CITY OF GREENFIELD

2005 - 2025 Water System Capital Improvement Plan Update and Capacity Charge Study

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EXECUTIVE SUMMARY

The purpose of this Water Capital Improvement Plan Update is to identify capacity deficiencies in the water system (both existing and at build-out) and recommend improvements to correct them. A staged capital improvement program (CIP) is proposed that presents the costs of the required improvements and the approximate time frame when they will be needed.

WATER SYSTEM ANALYSIS

The existing City of Greenfield water system has been analyzed for its capacity to handle existing and future demands. In addition, waterline extensions into presently undeveloped areas were identified and their capacity requirements were determined. The capacity analysis was performed on the major pipes in the water system.

Water demands were estimated based on land use information provided by the City of Greenfield Planning Department and by Pacific Municipal Consultants from the planning area defined in the 2005–2025 Greenfield General Plan. The water system analysis was based on design criteria established jointly between the City and Terra Engineering. Two time frames were studied as follows:

- ***Existing Development*** - For the purposes of this study, existing development corresponds to the start of 2003 and the start of the General Plan update. There has been no significant change in water usage data in the period from 2003 to 2005.
- ***Build-out Development (2025)*** - Build-out development refers to build-out according to the 2005–2025 General Plan at an even rate for twenty years.

As described below, the water system analysis indicated that there are no significant deficiencies in the existing system under existing development conditions. Accordingly, the City's existing water distribution system will have to be enlarged to meet future demand and the required improvements identified in the analysis are necessary to serve future development.

There are no booster pumping deficiencies under existing development. Additional booster pumping capacity at the 10th Street Corporation Yard will be required to meet future needs in the in the northern and eastern areas of the city.

There are no waterline deficiencies under existing development conditions. Some improvements to existing water lines are needed to meet future demands. The City has standby power on Well #5 and a portable generator available for the other two existing primary wells (Well #1 & #6) and should continue to install standby power at future well sites to increase the reliability of operations and to be able to utilize the wells as an emergency water supply.

The City has adequate existing well capacity to meet its current needs. Additional wells will be needed in the near future to meet anticipated future needs through build-out and there is funding in the 2004/2005 budget for construction of a water well at the 10th Street Corporation Yard or other location.

RECOMMENDED CAPITAL IMPROVEMENT PROJECTS (CIP)

The recommended capital improvement projects are indicated in the table below.

Recommended Water System Capital Improvement Projects	
Facility	**Estimated Cost**
Water Supply Wells	**$ 2,400,000**
Reservoirs	**$ 1,800,000**
Pump Stations	**$ 1,750,000**
Pipelines	**$ 6,948,000**
SCADA	**$ 300,000**
Total Construction Cost	**$13,198,000**
Contract Administration, Engineering & Contingencies	**$ 3,959,400**
Land Acquisition	**$ 100,000**
Total Capital Improvement Cost	**$17,257,400**
Administration (1.5% of total costs)	**$ 258,861**
Total Water Capacity Charge Costs	**$17,516,261**

All recommended projects in the above CIP projects are fully attributable to future development.

PROJECT IMPLEMENTATION

Implementation of the CIP should be undertaken as soon as possible. Implementation activities should include:

- Incorporate CIP recommendations into the City's CIP program.
- Incorporate recommendations into the City's rate study.
- Develop a plan for environmental review of projects.
- Coordinate the water projects with other construction projects such as storm drains and sewer, gas, electric, or telephone transmission facilities, or street paving projects that may share common alignments.

WATER CAPACITY CHARGES

Shown below are the water capacity charges that must be imposed on new development to finance new developments share of the costs of the recommended capital improvement projects.

Type	**Unit Cost**
Typical Residence Cost ((WFU/DU) x $111.08)	**$3,110.24**
Typical Commercial Cost (Unit Cost per water fixture unit)	**$111.08**

(from Section 7 - Table 17)

SECTION 1 - INTRODUCTION

This report presents the City of Greenfield Domestic Water System Capital Improvement Plan Update. It identifies water system deficiencies at build-out under the 2005–2025 General Plan, recommends projects to correct these deficiencies, and summarizes the planning level capital costs associated with these projects. In addition, it identifies the general locations and sizes for trunk water main extensions to serve further development within the study area.

The recommendations included in the report are based on the existing system conditions, existing service area, and anticipated demands within the planning area as defined by the 2005–2025 Greenfield General Plan (which becomes effective June 30, 2005). The City of Greenfield Sphere of Influence, which includes areas for future growth in accordance with the General Plan, is shown on **Figure 4 – Future Land Use (from the 2005–2025 Greenfield General Plan)**. The City's intent in commissioning this update is to sustain an ongoing responsible planning, design, and construction effort, that stays ahead of anticipated growth and development of the City of Greenfield.

BACKGROUND

The City of Greenfield has undertaken this Capital Improvement Plan Update effort to ensure adequate water system capacity for existing and future users and to plan for "trunk" water distribution main extensions and other water production and water storage facilities in developing areas. In addition to the analysis of the major trunk mains, this Capital Improvement Plan Update effort provides a base map of the existing water system (shown on Figure 3), and develops the proposed improvements needed to maintain adequate and dependable service (shown on **Figure 5)**.

This Update is being performed in conjunction with a similar study of the City's wastewater (sewer) system. The results of this sewer update are presented in a separate Wastewater System Capital Improvement Plan Update. These Capital Improvement Plan Updates have relied on common land use assumptions made in previous Master Plans and current General Plan Update to describe existing development and projected future growth in the study area.

PROJECT SCOPE

This Water System Capital Improvement Plan Update was prepared to identify improvements in the water system to determine deficiencies, optimize existing operations and to meet projected growth demands. This Capital Improvement Plan Update analyzed the existing water system to determine necessary improvements to correspond to expected potential growth.

Land use data and water consumption data provided the basis to determine the existing characteristics of the distribution and storage system. Major tasks completed during this Capital Improvement Plan Update are as follows:

- **Review Existing Information**. Available planning reports, documents, and maps were reviewed to develop a comprehensive informational database. Potential future developments and necessary extensions of the existing system were defined. Water consumption data were obtained and are also included in the informational database.

- **Develop Peak Demand Flows**. Existing and future demand flows were projected. The actual growth for each area for future growth was determined to quantify the maximum daily demand and fire flow requirement.

- **Determine Distribution System Capacity**. Present and future flow information was routed through the existing major distribution pipelines, using a computer model to determine the required pipe sizes to transport peak demand flows through the system.

- **Present Results**. The results are presented as required improvements for the City to upgrade the water system to supply water under peak demand conditions expected.

This Capital Improvement Plan Update should remain flexible to incorporate changes in development categories. The significant influence affecting new distribution pipelines is the size of the development. As additional information becomes available, the facilities in the recommended plan should be reviewed and updated.

STUDY AREA

Greenfield is located in southern Monterey County approximately 42 miles south of Salinas. It has no common boundaries with other municipalities, and is completely surrounded by unincorporated areas of Monterey County. The City's nearest neighbors are Soledad, approximately eight miles to the north, and King City, approximately ten miles to the south. The location of the City of Greenfield is shown in **Figure 1 – Location Map.**

The study area is situated on a flat alluvial plain between the Santa Lucia Range to the west and the Gabilan Range to the east. The study area is located in the central Salinas Valley. The majority of the study area consists of a moderate slope to the northeast towards the Salinas River. The principal watercourse within the immediate area is the Salinas River that flows generally to the northwest to join the Monterey Bay near the community of Pajaro, approximately fifty-five miles north of Greenfield.

The climate of Greenfield is characterized by tepid, windy summers, and cool, moist winters. The mean annual precipitation averages about 12 inches. Most of the annual precipitation occurs during the period from November through April.

The study area encompasses a total area of approximately 3.25 square miles, with more than half of the area currently developed. The area is assumed to be fully developed at build-out. The population of Greenfield is about 13,167 people within the existing City core area. At present, the water system serves only the City core area and does not serve any adjacent unincorporated areas. At build-out, the City population is projected to be about 36,000.

The study area for this Capital Improvement Plan Update is shown on **Figure 2 – Study Area** and includes the planning area defined in the 2005–2025 Greenfield General Plan.

