk exposure that an agency is likely to confront through a potential failure of an asset. Assets with the highest risk have both a high likelihood of failure (i.e., poor condition or increased potential to underperform) and a high consequence of failure (i.e., significant consequences should failure occur).

The conventional risk equation, which was employed in this assessment, is the product of LOF and COF:

$$Risk = COF \times LOF$$

7.1 Risk Interpretation

Individual COF and LOF factor definitions were combined to define the overall risk of each asset, interpreted as a Low, Medium, Medium-High, or High risk level. Table 16 presents the risk level matrix and risk definitions.

Table 16. Risk Level Matrix

		LOF Rating and Definition			
		1 Unlikely	2 Possible	3 Likely	4 Very Likely
COF Rating and Definition	1 Negligible	Low	Low	Low	Low
	2 Minimal	Low	Low	Medium	Med-High
	3 Moderate	Medium	Medium	Med-High	High
	4 Severe	Medium	Med-High	High	High

7.2 Risk Results

The risk results are summarized in the tables below, including notation of the median risk rating for each asset type.

7.2.1 Pipelines

Table 17 presents the risk results for pipelines by percent of total pipeline length in each risk level. Table 18 presents the detailed LOF and COF ratings by pipeline length. The median risk level for pipelines is Low, with an associated LOF of 3 and COF of 1. Pipeline risk is also presented spatially in Figure 3.

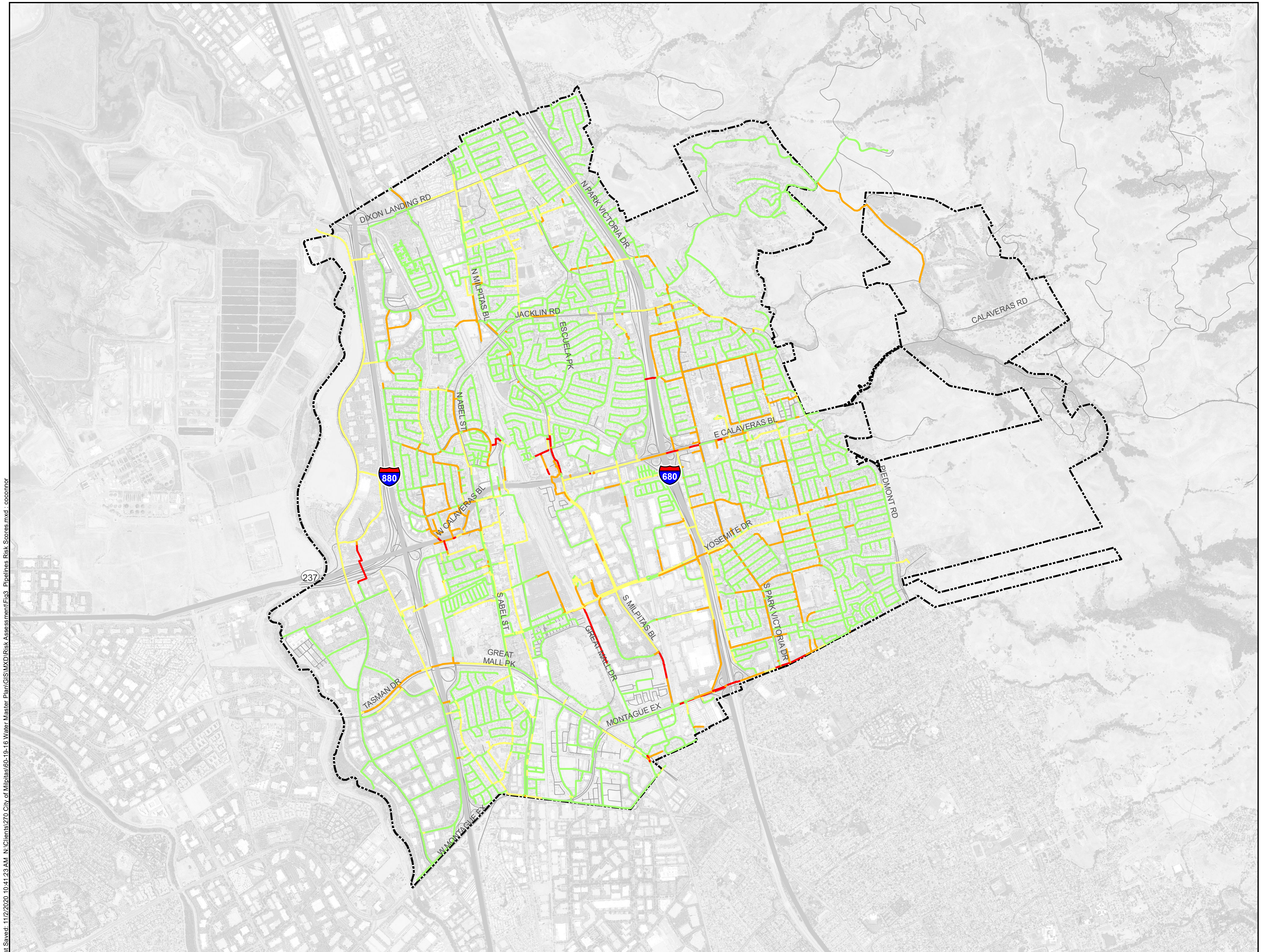
Table 17. Pipeline Risk, Percent of Total Pipeline Length by Risk Level

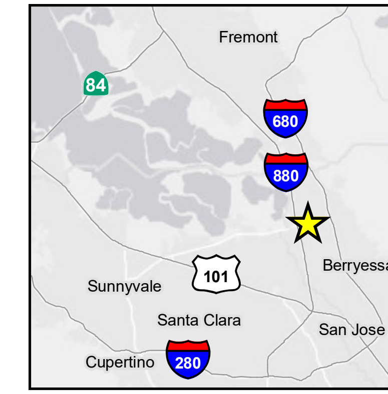
Risk Level	Percent
Low	71
Medium	15
Medium-High	13
High	1

Table 18. Pipeline Risk by LOF and COF, Miles of Pipeline

		LOF				Total Length
		1	2	3	4	
COF	1	15.1	3.0	17.2[(a)]	46.4	81.8
	2	23.6	24.7	15.7	19.8	83.8
	3	5.7	5.6	2.9	1.9	16.2
	4	0.3	0.2	0.4	0.1	0.9
	Total	**44.7**	**33.5**	**36.2**	**68.2**	**183**

(a) Denotes the median risk score for all pipelines





N

0 1,500 3,000
Scale in Feet

City Limits
Low
Medium
Med-High
High

Figure 3

Existing Pipelines Risk Classifications

City of Milpitas
2020 Water Master Plan Update

7.2.2 Hydrants

Table 19 presents the risk results for hydrants by percent of total hydrants in each risk level. Table 20 presents the detailed LOF and COF ratings for all hydrants. The median risk level for hydrants is Low, with an associated LOF of 2 and COF of 2.

Table 19. Hydrant Risk, Percent of Total Hydrants by Risk Level

Risk Level	Percent
Low	78
Medium	22
Medium-High	<0.5
High	0

Table 20. Hydrant Risk by LOF and COF, Count of Hydrants

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="4">LOF</th><th rowspan="2">Total Hydrants</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th rowspan="4">COF</th><th>1</th><td>71</td><td>523</td><td>329</td><td>0</td><td>923</td></tr>
<tr><th>2</th><td>114</td><td>1,219[(a)]</td><td>216</td><td>0</td><td>1,549</td></tr>
<tr><th>3</th><td>54</td><td>376</td><td>4</td><td>0</td><td>434</td></tr>
<tr><th>4</th><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>239</td><td>2,118</td><td>549</td><td>0</td><td>2,906</td></tr>
<tr><td colspan="7">(a) Denotes the median risk score for all pipelines</td></tr>
</table>

7.2.3 Valves

Table 21 presents the risk results for valves by percent of total valves in each risk level. Table 22 presents the detailed LOF and COF ratings for all valves. The median risk level for valves is Low, with an associated LOF of 2 and COF of 2.

Table 21. Valve Risk, Percent of Total Valves by Risk Level

Risk Level	Percent
Low	87
Medium	13
Medium-High	<0.5
High	0

Table 22. Valve Risk by LOF and COF, Count of Valves

		LOF				Total Valves
		1	2	3	4	
COF	1	412	1,370	967	0	2,749
	2	509	2,248[a]	549	0	3,296
	3	83	187	26	0	296
	4	0	0	0	0	0
	Total	**1,004**	**3,794**	**1,542**	**0**	**6,341**

(a) Denotes the median risk score for all pipelines

7.2.4 Meters

Table 23 presents the risk results for meters by percent of total meters in each risk level. Table 24 presents the detailed LOF and COF ratings for all meters. The median risk level for meters is Low, with an associated LOF of 4 and COF of 1.

Table 23. Meter Risk, Percent of Total Meters by Risk Level

Risk Level	Percent
Low	>99.9
Medium	<0.1
Medium-High	<0.1
High	0

Table 24. Meter Risk by LOF and COF, Count of Meters

		LOF				Total Meters
		1	2	3	4	
COF	1	0	476	3,555	12,312[a]	16,343
	2	0	2	4	2	8
	3	0	0	0	0	0
	4	0	0	0	0	0
	Total	**0**	**478**	**3,559**	**12,314**	**16,351**

(a) Denotes the median risk score for all pipelines

7.2.5 Vertical Assets

Table 25 presents the risk results for all vertical assets by percent of total assets in each risk level. Table 26 presents the detailed LOF and COF ratings for all vertical assets. The median risk level for all vertical assets is Medium-High, with an associated LOF of 3 and COF of 3.

Table 25. Vertical Asset Risk, Percent of Vertical Assets by Risk Level

Risk Level	Percent
Low	1
Medium	25
Medium-High	25
High	48

Table 26. Vertical Asset Risk by LOF and COF, Count of Vertical Assets

		LOF				Total Vertical Assets
		1	2	3	4	
COF	1	0	0	0	0	0
	2	0	0	13	0	13
	3	1	4	29[(a)]	40	74
	4	0	0	0	0	0
Total		**1**	**4**	**38**	**40**	**87**

(a) Denotes the median risk score for all pipelines

7.2.6 Facility Risk Results

The risk for each facility was evaluated based on the resulting facility LOF and COF ratings discussed previously and the risk equation. Table 27 presents the detailed LOF and COF ratings for each facility. Note the four-by-four risk matrix has been expanded to one decimal to provide greater granularity. The overall facility risk scores (LOF x COF) and risk levels are shown in Table 28 from lowest to highest risk.

Table 27. Risk of Facilities by LOF and COF

		LOF							
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
COF	0.5	--	--	--	--	--	--	--	--
	1.0	--	--	--	--	--	--	--	--
	1.5	--	--	--	--	--	--	--	--
	2.0	--	--	--	--	Calera Creek Heights PRV, Main PRV	Curtis Well, Live Oak PRV, North Vault PRV, South Vault PRV	--	--
	2.5	--	--	--	--	SJWC Intertie, Sunnyhills PRV, Milpitas PRV, ACWD Intertie, Capitol PRV, Curtis PRV	Abel PRV, SCVWD Intertie, Gibraltar PRV, McCarthy PRV, Sinclair PRV, Main Street Turnout, Montague PRV	--	--
	3.0	--	--	--	Minnis Reservoir	--	Calaveras Turnout, Sunnyhills Turnout, Tularcitos Reservoir, Gibraltar Turnout, Country Club Pump Station, Tularcitos Pump Station, Ayer Reservoirs	--	--
	3.5	--	--	--	Gibraltar Reservoir (SC), Gibraltar Reservoir (SF)	--	--	Pinewood Well, Gibraltar Pump Station, Ayer Pump Station	--
	4.0	--	--	--	--	--	--	--	--

Table 28. Facilities by Risk Score and Risk Level

Facility	Risk Score (LOF x COF)	Risk Level
Calera Heights PRV, Main PRV	4.8	Medium
SJWC Intertie	5.4	Medium
Curtis Well	5.5	Medium
Minnis Reservoir	5.8	Medium
Live Oak PRV, North Vault PRV, South Vault PRV,	6.0	Medium
ACWD Intertie, Capitol PRV	6.3	Medium-High
Gibraltar Reservoir (SC), Gibraltar Reservoir (SF)	6.5	Medium-High
Curtis PRV	6.6	Medium-High
Abel PRV, SCVWD Intertie	6.8	Medium-High
Gibraltar PRV, McCarthy PRV, Sinclair PRV	7.1	Medium-High
Sunnyhills PRV	5.7	Medium-High
Milpitas PRV	6.0	Medium-High
Main Street Turnout	7.5	Medium-High
Montague PRV	7.9	Medium-High
Calaveras Turnout, Sunnyhills Turnout	8.3	Medium-High
Tularcitos Reservoir, Gibraltar Turnout	8.6	Medium-High
Country Club Pump Station, Tularcitos Pump Station	9.2	Medium-High
Ayer Reservoir	9.4	Medium-High
Pinewood Well	11.1	High
Gibraltar Pump Station	12.0	High
Ayer Pump Station	12.2	High

8.0 CONCLUSIONS

8.1 Horizontal Assets

The desktop analysis indicates the horizontal infrastructure of the water system is well into its useful life curve with most assets rated 3 ("likely" asset failure) or higher for LOF.

The consequence of failure analysis indicates that horizontal assets expose mostly a negligible to minimal impact should they fail, with a small percentage of assets potentially yielding a moderate impact.

Overall, the majority (71%) of pipeline assets have a risk rating of Low, with a high LOF and low COF. There is a significant risk exposure to pipeline failure due to this high LOF, which is primarily due to asset age. Hydrants, valves, and meters are also at a Low risk level with generally advanced age contributing to a higher LOF but a relatively low COF.

8.2 Vertical Assets – Facilities

Facilities were generally rated 2 or higher for LOF. The City has developed most of its newer infrastructure in well and reservoir facilities (Curtis Well, Gibraltar Reservoirs, Minnis Reservoir), which are rated with an LOF of less than 3. Remaining facility LOF was consistently rated between 2.4 and 3, except for the Country Club Pump Station, Tularcitos Pump Station, Pinewood Well, Ayer Pump Station and Gibraltar Pump Station which were rated from 3.2 to 3.7. These higher LOF values are indicative of higher asset values with advanced age, suggesting a greater and more immediate investment need in asset renewal.

Facility COF ratings ranged from 2 to 3.4, with the highest ratings assigned to pump stations, reservoirs, and wells. PRVs, interties, and turnouts were all rated below 2.9.

8.3 System Level Risk Summary

The overall risk of the water system is low for horizontal infrastructure and medium-high for facilities. Table 29 illustrates the risk at the distribution system level, allocated by each asset type. Note that some facility types are noted in multiple risk levels.

Table 29. Risk at Water System Level

		LOF			
		1	2	3	4
COF	1	--	--	Pipelines	Meters
	2	--	Hydrants Valves	Well PRVs	--
	3	--	Reservoir	PRVs Turnouts Reservoirs Pump Stations	Well Pump Stations
	4	--	Reservoirs	--	--

Appendix E

Seismic Risk Assessment

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TECHNICAL MEMORANDUM

DATE: October 28, 2020

Project No.: 270-60-19-16
SENT VIA: EMAIL

TO: Harris Siddiqui

FROM: Whitney Sandelin, PE, RCE #86703
Amara Cairns

REVIEWED BY: Mel Damewood III, PE

SUBJECT: City of Milpitas - Summary of Methodologies and Results from Hazus® Earthquake Model and American Lifelines Alliance® Analysis

PURPOSE AND INTRODUCTION

The purpose of this technical memorandum (TM) is to document the methodologies used to estimate consequences and risks associated with an earthquake event affecting the City of Milpitas (City) water system. The results of this analysis conclude in the estimation of the direct consequence of a representative earthquake scenario for the City. The consequence estimates presented herein do not include consideration of community economic losses (e.g. indirect or induced) that may occur due to extended periods without water service.

This TM is organized as follows:

- Introduction to Hazus and American Lifelines Alliance (ALA) Methodologies
- Earthquake Scenario Selection
- Estimated Damage States and Restoration Times
- Estimated Service Denial
- Conclusion and Disclaimer
- References

INTRODUCTION TO HAZUS AND ALA METHODOLOGIES

The Federal Emergency Management Agency (FEMA) has developed a standardized methodology for estimating losses from certain natural hazards, including earthquakes. The methodology, known as Hazus, addresses flooding, hurricanes, coast surge, tsunamis and earthquakes. Specifically, the Hazus Earthquake Model is designed to "produce loss estimates for use by federal, state, regional and local governments in planning for earthquake risk mitigation, emergency preparedness, response and recovery".

The American Water Works Association (AWWA) J100 Standard, *Risk and Resilience Management of Water and Wastewater System* (J100 Standard), recommends the Hazus methodology to estimate the damage states and restoration times for individual facilities, such as pump stations and storage tanks. However, West Yost understands that the draft version of the forthcoming update to the J100 Standard recommends the use of the ALA methodology for estimating damages to pipelines and distribution systems under a selected earthquake event. The authors of Hazus acknowledge its limitation for pipelines. As described in the "Message to Users" section of the Hazus Manual, while the Hazus methodology has been tested against the judgment of experts and, to the extent possible, against records from several past earthquakes, limited and incomplete data about actual earthquake damage precludes complete calibration of the methodology.

Although the revised J100 Standard has not yet been released by AWWA, West Yost considers it to reflect best management practices for conducting earthquake consequence analyses for public water systems. Therefore, West Yost is using two methods in this analysis:

- Hazus for non-linear assets (i.e., storage tanks, pump stations, and treatment facilities). The methodologies presented herein are based on the *Hazus Multi-Hazard Technical Manual, Version 2.1* (Hazus Manual).
- *ALA Seismic Fragility Formulations for Water Systems, Part 1, April 2001 (ALA Manual)* for linear assets.

Hazus deals with all aspects of the built environment, including water system infrastructure. Chapter 8 focuses on direct damage to Utility Systems, including a loss estimation methodology for water system supply, storage, transmission, and distribution components. The ALA Manual provides recommended pipe vulnerability functions and fragility curves in Chapter 4.

The following sections document the specific steps taken to estimate consequences associated with an earthquake event, using the Hazus and ALA methodologies to assess select assets within the City's water system.

EARTHQUAKE SCENARIO SELECTION

In order to apply the Hazus and ALA methodologies, a user must first identify specific parameters associated with a potential ground shaking event, including peak ground acceleration (PGA), peak ground velocity (PGV), and peak ground deformation (PGD). The United States Geological Survey (USGS) Earthquake Scenario Catalogs (also referred to as ShakeMaps) were examined to identify a relevant earthquake scenario for the utility's service area.

The earthquake scenario selected for the City of Milpitas is the Hayward-Rodgers Creek event described in the USGS Northern California Legacy Catalog. At magnitude 6.8, this event represents the largest magnitude event described by ShakeMap in relatively close proximity to key City utilities. The scenario map from the USGS site is shown on Figure 1; the scenario selected for the utility is highlighted in blue. According to USGS, this event has an estimated annual probability of approximately 0.74 percent (i.e., a 0.74 percent chance of occurring in any given year), and an approximately 31.02 percent chance of occurrence within the next 50 years. This event is a scenario (i.e., it is not a historical event) and is intended for planning purposes only.

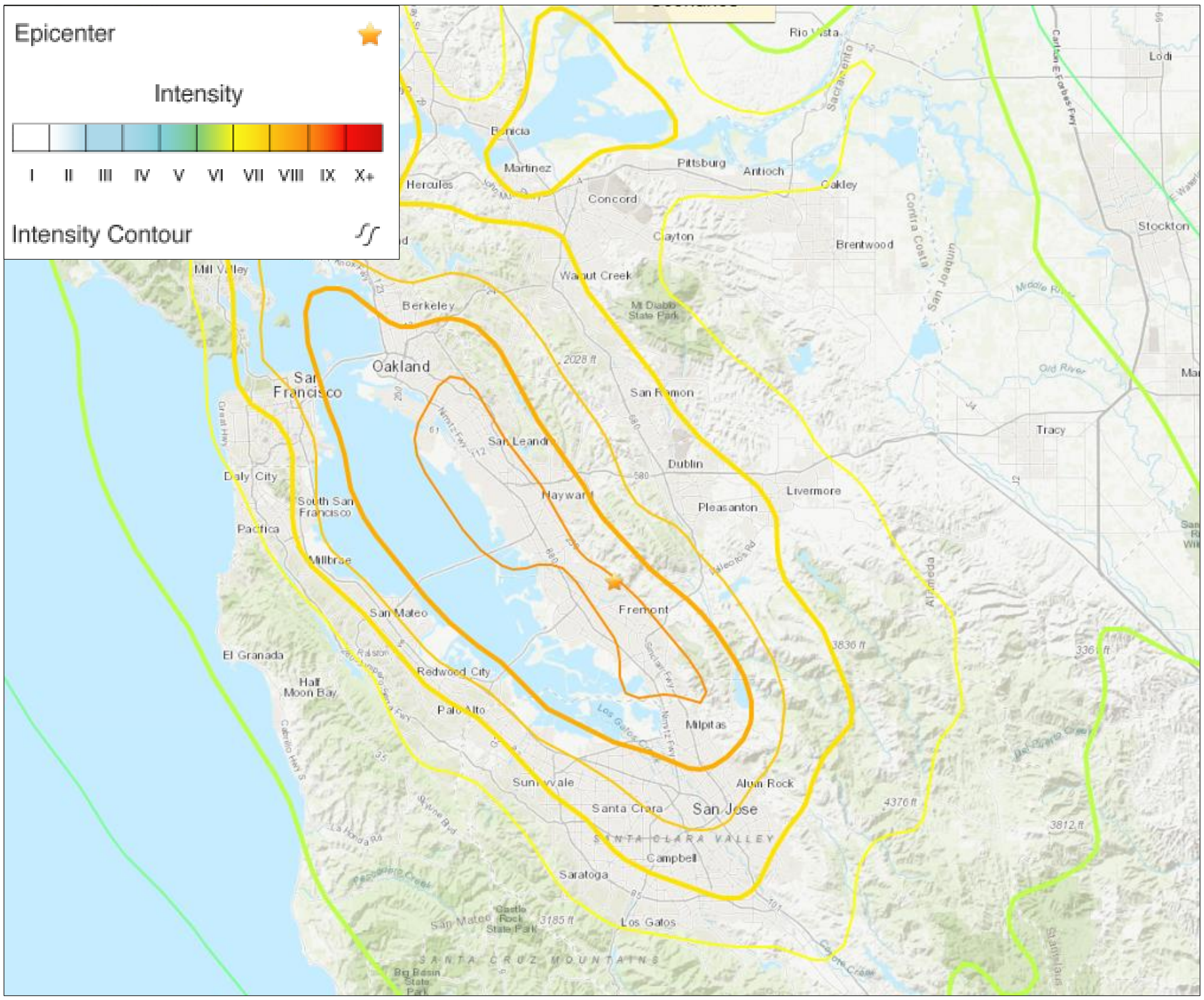

Figure 1. USGS ShakeMap—6.8 Magnitude Earthquake Event for the City of Milpitas

Utilizing the interactive geospatial data interface provided by USGS, ground motion contours were examined based on the scenario epicenter and fault location(s). Values for PGA and PGV were visually interpolated for the location of each asset. For the selected scenario, PGD values were not specified on the USGS ShakeMaps. Table A-1 of Attachment A shows the PGA values assigned to each of the City's selected non-linear assets.

