CITY OF ESCALON
Water Master Plan



January 2007

Prepared for
City of Escalon

Prepared by
ECO:LOGIC Engineering

ECO:LOGIC

Consulting Engineers

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Introduction

1.1 BACKGROUND

The City of Escalon (City) currently serves approximately 7,100 people with approximately 1,990 water service connections. Water service is provided to residential, commercial and industrial sites. The primary purpose of this Master Plan is to develop an improvement plan consisting of water supply, transmission/distribution pipelines, storage and pumping facilities to provide domestic water service for future growth.

The projected growth and land uses used to determine the magnitude and location of future water demands are based on the City's updated General Plan that was adopted in June 2005 and prepared by Quad Knopf. The General Plan identifies the land uses within City limits, and provides the overall framework for how the City will grow, including areas within the City's Sphere of Influence (SOI). The General Plan defines three distinct planning horizons including the years 2015, 2025 and 2035. The General Plan land uses, population projections and planning horizons were used in the development of the Water Master Plan for planning capital improvements.

The objectives of the Water Master Plan include:

- Development of a logical expansion plan that can be phased based on the growth projections and land uses identified in the General Plan. This can be particularly challenging given the City's Growth Ordinance which limits residential development to a maximum of 75 residential units per year. Revenue generated by connection charges for improvements will be limited accordingly.
- Integration of surface water from the South San Joaquin Irrigation District (SSJID) South County Water Supply Program into the City's water system.
- Projection of future water demands based on historical water use data and approved land uses as defined in the General Plan.
- Identification of water infrastructure needs to meet the goals and objectives of the General Plan including supply, storage, pumping and distribution facilities.
- Description of improvements including capital costs which will be used to develop the appropriate water connection charge.
- Development of an implementation plan and recommended water connection charge.

1.2 SCOPE

The scope of this work consists of the following major elements:

- Review existing reports, drawings, land use and zoning maps, and other relevant drawings.
- Evaluate existing facilities, particularly in regards to how they will be impacted by future facilities.
- Project future water demands based on land uses defined in the City's General Plan and existing water consumption data.
- Evaluate existing water supply capacity, storage, pumping and distribution/transmission system alignments to serve future growth.
- Prepare a hydraulic model of the distribution system.
- Develop and describe a recommended plan of expansion including costs and staging
- Recommend an appropriate water connection charge for master planned facilities

1.3 ACKNOWLEDGMENTS

The cooperation, input and support received from Doug Stidham and his staff are gratefully acknowledged.

Section 2

Executive Summary

The primary purpose of this Master Plan is to develop an improvement plan consisting of water supply, transmission/distribution pipelines, storage and pumping facilities to provide domestic water service for future growth.

The scope of this work consists of the following major elements:

- Review existing reports, drawings, land use and zoning maps, and other relevant drawings.
- Evaluate existing facilities, particularly in regards to how they will be impacted by future facilities.
- Project future water demands based on land uses defined in the City's General Plan and existing water consumption data.
- Evaluate existing water supply capacity, storage, pumping and distribution/transmission main alignments to serve future growth.
- Prepare a hydraulic model of the distribution system.
- Develop and describe a recommended plan of expansion including costs and staging.
- Recommend an appropriate water connection charge for master planned facilities.

A summary of the Water System Master Plan including results and recommendations is included in this section.

2.1 EXISTING SYSTEM

Historically, water supply within the City has been from groundwater wells. Service was initially provided by the Escalon Water Company, which was a private company established in the early 1900's. In the late 1960s, the City took over the operation of a well and distribution system serving a small residential subdivision from a developer. In the early 1980s the City purchased the Escalon Water Company and took over the operation of the entire water system.

Water supply for domestic service and fire flow is currently supplied from four active wells which provide day-to-day domestic water and fire flow supply. One additional well is used for standby and only operated in emergency conditions, although all water quality testing is kept up to date. There is one 500,000-gallon storage tank located at the Well 1 site.

Well 1 has been equipped with two granular activated carbon (GAC) contactors that remove Dibromochloropropane (DBCP). Each vessel is rated for 700 gpm of capacity. The treated water from the contactors enters the 0.5 MGal storage tank and is then pumped into the system through the booster pump station. No other treatment is necessary throughout the system, although the City adds chlorine as a disinfectant as a preventative measure, which is considered to be good practice.

The existing distribution system consists of approximately 33 miles of piping. Pipeline diameters range from three to 16 inches. The original system was built with small diameter steel pipe, which was inadequate to convey flows at adequate pressures. Due to the dilapidated condition of the system, the City applied for and was awarded a state loan and federal grant in 1983. To date, almost all of the old pipelines have been replaced, and as a result, the distribution system is in excellent condition. The existing distribution system is also shown on Figure 2-1.

The system pressure is maintained automatically with a supervisory control and data acquisition system (SCADA). Operators enter the desired system pressure and configure the wells in a lead/lag configuration. If the well set in the primary position cannot maintain the system pressure, the second well in the series will start. The existing control system works well.

2.2 LAND USE AND WATER DEMANDS

Projections of future water demands, including the magnitude and location, are necessary to plan future water system improvements. Water demands are developed using approved land uses included in the City's General Plan (June 2005) and the General Plan Background Report (February 2004). Projected water demands for various levels of development were considered from current conditions through the ultimate build out condition in 2035, as defined in the General Plan.

The planning boundaries defined in the General Plan include:

- 2015 General Plan Growth Boundary
- 2025 General Plan Growth Boundary
- 2035 General Plan Growth Boundary

Although each planning boundary is identified with an apparent time line, the City plans to develop the area encompassed by each boundary prior to growing into the subsequent boundary. As an example the land within the 2015 boundary could develop sooner or later than 2015, and will depend on a number of factors out of the City's control including the economy, interest by the development community to construct in Escalon, public support/opposition of new projects, etc.

2.2.1 LAND USE

The General Plan projects land uses within the City Limits as listed in Table 2-1. Although not expressly stated in the General Plan documentation, the planners added additional land over and above what would be expected to develop within the defined planning boundaries. The additional land provides the developers options and choices regarding what parcels are actually developed in the future, and as a result, there is no means to determine which areas will develop, to what level, and how quickly.

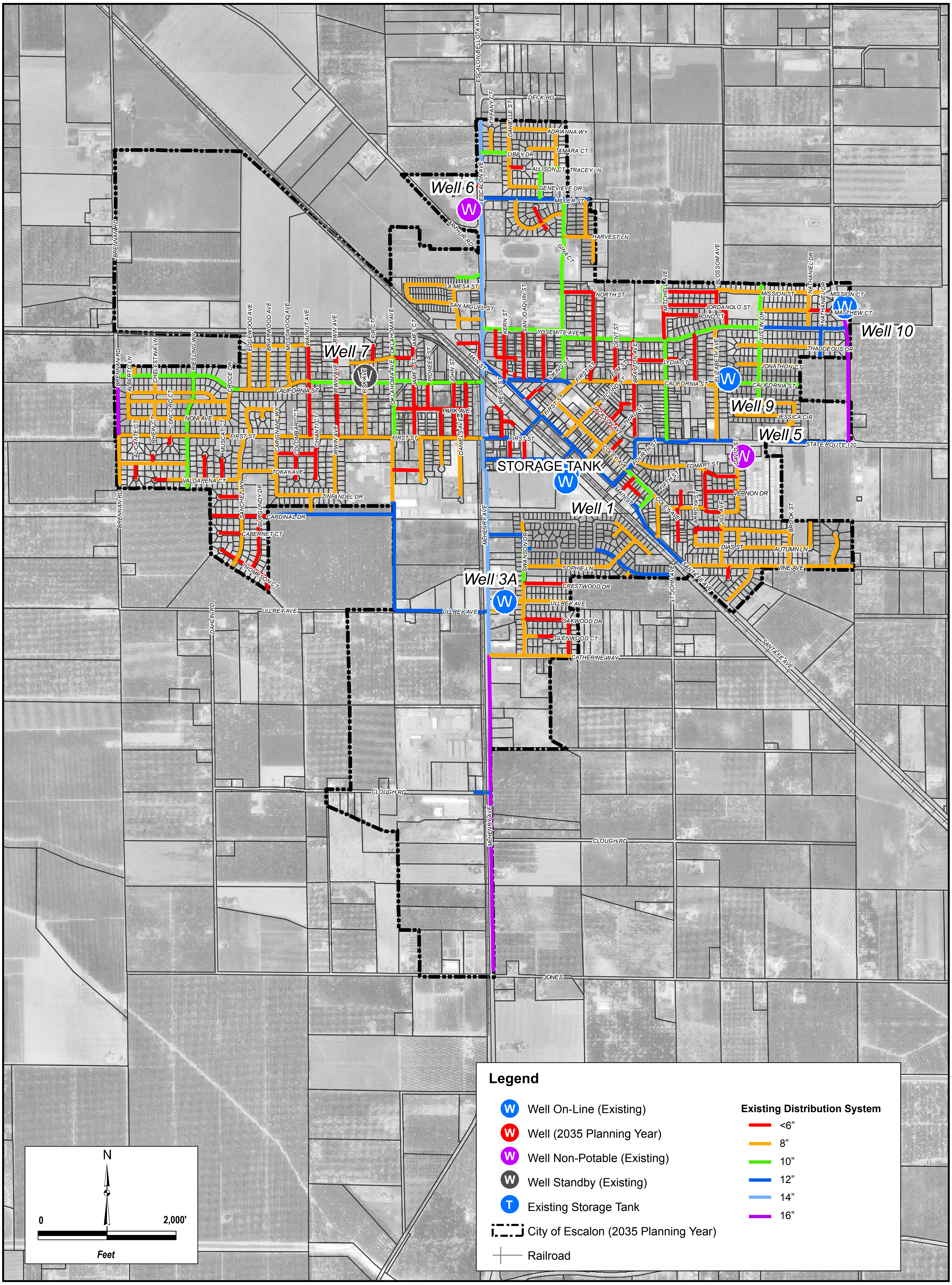

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Figure 2-1
Existing Water System Infrastructure

Table 2-1
General Plan Land Use by Planning Boundary

General Plan Land Use Category	Acres Added				
	Current	2015	2025	2035	Total
Commercial	175	22	23	25	245
Industrial	370	102	0	90	562
Low Density Residential	413	254	242	317	1226
Medium Density Residential	29	10	0	6	45
High Density Residential	29	17	4	0	50
Park/Open Space	42	10	52	33	137
Public Facilities	72	0	0	0	72
Total	**1,130**	**415**	**321**	**471**	**2,337**

Source: City of Escalon Environmental Impact Report, April 2005, and ECO:LOGIC Engineering 2006 Land Use Survey.

The largest restriction on growth is the number of residential building permits that will be issued on an annual basis, which is limited to a maximum of 75 single-family residential building permits by the City's growth ordinance. Even though the City's growth ordinance does not limit commercial and industrial growth, the commercial and industrial businesses rely upon serving the new residents and will be affected by the limited growth of the residential areas. The estimated population and projected acreage needed for the various types of development was proposed for 2005 through 2025 and is summarized in Table 2-2. These projections reflect the City's current growth policies, and were provided by the planners in the General Plan Update Background Report (February 2004).

Table 2-2
Community Development Needs, 2005-2025[a]

Year	Population	Added Residential (Acres)	Added Commercial (Acres)	Added Industrial (Acres)
2005	7,150	3	0	1
2010	8,350	79	4	15
2015	9,550	156	7	30
2020	10,750	232	11	45
2025	11,950	308	14	60

[a] Source: City of Escalon General Plan Update Background Report (February 2004)

As discussed below, two sets of water demands projections were developed based on the build-out and the market condition land uses discussed above.

2.2.2 PROJECTED WATER DEMANDS

The land uses combined with the water demand factors and peaking factors based on historical production and usage records were used to estimate future water demands under build-out and actual market conditions. Development of water demands based on the planning boundaries included in the

General Plan result in unrealistically high demands given the current City policies regarding growth. Although the demands are considered to be reasonable for each boundary once built-out, the growth projections they are applied to do not reflect realistic growth within time frames typically used to plan water facilities.

A more realistic estimate of growth and associated water demands is based on actual market conditions which take into account existing constraints to development within the City, primarily the current growth ordinance. As such, a second set of water demands based on market conditions were estimated based on that forecast and are much lower. Each demand projection is discussed below.

Water demand estimates for the build-out and market conditions are included in Tables 2-3 and 2-4, respectively**.**

Table 2-3
Water Demands Based on Full Build-Out [a], [b]

Planning Boundary	Annual Average, Mgal/d	Maximum Day, Mgal/d	Peak Hour, Mgal/d
Existing Development within City Limits	1.4	3.2	4.6
Buildout within City Limits (Infill)	2.4	5.8	8.3
2015 Planning Area	3.7	8.9	12.7
2025 Planning Area	4.4	10.6	15.2
2035 Planning Area	5.7	13.7	19.6

[a] Water demands based on annual average demand with peaking factors applied. Unaccounted for water is included in the average annual demand, but the peaking factor is not applied to unaccounted water for calculating peak hour and maximum day.

[b] Planning boundaries have been established based on the General Plan for planning water system improvements. Demands shown will occur upon full build-out of each planning area; however, the year associated with each planning boundary may not reflect the actual time frame and will depend on actual growth.

Table 2-4
Water Demands Based on Market Conditions [a], [b]

Planning Boundary	Annual Average, Mgal/d	Maximum Day, Mgal/d	Peak Hour, Mgal/d
Existing Development within City Limits	1.4	3.2	4.5
2010	1.7	4.4	6.5
2015	2.0	5.1	7.6
2020	2.4	5.9	8.9
2025	2.7	6.8	10.2

[a] Water demands based on annual average demand with peaking factors applied.
[b] Planning boundaries are based on community needs estimated included in the General Plan Background Report.

Recommended Demand Projections

In the General Plan Background Report, the planners provided an estimate of the community needs based on actual market projections. The anticipated level of actual development is much less than shown in the General Plan. As a result, water demand projections based on the General Plan build-out are considered too high, and use of the market condition projections are considered the most appropriate to forecast water demands over time under the current growth ordinance.

2.3 RECOMMENDED IMPROVEMENTS

A summary of water supply, storage, pumping and distribution/transmission pipelines is included in this section. For the purpose of identifying water supply improvements the market condition demand scenario was used. Pipelines have been sized based on the build-out condition, and pumping facilities should be designed so that they can be expanded easily in the future.

2.3.1 WATER SUPPLY FACILITIES

The City of Escalon's water supply has historically been provided from groundwater wells, and the City's future supply will continue to utilize groundwater and be augmented by surface water from the South San Joaquin Irrigation District (SSJID) South County Water Supply Project. Two independent water supplies in a conjunctive use program will provide redundancy and reliability to the City's long-term water supply.

Capital improvement items associated with additional water supply, including new wells and the SSJID surface water supply are discussed below.

Groundwater Wells

Two new wells are being proposed through the year 2020. One new well should be constructed immediately along with a storage tank and booster pump station. Based on the market growth projects, the second well will be needed sometime around 2020. Two additional wells could be required based on the demand projections through 2035 for the build-out condition; however, they have not been included in the improvement list or capital costs. The construction of the future wells should be based on the level of development and built as the system demands increase along with development. The location of the proposed wells is discussed below.

For the purposes of this report new wells have been assumed to have capacities of at least 1,200 gpm, and the underlying aquifer has been assumed to have adequate long-term yield. The latter assumption should be verified through a hydro-geological characterization.

South San Joaquin Irrigation District Surface Water Supply

The City is a participant in the South San Joaquin Irrigation District (SSJID) South County Water Supply Program. SSJID entered into a Water Supply Development Agreement in 1995 with the Cities of Escalon, Manteca, Lathrop and Tracy for the delivery of treated surface water to supplement the municipal and industrial water supplies of these communities. The purpose of the project is to provide a reliable supply of water to these cities to reduce the potential negative impacts of over-drafting the groundwater aquifers providing the water supply to the various communities.

The City was initially slated to take delivery of up to 2,015 acre-feet of treated water after completion of Phase I and has been allotted up to 2,799 acre-feet of treated through Phase II. The

City opted to defer delivery of project water until Phase II to defer costs and rely on the groundwater supply in the interim. Even if the SSJID project is delayed after 2012, the City will be able to meet projected demands with wells, and not be affected negatively by the lack of the surface water supply by constructing storage and new wells.

The primary facilities associated with the SSJID project include the transmission pipeline to convey treated water from the project transmission main to the City and the turnout facilities, which would include two 1 Mgal tanks and a booster pump station. The City will own and operate the tanks and booster pump station. One 1 Mgal tank is being proposed initially at the well site proposed in the Liberty Industrial Park. A second tank will be constructed at the site in the future when water demands increase. Two tanks will minimize upfront capital costs, reduce the potential for water quality degradation resulting from excessive residence time in the tank, and provide operational flexibility in the future.

2.3.2 TRANSMISSION AND DISTRIBUTION SYSTEM

The proposed distribution system improvements correlate to the water supply improvements and would be constructed simultaneously with the water supply improvements and/or as development occurs in a particular area of the City. The planning boundaries and demands associated with full build-out of the General Plan planning horizons were used for planning distribution system improvements which are higher than the market projections. A hydraulic model was used to size pipelines.

Distribution system improvements were sized based on the modeling results and criteria presented previously, input from City staff and review of the system. The primary objective of the distribution system improvements is to ensure that adequate flow and pressure are available throughout the system. Master planned facilities are described below.

Current Conditions/Infill through 2015 Planning Area

Based on the reliable capacity of the existing system, a new well should be provided along with a storage and booster pump station immediately. The suggested location for the new well, storage tank and booster pump station is the northwest corner of the City in the proposed Liberty Park project and is shown on Figure 2-2.

The proposed tank will be located within a 219-acre commercial/industrial development. The City has identified this area as a potential location for a new well and water storage tank located within the development. Discussions with land owners and consideration of development plans currently under preparation will be necessary to site the tank, well and booster pump station facilities. The site should be large enough for two 1 Mgal storage tanks (one now, then one in the future), the pump station, and ideally the well site. Initially the well would pump directly into the tank, then water would be pumped through the booster pump station into the system.

Currently all of the water supply wells are located east of McHenry Avenue and the proposed improvements at this location would provide fire flow within the new industrial development reinforce the water supply to existing development west of McHenry Avenue.

Initially the capacity of the booster pump station would be around 3,000 gpm expandable to 7,000 gpm at ultimate build-out conditions. Based on the revised market demand projections, 4,000 gpm would be adequate through 2025; however, pump cans and piping should be designed to provide additional flow more closely reflecting build-out condition. Over sizing these components adds minimal cost to the project, but provides flexibility for future expansions.

The booster pump station would pump from the tank, supplied by the new well, to the distribution system. With the addition of the storage tank and booster pump station, only one new well would be required; however, if the tank and booster pump station were not installed, a second well would be necessary to meet the maximum demand periods with the larges source out service. The storage tank and booster pump station would receive SSJID surface water supply in the future.

Distribution system improvements are shown on Figure 2-2 and described in Table 2-5 along with the water supply improvements at the end of this section.

2015 through 2020 Planning Area

Additional pumping capacity at the booster pump station is recommended, and would consist of adding approximately 1,000 gpm of capacity to increase the reliable pumping capacity from 3,000 to 4,000 gpm. The additional pumping capacity is necessary to meet the maximum day plus fire flow condition. Expansions to the pump station could be accomplished relatively easily by adding an additional pump, replacing one or more of the existing pumps, or modifying the pumps and motors to provide the additional capacity. These alternatives should be determined as part of the predesign. During the initial design of the pump station, features should be included to accommodate the expansion such as ensuring the piping, electrical equipment, etc. and should be sized for future facilities.

It is likely that the SSJID surface water supply will be available about this time. The SSJID water will supplement the City's groundwater supply and provide a redundant source of supply. The timing of the SSJID supply could vary depending on a number of factors including: the actual demands in the City, schedule of the SSJID Phase II expansion, and financial considerations associated with the necessary improvements.

The SSJID water supply is important from the City's long-term water supply and reliability perspective as part of a conjunctive use program, but there is not an acute need for the SSJID water to meet projected demands based on the market projections at least through 2020, and probably sometime beyond that based on current expectations of well yields in the area and the addition of the storage tank(s)/booster pump station.

Due to the apparent ability of the groundwater supply to meet future demands, the City may have opportunities to temporarily lease or sell a portion of its SSJID allotment to other project Cities that do not have well capacity or other sources of supply. These opportunities provide an interim solution to the other Cities, while potentially offsetting some of Escalon's costs to participate in the project in the future. The long-term aquifer yield in the Escalon area should be verified via a hydro-geological characterization to ensure that the well yields will be adequate meet demands. Permanently relinquishing its ability to receive surface water is not recommended at this time.

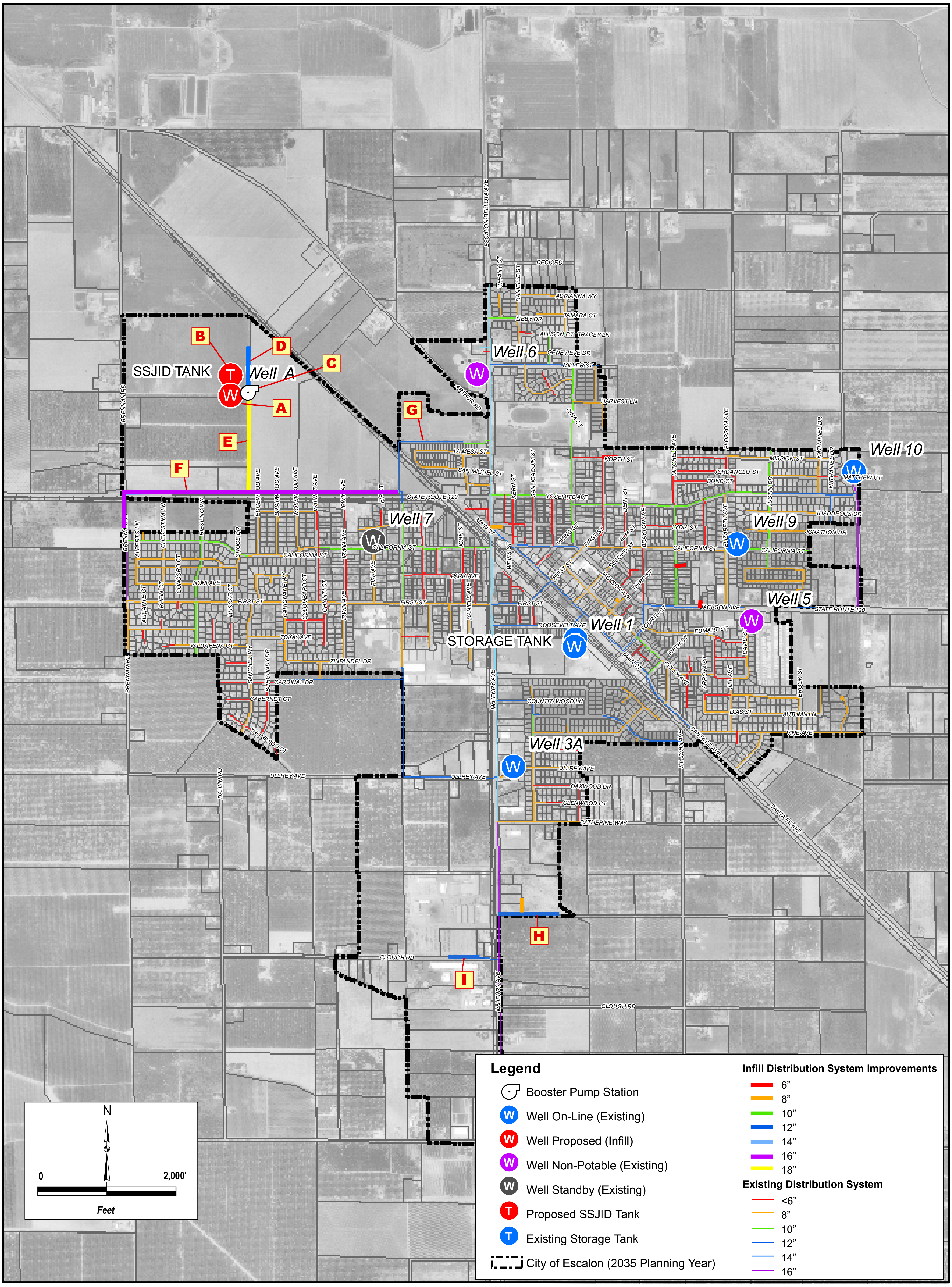

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Figure 2-2
Water Distribution System
City Infill Through 2015 Planning Area

In fact, the ability to receive surface water could be integral in the City's long-term plans such as an aquifer recharge program. A recharge program would involve recharging the aquifer using treated surface water from SSJID during the winter months when demands at the water treatment plant are low, and there is excess capacity – in fact this could be a tool that other project Cities utilize, however there are permitting issues with the Department of Health Services and the Regional Water Quality Control Board that would need to be addressed. Utilizing excess plant capacity during the non-peak season for the purpose of aquifer recharge is common in Nevada where water supplies are less substantive than in California, and recharge is an integral part of the State's water supply.