Greenfield occupies a central location in the southern part of the county along U.S. Route 101. Commercial activities are centered along El Camino Real in the downtown area, which is defined as the area bounded by Cherry Avenue on the north, the Elm Avenue on the south. The older residential area of the City is located just west and east of the downtown area. New residential development is expected to occur mainly in the western, northern, and eastern portions of the study area. Industrial development is generally located to the along El Camino Real from Cherry Avenue to Thorne Road in the northern area of the City and east of Hwy. 101 and south of Oak Avenue in the in the southeastern area portions of the City. Industrial development is expected to occur in the same areas in the future. The current developed land use is approximately three-quarters residential and one-quarter commercial/industrial. At General Plan build-out, future growth will be about forty percent residential and sixty percent commercial / industrial.

SECTION 2 - EXISTING WATER SYSTEM

This section summarizes and describes the major features of the City's existing water system. Included are the existing water sources, reservoirs, pump stations, and distribution/transmission pipelines. The existing water facilities (distribution system, storage, and pumping facilities) are shown on **Figure 3 – Water System Map.**

The existing water system contains three primary water production wells, one ground water storage tank, a water booster pump station, over 17 miles of water distribution pipelines made of cast iron, asbestos cement, plastic (AWWA C-900), and steel. The distribution is pressurized by a pumping plant at Oak Avenue and Thirteen Street in one pressure zone that provides static pressure of 66 psi at elevation 335 with the static pressure varying between 66 psi and 71 psi across the City. There are about 2,550 metered water services. The water system is operated under a permit from the Stated of California Department of Health Services (DOHS) and is considered a large water system.

WATER SUPPLY WELLS

The City currently utilizes groundwater from the Salinas River and Arroyo Seco aquifers as its sole source of supply. The groundwater basin underlying the study area is the Lower Aquifer sub-basin in the Salinas Valley. Regional groundwater flow in the Lower Aquifer sub-basin is northerly toward the Monterey Bay.

Three wells containing line-shaft vertical turbine pumps remove groundwater and deliver it to the water system. Chlorine solution is injected into the pumped water at each well to provide for distribution system residual disinfection. The City's 3 existing wells are shown on **Table 1- Existing Water Supply Wells** shown below:

Table 1
Existing Water Supply Wells

Well #	Location	Depth	Capacity	Capacity	Seal Depth
		(feet)	(gpm)	(MGD)	(feet)[3]
1	Fourteenth St./Cherry Av.	883	1,400	2.0	330
5 [1]	Thirteenth St./Oak Ave.	860	900 [2]	1.3 [2]	600
6	Fourteenth St./Cherry Ave.	880	1,550	2.2	280
	Total Existing Capacity		**3,850**	**5.3**	

Notes:

1. Wells 2, 3, and 4 have been abandoned, or are presently not in use.
2. Well #5 was extensively rehabilitated in early 2004, but production problems have continued. The well is being evaluated and tested at this time and a recommendation will be completed in November 2004.
3. The well screen or louvers extend from the bottom of the seal to 20 feet above the bottom of each well in most cases.

The City operates its wells to meet system demands based on keeping the 1,000,000 gallon ground level storage tank (reservoir) at Thirteen Street and Oak Avenue full at all times. The wells are also operated to meet peak demands and fire flows based on system pressures by maintaining a relatively constant water level in the Oak Avenue reservoir. The wells pump directly into the 1.0 million-gallon reservoir. The wells are located far enough apart that they do not influence each other when pumping simultaneously. However, Well #5, has experienced production problems in recent months and is being tested and evaluated at the current time (November 2004). Well #5 has a current capacity of 900 gpm, and cannot individually meet demand and fill the reservoir.

The City of Greenfield's water system maintains its pressure with variable frequency drive pumps. The variable frequency drive pumps respond automatically to the system demand by drawing water from the 1.0 million-gallon (1.0 MG) Oak Avenue reservoir. A 1,500-gallon hydro-pneumatic surge tank counters short term fluctuation in demand. As the 1.0 MG reservoir is drawn, the wells respond to refill the reservoir.

As required by DOHS, the City routinely tests its all its wells to ensure that the groundwater pumped meets EPA and DOHS drinking water standards. The water quality of the primary wells is good and meets all standards. The City is not currently experiencing nitrate problems with its active wells. Refer to Appendix B for the Annual Water Quality Report for a complete listing of the mineral (organic and inorganic) constituents of the groundwater.

STORAGE RESERVOIRS

The water system contains two water storage reservoirs. The oldest reservoir is an elevated welded steel tank located on Oak Avenue between Tenth and Eleventh Streets and has been taken out of service. This tank has a capacity of 100,000 gallons (0.1 MG) and was constructed in the 1940s. The other reservoir is a 1,000,000-gallon (1.0 MG) welded steel ground storage tank located at Thirteen Street and Oak Avenue in the southwest corner of the city. This reservoir was constructed in 1992. **Table 2 – Existing Reservoirs** describes these reservoirs.

Table 2
Existing Reservoirs

Zone	Reservoir Capacity (MG)	Type	Diameter (ft)	Water Surface Elevation (ft) Maximum (overflow)	WSE (ft) Minimum (bottom)
Base	1.0	Ground	72	335	329
Base	0.1 [1]	Elevated	25	N/A	N/A

Note:
1. This 100,000-gallon elevated tank is presently not in use and is scheduled for demolition in the near future. The demolition of this tank will require careful dismantling because of lead base paint.

The 1.0 MG ground storage tank provides water for the booster pumping plant that provides the required pressure in the City. Both reservoirs were inspected for structural deficiencies and integrity of the coatings by Los Osos Engineering in 2004. The inspection report recommended that:

1. The 1.0 MG ground storage is in very good condition and will probably require recoating in the next two years;
2. The 0.1 MG elevated tank coatings are delaminating and given the cost of recoating the lead-based exterior paint, and the 1999 Inspection Report recommended that this tank be taken out of service.

BOOSTER PUMPING STATIONS

A booster pump station located adjacent to the 1.0 MG storage tank at Thirteen Street and Oak Avenue provides water pressure for the City of Greenfield. This booster pump station contains four pumps that operate on a variable speed principal using variable frequency drive motors (VFD) which vary the amount of water pumped in accordance with the pressure and demand**. Table 3 – Existing Booster Pump Station** describes this existing booster pump station.

Table 3
Existing Booster Pump Station
(13th Street/Oak Avenue)

Service Area	No. of Pumps	Pump Type	Pump Rating Each (gpm)	Pump Capacity (gpm)
City-wide	2	VFD Vertical Turbine	1200	2,400
City-wide	2	VFD Vertical Turbine	500	1,000
Total				**3,400**

PRESSURE ZONES

The City's existing distribution system is served by one pressure zone. Since there are no significant changes in elevation throughout the study area, this zone serves all of the existing developed areas in the City.

TRANSMISSION AND DISTRIBUTION WATERLINES

The City's existing transmission and distribution water pipe lines vary in diameter from 4 inches to 16 inches. A summary tabulation is shown on **Table 4 Existing Water Pipelines** shown below.

Table 4
Existing Water Pipelines

Diameter, inches	**Total Length, feet**
4"	11,590
6"	29,940
8"	19,610
10"	1,390
12"	21,955
16"	5,860
TOTAL:	**90,345 LF**
Miles:	17.11 miles

SECTION 3 – FUTURE LAND USE

The planning criteria for the Water System Capital Improvement Plan Update include a number of factors such as the land use assumptions, water demand factors, and hydraulic parameters. Existing and future land use assumptions were developed for use in estimating water demand. These factors are described in this section of the report.

LAND USE CATEGORIES

The land use categories for the Capital Improvement Plan Update process were determined from the Greenfield 2005–2025 General Plan and related information. There are 14 land use categories identified in the proposed General Plan, as set forth in the table below. Those proposed land uses and the acreages of each designation were used to determine future demand.

RE	Residential Estate (1-2 DU/acre)
LDR	Low Density Residential (3-7 DU/acre)
MDR	Medium Density Residential (7-12 DU/acre)
HDR	High Density Residential (12-20 DU/acre)
NC	Neighborhood Commercial
DTC	Downtown Commercial
HC	Highway Commercial
LI	Light Industrial
HI	Heavy Industrial
PO	Professional Office
PQP	Public Quasi Public
A	Agricultural
AAVS	Artisan Agricultural Visitor Serving
ROS	Recreation Open Space

FUTURE LAND USE ASSUMPTIONS

Figure 4 – Future Land Use shows land use map and the build-out land uses assumed for Greenfield. The map is divided into four quadrants with Highway 101 as the north/south axis and Walnut Ave the east/west axis. Quadrant 1 (**Q_1**) is the northeast quadrant with the other quadrants following clockwise. The acreage in any given land use category is assumed to include streets and roads. **Table 5 – Future Land Use** describes each of the future growth areas.