ESTIMATED DAMAGE STATES AND RESTORATION TIMES

The Hazus and ALA methodologies are intended to provide a high-level estimate of damage states for select assets. The purpose of this evaluation is to identify and prioritize more detailed evaluation and mitigation measures in the future.

Based on the PGA and asset type, the Hazus methodology yields an estimate of the damage state for each non-linear asset, along with an associated restoration time as part of the Hazus program. Damage states estimated in this analysis include moderate and extensive for both pump stations and storage tanks. Descriptions of these damage states are included below.

Pump Stations

- **Extensive damage** for pump stations is defined as extensive damage to facility buildings or damage to pumps beyond repair.
- **Moderate damage** for pump stations is defined by the loss of electric power for approximately one-week, considerable damage to mechanical and electrical equipment, or moderate damage to buildings.

Storage Tanks

- **Extensive damage** for storage tanks is defined as damage to the tank extensive enough to require removal of the tank from service, including, for example, elephant foot buckling for steel tanks with loss of content or shearing of concrete tank walls.
- **Moderate damage** for storage tanks is defined by the tank being considerably damaged but with only minor loss of content. Examples of moderate damage include elephant foot buckling for steel tanks without loss of content, or moderate cracking of concrete tanks with minor loss of content.

Similarly, the ALA methodology yields estimated numbers of breaks and leaks among linear assets, based on PGV, PGD, and specific asset attributes (e.g., pipeline material, joint type, etc.). The following sections describe these methodologies and the results of their application to the City's assets in greater detail.

Restoration Times

Restoration time is defined as the time to restore the facility to a functioning level. This analysis considered the time to restore select assets owned and operated by the City. Assets which are required for the delivery of both San Francisco Public Utilities Commission (SFPUC) and Valley Water (VW) source water from the wholesaler to the City were not included in this analysis; it should be noted that, on a regional level, an earthquake event could disrupt supply infrastructure from SFPUC and VW to the City's distribution system, limiting the City's capacity to any wells that are repaired or remain functional.

In this analysis, total restoration time consists of the time to repair the damage (construction and repair activities) plus the preconstruction activities, such as the time involved with the immediate post event, pre-restoration assessment, planning, and mobilization activities. The total restoration time is estimated by using construction/repair duration provided in the Hazus method and adding to this an estimate of the time required for preconstruction activities. Engineering judgement and input from the City were utilized to fine tune the total restoration times. For linear assets (Pipelines) engineering judgement and input from the City were utilized to estimate restoration times.

Hazus conducted statistical analyses method to provide estimate of the amount of time needed to conduct construction and repair activities for a variety of non-linear assets and a range of damage states. They provide the “mean restoration time” and the standard deviation. This analysis is using the “mean restoration time” provided by Hazus.

Methodology Summary

The overall methodology to this analysis is to estimate the damage to non-linear and linear utility assets from an earthquake, estimate the restoration time for each damaged asset, and then calculate cost to restore the system based on the restoration time needed for each asset. Repair and replacement costs are calculated using the crew size available to the City, the labor rate, the shift duration and order of magnitude material costs for the City. The next section describes how damage is estimated for non-linear and linear assets.

Non-Linear Assets: Reservoirs, Pump Stations, and Key City Properties

Non-linear assets include reservoirs, pump stations, and key city properties. Each facility was assigned a Hazus “facility classification.” Classifications are generally based on the type of facility and whether the facility features anchored components/equipment. Hazus defines anchored as “equipment designed with special seismic tiedowns or tiebacks,” while unanchored equipment refers to equipment designed with no special considerations other than the manufacturer’s normal requirements. Based on review of previously prepared seismic facility assessments and observations made during site visits, all of the utility’s assets were assigned to the anchored component facility classification.

The resulting Hazus facility classifications for the City’s assets are presented in Table A-1. Hazus Tables 8.3, 8.6, 8.7 and 8.9 (reproduced in Figures A-1 through A-4 in Attachment A) were used to assign damage states based on PGA or PGV values obtained for the selected earthquake event. In the utility’s case, there are several non-linear facility classifications deemed susceptible to PGD, including reservoirs and pump stations.

Hazus Table 8.1.a (reproduced as Figure A-5 of Attachment A) was used to estimate the damage state and associated mean restoration time for each facility. Hazus-recommended restoration time estimates are based on Hazus restoration function curves and represent an average time for the facility classification. In addition to the restoration time suggested by Hazus, three days were added to account for the immediate post-event, pre-restoration assessment, planning, and mobilization activities. Table A-1 shows the resulting estimated restoration time for each asset.

Non-Linear Asset Damage State

Using the Hazus Method for non-linear assets, the Hayward-Rogers Creek 6.8 magnitude earthquake scenario is estimated to cause moderate damage to the City’s pump stations, storage tanks, and buildings. This is primarily due to the high Peak Ground Acceleration and Velocity (PGA, PGV) that the earthquake will produce in the City’s service area. Liquefaction susceptibility ranges from very low to moderate for non-linear assets in the City’s service area as well. Probabilities are assigned to each liquefaction susceptibility, as described in Table 3.

The Country Club, Tularcitos, and Ayer pump stations are expected to have extensive damage and require approximately seventeen days for restoration. Extensive damage for pump stations is defined as extensive damage to facility buildings or damage to pumps beyond repair. The Gibraltar pump station (SFPUC and VW) is expected to have moderate damage and take approximately six days for restoration. Moderate damage for pump stations is defined by the loss of electric power for approximately one-week, considerable damage to mechanical and electrical equipment, or moderate damage to buildings. By deploying portable generators in the event of an outage, the City can reduce service losses and associated costs lower than estimated using the Hazus Method.

The Tularcitos, Minnis, and Ayer reservoirs are expected to have extensive damage and require approximately 96 days each for restoration. Extensive damage for storage tanks is defined as damage to the tank extensive enough to require removal of the tank from service, including, for example, elephant foot buckling for steel tanks with loss of content or shearing of concrete tank walls.

Moderate damage was estimated for the Gibraltar Reservoirs (SFPUC and VW) and each are estimated to require six days for restoration. Moderate damage for storage tanks is defined by the tank being considerably damaged but with only minor loss of content. Examples of moderate damage include elephant foot buckling for steel tanks without loss of content, or moderate cracking of concrete tanks with minor loss of content.

The City Hall and Corporation Yard buildings are expected to have moderate damage and take approximately six days for restoration. Moderate damage could include rotation of steel members at connections, cracks through welds, or broken bolts for steel frame buildings; hairline cracks on beams and columns; and larger flexural cracks and concrete spalling. Buildings with red or yellow tags cannot be occupied until an onsite assessment is made by an engineer and will require additional time as needed for restoration.

Reservoir Sloshing Wave Assessment

To supplement the Hazus assessment, a review of the maximum operating levels of each of the City's water storage reservoirs was performed to determine if operating levels are appropriately set to mitigate against the impact of seismically induced sloshing waves. When operating levels within reservoirs are too high, the sloshing wave within the reservoir that is produced by the seismic forces can cause damage to the significant reservoir structure, including potential roof collapse.

The site-specific seismic design parameters for each reservoir site are summarized in Table 1; these parameters were used to calculate the height of the sloshing wave.

Table 1. Site-Specific Seismic Design Parameters

Reservoir	Seismic Risk Category	Site Soil Class[a]	TL[b]	SD1[c]	SDs[d]
Ayer	IV	D – Stiff Soil	12	0.82	1.341
Gibraltar	IV	D – Stiff Soil	12	0.682	1.147
Minnis	IV	C – Very Dense Soil and Soft Rock	8	0.886	1.638
Tularcitos	IV	C – Very Dense Soil and Soft Rock	8	0.828	1.535

(a) Site soil class from *City of Milpitas Seismic Isolation Study*, ABR Engineers, January 2002. Additional study of the site-specific soil conditions could change the soil classification, which would in turn impact the seismic design parameters.
(b) Long-period transition period
(c) Design spectral response acceleration parameter at a period of 1-s
(d) Design spectral response acceleration parameter at short periods

Typically, a reservoir is constructed so that the distance between the overflow and the reservoir roof is great enough to accommodate the full height of the produced sloshing wave. In concrete reservoirs, the concrete roof may be designed to withstand some of the force of the sloshing wave, allowing for less distance to be provided between the overflow and reservoir roof (potentially up to half of the sloshing wave height). West Yost reviewed the maximum operating water levels and reservoir roof heights for each of the reservoirs and compared this distance to the sloshing wave height. A sloshing wave height that is greater than the distance between the maximum water level and the roof indicates that that the standard is not met, and the sloshing wave could collide with the roof structure, potentially causing structural damage. The results of the sloshing wave analysis are presented in Table 2. The analysis shows that none of the City's reservoirs currently meet the standard for sloshing waves.

Table 2. Sloshing Wave Analysis

Reservoir	Inside Diameter, ft	Normal Operating Range (el.)	Overflow Height (el.)	Roof Height (el.)	Sloshing Wave Height, ft	Sloshing Wave Assessment
Ayer	181	78.2 – 83	85.0	89.96	14.2	Does not meet standard [a]
Gibraltar	158	37 – 46.5	48.0	49.7	10.4	Does not meet standard [b]
Minnis	51	900.5 – 907	908.5	909.5	10.0	Does not meet standard [c]
Tularcitos	48	559.2 – 565.7	567.2	568.2	9.2	Does not meet standard [d]

(a) A distance of 4.96 ft is provided between the reservoir roof and the overflow, and a distance of 6.96 ft is provided between the reservoir roof and the high operational level; the calculated sloshing wave height of 14.2 ft exceeds both distances. The concrete tank roof may be capable of withstanding the force of the sloshing wave, but additional structural analysis is needed to confirm this.
(b) A distance of 1.7 ft is provided between the reservoir roof and the overflow, and a distance of 3.2 ft is provided between the reservoir roof and the high operational level; the calculated sloshing wave height of 10.4 ft exceeds both distances. The concrete tank roof may be capable of withstanding the force of the sloshing wave, however, as a rule of thumb, the roof is typically assumed to be capable of withstanding a maximum of only half of the sloshing wave height.
(c) A distance of 1.5 ft is provided between the reservoir roof and the overflow, and a distance of 2.5 ft is provided between the reservoir roof and the high operational level; the calculated sloshing wave height of 10.0 ft exceeds both distances.
(d) A distance of 1.0 ft is provided between the reservoir roof and the overflow, and a distance of 2.5 ft is provided between the reservoir roof and the high operational level; the calculated sloshing wave height of 9.2 ft exceeds both distances.

For steel tanks (e.g., the Minnis and Tularcitos Reservoirs), the tank may be retrofitted to meet the sloshing wave standard by adding a steel ring to the top of the tank, thereby increasing the total tank height so that the height of the sloshing wave may be accommodated. Steel tanks typically have a distance between the tank overflow and the tank roof of the sloshing wave height plus one additional foot. When preparing detailed tank retrofit plans, other damage mechanisms should be considered to better reinforce the structure against potential risks, not limited to shearing off inlet/outlet pipes, anchorage system failure causing uplift, and tank shell failure.

Non-Linear Asset Restoration Time

Hazus Table 8.1.a (reproduced as Figure A-3 of Attachment A) was used to estimate the associated mean restoration time for each facility, using the damage state from Hazus Tables 8.6 and 8.9. Hazus-recommended restoration time estimates are based on Hazus restoration function curves and available crews for restoration and represent an average time for the facility classification. In addition to the restoration time suggested by Hazus, three days were added to account for the immediate post-event, pre-restoration assessment, planning, and mobilization activities. Table A-1 shows the resulting estimated restoration time for each asset.

Two, four- person crews working 12-hour days were assumed to be available to repair and restore facilities following the selected earthquake event. This assumption forms the basis of the overall restoration time for repair and replacement work. This assumption does not include utilizing mutual aid via the Water/Wastewater Agency Response Network (WARN). Utilizing WARN can significantly reduce the time of restoration, which is scalable in the results. The number of days vary based on the size and damage state severity of the facility. Table A-1 shows the resulting estimated restoration time for each asset.

Non-Linear Consequences Cost Estimates

Utility lost water production and utility economic loss were calculated using the total restoration time and service level for each facility, along with the City of Milpitas' cost of water ($7,981/million gallons). Replacement costs for reservoirs and pump stations were calculated using the replacement costs documented in the 2020 WY Asset Management TM scaled to reflect the severity of damage (50% for extensive and 25% for moderate damage). This value was selected to represent the repair/replacement cost for all reservoirs and pump stations.

As shown in Table A-1, the analysis found that Ayer Reservoir, Gibraltar Pump Stations (SFPUC and VW) and Gibraltar Reservoirs (SFPUC and VW) had the largest repair and replacement costs and water lost costs of all non-linear assets for the selected earthquake event. Repair and replacement costs are calculated using crew size, labor rate, shift duration and order of magnitude material costs.

The total cost consequence of the non-linear assets is $5,967,160. This cost includes the total cost of repair and the total cost of water loss.

Linear Assets: Pipelines

The City owns and maintains 183 miles of pipelines, with pipe sizes ranging in diameter from 6 inches to 24 inches. Based on available pipeline material information contained in the utility's pipeline geographic information system (GIS), the majority of the system is made up of asbestos cement (approximately 133.5 miles by length) and polyvinyl chloride (PVC) (approximately 27.4 miles by length) pipe. The system also contains concrete cylinder, cast iron, ductile iron, and steel pipelines. Using the ALA methodology, West Yost assed the distribution system as a whole to estimate the number of anticipated leaks and breaks. The results of this assessment are presented in Table B-2.

The City had previously identified a select subset of pipelines within the City's service area and designated it as the "backbone". The "backbone" pipelines are pipelines which transmit water from the sources to all parts of the service area. West Yost broke the "backbone" pipeline network into 28 individual pipeline reaches and assessed the individual reach to estimate the number of anticipate leaks and breaks that would occur on the individual pipeline reaches as a result of a seismic event. Pipeline reaches are identified in Figure B-1. The results of this assessment are presented in Table B-1.

Linear Asset Damage State

The ALA methodology considers two damage states for buried pipelines: leaks and breaks. The methodology assumes that damage due to seismic waves (represented by PGV) will consist of 80 percent leaks and 20 percent breaks, while damage due to ground failure (represented by PGD) will consist of 20 percent leaks and 80 percent breaks. Two damage algorithms are used to estimate the number of leaks and breaks:

1. **For Ground Shaking**: $\frac{Repair\ Rate}{1000\ ft} = K_1 \times 0.00187 \times PGV$

   Where K_1 is a fragility constant related to the expected performance of a given pipe material[1]. Units for PGV are inches per second. Assigned K_1 values can be found on table B-1 and B-2 in Attachment B.

2. **For Peak Ground Deformation**: $\frac{Repair\ Rate}{1000\ ft} = K_2 \times 1.06 \times PGD^{0.319} \times L_S$

   Where K_2 is a fragility constant related to the expected performance of a given pipe material[2], and L_S is the estimated probability that PGD will occur during ground shaking. Units for PGD are inches. Assigned K_2 values can be found on table B-1 and B-2 in Attachment B.

ShakeMap information was used to obtain an average PGV value for all pipelines. Spatial liquefaction susceptibility data published by USGS were used to identify areas within the distribution system with "very low", "low", "moderate", "high" and "very high" susceptibility to liquefaction (and therefore, PGD). The estimated probabilities of liquefaction occurring in each liquefaction susceptibility category are listed in Table 3 below. For very low, low, moderate, and high liquefaction susceptibility areas, a PGD of six inches was assumed in accordance with J100 Standard recommendations; for very high liquefaction susceptibility areas, a PGD of 12 inches was assumed. The PGV and PGD calculations were considered additive, and resulted in conservative estimates for breaks and leaks, as summarized on Tables B-1 and B-2 in Attachment B.

[1] See Figure B-1 in Attachment B for a reproduction of K_1 values recommended by the ALA methodology.

[2] See Figure B-2 in Attachment B for a reproduction of K_2 values recommended by the ALA methodology.

Table 3. Liquefaction Susceptibility and Probability

Liquefaction Susceptibility	Probability of Liquefaction
Very High	0.50
High	0.25
Moderate	0.10
Low	0.05[a]
Very Low	0.02[a]

(a) Hazus recommends using 0.05 for low and 0.02 for very low liquefaction susceptibility.

Two, four-person crews working 12-hour days were assumed to be available to repair breaks and leaks following the selected earthquake event. This assumption forms the basis of the overall restoration time for leaks and breaks. An additional 3 days were added to the resulting total to account for the immediate post-disaster assessment, planning, and mobilization time. Total restoration time and total pipeline repair labor and material cost is summarized on Table B-3 in Attachment B.

Using the ALA methodology for linear assets, the Hayward-Rodgers Creek - 6.8 magnitude earthquake scenario is estimated to cause 192 breaks and 58 leaks to the collective transmission pipeline and distribution pipeline. Break and leak estimates and total restoration time for transmission pipelines and distribution pipelines is summarized on Table B-2 in Attachment B. It is estimated to take approximately 113 days to reach total restoration. This includes 3 days for the immediate post-disaster assessment but does not assume the utilization of mutual aid for pipeline restoration, which would shorten the time of restoration significantly if pipe repair crews were to be brought in from other entities in an isolated event. However, the regional impacts of the anticipated earthquake scenario pose a threat to the availability of mutual aid resources, which consequently may need to be sourced from a significant distance away. The City's emergency response preparation should consider the regional impacts of this earthquake scenario.

Estimated Service Denial

Using the Hazus Method for non-linear assets, the Hayward-Rodgers Creek 6.8 magnitude earthquake scenario is estimated to cause extensive damage to the City's facilities due to an estimated maximum peak ground acceleration of 0.65 g, with g being earth's gravitational acceleration. Hazus predicts significant damage to City facilities would equate to loss of electrical power and backup power and extensive damage to pumping stations and storage tanks. It is also assumed that a loss of water quality would be imminent. Due to the damage anticipated it is expected that there would be a loss of service equivalent to approximately 165 million gallons.

Linear Consequences Cost Estimates

The analysis found the City's trunk lines could have 8 breaks and 32 leaks, as shown in Table B-1. The overall distribution system was estimated to experience 192 breaks and 58 leaks, as shown in Table B-2. Repair and replacement costs are calculated using crew size, labor rate, shift duration and order of magnitude material costs.

The direct linear consequence costs by type of pipeline are presented in Table B-3. The total cost consequence of the linear assets is $334,173 for the trunk lines and $2,515,349 for the overall distribution system. This total includes the cost of the estimated water loss and the cost of repair labor and material.

Consequence Costs Summary

The Hayward-Rodgers Creek - 6.8 magnitude earthquake is estimated to cause significant damage to the City's non-linear and linear assets, with a total consequence cost of approximately $10,322, 527. The consequence cost of all linear assets is approximately $4,355,366, and the consequence cost of all non-linear assets is approximately $5,967,160. The Hazus Method estimates moderate damage to the buildings and moderate/severe damage to the pump stations and reservoirs. The ALA Method estimates 8 breaks and 32 leaks from the trunk lines and 192 breaks and 58 leaks from the distribution pipelines. Table 4 below shows the consequence costs of each asset from the Hayward-Rodgers Creek earthquake. For the purposes of this TM, the costs indicated below reflect the repair and replacement costs and loss of service. See Table A-1 for a breakdown of these individual cost components.

