Chapter 5 - Distribution System

Introduction

This chapter discusses the City's existing water distribution system, which delivers water to residential, commercial, and industrial users. Components of the distribution system include booster pump stations, pipelines, valves, water meters, water service lines, and fire hydrants. The distribution system has been evaluated for both present and future City needs. Recommended distribution system improvements have been developed to address existing identified deficiencies and provide future service to help meet both Oregon Health Authority - Drinking Water Services (DWS) requirements and Oregon Fire Code (OFC) fire flow requirements. Cost estimates for the recommended distribution system improvements are presented at the end of this chapter.

Existing System

Historical information for the City's water distribution system was obtained from the Water System Master Plan (WSMP) prepared in 1998 by Anderson Perry & Associates, Inc., water system improvements Record Drawings, and from City water system maps provided by the City of Stanfield.

The City's original water system was constructed in 1920 and was improved in the 1960s, 1970s, 1980s, and in 2013. The original system consisted of a well located at the present City Hall site (not the existing Well No. 3), the elevated Reservoir No. 1, and 4-inch diameter steel water lines.

From 1974 through 1976, new 6- and 8-inch diameter asbestos concrete (AC) water lines and fire hydrants were installed in the Old Town area of Stanfield. In the 1970s, water distribution lines were also installed to serve the Stanfield Heights Subdivision, the Vantage North Subdivision, and the Secondary School. Well No. 4 and Reservoir No. 2 were constructed in North Stanfield in the 1970s. In the Old Town area, most of the original steel water lines were left in service alongside the new AC water lines. As the older lines deteriorate, the City should consider abandoning them and transferring water service lines to newer water main lines.

Most recently, the City completed water system improvements in 2013 and 2014. The improvements included drilling a new well (Well No. 5), construction of a 1,000,000-gallon ground-level welded steel reservoir (Reservoir No. 3), and construction of the South Stanfield booster pump station. The project also included construction of a new 16-inch transmission line from the new Reservoir No. 3 location, to the Old Town area. The installation of the South Stanfield booster pump station also allowed for the creation of a South Stanfield pressure zone with a dedicated pump and transmission line available to serve the new pressure zone.

Water Meters

With the exception of Coe City Park, all services within the City's system are metered. The City performs routine maintenance of the meters and replaces them as necessary. The City should continue routine maintenance and replacement of meters, as necessary, and also provide water meters for Coe City Park.

Water Loss

The City of Stanfield's distribution system piping is primarily polyvinyl chloride (PVC) and is in relatively good condition. The City recently completed a leak detection survey covering more than 80 percent of the distribution system. Two leaks estimated to have a total flow of 11 gallons per minute (gpm) were identified and repaired. The City intends to continue regular leak detection surveys, until the entire system has been surveyed. Meter calibration and consistent audits should be completed to ensure water audit data is as accurate as possible. The City does not currently have sufficient, accurate data to complete a meaningful water audit.

The City intends to begin annual water audits as a regular practice. By using monitoring techniques to identify suspected leaks, the City is proactively using the best management practices available to them to identify water losses and continues to work toward a low volume of unaccounted for water in the system. In the City's water audit, all unmetered uses, such as water use from hydrants will be estimated and documented.

Distribution System Pressure

The City of Stanfield has three pressure zones serving the distribution system, with system pressures provided by the South Stanfield booster pump station and the North Stanfield booster pump station. Elevations within the City of Stanfield range from approximately 585 to 715 feet above mean sea level. Water stored in Reservoir No. 3 supplies the South Stanfield booster pump station, which provides pressure to the Old Town and South Stanfield systems. The South Stanfield booster pump station provides a pressure of approximately 36 pounds per square inch (psi) to the Old Town system and 60 psi to the South Stanfield system at the respective pump discharge under normal current operation. Reservoir No. 2 is filled from the Old Town system or Well No. 4 and then supplies water to the North Stanfield booster pump station. The North Stanfield booster pump station provides a pressure of approximately 80 psi to the North Stanfield system at the pump discharge. According to the hydraulic model completed as part of this WSMP, the normal operating pressures throughout the entire system when using the 2017 peak daily demand (PDD) (as described later in this chapter) range from approximately 55 to 85 psi, as depicted on Figure 5-1. The City of Stanfield generally has adequate pressure throughout the system. System pressures are discussed in more detail later in this chapter.

Distribution System Water Quality

Coliform Bacteria

As discussed in Chapter 3, the City routinely obtains samples from the distribution system for analysis of total coliforms and *E. coli*. Routine sample results on file with the DWS were reviewed through February 2017. These test results are included in Appendix G. Ten samples tested positive for total coliforms according to the DWS. The most recent occurrence was in June 2002. No samples over this period were positive for fecal coliforms or *E. coli* bacteria. Based on these test results, it does not appear the City has any regularly occurring issues with coliform bacteria in the distribution system.

Lead and Copper

The City has also obtained samples from the distribution system to satisfy chemical analysis requirements for total lead and copper. The DWS database lists the 90th percentile results of lead concentrations detected for these sampling events, which ranged from 0.0000 to 0.0050 milligrams per liter (mg/L). The U.S. Environmental Protection Agency (EPA) action limit for total lead in municipal water systems is 0.0155 mg/L. Copper was also detected in the samples with 90th percentile concentrations ranging from 0.0000 to 0.044 mg/L. The EPA action level for copper is 1.35 mg/L. A copy of the lead and copper analytical results summary sheet from the DWS database is included in Appendix G.

Fire Protection

General

The City's existing water supply, storage, and distribution system provides adequate fire protection to the majority of the system, although certain areas of the City do not have adequate fire protection. DWS regulations and the 2014 OFC require the entire water system remain above 20 psi residual pressure while fire flow demands are placed on the system. The City of Stanfield generally has adequate pressure in the system during fire flow events but has several areas that do not provide the recommended fire flow, as discussed in Chapter 2. A computer model of system fire flows, along with recommended improvements to address the deficiencies in fire flows, is discussed in more detail later in this chapter.