Table 5
Future Land Use

Designation	Zoning	Vacant Existing City Limits	Vacant Future Growth Area	Vacan t Total
		(ac.)	(ac.)	(ac.)
Residential Estate (1-2 DU/acre)	**RE**	0	129	129
Low Density Residential (3-7 DU/acre)	**LDR**	10	235	245
Medium Density Residential (7-12 DU/acre)	**MDR**	0	194	194
High Density Residential (12-20 DU/acre)	**HDR**	0	0	0
Neighborhood Commercial	**NC**	0	4	4
Downtown Commercial	**DTC**	4	0	4
Highway Commercial	**HC**	97	152	249
Light Industrial	**LI**	102	39	141
Heavy Industrial	**HI**	0	296	296
Professional Office	**PO**	0	0	0
Public Quasi Public	**PQP**	0	0	0
Artisan Ag. Visitor Serving	**AAVS**	0	315	315
Recreation Open Space	**ROS**	0	19	19
Totals		**213**	**1383**	**1596**

Multiple uses for areas were assumed as shown. Average unit densities for the different uses were assumed such that equivalent housing units could be calculated.

DEVELOPMENT ASSUMPTIONS

Land uses were quantified by the number of units in each land use category for two different time frames: Existing (2003) and Build-out (2025).

- ***Existing Development*** - For the purposes of this study, existing development corresponds to the 2003 period.
- ***Build-out Development (2025)*** - Build-out development refers to build-out according to the Greenfield 2005–2025 General Plan at an even rate for twenty years.

Specific development assumptions are shown in Section 4.

SECTION 4 - WATER DEMAND REQUIREMENTS

This chapter develops existing and future water demand requirements for the City of Greenfield. The projected water demand requirements are based on historical water consumption, the land use assumptions set forth in Section 3, and estimated water demand rates. The future water requirements are used to determine the water storage and distribution facilities necessary to serve the City at General Plan build-out.

EXISTING WATER REQUIREMENTS

City of Greenfield's water production data for the year 2001 and 2002 was analyzed. A total of 1,117 million gallons of water was pumped during this period. The monthly data showed peak demand in the summer months of May through September and the minimum demand in the months December through March. Seasonal variations are primarily due to summer irrigation needs. **Table 6 - 2001 and 2002 Water Production Data** illustrates the water production during this period.

Table 6
2001 and 2002 Water Production Data
City of Greenfield

Year	**Peak Day**	**Peak Month**	**Total Production**
	(MG)	(MG)	(MG)
2001	3.0	62.6	540.5
2002	3.2	66.0	576.4
2001 Average Daily Flow (MGD)			**1.48**
2002 Average Daily Flow (MGD)			**1.58**
2001 Average Max. Month Daily Flow (MGD)			**2.02**
2002 Average Max. Month Daily Flow (MGD)			**2.20**

Assuming a population of 12,825 people, the per capita water production for the two-year period was 119 gallons per person per day. Greenfield had 2,271 residential water service connections in 2002. The number of people per residential water service is 5.65 (12,825 people/2,271 connections).

The seasonal fluctuations in water requirements were broken down to monthly average daily flow quantities to determine a monthly peaking factor. The monthly peaking factor is defined as the average rate of production during the peak month divided by the average rate of production for the entire year. The monthly peaking factor for Greenfield is 1.4.

For water systems, the peak day versus average day factor is important. In general, the peak day factor is higher than the maximum month factor since it is a more specific condition. Typically, the peak day production ranges from approximately 1.75 to 2.0 times greater than the annual average day production on a system-wide basis. The peak day factor for Greenfield is 2.0.

There were no hourly water production data available to calculate the peak hour factor. However, it typically ranges from approximately 1.5 to 2.0 times greater than the peak day demand. A 1.5 factor is commonly used to approximate the peak hour factor.

Water consumption data by user type is not available in Greenfield. Therefore, it is not possible to compare peak month to average month consumption, peak day to average day consumption, or peak hour use for the City user types. Generally, the factors defined for specific land uses are similar to the system-wide factor. For this study, the system-wide factors will be used for all land use categories.

The following factors will be used to generate demands for the hydraulic analysis:

- **Peak Day Demand = 2.0 times Average Day Demand**
- **Peak Hour Demand = 1.5 times Maximum Day Demand**

The following **Table 7 – Summary of Existing Water Use Factors summarizes the existing water use for Greenfield.**

Table 7
Summary of Existing Water Use Factors

Factor	**Amount**
Average Daily Flow (ADF)	1.58 MGD
Maximum Monthly Flow	2.2 MGD
Average Yearly Per Capita Use	119 gpcpd
Peak Day Demand (PDF)	3.2 MGD
Peak Hour Rate of Maximum Day	3,333 gpm

UNIT DEMAND FACTORS

For this study, the unit water demands were developed using the land uses from the 2005 – 2025 General Plan (shown in Section 3) and .in conjunction with the available system-wide water production data. Based on the data developed above, the per capita residential water use was assumed to be 119 gallons per day per capita (gpdc) and 5.65 people per dwelling.

Using data derived in the previous section, the following unit demand factors shown on **Table 8 – Unit Demand Factors for Land Use Categories** were chosen based upon production records and on historic demand factors developed by county agencies or standard engineering planning practice for South Monterey County.

Table 8
Unit Demand Factors for Land Use Categories

Land Use Category	Average Day Demand
Residential Estate (1-2 DU/acre)	1,333 gpd/acre
Low Density Residential (3-7 DU/acre)	3,332 gpd/acre
Medium Density Residential (7-12 DU/acre)	6,664 gpd/acre
High Density Residential (12-20 DU/acre)	10,662 gpd/acre
Neighborhood Commercial	1,000 gpd/acre
Downtown Commercial	1,000 gpd/acre
Highway Commercial	1,000 gpd/acre
Light Industrial	1,000 gpd/acre
Heavy Industrial	2,500 gpd/acre
Professional Office	1,000 gpd/acre
Public Quasi Public	1,000 gpd/acre
Agricultural	N/A
Artisan Agricultural Visitor Serving	1,000 gpd/acre
Recreation Open Space	1,000 gpd/acre
Mixed Use Overlay	9,330 gpd/acre

These unit demand factors are assumed to account for system losses, since they were derived from production rather than consumption data. Losses within the City system might occur from service leaks, pipe joint leaks, main breaks and other unknown causes. Typically, losses between production and consumption range from 5 to 10 percent.

ESTIMATES OF FUTURE WATER DEMANDS

Water demands are calculated by multiplying the acreage of each land use within a sub-area by the appropriate unit demand factor. Water demand estimates were developed based on unit demand factors discussed previously. The following **Table 9 – Future Land Use Flows** shows average day flows (ADF) and peak day flows (PDF) for each area:

Table 9 **Future Water Use**								
Designation	**Zoning**	**Total**	**Ave. DU**	**Total DU**	**Unit Rate**	**ADF**	**PDF**	**WFU**
		(ac.)			(gpd)	(gpd)	(gpd)	(water fixture unit)
Residential Estate	**RE**	129	2	258	1,333	171,931	343,862	7,224
Low Density Residential	**LDR**	245	5	1225	3,332	816,340	1,632,680	34,300
Medium Density Residential	**MDR**	194	10	1940	6,664	1,292,816	2,585,632	54,320
High Density Residential	**HDR**	0	16	0	10,662	0	0	0
Neighborhood Commercial	**NC**	4	N/A		1,000	4,000	8,000	168
Downtown Commercial	**DTC**	4	N/A		1,000	4,000	8,000	168
Highway Commercial	**HC**	249	N/A		1,000	249,000	498,000	10,462
Light Industrial	**LI**	141	N/A		1,000	141,000	282,000	5,924
Heavy Industrial	**HI**	296	N/A		2,500	740,000	1,480,000	31,092
Professional Office	**PO**	0	N/A		1,000	0	0	0
Public Quasi Public	**PQP**	0	N/A		1,000	0	0	0
Artisan Ag. Visitor Serving	**AAVS**	315	N/A		1,000	315,000	630,000	13,235
Recreation Open Space	**ROS**	19	N/A		1,000	19,000	38,000	798
Total				**3,423**		**3,753,087**	**7,506,174**	**157,691**
Standard Residential Dwelling = 28 water fixture units.								
Residential zones have a peak day flow of 4,562,174 gpd and 95,844 wfu.								
Zones other than residential use based upon 0.0210084 wfu per pdf								