Table 4. Earthquake Threat Asset Pair Consequence Costs

Threat	Asset	Consequence Cost, dollars
Earthquake / Landslide	Tularcitos Reservoir	1,550,471
Earthquake / Landslide	Minnis Reservoir	1,690,507
Earthquake / Landslide	Country Club Pump Station	1,235,196
Earthquake / Landslide	Tularcitos Pump Station	1,390,946
Earthquake / Liquefaction	City Hall	50,020
Earthquake / Liquefaction	Corporation Yard	50,020
Earthquake / Liquefaction	Reach 1 / McCarthy PRV	106,632
Earthquake / Liquefaction	Reach 2 / California Circle PRV	26,291
Earthquake / Liquefaction	Reach 3	12,984
Earthquake / Liquefaction	Reach 4 / Junipero PRV	34,911
Earthquake / Liquefaction	Reach 5 / Live Oak PRV	4,631
Earthquake / Liquefaction	Reach 6	11,516
Earthquake / Liquefaction	Reach 7 / Main PRV	14,069
Earthquake / Liquefaction	Reach 8 / Parc Metro PRV	8,335
Earthquake / Liquefaction	Reach 9 / Curtis PRV	13,982
Earthquake / Liquefaction	Reach 10	17,501
Earthquake / Liquefaction	Reach 11	31,285
Earthquake / Liquefaction	Reach 12 / Gibraltar PRV / Gibraltar Turnout	23,650
Earthquake / Liquefaction	Reach 13 / Capitol PRV	20,874
Earthquake / Liquefaction	Reach 14	8,672
Earthquake / Liquefaction	Reach 15 / Sunnyhills PRV	17,575
Earthquake / Liquefaction	Reach 16	2,569
Earthquake / Liquefaction	Reach 17	6,297
Earthquake / Liquefaction	Reach 18	4,424
Earthquake / Landslide	Reach 19 / Calera Creek Heights & Tularcitos PRVs	9,028
Earthquake / Liquefaction	Reach 20 / North Milpitas PRV	21,612
Earthquake / Liquefaction	Reach 21 / Montague PRV	4,882

Table 4. Earthquake Threat Asset Pair Consequence Costs

Threat	Asset	Consequence Cost, dollars
Earthquake / Liquefaction	Reach 22	11,495
Earthquake / Liquefaction	Reach 23 / Yosemite PRV	14,714
Earthquake / Liquefaction	Reach 24	3,830
Earthquake / Liquefaction	Reach 25	12,547
Earthquake / Liquefaction	Reach 26	6,210
Earthquake / Liquefaction	Reach 27	2,952
Earthquake / Liquefaction	Reach 28	7,433
Earthquake / Liquefaction	Distribution System	3,894,466
	Total	**10,322,527**

CONCLUSION AND DISCLAIMER

The methodology and results presented in this TM were based on the Hazus Earthquake Model Methodology and Manual and the ALA Methodology. The Hazus and ALA methodologies have been utilized as best management practice, as recommended in the J100 Standard. Data and assumptions used in the analysis were based on best available information. The methodologies have been interpreted to best suit specific City assets and site conditions. Also note that the ALA pipeline damage results are subject to a range of minus 50 percent to plus 100 percent in accuracy.

REFERENCES

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Attachment A

Hazus Methodology Results for Non-Linear Assets

Table A-1. HAZUS Methodology Results for Non-Linear Assets

Facility/Asset	Year Built	Service Level, MGD	ShakeMap PGA, g	ShakeMap PGV, cm/s	Liquefaction Susceptibility, %	Assumed PGD, In	HAZUS Damage State, PWT1	HAZUS Mean Restoration Time, d	Days to assess and plan (pre-restoration time), d	Total Time to Restoration, d	Lost Water Production, MG	Utility Economic Loss – Water, $	Repair / Replacement Crew Cost, $/d	Repair / Replacement Cost, $
Reservoirs														
Tularcitos Reservoir	1980	0.06	0.42	41	2%, Very Low	-	extensive	93	3	96	5.76	45,971	8,200	1,504,500[(a)]
Minnis Reservoir	1980	0.17	0.42	41	5% Low	-	extensive	93	3	96	16.32	130,250	8,200	1,560,258[(a)]
Ayer Reservoir	1993	4.14	0.4	40	10%, Moderate	6	extensive	93	3	96	397.44	3,171,969	8,200	7,145,000[(a)]
Gibraltar Reservoir (SFPUC)	1991	4.03	0.35	37	10%, Moderate	6	moderate	3.1	3	6.1	24.58	196,197	8,200	3,272,500[(a)]
Gibraltar Reservoir (VW)	1991	5.99	0.35	37	10%, Moderate	6	moderate	3.1	3	6.1	36.54	291,618	8,200	3,272,500[(a)]
Pump Stations														
Country Club Pump Station	1981	0.06	0.42	49	2%, Very Low	-	extensive	13.5	3	16.5	0.99	7,901	8,200	1,227,295[(a)]
Tularcitos Pump Station	1981	0.17	0.42	41	2%, Very Low	-	extensive	13.5	3	16.5	2.81	22,387	8,200	1,368,560[(a)]
Ayer Pump Station	1995	4.14	0.4	40	10%, Moderate	6	extensive	13.5	3	16.5	68.31	545,182	8,200	2,489,563[(a)]
Gibraltar Pump Station (SFPUC)	1993	4.03	0.35	37	10%, Moderate	6	moderate	3.1	3	6.1	24.58	196,197	8,200	4,366,522[(a)]
Gibraltar Pump Station (VW)	1993	5.99	0.35	37	10%, Moderate	6	moderate	3.1	3	6.1	36.54	291,618	8,200	4,366,522[(a)]
Other														
City Hall	2000	-	0.365	39	10%, Moderate	6	moderate	3.1	3	6.1	-	-	8,200	50,020[(b)]
Corporation Yard	-	-	0.38	40	10%, Moderate	6	moderate	3.1	3	6.1	-	-	8,200	50,020[(b)]
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**613.87**	**$4,899,288**		**30,673,259**

(a) Cost based on percentage of replacement cost as documented in the 2020 WY Asset Management TM (50% for extensive damage and 25% for moderate damage).

(b) Costs based on (Total Time to Restoration) X (Repair/Replacement Crew Cost)

Table 8.3: Damage Algorithms for Small Water Treatment Plants

Peak Ground Acceleration			
Classification	**Damage State**	**Median (g)**	**β**
Plants with anchored subcomponents (PWT1)	slight/minor	0.25	0.50
	moderate	0.38	0.50
	extensive	0.53	0.60
	complete	0.83	0.60
Plants with unanchored subcomponents (PWT2)	slight/minor	0.16	0.40
	moderate	0.27	0.40
	extensive	0.53	0.60
	complete	0.83	0.60

Figure A-1. Hazus Table 8.3

Table 8.6: Damage Algorithms for Small Pumping Plants

Peak Ground Acceleration			
Classification	**Damage State**	**Median (g)**	**β**
Plants with anchored subcomponents (PPP1)	slight/minor	0.15	0.70
	moderate	0.36	0.65
	extensive	0.66	0.65
	complete	1.50	0.80
Plants with unanchored subcomponents (PPP2)	slight/minor	0.13	0.60
	moderate	0.28	0.50
	extensive	0.66	0.65
	complete	1.50	0.80

Figure A-2. Hazus Table 8.6

Table 8.7: Damage Algorithms for Medium/Large Pumping Plants

Peak Ground Acceleration			
Classification	**Damage State**	**Median (g)**	**β**
Plants with anchored subcomponents (PPP3)	slight/minor	0.15	0.75
	moderate	0.36	0.65
	extensive	0.77	0.65
	complete	1.50	0.80
Plants with unanchored subcomponents (PPP4)	slight/minor	0.13	0.60
	moderate	0.28	0.50
	extensive	0.77	0.65
	complete	1.50	0.80

Figure A-3. Hazus Table 8.7

Table 8.9: Damage Algorithms for Water Storage Tanks

Peak Ground Acceleration			
Classification	**Damage State**	**Median (g)**	**β**
On-Ground Anchored Concrete Tank (PST1)	slight/minor	0.25	0.55
	moderate	0.52	0.70
	extensive	0.95	0.60
	complete	1.64	0.70
On-Ground Unanchored Concrete Tank (PST2)	slight/minor	0.18	0.60
	moderate	0.42	0.70
	extensive	0.70	0.55
	complete	1.04	0.60
On-Ground Anchored Steel Tank (PST3)	slight/minor	0.30	0.60
	moderate	0.70	0.60
	extensive	1.25	0.65
	complete	1.60	0.60
On-Ground Unanchored Steel Tank (PST4)	slight/minor	0.15	0.70
	moderate	0.35	0.75
	extensive	0.68	0.75
	complete	0.95	0.70
Above-Ground Steel Tank (PST5)	slight/minor	0.18	0.50
	moderate	0.55	0.50
	extensive	1.15	0.60
	complete	1.50	0.60
On-Ground Wood Tank (PST6)	slight/minor	0.15	0.60
	moderate	0.40	0.60
	extensive	0.70	0.70
	complete	0.90	0.70
Permanent Ground Deformation			
Classification	**Damage State**	**Median (in)**	**β**
Buried Concrete Tank (PST7)	slight/minor	2	0.50
	moderate	4	0.50
	extensive	8	0.50
	complete	12	0.50

Figure A-4. Hazus Table 8.9

Table 8.1.a: Continuous Restoration Functions for Potable Water Systems (After ATC-13, 1985)

Restoration Functions (All Normal Distributions)			
Classification	**Damage State**	**Mean (Days)**	**σ (days)**
Water Treatment Plants	slight/minor	0.9	0.3
	moderate	1.9	1.2
	extensive	32.0	31.0
	complete	95.0	65.0
Pumping Plants	slight/minor	0.9	0.3
	moderate	3.1	2.7
	extensive	13.5	10.0
	complete	35.0	18.0
Wells	slight/minor	0.8	0.2
	moderate	1.5	1.2
	extensive	10.5	7.5
	complete	26.0	14.0
Water Storage Tanks	slight/minor	1.2	0.4
	moderate	3.1	2.7
	extensive	93.0	85.0
	complete	155.0	120.0

Figure A-5. Hazus Table 8.1.a

Attachment B

ALA Methodology Results for Linear Assets

Table B-1. Trunk Pipeline Lengths and Fragility

Pipe Reach	Total Pipe Length, miles	Average Pipe Diameter, inches	Most Common Pipe Type	K1	K2	Average PGV, cm/s	No. Leaks			No. Breaks		
							Ground Shaking	Ground Deformation	Total	Ground Shaking	Ground Deformation	Total
1	3.9	13	DIP	0.5	0.6	35.5	0.6	11.4	11.9	0.1	2.8	3.0
2	1.6	12	ACP	0.5	0.8	40.8	0.3	2.5	2.7	0.1	0.6	0.7
3	0.5	11	ACP	0.5	0.7	39.8	0.1	1.3	1.4	0.0	0.3	0.3
4	3.3	12	ACP	0.5	0.8	36.5	0.5	2.9	3.4	0.1	0.7	0.8
5	0.4	11	ACP	0.5	0.7	33.8	0.1	0.2	0.3	0.0	0.1	0.1
6	1.0	12	DIP	0.5	0.6	34.3	0.1	0.5	0.6	0.0	0.1	0.2
7	0.5	18	ACP	0.5	0.7	36.5	0.1	0.6	0.7	0.0	0.2	0.2
8	0.7	19	DIP	0.5	0.5	36.3	0.1	0.3	0.4	0.0	0.1	0.1
9	1.1	18	DIP	0.5	0.5	36.3	0.1	0.6	0.7	0.0	0.1	0.2
10	0.9	14	ACP	0.5	0.6	36.5	0.1	0.7	0.9	0.0	0.2	0.2
11	0.2	24	STL	0.3	0.3	36.3	0.0	0.1	0.1	0.0	0.0	0.0
12	0.1	12	ACP	0.5	0.8	36.3	0.0	0.1	0.1	0.0	0.0	0.0
13	1.2	17	ACP	0.5	0.7	34.5	0.2	0.6	0.8	0.0	0.2	0.2
14	1.4	14	ACP	0.5	0.6	35.8	0.2	0.2	0.4	0.1	0.1	0.1
15	3.5	11	ACP	0.5	0.8	38.5	0.5	0.6	1.2	0.1	0.2	0.3
16	0.0	10	ACP	0.5	0.8	41.4	0.0	0.0	0.0	0.0	0.0	0.0
17	1.1	10	ACP	0.5	0.8	41.4	0.2	0.1	0.3	0.0	0.0	0.1
18	0.3	12	ACP	0.5	0.8	41.0	0.0	0.0	0.1	0.0	0.0	0.0
19	2.0	11	ACP	0.5	0.8	41.0	0.3	0.3	0.6	0.1	0.1	0.1
20	2.9	15	ACP	0.5	0.7	37.3	0.4	1.2	1.7	0.1	0.3	0.4
21	0.4	10	ACP	0.5	0.8	35.3	0.0	0.2	0.3	0.0	0.1	0.1
22	0.8	18	DIP	0.5	0.5	37.0	0.1	0.3	0.4	0.0	0.1	0.1
23	1.8	14	ACP	0.5	0.6	37.3	0.3	0.8	1.1	0.1	0.2	0.3
24	0.3	16	DIP	0.5	0.6	39.3	0.1	0.0	0.1	0.0	0.0	0.0
25	1.3	12	ACP	0.5	0.8	38.8	0.2	0.5	0.7	0.1	0.1	0.2
26	0.3	22	STL	0.2	0.2	38.3	0.0	0.0	0.1	0.0	0.0	0.0
27	0.1	18	DIP	0.5	0.5	39.0	0.0	0.0	0.1	0.0	0.0	0.0
28	0.8	11	ACP	0.5	0.8	39.5	0.1	0.4	0.5	0.0	0.1	0.1
Total	**32.6**	**-**	**-**	**-**	**-**	**-**	**4.8**	**26.7**	**31.5**	**1.2**	**6.7**	**7.9**

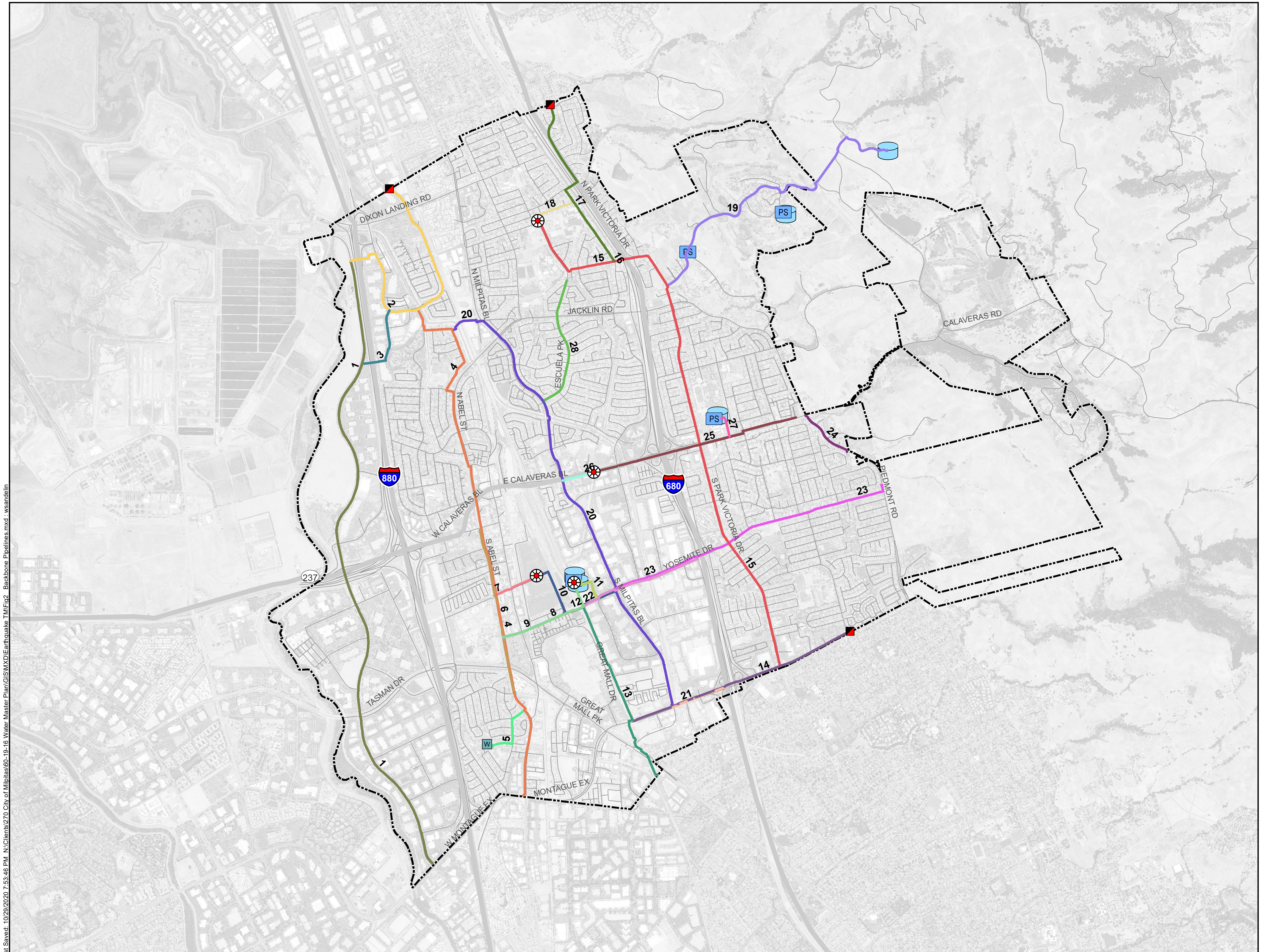
Table B-2. Overall Pipeline Distribution Lengths and Fragility

Pipe Material	Total Pipe Length, miles	Average Pipe Diameter	K1	K2	Average PGV, cm/s	No. Leaks			No. Breaks		
						Ground Shaking	Ground Deformation	Total	Ground Shaking	Ground Deformation	Total
AC/ACP	133.5	Small	0.5	0.8	36.1	7.4	36.2	43.7	1.9	144.9	146.8
CCP	0.2	Small	0.8	1.0	36.1	0.0	0.1	0.1	0.0	0.2	0.2
CIP	0.9	Small	0.8	0.8	36.1	0.1	0.3	0.3	0.0	1.0	1.1
DIP	15.3	Large	0.5	0.5	36.1	0.3	0.9	1.2	0.1	3.5	3.5
PVC	27.4	Small	0.5	1.0	36.1	0.0	0.1	0.1	0.0	0.5	0.5
STL	5.3	Large	0.15	0.15	36.1	0.0	0.1	0.1	0.0	0.4	0.4
Total	**182.6**	**-**	**-**	**-**	**36.1**	**10.3**	**47.2**	**57.5**	**2.6**	**188.9**	**191.4**

Table B-3. Pipeline Repair Cost Estimates

Evaluation	Total Repair Time, crew days	Total Pipeline Repair Labor and Material Cost, dollars
Trunk Lines	14.8	$334,173
Overall Distribution	113.0	$2,515,349

(a) Total Pipeline Repair Labor and Material Cost based on crew size 4 workers, 2 crews, $150/hr labor cost, $2500/crew day material cost, and a $50,000 administrative adder.



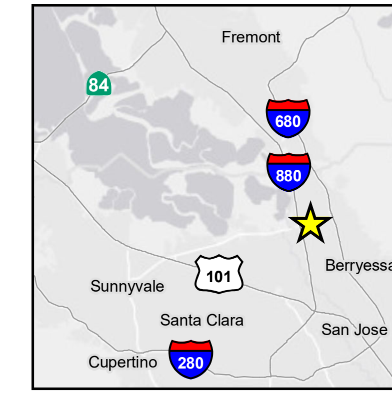


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Figure B-1

Backbone Pipeline Reaches

City of Milpitas

Pipe Material	Joint Type	Soils	Diam.	K_1	Reference Sections
Cast iron	Cement	All	Small	1.0	4.4.2
Cast iron	Cement	Corrosive	Small	1.4	4.4.2
Cast iron	Cement	Non-corrosive	Small	0.7	4.4.2
Cast iron	Rubber gasket	All	Small	0.8	4.4.2
Welded steel	Lap - Arc welded	All	Small	0.6	4.4.4
Welded steel	Lap - Arc welded	Corrosive	Small	0.9	4.4.4
Welded steel	Lap - Arc welded	Non-corrosive	Small	0.3	4.4.4
Welded steel	Lap - Arc welded	All	Large	0.15	4.4.4
Welded steel	Rubber gasket	All	Small	0.7	4.4.6
Welded steel	Screwed	All	Small	1.3	4.4.6 A.3.11
Welded steel	Riveted	All	Small	1.3	4.4.6
Asbestos cement	Rubber gasket	All	Small	0.5	4.4.3 4.4.5
Asbestos cement	Cement	All	Small	1.0	4.4.3
Concrete w/Stl Cyl.	Lap - Arc Welded	All	Large	0.7	4.4.6
Concrete w/Stl Cyl.	Cement	All	Large	1.0	4.4.6
Concrete w/Stl Cyl.	Rubber Gasket	All	Large	0.8	4.4.6
PVC	Rubber gasket	All	Small	0.5	4.4.6
Ductile iron	Rubber gasket	All	Small	0.5	4.4.5 4.4.6

Table 4-5. Ground Shaking - Constants for Fragility Curve

Figure B-2. ALA-Recommended K_1 Fragility Constants for Pipelines

Pipe Material	Joint Type	K_2	Reference Sections
Cast iron	Cement	1.0	4.4.2
Cast iron	Rubber gasket	0.8	4.4.2
Cast iron	Mechanical restrained	0.7	4.4.2
Welded steel	Arc welded, lap welds (large diameter, non corrosive)	0.15	4.4.4
Welded steel	Rubber gasket	0.7	4.4.3
Asbestos cement	Rubber gasket	0.8	4.4.3
Asbestos cement	Cement	1.0	4.4.6
Concrete w/Stl Cyl.	Welded	0.6	4.4.6
Concrete w/Stl Cyl.	Cement	1.0	4.4.6
Concrete w/Stl Cyl.	Rubber Gasket	0.7	4.4.6
PVC	Rubber gasket	0.8	4.4.6
Ductile iron	Rubber gasket	0.5	4.4.6

Table 4-6. Permanent Ground Deformations - Constants for Fragility Curve

Figure B-3. ALA-Recommended K_2 Fragility Constants for Pipelines

Appendix F

Water Utility Financial Plan

RAFTELIS

Project Memo

DATE: June 9, 2022

TO: Tony Ndah
Public Works Director

FROM: Todd Cristiano
Senior Manager

SUBJECT: Water Financial Plan Options

Introduction

The City of Milpitas retained Raftelis to complete a comprehensive financial planning forecast for their water, wastewater[1], and stormwater utilities[2]. Separate financial plans and memorandums were developed for each utility and this memorandum summarizes the water financial plan results. The analysis included the following:

1. ***Revenue forecast.*** Includes the projection of rate revenues, the number of accounts, growth in accounts, and billed volume per account; projection of other operating and non-operating income, and development fees.
2. ***Expenditures forecast.*** Includes the projection of operation and maintenance expenses, transfers to the general fund, payments on existing debt service, and capital projects identified in the most recent master plan documents.
3. ***Revenue adjustments***. Optimizing the use of rate revenues and bond issues to minimize revenue adjustments while meeting annual revenue requirements, debt service coverage, and reserve targets.