Fire Hydrant Flow Tests

For this WSMP, the City completed fire hydrant flow tests on several fire hydrants in the distribution system. These test results have been tabulated and are included in Appendix C for reference. Based on the results of the individual hydrant flow test performed by the City, the City's water system is able to deliver fire flows ranging from approximately 1,000 to 1,160 gpm with residual pressures ranging from 36 to 51 psi. System pressures may drop below these reported pressures in higher elevation areas of the system when fire flows occur. These flows are the measured flows observed during flow tests. Higher fire flows may be available if more than one hydrant were opened at a time.

Theoretical Fire Flows

In some cases, such as in Insurance Services Office, Inc. (ISO) fire hydrant flow capacity reporting, the available flow from a fire hydrant is calculated using a theoretical formula. The formula assumes the water supply "feeding" the tested area is generally not limited and the 20 psi residual pressure resulting from the fire flow occurs where the hydrants are being tested. In reality, there are likely other connections in the distribution system, such as users in the City on small-diameter main lines or at higher elevation areas that would fall below 20 psi sooner than the formula predicts. Considering this, the theoretical formula can overestimate available fire flows at 20 psi. The hydraulic computer modeling completed as part of this WSMP, as discussed later in this chapter, presents more accurate available fire flows.

Fire Hydrant Limitations

The fire flow tests completed by the City are generally conducted by opening one fire hydrant at a time, while ISO fire flow tests are conducted by opening multiple fire hydrants at one time. If large enough main lines are present, individual fire hydrants can typically provide flows in the range of 800 to 1,200 gpm from a small port and nearly 2,000 gpm from both small ports and the larger "pumper" port, assuming the hydrant has a large port. During a fire there will be some water use from others on the system, so the actual available flow out in the distribution system will be less due to other uses and pipeline pressure losses resulting from higher flows.

Generally, the City's water system is in need of improvements to provide adequate fire flows to several areas. The discussion presented herein is intended to provide caution concerning the actual available fire flows from the City's distribution system and fire hydrants. System improvements are needed to provide the recommended fire flows of 3,500 gpm for industrial/commercial/institutional areas, 3,000 gpm in the downtown area, 2,000 gpm in multi-family residential areas, and 1,000 gpm for residential areas while maintaining 20 psi in the system.

Fire Hydrant Coverage

The OFC outlines maximum recommended fire hydrant spacing depending on several factors, such as fire flow requirements of the area, the number of fire hydrants in the area, if the area is on a dead-end street or has limited access, etc. As required by the 2014 OFC, the maximum spacing between any two hydrants for a fire flow requirement of 1,750 gpm or less is 500 feet and as little as 350 feet for a fire flow requirement of 3,500 to 4,000 gpm. The maximum required distance from any point of a street or road frontage to a hydrant is 250 feet for 1,750 gpm or less and 210 feet for 3,500 to 4,000 gpm.

The spacing of the City of Stanfield's existing hydrants was analyzed to identify areas not covered in accordance with the maximum spacing and frontage distance to a fire hydrant as recommended in the OFC. The City of Stanfield's existing hydrants, as identified on the Existing Water System Map (contained in a pocket at the end of this WSMP), are typically spaced approximately 300 feet or less apart; however, some areas of the City are not covered by existing fire hydrants. For the purposes of this WSMP, it was assumed hydrant spacing in residential areas will be 500 feet due to the required fire flow being less than 1,750 gpm. Similarly, hydrant spacing in commercial, industrial, and institutional areas was assumed to be 400 feet to account for the higher flow requirements. Many factors affect the required hydrant spacing per the OFC but these assumptions are intended to generally conform to the OFC.

To assist with the fire hydrant spacing analysis, a Fire Hydrant Coverage Map showing existing and proposed fire hydrants was prepared. This map is contained in a pocket at the end of this WSMP. In preparing the Fire Hydrant Coverage Map, the Existing Water System Map was utilized by placing 500-foot diameter circles around each existing hydrant located in residentially zoned areas and 400-foot diameter circles around each existing hydrant located in commercial/industrial/ institutional zoned areas. Proposed hydrants were then placed in areas where additional coverage is recommended. Similar to the existing hydrants, 500-foot diameter circles were placed around proposed hydrants located in residential zoned areas and 400-foot diameter circles around proposed hydrants in commercial/industrial/institutional zoned areas. On the Fire Hydrant Coverage

Map, existing fire hydrant coverage areas are shown in orange and proposed fire hydrant coverage areas are shown in red.

Approximately 94 fire hydrants exist in the City of Stanfield. Seventeen hydrants are proposed to be added to the distribution system. Nine of the proposed hydrants are located on existing main lines while the remaining eight would require new main lines to be installed. Areas with limited fire hydrant coverage are readily apparent on the map. Undeveloped areas were not included in this analysis, as it is assumed that hydrants would be installed along with other required utilities when these areas are developed. Also, the hydrant analysis included only the area within the city limits where existing structures are located.

This analysis was completed for general compliance with the maximum recommended spacing and frontage distance to a hydrant. Depending on the fire flow demands of a particular area, the City may wish to modify these requirements to the more stringent requirements of the OFC. This analysis is intended to provide the City with a basic understanding of areas lacking fire hydrant coverage. It is recommended the City install fire hydrants in the areas needing improved coverage as funds allow. All fire hydrant installations should be reviewed and approved by the Umatilla County Fire District No. 1.

Water System Modeling

General

As part of this WSMP, a detailed water model of the City's water system was developed to analyze system pressures, hydraulic capacity, and available fire flows from the City's fire hydrants. A general description and the results of each computer run performed for both the existing and improved water systems are described herein. More detailed information for the water model, including supporting data tables for each computer run, has been summarized in a separate bound document titled *City of Stanfield, Oregon - Water Distribution System Computer Model Summary - 2017*. It is recommended the reader refer to that document for additional computer model information.

To develop the model, the City's Geographic Information System (GIS) mapping was obtained and used as the basis for the model. The GIS mapping showed all water system features including reservoirs, wells, pipes (location, size, and material), pipe interconnections, hydrant locations, and water meter locations. The main line pipes, interconnections, and hydrants were exported from GIS to the water model. Reservoir, booster pumps, and other features that were not transferred from GIS were manually added to the model to create a complete system. In the water model, each pipe was assigned a number for reference (e.g., P-45). Junctions at pipeline intersections and at key locations, such as hydrants, were assigned junction or hydrant numbers (e.g., J-50 or H-10). The pipe and junction distribution system labels are shown on the map in the *Water Distribution System Computer Model Summary*. Elevations at the locations of water system features such as reservoirs, pipe connections, wells, hydrants, etc., were obtained from the National Elevation Dataset provided by the U.S. Geological Survey.