Distribution system improvements are shown on Figure 2-3 and described in Table 2-5 along with the water supply improvements at the end of this section.

2020 through 2025 Planning Area

Based on the market projections, a new well will be needed to satisfy peak demand conditions. A preliminary location for the well is shown on Figure 2-4; however, the actual location should be in an area near, or adjacent to the concentrations of growth within the City. If demands do not manifest because growth occurs more slowly than anticipated, the addition of the additional well can be delayed. Water supply improvements after 2020 will depend on the actual demands resulting from growth in the City.

Addition of the second 1 Mgal storage tank is also recommended. With the addition of the second tank the system storage would be increased to 2.5 Mgal (including the existing tank at Well 1, and would provide about one average day's worth of storage, and just under half a max day of storage, which is adequate for meeting peak demand periods with the additional wells within the system. Addition of the second tank will also allow for heavy maintenance on the existing tanks, such as recoating, which typically lasts 10 to 15 years.

2025 Through Build-Out Conditions

This condition represents the growth beyond that included in the market projections for water demand. Water supply improvements identified herein can be provided on an as needed basis. These water supply improvements will not likely be needed for 20 to 30 years unless the City allows for more rapid growth. Due to the length of time between current conditions to the likely build-out, the additional wells have not been included in the capital cost estimates, or in the connection charge calculation included in Section 6.

Distribution system improvements shown may be needed and will depend on the location of development within the City. The larger diameter pipelines are considered master plan facilities and have been included in the capital cost estimates because they may be needed if development occurs in the southern portion of the City.

Based on the build-out water demand projections up to three additional wells could be needed as some point in the future. These include Wells C, D, and E that would be located in the southern portion of City. The City should consider identifying sites for these wells for future use.

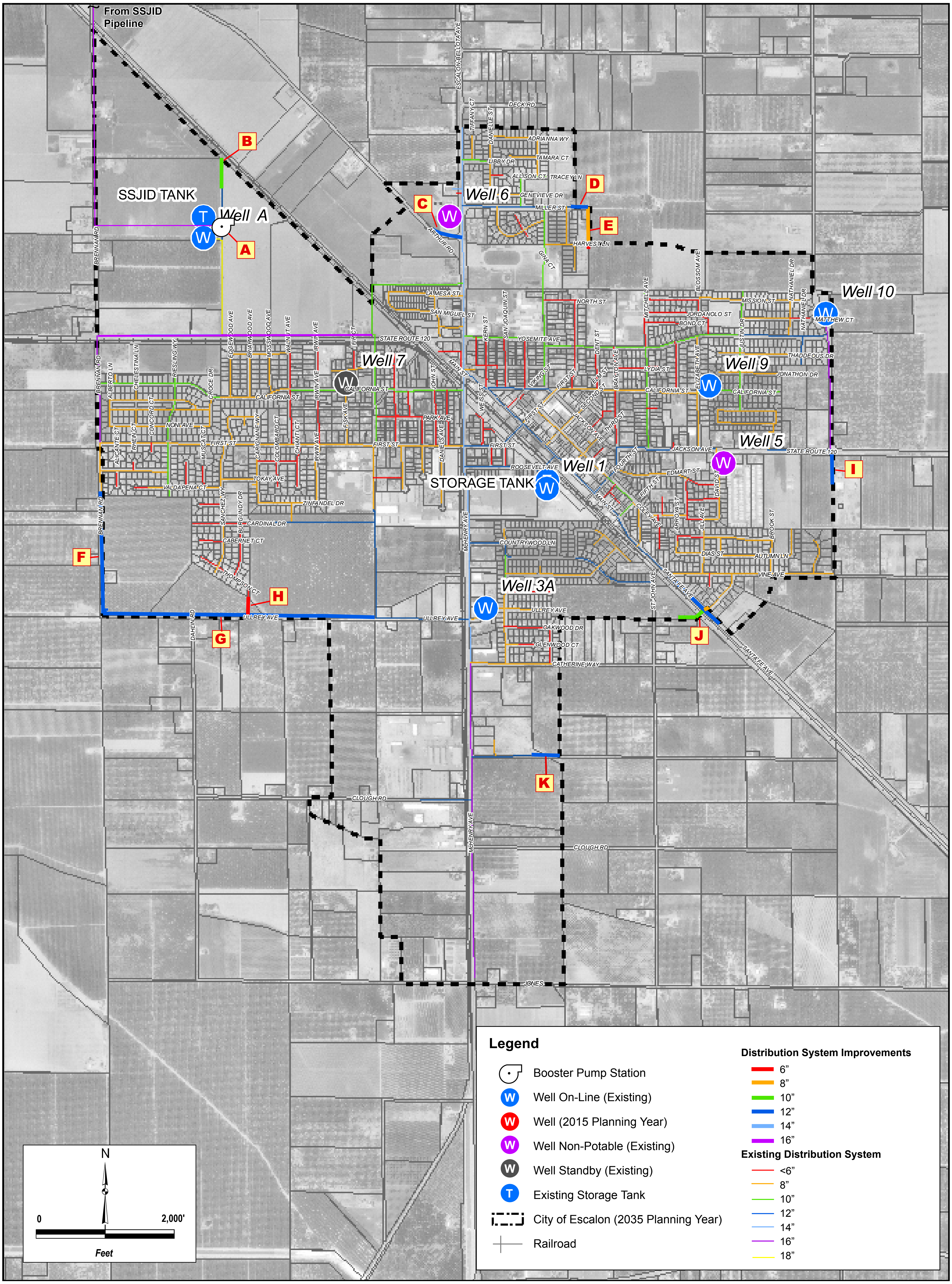

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Figure 2-3
Water Distribution System
2015 Through 2020 Planning Area

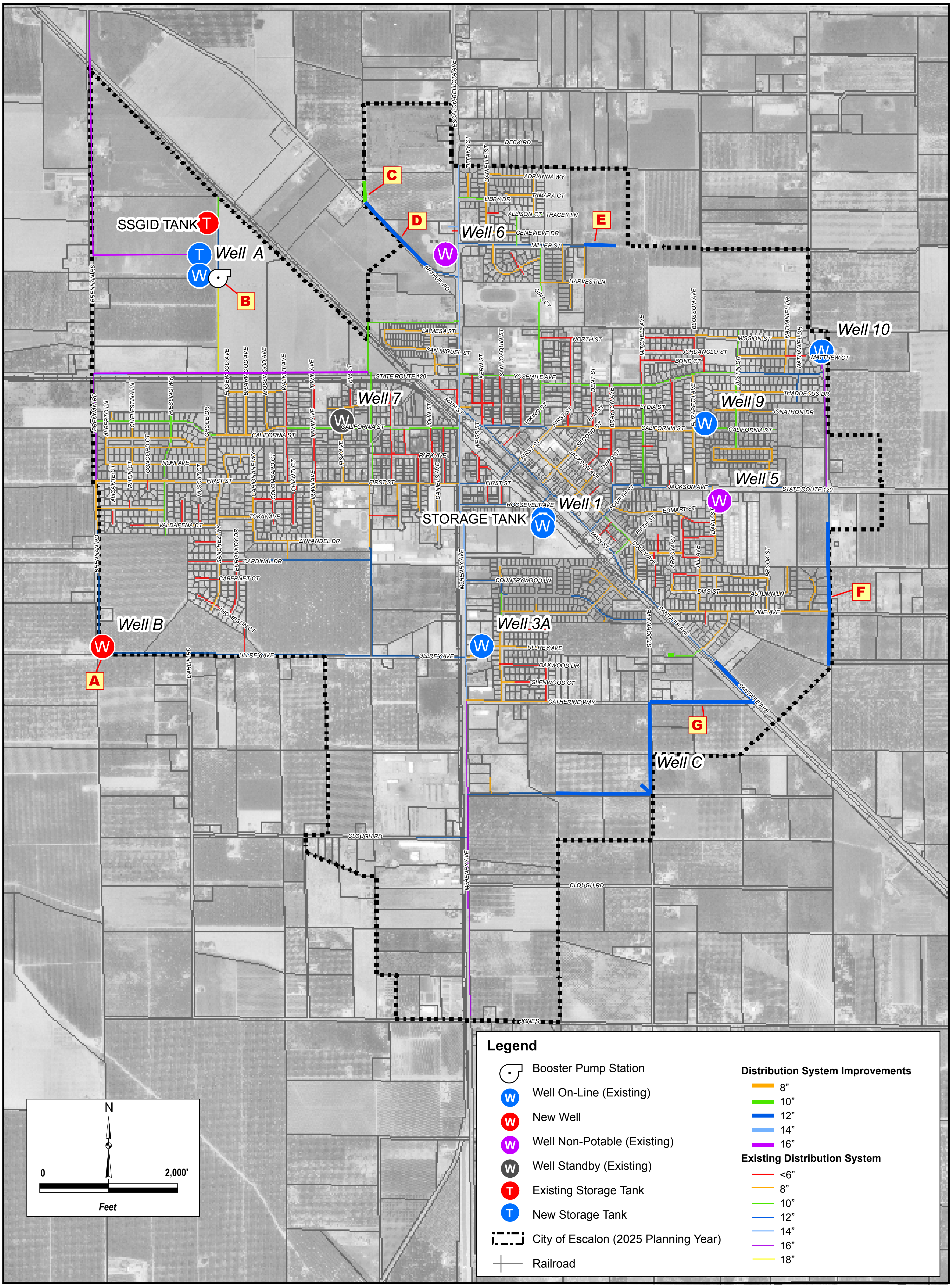

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Figure 2-4
Water Distribution System
2020 Through 2025 Planning Area

The booster pump station located at the 1 Mgal tank site will also need to be upgraded, potentially upwards of 7,000 gpm based on full build-out of the City's General Plan.

Planning improvements through 2035 includes a lot of uncertainty. The proposed distribution system improvements are shown on Figure 2-5 and described with the water supply improvements in Table 2-5. Adjustments to the well locations and pipeline alignments would be anticipated.

Table 2-5
Proposed Improvements

Infill Through 2015 Horizon		**Cost[a]**
Water Supply		
A	New water supply well with minimum capacity of 1,200 gpm located in northwest corner of City	N/A
Storage/Pumps		
B	New one million gallon treated water storage tank – site piping to allow for future tank	$1,200,000
C	Construct 3,000 gpm booster pump station	$500,000
Distribution		
D	Construct approximately 700 lf of 12-inch diameter pipeline north from Well A	$84,000
E	Construct 1,400 lf of 18-inch diameter pipeline south from Well A to State Highway 120	$252,000
F	Construct approximately 3,900 lf of 16-inch diameter pipeline parallel to State Hwy 120 (preferably out of highway right-of-way)	$624,000
G	Construct approximately 2,800 lf of 12-inch diameter pipeline extending north of the State Highway 120; bore under UPRR tracks and connect to existing 10-inch diameter pipeline north of La Mesa Street	$336,000
H	Construct approximately 400 lf of 12-inch pipeline along the southern boundary of existing City limit	$48,000
I	Construct approximately 800 lf of 12-inch pipeline along Clough Rd	$96,000
	Miscellaneous smaller pipes	$30,800
	Subtotal	$3,171,000
	Contingencies at 20%	$634,000
	Subtotal	$3,805,000
	Administration, Engineering @ 20%	$761,000
	Phase I contribution to SSJID Project [c]	$700,000
	Total	$5,270,000

[a] 2006 cost level.
[b] Cost of new well already included in current City budget and not included in cost projections.
[c] Based on the remaining SSJID balance.

Table 2-5
Proposed Improvements (cont'd)

2015 Through 2020 Planning Area		Cost[a]
Water Supply		
A	Provide additional 1,000 gpm of capacity to Booster Pump Station 2 – total reliable capacity of 4,000 gpm	$150,000
Distribution		
B	Construct approximately 400 lf of 10-inch diameter pipeline north of Well A connecting to the 12-inch pipeline	$40,000
C	Construct approximately 500 lf of 12-inch diameter pipeline to connect Arthur Rd with McHenry Rd.	$60,000
D	Construct approximately 300 lf of 12-inch diameter pipeline along Miller St.	$36,000
E	Construct approximately 500 lf of 8-inch diameter pipeline south of Miller St.	$40,000
F	Construct approximately 1,000 lf of 12-inch diameter pipeline north of Well B along Brennan Rd.	$120,000
G	Construct approximately 3,900 lf of 12-inch diameter pipeline east of Well B along Ullrey Ave.	$468,000
H	Construct approximately 300 lf of 6-inch diameter pipeline to connect Thompson Ct with Ullrey Ave.	$18,000
I	Construct approximately 500 lf of 12-inch diameter pipeline along eastern boundary of City south of Highway 120	$60,000
J	Construct approximately 1,000 lf of 8, 10, and 12-inch diameter pipeline along Santa Fe Road	$108,000
K	Construct approximately 400 lf of 12-inch diameter pipeline along unnamed road in the southern part of the City	$48,000

Subtotal	$1,148,000
Contingencies at 20%	$230,000
Subtotal	$1,378,000
Administration, Engineering @ 20%	$276,000
	$164,000
Phase II contribution to SSJID Project including treatment and pipeline[b]	$5,837,000
Total	$7,491,000

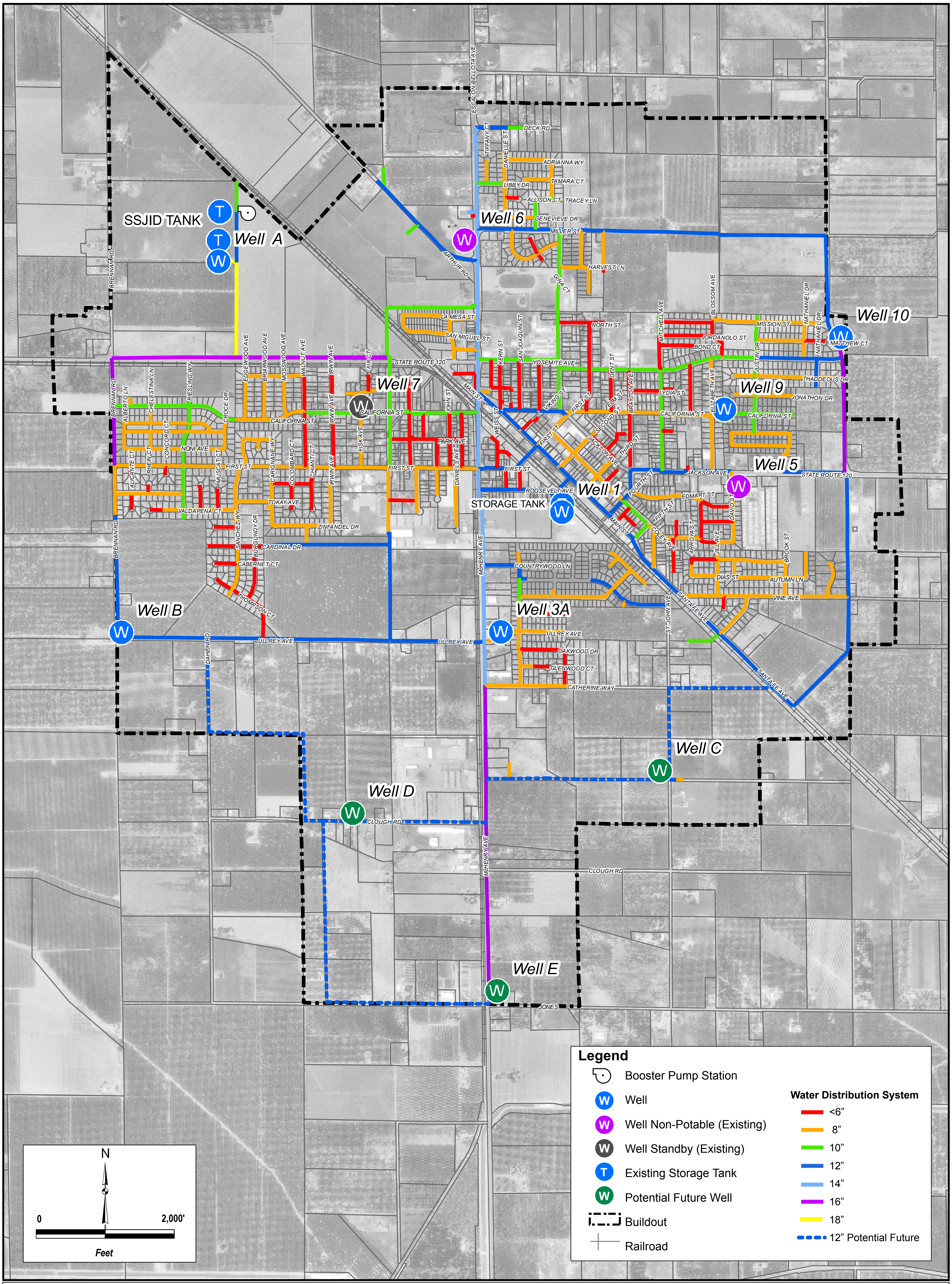
[a] 2006 cost level.

[b] SSJID Phase II cost based on B&V estimates, omitting tank and adjusted with ENR for 2010. Cost includes the pipeline and engineering.

Table 2-5
Proposed Improvements (cont'd)

2020 Through 2025 Planning Boundary		Cost[a]
Water Supply		
A	New proposed well in southeastern corner of City	$1,000,000
Storage/Pumps		
B	Add a second 1 Mgal storage tank	$1,000,000
Distribution		
C	Construct approximately 300 lf of 10-inch diameter pipeline to connect to Arthur Rd.	$30,000
D	Construct approximately 1,300 lf of 12-inch diameter pipeline along Arthur Rd.	$156,000
E	Construct approximately 500 lf of 12-inch diameter pipeline along Miller St.	$60,000
F	Construct approximately 2,000 lf of 12-inch diameter pipeline along eastern boundary of City south of Highway 120	$240,000
G	Construct approximately 5,100 lf of 12-inch diameter pipeline west from Well C and to the northeast to connect with an existing 12-inch pipeline on Santa Fe Ave.	$612,000
	Subtotal	$3,098,000
	Contingencies at 20%	$620,000
	Subtotal	$3,718,000
	Administration, Engineering @ 20%	$744,000
	Total	$4,460,000
	Project Total	$17,221,000

[a] 2006 cost level.



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*Potential improvements past 2025 may be needed, but will depend on actual long-term development.

Figure 2-5
Water Distribution System Complete Buildout

2.4 RECOMMENDED CONNECTION CHARGE

Capacity improvements and associated capital costs have been identified in previous sections of this master plan. Facilities financed with connection charges include backbone facilities such as water supply, storage/pumping and distribution system improvements, which provide the necessary capacity to serve future growth. A recommended water connection charge to fund these improvements is developed in this section. Consistent with California law, the cost of future expansions should be assigned to future development and not existing users.

Specific onsite improvements within specific developments that are needed to provide service to the development include distribution system piping, services, blow offs, fire flows in excess of normal requirements, and other appurtenances. These improvements are financed by the developer, constructed to City standards and deeded to the City. These “onsite” improvements should be paid for by the developer and are not included or credited to the connection charge fees.

Depending on the nature of the improvements and the amount and timing of development, sufficient funds from connection charges may not fully fund the capacity expansions in the short-term. In such cases it is typical for developers to provide capacity in excess of their need with a reimbursement from the City as additional connections occur. Based on that approach, connection charges established herein do not include financing costs.

2.4.1 METHODOLOGY

Connection charges presented herein are based on a slightly different approach compared to the historical method which looked at the cost of capacity based on actual flow. To simplify the process of determining the share of these costs for which an increment of future development is responsible, the concept of the Equivalent Dwelling Unit (EDU) will be used. An EDU represents the water demand in relation to the water demand for a single family dwelling unit.

This method is a common and simple means of determining the connection charge and still considers the relative demand that new service places on the system. This new approach is simpler, especially given the variations in the relative unit costs of capacity between groundwater and surface water that will be a factor for the City in the near future.

2.4.2 FORMULATION OF CHARGE

The total estimated cost of improvements to serve development through 2025 based on the market condition projections is $17.2 million dollars with an estimated additional 2,220 EDU added as shown in Table 2-6. The number of EDU represent the equivalent number of single family homes from a water demand standpoint; however, much of the future water demand will generated by commercial and industrial use. The City’s current growth ordinance limits the number of residential building permits to 75 per year. Therefore between 2007 through 2025 a maximum of 1,425 homes are anticipated. The remaining EDUs represent commercial and industrial demand.

Table 2-6
Summary of Residential Connection Charge

Year	Avg. Annual Flow, mgd	EDU Added	EDU
2006 [a]	1.5	---	2,778
2010	1.7	370	3,148
2015	2	556	3,704
2020	2.4	741	4,444
2025	2.7	556	5,000
		2,222	

[a] Based on 1.5 mgd average annual flow at the end of 2006.