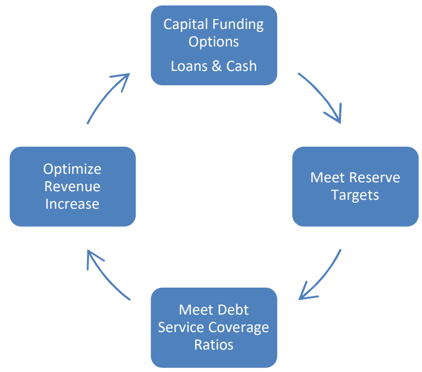
The forecast presented in this memo is for the study period FY 2022 through FY 2040. The City's water utility is financially self-sufficient with funding for capital and operating requirements derived primarily from rates.

[1] Wastewater and sewer utility are used interchangeably throughout this memo.
[2] Stormwater activities are currently within the general fund and is not a stand-alone utility. For the purposes of this study, we created a cash flow consolidating the O&M costs for the various areas in the general fund and projects identified in the most recent master plan.

Financial Planning Process

A primary consideration in developing an 'optimal' financial plan is minimizing annual revenue increases by balancing the use of reserves, existing rate revenue, and debt proceeds. This balance is subject to the constraints of meeting the City's target reserve policies and debt service coverage requirements on any proposed debt.

This approach is an iterative process. For example, while issuing debt to fund a capital project may keep revenue increases low, new debt payments may decrease the coverage below the target level. As a result, a revenue increase may be needed to maintain compliance with the target. This revenue may produce an ending balance which exceeds the target reserve. This excess can be used to partially fund the capital project which, in turn, could reduce the proposed debt issuance amount.



Reserves

The City maintains three reserves for the wastewater utility. The excerpts below are from the City's financial reserve policy 11. These descriptions can also be found in the City's consolidated annual financial report. The proposed financial plan allows the City to maintain reserves in compliance with this policy.

Capital reserves for emergencies. The City will maintain capital reserves in the Water and Sewer utility enterprise funds to provide for future capital projects and unanticipated emergencies. The City will attempt to maintain a capital reserve of approximately 30% of the annual operating and maintenance expenses for the Water utility fund and 25% of the annual operating and maintenance expenses for the Sewer utility fund.

Rate stabilization reserve. The City will maintain a Rate Stabilization Reserve (RSR) in the Water and Sewer utility enterprise funds with a goal of at least 16.67% or two months of the respective annual operating expenditures after the Capital Reserve requirements have been met. The RSR shall be used to mitigate the effects of occasional shortfalls in revenue or unanticipated expenditures that cannot be rebalanced within existing budgeted resources in any given fiscal year.

Public Employees Retirement (PERS) Rate Stabilization Reserve. The City will maintain in the Utility Enterprise Funds or in a Section 115 Trust a Public Employees Retirement (PERS) Rate Stabilization Reserve to be funded by 20% of any General Fund or Enterprise Funds annual operating surpluses. The Water and Sewer Utility Enterprise Funds' portion of the Unfunded Actuarial Liability for the Miscellaneous Retirement Plan is 8.5% and 6.6%, respectively. The Utility Funds' portion of the contribution to the PERS Rate Stabilization Reserve shall be consistent with the General Fund contributions and only be funded after the Capital Reserve and Rate Stabilization Reserve (RSR) requirements in the Water and Sewer utility funds have been met.

Water Utility Findings

Raftelis used the assumptions shown in Table 1 to develop the financial plan options. Changes in these assumptions could materially affect the results. These assumptions were based on information provided by Staff over the course of the study including annual budgets, detailed billing data, forecasts of new customer connections, and master plan reports. The detailed water cash flows are attached at the end of this memorandum.

Table 1: Water Utility Assumptions

Item		Description
FY 2022 Beginning Fund Balance		
Capital Reserve for Emergencies		$8,614,458
Rate Stabilization Reserve		$4,347,276
Capital Fund		$13,199,527
TASP Fund		$17,869,842
Average growth in number of accounts		2.2%
Annual average O&M Inflation [1]		5.7%
Average Annual Capital Projects Inflation		6.0% (FY 2023 – FY 2026) 4.0% (FY 2027 – FY 2040) Study period average ~4.3%
Projected Wholesale Water Rate Increases [2]		
Year	**SFPU**	**Valley Water**
FY 2023	15.9%	15.0%
FY 2024	11.2%	15.0%
FY 2025	0.0%	15.0%
FY 2026	0.0%	9.1%
FY 2027	0.8%	9.1%
FY 2028	4.5%	9.1%
FY 2029	4.5%	9.1%
FY 2030 – FY 2040	4.5% Annually	5.0% Annually
[1] Includes the water purchase cost increases. **[2] Current FY22 Rates** SFPUC ($4.10/Ccf FY22 rate) Valley Water ($3.71/Ccf FY22 rate)		

The water utility financial plan consists of three sub-funds:

- ***Operating Fund.*** Funds activities associated with annual operation and maintenance of the utility, maintaining emergency and rate stabilization reserves, and transfers of any surplus to the Capital Fund.
- ***Capital Fund***. Tracks activities associated with debt service on bond issues, previously adopted CIP projects, and projects identified in the master plan. Sources of funding include capital fees, transfers from the operating fund, and debt issuance proceeds.
- ***TASP Fund***. Tracks funding and projects that have specifically been identified as being funded by TASP or future METRO development fees[3].

[3] Future METRO fees have not been adopted as of the date of this memorandum

Separation of these sub-funds ensures that sources of funds were being used for their appropriate purposes. For example, capital fees and bond issues fund the capital improvement program but should not fund operations.

Operating Fund

Sources of Funds

Sources of funds consist primarily of rate revenue, other operating income, and non-operating income. Rate revenue consists of a bimonthly base charge and a uniform volume rate. Rate revenues with proposed increases is projected to increase from $33.0 million in FY 2023 to $44.2 million in FY 2040. This includes an average annual account growth of 2.2% from FY 2023 to FY 2040 based on future METRO plan development forecasts.

Uses of Funds

Uses of Funds consist of operation and maintenance expense and transfers to the capital fund to assist in funding the capital improvement program. O&M consists of the items required to distribute water to customers as well costs associated with administration of the utility, and customer services.

Water purchases make up approximately 70% of O&M. The City purchases water from San Francisco Public Utilities Commission (SFPUC) and Santa Clara Valley Water District (Valley Water) on an annual basis. The wholesale rate is set annually by each wholesale water agency. The City expects the water purchase rate from SFPUC to increase by 15.9% in 2023 and 11.2% in 2024; 0.0% in FY 2025 and FY 2026, 0.8% in FY 2027, and 4.5% from FY 2028 through FY 2040. Valley Water purchased water rates are expected to increase by 15.0% each year from FY 2023 through FY 2025, 9.1% from FY 2026 to FY 2029, and 5.0% annually from FY 2030 through FY 2040.

O&M expenses for the City's core operations (personnel services, general supplies, contractual services excluding water purchases, etc.) will increase by 4.0% from FY 2023 through FY 2025. This short-term inflation estimates are based on publications from the Philadelphia Federal Reserve. Inflation from FY 2026 through FY 2040 is estimated at 3.0% based on historical trends of Consumer Price Index (CPI). Total O&M <u>including</u> water purchases will increase by an average of 5.7% annually over the study period or from $31.2 million in FY 2023 to $84.9 million in FY 2040.

Capital Fund

Sources of Funds

Funding includes the capital surcharge, transfers from the operating fund, and bond proceeds. The capital surcharge currently collects approximately $4.0 million per year. Transfers from the operating fund are made in years where operating revenue exceeds operating expenses and required transfers to reserve funds.

Uses of Funds

Expenditures include debt service on the City's existing Series 2019 bonds and capital projects identified in the adopted FY 2023 – FY 2040 capital budget and master plan. Capital improvement program costs total $82.0 million for the study period which includes an annual inflation of 6.0% from FY 2023 through FY 2025 and 4.0% from FY 2026 through FY 2040.

Revenue Requirement

Revenue from rates and other miscellaneous revenue should be sufficient to meet annual revenue requirements in the operating and capital funds. Revenue requirements include operation and maintenance expenses, capital project funding, and meeting target reserves. Raftelis and City staff developed a financial plan to fully fund expenses, including the master plan projects, using revenue derived from user rates and the capital surcharge.

Proposed Financial Plan

The financing plan developed by Raftelis and City staff proposes to fully fund the expenses described above using rate revenue.

- ***Operating Fund.*** Annual increases to water user charges of 6.0% are required in FY 2024 through FY 2026, 4.0% from FY 2027 through FY 2031, and 3.0% from FY 2031 through FY 2040. The revenue from these increases will adequately fund O&M, water purchases, reserve requirements, and provide surplus revenue to transfer to the CALPERS and capital funds.
- ***Capital Fund.*** The proposed financing plan does not require the use of bonds in any year of the forecast. Payment on existing debt service, the adopted CIP projects, and master plan projects can be fully funded by the capital surcharge with annual increases of 10.0% from FY 2024 through 2030.
- ***TASP Fund.*** Several projects in the master plan, including Curtis Well and assets associated with the Valley Water Second Water Supply, have been identified as requiring funding from the TASP fund. However, the existing fund balance and expected 2023 proceeds from TASP development fees are insufficient to fully fund all identified projects. This plan assumes that future METRO development fees will be able to provide an additional $4.1 million by FY 2027 to fully finance these projects.
- ***Water Monthly Bill Impact.*** Based on the rate increases proposed in this financial plan, the bimonthly bill for typical single-family residential customer with a 5/8" meter is projected to increase $9.19 from $143.02 to $152.51 based on usage of 14 hcf.

Reliance on City Provided Data

During this project, the City (and/or its representatives) provided Raftelis with a variety of technical information, including cost and revenue data. Raftelis did not independently assess or test for the accuracy of such data – historic or projected. Raftelis has relied on this data in the formulation of our findings and subsequent recommendations, as well as in the preparation of this memorandum.

There are often differences between actual and projected data. Some of the assumptions used for projections in this memorandum will not be realized, and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the data or results projected in this memorandum and actual results achieved, and those differences may be material. As a result, Raftelis takes no responsibility for the accuracy of data or projections provided by or prepared on behalf of the City, nor do we have any responsibility for updating this memorandum for events occurring after the date of this memorandum.

Table A-1
City of Milpitas, CA
Water Utility Cash Flow Analysis

Line No.	Operating Fund	Budget FY 2022	Projected FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
	Sources of Funds										
1	Revenue from Adopted Water Rates	$ 31,013,210	$ 32,994,216	$ 33,108,574	$ 33,783,900	$ 34,458,744	$ 35,133,589	$ 35,808,434	$ 36,483,279	$ 37,158,124	$ 37,861,346
2	Add'l Revenue from Proposed Rate Increases	-	-	1,986,514	4,175,690	6,582,172	8,384,864	10,320,095	12,394,502	14,615,043	17,001,754
3	Total Water Rate Revenue	31,013,210	32,994,216	35,095,088	37,959,590	41,040,916	43,518,454	46,128,529	48,877,781	51,773,167	54,863,099
4	Investment Interest	$ 372,000	$ 369,729	$ 187,521	$ 202,530	$ 220,657	$ 231,585	$ 244,112	$ 260,891	$ 279,020	$ 294,383
5	Other Misc. Revenue	17,601	-	-	-	-	-	-	-	-	-
6	**Total Sources**	**$ 31,402,811**	**$ 33,363,945**	**$ 35,282,609**	**$ 38,162,120**	**$ 41,261,573**	**$ 43,750,038**	**$ 46,372,641**	**$ 49,138,671**	**$ 52,052,187**	**$ 55,157,482**
	Uses of Funds										
7	Operation and Maintenance Expense	$ 25,734,839	$ 28,566,070	$ 31,737,245	$ 33,869,560	$ 35,603,584	$ 37,601,626	$ 40,305,556	$ 43,231,859	$ 45,694,157	$ 48,324,559
8	Transfer to General Fund	2,571,407	2,687,393	2,794,889	2,906,684	2,993,885	3,083,701	3,176,212	3,271,499	3,369,644	3,470,733
9	**Total Uses of Funds**	**$ 28,306,246**	**$ 31,253,463**	**$ 34,532,133**	**$ 36,776,244**	**$ 38,597,469**	**$ 40,685,328**	**$ 43,481,769**	**$ 46,503,358**	**$ 49,063,801**	**$ 51,795,292**
10	**Operating Surplus**	$ 3,096,565	$ 2,110,482	$ 750,476	$ 1,385,876	$ 2,664,105	$ 3,064,711	$ 2,890,872	$ 2,635,313	$ 2,988,386	$ 3,362,190
	Reserve Fund Summary										
11	Capital for Emergencies	$ 8,614,458	$ 9,376,039	$ 10,126,515	$ 11,032,873	$ 11,579,241	$ 12,205,598	$ 13,044,531	$ 13,951,007	$ 14,719,140	$ 15,538,588
12	Rate Stabilization	4,718,651	5,209,952	5,209,952	5,689,469	6,434,198	6,782,244	7,248,411	7,752,110	8,178,936	8,634,275
13	CALPERS	545,038	716,558	716,558	716,558	991,160	1,409,221	1,726,376	1,971,403	2,330,089	2,747,569
14	Infrastructure	13,464,473	16,625,757	7,629,326	3,827,790	2,689,612	5,059,757	5,306,748	6,426,325	11,413,754	12,457,408
15	**Total Reserves**	**$ 27,342,620**	**$ 31,928,306**	**$ 23,682,351**	**$ 21,266,690**	**$ 21,694,210**	**$ 25,456,820**	**$ 27,326,065**	**$ 30,100,845**	**$ 36,641,919**	**$ 39,377,840**

Line No.	Reserve Fund Detail	Budget FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
	Capital Reserve for Emergencies										
1	Beginning Balance	$ 8,614,458	$ 8,614,458	$ 9,376,039	$ 10,126,515	$ 11,032,873	$ 11,579,241	$ 12,205,598	$ 13,044,531	$ 13,951,007	$ 14,719,140
2	Contribution		761,581	750,476	906,358	546,367	626,358	838,932	906,477	768,133	819,447
3	Use		-	-	-	-	-	-	-	-	-
4	**Ending Balance**	**$ 8,614,458**	**$ 9,376,039**	**$ 10,126,515**	**$ 11,032,873**	**$ 11,579,241**	**$ 12,205,598**	**$ 13,044,531**	**$ 13,951,007**	**$ 14,719,140**	**$ 15,538,588**
5	*Target*	*8,491,874*	*9,376,039*	*10,359,640*	*11,032,873*	*11,579,241*	*12,205,598*	*13,044,531*	*13,951,007*	*14,719,140*	*15,538,588*
	Rate Stabilization Reserve										
6	Beginning Balance	$ 4,347,276	$ 4,718,651	$ 5,209,952	$ 5,209,952	$ 5,689,469	$ 6,434,198	$ 6,782,244	$ 7,248,411	$ 7,752,110	$ 8,178,936
7	Contribution	371,375	491,301	-	479,517	744,729	348,046	466,167	503,699	426,826	455,340
8	**Ending Balance**	**$ 4,718,651**	**$ 5,209,952**	**$ 5,209,952**	**$ 5,689,469**	**$ 6,434,198**	**$ 6,782,244**	**$ 7,248,411**	**$ 7,752,110**	**$ 8,178,936**	**$ 8,634,275**
9	*Target*	*4,718,651*	*5,209,952*	*5,756,507*	*6,130,600*	*6,434,198*	*6,782,244*	*7,248,411*	*7,752,110*	*8,178,936*	*8,634,275*
	CALPERS Reserve										
10	Beginning Balance	$ -	$ 545,038	$ 716,558	$ 716,558	$ 716,558	$ 991,160	$ 1,409,221	$ 1,726,376	$ 1,971,403	$ 2,330,089
11	Contribution	545,038	171,520	-	-	274,602	418,061	317,155	245,027	358,686	417,481
12	**Ending Balance**	**$ 545,038**	**$ 716,558**	**$ 716,558**	**$ 716,558**	**$ 991,160**	**$ 1,409,221**	**$ 1,726,376**	**$ 1,971,403**	**$ 2,330,089**	**$ 2,747,569**
13	**Transfer to Infrastructure Replacement**	$ 2,180,152	$ 686,080	$ -	$ -	$ 1,098,407	$ 1,672,246	$ 1,268,619	$ 980,110	$ 1,434,742	$ 1,669,923
	Check	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*
	Infrastructure Replacement										
14	Beginning Balance	$ 13,199,527	$ 13,464,473	$ 16,625,757	$ 7,629,326	$ 3,827,790	$ 2,689,612	$ 5,059,757	$ 5,306,748	$ 6,426,325	$ 11,413,754
15	Contribution	264,946	3,161,284	(8,996,431)	(3,801,537)	(1,138,178)	2,370,145	246,991	1,119,577	4,987,430	1,043,653
16	**Ending Balance**	**$ 13,464,473**	**$ 16,625,757**	**$ 7,629,326**	**$ 3,827,790**	**$ 2,689,612**	**$ 5,059,757**	**$ 5,306,748**	**$ 6,426,325**	**$ 11,413,754**	**$ 12,457,408**
17	*Target*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*
18	**Annualized Water Service Revenue Increase**	0.0%	0.0%	6.0%	6.0%	6.0%	4.0%	4.0%	4.0%	4.0%	4.0%
19	**Cumulative Revenue Increase**	0.0%	0.0%	6.0%	12.4%	19.1%	23.9%	28.8%	34.0%	39.3%	44.9%
20	**Debt Service Coverage**	6.71	5.77	4.87	5.98	7.78	8.79	9.33	9.41	10.10	10.61

Table A-1
City of Milpitas, CA
Water Utility Cash Flow Analysis

Line No.	Operating Fund	Projected FY 2032	FY 2033	FY 2034	FY 2035	FY 2036	FY 2037	FY 2038	FY 2039	FY 2040
	Sources of Funds									
1	Revenue from Adopted Water Rates	$ 38,565,143	$ 39,269,521	$ 39,974,483	$ 40,680,033	$ 41,386,178	$ 42,092,920	$ 42,800,265	$ 43,508,218	$ 44,216,783
2	Add'l Revenue from Proposed Rate Increases	19,553,114	22,277,434	25,183,430	28,280,236	31,577,431	35,085,056	38,813,634	42,774,199	46,978,313
3	Total Water Rate Revenue	58,118,257	61,546,955	65,157,912	68,960,270	72,963,609	77,177,976	81,613,900	86,282,417	91,195,096
4	Investment Interest	$ 310,772	$ 328,230	$ 346,630	$ 366,013	$ 386,608	$ 408,284	$ 431,281	$ 455,659	$ 481,282
5	Other Misc. Revenue	-	-	-	-	-	-	-	-	-
6	**Total Sources**	**$ 58,429,029**	**$ 61,875,185**	**$ 65,504,542**	**$ 69,326,282**	**$ 73,350,217**	**$ 77,586,260**	**$ 82,045,181**	**$ 86,738,075**	**$ 91,676,378**
	Uses of Funds									
7	Operation and Maintenance Expense	$ 51,130,227	$ 54,089,550	$ 57,209,530	$ 60,528,366	$ 64,023,861	$ 67,735,937	$ 71,674,528	$ 75,817,014	$ 80,206,062
8	Transfer to General Fund	3,574,855	3,682,101	3,792,564	3,906,341	4,023,531	4,144,237	4,268,564	4,396,621	4,528,519
9	**Total Uses of Funds**	**$ 54,705,082**	**$ 57,771,651**	**$ 61,002,093**	**$ 64,434,707**	**$ 68,047,392**	**$ 71,880,174**	**$ 75,943,092**	**$ 80,213,635**	**$ 84,734,581**
10	**Operating Surplus**	$ 3,723,947	$ 4,103,535	$ 4,502,449	$ 4,891,575	$ 5,302,826	$ 5,706,086	$ 6,102,089	$ 6,524,441	$ 6,941,796
	Reserve Fund Summary									
11	Capital for Emergencies	$ 16,411,524	$ 17,331,495	$ 18,300,628	$ 19,330,412	$ 20,414,218	$ 21,564,052	$ 22,782,928	$ 24,064,090	$ 25,420,374
12	Rate Stabilization	9,119,337	9,630,534	10,169,049	10,741,266	11,343,500	11,982,425	12,659,713	13,371,613	14,125,255
13	CALPERS	3,220,759	3,755,232	4,354,193	5,012,108	5,735,465	6,518,930	7,360,115	8,266,391	9,232,765
14	Infrastructure	13,577,145	14,785,579	16,085,586	17,444,638	18,877,091	20,344,739	21,825,055	23,328,490	24,825,865
15	**Total Reserves**	**$ 42,328,765**	**$ 45,502,841**	**$ 48,909,456**	**$ 52,528,423**	**$ 56,370,274**	**$ 60,410,147**	**$ 64,627,811**	**$ 69,030,584**	**$ 73,604,258**