The computer model evaluates pressure and flows in the distribution system during a simulated water use demand. Available fire flows are then determined under different demand conditions. Typical water system demands used for the computer model include the average daily demand (ADD) and the PDD previously discussed in Chapter 2.

The computer model also utilizes detailed information about the distribution system pipes. Each individual pipe was assigned a roughness coefficient based on the pipe material, such as PVC, ductile iron, AC, steel, etc. This allows the water model program to calculate water main line pressure losses under any demand condition desired, including fire flow analyses. Junctions were identified in the water model that allowed the model to compute where and at what elevation pipe intersections occur. Water demands can then be placed on the distribution system at each junction to simulate ADD or PDD use demands.

Model Overview

The hydraulic model of the City's water distribution system was developed utilizing the Bentley WaterCAD modeling system, version 8. Demand scenarios for years 2017 and 2037 were derived from the design criteria presented in Chapter 2. Fire flow test data, provided by the City, were used to check the accuracy and calibrate the computer model compared to field conditions. The model was calibrated by adjusting pipe roughness coefficients to simulate available flows and system pressures similar to those reported in the City's fire hydrant test, where possible. During calibration, it was discovered the North Stanfield booster pump station discharge pipe was not the correct size. The pipe size was adjusted to match actual field conditions. In general, the model depicted the existing system conditions relatively well based on the fire flow test data provided by the City.

A water model run provides distribution system pipe flows and junction pressure under a given demand on the system. To represent current conditions, the year 2017 water system demands were selected and distributed evenly among the junctions in the distribution system. For future conditions, the year 2037 PDD water system demands were selected and distributed evenly among the junctions in the distribution system. The demand conditions used in modeling the system are as follows:

- Year 2017 PDD. The current PDD for the City of Stanfield is estimated to be 660 gallons per capita per day (gpcd), or 980 gpm, at the current population of 2,130. With approximately 353 junctions and hydrants in the existing system water model, this represents a demand of approximately 2.78 gpm at each junction and hydrant.
- Year 2037 PDD. The 2037 PDD for the City of Stanfield is estimated to be 660 gpcd, or 1,030 gpm, at the projected population of 2,252. With approximately 353 junctions and hydrants in the existing system water model, this represents a demand of approximately 2.92 gpm at each junction and hydrant.

Model Results

System Pressure

The existing system pressures under the 2017 PDD demand scenario are presented on Figure 5-1. As shown on Figure 5-1, the system provides pressures ranging from approximately 55 to 85 psi. The City has adequate pressure to meet DWS regulations, and improvements are not required to provide additional pressure to the system.

Fire Flows

Figure 5-2 presents the fire flow available in the existing system under the 2017 PDD. As previously discussed, fire flow capacity requirements generally range from 1,000 gpm in residential areas to approximately 3,500 gpm in commercial and institutional areas, as recommended by ISO and according to the OFC. For the purposes of this WSMP, a fire flow capacity of 1,000 gpm was used in residential areas, 2,000 gpm in residential/multi-family areas around downtown, 3,000 gpm in the downtown area, and 3,500 gpm in all industrial/ commercial/institutional areas. Figure 5-2 shows the estimated fire flow capacity throughout the entire system and whether the existing hydrants meet the recommended fire flows. Figure 5-2 shows that 35 of the 94 existing hydrants do not meet the recommended fire flow for the area in which they are located. The majority of these hydrants are located in the downtown area or industrial/commercial/institutional areas requiring 3,000 or 3,500 gpm, respectively.

Recommended distribution system improvements to provide adequate fire flow capacities are shown on Figure 5-3. The distribution system improvements are separated into three categories. The first category shows the proposed high priority distribution system improvements. The proposed high priority improvements generally consist of improvements required to improve fire flow capacity at existing hydrants throughout the entire system.

The second category shows proposed medium priority improvements. The proposed medium priority improvements generally include improvements to install main lines in areas not covered by existing fire hydrants and increase fire flow capacities to existing hydrants that were slightly lower than the recommended flow rates.

The third category of improvements is the proposed long-term or future development improvements. These improvements generally include eliminating the remaining dead-end lines that were not looped as part of the high or medium priority improvements, replacing small deteriorating lines, and adding new lines for future development within the City.

The water model confirmed that, for the most part, the City's existing distribution system is fairly well looped, provides adequate pressures, and has adequate capacity for delivering fire flows to most residential areas. Other areas, particularly downtown and areas zoned as industrial, need improvements to meet fire flow requirements. The improvements shown on Figure 5-3 will help increase fire flows throughout the distribution system and improve water circulation. Figure 5-4 presents the available fire flow in the water system after the proposed distribution system improvements are incorporated. Figure 5-4 confirms that after the improvements are incorporated, the system should be able to provide at least the recommended fire flows to the majority of the system.

Limitations of Water Model Results

Reported fire flows from the water model analysis indicate theoretical distribution system piping capacity. Actual field conditions and head loss in fire hydrants may reduce fire flows beyond what is indicated. Individual fire hydrants generally also have a maximum capacity of 1,000 to 1,500 gpm, so multiple hydrants may need to be operated to attain the flows indicated in the model.

Undersized Main Lines

Many cities have adopted minimum water main line size standards requiring at least 6-inch diameter and, often, 8-inch diameter be installed when a fire hydrant is required. The significant capacity advantages of an 8-inch diameter main line compared to a 6-inch line normally outweigh the small additional cost to install an 8-inch line.

For the purposes of this WSMP, undersized mains have been identified as those mains that do not allow the fire demand and minimum pressure criteria, shown on Figure 2-2 in Chapter 2,to be met. Several areas within the City's distribution system have undersized main lines. The improvements shown on Figure 5-3 that replace undersized main lines are described in more detail below.