In order to fund future expansions the connection charge must be adequate to cover the cost of expanding the system capacity. Based on the number of new connections (including all commercial and industrial development that is expected, converted to EDUs) and capital costs the average cost per EDU is $7,740.

Residential Connection Charge

The connection charge will vary depending on the type of development (e.g. single family, duplex, multi-unit, etc.) and the demand on the system. Table 2-7 includes a summary of the various types of residential development. Recommended connection charges are included for single family dwellings and for duplexes. There is significant variation in the type of multi-family and apartment buildings, and their associated water demands. Based on historical meter data, average water demand ranges from about 2,000 to about 9,500 gpd for multi-unit and apartments, respectively. The usage rate depends on the number of units, landscaping, and amenities (e.g. pool, spa and landscaping). Connection fees for multi-family and apartments should be based on the meter size and usage as discussed in the following section.

Table 2-7
Summary of Residential Connection Charge

Water User	Equivalent Dwelling Units (EDUs)	Annual Average Water Demand Factor, gpd/connection	Connection Charge
Single-Family Home	1.0	540	$7,740
Duplex[a]	1.37	740	$10,600
Multi-unit Housing	Varies	2,000[a]	Site specific
Large Apartment	Varies	9,500[a]	Site specific

[a] Based one meter for two units.
[b} Demand factor can vary. Connection charge should be based on site specific conditions related to demands.

Non-Residential/Multi-Unit/Apartment Connection Charge

Non-residential, multi-unit and apartment connection charges are discussed in this section. Historically the connection charges have been calculated using the meter size as determined by the meter equivalence ratio. This method can result in a connection fee that is too high or low in the larger meter sizes.

The minimum recommend connection charge for 1.5 through 6-inch meters is included in Table 2-8, and is directly proportional to the meter size and ratio. However, an alternative means of calculating the connection charge for commercial/industrial and multifamily sites is recommended based on the use ratio compared to single family dwelling unit. The applicant should provide the City with the average and maximum day water demands expected to be placed on the system which can then be converted to an EDU basis and used to determine the connection charge. This information would be submitted as part of the will serve application for the development.

Table 2-8
Non-Residential Water Service Connection Charge

Meter Size	Based on Historical Meter Ratios	Based on Revised Meter Ratios[b]
5/8	$7,740	n/a
3/4	$7,740	$7,740
1	$10,835	$13,160
1.5 [a]	$13,932	$24,540
2 [a]	$22,445	$41,020
3 [a]	$85,140	$90,660
4 [a]	$108,360	$162,540
6 [a]	$162,540	$541,800

[a] Minimum recommended connection charge; to be determined on a site specific basis.
[b] Revised meter ratio based on ¾ meter as standard.

Summary of Proposed Water Connection Charge

The proposed water service charges for residential and non-residential water connections are included in Table 2-9. The connection charges are considered based on demands for the particular non-residential service. Connection charges for metered services larger than 1-inch should determined on a site specific basis.

2.4.3 Indexing of Fees

Indexing is used to provide for automatic adjustment of fees to account for inflationary cost increase. The enabling ordinance can provide for automatic fee adjustment on a prescribed date each year, or every other year or third year, etc. Annual indexing revisions are recommended to minimize the magnitude of the change and insure that revenue more closely follows expenses. One approach involves adjustment based on an accepted cost indicator such as the CPI (Consumer Price Index) or the ENR Construction Cost Index. The latter is preferred since it more closely reflects costs in the construction industry, which are used as the basis for computing connection fees. This approach provides the most accurate adjustment, although the incremental change (increase or decrease) is not known beyond the current year.

Table 2-9
Summary of Recommended Water Connection Charges

Service Type	Connection Charge
Residential Connection Fees	
Single Family	$7,740
Duplex	$10,600[a]
Multi-Unit and Apartments	Site Specific
Non-Residential Connection Fee	
Meter Size, in	Connection Charge
5/8	n/a
3/4	$7,740
1	$13,160
Meter Size, in	Min. Connection Charge [b]
1.5	$24,750
2	$41,020
3	$90,660
4	$162,540
6	$541,800

[a] Based on one meter serving two units.
[b] Recommended minimum connection charge; to be considered on site specific conditions.

2.5 IMPLEMENTATION PLAN

This proposed implementation plan outlines the infrastructure improvements necessary to serve expected development as defined in the City's General Plan by increasing the City's water supply, and improving the City's storage/pumping and distribution systems. Project phasing will depend on the rate of growth experienced in the City. The City recently completed a General Plan Update (General Plan) and projected water demands are based on the boundaries and land uses described in that document. Estimated capital costs have been provided for the improvements and used to calculate the water connection charge.

2.5.1 RECOMMENDED PROJECT

Improvements for each planning boundary identified in the General Plan are described in Section 5. They include:

- New domestic water supply wells
- Construction of a new potable water tank and booster pump station
- Implementation in the South San Joaquin Irrigation District South County surface water supply project
- Transmission and distribution system pipeline extensions

Approximate locations within the City have been identified for the new water supply wells as well as the point of connection to a new surface water supply. A hydraulic model was prepared and used to size pipelines. The locations of new wells will vary depending on the specific development plans in each area; however, it is recommend they be kept in the general vicinity shown on the figures.

The transmission and distribution system piping have been sized based on the water demand projections associated with the planning boundaries identified in the General Plan; however, water supply improvements are based on lower water demands associated with the market condition water demand estimates that account for the slow growth within Escalon.

2.5.2 PROJECT SCHEDULING

Project scheduling will depend largely on the rate and location of development within the City. The planning boundaries defined in the General Plan include:

- 2015 General Plan Growth Boundary
- 2025 General Plan Growth Boundary
- 2035 General Plan Growth Boundary

Growth projections were provided in the General Plan Background Report (February 2004) based on projected market demands and reflecting the City's current growth restriction ordinance. Water demands based on the General Plan Planning Boundaries were considered to be unrealistic. The recommended improvements (e.g. wells) are based on water demand projections generated assuming "market conditions" will control growth as opposed to the projections developed using the Planning Boundaries included in the General Plan. Utilizing the market condition analysis, planning periods of 2010, 2015 and 2025 were identified.

The SSJID surface water supply was anticipated to be available around 2012; however, it appears it may be delayed until participating Cities need the additional water supply. For the purpose of this report, water from SSJID was assumed to be available around 2015. At that time the City will be required to contribute its share of the project cost. Prior to then, the new tank, well and booster pump station will likely be constructed in the northwest industrial park area (as described in Section 5). After the surface water supply is online, the well at the tank site can be used to supplement the surface water or used as a back up during service interruptions from the SSJID project.

The improvements included in Section 5 are based on water demand projections utilizing the market projection from the Background Report and are expected to be needed in time frames which differ substantially from the 2015, 2025 and 2035 scenarios presented in the General Plan. As demands increase, those projects should be implemented.

2.5.3 CONNECTION FEES

Connection fees have been calculated based on the improvements necessary to provide additional water supply and distribution capacity to future development. Capacity charges were calculated based on a cash pay-as-you go basis, whereby connection fees collected by the City are used to construct facilities as they are needed and there are no costs associated with financing included in the recommend charges. Therefore, developers will be required to provide upfront capital to fund major projects, this is particularly true with the SSJID supply.

The connection fee calculation has been modified from the City's historical practice of utilizing the cost of capacity based on a gallon per minute basis. Although this method provided a fair and equitable means, it is not convenient with the inclusion of the SSJID surface water supply. The unit cost of that supply on a gallon per minute basis is significantly higher than utilizing wells. Instead the capital cost to construct the facilities was used in conjunction with the number of units that can be served by the new capacity. The cost was then divided on a per unit basis to arrive at a per EDU charge.

New development will pay based on its demand on the system as a multiple of an EDU. The City should consider this new means of calculating the connection charge and up date its fee schedule through its formal rate setting procedure. Once adopted, the connection charge should be adjusted annually based on an accepted index. One approach involves adjustment based on an accepted cost indicator such as the CPI (Consumer Price Index) or the Engineering News Record (ENR) Construction Cost Index. The latter is preferred since it more closely reflects cost changes in the construction industry, which are used as the basis for computing City connection fees. This approach provides the most accurate adjustment, although the incremental change (increase or decrease) is not known beyond the current year.

2.5.4 Future Updates

The water master presented herein should be adopted by the City and implemented accordingly. Periodic updates to the master plan are recommended on a five to ten year basis to ensure that the assumptions presented herein remain valid. The Master Plan should also be updated if any major changes in the City's growth ordinance policy occur that would significantly increase the number of residential building permits issued.

Section 3

Land Use and Water Demand

Projections of future water demands, including the magnitude and location, are necessary to plan future water system improvements. Water demands are developed in this section using approved land uses included in the City's General Plan (June 2005) and the General Plan Background Report (February 2004). Projected water demands for various levels of development were considered from current conditions through the ultimate build-out condition in 2035, as defined in the General Plan.

The planning boundaries defined in the General Plan include:

- 2015 General Plan Growth Boundary
- 2025 General Plan Growth Boundary
- 2035 General Plan Growth Boundary

Although each planning boundary is identified with an apparent time line, the City plans to develop the area encompassed by each boundary prior to growing into the subsequent boundary. As an example the land within the 2015 boundary could develop sooner or later than 2015, and will depend on a number of factors out of the City's control including the economy, interest by the development community to construct in Escalon, public support/opposition of new projects, etc. City Planning staff will monitor growth and determine the appropriate point to expand the City boundary for development based on actual development. This approach is necessary to control development within the City limits to prevent isolated pockets of growth non-contingent to the outer boundary of existing development. This process tends to be self regulating due to the cost to extend facilities for water, sewer, roads, etc. which make it cost prohibitive to develop a long distance from existing development and facilities.

3.1 LAND USE

Existing and future land use was established from the City of Escalon General Plan and parcel data provided by the San Joaquin County Assessor office. The General Plan considers three planning boundaries for the years 2015, 2025, and 2035. For planning water system demands and improvements, various levels of development were considered in an effort to stage future infrastructure commensurate with planned growth. The planning boundaries used for master planning improvements include:

- Existing City Limit
- 2015 General Plan Growth Boundary
- 2025 General Plan Growth Boundary
- 2035 General Plan Growth Boundary

A summary of the land uses is included below based on existing land use and future projections.

3.1.1 EXISTING LAND USE

The existing land uses within the current City limits are shown on Figure 3-1. A summary of existing land use within and outside of the City limits is presented in Table 3-1.

Table 3-1
2002 Existing Land Use, acres [a]

Land Use	Within the City Limits	Outside City Limits Within SOI	Total
Right-of-Way	246	24	270
Agriculture	321	643	964
Commercial	71	0	71
Industrial	87	0	87
Park/Open Space	41	0	41
Public Facilities	82	0	82
Quasi-Public	18	0	18
Residential	451	33	484
Vacant	109	22	131
Total	1,425	722	2,147

[a] Source: City of Escalon General Plan Update Background Report (February 2004)

3.1.2 FUTURE LAND USE

The General Plan projects land uses within the City Limits as listed in Table 3-2 and shown in Figure 3-2. During the process, the County tax assessor data was used to determine the current land uses within the City. Some discrepancies were identified in the tax assessor data and relatively minor corrections were made. As a result, the total acreages will not match general plan land uses precisely, but will not impact water demand projections.

Although not expressly stated in the General Plan documentation, the planners added additional land over and above what would be expected to develop within the defined planning boundaries. The additional land provides the developers options and choices regarding what parcels are actually developed in the future, and as a result, there is no means to determine which areas will develop, to what level, and how quickly.

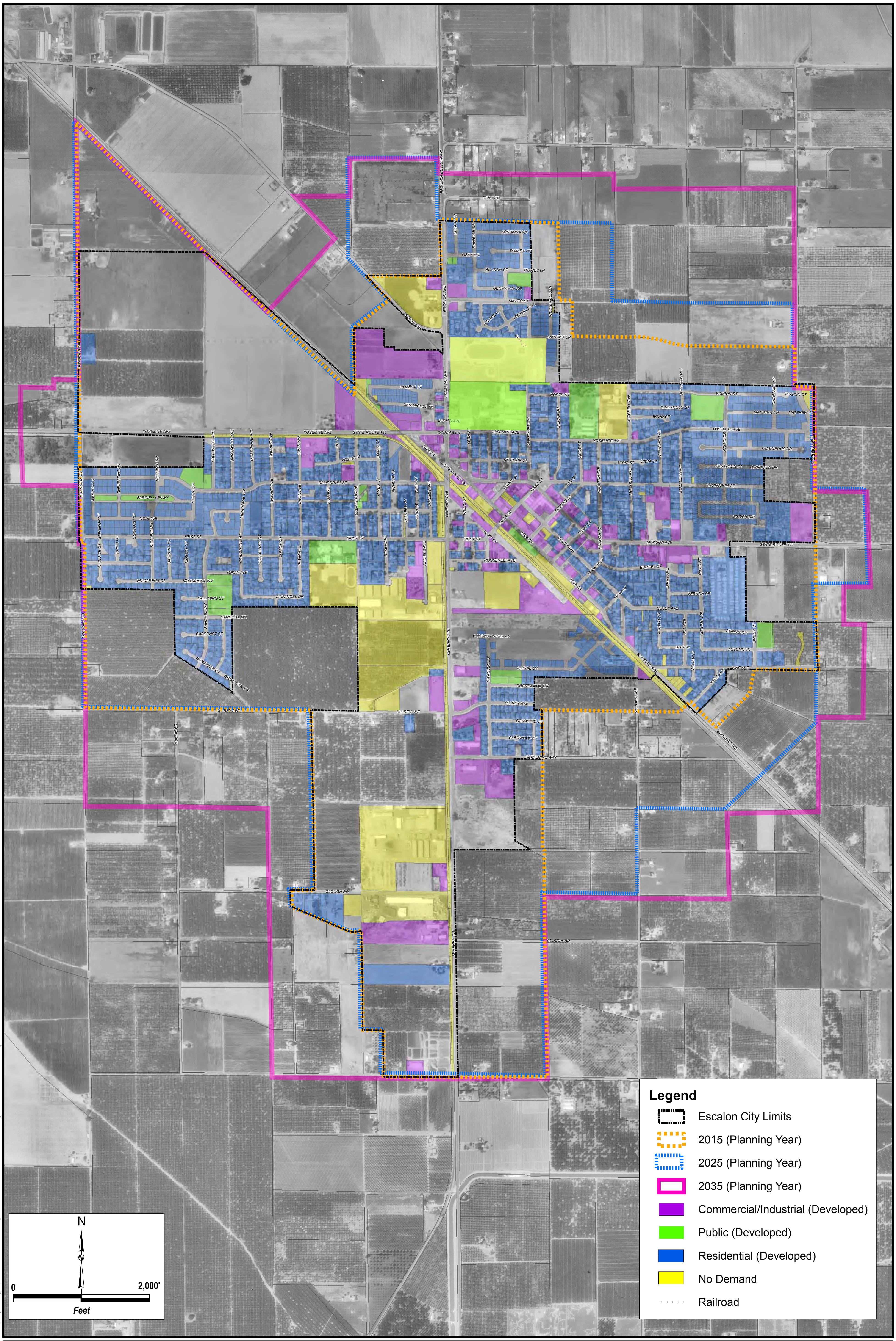

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Figure 3-1
Existing Land Use

Table 3-2
General Plan Land Use by Planning Boundary, acres

General Plan Land Use Category	Acres Added				
	Current	2015	2025	2035	Total
Commercial	175	22	23	25	245
Industrial	370	102	0	90	562
Low Density Residential	413	254	242	317	1,226
Medium Density Residential	29	10	0	6	45
High Density Residential	29	17	4	0	50
Park/Open Space	42	10	52	33	137
Public Facilities	72	0	0	0	72
Total	**1,130**	**415**	**321**	**471**	**2,337**

Source: City of Escalon Environmental Impact Report, April 2005, and ECO:LOGIC Engineering 2006 Land Use Survey.

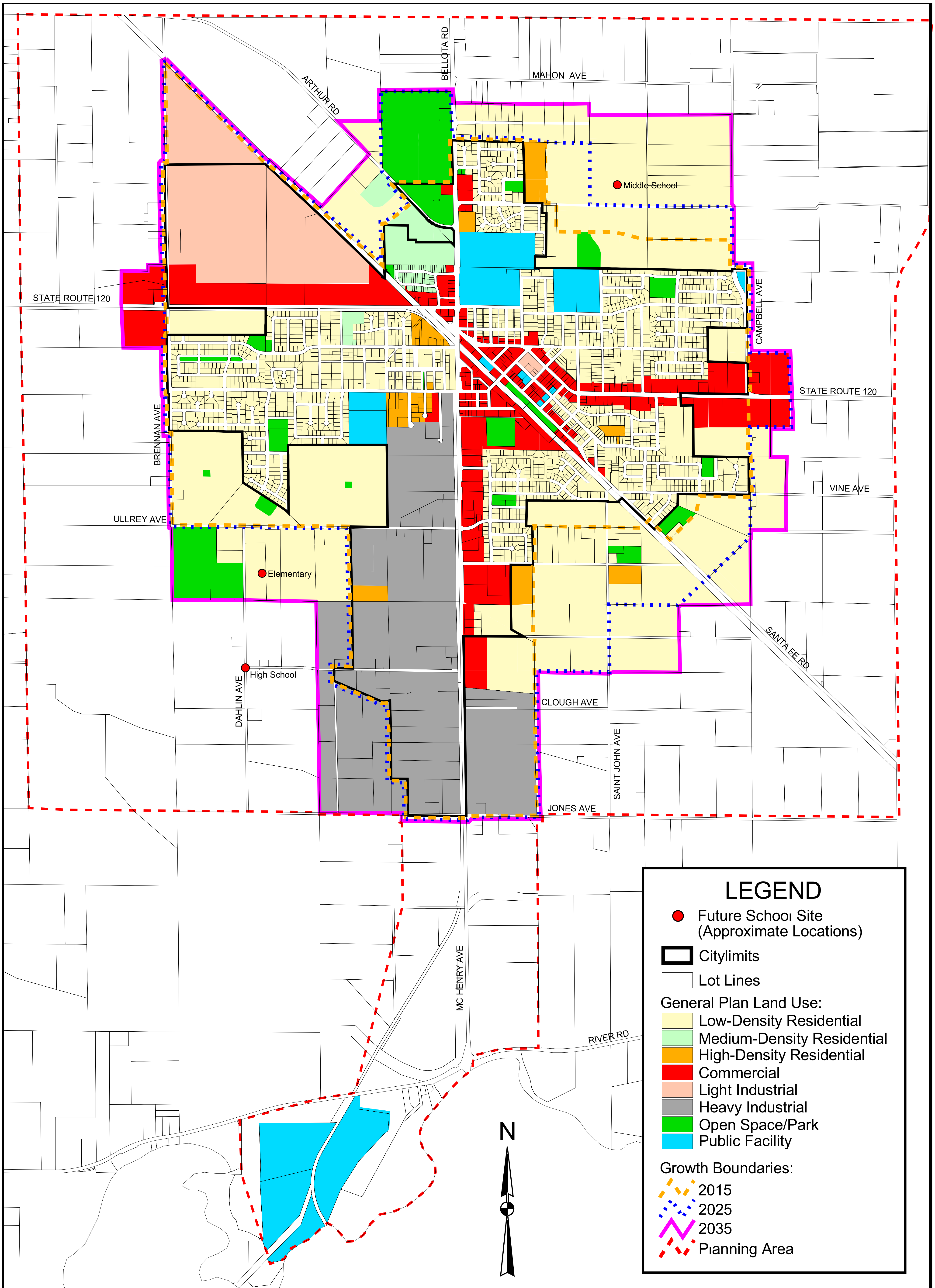
The largest restriction on growth is the number of residential building permits that will be issued on an annual basis, which is limited to a maximum of 75 single-family residential building permits by the City's growth ordinance. Even though the City's growth ordinance does not limit commercial and industrial growth, the commercial and industrial businesses rely upon serving the new residents and will be affected by the limited growth of the residential areas. The estimated population and projected acreage needed for the various types of development was proposed for 2005 through 2025 and is summarized in Table 3-3. These projections reflect the City's current growth policies, and were provided by the planners in the General Plan Update Background Report (February 2004).

Table 3-3
Community Development Needs, 2005-2025[a]

Year	Population	Added Residential (Acres)	Added Commercial (Acres)	Added Industrial (Acres)
2005	7,150	3	0	1
2010	8,350	79	4	15
2015	9,550	156	7	30
2020	10,750	232	11	45
2025	11,950	308	14	60

[a] Source: City of Escalon General Plan Update Background Report (February 2004)

The potential maximum number of residential units added per the General Plan planning boundaries is shown in Table 3-4 based on the projected land uses shown in Table 3-2. Future water demands were projected from these additional units and represent the potential maximum water demand if land fully developed per the land uses included in the General Plan.



Source: City of Escalon, 2005

Figure 3-2
General Plan Zoning Map

As discussed above, the planners do not anticipate that all of the land will be developed within a particular General Plan planning boundary within the time frame indicated; however, for projecting water demands and future distribution and transmission facilities, full build-out was assumed to prevent under sizing the facilities resulting in the need to return and upsize or add major infrastructure in the future. Based on actual growth and associated increases in water demands, the City will be able to determine which master planned water supply and storage components identified in Section 5 should be constructed and when.

Table 3-4
Potential Maximum Units Added Based on Acres Added [a]

General Plan Land Use Category	Density, Units per acre [b]	Current	2015	2025	2035	Total
Low Density Residential	6	2,106	1,295	1,234	1,617	6,253
Medium Density Residential	12	296	102	0	61	459
High Density Residential	26	641	376	88	0	1,105

[a] Represents the maximum potential number of units that could be added during each planning phase, including current conditions.

[b] Assumes 85% of land can be developed to account for roadways, right-of-ways, etc.

Use of the maximum number of potential units to project water demands has a minimal effect on the size of the water transmission and storage facilities because the fire flow conditions govern sizing of the conveyance facilities. Unlike transmission and distribution pipelines which are installed under City streets, water supply improvements are more easily added incrementally (provided they are planned for and anticipated) as development increases demands.

3.2 WATER PRODUCTION

The historical water production rates from the City's existing wells were determined based on historical data. Production data represents the amount of water pumped into the distribution system. The majority of that water is sold and accounted for; however, a portion of the water is unaccounted for and "lost". Review of the production data is useful to view water demand trends, establish peaking factors, and quantify the unaccounted water.

3.2.1 SUMMARY OF WATER PRODUCTION

Daily meter readings are collected at all of the well sites and provide a means to calculate maximum day, monthly, and annual production. A summary of water production data from 1998 through 2005 was used for the analysis.

Annual Production

The combined annual water production from all of the domestic supply wells is included in Table 3-5 and is shown graphically in Figure 3-3. As expected, water production has increased over time in concert with growth.

Table 3-5
Annual Water Production

Year	Water Production, MG
1998	409
1999	507
2000	518
2001	509
2002	529
2003	559
2004	563
2005	557

Monthly water production patterns from 1998 through 2005 are shown in Figure 3-4. Water production for each month was compared to the annual average.