Line No.	Reserve Fund Detail	FY 2032	FY 2033	FY 2034	FY 2035	FY 2036	FY 2037	FY 2038	FY 2039	FY 2040
	Capital Reserve for Emergencies									
1	Beginning Balance	$ 15,538,588	$ 16,411,524	$ 17,331,495	$ 18,300,628	$ 19,330,412	$ 20,414,218	$ 21,564,052	$ 22,782,928	$ 24,064,090
2	Contribution	872,937	919,971	969,133	1,029,784	1,083,805	1,149,835	1,218,875	1,281,163	1,356,284
3	Use	-	-	-	-	-	-	-	-	-
4	**Ending Balance**	**$ 16,411,524**	**$ 17,331,495**	**$ 18,300,628**	**$ 19,330,412**	**$ 20,414,218**	**$ 21,564,052**	**$ 22,782,928**	**$ 24,064,090**	**$ 25,420,374**
5	*Target*	*16,411,524*	*17,331,495*	*18,300,628*	*19,330,412*	*20,414,218*	*21,564,052*	*22,782,928*	*24,064,090*	*25,420,374*
	Rate Stabilization Reserve									
6	Beginning Balance	$ 8,634,275	$ 9,119,337	$ 9,630,534	$ 10,169,049	$ 10,741,266	$ 11,343,500	$ 11,982,425	$ 12,659,713	$ 13,371,613
7	Contribution	485,062	511,197	538,515	572,217	602,235	638,925	677,288	711,899	753,642
8	**Ending Balance**	**$ 9,119,337**	**$ 9,630,534**	**$ 10,169,049**	**$ 10,741,266**	**$ 11,343,500**	**$ 11,982,425**	**$ 12,659,713**	**$ 13,371,613**	**$ 14,125,255**
9	*Target*	*9,119,337*	*9,630,534*	*10,169,049*	*10,741,266*	*11,343,500*	*11,982,425*	*12,659,713*	*13,371,613*	*14,125,255*
	CALPERS Reserve									
10	Beginning Balance	$ 2,747,569	$ 3,220,759	$ 3,755,232	$ 4,354,193	$ 5,012,108	$ 5,735,465	$ 6,518,930	$ 7,360,115	$ 8,266,391
11	Contribution	473,190	534,473	598,960	657,915	723,357	783,465	841,185	906,276	966,374
12	**Ending Balance**	**$ 3,220,759**	**$ 3,755,232**	**$ 4,354,193**	**$ 5,012,108**	**$ 5,735,465**	**$ 6,518,930**	**$ 7,360,115**	**$ 8,266,391**	**$ 9,232,765**
13	**Transfer to Infrastructure Replacement**	$ 1,892,759	$ 2,137,894	$ 2,395,841	$ 2,631,659	$ 2,893,428	$ 3,133,861	$ 3,364,740	$ 3,625,103	$ 3,865,496
	Check	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*	*TRUE*
	Infrastructure Replacement									
14	Beginning Balance	$ 12,457,408	$ 13,577,145	$ 14,785,579	$ 16,085,586	$ 17,444,638	$ 18,877,091	$ 20,344,739	$ 21,825,055	$ 23,328,490
15	Contribution	1,119,737	1,208,434	1,300,008	1,359,052	1,432,453	1,467,648	1,480,316	1,503,435	1,497,375
16	**Ending Balance**	**$ 13,577,145**	**$ 14,785,579**	**$ 16,085,586**	**$ 17,444,638**	**$ 18,877,091**	**$ 20,344,739**	**$ 21,825,055**	**$ 23,328,490**	**$ 24,825,865**
17	*Target*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*	*2,000,000*
18	**Annualized Water Service Revenue Increase**	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
19	**Cumulative Revenue Increase**	50.7%	56.7%	63.0%	69.5%	76.3%	83.4%	90.7%	98.3%	106.2%
20	**Debt Service Coverage**	11.08	11.57	12.10	12.63	13.20	13.71	14.24	14.75	15.34

Table A-2
City of Milpitas, CA
Water Utility
Water Capital Improvement Plan (CIP)

Line No.	Capital Financing Plan	Budget FY 2022	Projected FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
	Sources of Funds										
1	Beginning Balance	$ 13,199,527	$ 13,464,473	$ 16,625,757	$ 7,629,326	$ 3,827,790	$ 2,689,612	$ 5,059,757	$ 5,306,748	$ 6,426,325	$ 11,413,754
2	Revenue Bonds	-	-	-	-	-	-	-	-	-	-
4	Capital Charge Revenue	3,913,678	3,926,784	4,333,879	4,868,338	5,466,553	6,135,726	6,884,069	7,229,405	7,589,265	7,737,742
5	Development Fees	297,000	1,002,155	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
6	Misc. Revenue	7,216	7,215	7,431	7,654	7,884	8,121	8,364	8,615	8,874	9,140
7	Interest	221,000	192,000	332,515	152,587	76,556	53,792	101,195	106,135	128,526	228,275
8	Transfer of Surplus from O&M	2,180,152	686,080	-	-	1,098,407	1,672,246	1,268,619	980,110	1,434,742	1,669,923
9	**Subtotal: Sources**	$ 19,818,573	$ 19,278,707	$ 21,599,583	$ 12,957,905	$ 10,777,189	$ 10,859,496	$ 13,622,004	$ 13,931,013	$ 15,887,732	$ 21,358,834
	Uses of Funds										
10	CIP Projects	$ 5,310,050	$ 1,605,900	$ 12,925,806	$ 8,083,666	$ 7,043,128	$ 4,753,039	$ 7,267,306	$ 6,456,488	$ 3,426,528	$ 7,855,726
11	Debt Service	1,044,050	1,047,050	1,044,450	1,046,450	1,044,450	1,046,700	1,047,950	1,048,200	1,047,450	1,045,700
12	**Subtotal: Uses**	$ 6,354,100	$ 2,652,950	$ 13,970,256	$ 9,130,116	$ 8,087,578	$ 5,799,739	$ 8,315,256	$ 7,504,688	$ 4,473,978	$ 8,901,426
13	**Ending Balance**	$ 13,464,473	$ 16,625,757	$ 7,629,326	$ 3,827,790	$ 2,689,612	$ 5,059,757	$ 5,306,748	$ 6,426,325	$ 11,413,754	$ 12,457,408
	CIP Adjustments										
15	Completion Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
16	Annual Cost Inflation	0.0%	6.0%	6.0%	6.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
17	Cumulative Inflation Rate	100.0%	106.0%	112.4%	119.1%	123.9%	128.8%	134.0%	139.3%	144.9%	150.7%

Table A-2
City of Milpitas, CA
Water Utility
Water Capital Improvement Plan (CIP)

Line No.	Capital Financing Plan	Projected FY 2032	FY 2033	FY 2034	FY 2035	FY 2036	FY 2037	FY 2038	FY 2039	FY 2040
	Sources of Funds									
1	Beginning Balance	$ 12,457,408	$ 13,577,145	$ 14,785,579	$ 16,085,586	$ 17,444,638	$ 18,877,091	$ 20,344,739	$ 21,825,055	$ 23,328,490
2	Revenue Bonds	-	-	-	-	-	-	-	-	-
4	Capital Charge Revenue	7,886,322	8,035,005	8,183,791	8,332,683	8,481,679	8,630,781	8,779,990	8,929,307	9,078,731
5	Development Fees	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
6	Misc. Revenue	9,414	9,696	9,987	10,287	10,595	10,913	11,241	11,578	11,925
7	Interest	249,148	271,543	295,712	321,712	348,893	377,542	406,895	436,501	466,570
8	Transfer of Surplus from O&M	1,892,759	2,137,894	2,395,841	2,631,659	2,893,428	3,133,861	3,364,740	3,625,103	3,865,496
9	**Subtotal: Sources**	$ 22,795,050	$ 24,331,282	$ 25,970,910	$ 27,681,927	$ 29,479,234	$ 31,330,189	$ 33,207,605	$ 35,127,544	$ 37,051,213
	Uses of Funds									
10	CIP Projects	$ 8,169,955	$ 8,496,754	$ 8,836,624	$ 9,190,089	$ 9,557,692	$ 9,940,000	$ 10,337,600	$ 10,751,104	$ 11,181,148
11	Debt Service	1,047,950	1,048,950	1,048,700	1,047,200	1,044,450	1,045,450	1,044,950	1,047,950	1,044,200
12	**Subtotal: Uses**	$ 9,217,905	$ 9,545,704	$ 9,885,324	$ 10,237,289	$ 10,602,142	$ 10,985,450	$ 11,382,550	$ 11,799,054	$ 12,225,348
13	**Ending Balance**	$ 13,577,145	$ 14,785,579	$ 16,085,586	$ 17,444,638	$ 18,877,091	$ 20,344,739	$ 21,825,055	$ 23,328,490	$ 24,825,865
	CIP Adjustments									
15	Completion Percentage	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
16	Annual Cost Inflation	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
17	Cumulative Inflation Rate	156.7%	163.0%	169.5%	176.3%	183.4%	190.7%	198.3%	206.2%	214.5%

Table A-3
City of Milpitas, CA
Water Utility
Water TASP Capital Improvement Plan (CIP)

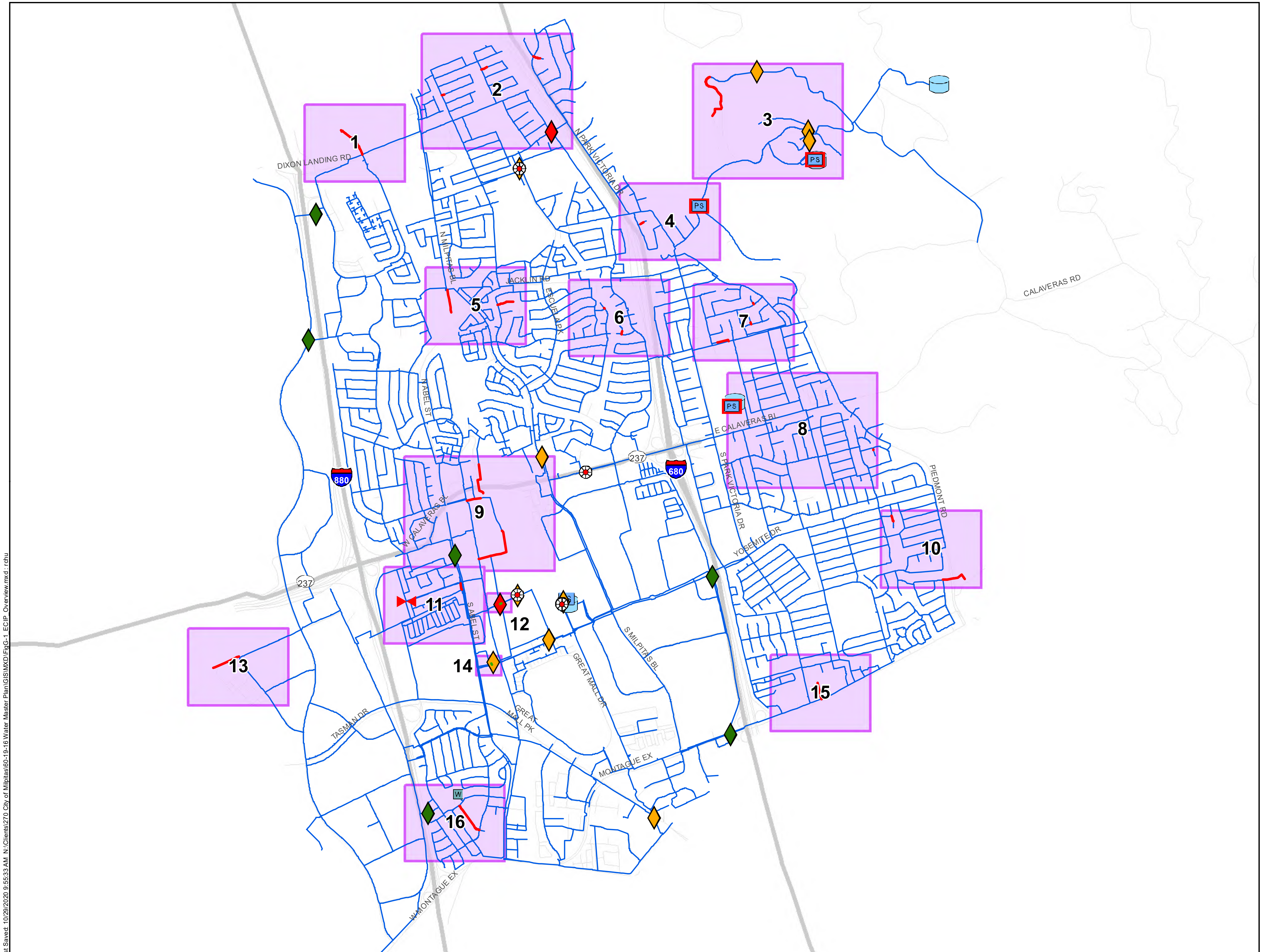
Line No.	Capital Financing Plan - TASP	Budget FY 2022	Projected FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
	Sources of Funds										
1	Beginning Balance	$ 17,869,842	$ 17,869,842	$ 24,484,221	$ 17,798,801	$ 17,798,801	$ 17,798,801	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
2	TASP Development Fees	-	6,932,379	-	-	-	-	-	-	-	$ -
3	**Subtotal: Sources**	$ 17,869,842	$ 24,802,221	$ 24,484,221	$ 17,798,801	$ 17,798,801	$ 17,798,801	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
	Uses of Funds										
4	CIP Projects	$ -	$ 318,000	$ 6,685,420	$ -	$ -	$ 21,836,327	$ -	$ -	$ -	$ -
5	**Subtotal: Uses**	$ -	$ 318,000	$ 6,685,420	$ -	$ -	$ 21,836,327	$ -	$ -	$ -	$ -
6	**Ending Balance**	$ 17,869,842	$ 24,484,221	$ 17,798,801	$ 17,798,801	$ 17,798,801	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
7	**Cumulative Inflation Rate**	100.0%	106.0%	112.4%	119.1%	123.9%	128.8%	134.0%	139.3%	144.9%	150.7%

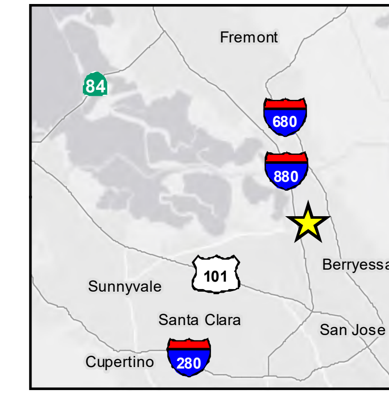
Table A-3
City of Milpitas, CA
Water Utility
Water TASP Capital Improvement Plan (CIP)

Line No.	Capital Financing Plan - TASP	Projected FY 2032	FY 2033	FY 2034	FY 2035	FY 2036	FY 2037	FY 2038	FY 2039	FY 2040
	Sources of Funds									
1	Beginning Balance	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
2	TASP Development Fees	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	**Subtotal: Sources**	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
	Uses of Funds									
4	CIP Projects	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5	**Subtotal: Uses**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	**Ending Balance**	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)	$ (4,037,526)
7	**Cumulative Inflation Rate**	156.7%	163.0%	169.5%	176.3%	183.4%	190.7%	198.3%	206.2%	214.5%

Appendix G

Capital Improvement Program
Mapbook and Project Summary Sheets





N

0 1,250 2,500

Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

WEST YOST

Figure G-1

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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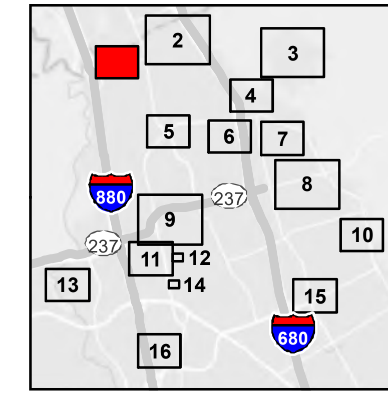

0 100 200
Scale in Feet

Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.1

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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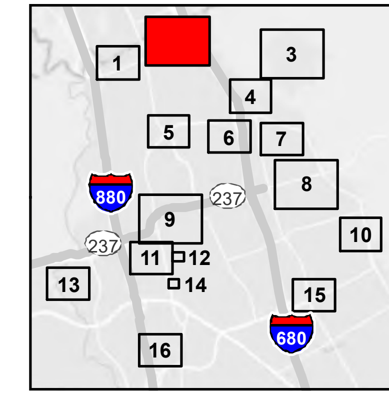


0 150 300
Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

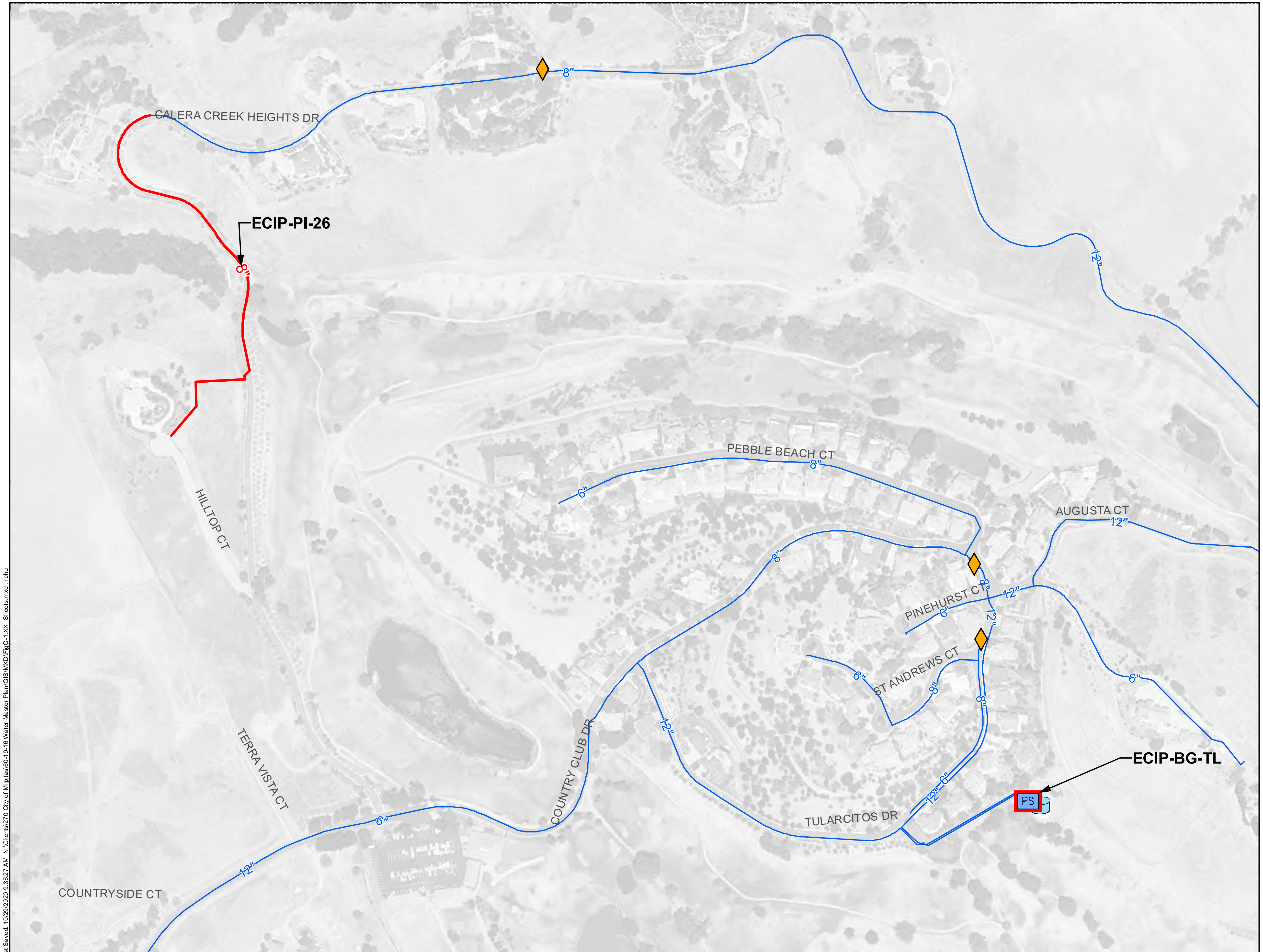
Existing Facilities

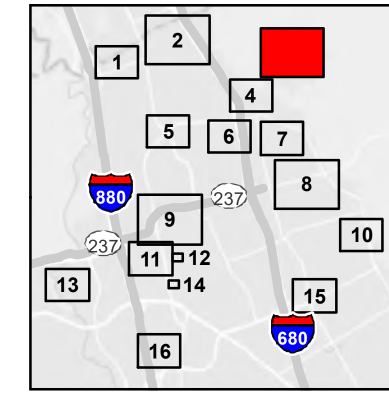
- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.2