- Main Street - An 8-inch diameter line extends from East Ball Avenue to West Page Avenue. This line distributes water through the 16-inch diameter line from the South Stanfield booster pump station to the Old Town pressure zone and provides water to many of the fire hydrants located on the west side of the downtown area.
- West Page Avenue - An 8-inch diameter line extends from South Main Street to South Barbara Street. This line distributes water through the 16-inch diameter line from the South Stanfield booster pump station to the Old Town pressure zone and provides water to many of the fire hydrants located on the west side of the downtown area.
- Barbara Street - A 4-inch diameter line extends from West Page Avenue to West Wood Avenue. This line distributes water through the 16-inch diameter line from the South Stanfield booster pump station to the Old Town and North Stanfield pressure zones and provides water to many of the fire hydrants located on the west side of the downtown area.
- East Ball Avenue - An 8-inch diameter line extends from South Main Street to South Glendening Street. This line distributes water through the 16-inch diameter line from the South Stanfield booster pump station to the east side of the Old Town pressure zone.
- Glendening Street - A 4-inch diameter line extends from East Ball Avenue to East Wood Avenue. This line provides water to many of the fire hydrants located on the east side of the downtown area.
- West Coe Avenue - A 4- and 2-inch diameter line extends from North Sherman Street below the railroad to Hoosier Lane. This line serves three hydrants located in an industrial zoned area.
- East Coe Avenue - A 6-inch diameter line extends from Wayne Street to Rauch Lane. This line serves three fire hydrants.
- West Roosevelt Avenue - A 2-inch line extends from North Barbara Street to North Sherman Street. This line would aid in providing the fire flow capacity needed in the industrial areas if the new line from the line in Hinkle Road (supplying the wastewater treatment facility [WWTF]) to the line west of Hoosier Road is constructed.
- Hinkle Road - An 8-inch diameter line extends from North Sherman Street to Hinkle Road and then the WWTF. This line serves a fire hydrant and could provide more flow to industrial areas on this side of the City if a new line connecting this line to the line west of Hoosier Road is installed.
- Harding Avenue - An 8-inch line extends from North Barbara Street across Highway 395 to North Glendening Street. This line serves one fire hydrant.

- North Dunne Street - A 6-inch diameter line extends from East Wood Avenue to East Harding Avenue. This line provides water to the northern portion of the Old Town system.
- Northeast Wheeler Avenue - A 2-inch diameter line extends from the intersection of Northeast Wheeler Avenue and North Dunne Street to a hydrant located approximately 20 feet west on Northeast Wheeler Street.
- Locust Street - An 8-inch line extends along Locust Street across Highway 395. This line serves three fire hydrants.

Dead-End Main Lines

The City's distribution system is fairly well looped. However, several areas in the distribution system have dead-end main lines. It is difficult to eliminate all dead-end water mains from a system. Physical limitations, such as stream crossings, state highway crossings, undeveloped land, or other limitations (such as no customers in the area) can result in dead-end lines. Often these lines are eventually looped as expansion occurs. The areas where new mains are proposed to eliminate dead-end lines are as follows:

- South Main Street - An 8-inch diameter line dead-ends approximately 2,260 feet south of the intersection of South Main Street and West Ball Avenue. Branch lines extend to the east from this 8-inch diameter line and also dead-end on Southeast Palm Street, Seibel Lane, and Deer Run Court. A new line can be installed from Highway 395 down South Dunne Street to loop these dead-ends.
- South Dunne Street - A 2-inch line dead-ends approximately 260 feet south of the intersection between South Dunne Street and East Ball Avenue. A new line can be installed along Highway 395 to East Ball Avenue to loop this dead-end.
- East Ball Avenue/East Tuttle Avenue - A 6-inch diameter line in East Ball Avenue dead-ends approximately 170 feet east of the intersection of East Ball Avenue and South Dunne Street. Another 2-inch line in East Tuttle Avenue dead-ends approximately 245 feet east of the intersection of East Tuttle Avenue and South Dunne Street. These two dead-ends can be looped by extending the line in East Ball Avenue to South Earl Street and then turn north to connect to the line in Tuttle Avenue. The line in South Earl Street can be extended to the existing line in East Taft Avenue to provide even more circulation.
- West Taft Avenue - A 2-inch diameter line dead-ends approximately 450 feet west of the intersection of West Taft Avenue with South Sherman Street. This line can be connected to the existing line in West Coe Avenue to loop the dead-end.
- Rauch Lane - A 2-inch diameter line dead-ends approximately 400 feet south of the intersection of Rauch Lane with East Coe Avenue. This line could be extended south to East Taft Avenue then to the west to connect to the existing line at the intersection of East Taft Avenue and South Wayne Street to loop the dead-end.
- East Coe Avenue/East Wood Avenue - An 8-inch diameter line in East Coe Avenue dead-ends approximately 210 feet east of the intersection of East Coe Avenue and North Sloan Street. A 6-inch diameter line in East Wood Avenue dead-ends approximately 275 feet east of the intersection of East Wood Avenue and North Sloan Street. These two dead-ends can be looped by extending them east to South Edward Road, where a new line could be installed to the north to connect to the existing line in East Harding Avenue.