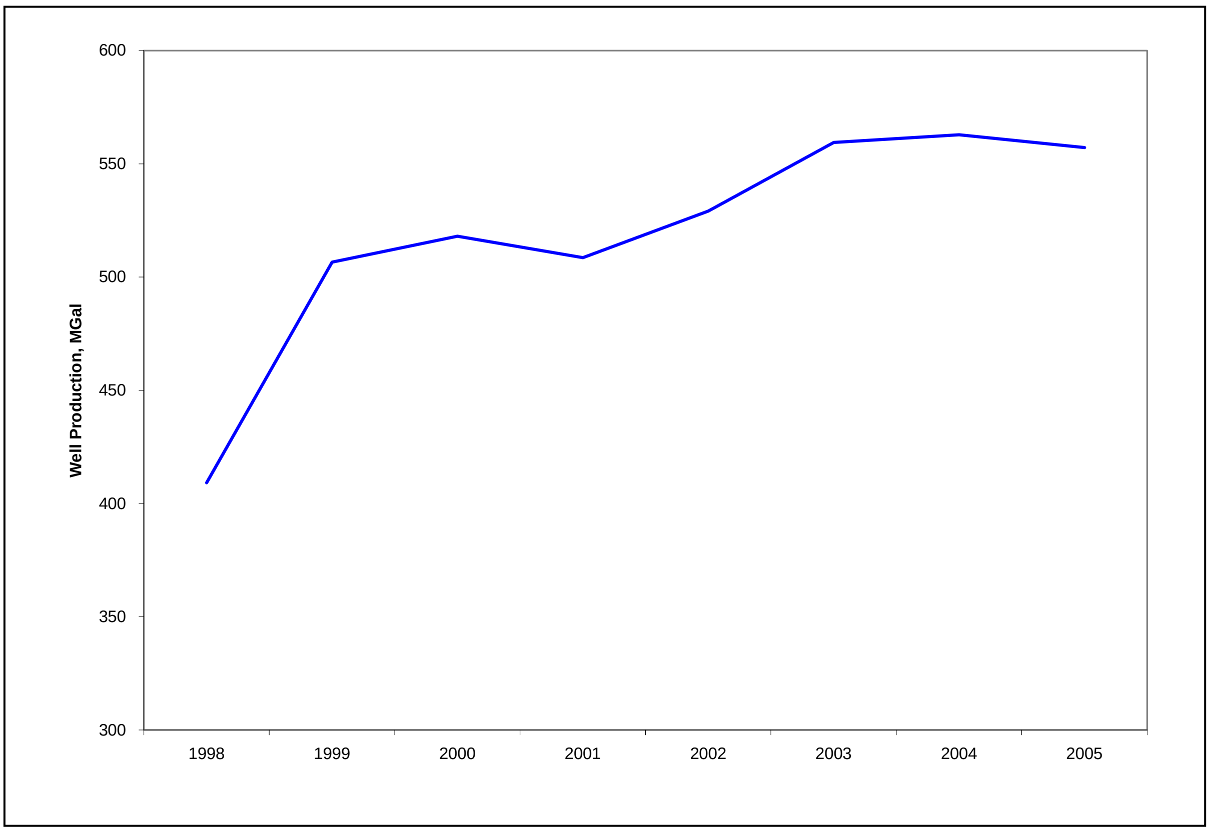


Figure 3-3
Annual Water Production Data

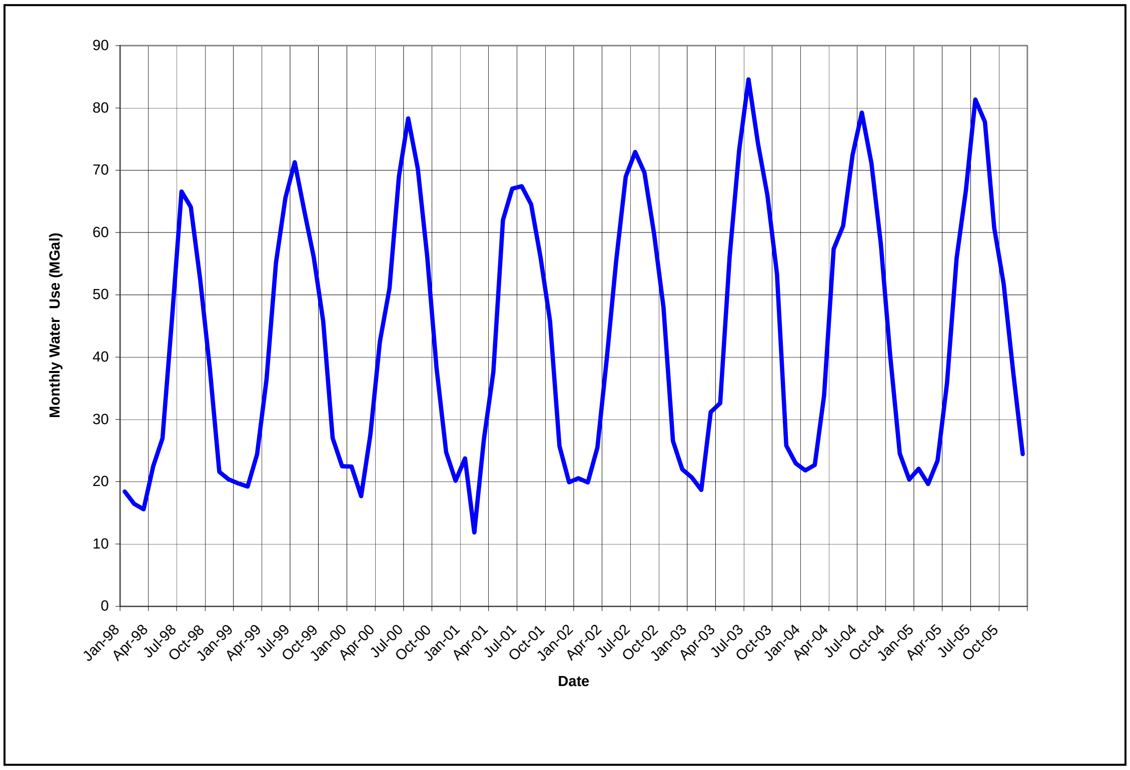


Figure 3-4
Monthly Water Production Data

Unaccounted Water

Unaccounted for water is considered water that is produced and distributed but is not sold or metered. Less than 10 residential services within the system are unmetered, so the residential unmetered component is considered negligible. The City tracks construction water usage and this has been included in the calculations. Sources of unaccounted water include:

- Leaks, slow meters, theft, fire protection.
- Unmetered construction water used for flushing pipelines.
- Unmetered water used for flushing dead ends within the system to maintain water quality.
- Irrigation of parks and median strips, the majority which are not metered.
- Backwashing of the water treatment units at Well 1.

Table 3-6 includes a summary of historical production and metered data. As shown in the table, the unaccounted water is around 20 to 23 percent. Unaccounted water is included in the water demand projections discussed later in this section.

Table 3-6
Unaccounted Water

Year	Production, Mgal	Metered Water, Mgal	Unaccounted Water, %
2002	563	434	20
2003	559	482	24
2004	529	424	23
2005[a]	224	172	23

[a] Data available through June 2005.

The average unaccounted for water based on the 2002-2005 data is 22.5 percent and was used in calculating future water demand and production data. Irrigation of parks and median strips probably account for the majority of the unaccounted for water.

Unaccounted water stays relatively constant and therefore was added on top of projected demands without a peaking factor applied.

Maximum Day Water Production

Production data is typically the only daily data available because individual service meters are read on a monthly or bi-monthly basis and is used to determine the maximum day demand. Daily reading of individual service meters is not practical. In the case of Escalon, the maximum day production would be expected to occur during July or August, as is the case with most systems. In 2005, the maximum day occurred in July and was about 3.5 Mgal/d and the maximum day during August was 2.8 Mgal/d. Maximum day and average month productions were determined and peaking factors as calculated in Table 3-7.

Table 3-7
Maximum Day Water Production

Month	Maximum Day Water Production, MGal/d	Average Production per Month, MGal/d	Ratio of Maximum Day to Monthly Average Production
July 2005	3,426,200	2,624,100	1.3
August 2005	2,833,100	2,507,700	1.1

[a] Based on 2005 water production data.

Diurnal Production Pattern

Water demands in the City of Escalon, as in all municipal water systems, are not constant throughout the day but vary with minimum flows typically occurring late at night with peaks occurring in the morning and again in the late afternoon.

The peak demand periods typically occur between 5:00 a.m. to 9:00 a.m. when customers are waking, showering, and irrigating outside landscaping. A second peak demand period typically occurs between 4:00 p.m. and 8:00 p.m. when customers are arriving home after work, preparing meals and performing outside chores such as landscaping. These peaks can be reduced by encouraging irrigation during non-peak hours.

Well production meters are read daily and no hourly data are available. A typical diurnal curve was used to determine the peaking factor for determination of the peak hour flow. The diurnal residential/commercial water demand pattern is based on the maximum summer demand curve from Figure 15.2, Water Resources and Environmental Engineering 4th Edition (McGraw Hill as shown in Figure 3-5). The curve is based on a system of an annual average flow of 1.5 Mgal/d, similar to the City's current level of demand.

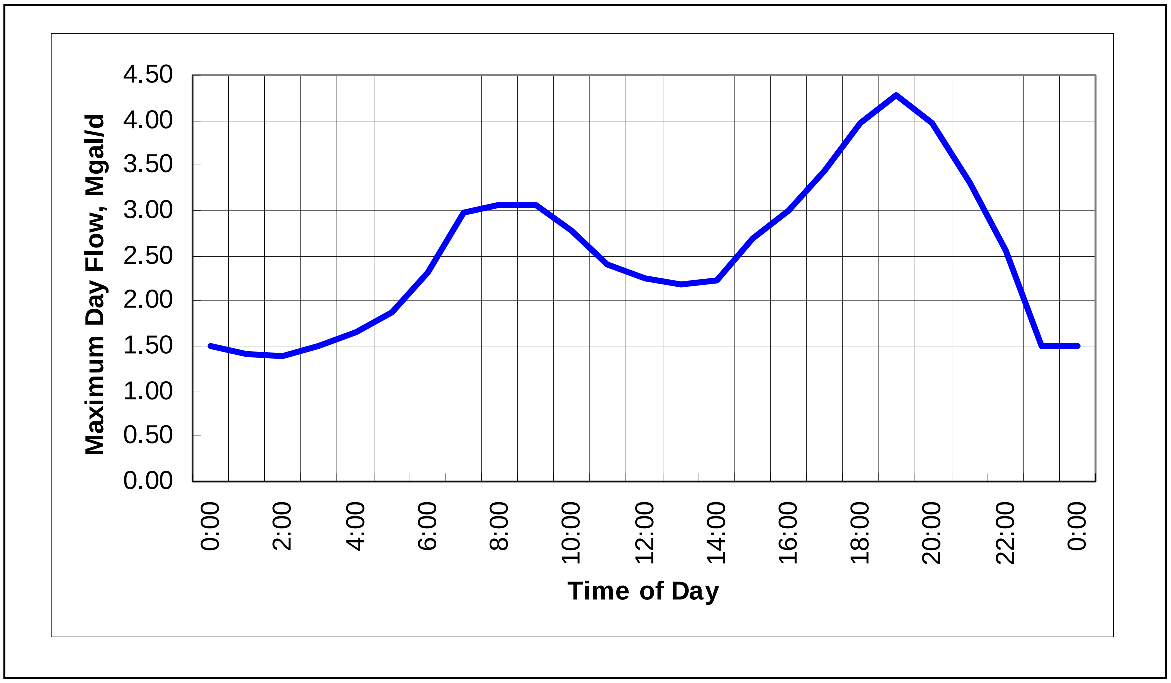


Figure 3-5
Typical Diurnal Demand Pattern

To calculate overall peak hour City water usage, a peaking factor of 1.5 was multiplied by the maximum day demand. This peaking factor was applied to all demands within the City regardless of whether the water demand was residential or commercial. It is noteworthy that the large industrial sites within the City provide process water through privately owned onsite wells and do not affect the City's water system.

Summary of Peaking Factors

The peaking factors developed in this section and used for predicting future water demands are summarized in Table 3-8.

Table 3-8
Water Use Peaking Factors

	Peaking Factor
Peak Month/ Annual Average [a]	1.7
Maximum Day-residential/ Annual Average [b]	2.5
Maximum Day-commercial/ Annual Average [b]	3.0
Peak Hour/Maximum Day [c]	1.5

[a] Based on well production data.

[b] City of Escalon Water Standards (2003) and considered reasonable compared to other communities with similar demographics.

[c] Based on typical values for published data.

Water Production Per Capita

The water production per capita for 2003 through 2005 is shown in Table 3-9. Per capita production ranged from 214 to 230 gpd per person with an average of 222 gpd per person. The trend seems to be decreasing; however, there is no apparent reason at this time other than 2005 precipitation totals were well above average. It is noteworthy that the per capita usage between 2003 and 2005 was similar to rates calculated in the 1983 Water Master Plan and suggest relatively consistent use.

Table 3-9
Annual Water Production Per Capita

Year	Population[a]	Annual Water Production, MG	GPD per capita
2003	6,650	559.4	230
2004	6,900	562.8	223
2005	7,150	557.2	214
Average			222

[a] Population from General Plan Update Background Report (2004) for 2003. Population for 2005 was 7,150. 2004 population was interpolated assuming linear growth.

3.3 WATER DEMAND FACTORS

Improvements to the water supply system necessary to serve future growth depend on the magnitude and location of the water demands. For master planning purposes, it is convenient to express the water demands for each type of development as some type of a water demand factor as gallon per acre per day (gpad) basis, gallon per capita day, or gallon per connection per day.

The City of Escalon has developed water demand factors as part of their standard water design criteria as shown in Table 3-10.

Table 3-10
City of Escalon Water Standards Design Criteria [a]

Water User	Units per Acre	Capita per Unit	Average Design Flow	Peaking Factor
R1 Residential	4	3	750 gpd	2.5
RM Medium Density Residential	15	2.5	500 gpd	2.5
RH High Density Residential	30	2.3	575 gpd	2.5
Commercial	--	--	6,000 gal/ acre	3.0

[a] Based on City of Escalon Water Design Criteria (2003).

The City standard water demand factors were compared to historical billing records from July 2001 to June 2005. The majority of the water system is metered and billing records include the type of service, meter size, and consumptive use information. Annual average water demands were developed for each type of customer summarized below, and the resulting demand factors are shown Table 3-11.

- **Single-Family Home**. Represents single-family dwellings on one parcel.
- **Duplex**. Represents two dwelling units on one parcel.
- **Multiunit Housing**. Represents three to four dwelling units on one parcel.
- **Large Apartment**. Represents five to 100 dwelling units on one parcel.
- **Commercial/Industrial**. Represents the range of commercial and industrial uses including office buildings, hotels, restaurants, convenience stores, veterinary hospitals, medical offices, dental offices, day care centers, banks, laundromats, carwashes, warehousing, and churches.
- **School**. Includes cafeteria, gym and restroom uses and, irrigation of the facility.
- **Park**. Represents parks irrigated with potable water.

The water demand factors calculated based on historical billing data are lower than the current City design criteria. A summary of the water demand factors used in this Master Plan for projecting future water supply requirements is included in Table 3-11 and is considered to be representative of existing conditions and recommended for future use based on billing and usage records. For comparison, the water demand factors used in Improvement Standards for San Joaquin County (1997) are listed below.

Residential	450 gallons per day per dwelling unit
Commercial	2,000 gallons per acre per day
Industrial	1,800 gallons per acre per day

The water demand factors developed and shown below using historical usage data closely match County design standards.

Table 3-11
Water Demand Factors Developed

Water User	Annual Average Water Demand Factor
Single-Family Home[a]	540 gpd/ water meter connection
Duplex[a]	740 gpd/ water meter connection
Multiunit Housing[a]	2,000 gpd/ water meter connection
Large Apartment[a]	9,500 gpd/ water meter connection
Commercial/Industrial[b]	2,000 gpad
School[a]	15,000 gpd/ water meter connection
Park[c]	2,000 gpad

[a] Calculated from meter data.

[b] For planning purposes, assumed to be higher than measured in meter data. Consistent with San Joaquin County Design Standards.

[c] Calculated to be 2,000 gpad using agronomic water application rates.

3.4 PROJECTED WATER DEMANDS

The land uses combined with the water demand factors and peaking factors were used to project future water demands under build-out and actual market conditions. Development of water demands based on the planning boundaries included in the General Plan result in unrealistically high demands given the current City policies regarding growth. Although the demands are considered to be reasonable for each boundary once built-out, the growth projections they are applied to do not reflect realistic growth within time frames typically used to plan water facilities.

A more realistic estimate of growth and associated water demands is based on actual market conditions which take into account existing constraints to development within the City, primarily the current growth ordinance. The estimated acreages of land based on market factors and constraints were previously shown in Table 3-3, which includes the estimated community development needs presented in the General Plan Background Report. A second set of water demands based on market conditions were estimated based on that forecast and are much lower. The build-out and market condition demand projections are discussed below.

3.4.1 BUILD-OUT DEMAND CONDITIONS

Water demand factors were applied to the various land use types included in each planning horizon identified in the General Plan including infill, 2015, 2025 and 2035. Full build-out within each planning area was assumed.

Existing Water Demands Within City Limits

Existing water demands were calculated using the land uses listed in the assessor's data and the water demands revealed in the metered use data. Only developed lots were included in this scenario per the assessor data. Parcels known to use private wells were excluded from the demand estimate and included agricultural parcels, Hogan Sports Complex, and some large businesses/industrial sites with private wells.

Build-out Within City Limits Water Demands (Infill)

Infill within the existing City limits will occur and the projection of the associated water demand associated with the development was made. All undeveloped property was assumed to have been developed per the land uses included in the General Plan.

Beyond current City limits Water Demands

Water demand projections outside of existing City limits for the 2015, 2025, and 2035 planning boundaries were made in much the same way as for the infill condition. The water demand factors were established and the number of units were calculated along with the projected demands. Peaking factors developed in Section 3.2 were applied to determine the maximum day and peak hour flow.

The water demand projections based on the build-out condition within the existing City Limits, and the 2015, 2025, and 2035 planning areas are listed in Table 3-12.

Table 3-12
Water Demands Based on Full Build-Out [a], [b]

Planning Boundary	Annual Average, Mgal/d	Maximum Day, Mgal/d	Peak Hour, Mgal/d
Existing Development within City Limits	1.4	3.2	4.6
Buildout within City Limits (Infill)	2.4	5.8	8.3
2015 Planning Area	3.7	8.9	12.7
2025 Planning Area	4.4	10.6	15.2
2035 Planning Area	5.7	13.7	19.6

[a] Water demands based on annual average demand with peaking factors applied. Unaccounted for water is included in the average annual demand, but the peaking factor is not applied to unaccounted water for calculating peak hour and maximum day.

[b] Planning boundaries have been established based on the General Plan for planning water system improvements. Demands shown will occur upon full build-out of each planning area; however, the year associated with each planning boundary may not reflect the actual time frame and will depend on actual growth.

3.4.2 MARKET CONDITIONS

The market conditions water demand projection is based on the land uses included in Table 3-3. For the purpose of estimating demands the number of single family residential units was calculated based on the population divided by an average of three persons per home. The intent was to come up with a number of equivalent dwelling units (EDU), then apply the current demand factor of 540 gpd/EDU to determine the residential water demand. The estimate does not differentiate demands for the various types of residential development (e.g. single family homes, medium density and high density).

Commercial and industrial demands were calculated based on the total acreage expected to develop based projections by the planners during each time frame. The water demand factor of 2,000 gpd/ac was used to calculate the industrial and commercial demands. Peaking factors and fire flows were then applied to the residential, commercial and industrial composite and projected demands are included in Table 3-13.

Table 3-13
Water Demands Based on Market Conditions [a], [b]

Planning Boundary	Annual Average, Mgal/d	Maximum Day, Mgal/d	Peak Hour, Mgal/d
Existing Development within City Limits	1.4	3.2	4.5
2010	1.7	4.4	6.5
2015	2.0	5.1	7.6
2020	2.4	5.9	8.9
2025	2.7	6.8	10.2

[a] Water demands based on annual average demand with peaking factors applied.

[b] Planning boundaries are based on community needs estimated included in the General Plan Background Report.

3.4.3 Recommended Demand Projections

The water demands included in Table 3-12 are based on build-out within the particular planning boundary as shown on Figures 3-1 and 3-2. As previously discussed, the General Plan identified the boundaries based on planning horizons identified over time (e.g. 2015, 2025, and 2035). Whether or not the individual planning boundaries will be built-out within the time frame associated with each boundary is unknown. According to City planners, expansion of the City limit into the sequential planning zone will not occur until the previous boundary has been nearly built-out to avoid non-contiguous development within the City limits.

In the General Plan Background Report, the planners provided an estimate of the community needs based on actual market projections. The anticipated level of actual development is much less than shown in the General Plan. As a result, water demand projections based on the General Plan build-out are considered too high, and use of the market condition projections are considered the most appropriate to forecast water demands over time under the current growth ordinance.

Water supply improvements (e.g. new wells, storage, and surface water) should be sized based on the market condition demands; however, pipelines should be sized based on build-out, which, as discussed below does not have a significant impact on sizing due to fire flow requirements.

The pipelines identified within the General Plan areas for 2015, 2025 and 2035 are sized to accommodate full build-out to avoid under sizing facilities leading to the need to upsize facilities in the future. Demands determined for the build-out condition were distributed throughout the City according to the land uses established in the General Plan and were used to develop the hydraulic model and water supply, storage and pumping improvements discussed in Section 5 of this report. This approach had a minimal effect on the size of the water transmission and storage facilities due to the need to meet fire flow condition which dominates system flows.

The water supply facilities are more sensitive to the level of development as they must be capable of meeting peak demands. Improvements discussed in Section 5 are based on water supply facilities (e.g. wells, SSJID, storage/pumping) based on the market conditions and were used to determine the recommended connection charge. Ultimately the staging of water supply improvements should be adjusted based on the actual development and the generation of the associated demands.

Section 4

Existing Facilities

A description of the City's existing water supply system is included in this section. Information from previous studies, regulatory documentation, field investigations and discussions with the engineering and operations staff were compiled herein.

4.1 EXISTING WELL SYSTEM

Historically, water supply within the City has been from groundwater wells. Service was initially provided by the Escalon Water Company, which was a private company established in the early 1900's. In the late 1960's the City took over the operation of a well and distribution system serving a small residential subdivision from a developer. In the early 1980's the City purchased the Escalon Water Company and took over the operation of the entire water system.

The well network has been expanded over the years with a total of eleven wells having been drilled and placed into service, although not all of the wells have been in service simultaneously. Water supply for domestic service and fire flow is currently supplied from four active wells. One additional standby well provides backup capacity and is operated in emergency conditions.
A number of the wells have been abandoned and destroyed due to either mechanical problems or deterioration of water quality – primarily nitrate concentrations that exceed drinking water standards. The status of each well, including details such as the size, diameter, depths, etc. is included in Table 4-1. The well locations are shown on Figure 4-1.