DEMAND ALLOCATION METHODOLOGY

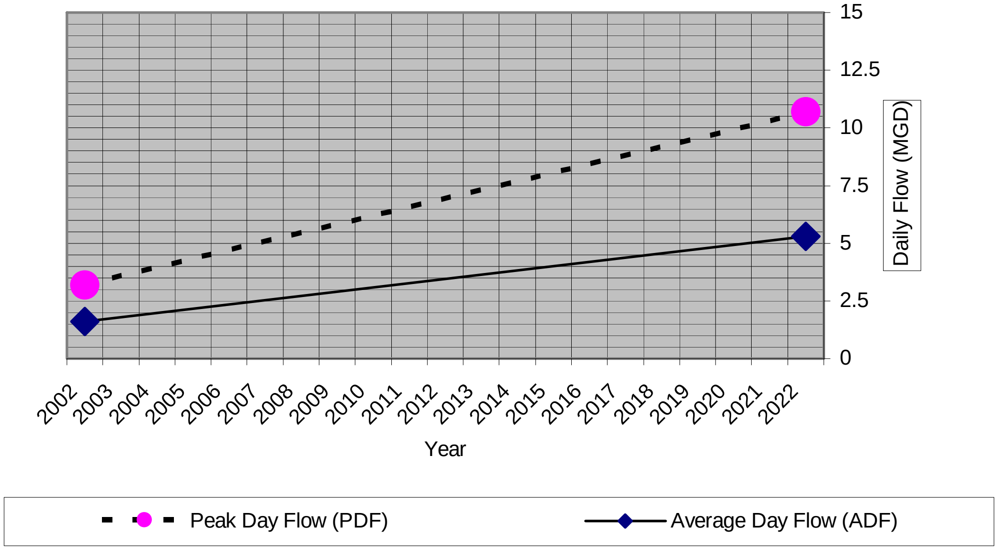
The following **Table 10 – Summary of Future Water Demands** shows the build-out calculations for each area:

Table 10 **Summary of Future Water Demands**			
Designation	**ADF**	**PDF**	**Peak Hour**
	(MGD)	(MGD)	(gpm)
2002 Existing Use	1.6	3.2	3,333
Future Land Use	3.7	7.5	7,813
Estimated Total	**5.3**	**10.7**	**11,145**

Therefore, the future average day flow will be about **5.3 MGD**, the future peak day flow will be about **10.7 MGD,** and the peak hour flow will be **11,145 gpm.**

Assuming a 20-year built rate, **Table 11 – Future Water Demand** is a graph showing the future water demands extended at a constant rate over the twenty year period.

Table 11
City of Greenfield Future Water Use



SECTION 5 – FACILITIES EVALUATION

Section 2 – Existing Water System presented a description of the City's existing water system and Section 3 – Future Land Use described planning criteria related to demand estimates and hydraulic requirements. This section presents an analysis of the system based upon meeting the water demands for existing conditions through build-out development. The evaluation includes water supply, storage reservoirs, pump stations, and major transmission/distribution pipelines. The piping analysis includes identifying capacity deficiencies of existing pipes needed to serve future development and waterline extensions needed to serve future development.

WATER SUPPLY ANALYSIS

The source capacity is evaluated in terms of the capacity of the wells to supply existing and future demands. As shown on **Table 1 – Existing Wells** from Section 2 of this report, the existing wells can supply 3,850 gpm peak rate and peak day 5.3 MG. The estimated existing peak day demand is 3.2 MGD. The estimated future peak day demand is 10.7 MGD.

There is adequate existing well capacity to meet the City's current needs. However, to achieve the projected future demand, additional source capacity of about 5.4 MGD (10.7 MGD – 5.3 MGD = 5.4 MGD) would be required. This would be about three wells of a size similar to the existing Wells #1 and #6 (1,400 to 1,550 gpm).

As part of the ongoing Greenfield Wastewater Treatment Plant (GWWTP) expansion Terra Engineering and Freitas + Freitas prepared a Wastewater Disposal Report that discussed reclaimed wastewater from the GWWTP. Wastewater reclamation could be used to reduce landscape irrigation peak day demands and thereby reduce peak day water demands. At this time there is no existing wastewater reclamation facility treating the wastewater. The preliminary costs for a reclamation system were greater than the City of Greenfield can afford. The City will continue investigating the potential markets and the economics of reclaimed wastewater use in the area.

STORAGE ANALYSIS

The water reservoir storage requirements for the water system were evaluated for each of the City's individual pressure zones. The major components of water system storage include:

- Operational storage
- Emergency storage
- Fire storage.

Operational storage is the quantity of storage needed to meet normal peak demands that exceed a constant supply rate. Operational storage should regulate peak fluctuation in hourly demands beyond supply capacities. Operational storage requirements are greatest on the day of maximum demand and so should be sized accordingly.

This storage is determined by the variation in the hourly demands during the day of maximum day demand. Operating in this manner reduces both the capital and energy costs associated with the pumping facilities. Because no diurnal data is available to do a detailed calculation, estimates are developed for the required operational storage volume. A criterion of 30 percent of the maximum day demand is appropriate for operational storage. Well capacity in excess of the maximum day demand may be used to help meet this requirement. However, there is no available peaking capacity in excess of the maximum day demand assuming that a couple of the existing wells may be out of service at any time.

Emergency storage is the volume of water required to supply the pressure zone during planned or unplanned equipment outages (e.g., booster pump stations), power outages, or well shutdowns. This storage needs to be sufficient to provide a reasonable level of uninterrupted service under these circumstances. As the City wells are the only source of supply to the City, consideration must be given to emergency storage.

The minimum recommended emergency storage generally represents a 3-hour power outage on the maximum day use (12.5 percent of maximum day demand). A typical assumption for emergency storage is that there may be supply outage and/or power outage for up to a 12-hour duration on the maximum day of use (50 percent of the maximum day demand).

However, the City has permanent standby electrical power at the pumping plant / Well #5 and a standby portable electrical power generator for use at the other two primary wells and is planning to install standby power at all future well sites. The wells feed directly into the water distribution system. With standby electrical power, the wells could be considered as part of emergency storage

Fire Storage requirements are normally based on guidelines developed by the National Insurance Underwriters Association (e.g. Insurance Services Office [ISO]). The fire flow requirements are a function of the type of structures contained within that particular area, including building material, building separation, and whether the buildings are equipped with sprinkler systems. **Table 12 - Insurance Service Office Fire Storage Criteria** below indicates the fire flow demand and/or duration used for this study. The required fire flow and pressure zone is dependent on the most critical structure or land use development within that pressure zone.

Table 12 Insurance Service Office Fire Storage Criteria			
Land Use Category	**Fire Flow** (gpm)	**Duration** (hr)	**Storage Volume** (MGD)
Residential	1,500	2	0.18
Commercial	3,000	3	0.54
Light Industrial	5,000	5	1.5
Heavy Industrial	5,000	5	1.5
Schools	3,000	3	0.54

For Greenfield, schools and commercial are the significant land use categories, each of which requires about 0.54 MG of storage. **Table 13 – Water Storage Requirements** shows the water storage requirements using these categories.

Table 13 Water Storage Requirements		
Requirement	**Existing (1999)**	**Build-out (2023)**
Demand, MGD		
Average	1.6	5.3
Peak	3.2	10.7
Storage, MG		
Operational (0.3 x PDF)	0.96	3.21
Emergency	-	-
Fire	0.54	0.54
Total Storage Required, MG	**1.5**	**3.75**
Total Existing Storage, MG	1.0	1.0
Storage Deficit, MG	**0.5**	**2.75**

Table 13 – Water Storage Requirements identifies an existing 0.5 MG deficit. The 2003/2004 City budget has provided for a second 1.0 MG ground storage tank immediately adjacent to the existing City Corporation Yard on Tenth Street. With the addition of this tank sufficient storage until peak day flows reach about 4.9 MGD would be available for the city. Additional storage tanks should be constructed for a total of 3.75 MG storage at build-out.