- North Harriman Street - A 1-inch diameter line dead-ends approximately 170 feet north of the intersection of North Harriman Street and West Wood Avenue. This line could be connected to the existing line in West Roosevelt Avenue to the north.
- North Harriman Street - A 2-inch diameter line that increases to a 4-inch diameter line dead-ends approximately 260 feet south of the intersection of North Harriman Street and West Harding Avenue. This line could be connected to the existing line in West Roosevelt Avenue to the south.
- North Glendening Street - A 2-inch diameter line dead-ends approximately 190 feet north of the intersection of North Glendening Street with East Wood Avenue. This line could be connected to the existing line in North Dunne Street to the east.
- North Earl Street - A 2-inch diameter line dead-ends approximately 255 feet north of the intersection of North Earl Street with East Wood Avenue. This line could be connected to the existing line in North Dunne Street to the west.
- North Sloan Street - A 2-inch diameter line dead-ends approximately 260 feet south of the intersection of North Sloan Street and East Harding Avenue. This line can be looped to the proposed line in South Edward Road to the east.
- Willow Drive - A 4-inch diameter line dead-ends approximately 650 feet north of the west intersection between Willow Drive and West Harding Avenue. A 12-inch diameter line runs along the east portion of Willow Drive and continues to Reservoir No. 2. The two lines can be connected at the north end of Willow Drive to loop the dead-end.
- Jason Avenue/Blankenship Drive - A 4-inch diameter line on Jason Avenue dead-ends approximately 330 feet west of the intersection of Jason Avenue with North Dunne Street. Another 4-inch diameter line on Blankenship Drive dead-ends approximately 330 feet west of the intersection of Blankenship Drive with North Dunne Street. The line in Jason Avenue can be connected to the line in Blankenship Drive and then extended to the existing line in East Harding Avenue to loop the two dead-ends.
- North Lucy Street/North Wayne Street - A 6-inch diameter line in North Lucy Street dead-ends approximately 470 feet north of the intersection of North Lucy Street with East Harding Avenue. Another 6-inch diameter line in North Wayne Street dead-ends approximately 310 feet north of the intersection of North Wayne Street and East Harding Avenue. These two lines can be connected to loop the dead-end lines.
- North Dunne Street/Jason Avenue/Earl Court - An 8-inch diameter line in North Dunne Street dead-ends approximately 340 feet north of the intersection of North Dunne Street and Jason Avenue. Another 8-inch diameter line in Jason Avenue dead-ends approximately 250 feet from the intersection of Jason Avenue with North Dunne Street. At the intersection of Jason Avenue and Earl Court an 8-inch line dead-ends to the north approximately 305 feet. All three of these dead-ends can be eliminated by extending the line in Jason Avenue to the north to connect to the line at the end of Earl Court and then continue to the north and then the west to connect to the line in North Dunne Street.
- North Sloan Street - An 8-inch diameter line dead-ends approximately 1,220 feet north of the intersection of North Sloan Street and East Harding Avenue. This line can be connected to the existing line in North Dunne Street to the west.

- North Howard Street - An 8-inch diameter line dead-ends approximately 670 feet north of the intersection of North Howard Street with east Harding Avenue. This line can be connected to the existing line in Ardith Street to the southeast.
- East Harding Avenue/Ardith Street - An 8-inch diameter line in East Harding Avenue dead-ends approximately 660 feet east of the intersection of East Harding Avenue and North Howard Street. A 6-inch diameter line in Ardith Street dead-ends at the intersection of Ardith Street and South Edwards Road. These two dead-end lines can be connected to each other by installing a new line down South Edwards Road.
- Arborvitae Lane/Stanfield Secondary School - An 8-inch line dead-ends near the intersection of Arborvitae Lane with Highway 395, a 4-inch diameter line dead-ends along the Stanfield Secondary School drop-off loop on the north side of the building, and another 8-inch diameter line dead ends near the intersection of the Stanfield Secondary School drop-off loop and Highway 395. These three dead-ends could be looped by installing a new line in the Stanfield Secondary School drop-off loop that would connect all three dead-ends.

Easements may be required across private property to loop these existing main lines. These easements would allow both the pipe installation and future maintenance activities to occur. Ideally, easements for water mains are 20 feet wide but are recommended to be 10 feet wide at a minimum.

Recommended Distribution System Improvements

In general, the City's distribution system is fairly well looped but has several undersized main lines and dead-end lines. The undersized and dead-end main lines in the system result in fire flow capacity limitations and water circulation issues. Some of these lines have been recommended for upgrading where improved fire flow capacities are needed. It is recommended the City complete improvements to the distribution system to eliminate as many undersized main lines as possible, loop the dead-end main lines, and provide improved system fire flow capacities in areas lacking adequate fire flows. Key main line improvements have been identified to meet the following objectives:

1. Increase flow capacity to the existing system to provide adequate fire flows to residential, commercial, and industrial areas and improve water circulation.
2. Modify valving at the existing Reservoir No. 2 to allow it to supply water to the Old Town system during an emergency or fire flow event.
3. Eliminate dead-ends to improve water quality and circulation.

The recommended distribution system improvements are shown on Figure 5-3 at the end of this chapter. High and medium priority proposed improvements are in response to current deficiencies. The highest priority improvements proposed are ranked by yellow numbers on Figure 5-3 and include upsizing pipes to 6- and 8-inch diameter pipes. Medium priority, ranked in orange, involve upsizing to 8- and 10-inch diameter pipes. Long-term future improvements will be development driven and involve upsizing to 6- and 8-inch diameter pipes.