Active wells are used to provide day-to-day domestic and fire flow supply. The standby well provides redundancy in the event one of the primary wells is offline during peak demand periods. Inactive wells are never used for domestic supply and have been physically disconnected from the system. They are used for construction and/or irrigation water for parks to reduce the demand on the potable water system.

Table 4-2 includes a summary of the mechanical well equipment including the motor size, out put pressure and flow, type of pump, etc. Wells 3a, 9 and 10 are all equipped with variable speed drives (VFD). The pump speed is increased or decreased to maintain a prescribed system pressure set by the operators through the supervisory control and data acquisition (SCADA) system. Production from each well is measured with a manually read turbine meter.

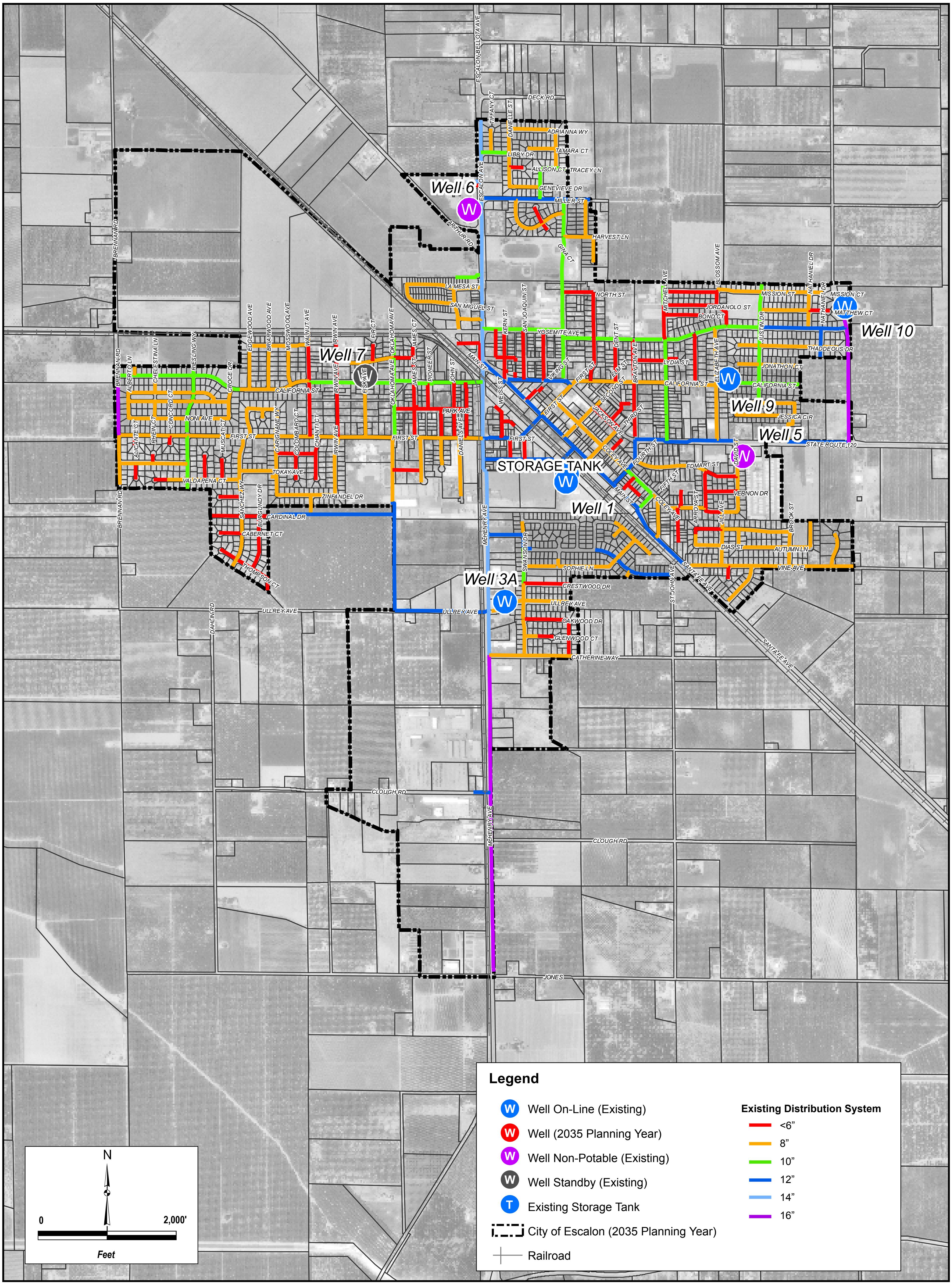


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Figure 4-1
Existing Water System Infrastructure

Table 4-1
City of Escalon Well Characteristics

Current Well - State Well Nos.	Date Drilled	Well Size	Total Depth (ft)	Cased Depth (ft)	Sanitary Seal (ft)	Perforations (ft)	Location	Current Status	Notes
1 -2S/9E-4E1	1966	14"x12"	352	225	0-50	N/A	Roosevelt Ave. near Santa Fe RR tracks	Active	GAC Reactors for DBCP removal (chorine added at tank)
2 - 2S/9E-4C1	1949	14"	200	105	No	N/A	California St. across from Sierra Drive	Abandoned/ Destroyed	
3 - 2S/9E-4F1	1954	12"	324	154	No	N/A	Corner of Franklin and Coley Streets	Abandoned/ Destroyed	
3a - 391003-010	1993	12”	587	540	0-150	425-535	Ulrey Ave. in Swanson Estates	Active	Chlorinated
4 - 2S/9E-4B1	1961	12"x10"	425	293	No	281-293	Yosemite Ave. between Elizabeth and Carolyn Ave.	Abandoned/ Destroyed	
5 - 2S/9E/4G1	1968	14"x10"	185	185	0-50	165-185	David Drive	Inactive	Used only for construction water due to high nitrates
6 - 2S/9E-5B1	1977	12”	245	225	0-60	100-225	Arthur Road and Escalon Ave. next to Community Service Center	Inactive	Used only for irrigation
7 - 2S/9E-32J1	1971	12"	195	195	0-50	89-195	California and Fisk Avenues	Active / Standby	Chlorinated
8 - 2S/9E-5F1	1978	12"	360	360	0-60	115-355	Tokay Avenue	To be abandoned	
9 - 2S/9E-4B2	1985	16”	615	590	0-185	190-585	California and Elizabeth Avenues	Active	Chlorinated
10 - J39/003-010	1997	12”	600	600	0-255	270-590	Campbell Road just north of Yosemite Avenue	Active	Chlorinated

Table 4-2
Well Pump Characteristics

Current Well No.		Motor Size (HP)	Pump Output (gpm)	Discharge Pressure (psi)	Pump (make and type)[b]	Hydropneumatic Tank Size (gallons)	VFD Equipped	Emergency Power
1	Active	30	700[a]	N/A	Universal, LST	Feeds to 0.5 Mgal tank	---	Yes
2	Abandoned/ Destroyed	25	221	35.5	B & J, LST	3,000	---	---
3	Abandoned/ Destroyed	30	323	53.5	Jacuzzi, LST	2,200	---	---
3a	Active	100	1,300	54.5	Floway DKH	---	Yes	Yes
4	Abandoned/ Destroyed	25	268	40.5	Berkeley, LST	---	---	---
5	Inactive	20	236	52.5	Peerless, LST	5,000	---	---
6	Inactive	7.5	87	52.6	Berkeley, SUBT	1,000	---	---
7 [a]	Active / Standby	20	265	55.9	Vertiline, LST	1,000	---	---
8	To be abandoned	30	426	55	Goulds, LST	7,500	---	---
9	Active	60	900	64	Floway DWT	---	Yes	Yes
10	Active	125	1,250	57	Floway DWT	---	Yes	Yes

[a] Rehabilitated to increase the capacity from the previous 451 gpm.

[b] LST – Line shaft turbine, SUBT - Submersible Turbine

Well 1 requires treatment for 1,2-dibromo-3-chloropropane (DBCP). The untreated groundwater is pumped through granular activated carbon treatment vessels and into a 0.5 million gallon (Mgal) storage tank. A booster pump station pumps water from the tank into the distribution system using three constant speed pumps. The booster pump station is discussed in Section 4-4.

The standby well is equipped with a hydro-pneumatic tank. The cut-in pressure is adjustable and typically around 40 psi and the cutout pressure is 55 psi at which point the pump turns off.

All four of the primary (active) wells have emergency power that automatically switch to the generator in the event of a power outage.

The water distribution system pressure is maintained automatically with a SCADA system. Operators enter the desired system pressure and configure the wells in a lead/lag configuration. If the well set in the primary position cannot maintain the system pressure, the second well in the series will start. If system pressure continues to decrease, the next well turns on and so on. Wells begin to shutdown one at a time as the pressure in the system increases. The SCADA system also controls the booster pump station and level in the 0.5 Mgal storage tank. The SCADA control is located at the City corporation yard.

4.1.2 EXISTING CAPACITY

A summary of the existing well capacities are listed in Table 4-3. The overall capacity of the system with all the active pumps operating is approximately 6 MGD or about 4,200 gpm. The reliable capacity of a water system is based on the overall capacity with the largest source of supply out of service due to maintenance or some unforeseen emergency.

Table 4-3
Summary of Well Capacity

Well Number	Status	Capacity	
		GPM	MGD
1	Active	700	1.0
3a	Active	1,330	1.9
9	Active	900	1.3
10	Active	1,250	1.8
	Total Active Pumping Capacity	**4,180**	**6.0**
7	Standby	300	0.4
	Total Standby Pumping Capacity	**300**	**0.4**

[a] Based on 1981 pump tests.

Currently Well 3a has a capacity of approximately 1,300 gpm and is the largest source. With Well 3a out of service and the standby well online, system capacity is reduced to about 4.5 MGD. The estimated peak hour demand of the existing water system is 4.5 MGD. With all of the wells online, the system has ample capacity to meet the estimated peak hour demand; however, with the largest source out of service, the existing wells can produce just enough water to meet the peak hour condition.

4.2 WATER TREATMENT FACILITIES

The water pumped from the underlying aquifer is not considered to be under the influence of surface water, and treatment under the Surface Water Treatment Rule does not apply for the removal of turbidity and pathogens; however, contaminants of concern have been detected in the City's groundwater as part of normal sampling. Known contaminants of concern that have been detected in the City's water supply include:

- Nitrate – Sources from runoff and leaching from fertilizer use; leaching from septic tanks and sewerage; erosion of natural deposits
- Dibromochloropropane (DBCP) – A banned nematocide present in soils due to runoff/leaching from former use on various crops typically grown in the San Joaquin Valley

The City has historically abandoned wells that produced water with high nitrate concentrations and have not provided treatment. Water from Well 1 has contained detectable concentrations of DBCP. The treatment system is discussed below.

4.2.1 DBCP TREATMENT

Well one has been equipped with two granular activated carbon (GAC) contactors that remove DBCP. Each vessel is rated for 700 gpm of capacity. The treated water from the contactors enters the 0.5 MGal storage tank and is then pumped into the system through the booster pump station. Shortly after the treatment system was started, heterotrophic plate counts (HPC) in the treated water from the contactors began to increase, with spikes occurring when the contactors were shutdown and then restarted.

The stagnant water, coupled with the large porous surface area and carbon substrate to provide nutrients provides an ideal environment for any bacteria present and allows rapid growth of the organisms and is thought to be the cause of the elevated HPC counts. A revised operating and monitoring program was developed to limit the growth potential of the bacteria.

Well 1 is now operated between March and November when water demands are higher and the contactor(s) remain online continuously. Treated water is pumped through the contactor(s), then into the tank. The tank level fluctuates – during the day the tank draws down, then refills overnight. Operation staff makes adjustments to the flow into and out of the tank so that it never fills completely and the contactors can remain online without shutdowns. This operating strategy has eliminated the HPC spikes.

Prior to start up in March, and in the event the treatment system is shutdown, the City must disinfect the GAC beds. Chlorine is not effective, so sodium hydroxide is used. After the unit has been flushed with sodium hydroxide, samples are collected for enumeration of hetrotrophic bacteria (i.e. HPC), total coliform, nitrate, and DBCP. Sampling requirements are included in Permit Amendment No. 03-10-03PA-014.

Due to the Department of Health Services (DHS) requirement that the treatment units must remain online continuously when in use, the system is typically operated at about half capacity with only one contactor in service at a time to limit the flow rate. As part of the City's operating strategy flow from Well 1 is kept below the rated capacity of individual contactors of 700 gpm. Flows above 700 gpm would require that both units be operated and could result in the need to start/stop the unit thus requiring disinfection and testing each time.

4.2.2 CHLORINE FACILITIES

The City maintains a chlorine residual within the distribution system as a preventive measure against potential microbial contamination. Although the supply is not considered to be under the influence of surface water and disinfection is not required, adding a small amount of chlorine is considered to be good practice. The chlorine facilities at all of the active well sites consist of a small diaphragm feed pump that pumps a chlorine solution into the system.

The solution is formed with a tablet chlorine feeder that dissolves calcium hypochlorite tablets into a small mixing tank that acts as a wet well for the chemical feed pumps. The tablets are easy to use and very safe compared to other forms of chlorine such as gas. The chlorine feed rate is manually adjusted by operators. The chemical feed pump activates when the well pump turns on. The chlorine residual within the distribution system is maintained between approximately 0.2 to 0.6 mg/L, which is well below the maximum disinfectant residual limit set by DHS for chlorine of 4 mg/L.

4.3 DISTRIBUTION SYSTEM

The existing distribution system consists of approximately 33 miles of piping. Pipeline diameters range from three to 16-inches. The original system was built with small diameter steel pipe, which was inadequate to convey flows at adequate pressures. As the steel pipelines aged, deterioration as a result of corrosion became a problem. Due to the dilapidated condition of the system, the City applied for and was awarded a state loan and federal grant in 1983. Over the years, the City has been installing plastic (PVC) pipe in both extensions of the distribution system and to replace aging steel pipe. To date, almost all of the old pipelines have been replaced, and as a result, the distribution system is in excellent condition; however, there are still some areas with asbestos concrete pipe (ACP) and some old steel pipe.

A summary of the pipeline diameters and materials that make up the distribution system are listed in Tables 4-4 and 4-5, respectively. The existing distribution system is also shown on Figure 4-1.

Table 4-4
Pipe Diameter Summary

Pipe Diameter (inches)	Length (Miles)
3	0.5
4	0.9
6	7.2
8	13.5
10	4.1
12	4.0
14	0.03
16	2.9
Total	**33.1**

Table 4-5
Pipe Material Summary

Pipe Material	Length (Miles)
ACP	5.9
PVC	25.7
Steel	1.2
Other	0.3
Total	**33.1**

4.4 STORAGE AND PUMPING FACILITIES

The City's 0.5 million gallon storage tank is located at the Well 1 site. The tank was installed as part of a Community Development Block Grant to provide equalization and emergency storage. Normally Well 1 pumps untreated water through the GAC contactors into the storage tank, and the treated water is pumped from the storage tank into the distribution system. If needed for emergencies such as fire flow, the site piping allows Well 1 to pump directly into the distribution system.

As discussed in Section 4.2.1, Well 1 and the associated treatment, storage and pumping facilities are only operated from March through November. The booster pump station has a reliable capacity of approximately 900 gallons per minute. There are three constant speed pumps, two duty and one stand-by. The pump suction is directly from the storage tank. Table 4-6 summarizes the specifications of the storage tank booster pump station.

Table 4-6
0.5 Million Gallon Storage Tank Booster Pump Station Specifications

Item	Number or Name
Pump	Paco
Number	3 (2 duty 1 standby)
Type	Close coupled centrifugal
Total Reliable Capacity	900 gpm @ 120 feet
Motor	US Motor
Size	15, 25, 40 hp
RPM	3,600
Standby Power	Diesel Generator
Manufacturer	Caterpillar
Size	150 kW
Control	Automatic

4.5 WATER QUALITY

Public water supplies must meet water quality standards established to protect the public health and to assure consumer acceptance. “Domestic Water Quality and Monitoring Regulations” as adopted by the State of California include bacteriological; general physical; and inorganic, organic, and general chemical monitoring and testing The water delivered to users must meet maximum contaminant level requirements applicable to public water supplies (Title 22 requirements). Monitoring and testing of the City's water supply is carried out in accordance with the applicable requirements.

All active wells are sampled and tested for general mineral, general physical, bacteriological, inorganic, and organic chemical analyses in compliance with Title 22 requirements. The water quality information discussed in this section is from Wells 1, 3a, 9, and 10. Well 7 has recently been rehabilitated and is being brought back online as an active well and will be included in the future sampling.

Overall water quality from the wells meet the water quality criteria. Constituents of concern in the Escalon water system are discussed below. The system is in good standing with the California Department of Health Services, the regulatory agency overseeing the operation of public water systems.

4.5.1 BACTERIOLOGICAL QUALITY

Well 1 has experienced elevated HPC in the past. The high HPC were related to the carbon contactors on the DBCP removal system, and the result of operating the carbon contactors intermittently. The problem has been eliminated by operating the Well 1 and the carbon contactors continuously during the peak water season. Before bringing Well 1 online for the season, the well is disinfected. Modifying the operation of the treatment system seems to have controlled the problem.

4.5.2 ORGANICS

The DBCP concentration measured at Well 1 in 2005 has ranged from non-detect to 0.2 parts per billion (ppb). The water is treated at Well 1 with granular activated carbon treatment to ensure the level stays below the maximum allowable contaminant level of 0.2 ppb. Wells 3 and 8 have also had measurable levels of DBCP in concentrations higher than the maximum allowable concentration limit. Well 3 (not to be confused with Well 3a) has been destroyed. The City is also in the process of destroying Well 8.

4.5.3 NITRATE

Nitrates have been detected in the active wells in concentrations ranging from 13.0 to 36.4 ppm in 2005. The maximum allowable concentration of nitrate is 45 mg/L (as nitrate). Wells 2, 3 and 4 have been removed from the system due to high nitrate concentrations rather than treating the water. As mentioned above, the City is in the processes of destroying Well 8 due to high nitrate concentrations. Elevated nitrate concentrations have also been observed in Well 5, which has been physically disconnected from the system and is used for non-potable irrigation uses only.

Section 5

Recommended Improvements

Water supply, storage, pumping and distribution/transmission improvements have been identified along with planning level cost estimates in this section. Improvements are based on the background information presented in the preceding sections.

A fundamental concept included in the improvement plan is to provide a logical and practicable means of expanding the water facilities. A primary goal of the improvement staging is to minimize the necessary infrastructure while ensuring a reliable water supply.

As discussed in Section 3 there are two water demand projection scenarios used to develop system improvements. The first is based on build-out of the planning horizons identified in the General Plan, and the second is based on the market conditions analysis in the General Plan Background Report. Use of the build-out projections for projecting water demands results in a rapid escalation of projected demands, which is considered to be unlikely given the City's existing growth ordinance that allows for a maximum of 75 residential building permits a year. However, distribution and transmission main improvements have been sized based on ultimate demands for the build-out scenario including fire flow conditions. Using the higher demands is considered necessary to prevent the need to upsize or parallel pipelines in the future. Such distribution system retrofits can be especially costly to construct, create significant impacts on City infrastructure (such as streets) and have a negative impact on businesses and other users in the vicinity of the project.

For the purpose of identifying water supply improvements the market condition demand scenario was used. These demand projections are lower than the build-out projections and are considered more realistic based on the City's current growth rate and community needs estimate provided by the planners. Over time, as build out occurs, the demands will manifest; however, given projected growth rates it could be sometime, likely more that 20 or 30 years, which is typical of planning horizons associated with water supply facilities. As the additional demand occurs additional sources of supply (e.g. wells, SSJID, or storage/pumping) will be necessary and can be added as needed.

A discussion of improvements considered necessary to provide adequate future water supply is included below and include water supply, storage/pumping and distribution facilities.

5.1 WATER SUPPLY FACILITIES

The City of Escalon's water supply has historically been provided from groundwater wells. The City's future supply will continue to utilize groundwater, but will be augmented by surface water from the South San Joaquin Irrigation District (SSJID) South County Water Supply Project. Two independent water supplies in a conjunctive use program will provide redundancy and reliability to the City's long-term water supply.

The methodology for determining the water supply and pumping facilities is discussed below, and a description of specific improvements follows.

5.1.1 METHODOLOGY

The reliable pumping capacity of the system must be able to meet either the maximum day plus fire flow (MDFF) condition or the peak hour demand depending on which is higher. Currently, the MDFF situation governs, but as growth occurs, the peak hour condition will become the governing condition.

Regardless of the governing condition, the pumping capacity in the system must be able to deliver the required flow. The existing capacity is made up of wells that pump directly into the distribution system and booster pump stations. Wells such as Well 1 that pump directly to a tank are not included in the pumping capacity, although the booster pump supplied by the tank contributes to overall pumping capacity. This is qualified in the City's case because Well 1 does have the ability to pump directly to the system bypassing the tank if needed. The reconfiguration is done manually by operators.

The City's water supply includes all domestic water supply wells within the system and will include the SSJID surface water source in the future. The water supply capacity does not have to meet the governing condition as long as storage is provided. If the water supply does not meet or exceed the system demand under peak demand periods, the level in the storage tanks will decrease. After the peak demand period the tanks will refill. Operation of water systems utilizing storage in this manner is a common and accepted practice because it eliminates the need for excess treatment and supply capacity to meet peak demand periods, which normally occur over a short period of time on the order of four hours or less. Storage is also required as part of the SSJID Surface Water Supply Project for operational reasons discussed later in this section.

The staging of the water supply improvements depends on demands which will increase as residential, commercial and industrial development occurs within the City. The demand projections associated with the build-out condition (described in Section 3 and the introduction to this section) are considered credible as each of the planning boundaries reach full build-out; however, the projected build-out of the planning boundaries is not expected to occur within time frames typically associated with water supply planning which typically is 10 to 20 years unless there are significant changes in the rate of growth within the City or other assumptions used to develop the master plan.

Whether or not development and the associated demands occur within the time frame associated with a particular planning horizon identified in the City's General Plan has minimal impact to the overall cost of the transmission and distribution system improvements. Proposed water supply improvements (e.g. new wells) are based on the market projection demands, and do not need to be constructed until the demand occurs which can be forecasted based on actual growth.

In terms of cost, the additional wells and the SSJID surface water supply are the largest expenditures. Well staging is recommended based on the average day demand; if the demand is not present then the construction of new wells can be deferred until the additional capacity is needed. Developing the SSJID supply requires the construction of a significant amount of pipeline and contribution by the City to fund its share of the treatment plant capacity before any water can be delivered. The development of the SSJID supply could require a large up-front expenditure but provides significant benefits to the City's long-term water supply.