PUMP STATION ANALYSIS

Pump stations should have the ability to meet the peak hour of the peak day demand for the zone into which it is pumping.

The City's only existing booster pump station was described in **Section 2 – Existing Water System**. The booster pump station is used to provide water pressure to the City water system. As discussed, sizing of a booster pump station is based on the ability to meet the peak hour of peak day demands for the zone into which it is pumping.

Based on the peak day demands, the existing 13th Street/Oak Avenue Pump Station has a capacity of 3,400 gpm and is adequate for existing conditions. However, growth would require booster pumping stations to pump about 11,500 gpm on the peak hour of peak day. This would require installing new booster pumping stations to more than triple the capacity. New booster pumping plants should be constructed to pump a minimum of 11,500 gpm for the entire city. Each new booster pumping plant should pump a minimum of about 2,700 gpm if three pump stations were added.

TRANSMISSION AND DISTRIBUTION WATERLINES

In order to provide adequate flow to individual service connections the pressure in the distribution system was evaluated under several scenarios. The following criteria were used to evaluate system pressures:

- Minimum pressures at the nodes throughout the system should be 50 psi or greater during peak day demand plus fire flow.
- Maximum pressures should be limited to 100 psi. Greenfield requires pressure-reducing values in areas where system pressure exceeds 80 psi.
- Maximum velocity - 12 fps.
- Maximum head loss with peak day flows - 10-ft/1000 ft.

In order to evaluate the impact on the residual pressures within the system under fire flow conditions, critical locations for fires were identified within each pressure-zone. These representative locations were developed by first identifying the maximum fire flows which could occur within the pressure zone, and then identifying locations which would provide a maximum stress on the system based on elevation, surrounding piping system, and land use type.

The Hazen-Williams C factors used to determine pipe friction losses vary depending on the material of the pipe. For this study a C factor of 120 was assumed for the modeled pipes; except in the older portion of the downtown area where a C factors of 80 was used.

PIPING SYSTEM ANALYSIS AND COMPUTER MODEL

The City's network of transmission and distribution system piping was evaluated under existing and estimated future demand conditions. This analysis allowed the determination of additional required piping to provide sufficient flow of water at appropriate pressure levels to all areas within the existing City system and to provide water service to future development. The evaluation was performed with the assistance of computer simulation model of the water distribution system.

The following information on the water system facilities was placed in the database:

- Pipe diameters, lengths, and estimated friction factors.
- Ground surface elevations at junctions (nodes).
- Reservoir diameter, bottom and overflow elevations.
- Pump characteristic curves.
- Minimum pressures should be 20 psi or greater during maximum day demand plus fire flow and 35 psi or greater during peak hour demand.
- Maximum pressures should be limited to 100 psi.
- Peak day demand
- Maximum day demand with fire flow.

The data developed and stored in the database for piping, reservoirs, pump stations, and wells was used for performing computer simulation analyses of the distribution system. The computer modeling software used for this purpose was *Cybernet by Haestad Methods*. The entire City system was represented by a link node system, with each link representing a major pipe in the system and nodes representing connection points between each pipe. Demands were allocated to each of the nodes. Each pipe and each node was assigned a different number for identification purposes.

The computer model was operated under various demand conditions to evaluate the impact on residual pressures within the system. The initial analysis was based on the City's existing storage, pumping, and well facilities. The model was also modified to analyze the water system improvements, which are described later in this section.

DISTRIBUTION SYSTEM ANALYSIS RESULTS

The water system analysis indicated that there are no significant deficiencies in the existing system but future demand creates deficiencies that were considered in the development of the recommended water system improvements discussed in **Section 6 – Recommended Capital Improvement Program**. The required improvements identified in the analysis are attributable to future development and the need to provide more pipelines across Highway 101 and provide a 12” diameter pipeline grid east of Highway 101.

Waterline extensions will be required to serve future development, and will be the direct responsibility of future development. These extensions have been identified conceptually and sized as part of the Capital Improvement Program process and are discussed in **Section 6 – Recommended Capital Improvement Program**; however, the exact alignments will need to be defined as part of the detailed subdivision planning required for the area.

SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

Addition of new wells, pump stations, and storage reservoirs required by future development also requires that a modern control and data acquisition system be installed which could monitor all aspects of the expanded water system. The existing system is operated manually.

Each facility should have a remote telemetry panel and be connected by telephone lines or radio communication signals to a master control panel where the status of each facility can be viewed. This would include all status, flow, level, pressure, and residual chlorine measurements at each facility. All measurements can be recorded on a continuous basis from which daily, weekly, monthly, and yearly summary status reports can be generated.

The master control panel should be located in the Public Works Department office.

SECTION 6 - RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

The recommended capital improvement program (CIP) for the Greenfield water system is based on the need for additional water facilities in the City as indicated by the water system analysis. The CIP has several elements including water supply projects, reservoir projects, pump station projects, waterline projects, and SCADA projects.

Pipeline extensions will need to be designed to accommodate the specific developments as they are planned and constructed. The City will need to review projects that are designed and built by developers to ensure adequate ultimate capacity in the system. The information presented herein is intended to serve as a sizing guideline.

Only pipes shown in this Water System Capital Improvement Plan will be paid for by proposed Water Capacity Charges. All other pipes are considered as serving the specific development project and are to be paid for by the developers.

RECOMMENDED WATER SUPPLY PROJECTS

To achieve the projected future demand, additional source capacity of about 5.4 MGD would be required. The estimated number of new wells would be based on the anticipated well pumping capacity. This 5.4-MGD deficit would require about three new wells of a size similar to Wells #1 and #6 (1,400 to 1,550 gpm) for the build-out 20-year period. This would be a new well every seven years.

The 2004/2005 City budget has provided funds for a new well at the expanded City Corporation Yard or other location. With the addition of this well, sufficient water production for about fourteen years would be available for the City.

The actual number of wells required would depend on the actual pumping capacity of each new constructed well. Standby electrical power will be required for the wells to serve as an emergency water supply.

The estimated capital costs include construction costs of about $800,000 per well for well development, pump house, standby power, and site development plus 30% for engineering, legal, administration, and contingencies. The costs for these wells needed for future scenarios are solely attributable to future development.

RECOMMENDED RESERVOIR PROJECTS

The 2004/2005 City budget has provided for a second 1.0 MG ground storage tank immediately adjacent to the existing City Corporation Yard or other location. With the addition of this tank, sufficient storage for about four years would be available for the city.

Additional water storage tanks are then needed to bring the City total storage to 3.75 MG. As the need arises, a second 1.0 MG ground storage tank should be added to the 13th Street/Oak Avenue site and a second 1.0 MG ground storage tank should be added to the City Corporation Yard site.

RECOMMENDED PUMP STATION PROJECTS

Based on the peak day demands, the existing 13th Street/Oak Avenue Pump Station has a capacity of 3,400 gpm and is adequate for existing conditions. However, growth would require pumping stations to pump about 11,500 gpm on the peak hour of peak day. This would require installing new pumping stations to more than triple the capacity. New pumping plants should be constructed to pump a minimum of 11,500 gpm for the entire city. Each new pumping plant should pump a minimum of about 2,700 gpm if three pump stations were added.

The 2003/2004 City budget has provided for a pumping plant immediately adjacent to the existing City Corporation Yard. With the addition of this pump station, sufficient storage for about ten years would be available for the city.

As the need arises, the pumping capacity of the 13th Street/Oak Avenue Pump Station should be increased by the additional 2,600 gpm pumping capacity and the capacity of the City Corporation Yard pump station should be increased by the additional 2,700 gpm.

RECOMMENDED WATERLINE PROJECTS

The water system analysis indicated that the required improvements identified in the analysis are attributable to future development and include the need to provide more pipelines across Highway 101 and a 12” diameter pipeline grid east of Highway 101.

Waterline extensions will be required to serve future development. These extensions have been identified conceptually and sized as part of the Capital Improvement Plan Update process and are discussed in **Section 5 - Facilities Evaluation;** however, the exact alignments will need to be defined as part of the detailed subdivision planning required for the area. The major pipeline from a new booster pump station to a new water storage reservoir should be included in the Capital Improvement Program. These backbone pipelines should be a minimum of 12” inside diameter.