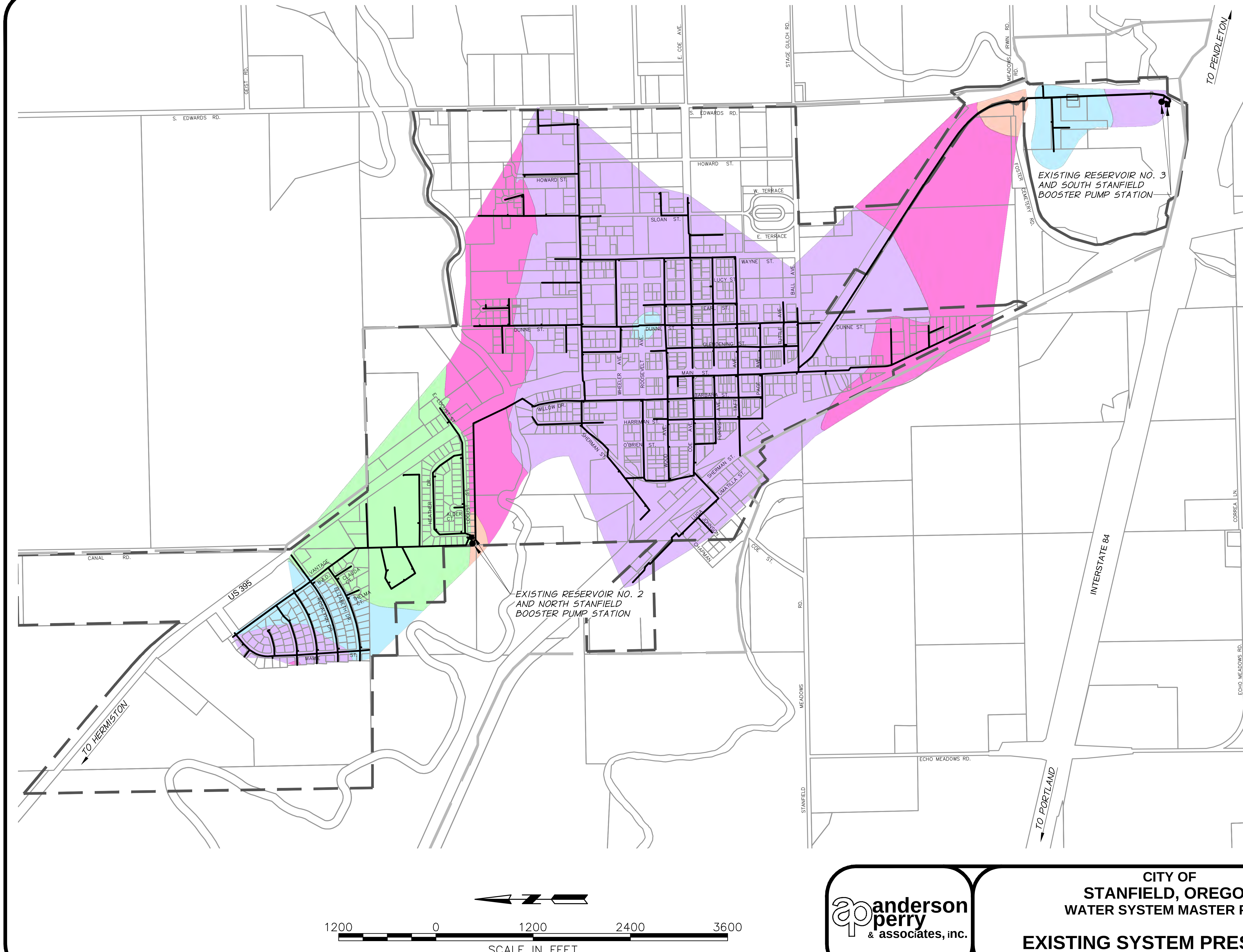
Maintenance Records

One of the important operational functions regarding the City's distribution system is to keep accurate records of various system components. These records become valuable as time passes in terms of planning future improvements and replacing old or deteriorated components. It is recommended the

City keep accurate records on all water meters installed so, in the future, these meters can be periodically pulled, checked for accuracy, and replaced as needed. The City should also keep records of all hydrants, valves, and other distribution system components. The distribution system evaluation in this WSMP did not include determining existing fire hydrant, valve, and water meter condition. Hydrants should be checked, at least annually, for proper operation, and all water valves should be exercised, at least annually, with records kept on the operating condition, location, etc.

Summary

In general, the City's distribution piping system is in relatively good condition, although several areas cannot currently provide adequate fire flow. Undersized, dead-end, and supply distribution within the City lead to low fire flow capacity and issues with water circulation in these areas; therefore, some areas need improvement, namely areas with undersized main lines and dead-end lines. Improvements outlined in this chapter include installing water main lines to replace undersized lines and improving system looping, circulation, and fire flow capacities. These improvements were selected to address key areas of concern to improve fire flow capacity in the system.



LEGEND

- 40 PSI TO 50 PSI
- 50 PSI TO 60 PSI
- 60 PSI TO 70 PSI
- 70 PSI TO 80 PSI
- ABOVE 80 PSI
- CITY LIMITS
- URBAN GROWTH BOUNDARY

NOTE:
SYSTEM PRESSURES SHOWN ARE BASED ON A HYDRAULIC COMPUTER MODEL. SYSTEM PRESSURES SHOULD BE FIELD VERIFIED PRIOR TO MAKING IMPROVEMENTS.

anderson perry & associates, inc.

CITY OF
STANFIELD, OREGON
WATER SYSTEM MASTER PLAN

EXISTING SYSTEM PRESSURES AT 2017 PDD

FIGURE 5-1

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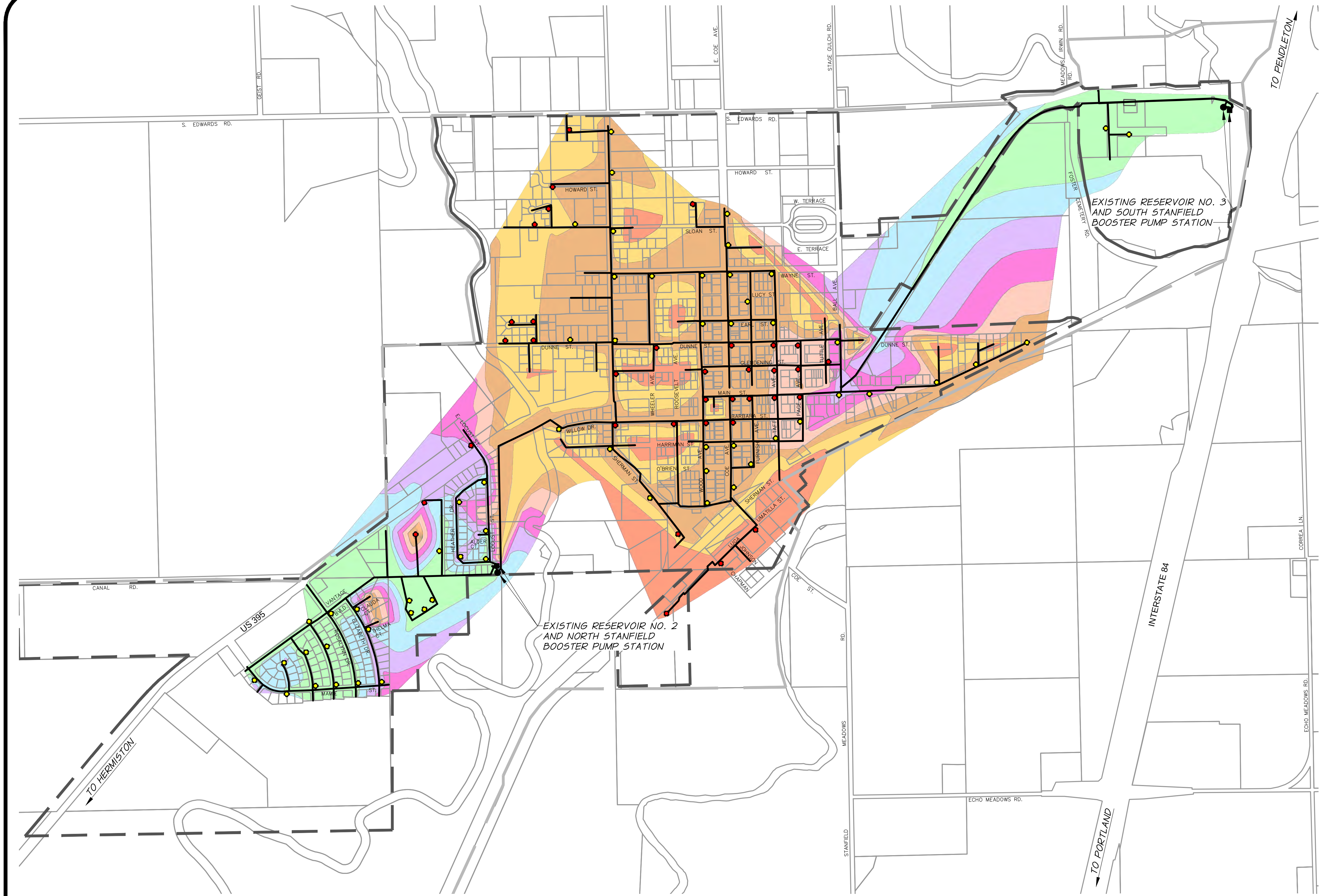