The addition of the SSJID surface water supply will provide the City with additional water supply independent of the existing groundwater resource and is considered beneficial to the long-term sustainability of the City's water supply. Portions of the groundwater basin underlying San Joaquin County are in an overdraft condition, which means that more water is being pumped from the aquifer than is recharging and as a result water tables are decreasing. Results of over-drafting include higher pumping costs, lower yields, decreasing water quality and subsidence of the soil resulting in irreversible settlement of the soils. There is no evidence that the aquifer underlying the City of Escalon is currently over-drafted, likely due to the proximity of the Stanislaus River which may be acting as a continuous source of recharge in the vicinity; however, that was not confirmed as part of this scope. Changing climatic conditions, development inside or outside of the City relying on groundwater, or agricultural pumping could induce stresses on the aquifer in the future.

The SSJID South County Water Supply Project was developed to alleviate over-drafting in the County, preserve groundwater resources, and provide operational flexibility to increase the reliability of the regional water supply. The concept involves utilizing surface water to supplement a portion of the current water supply needs for a number of communities including Escalon, Manteca, Lathrop and Tracy. During wet years, surface water would be available for municipal and industrial uses to reduce the demand on the groundwater preserving it for periods of reduced precipitation. During dry years communities would rely more on groundwater to meet demands. Under this conjunctive use model, the communities would be able to meet demands based on the most abundant source of water supply available at the time.

The ability to receive surface water could be integral in the City's long-term plans such as an aquifer recharge program. A recharge program would involve recharging the aquifer using treated surface water from SSJID during the winter months when demands at the water treatment plant are low, and there is excess capacity – in fact this could be a tool that other project Cities utilize, however there are permitting issues with the Department of Health Services and the Regional Water Quality Control Board that would need to be addressed. Utilizing excess plant capacity during the non-peak season for the purpose of aquifer recharge is common in Nevada where water supplies are less substantive than in California, and recharge is an integral part of the State's water supply.

Capital improvement items associated with additional water supply, including new wells and the SSJID surface water supply are discussed below.

5.1.2 GROUNDWATER WELLS

The staging and construction of new groundwater wells for water supply is included below. Assumptions regarding the future wells are as follow:

- New wells will produce a minimum of 1,200 gallons per minute (gpm).
- Water quality will meet California Department of Health Services requirements for drinking water and will not require treatment.
- All wells will be chlorinated similar to current practices.
- The underlying groundwater aquifer will provide adequate long-term water supply. Conducting a hydro-geologic study is recommended to assess the long-term yield and sustainability of the water supply aquifer(s) supplying the City.
- All new wells will be operated using a variable frequency drive (VFD) to adjust flow and pressure within the distribution system.
- Land needed for new wells will be provided by developers.
- New wells will be constructed inside a structure.
- Stand-by/emergency power will be provided for all wells utilizing a diesel powered generator and automatic transfer switch.
- The system capacity will be sized so that peak flows can be met with the largest well (or other source) out of service.

Proposed Domestic Wells

Two new wells are being proposed through the year 2020. One new well should be constructed immediately along with a storage tank and booster pump station. Based on market growth projections, the second well will be needed sometime around 2020. Two additional wells could be required based on the demand projections through 2035 for the build-out condition; however, they have not been included in the improvement list or capital costs. The construction of the future wells should be based on the level of development and built as the system demands increase over time.

The location of the wells and summary of the capacity are discussed in Section 5.3. The number and timing of the wells was considered in conjunction with the development of the SSJID surface water supply.

5.1.3 SOUTH SAN JOAQUIN IRRIGATION DISTRICT SURFACE WATER SUPPLY

The City is a participant in the South San Joaquin Irrigation District (SSJID) South County Water Supply Program. SSJID entered into a Water Supply Development Agreement in 1995 with the

Cities of Escalon, Manteca, Lathrop and Tracy for the delivery of treated surface water to supplement the municipal and industrial water supplies of these communities. The purpose of the project is to provide a surface water supply to these cities to reduce the potential negative impacts of over-drafting the groundwater aquifers.

Raw water for the project is supplied from the SSJID's Stanislaus River water rights. Woodward Reservoir is considered the point of delivery for the South County Water Supply Program. Raw water is conveyed approximately 6,000 feet to the SSJID water treatment plant. Water is treated and stored at the treatment plant site and conveyed to the communities through a transmission main. The treatment plant is being constructed in two phases to match the water demands. Phase I capacity is 40 MGD and the treatment plant began delivery of treated water to the Cities of Manteca, Lathrop and Tracy in Spring 2005. Maximum day demands are projected to reach approximately 20 MGD during the summer of 2006. Phase II will increase the capacity of the treatment plant to 60 MGD. Phase II improvements are expected to be online around 2012, but will depend on the water supply needs of the member Cities.

The City was initially slated to take delivery of up to 2,015 acre-feet of treated water after completion of Phase I and has been allotted up to 2,799 acre-feet of treated through Phase II. The City opted to defer delivery of project water until Phase II to defer costs and rely on the groundwater supply in the interim. Even if the SSJID project is delayed after 2012, the City will be able to meet market growth projected demands with wells, and not be affected negatively by the lack of the surface water supply.

The primary facilities associated with the SSJID project include the transmission pipeline to convey treated water from the project transmission main to the City and the turnout facilities, which are discussed below.

Surface Water Transmission Pipeline

A 54-inch diameter transmission main extends from the SSJID water treatment plant along Dodds Road and runs west towards Manteca. A tee was installed at the intersection of Dodds Road and Escalon Belota Avenue from which service to the City would be extended during Phase II. Downstream of the tee, the transmission pipeline diameter reduces to 48-inches.

A preliminary alignment was developed to determine the approximate cost of the supply pipeline to Escalon. The alignment proposed herein is considered conceptual and used primarily to determine the construction cost. Factors such as easements, environmental constraints, utilities, right-of-ways, operation and maintenance, etc. should be investigated to determine the preferred alignment during preliminary design of the pipeline.

For the purpose of this report, the supply pipeline would follow an alignment south along Escalon Belota Avenue for approximately two miles to the intersection with Lone Tree Road. The pipeline would then run along Lone Tree Road for approximately one mile west to Brennan Road, then south approximately 1.7 miles before going east 0.4 miles to a proposed tank site.

The City will be responsible for paying the cost of a portion of the pipeline alignment described above. Initially, the transmission main between the water treatment plant and the City was to be located along Lone Tree Road; however, the pipeline was eventually constructed along Dodds Road. The relocation results in approximately two miles of additional pipeline that the City would be have to install and finance. The additional cost of the pipeline was not budgeted by the City, and to offset the cost impact related to relocating the transmission main, the SSJID project participants incurred the additional costs for that portion of the pipeline. Therefore, SSJID will pay for the pipeline between Dodds Road and Lone Tree Road. The City will be responsible for the cost of the remainder of the pipeline.

Although the City is responsible for paying for the pipeline SSJID will own, operate and maintain it up to the storage tank located at the turnout.

Turnout Facilities

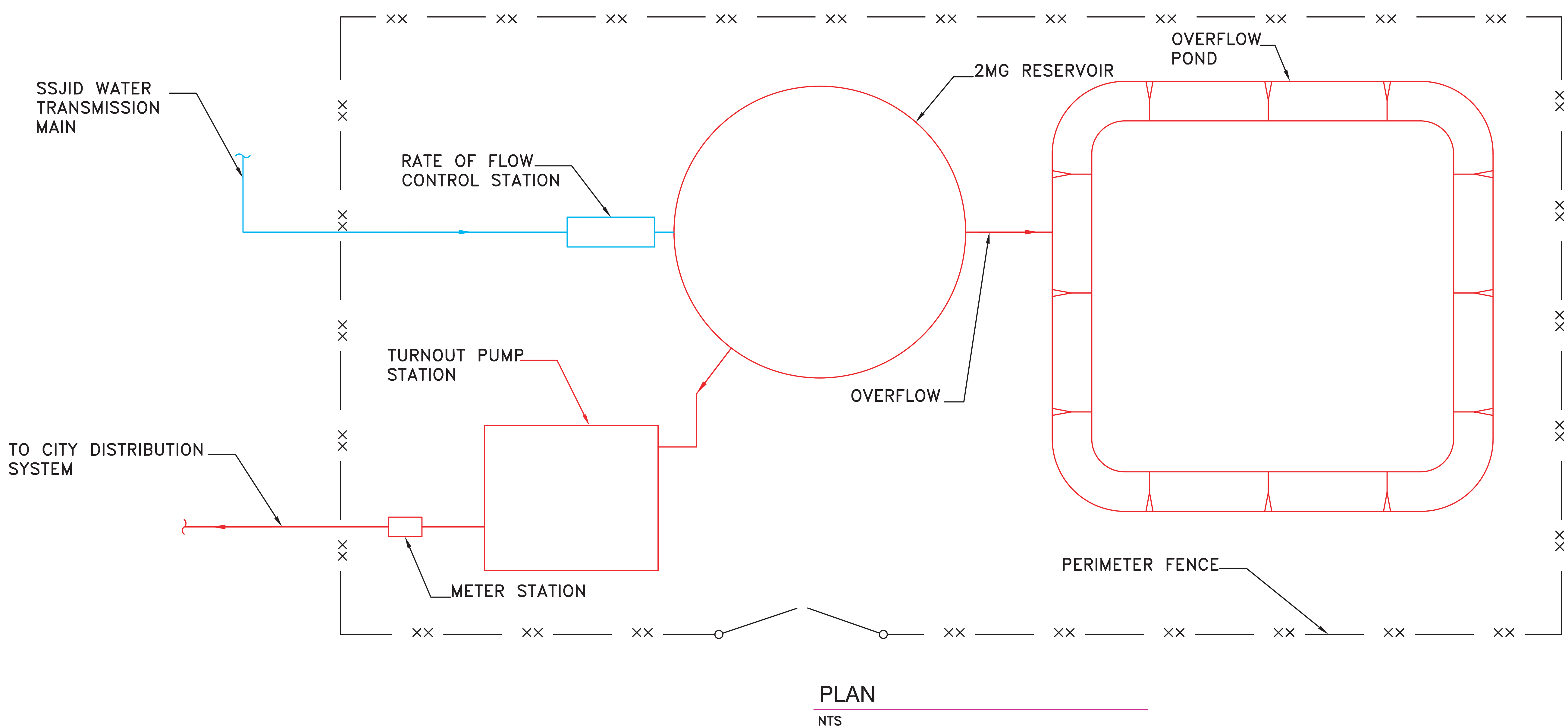
Treated surface water is supplied to each of the cities through a turnout. The turnouts allow SSJID to monitor and control flow to each customer. The turnouts are configured to hydraulically isolate each distribution system from the transmission main through a tank.

The Basis of Design Report (May 2002) prepared by Black & Veatch (design report) includes a layout for the turnouts and design criteria for the pumping station at each turnout. A schematic is included in Figure 5-1. Major facility components included in the turnouts are:

- Rate of flow control structure with bypass – used to control flow into the storage tank
- Inlet flow meter – used to monitor and control flow into the storage tank
- Storage tank – storage tank to provide storage and surge protection
- Booster pump station – used to pump water from the tank into the distribution system
- Metering station – metering station used to meter flow into the City's distribution system

The turnout configurations vary for the Cities of Manteca, Lathrop and Tracy. The anticipated facilities and assumed ownership and maintenance for the City of Escalon are shown on Figure 5-1. This assumes that City owned facilities at the turnout would be funded and constructed by the City as master planned water infrastructure, which the City would operate and maintain.

From the City's perspective there is an advantage to owning and operating the tank and booster pump station. As discussed below, the storage tank and booster pump station will be an integral component of the City's future water supply. In the event the wells are out of service, or there are increased demands due to fire, the City will be able to make adjustments to the flow from the tank into the system.



LEGEND	
(blue line)	OWNED & MAINTAINED BY SSJID
(red line)	OWNED & MAINTAINED BY CITY

NOTES:
1. BASIC SITE LAYOUT FROM BLACK & VEATCH BASIS OF DESIGN REPORT (MAY 2002).
2. SITE SHOWN SCHEMATICALLY. LAYOUT AND SPECIFIC SIZE OF SITE FACILITIES TO BE DETERMINED

P:\ESCA05-001 T1 ESCALON\ACT\FIGURE 5-1.dwg Oct 30, 2008 - 12:31pm

ESCALON

Figure 5-1
Proposed Turnout Schematic SSJID Supply

The proposed division of ownership, operation and maintenance is logically split. SSJID would be concerned with the rate of delivery to the City, which will affect the transmission main hydraulics and maintaining control of the delivery rate, whereas the City is concerned about maintaining adequate system pressure and sufficient water supply within its distribution system.

The Black & Veatch Basis of Design report includes design criteria for the turnout facilities including the booster pump station configuration and capacity. The City will construct the tank and booster pump station and be responsible for operating and maintaining the facilities because the tank/booster pump station will provide storage, equalization and pumping capacity for fire flow conditions.

The major proposed City owned facilities associated with the turnout are discussed in detail below.

Storage Tank

The Basis of Design Report recommends a 1 Mgal storage tank at each turnout. The purpose of the tank from SSJID's perspective is to provide hydraulic isolation and surge protection as well as equalization. The City will receive up to 2.5 MGD per the current water supply agreement, which translates to about 1,750 gpm. It is uncertain if the flow to the tank will remain constant or vary throughout the day, but the tank will provide equalization. From the City's perspective, the tank will also provide equalization and emergency storage for the City, so providing means to increase storage volume above and beyond that recommended in the Basis of Design Report is recommend, and discussed in detail below.

Sizing the proposed tank is based on several factors including equalization, emergency storage, fire flow and water quality considerations. The proposed location of the tank is in an area that will develop as industrial/commercial park.

The 1995 SSJID Water Supply Development Agreement does not include requirements for SSJID wholesale customers to provide emergency storage in the event the water treatment plant or transmission pipeline fails. In the event of a failure, it is expected the SSJID surface water supply could be interrupted for an extended period of time. The City's well system will provide reliability during these periods although the City's overall water supply will be reduced and may necessitate emergency conservation measures.

Under the worst case scenario, with the largest well out of service, SSJID supply offline, and the maximum day plus fire flow condition, the minimum recommended storage would be about 0.6 Mgal throughout the system and could include the existing tank located near Well 1, as well; however, provision of at least 1 Mgal is recommended per the Basis of Design Report and SSJID requirements – probably due to anticipated fluctuations in the delivery rate from the SSJID system and would provide adequate storage and minimize residence time in the tank.

Water quality degradation can occur through tanks resulting from long residence times. Typically one to two days is reasonable. Water quality could be maintained by monitoring chlorine residual into and out of the tank with the ability to add additional chlorine at both locations and designing and operating the tank to promote circulation with the ability to cycle the tank through SCADA controls.

As demands increase within the City, additional storage will be desirable above and beyond 1 Mgal. Therefore two 1 Mgal tanks are recommended - one constructed now and one constructed in the future when demands dictate. A two tank concept will provide redundancy for emergency shutdowns and major maintenance and also defer additional costs for the second tank until the facilities are needed. A 1 Mgal tank would have a nominal diameter of 75 feet with a 30 foot water depth. The City should ensure that the size of the site for the tanks, well and booster pump station will be adequate for the ultimate build-out condition.

An elevated tank was considered to take advantage of the pressure in the SSJID pipeline to fill the tank. The City's system would be fed from the elevated tank and avoid the need to construct and operate a booster pump station. Phase 2 of the SSJID project includes the construction of a booster pump station at the water treatment plant to increase the system pressure during peak demand periods. The current understanding is that the pump station discharge will vary depending on system demands and there will be pressure fluctuations in the transmission pipeline. The extent of the pressure variations and the minimum pressures are uncertainties at this time, but could impact the operation of the elevated tank and require that a pump station be constructed to fill the elevated tank – thus reducing the benefit of an elevated tank.

The cost of an elevated tank is much higher than a ground level tank. An economic analysis showed that the payback period would be over ten years. The long payback coupled with other disadvantages of an elevated tank, such as increased maintenance costs, aesthetics, and the need for a fall zone surrounding the tank, resulted in the decision to recommend a ground level storage tank.

Booster Pump Station

The booster pump station would pump water from the storage tank into the distribution system. The proposed design criteria for the booster pump station are shown in Table 5-1.

The tank and booster pump station would initially be supplied by the new well being proposed at the same site. Eventually the primary supply would be SSJID with backup from the well. The tank/booster pump station would be operated in the lead position and turn on first and turn off last in the well operating order.

The pumps will likely be canned vertical turbines. The can size should be such that the pumps can be significantly upsized to meet the build-out demands past 2025, which would be about 2,500 gpm and 100 to 150 hp to provide a total reliable pumping capacity of about 7,000 gpm.

Table 5-1
Booster Pump Station Design Criteria

Pump Type	Basis of Design Report Vertical Turbine	Initial Conditions Vertical Turbine[a]	Build-out – 2025 Vertical Turbine[a,b]
Number	3 (2 operating, 1 standby)	4 (3 operating, 1 standby)	4 (3 operating, 1 standby)
Min. P.S. Capacity, MGD	1.25	1.4	1.4
Avg. P.S. Capacity, MGD	2.5	2.5	2.5
Max. P.S. Capacity, MGD	2.5	4.5 [c]	7.2 [c]
Motor Horsepower, (each)	75	50	75
Drive Type	Constant Speed	Variable Speed	Variable Speed
Standby Power	None	Emergency/standby Generator w/automatic transfer switch	Emergency/standby Generator w/automatic transfer switch

[a] Max capacity is greater than the anticipated SSJID supply and provided to meet maximum day plus fire flow condition, which will exceed supply and draw down tank for period of time.

[b] Based on the market condition water demands, ultimately pumps could be larger under build-out condition.

[c] Combined capacity of three duty pumps.

5.2 TRANSMISSION AND DISTRIBUTION SYSTEM

The City's existing distribution system is shown on Figure 5-2. The four planning area boundaries identified in the General Plan include:

- Current City limit with infill
- 2015 Planning Boundary
- 2025 Planning Boundary
- 2035 Planning Boundary

The proposed distribution system improvements correlate to water supply improvements and would be constructed simultaneously with those improvements as development occurs in a particular area of the City. The planning boundaries and demands associated with full build-out of the General Plan planning horizons were used for planning distribution system improvements.

Master plan distribution system improvements generally include pipelines with diameters of 10 inches and larger. Smaller diameter pipelines and appurtenances such as services, blow-offs, fire hydrants, etc. are constructed to City standards, financed and then deeded to the City by the developers.

A hydraulic model was used to size master planned conveyance facilities as discussed below. A hydraulic model was prepared to assess the existing distribution system and future expansions. Using the model, various demand scenarios could be analyzed and used to size pipelines.

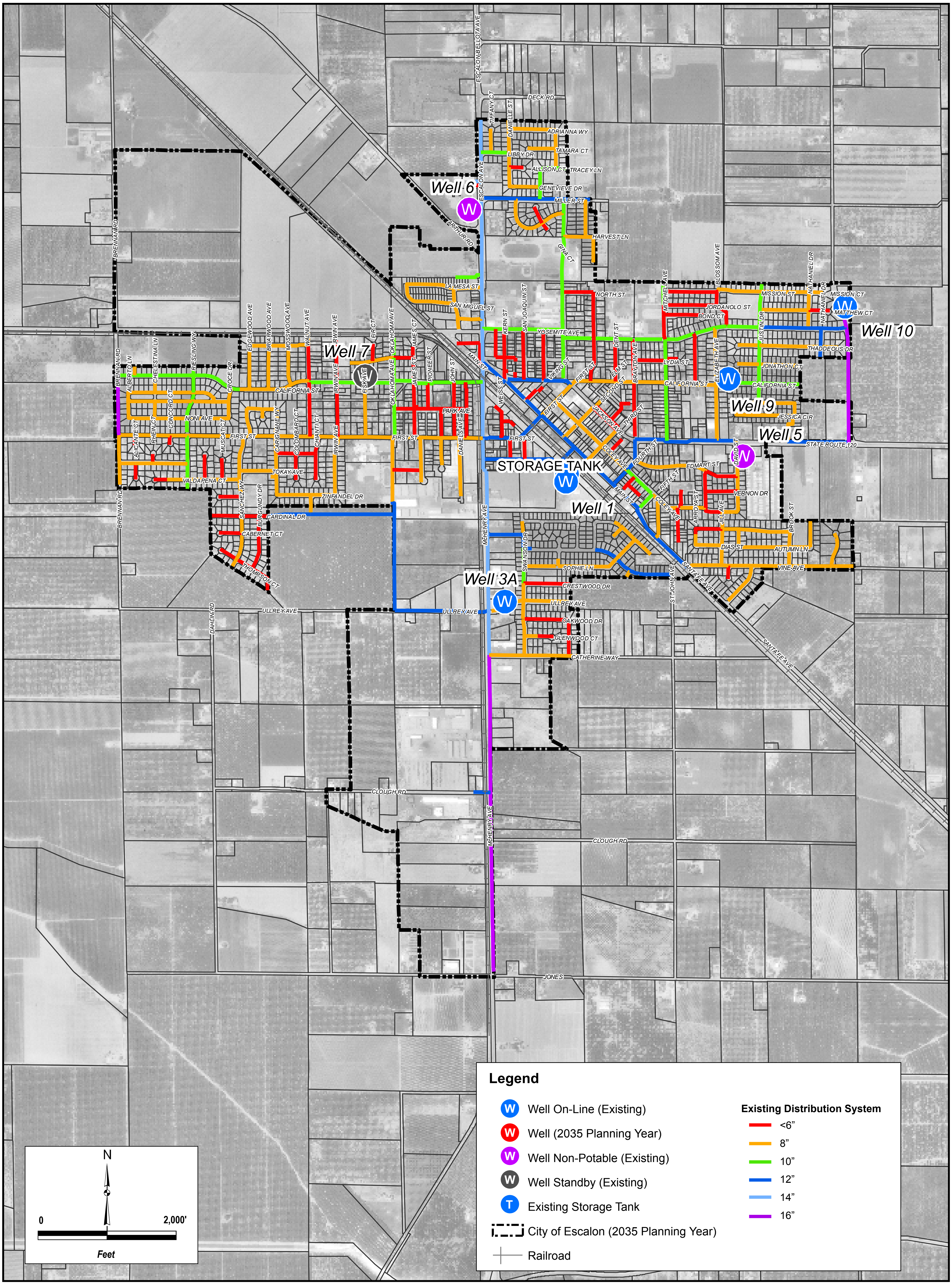


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Figure 5-2
Existing Water System Infrastructure

5.2.1 HYDRAULIC MODELING SUMMARY

A hydraulic model of the Escalon water distribution system was developed using Haestad's WaterGEMS 3.0 modeling software. The hydraulic model was used to determine the distribution system improvements for each planning boundary. Summary tables are included in Appendix A.

Scenarios Analyzed. The water distribution system model developed included a matrix consisting of five planning year scenarios each containing three demand conditions. The scenarios incorporated into the model were as follows:

- Existing distribution system
- 2010 – Includes distribution system improvements to supply infill areas within Escalon city limits
- 2015
- 2025
- 2035

Demand conditions used in the above scenarios included average day demand (ADD), maximum day demand (MDD) and peak hour demand (PHD). Fire flow analyses were conducted during MDD conditions.