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





N

0 150 300
Scale in Feet

Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.3

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.4

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

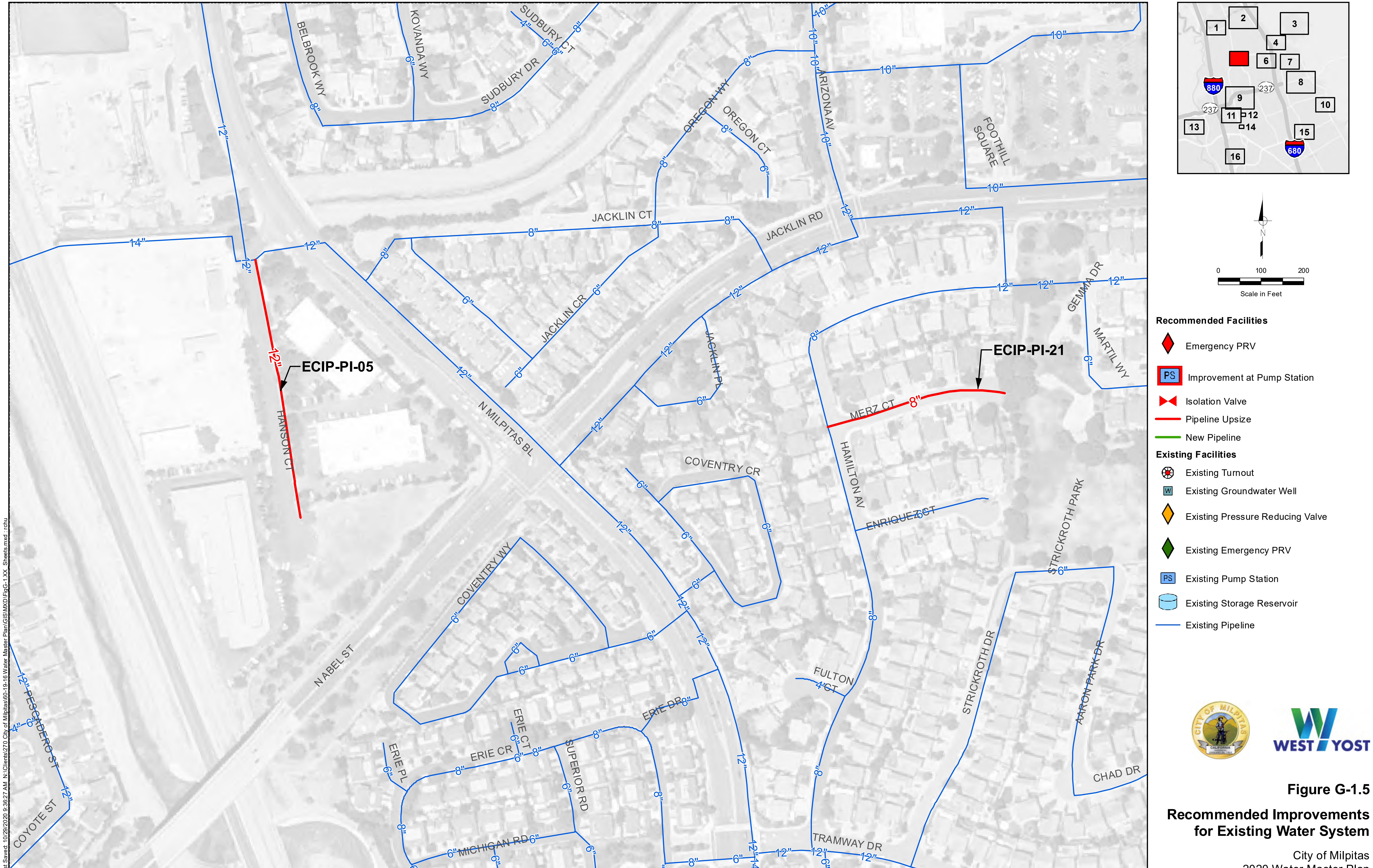

Figure G-1.5

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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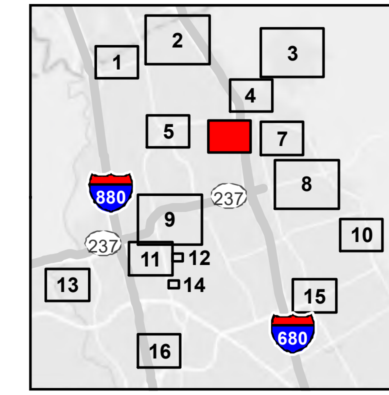

N

0 100 200

Scale in Feet

Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.6

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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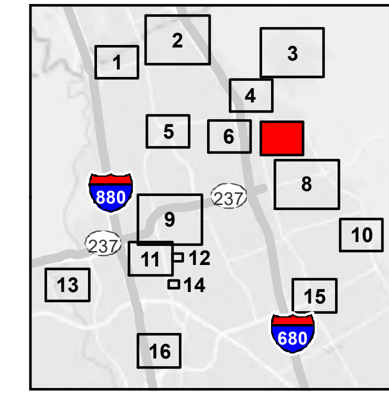

N

0 100 200
Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.7

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

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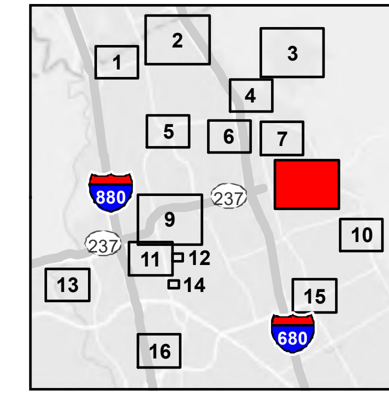


N

0 150 300
Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

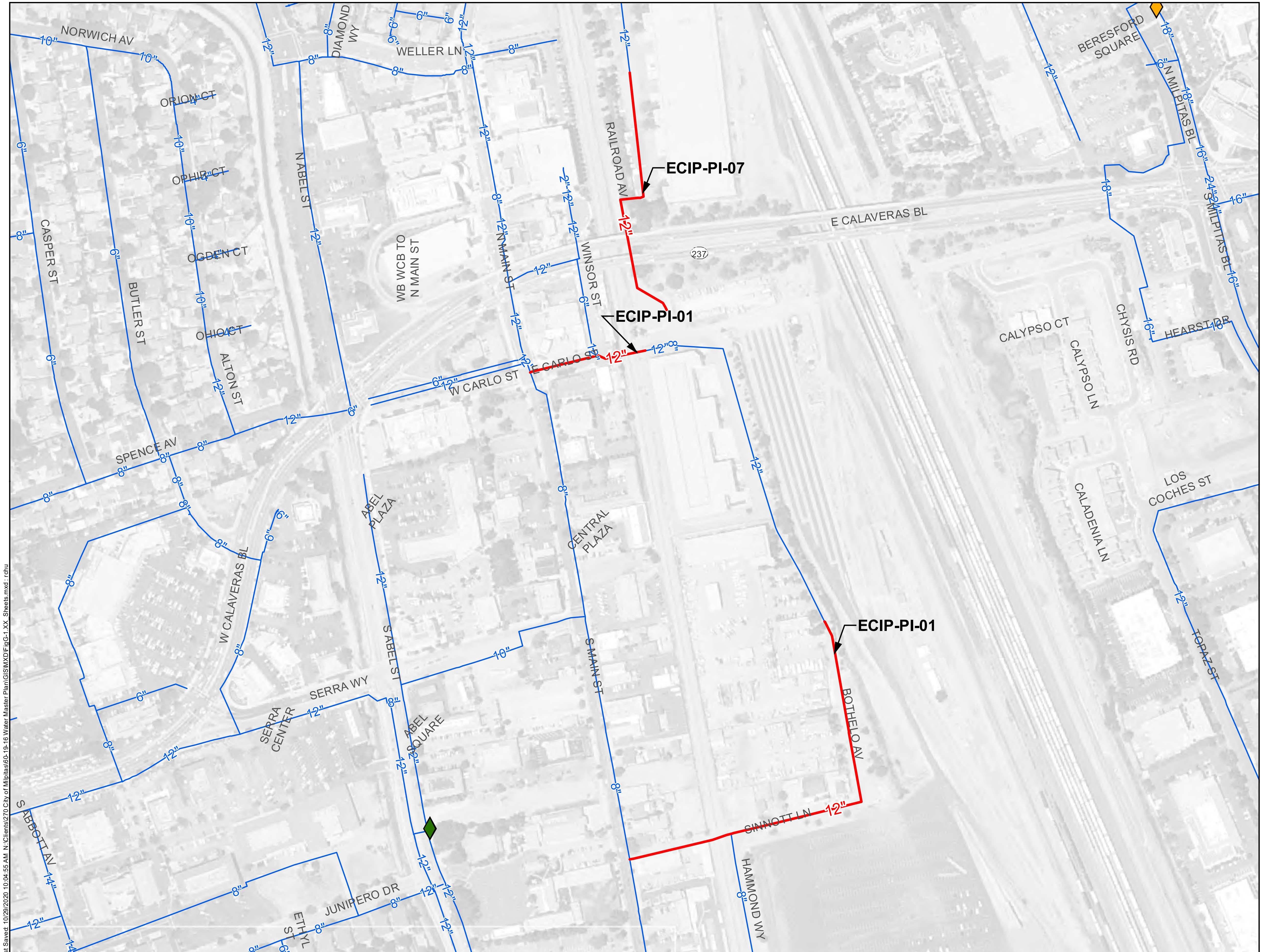
Existing Facilities

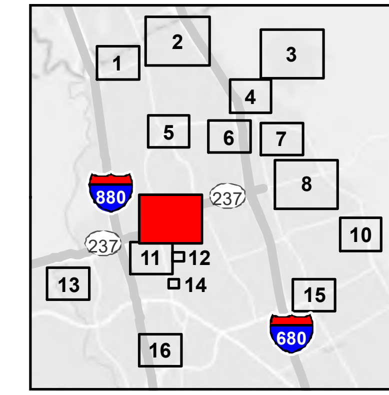
- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.8

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





N

0 150 300

Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

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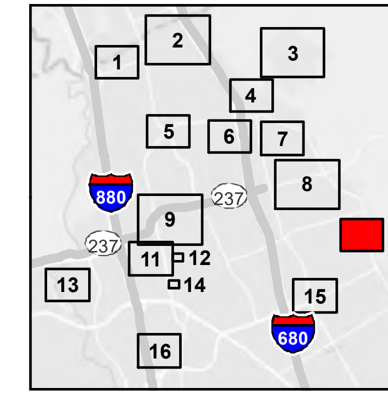
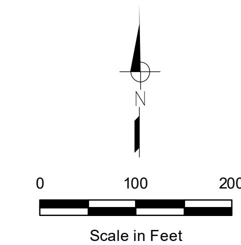
Figure G-1.9

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

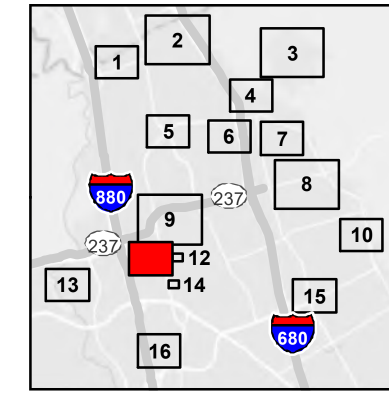
Existing Facilities

- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.10

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan



N

0 100 200

Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

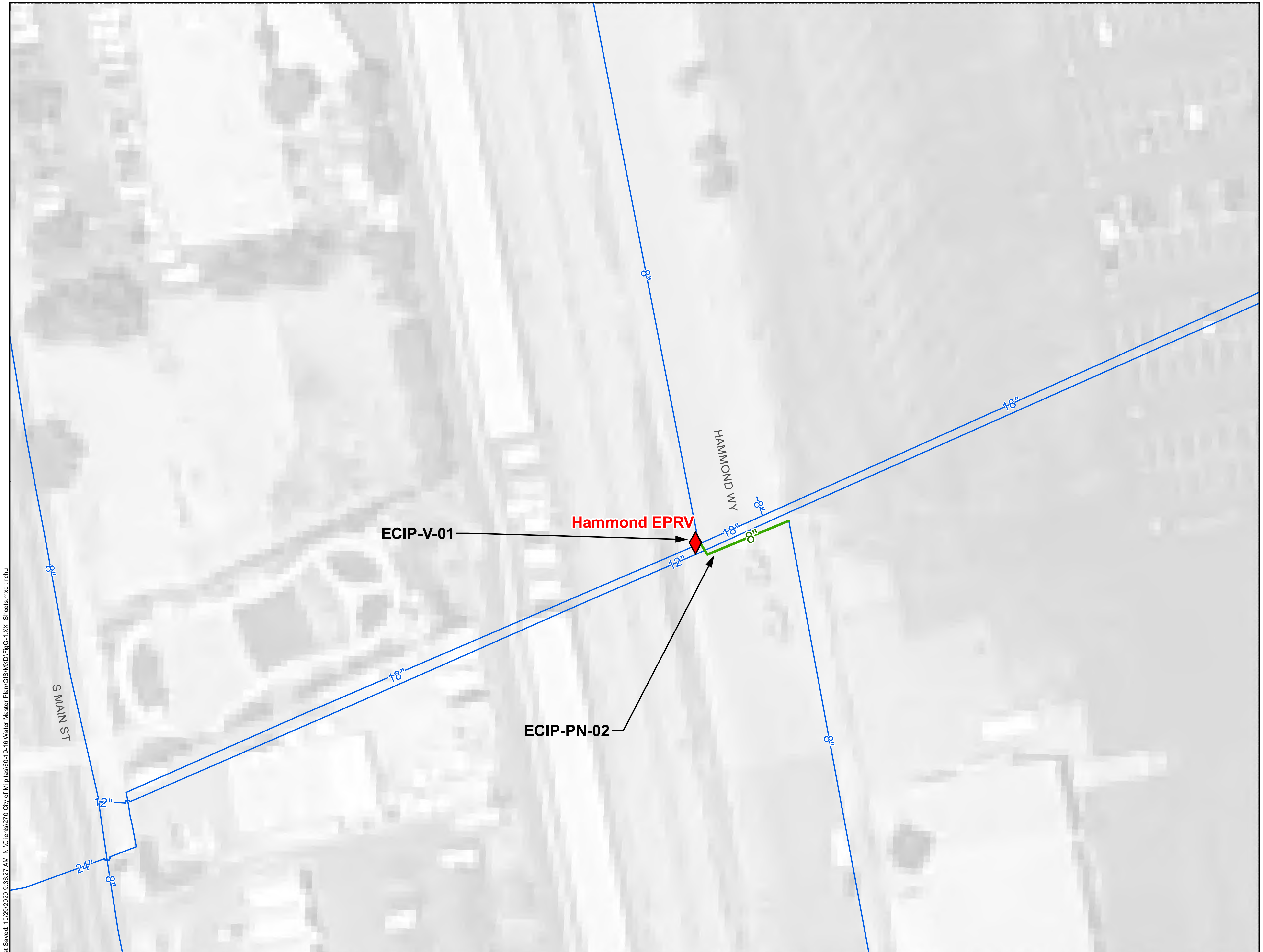
- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

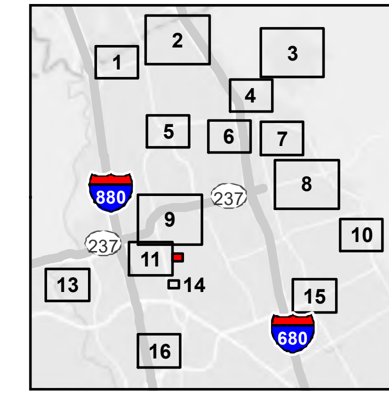
WEST YOST

Figure G-1.11

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





0 25 50
Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

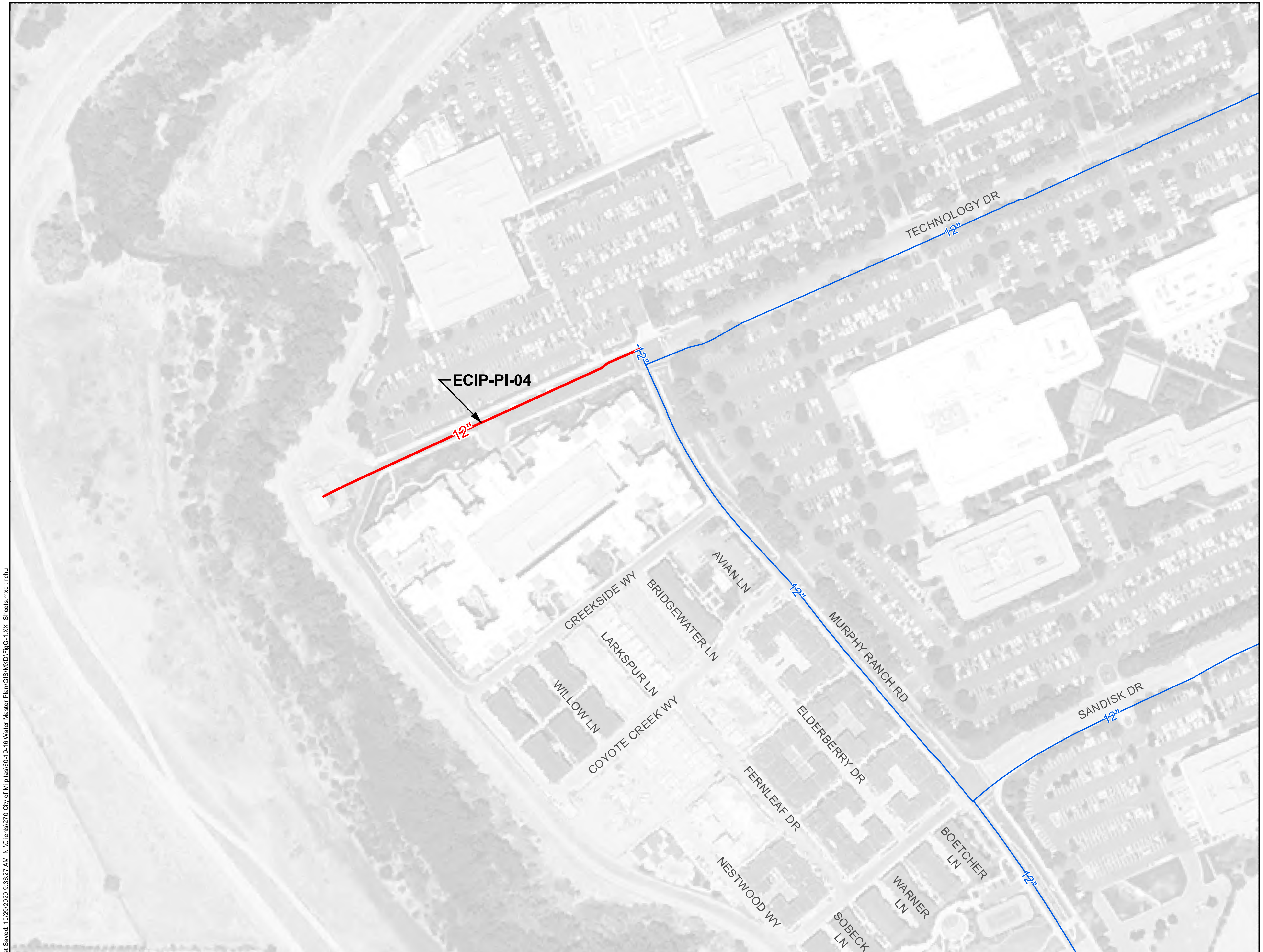
Existing Facilities

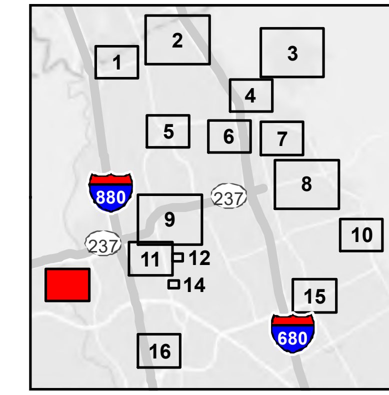
- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.12

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





N

0 100 200

Scale in Feet

Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

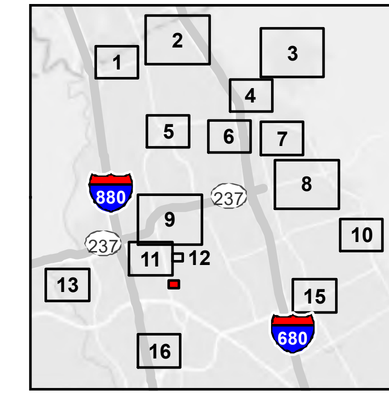
Existing Facilities

- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.13

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan



N

0 25 50

Scale in Feet

Recommended Facilities

- Emergency PRV
- PS Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

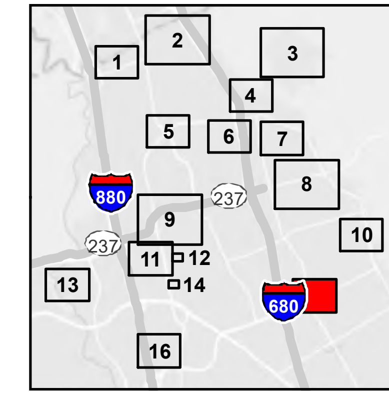
- Existing Turnout
- W Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- PS Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