LEGEND

- FLOW RATE LESS THAN 500 GPM
- FLOW RATE 500 GPM TO 1000 GPM
- FLOW RATE 1000 GPM TO 1500 GPM
- FLOW RATE 1500 GPM TO 2000 GPM
- FLOW RATE 2000 GPM TO 2500 GPM
- FLOW RATE 2500 GPM TO 3000 GPM
- FLOW RATE 3000 GPM TO 3500 GPM
- FLOW RATE ABOVE 3500 GPM
- FIRE HYDRANTS WITH LOW CAPACITY
- FIRE HYDRANTS WITH ADEQUATE CAPACITY
- CITY LIMITS
- URBAN GROWTH BOUNDARY

NOTES:

1. SYSTEM PRESSURES SHOWN ARE BASED ON A HYDRAULIC COMPUTER MODEL. SYSTEM PRESSURES SHOULD BE FIELD VERIFIED PRIOR TO MAKING IMPROVEMENTS.
2. FIRE HYDRANT CAPACITIES ARE BASED ON THE ZONING IN WHICH THEY ARE LOCATED. A CAPACITY OF 1,000 GPM WAS USED FOR RESIDENTIAL AREAS, 2,000 GPM IN RESIDENTIAL / MULTI-FAMILIY AREAS, 3,000 GPM IN THE DOWNTOWN AREA, AND 3,500 GPM IN COMMERCIAL / INDUSTRIAL / INSTITUTIONAL AREAS.

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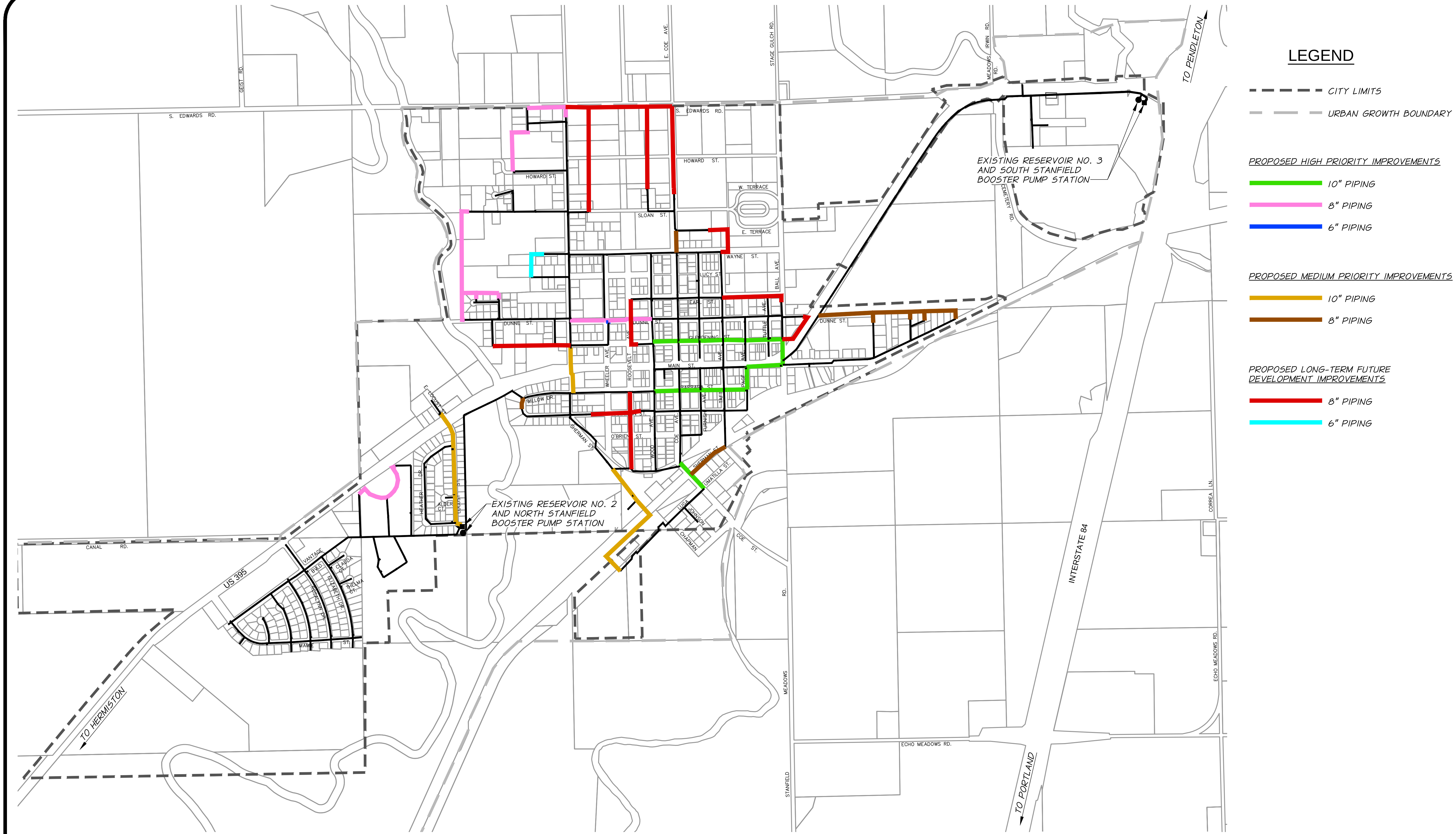
WATER SYSTEM MASTER PLAN
EXISTING SYSTEM AVAILABLE FIRE FLOW AT 2017 PDD