Existing system demands were estimated using existing metered well production data and historical customer usage data. Future demands were estimated by applying unit demand factors to the parcels within the planning area. GIS software was used to calculate and spatially allocate average day and maximum day demands to model nodes based on the land use.

5.2.2 INPUT AND DESIGN CRITERIA

The basic input and design criteria used in the model are summarized below.

Model Node Elevations. USGS information, including topographic maps and existing electronic benchmark data, were obtained and used to populate model nodes with elevations.

Distribution System Pressures. Maximum and minimum pressures in the distribution system ranged from around 75 psi under average day demand conditions to approximately 45 psi for peak hour conditions.

Distribution Pipe Sizing. The pipes in the model were sized according to the following design criteria:

- Pipe velocities under all demand conditions should not exceed 5 fps for ADD, MDD and PHD conditions.
- Velocity during max day demand + fire demand should not exceed 10 fps under fire flow condition.

- Pressure loss should not be greater than 6 psi/1,000 feet of pipeline.
- New piping "C" factor is 130.

Fire Flow Analysis. The following fire flow assumptions were made:

- The critical design condition was maximum day plus fire flow (MDD+FF)
- The proposed tank in the northwest industrial area provided storage for fire flow.
- The transmission and distribution system's ability to provide fire flow was analyzed. No attempt was made to model detailed hydrant connections and size hydrants, which could reduce flow depending on the configuration.
- Maximum pipe velocities in the distribution system of 10 fps during the MDD + FF condition.
- Minimum residual distribution system pressure of 20 psi during MDD + FF condition.
- Commercial/Industrial fire flows are 3,500 gpm for three hours.
- Residential fire flows are 1,500 gpm for two hours.
- Future developments will be responsible for augmenting fire flow where flow requirements in excess of 3,500 gpm are required.

5.2.3 DISTRIBUTION SYSTEM IMPROVEMENTS

Distribution system improvements were sized based on the modeling results and criteria presented previously, input from City staff and review of the system. The primary objective of the distribution system improvements is to ensure that adequate flow and pressure are available throughout the system.

Secondary goals include looping for operational reliability/flexibility and to prevent water quality degradation due to dead ends and to provide a practical means of expanding the system. The majority of the future pipelines are 10- and 12-inch diameter. However, there are some areas that will require larger diameters including 14-, 16- and 18-inch pipelines. The larger diameter pipelines occur in the northwest industrial area near the proposed storage tank and booster pump station and are the result of anticipated fire flow needs.

Detailed descriptions and figures of the distribution system improvements are discussed in Section 5.3.

5.3 IMPLEMENTATION OF IMPROVEMENTS

A summary of water supply, storage, and distribution system improvements based on planning boundaries is included below. Planning level costs are included for the improvements and are summarized for each planning boundary. The cost estimates are based on bid results received in 2005/2006 on other similar projects. All costs in the tables are 2006 price levels.

5.3.1 CURRENT CONDITIONS/INFILL THROUGH 2015 PLANNING AREA

Based on the reliable capacity of the existing system, a new well should be provided along with a storage and booster pump station. The suggested location for the new well, storage tank and booster pump station is the northwest corner of the City in the proposed Liberty Park project and is shown on Figure 5-3. Table 5-2 includes a summary of the proposed water supply improvements, and Table 5-3 includes proposed pumping capacity improvements based on the demand projections under the market conditions.

The proposed tank will be located within a 219-acre commercial/industrial development. The City has identified this area as a potential location for a new well and water storage tank located within the development. Discussions with land owners and consideration of development plans currently under preparation will be necessary to site the tank, well and booster pump station facilities. The site should be large enough for two 1 Mgal storage tanks (one now, then one in the future), the pump station, and ideally the well site. Initially the well would pump directly into the tank, then the water would be pumped through the booster pump station into the system.

Currently all of the City's water supply wells are located east of McHenry Avenue and the proposed improvements at this location would provide fire flow within the new industrial development and reinforce the water supply to existing development west of McHenry Avenue.

Initially the capacity of the booster pump station would be around 3,000 gpm expandable to 7,000 gpm at ultimate build-out conditions. Based on the revised market demand projections, 4,000 gpm would be adequate through 2025; however, pump cans and piping should be designed to provide additional flow more closely reflecting build-out condition. Over sizing these components adds minimal cost to the project, but provides flexibility for future expansions.

With the addition of the storage tank and booster pump station, only one new well would be required; however, if the tank and booster pump station were not installed, a second well would be necessary to meet the maximum demand periods with the largest source out of service. The storage tank and booster pump station would receive SSJID surface water supply in the future.

Improvements are shown on Figure 5-3 and described in Table 5-4 along with planning level costs at the end of this section.

5.3.2 2015 THROUGH 2020 PLANNING AREA

Additional pumping capacity at the booster pump station is recommended, and would consist of adding approximately 1,000 gpm of capacity to increase the reliable pumping capacity from 3,000 to 4,000 gpm. The additional pumping capacity is necessary to meet the maximum day plus fire flow condition. Expansions to the pump station could be accomplished relatively easily by adding an additional pump, replacing one or more of the existing pumps, or modifying the pumps and motors to provide the additional capacity. These alternatives should be determined as part of the predesign. During the initial design of the pump station, features should be included to accommodate the expansion such as ensuring the piping, electrical equipment, etc. are sized to accommodate future facilities.

Table 5-2
Water Supply Staging – Based on Market Demand Projections

Year	Existing Wells				Proposed Wells[a]					SSJID Surface Water	Total Supply Capacity	Reliable Supply Capacity[b]
	Well 1	Well 3A	Well 9	Well 10	Well A[c]	Well B	Well C	Well D	Well E			
2006	700	1,330	900	1,250	1,200	---	---	---	---	---	5,300	4,000
2010	700	1,330	900	1,250	1,200	---	---	---	---	---	5,300	4,000
2015	700	1,330	900	1,250	1,200					1,750	7,100	5,300
2020	700	1,330	900	1,250	1,200	1,200				1,750	8,250	6,500
2025	700	1,330	900	1,250	1,200	1,200				1,750	8,250	6,500

[a] Shading represents addition of a new well or source of supply from SSJID.
[b] Reliable well capacity based on largest well out of service.
[c] Well A pumps directly to new tank, not into system and is not considered part of future pumping capacity.

Table 5-3
Supply, Pumping and Storage Summary Based on Market Demand Projects

Year	ADD, MGD	Max Day, MGD	MDD+FF, gpm	Peak Hour Demand gpm	Reliable Pumping Capacity, gpm	Min. Fire Storage Required, gal [a]
2006	1.4	3.5	5,900	3,100	6,000	350,000
2010	1.7	4.4	6,500	4,500	6,000	455,000
2015	2.0	5.1	7,000	5,300	7,000	545,000
2020	2.4	5.9	7,600	6,200	8,200	430,000
2025	2.7	6.8	8,200	7,100	8,200	545,000

[a] Minimum storage volume for fire flow only, no storage included for equalization or emergencies

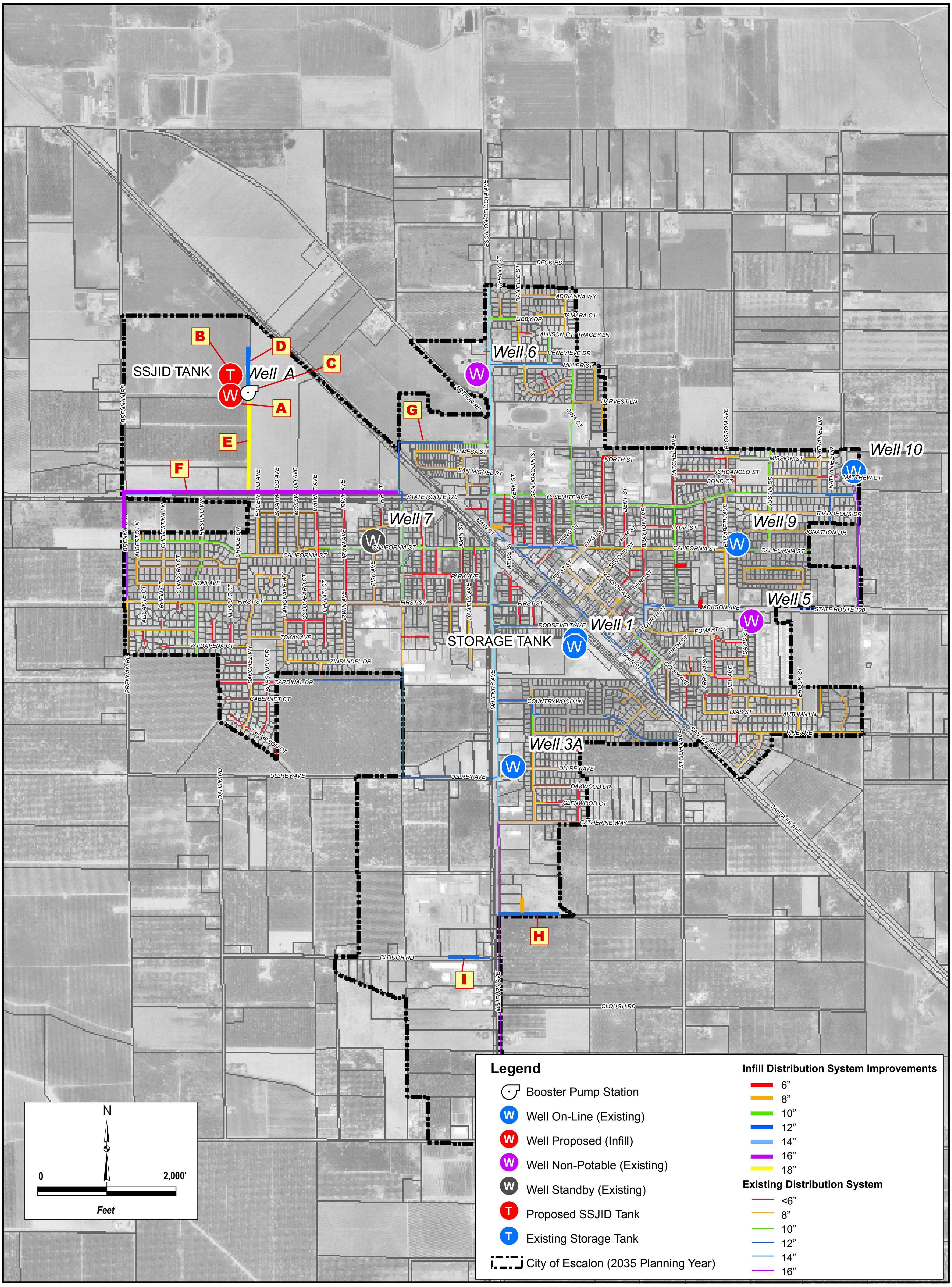

Figure 5-3
Water Distribution System
City Infill Through 2015 Planning Area

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It is likely that the SSJID surface water supply will be available about this time. The SSJID water will supplement the City's groundwater supply and provide a redundant source of supply. The timing of the SSJID supply could vary depending on a number of factors including: the actual demands in the City, schedule of the SSJID Phase II expansion, and financial considerations associated with the necessary improvements.

The SSJID water supply is important from the City's long-term water supply and reliability perspective as part of a conjunctive use program, but there is not an acute need for the SSJID water to meet future demands based on the market projections at least through 2020, and probably sometime beyond that based on current expectations of well yields in the area and the addition of the storage tank(s)/booster pump station.

Although the City may not need the capacity of the SSJID surface water supply to meet demands associated with the market demand conditions through 2020, it is considered to be an integral part of the City's long-term water supply to ensure a reliable supply. By providing a second, independent source of supply, the existing and future residents of Escalon will benefit. The City should plan on receiving the water at some point in the future, it is included in the connection charge to generate funding for the project.

Improvements are shown on Figure 5-4 and described in Table 5-4 along with planning level costs at the end of this section.

5.3.3 2020 THROUGH 2025 PLANNING AREA

Based on the market projections, a new well will be needed to satisfy peak demand conditions in this planning area. A preliminary location for the well is shown on Figure 5-5; however, the actual location should be in an area near, or adjacent to the concentrations of growth within the City. By 2020 the City may, or may not have SSJID water as discussed in Section 5.3.2. If demands do not manifest because growth occurs more slowly than anticipated, the additional well can be delayed as well as participation in the SSJID surface water.

Addition of the second 1 Mgal storage tank is also recommended. With the addition of the second tank the system storage would be increased to 2.5 Mgal (including the existing tank at Well 1), and would provide about one average day's worth of storage, and just under half a max day of storage, which is adequate for meeting peak demand periods with the additional wells within the system. Addition of the second tank will also allow for heavy maintenance on the existing tanks, such as recoating, which is typically required every 10 to 15 years.

Improvements are shown on Figure 5-5 and described in Table 5-4 along with planning level costs at the end of this section.

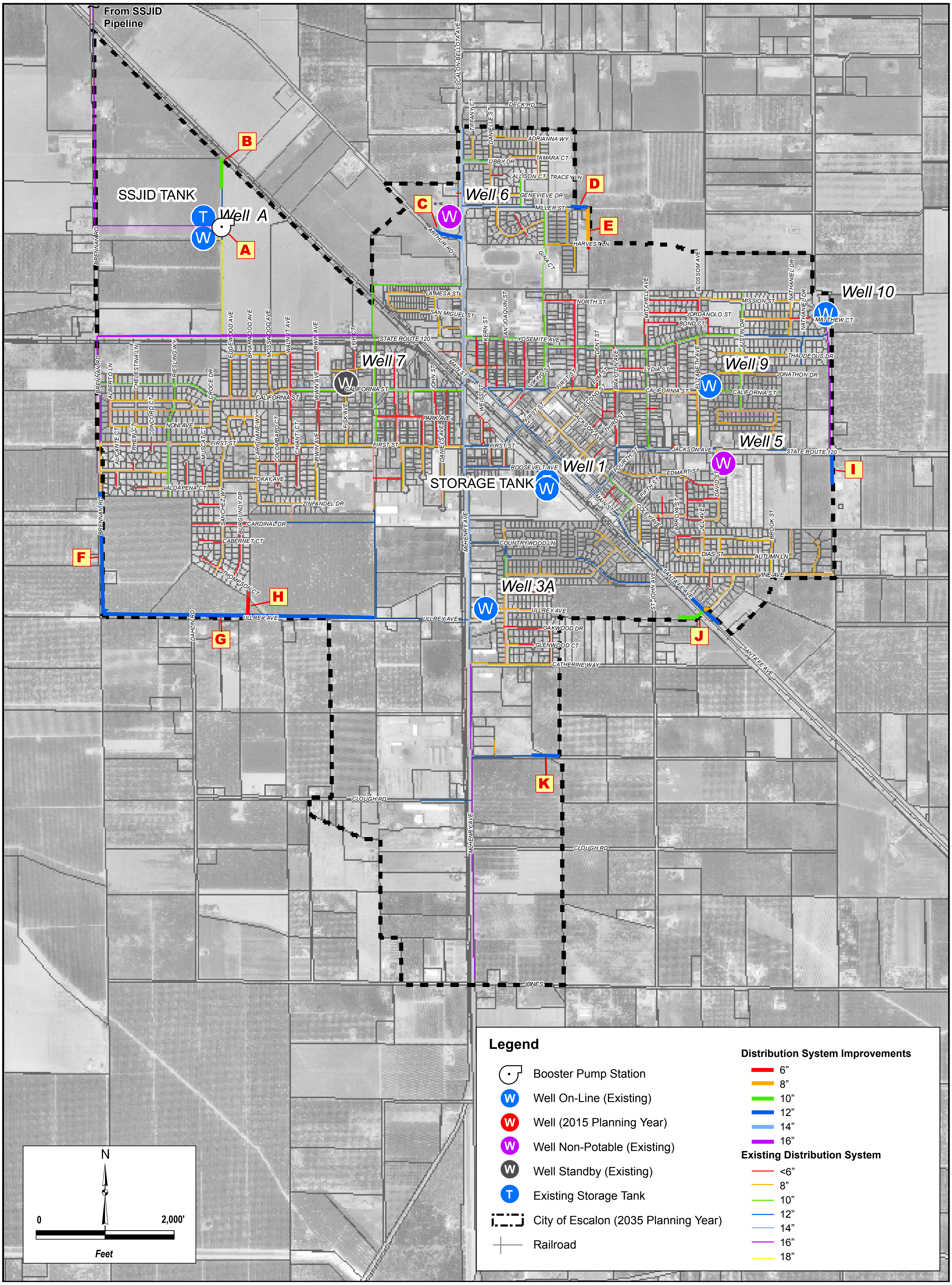

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Figure 5-4
Water Distribution System
2015 Through 2020 Planning Area

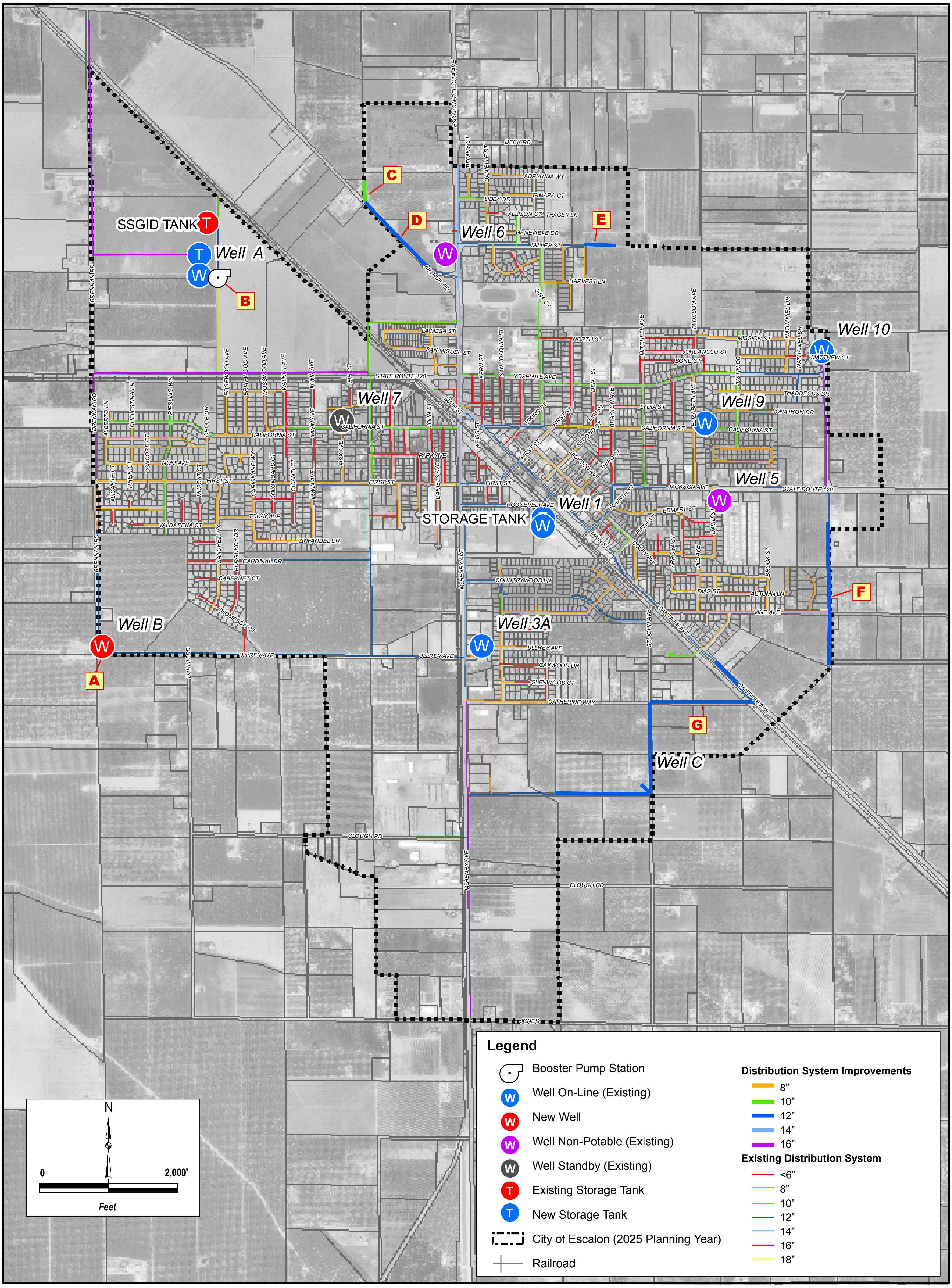


Figure 5-5
Water Distribution System
2020 Through 2025 Planning Area

5.3.4 2025 THROUGH BUILD-OUT CONDITIONS

This condition represents the growth beyond that included in the market projections for water demand. Water supply improvements identified herein can be provided on an as needed basis. These water supply improvements will not likely be needed for 20 to 30 years unless the City allows for more rapid growth. Due to the length of time between current conditions to the likely build-out, the additional wells have not been included in the capital cost estimates, or in the connection charge calculation included in Section 6.