WEST YOST

Figure G-1.14

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan



0 100 200
Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

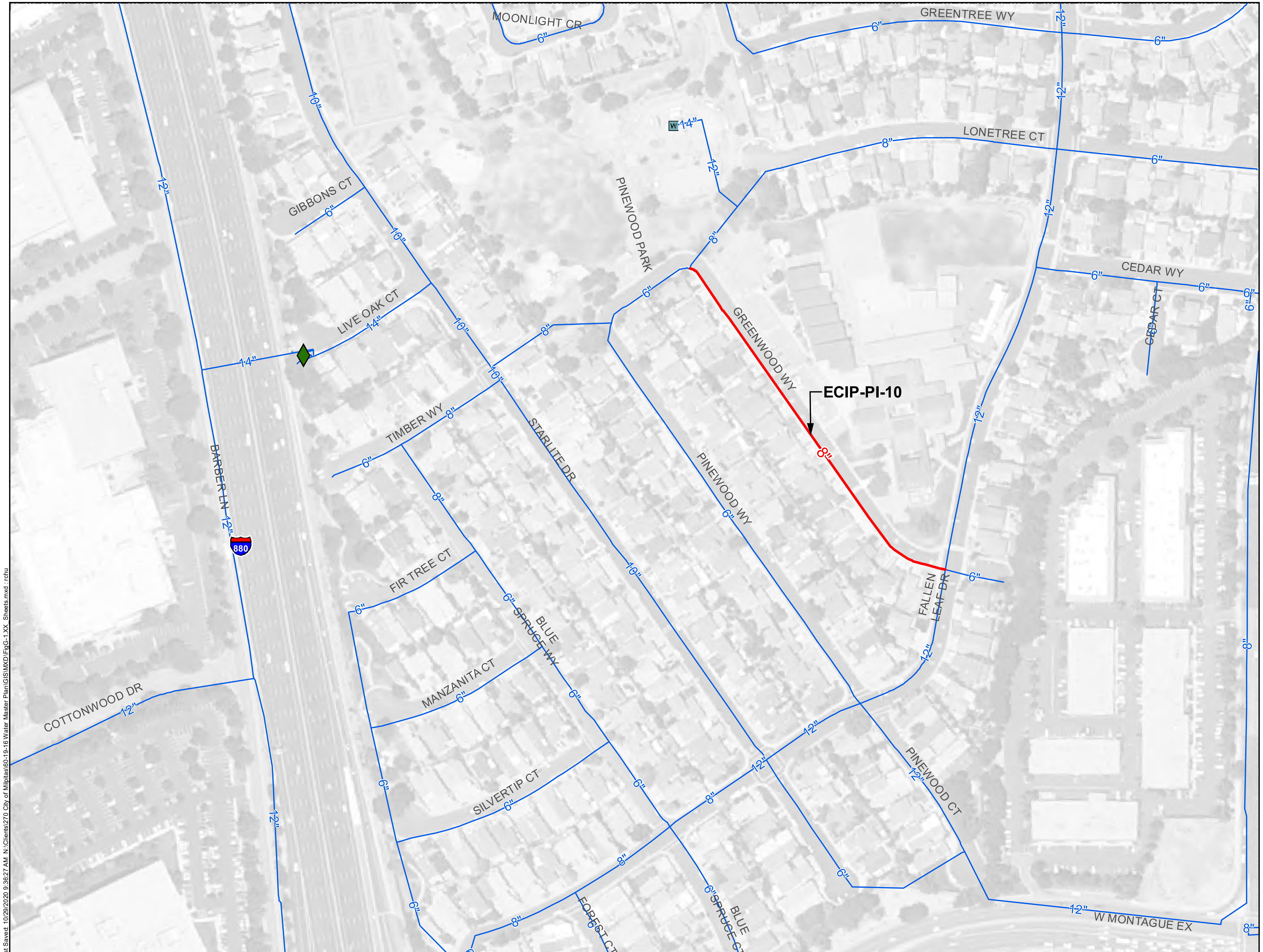
Existing Facilities

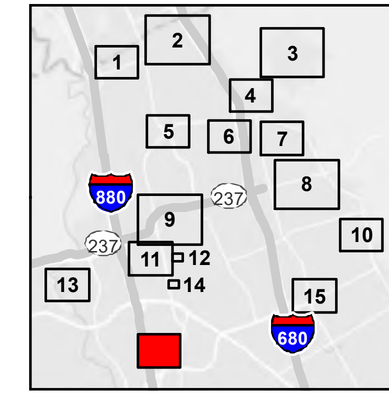
- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

Figure G-1.15

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan





N

0 100 200

Scale in Feet

Recommended Facilities

- Emergency PRV
- Improvement at Pump Station
- Isolation Valve
- Pipeline Upsize
- New Pipeline

Existing Facilities

- Existing Turnout
- Existing Groundwater Well
- Existing Pressure Reducing Valve
- Existing Emergency PRV
- Existing Pump Station
- Existing Storage Reservoir
- Existing Pipeline

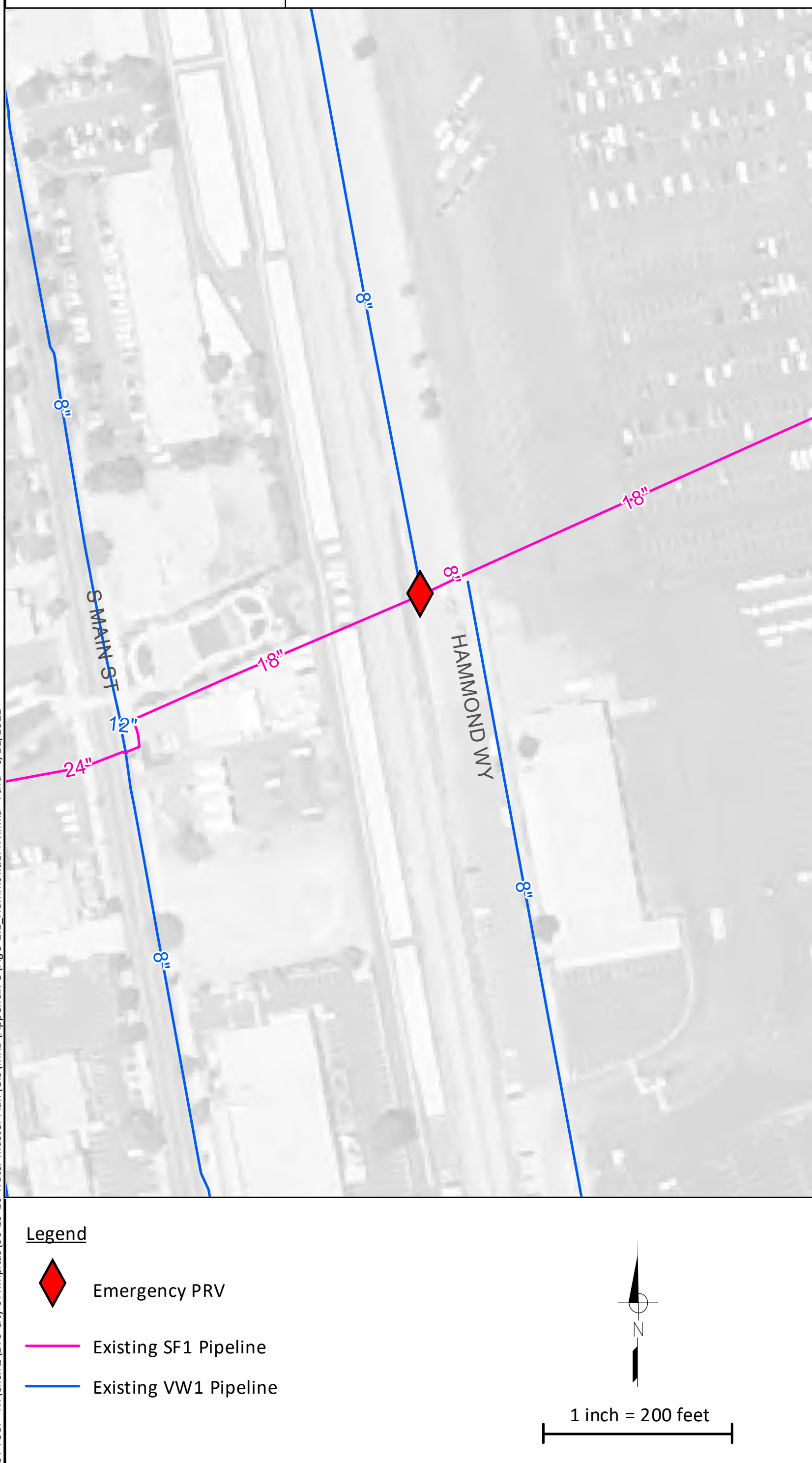
Figure G-1.16

Recommended Improvements for Existing Water System

City of Milpitas
2020 Water Master Plan

ECIP-V-01
Hammond Emergency PRV

CONSTRUCTION COST	$ 282,000
CAPITAL COST	$ 479,000
PRIORITY	High
PURPOSE	Fire Flow
LOCATION	Hammond Way near Tom Evatt Park
PRESSURE ZONE	SF1/VW1



RECOMMENDED IMPROVEMENT SIZE

8-inch diameter PRV and piping.

REASON FOR IMPROVEMENT

Provide fire flows from Zone SF1 to Zone VW1.

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

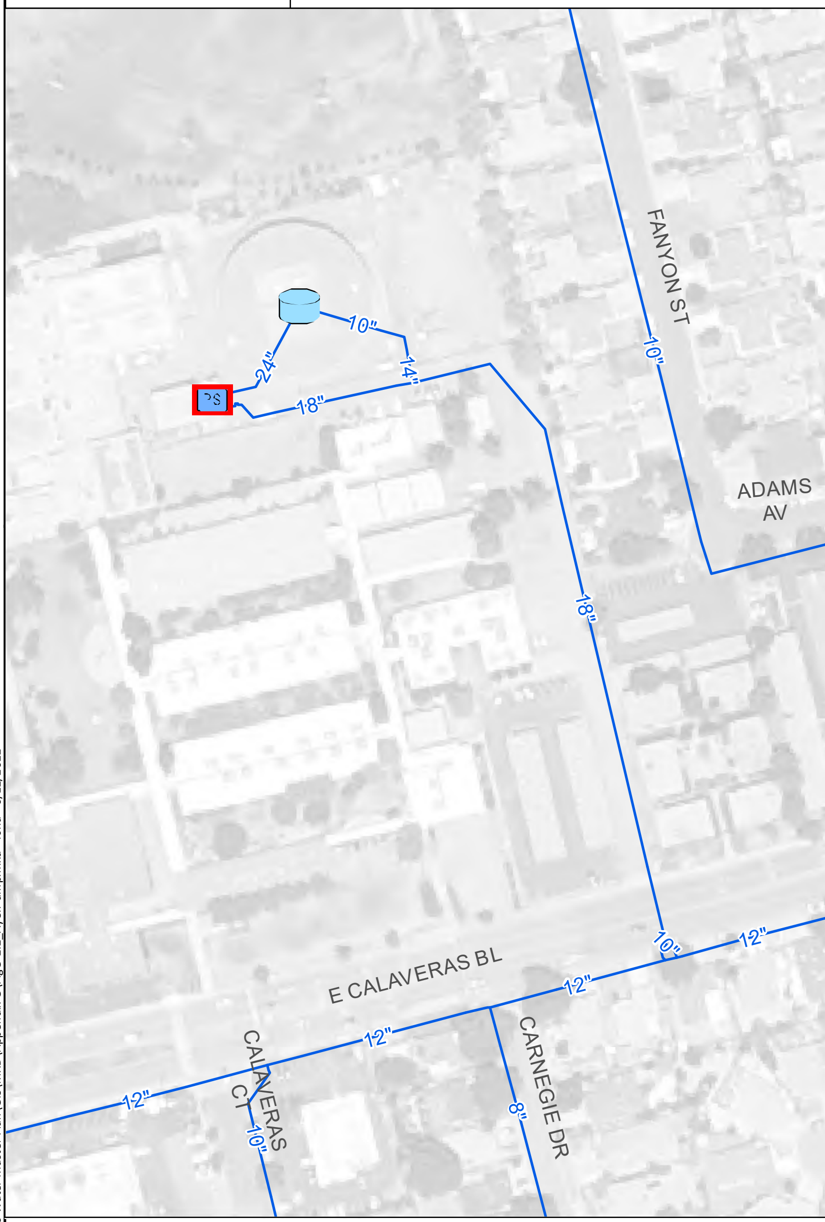
PRV costs include the installation of control valve(s), a concrete utility vault, access hatches, site piping, earthwork, paving, SCADA, and related sitework.

Figure G-2.1
City of Milpitas
Project Summary Sheet (ECIP-V-01)

WEST YOST - N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Appendix G\FigG-2.1_HammondEPRV.mxd - rchu - 6/12/2022

ECIP-PS-AY
New Fire Pump at Ayer Pump Station

CONSTRUCTION COST	$ 1,216,733
CAPITAL COST	$ 2,068,000
PRIORITY	Medium
PURPOSE	Fire Flow Backup
LOCATION	Ayer Pump Station
PRESSURE ZONE	SF2



Legend

Improvement at Pump Station

Existing Storage Reservoir

Existing Pipeline

N

1 inch = 200 feet

RECOMMENDED IMPROVEMENT SIZE

Install one new fire pump at the existing Ayer Pump Station. Capacity shall be 4,00 gallons per minute (gpm) (5.76 million gallons per day (mgd)).

REASON FOR IMPROVEMENT

Provide fire flows to Zone SF2 in the event of an SFPUC supply outage.

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

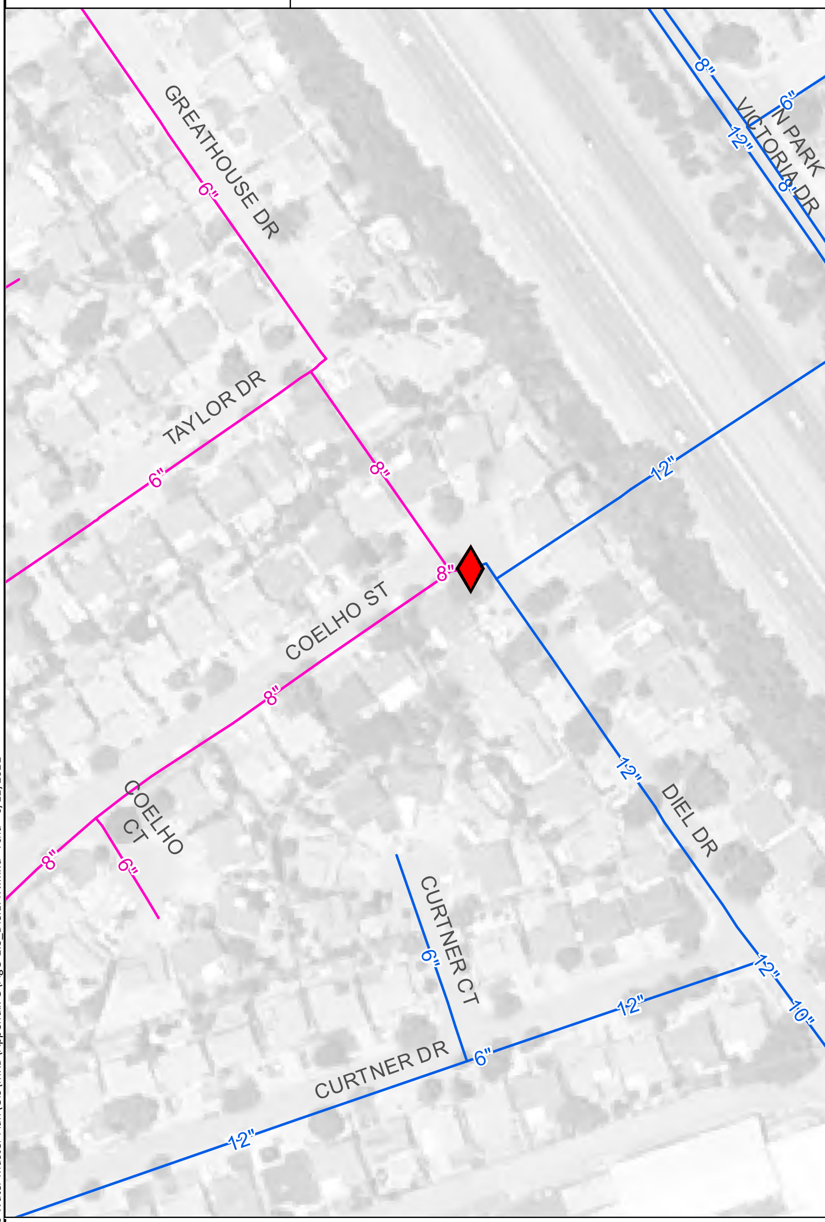
Pump station costs are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Since this improvement entails adding a pump to an existing pump station, costs for a new pump station (5.76 mgd firm capacity) have been discounted by 50 percent.

Figure G-2.2
City of Milpitas
Project Summary Sheet (ECIP-PS-AY)

WEST YOST - N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Appendix G\FigG-2.2_AyerPump.mxd - rchu - 6/12/2022

ECIP-V-03
Diel Emergency PRV

CONSTRUCTION COST	$ 282,000
CAPITAL COST	$ 479,000
PRIORITY	Medium
PURPOSE	Fire Flow Backup
LOCATION	Intersection of Coelho Street and Diel Drive
PRESSURE ZONE	SF2/SF1



Legend

Emergency PRV

Existing SF1 Pipeline

Existing SF2 Pipeline

N

1 inch = 200 feet

RECOMMENDED IMPROVEMENT SIZE

8-inch diameter PRV and piping.

REASON FOR IMPROVEMENT

Supplement existing Sunnyhills PRV in providing fire flows from Zone SF2 to Zone SF1.

PLANNING ASSUMPTIONS

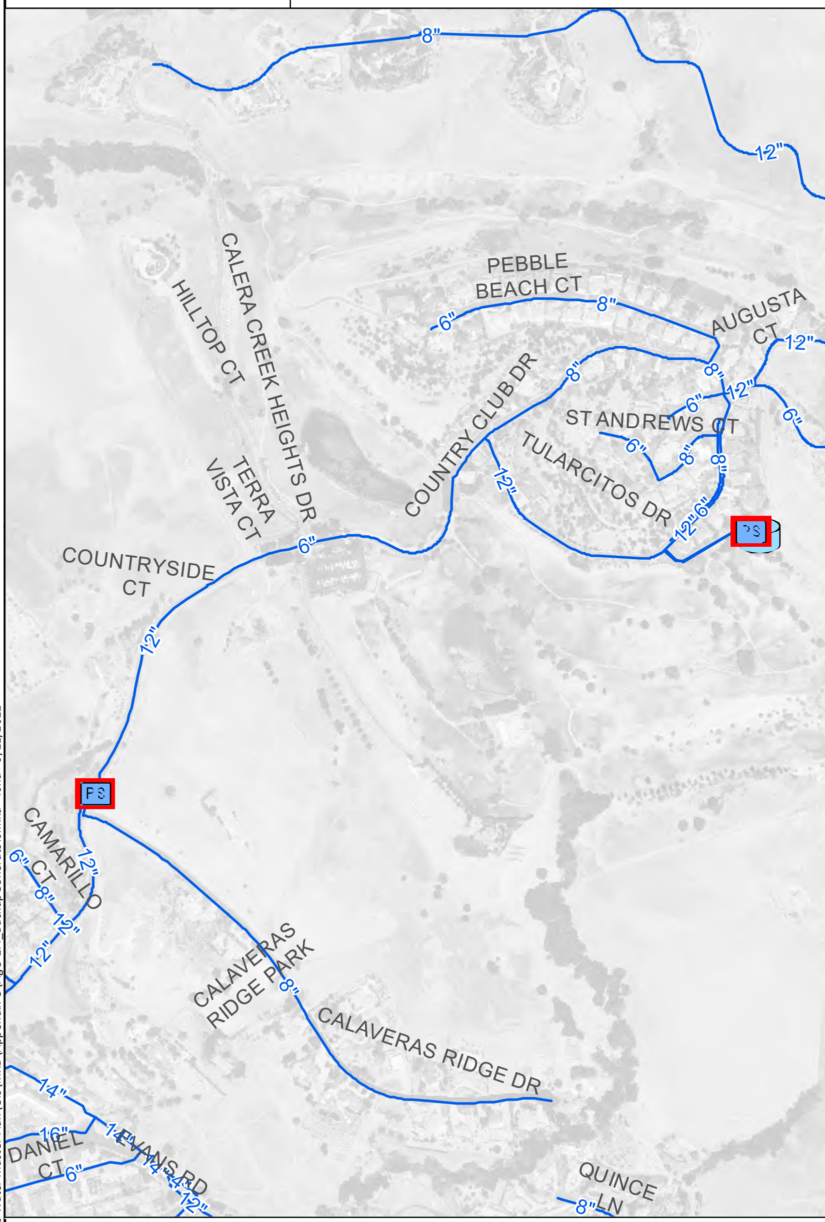
Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

PRV costs include the installation of control valve(s), a concrete utility vault, access hatches, site piping, earthwork, paving, SCADA, and related sitework.

Figure G-2.3
City of Milpitas
Project Summary Sheet (ECIP-V-03)

ECIP-BG-CC and ECIP-BG-TL
Backup Generators at Country Club and Tularcitos Pump Stations

CONSTRUCTION COST	$ 200,000 per generator ($400,000 total)
CAPITAL COST	$ 340,000 per generator ($680,000 total)
PRIORITY	Low
PURPOSE	General Reliability
LOCATION	Country Club and Tularcitos Pump Stations
PRESSURE ZONE	SF3 and SF4



Legend

- Improvement at Pump Station
- Existing Storage Reservoir
- Existing Pipeline

N

1 inch = 900 feet

RECOMMENDED IMPROVEMENT SIZE

Generators shall be sized to meet the power demands of each pump station.

REASON FOR IMPROVEMENT

Ensure continued pump operation in the event of a power outage.