These future waterline extensions are shown on **Figure 5 – Recommended Capital Improvement Projects** for Impact Fee studying purposes. These waterlines have been routed along existing roads or assumed extensions of existing roads. The sizes provided in the Capital Improvement Plan Update are intended to serve as a guideline for the City to use in evaluating and possibly up-sizing projects proposed by developers. The actual alignments and design details of the future waterlines will depend on the specific development schemes. These future waterlines will be designed and constructed as development occurs and all costs of these future waterlines are attributable to future users.

RECOMMENDED SCADA PROJECT

The existing water system is current manually operated. The addition of new wells, booster pump stations, and storage reservoirs requires that a modern control and data acquisition system be installed which can monitor and control all aspects of the water system.

Each existing and new facility should be connected by telephone lines or radio communication signals to a master control panel where the status of each facility can be viewed. This would include all status, flow, level, pressure, and residual chlorine measurements at each facility. All measurements can be recorded on a continuous basis from which daily, weekly, monthly, and yearly summary status reports can be generated.

The master control panel should be located in the Public Works Department office.

SUMMARY OF RECOMMENDED WATER SYSTEM IMPROVEMENTS

The water system CIP projects are shown on **Figure 5 – Capital Improvement Projects and Table 14 - Recommended Capital Improvement Projects** summarizes the estimated capital costs for the recommended water system improvements. The estimated capital costs are based upon experience with recent bid results for similar projects in the tri-county area. The CIP projects under the proposed land use conditions are sized to handle future demands, and thus serve to accommodate future growth. All projects in the CIP are fully attributable to future development.

Table14				
Recommended Water System Capital Improvement Projects				
#	**Facility**	**Size**	**Unit Cost**	**Estimated Cost**
	Water Supply	MGD		
1	New 1,350 gpm Well at 10th Street Corporation Yard	1.9 MGD	$800,000	$800,000
2	New 1,350 gpm Well Site To Be Determined	1.9 MGD	$800,000	$800,000
3	New 1,350 gpm Well Site To Be Determined	1.9 MGD	$800,000	$800,000
	Subtotal			**$2,400,000**
	Reservoirs	MGD		
4	10th Street Corporation Yard	1.0 MG	$600,000	$600,000
5	Second 1.0 MGD Reservoir at Oak/13th Site	1.0 MG	$600,000	$600,000
6	Second 1.0 MGD Reservoir at 10th St. Corporation Yard	1.0 MG	$600,000	$600,000
	Subtotal			**$1,800,000**
	Pump Stations	gpm		
7	10th Street Corporation Yard	2,600 gpm	$750,000	$750,000
8	Additions at Oak Ave./13th Site	2,600 gpm	$500,000	$500,000
9	Additions at 10th Street Corporation Yard	2,600 gpm	$500,000	$500,000
	Subtotal			**$1,750,000**
	Pipelines	feet		
10	12" Apple Ave. - Calaveras Way to Third St.	1,700	$150	$255,000
11	12" Walnut Ave. - Santa Lucia SC to Third St.	2,700	$250	$675,000
12	12" Cherry Ave. - El Camino Real to Third St.	3,400	$150	$510,000
13	12" Pine Ave. - El Camino to Third Street	3,400	$150	$510,000
14	12" Third Street - Pine Ave. to Apple Ave.	4,000	$150	$600,000
15	12" Elm Avenue - 4th Street to 3rd Street	1,400	$150	$210,000
16	12" Elm Avenue - 3rd Street to 2nd Street	2,600	$150	$390,000
17	12" Oak Avenue - Vineyard Estates to 2nd Street	1,320	$150	$198,000
18	12" Apple Avenue - Vineyard Estates to 2nd Street	1,560	$150	$234,000
19	12" Walnut Avenue - 3rd Street to 2nd Street	2,640	$150	$396,000
20	12" Cherry Avenue - 3rd Street to 2nd Street	2,640	$150	$396,000
21	12" Pine Avenue - 3rd Street to 2nd Street	2,640	$150	$396,000
22	12" 2nd Street - Elm Avenue to Pine Avenue	6,600	$150	$990,000
23	12" Cherry Avenue - 12th Street to El Camino Real	2,640	$150	$396,000
24	12" Pine Avenue - 12th Street to El Camino Real	2,640	$150	$396,000
25	12" 12th Street - Walnut Avenue to Pine Avenue	2,640	$150	$396,000
	Subtotal			**$6,948,000**
	SCADA	lump sum		
15	Install SCADA System	l.s.	$300,000	$300,000
	Subtotal			**$300,000**
	Total Construction Cost			**$13,198,000**
	Contract Admin., Engineering & Contingencies	30%		$3,959,400
	Land Acquisition Costs	2 acres	$50,000	$100,000
	Total Capital Improvement Cost			**$17,257,400**

The assumptions made in developing the CIP are presented below.

Assumptions

The CIP is based on the following assumptions:

- The sizing of waterline improvements is based on build-out demand conditions.
- Replacement waterlines are recommended if the existing waterlines are hydraulically deficient because of additional demand from future development.
- New waterlines are assumed to be in the same alignment as the existing lines.
- Standby power is included in the pump station costs. The Capital Improvement Plan Update is based on providing adequate storage to meet emergency conditions, such as power outages.
- The pump station project costs assume that the initial construction of a new pump station structure will be full size for the estimated build-out condition.
- Costs for ground steel tanks are provided. It is anticipated that future reservoirs will be ground steel tanks, similar to the City's existing reservoir.
- Detailed studies should be performed during pre-design of recommended water system improvements to determine project-specific criteria and to investigate alternate alignments or sites.

The cost estimates are planning-level capital costs and include construction costs plus 30 percent for engineering, legal, administration, and contingencies. The City will need to review projects that are designed and built by developers to ensure adequate ultimate capacity in the system. The information presented herein is intended to serve as a guide.

PROJECT IMPLEMENTATION

Implementation of the CIP should be undertaken as soon as possible. Implementation activities should include:

- Incorporate these CIP recommendations into the City’s Capital Improvement Plan.
- Incorporate recommendations and costs into the City's capacity charge study.
- Review availability of City staff to design and inspect projects or to manage the work of outside consultants.
- Develop a plan for environmental review of projects.
- Coordinate the water projects with other construction projects such as storm drains and sewer, gas, electric, or telephone transmission facilities, or street paving projects that share common alignments.

SECTION 7 - WATER CAPACITY CHARGES

This section presents the water capacity charges derived from the previous sections of this report. This section identifies a schedule of water capacity charges to ensure that proposed capital improvements attributable to new development in the City can be made in a reasonable manner.

CURRENT FEES

The City of Greenfield currently has an Impact Fee for water system expansions required by growth. The current water facilities mitigation charges fees summarized in **Table 15 - City of Greenfield Water Facilities Mitigation Fees.**

Table 15
City of Greenfield Water Facilities Mitigation Fee

Category	Fee	Unit
Single Family Residential	$ 2,260	per dwelling unit
Duplex Residential	$ 2,105	per dwelling unit
Triplex Residential	$ 1,865	per dwelling unit
Multifamily Residential	$ 1,545	per dwelling unit
Commercial, Industrial, Agricultural and Public	$ 112.50	per fixture unit

These fees are based on previous capital improvement studies and may not provide the revenue required to cover the proposed capital expenses that are required to serve new development in the City. Due to this Capital Improvement Plan Update, the water capacity charges should be adjusted to ensure revenues from the capacity charges match the City's capital improvement costs to accommodate growth and changing State and Federal regulations.

Under California law, water capacity charges may not exceed the estimated reasonable cost of providing the service for which the fee or charge is imposed. The proposed water capacity charge would imposed for the purpose of defraying the costs associated with providing the additional capacity in the water system necessary to serve build-out under the 2005–2025 Greenfield General Plan. To show that the capacity charge meets these requirements, this study must demonstrate that the estimated costs of the facilities are reasonable, and that those costs are allocated among the users (i.e. those connecting to the facilities in the future) in a fair and equitable manner.

This section calculates the maximum justifiable water capacity charge. Section 5 describes the additional facilities made necessary by new development, and Section 6 set forth the estimated costs of those facilities. Using the data and analysis set out in those two sections, this section allocates those costs among the future users in a fair and equitable manner to calculate the water capacity charge.