FIGURE
5-2



1200 0 1200 2400 3600

SCALE IN FEET

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STANFIELD, OREGON
WATER SYSTEM MASTER PLAN

PROPOSED DISTRIBUTION SYSTEM IMPROVEMENTS

FIGURE

5-3

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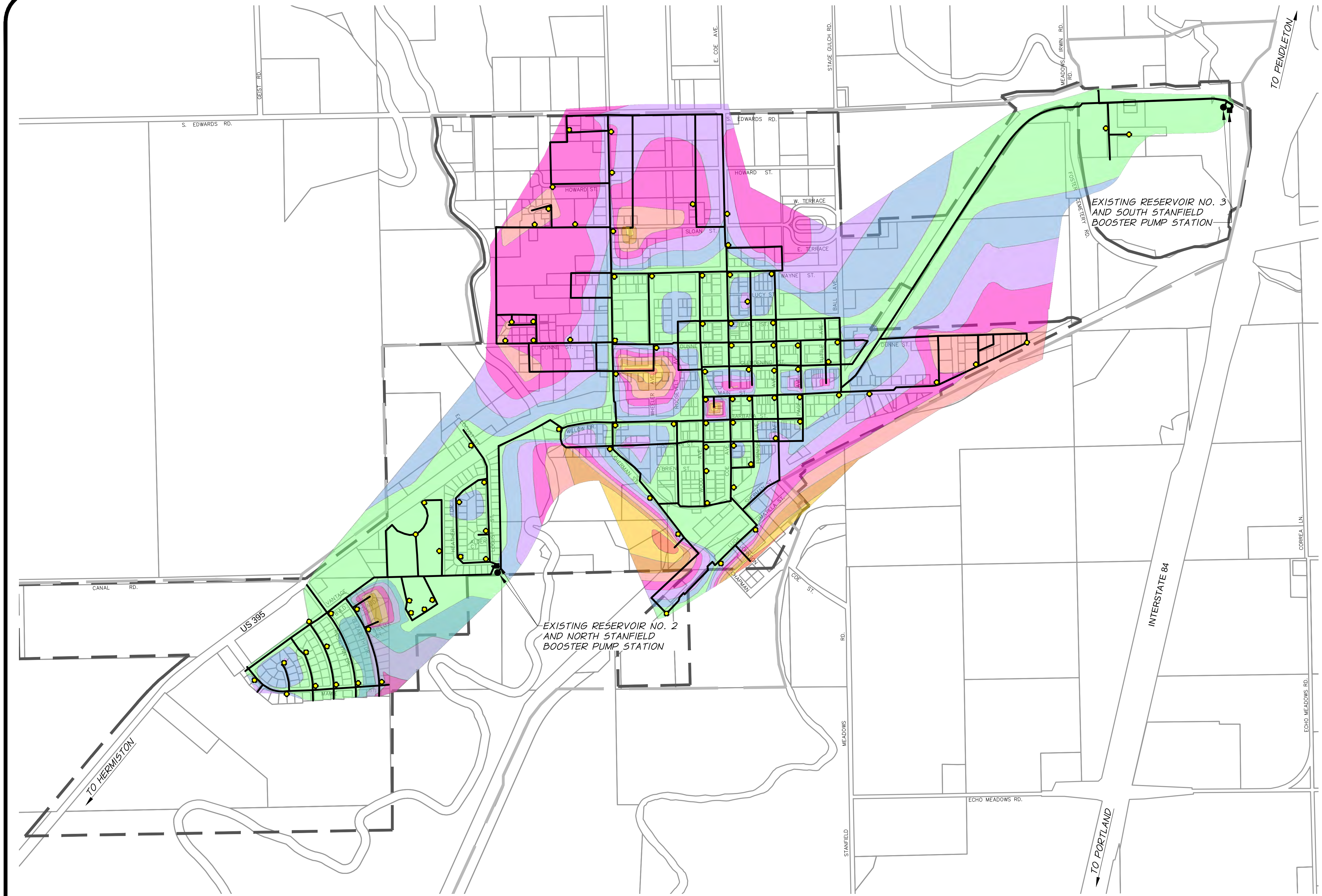

LEGEND

- FLOW RATE LESS THAN 500 GPM
- FLOW RATE 500 GPM TO 1000 GPM
- FLOW RATE 1000 GPM TO 1500 GPM
- FLOW RATE 1500 GPM TO 2000 GPM
- FLOW RATE 2000 GPM TO 2500 GPM
- FLOW RATE 2500 GPM TO 3000 GPM
- FLOW RATE 3000 GPM TO 3500 GPM
- FLOW RATE ABOVE 3500 GPM
- FIRE HYDRANTS WITH ADEQUATE CAPACITY
- CITY LIMITS
- URBAN GROWTH BOUNDARY

NOTES:

1. SYSTEM PRESSURES SHOWN ARE BASED ON A HYDRAULIC COMPUTER MODEL. SYSTEM PRESSURES SHOULD BE FIELD VERIFIED PRIOR TO MAKING IMPROVEMENTS.
2. FIRE HYDRANT CAPACITIES ARE BASED ON THE ZONING IN WHICH THEY ARE LOCATED. A CAPACITY OF 1,000 GPM WAS USED FOR RESIDENTIAL AREAS, 2,000 GPM IN RESIDENTIAL / MULTI-FAMILIY AREAS, 3,000 GPM IN THE DOWNTOWN AREA, AND 3,500 GPM IN COMMERCIAL / INDUSTRIAL / INSTITUTIONAL AREAS.

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WATER SYSTEM MASTER PLAN

PROPOSED SYSTEM AVAILABLE FIRE FLOW AT 2037 PDD

FIGURE 5-4

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