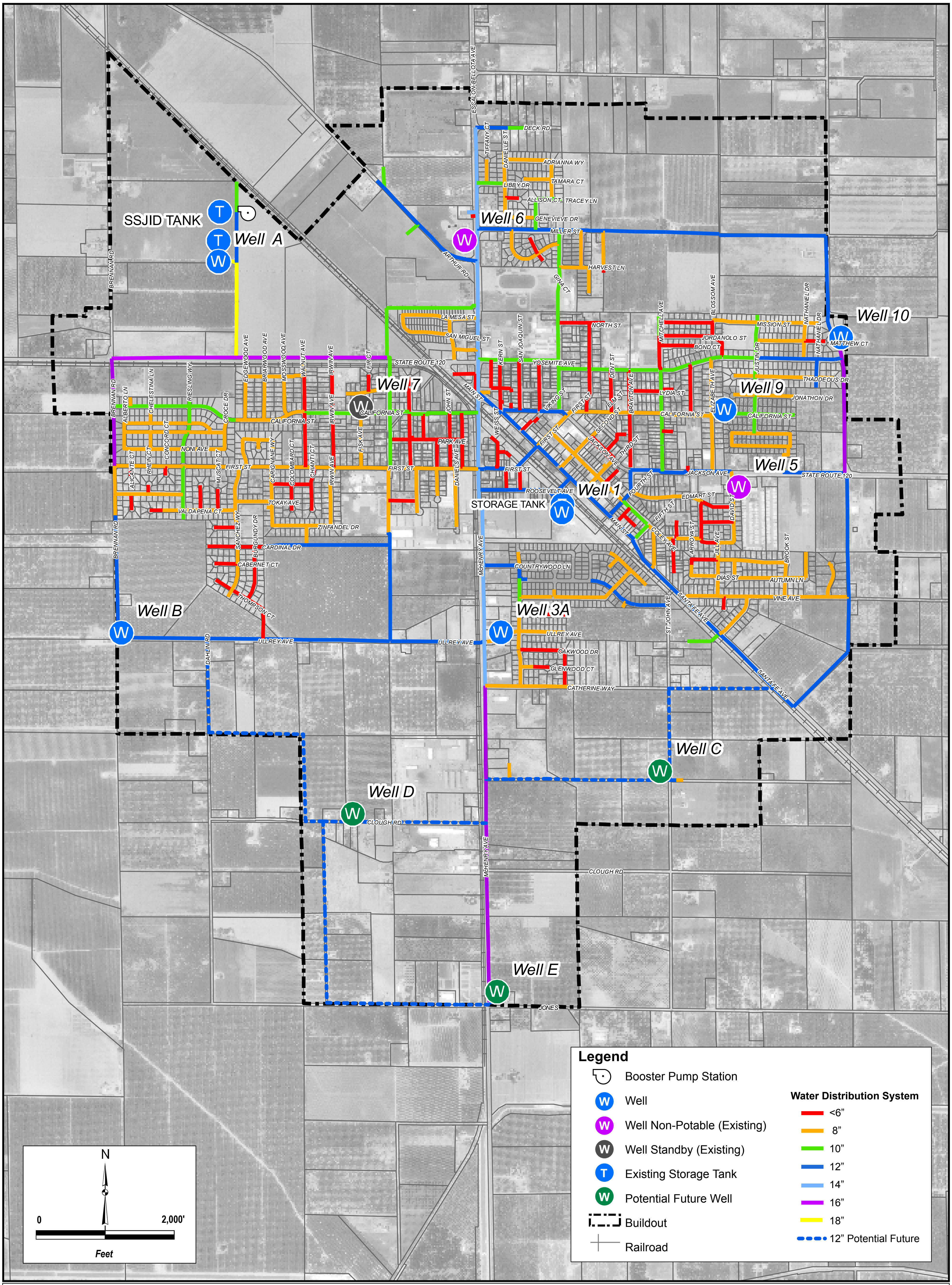
Distribution system improvements shown may be needed and will depend on the location of development within the City. The larger diameter pipelines are considered master plan facilities and have been included in the capital cost estimates because they may be needed if development occurs in the southern portion of the City.

Based on the build-out water demand projections up to three additional wells could be needed as some point in the future. These include Wells C, D, and E that would be located in the southern portion of City. The City should consider identifying sites and ensuring that the they are available for use in the future.

The booster pump station located at the 1 Mgal tank site will also need to be upgraded, potentially upwards of 7,000 gpm based on full build-out of the City's General Plan.

Planning improvements beyond 2025 includes significant uncertainty. Future updates of the water master plan should address these improvements as the picture of development becomes clearer.

The proposed improvements for build-out conditions are shown on Figure 5-6 and described with the water supply improvements in Table 5-4 at the end of this section. Capital costs associated with improvements beyond 2025 are not included.



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*Potential improvements past 2025 may be needed, but will depend on actual long-term development.

Figure 5-6
Water Distribution System
Complete Buildout

Table 5-4
Proposed Improvements

Infill Through 2015 Horizon		**Cost[a]**
Water Supply		
A	New water supply well with minimum capacity of 1,200 gpm located in northwest corner of City [b]	N/A
Storage/Pumps		
B	New one million gallon treated water storage tank – site piping to allow for future tank	$1,200,000
C	Construct 3,000 gpm booster pump station	$500,000
Distribution		
D	Construct approximately 700 lf of 12-inch diameter pipeline north from Well A	$84,000
E	Construct 1,400 lf of 18-inch diameter pipeline south from Well A to State Highway 120	$252,000
F	Construct approximately 3,900 lf of 16-inch diameter pipeline parallel to State Hwy 120 (preferably out of highway right-of-way)	$624,000
G	Construct approximately 2,800 lf of 12-inch diameter pipeline extending north of the State Highway 120; bore under UPRR tracks and connect to existing 10-inch diameter pipeline north of La Mesa Street	$336,000
H	Construct approximately 400 lf of 12-inch pipeline along the southern boundary of existing City limit	$48,000
I	Construct approximately 800 lf of 12-inch pipeline along Clough Rd	$96,000
	Miscellaneous smaller pipes	$30,800
	Subtotal	$3,171,000
	Contingencies at 20%	$634,000
	Subtotal	$3,805,000
	Administration, Engineering @ 20%	$761,000
	Phase I contribution to SSJID Project [c]	$700,000
	Total	$5,270,000

[a] 2006 cost level.

[b] Cost of new well already included in current City budget and not included in cost projections.

[c] Based on the remaining SSJID balance.

Table 5-4
Proposed Improvements (cont'd)

2015 Through 2020 Planning Area		Cost[a]
Water Supply		
A	Provide additional 1,000 gpm of capacity to Booster Pump Station 2 – total reliable capacity of 4,000 gpm	$150,000
Distribution		
B	Construct approximately 400 lf of 10-inch diameter pipeline north of Well A connecting to the 12-inch pipeline	$40,000
C	Construct approximately 500 lf of 12-inch diameter pipeline to connect Arthur Rd with McHenry Rd.	$60,000
D	Construct approximately 300 lf of 12-inch diameter pipeline along Miller St.	$36,000
E	Construct approximately 500 lf of 8-inch diameter pipeline south of Miller St.	$40,000
F	Construct approximately 1,000 lf of 12-inch diameter pipeline north of Well B along Brennan Rd.	$120,000
G	Construct approximately 3,900 lf of 12-inch diameter pipeline east of Well B along Ullrey Ave.	$468,000
H	Construct approximately 300 lf of 6-inch diameter pipeline to connect Thompson Ct with Ullrey Ave.	$18,000
I	Construct approximately 500 lf of 12-inch diameter pipeline along eastern boundary of City south of Highway 120	$60,000
J	Construct approximately 1,000 lf of 8, 10, and 12-inch diameter pipeline along Santa Fe Road	$108,000
K	Construct approximately 400 lf of 12-inch diameter pipeline along unnamed road in the southern part of the City	$48,000
	Subtotal	$1,148,000
	Contingencies at 20%	$230,000
	Subtotal	$1,378,000
	Administration, Engineering @ 20%	$276,000
		$164,000
	Phase II contribution to SSJID Project including treatment and pipeline[b]	$5,837,000
	Total	$7,491,000

[a] 2006 cost level.

[b] SSJID Phase II cost based on B&V estimates, omitting tank and adjusted with ENR for 2010. Cost includes the pipeline and engineering.

Table 5-4
Proposed Improvements (cont'd)

2020 Through 2025 Planning Boundary		Cost[a]
Water Supply		
A	New proposed well in southeastern corner of city	$1,000,000
Storage/Pumps		
B	Add a second 1 Mgal storage tank	$1,000,000
Distribution		
C	Construct approximately 300 lf of 10-inch diameter pipeline to connect to Arthur Rd.	$30,000
D	Construct approximately 1,300 lf of 12-inch diameter pipeline along Arthur Rd.	$156,000
E	Construct approximately 500 lf of 12-inch diameter pipeline along Miller St.	$60,000
F	Construct approximately 2,000 lf of 12-inch diameter pipeline along eastern boundary of City south of Highway 120	$240,000
G	Construct approximately 5,100 lf of 12-inch diameter pipeline west from Well C and to the northeast to connect with an existing 12-inch pipeline on Santa Fe Ave.	$612,000
	Subtotal	$3,098,000
	Contingencies at 20%	$620,000
	Subtotal	$3,718,000
	Administration, Engineering @ 20%	$744,000
	Total	$4,460,000
	Project Total	$17,221,000

[a] 2006 cost level.

Section 6

Proposed Connection Charge

Capacity improvements and associated capital costs have been identified in previous sections of this master plan. Facilities financed with connection charges include backbone facilities such as water supply, storage/pumping and distribution system improvements, which provide the necessary capacity to serve future growth. A recommended water connection charge to fund these improvements is developed in this section. Consistent with California law, the cost of future expansions should be assigned to future development and not existing users.

Specific onsite improvements within specific developments that are needed to provide service to the development include distribution system piping, services, blow offs, fire flows in excess of normal requirements, and other appurtenances. These improvements are financed by the developer, constructed to City standards and deeded to the City. These "onsite" improvements should be paid for by the developer and are not included or credited to the connection charge fees.

Depending on the nature of the improvements and the amount and timing of development, sufficient funds from connection charges may not fully fund the capacity expansions in the short-term. In such cases it is typical for developers to provide capacity in excess of their need with a reimbursement from the City as additional connections occur. Based on that approach, connection charges established herein do not include financing costs.

6.1 METHODOLOGY

Development of the connection charge must have a relationship to the cost of providing the service. California law and case history dictate that no user pay more than their fair share of the cost to provide public services. Historically, the City has based the water connection charge on the cost per gallon per minute of peak capacity. Non-residential service connection charges have been based on the meter size and capacity necessary to provide the amount of water needed for the customer's water demand.

To date, this method has provided a reasonably fair and equitable means of calculating an appropriate service charge and has resulted in adequate funding for improvements. This section presents a similar, but slightly different approach to determining connection charges. To simplify the process of determining the share of these costs for which an increment of future development is responsible, the concept of the Equivalent Dwelling Unit (EDU) will be used. An EDU represents the water demand in relation to the water demand for a single family dwelling unit.

Multi-family residential, commercial and industrial demands can be represented as a multiple of EDUs depending on their relative demand. In this way, the demands from various land uses can be put in terms of EDUs to determine the appropriate connection charge.

This method is a common and simple means of determining the connection charge and still considers the relative demand that new service places on the system. This new approach is simpler, especially given the variations in the relative unit costs of capacity between groundwater and surface water that factors into the connection charge.

6.1.1 FORMULATION OF CHARGE

As noted above, the EDU will serve as the basis for the water connection charge. The actual connection charge is dependent on the capital cost of improvements needed to serve the development. The typical single family home in Escalon has historically used an average of 540 gpd (as described in Section 3). The recommended connection charge is calculated based on the capital cost estimate for the improvements required to provide service to a single EDU within the system. It should be pointed out that existing users are not expected, or legally bound, to pay for capital improvements needed to expand the water system to serve new users. Thus, the connection charge is based solely on the number of new EDUs served by a given increment of water system improvements.

The total estimated cost of improvements to serve development through 2025 based on the market condition projections is $17.2 million dollars with an estimated additional 2,220 EDU added as shown in Table 6-1. The number of EDU represent the equivalent number of single family homes from a water demand standpoint; however, much of the future water demand will generated by commercial and industrial use. The City's current growth ordinance limits the number of residential building permits to 75 per year. Therefore between 2007 through 2025 a maximum of 1,425 homes are anticipated. The remaining EDUs represent commercial and industrial demand.

Table 6-1
Summary of Residential Connection Charge

Year	Avg. Annual Flow, mgd	EDU Added	EDU
2006 [a]	1.5	---	2,778
2010	1.7	370	3,148
2015	2	556	3,704
2020	2.4	741	4,444
2025	2.7	556	5,000
		2,222	

[a] Based on 1.5 mgd average annual flow at the end of 2006.

In order to fund future expansions the connection charge must be adequate to cover the cost of expanding the system capacity. Based on the number of new connections (including all commercial and industrial development that is expected, converted to EDUs) and capital costs the average cost per EDU is $7,740.

The projected costs are based on a pay-as-you go approach, assuming that developers will be required to construct improvements and will be reimbursed for any over sizing necessary with connection charges from subsequent development. Therefore the City, and existing residents, are not required to incur debt to pay down the loan, and no finance charges are included in the recommended connection charge.

Residential Connection Charge

The connection charge will vary depending on the type of development (e.g. single family, duplex, multi-unit, etc.) and the demand on the system. Table 6-2 includes a summary of the various types of residential development. Recommended connection charges are included for single family dwellings and for duplexes. There is significant variation in the type of multi-family and apartment buildings, and their associated water demands. Based on historical meter data, average water demand ranges from about 2,000 to about 9,500 gpd for multi-unit and apartments, respectively. The usage rate depends on the number of units, landscaping, and amenities (e.g. pool, spa and landscaping). Connection fees for multi-family and apartments should be based on the meter size and usage as discussed in the following section.

Table 6-2
Summary of Residential Connection Charge

Water User	Equivalent Dwelling Units (EDUs)	Annual Average Water Demand Factor, gpd/connection	Connection Charge
Single-Family Home	1.0	540	$7,740
Duplex[a]	1.37	740	$10,600
Multi-unit Housing	Varies	2,000[a]	Site specific
Large Apartment	Varies	9,500[a]	Site specific

[a] Based one meter for two units.
[b] Demand factor can vary. Connection charge should be based on site specific conditions related to demands.

Non-Residential/Multi-Unit/Apartment Connection Charge

Non-residential, multi-unit and apartment connection charges are discussed in this section. Historically the connection charges have been calculated using the meter size as determined by the meter equivalence ratio. This method can result in a connection fee that is too high or low in the larger meter sizes. A discussion of meter ratios and the recommended connection charge based on demand follows.

The size of the meter required to provide flows desired by the user can be used to determine the connection charge based on the meter equivalence ratio. Meter equivalent ratios are a common means of scaling connection charges and are based on the maximum capacity of the meter. Meter ratios have historically been used for determining the connection charges for non-residential services within the City.

The meter equivalence ratio is typically calculated based on the maximum capacity of a particular size of meter as determined by the American Water Works Association (AWWA) standards. Table 6-3 includes a summary of the meter ratios through a 6-inch meter. The table includes meter ratios historically used by the City, the AWWA standard and the proposed equivalence ratio determined and recommend as the basis moving forward.

The proposed meter equivalence ratio was revised from the AWWA standard because the smallest meter provided by the City is a ¾-inch meter and used for single-family residential homes. There are few, if any, 5/8-inch meters in the system, and they are the smallest standard water meter used for water service in public water systems. AWWA bases the meter equivalence ratios on a 5/8-inch meter; however, the smallest meter the City provides is a ¾-inch meter so the proposed equivalences are based on a ¾-inch meter capacity as a reference.

Basing the connection charge on the meter size works well with smaller meters up to 1-inch. The demand placed on the system by larger meters could be excessive, especially if onsite storage were provided to equalize peaks. As an example a 2-inch service could place a demand of 230,000 gpd (160 gpm x 1440 min) on the system, which is the equivalent of 425 single family homes (requiring a $3.2 million connection charge based on an EDU basis). As the meter gets larger, this discrepancy increases.

The minimum recommend connection charge for 1.5 through 6-inch meters is included in Table 6-3, and is directly proportional to the meter size and modified meter ratio. However, an alternative means of calculating the connection charge for commercial/industrial and multifamily sites is recommended based on the use ratio compared to single family dwelling unit. The applicant should provide the City with the average and maximum day water demands expected to be placed on the system which can then be converted to an EDU basis and used to determine the connection charge. This information would be submitted as part of the will serve application for the development.

As an example, the maximum day demand for a single family residential dwelling is 1,350 gpd (540x2.5). Another use that has a maximum daily demand of 2,000 gpd will have an EDU factor of 1.48 (2,000/1,350). The calculated connection charge would $11,455 ($7,740 x 1.48). The City would be responsible for sizing the water meter at the service based on the information provided by the owner.

If the charge were controversial, the City could review the usage records for the site after three years of service and make a determination as to the accuracy of the original estimate. If the applicant was overcharged, a refund would be made, or if the applicant was undercharged, then the additional money paid to the City. This approach protects the City and the applicant.

Table 6-3
Meter Equivalence Ratios

Meter Size, in	Meter Ratio			Meter Capacity (gpm) [d]
	Historical[a]	AWWA[b]	Proposed[c]	
5/8	1	1	n/a	20
3/4	1	1.5	1	30
1	1.4	2.5	1.7	50
1.5	1.8	5	3.3	100
2	2.9	8	5.3	160
3	11	17.5	11.7	350
4	14	31.5	21.0	630
6	21	70	46.7	1,400

[a] Historical meter ratio utilized by the City.
[b] American Water Works Association (AWWA) meter ratio calculation based on a 5/8-inch meter.
[c] Proposed meter ratio based on ¾-inch meter as basis for ratio.
[d] Based on AWWA standards for maximum flow through meter.

Connection charges for non-residential service connections are presented in Table 6-4 based solely on meter ratios. The calculated charge using the historical meter ratios is included for comparison. Use of the revised ratio is recommended. Connection charges for meters 1.5-inch and greater should be calculated on a site specific basis; however, the minimum recommend connection charge for 1.5- through 6-inch meters is included in Table 6-4.

Table 6-4
Non-Residential Water Service Connection Charge

Meter Size	Based on Historical Meter Ratios	Based on Revised Meter Ratios(b)
5/8	$7,740	n/a
3/4	$7,740	$7,740
1	$10,835	$13,160
1.5 [a]	$13,932	$24,540
2 [a]	$22,445	$41,020
3 [a]	$85,140	$90,660
4 [a]	$108,360	$162,540
6 [a]	$162,540	$541,800

[a] Minimum recommended connection charge; to be determined on a site specific basis.
[b] Revised meter ratio based on ¾ meter as standard.

Summary of Proposed Water Connection Charge

The proposed water service charges for residential and non-residential water connections are included in Table 6-5. The connection charges are considered based on demands for the particular non-residential service. Connection charges for metered services larger than 1.5-inches should determined on a site specific basis.

Table 6-5
Summary of Recommended Water Connection Charges

Service Type	Connection Charge
Residential Connection Fees	
Single Family	$7,740
Duplex	$10,600[a]
Multi-Unit and Apartments	Site Specific
Non-Residential Connection Fee	
Meter Size, in	Connection Charge
5/8	n/a
3/4	$7,740
1	$13,160
Meter Size, in	Min. Connection Charge [b]
1.5	$24,540
2	$41,020
3	$90,660
4	$162,540
6	$541,800

[a] Based on one meter serving two units.
[b] Recommended minimum connection charge; to be considered on site specific conditions.

6.1.3 INDEXING OF FEES

Indexing is used to provide for automatic adjustment of fees to account for inflationary cost increase. The enabling ordinance can provide for automatic fee adjustment on a prescribed date each year, or every other year or third year, etc. Annual indexing revisions are recommended to minimize the magnitude of the change and insure that revenue more closely follows expenses. One approach involves adjustment based on an accepted cost indicator such as the CPI (Consumer Price Index) or the ENR Construction Cost Index. The latter is preferred since it more closely reflects costs in the construction industry, which are used as the basis for computing connection fees. This approach provides the most accurate adjustment, although the incremental change (increase or decrease) is not known beyond the current year.

Section 7

Implementation Plan

This proposed implementation plan outlines the infrastructure improvements necessary to serve expected development as defined in the City's General Plan by increasing the City's water supply, and improving the City's storage/pumping and distribution systems. Project phasing will depend on the rate of growth experienced in the City. The City recently completed a General Plan Update (General Plan) and projected water demands are based on the boundaries and land uses described in that document. Estimated capital costs have been provided for the improvements and used to calculate the water connection charge.

7.1 RECOMMENDED PROJECT

Improvements for each planning boundary identified in the General Plan are described in Section 5. They include:

- New domestic water supply wells
- Construction of a new potable water tank and booster pump station
- Implementation in the South San Joaquin Irrigation District South County surface water supply project
- Transmission and distribution system pipeline extensions

Approximate locations within the City have been identified for the new water supply wells as well as the point of connection to a new surface water supply each of which are illustrated in Section 5. A hydraulic model was prepared and used to size pipelines to ensure adequate flow and pressure will be provided throughout the distribution system during critical demand periods (e.g. peak hour and maximum day plus fire flow) as the system expands. The locations of new wells will vary depending on the specific development plans in each area; however, it is recommend they be kept in the general vicinity shown on the figures.

The transmission and distribution system piping have been sized based on the water demand projections associated with the planning boundaries identified in the General Plan; however, water supply improvements are based on lower water demands associated with the market condition water demand estimates that account for the slow growth within Escalon.

7.2 PROJECT SCHEDULING

Project scheduling will depend largely on the rate and location of development within the City. The planning boundaries defined in the General Plan include:

- 2015 General Plan Growth Boundary
- 2025 General Plan Growth Boundary
- 2035 General Plan Growth Boundary

Growth projections were provided in the General Plan Background Report (February 2004) based on projected market demands and reflecting the City's current growth restriction ordinance. Water demands based on the General Plan Planning Boundaries were considered to be unrealistic. The recommended improvements presented in Section 5 are based on water demand projections generated assuming "market conditions" will control growth as opposed to the projections developed using the Planning Boundaries included in the General Plan. Utilizing the market condition analysis, planning periods of 2010, 2015 and 2025 were identified. Water supply improvements are based on those time horizons.

The SSJID surface water supply was anticipated to be available around 2012; however, it appears it may be delayed until participating Cities need the additional water supply. For the purpose of this report, water from SSJID was assumed to be available around 2015. At that time the City will be required to contribute its share of the project cost. Prior to then, the new tank, well and booster pump station will likely be constructed in the northwest industrial park area (as described in Section 5). After the surface water supply is online, the well at the tank site can be used to supplement the surface water or used as a back up during service interruptions from the SSJID project.

The improvements included in Section 5 are based on water demand projections utilizing the market projection from the Background Report and are expected to be needed in time frames which differ substantially from the 2015, 2025 and 2035 scenarios presented in the General Plan. As demands increase, those projects should be implemented.

7.3 CONNECTION FEES

Connection fees have been calculated based on the improvements necessary to provide additional water supply and distribution capacity to an equivalent dwelling unit, or EDU. Capacity charges were calculated based on a cash pay-as-you go basis, whereby connection fees collected by the City are used to construct facilities as they are needed and there are no costs associated with financing included in the recommend charges. Therefore, developers will be required to provide upfront capital to fund major projects, this is particularly true with the SSJID supply.

The connection fee calculation has been modified from the City's historical practice of utilizing the cost of capacity based on a gallon per minute basis. Although this method provided a fair and equitable means, it is not convenient with the inclusion of the SSJID surface water supply. The unit cost of that supply on a gallon per minute basis is significantly higher than utilizing wells. Instead the capital cost to construct the facilities was used in conjunction with the number of units that can be served by the new capacity. The cost was then divided on a per unit basis to arrive at a per EDU charge.

New service will pay based on its demand on the system as a multiple of an EDU. The City should consider this new means of calculating the connection charge and up date its fee schedule through its formal rate setting procedure. Once adopted, the connection charge should be adjusted annually based on an accepted index. One approach involves adjustment based on an accepted cost indicator such as the CPI (Consumer Price Index) or the Engineering News Record (ENR) Construction Cost Index. The latter is preferred since it more closely reflects cost changes in the construction industry, which are used as the basis for computing City connection fees. This approach provides the most accurate adjustment, although the incremental change (increase or decrease) is not known beyond the current year.

7.4 FUTURE UPDATES

The water master presented herein should be adopted by the City and implemented accordingly. Periodic updates to the master plan are recommended on a five to ten year basis to ensure that the assumptions presented herein remain valid. The Master Plan should also be updated if any major changes in the City's growth ordinance policy occur that would significantly increase the number of residential building permits issued.