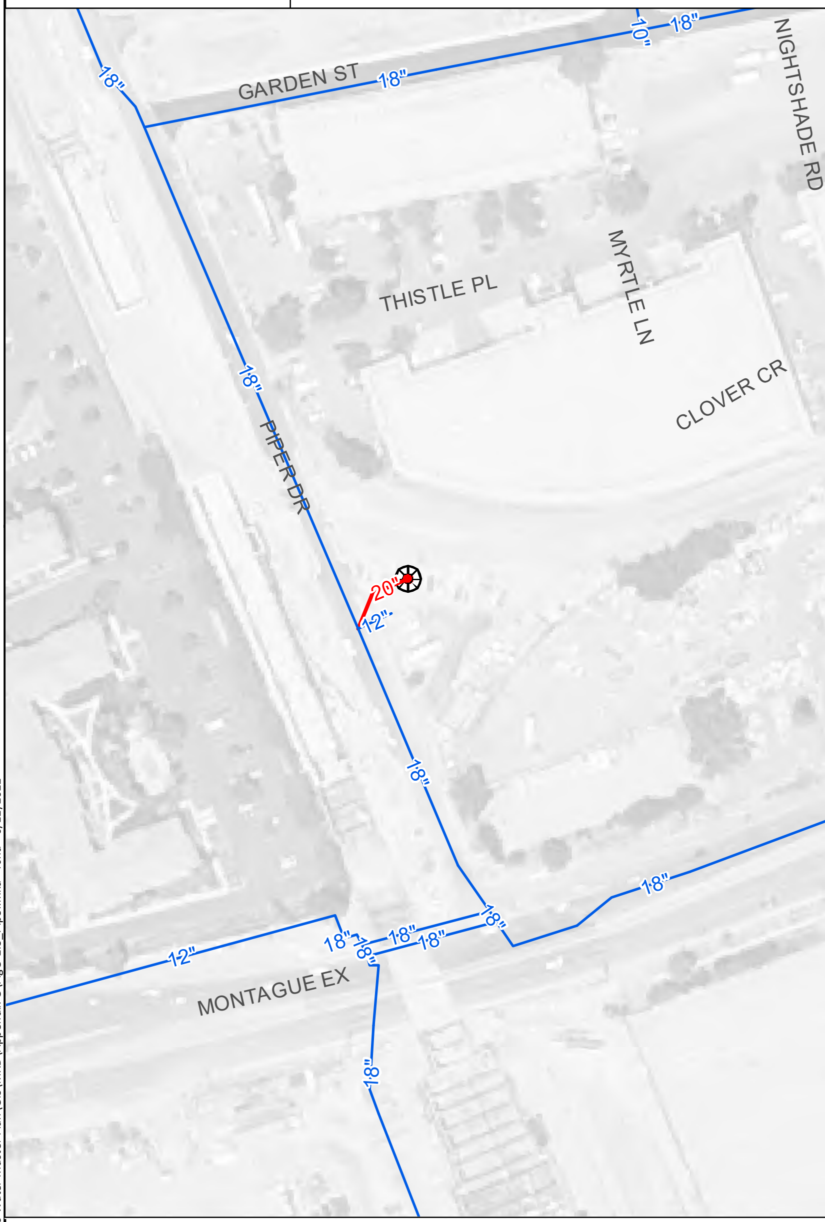
PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

Figure G-2.4
City of Milpitas - Project Summary Sheet (ECIP-BG-CC and ECIP-BG-TL)

BCIP-TO-01
Piper Turnout

CONSTRUCTION COST	$ 313,000
CAPITAL COST	$ 532,000
PRIORITY	High
PURPOSE	Firm Supply Capacity
LOCATION	Piper Drive south of Garden Street
PRESSURE ZONE	VW2



Legend

- Turnout
- Turnout Pipeline
- Existing Pipeline

N

1 inch = 200 feet

RECOMMENDED IMPROVEMENT SIZE

Same capacity as the existing Gibraltar turnout: 10,000 gallons per minute (gpm) (14.4 million gallons per day (mgd)).

Connection from the turnout to the existing 18-inch diameter transmission main on Piper Drive shall be a 20-inch diameter pipeline.

REASON FOR IMPROVEMENT

Insufficient firm supply capacity in the Valley Water service area at buildout.

PLANNING ASSUMPTIONS

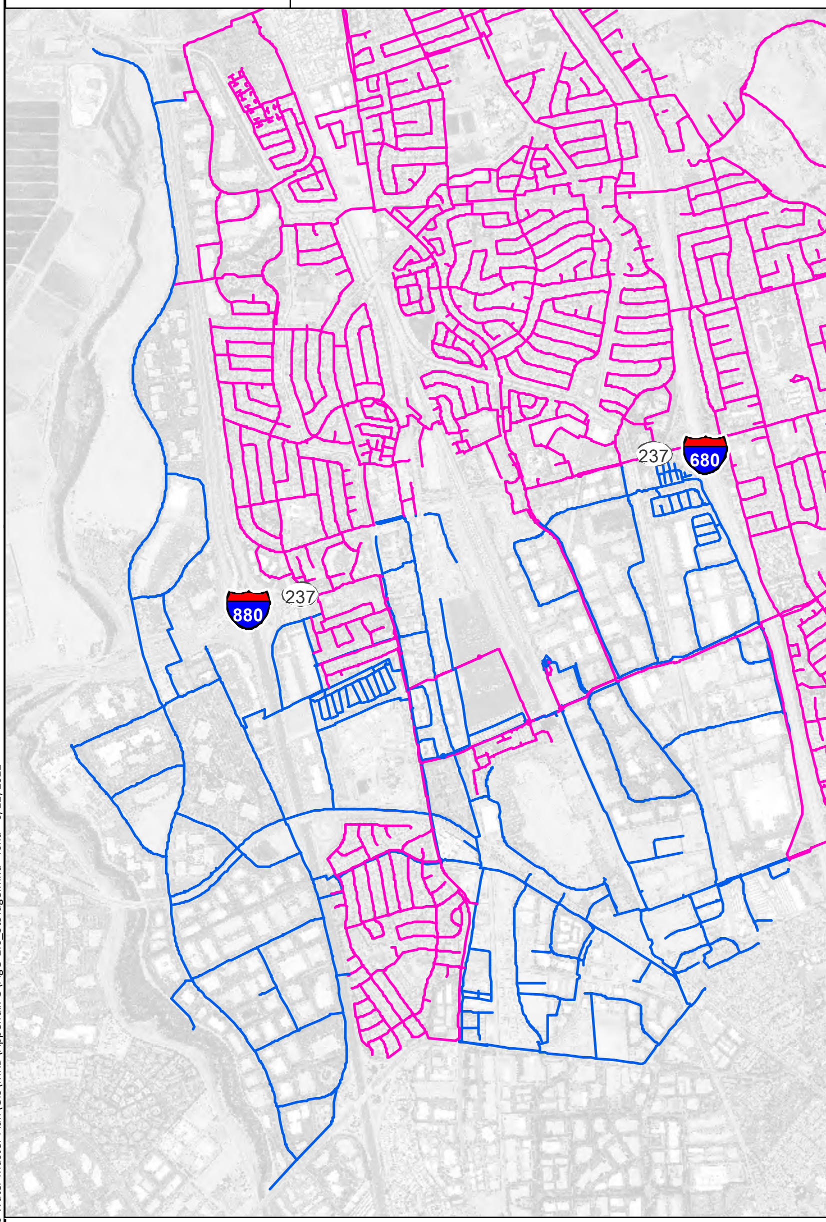
Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

Turnout costs include the installation of control valve(s), a concrete utility vault, access hatches, site piping, earthwork, paving, SCADA, and related sitework.

Figure G-2.5
City of Milpitas
Project Summary Sheet (BCIP-TO-01)

BCIP-S-01
Storage Reservoir in Valley Water Service Area

CONSTRUCTION COST	$ 3,254,000
CAPITAL COST	$ 5,532,000
PRIORITY	High
PURPOSE	Storage Capacity
LOCATION	Valley Water Service Area (Specific Location TBD)
PRESSURE ZONE	VW1 or VW2



Legend

- Existing SFPUC Pipeline
- Existing VW Pipeline

N

1 inch = 3,500 feet

RECOMMENDED IMPROVEMENT SIZE

2.0 million gallons (MG).

REASON FOR IMPROVEMENT

Insufficient storage capacity in the Valley Water service area at buildout.

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

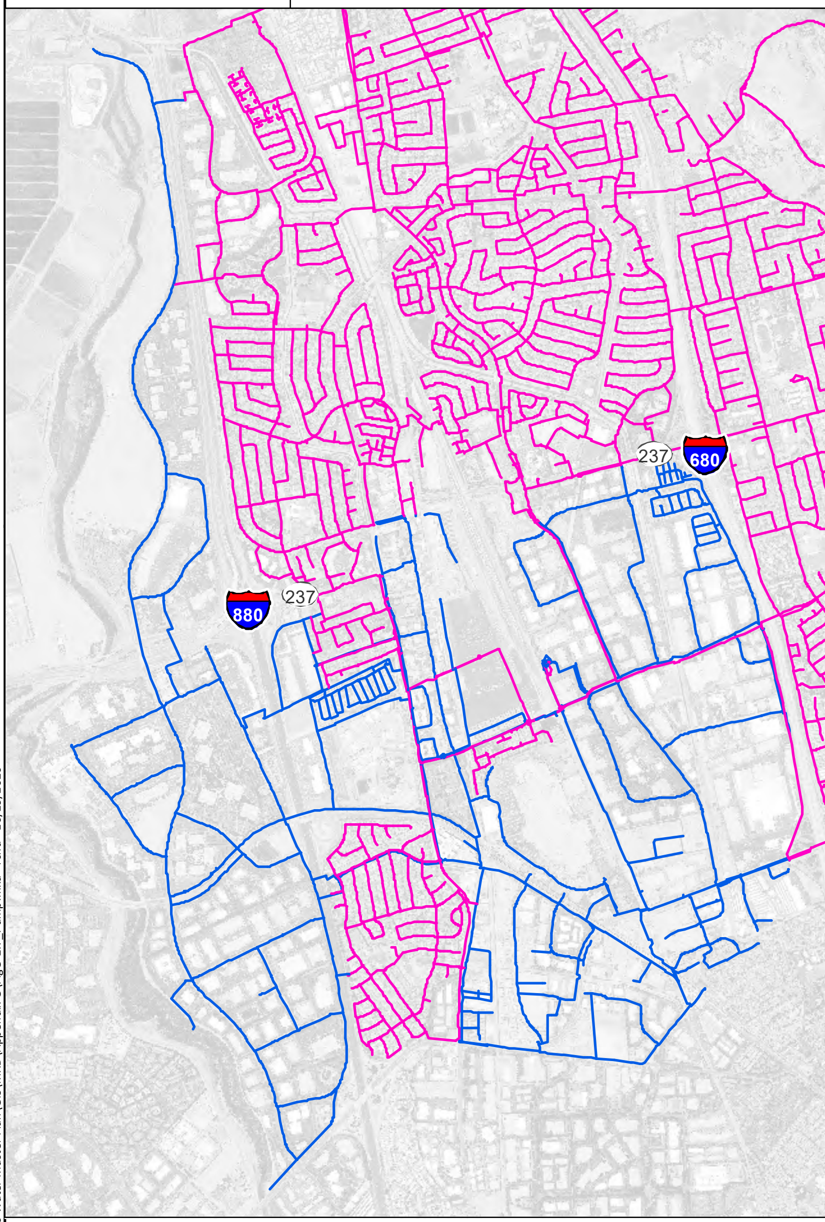
Storage reservoir will be aboveground steel tank. Costs include installation of the storage tank, site piping, earthwork, paving, instrumentation, and related sitework.

Figure G-2.6
City of Milpitas
Project Summary Sheet (BCIP-S-01)

WEST YOST - N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Appendix G\FigG-2.6_Storage.mxd - rchu - 6/12/2022

BCIP-PS-01
Pump Station for Reservoir in Valley Water Service Area

CONSTRUCTION COST	$ 2,433,466
CAPITAL COST	$ 4,137,000
PRIORITY	High
PURPOSE	Deliver Stored Water from New Reservoir
LOCATION	Valley Water Service Area (Specific Location TBD)
PRESSURE ZONE	VW1 or VW2



Legend

Existing SFPUC Pipeline

Existing VW Pipeline

N

1 inch = 3,500 feet

RECOMMENDED IMPROVEMENT SIZE

4,000 gallons per minute (gpm) firm capacity.

REASON FOR IMPROVEMENT

Pump station for recommended storage reservoir (BCIP-S-01).

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

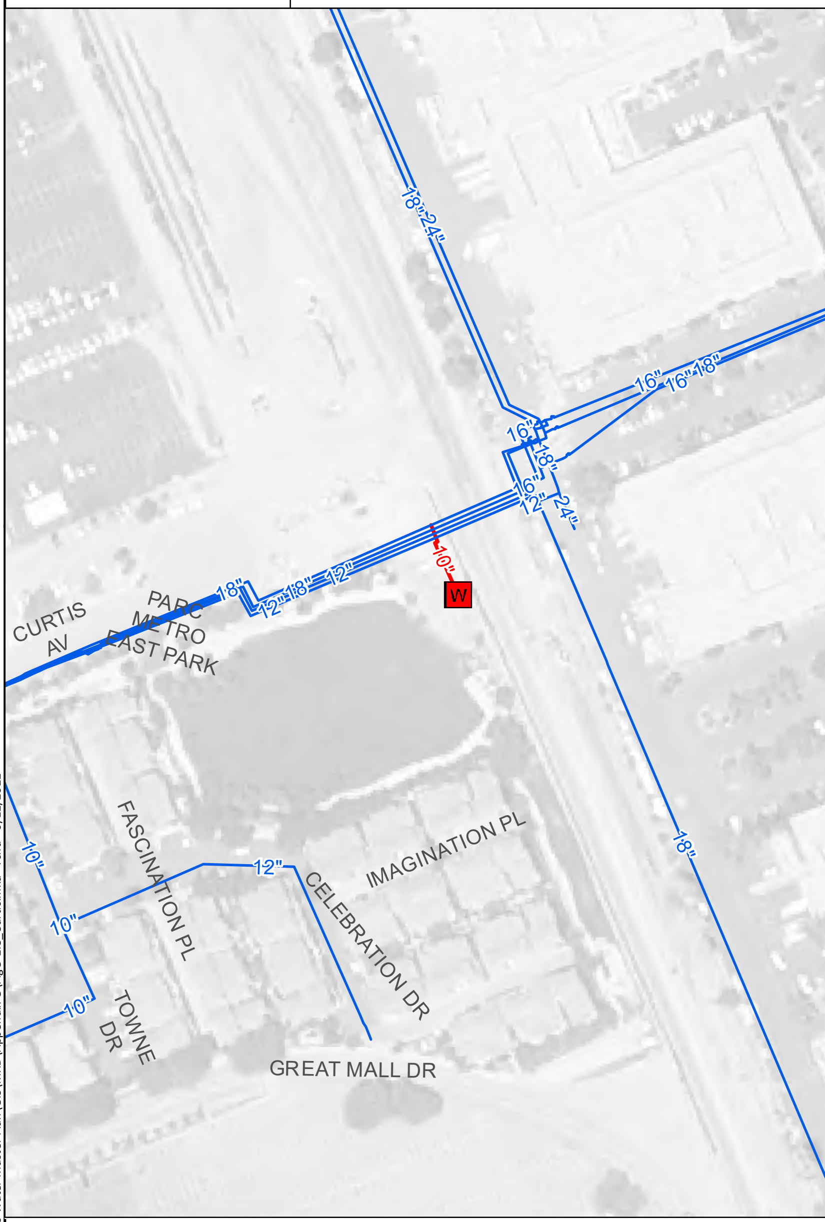
Costs assume an enclosed pump station with architectural and landscaping treatment suitable for residential areas.

Figure G-2.7
City of Milpitas
Project Summary Sheet (BCIP-PS-01)

WEST YOST - N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Appendix G\FigG-2.7_Pump.mxd - rchu - 10/29/2020

BCIP-W-01
Curtis Well

CONSTRUCTION COST	$ 3,500,000
CAPITAL COST	$ 5,950,000
PRIORITY	High
PURPOSE	Storage Capacity (Groundwater Credit)
LOCATION	Curtis Avenue near Parc Metro East
PRESSURE ZONE	VW2



Legend

- W Groundwater Well
- Well Pipeline
- Existing Pipeline

N

1 inch = 200 feet

RECOMMENDED IMPROVEMENT SIZE

Well capacity will be based on subsequent groundwater analysis that is not part of this report.

REASON FOR IMPROVEMENT

Increase supply reliability and reduce storage requirement via emergency groundwater storage credit.

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

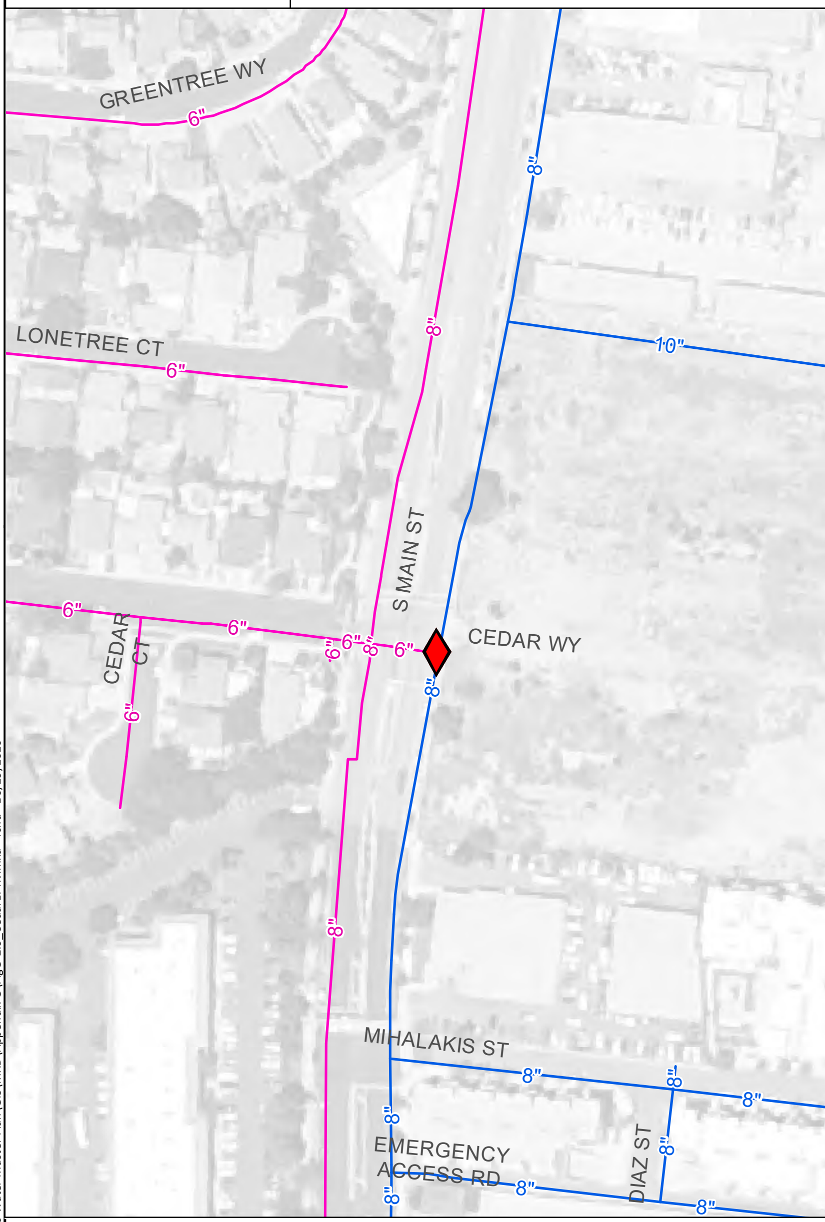
Well construction consists of pilot hole drilling, water quality/soil sampling, pilot hole reaming, well construction, well development and providing the necessary housing, pump, motor, automatic control equipment, discharge piping, supervisory control and data acquisition (SCADA), disinfection equipment, and a backup power generator. Costs assume a well capacity between 500 and 1,000 gpm. A higher capacity may increase costs.

Figure G-2.8
City of Milpitas
Project Summary Sheet (BCIP-W-01)

WEST YOST

BCIP-V-01
Cedar Emergency PRV

CONSTRUCTION COST	$ 282,000
CAPITAL COST	$ 479,000
PRIORITY	High
PURPOSE	Fire Flow
LOCATION	Intersection of Cedar Way and South Main Street
PRESSURE ZONE	SF1/VW1



Legend

- Emergency PRV
- Existing SF1 Pipeline
- Existing VW1 Pipeline

N

1 inch = 200 feet

RECOMMENDED IMPROVEMENT SIZE

8-inch diameter PRV and piping.

REASON FOR IMPROVEMENT

Provide fire flows from Zone SF1 to Zone VW1.

PLANNING ASSUMPTIONS

Costs are in 2020 dollars and assume normal construction conditions. Special or difficult conditions would significantly increase costs. Capital costs are rounded to the nearest thousand dollars and include mark-ups equal to 70 percent (Design and Construction Contingency: 35 percent; Engineering Design: 10 percent; Construction Management: 15 percent; and Permitting and Implementation: 10 percent).

PRV costs include the installation of control valve(s), a concrete utility vault, access hatches, site piping, earthwork, paving, SCADA, and related sitework.

Figure G-2.9
City of Milpitas
Project Summary Sheet (BCIP-V-01)

WEST YOST - N:\Clients\270 City of Milpitas\60-19-16 Water Master Plan\GIS\MXD\Appendix G\FigG-2.9_CedarEPRV.mxd - rchu - 10/29/2020

WE SUPPORT OUR COMMUNITIES

WE ARE WATER FOCUSED

WE TAKE PRIDE IN WHAT WE DO

WE STRIVE TO BECOME OUR BEST

WE DO WHAT'S RIGHT

WE BELIEVE IN QUALITY

WE LISTEN

WE SOLVE CHALLENGING PROBLEMS

WE SEE THE BIGGER PICTURE

WE TAKE OWNERSHIP

WE COLLABORATE

WE HAVE FUN

WE ARE WEST YOST

WEST YOST
Water. Engineered.