CIP IMPROVEMENTS AND DEVELOPMENT OF WATER CAPACITY CHARGES

Development impact fees must allocate, in an equitable manner, the costs to provide public facilities to serve new developments. **Section 6 – Recommended Capital Improvement Program** identified facilities and costs for improvements required for future service needs.

WATER CAPACITY CHARGE PROGRAM

Table 16 - Derivation of Water Capacity Charges presents the recommended water capacity charges. The Water Capacity Charges presented in this study are based on the General Plan land use and development projections set forth above, the need for additional facilities in the City created by that development, and the best available construction cost estimates, all as described in the earlier sections of this analysis. The calculation includes a component for the City's costs of administering the program, which is set at 1.5% of the total costs. This administrative charge is intended to allow the City to recover the costs of preparing the analysis that supports the charge, to prepare the necessary documents to adopt the charge, to calculate the annual inflationary increases, and to administer and collect the fee throughout its lifespan.

Table 16
Derivation of Water Capacity Charges

Item	**Derivation**	**Amount**
Total Capital Improvement Cost (TCIC)	Table 14	$17,257,400
Administration (1.5% of total costs)	Section 7	$258,861
Total Water Capacity Charge Costs		$17,516,261
Total Water Fixture Units	Table 9	157,691
Unit Cost per water fixture unit =	TWCCC / TWFU	**$111.08**

Table 17-Water Capacity Charges by Type is shown below:

Table 17
Water Capacity Charges By Type

Designation	Derivation	WFU	Cost	Water Capacity Charge	Unit
Residential Estate	Table 9	7,224	$802,440	$3,110.24	per dwelling unit
Low Density Residential	Table 9	34,300	$3,810,032	$3,110.24	per dwelling unit
Medium Density Residential	Table 9	54,320	$6,033,846	$3,110.24	per dwelling unit
High Density Residential	Table 9	0	$0	$3,110.24	per dwelling unit
Neighborhood Commercial	Table 9	168	$18,661	$111.08	per water fixture unit
Downtown Commercial	Table 9	168	$18,661	$111.08	per water fixture unit
Highway Commercial	Table 9	10,462	$1,162,115	$111.08	per water fixture unit
Light Industrial	Table 9	5,924	$658,036	$111.08	per water fixture unit
Heavy Industrial	Table 9	31,092	$3,453,688	$111.08	per water fixture unit
Professional Office	Table 9	0	$0	$111.08	per water fixture unit
Public Quasi Public	Table 9	0	$0	$111.08	per water fixture unit
Artisan Ag. Visitor Serving	Table 9	13,235	$1,470,140	$111.08	per water fixture unit
Recreation Open Space	Table 9	798	$88,642	$111.08	per water fixture unit
Total		157,691	$17,516,261		

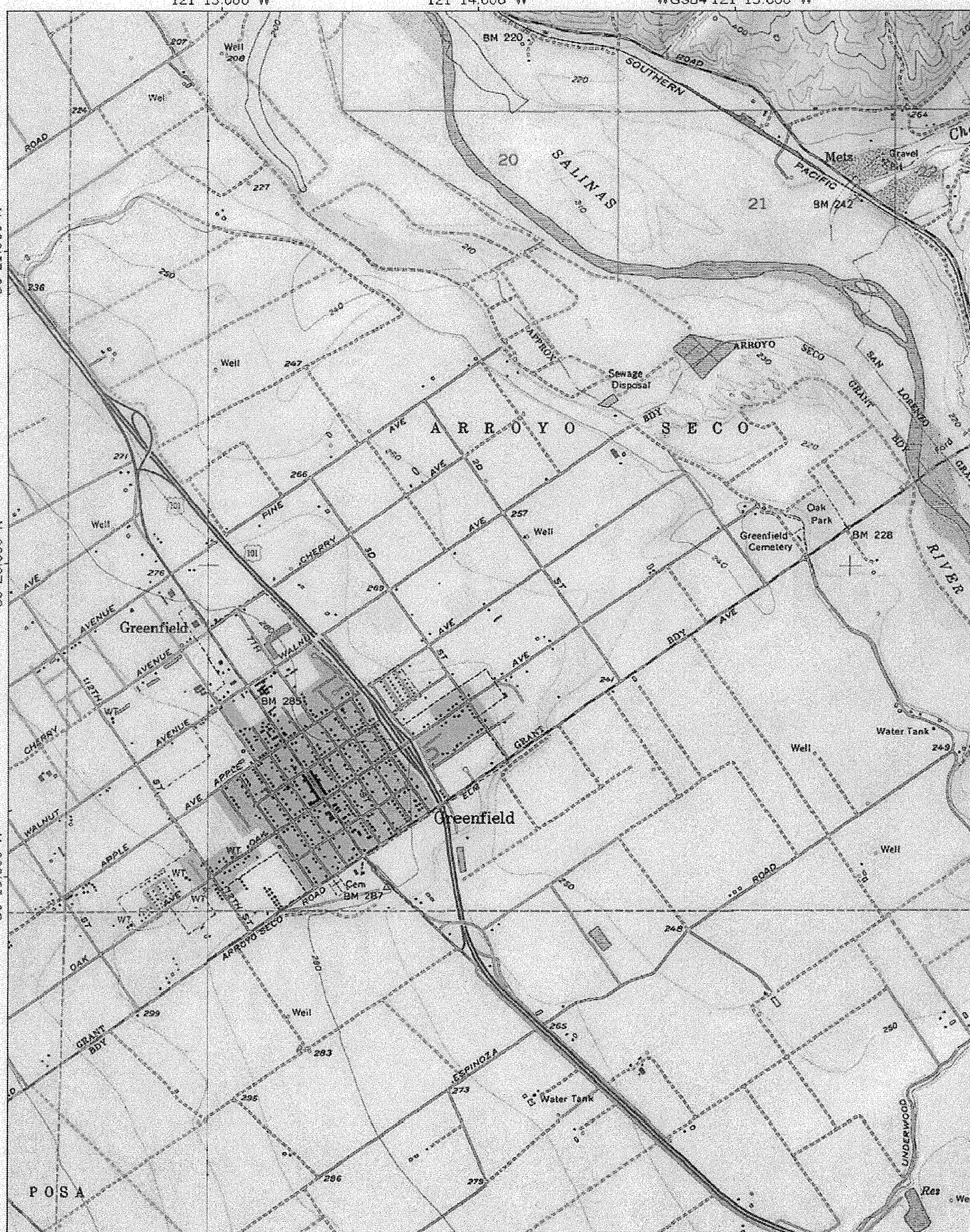
Table 17 assumes a Standard Residential Dwelling Unit = 28 water fixture units (average). Dwelling units that exceed 28 wfu shall have impact fees increased proportionately to the number of water fixture units.

Since the water capacity charges developed herein are estimates based on the best available information to date, it is recommended that adjustments to the Water Capacity Charges be made every five years to determine if development projects and cost estimates are still appropriate. In any case, it is recommended that the Water Capacity Charge be annually adjusted to account for inflation. It is recommended that the City use the Engineering News Record – Construction Cost Index (ENR - CCI) to reflect the costs of construction. In addition, the City may wish to consider adopting a policy that requires new development projects that propose changes to the City's General Plan to perform an analysis of impacts to the Water Capacity Studies and to quantify corresponding impacts to the fees.

It is also recommended that the City adopt a policy that requires development that triggers the need for certain facilities to construct those facilities or otherwise advance the necessary funding for those facilities. When a developer is required to construct facilities or advance monies for the construction of such facilities, the developer should be provided a credit against the Water Capacity Charge, which may be used to satisfy the developer’s obligations and which may be transferred to other developers. The credit could also convert to a right of reimbursement after a specified period of time, provided that the City had sufficient fee revenues available.

LIST OF FIGURES

TOPO! map printed on 12/17/03 from "California.tpo" and "Untitled.tpg"



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TERRA ENGINEERING, INC

CONSTRUCTION ADMINISTRATION - CIVIL ENGINEERING

820 Park Row #592 Salinas, CA 93901 Tel. 831.455.2344 Fax. 831.455.1921

DATE:	1-21-04
SCALE:	NONE
DRAWN BY:	JPD
APPROVED BY:	TE
DRAWING NO.:	03108

FIGURE 1

City of Greenfield

SHEET **1** OF 5 SHEETS

TERRA ENGINEERING, INC	DATE: 1-21-04	FIGURE 2	SHEET
CONSTRUCTION ADMINISTRATION - CIVIL ENGINEERING	SCALE: NONE	Study Area	2
820 Park Row #592 Salinas, CA 93901 Tel. 831.455.2344 Fax. 831.455.1921	DRAWN BY: JPD		OF 5 SHEETS
	APPROVED BY: TE		
	DRAWING NO.: 03108		

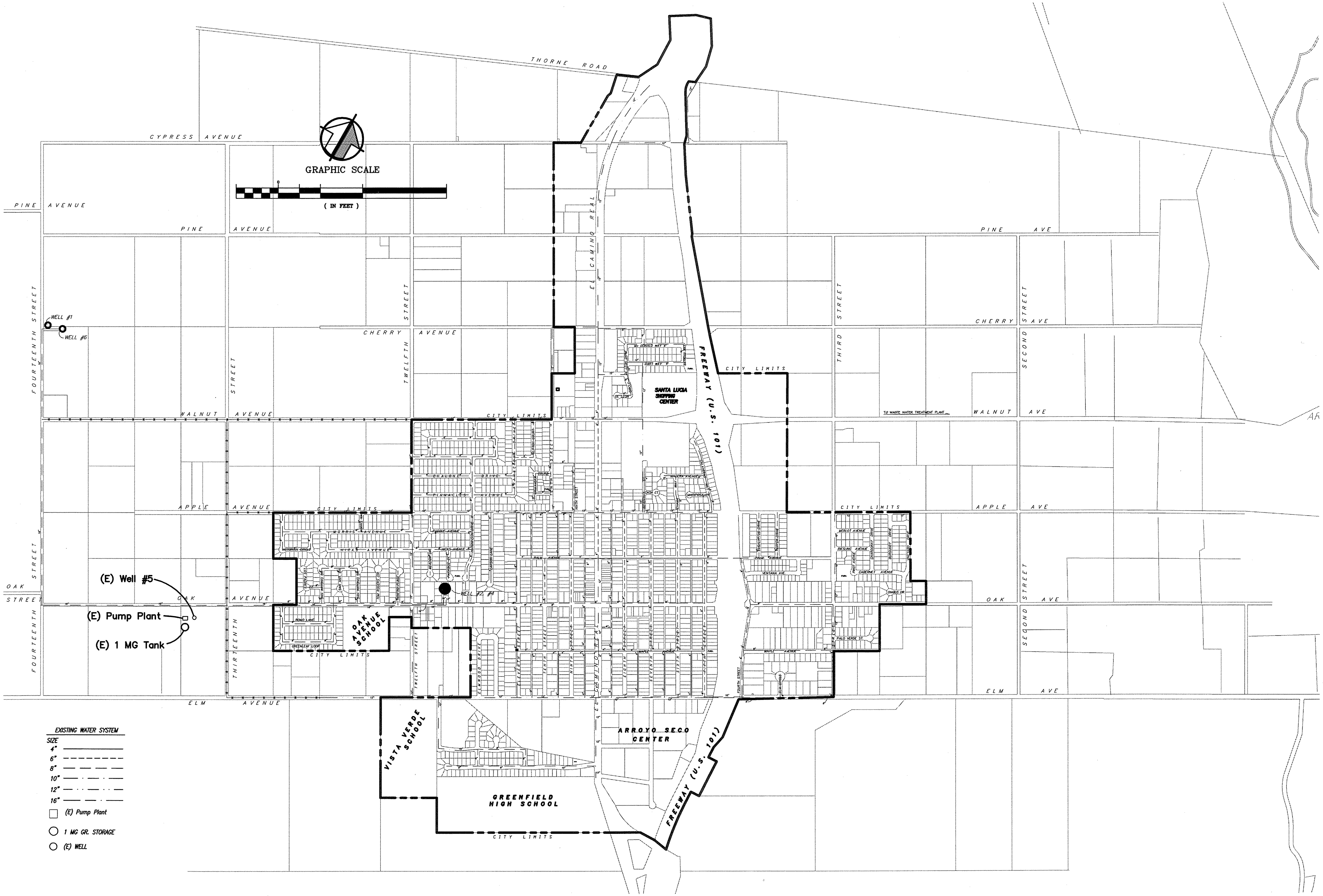

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FIGURE 3

Water System Map

SHEET

3

OF 5 SHEETS

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FIGURE 4
Future Land Use
City of Greenfield

SHEET 4 OF 5 SHEETS

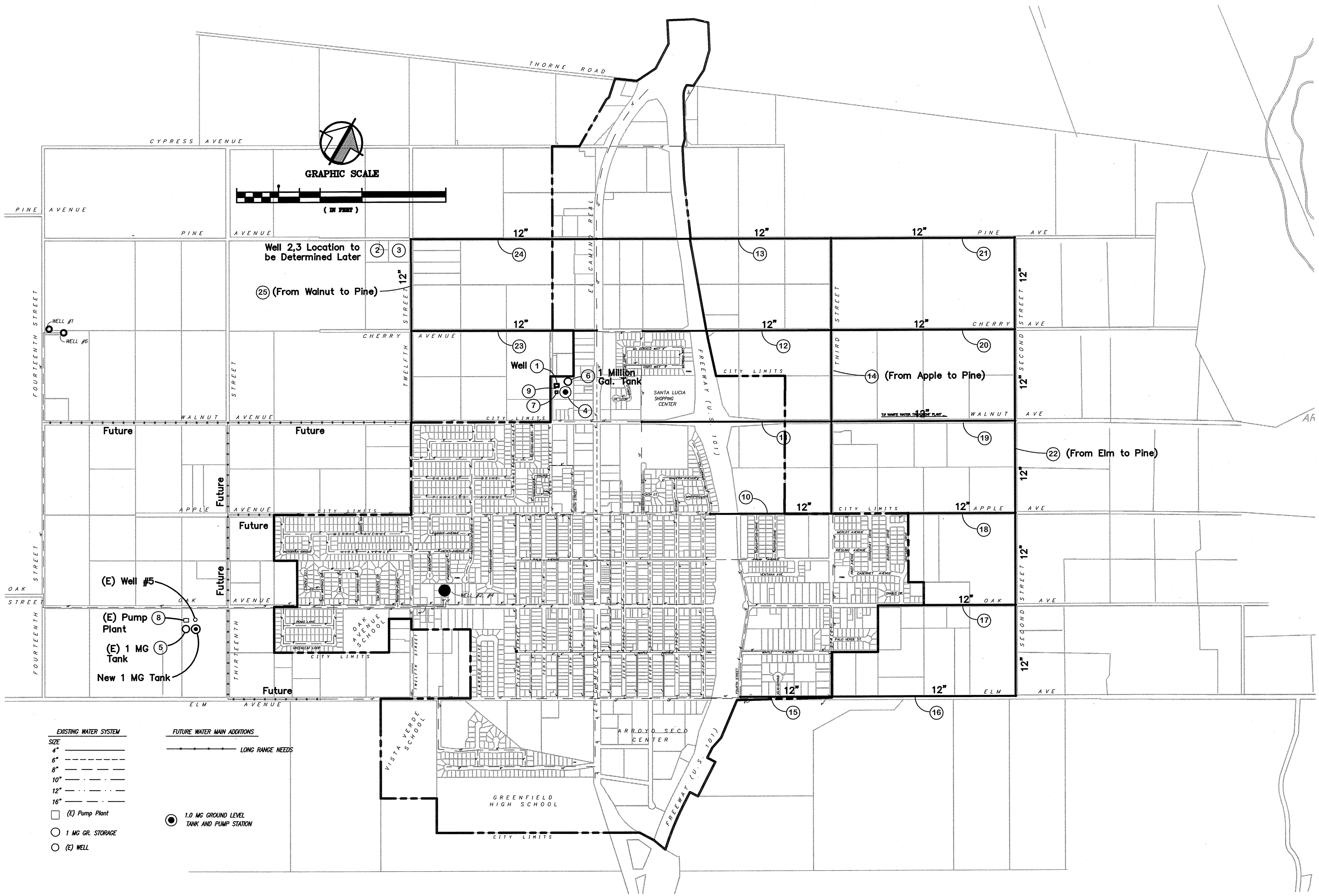

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FIGURE 5

Recommended Capital Improvement Project

SHEET 5 OF 5 SHEETS