the H_2O group

City of Patterson

2010 Urban Water Management Plan

FINAL
July 2012

City of Patterson
Water System

the H2O group
water engineering, planning & design

July 10, 2012

Department of Water Resources
State of California
Land and Water Use Program Manager
Office of Water Use Efficiency & Transfers
901 P Street, Room 313A
Sacramento, CA 95814

Subject: City of Patterson Urban Water Management Plan 2010 Update - Revised per DWR Comments

Gentlemen:

On behalf of the City of Patterson, please find enclosed the *City of Patterson, Urban Water Management Plan, 2010 Update*, as required by the Department of Water Resources per the Urban Water Management Planning Act. This document (dated July 2012) is revised to address your offices comments as provided to the City in July, 2012.

The document was originally adopted by the Patterson City Council on June 21, 2011. This revised document was re-adopted as requested by your office.

On behalf of the City of Patterson, please accept this *Final Urban Water Management Plan, 2010 Update* for acceptance by DWR. If you have questions, please contact me at (916) 806-3970.

Very Truly Yours,

Cort Abney, P.E.
City Water Engineer
City of Patterson

Cc: Mike Willett, Director of Public Works, City of Patterson

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City of Patterson

Urban Water Management Plan
2010 Update

Final

July 2012

Prepared by:

The H20 Group

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Abbreviations and Acronyms

AF or af	Acre Feet
AFY or afy	Acre Feet per Year
BOR	US Bureau of Reclamation
CA	California Aqueduct
CEQA	California Environmental Quality Act
the City	City of Patterson
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
DHS	State of California, Department of Health Services
DMC	Delta Mendota Canal
DMM	Demand Measurement Measures
DWR	State of California, Department of Water Resources
ETo	Evapotranspiration
GMP	Groundwater Management Plan
gpcd	gallons per capita per day
GPM or gpm	Gallons per Minute
gpm/ft	gallons per minute per foot (units of transmissivity)
IRWP	Intergraded Regional Water Plan
MG	Million Gallons
MGD	Million Gallons per Day
M&I	Municipal and Industrial
mg/l	Milligrams per liter
NWS	National Weather Service
NPWP	Non-Potable Water Program
ppb	Parts per billion (identical to ug/l)
ppm	Parts per million (identical to mg/l)
RWQCB	Regional Water Quality Control Board
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
ug/l	Micrograms per liter
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
UWMP	Urban Water Management Plan
WSA	City of Patterson 2010 Water Supply Assessment
WPS	City of Patterson 2006 Water Planning Study
WTP	Water Treatment Plant
WTSF	Water Treatment and Storage Facility

Agency Information

Utility Name	City of Patterson
Address	1 Plaza
City	City of Patterson
State	CA
Zip Code	95363

Contact Information

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Section 1 Introduction

This Urban Water Management Plan Update ("UWMP") was prepared by the City of Patterson (City) in accordance with state of California requirements, as defined in the California Water Code. The UWMP is an update of the previous plan developed in 2006, titled "*City of Patterson – Urban Water Management Plan 2005 Update*".

Background

Notable changes since the completion of the 2005 UWMP include an update to the City's General Plan in 2010, implementation of a non-potable water system for irrigation of large landscapes, and progress toward formation of a local groundwater management plan. The City has also completed replacement of large sections of aging water distribution pipe in its Old Town Area, and additional potable water transmission mains to improve conveyance. Two (2) additional water supply wells were constructed and became operational during this period, and one (1) well was converted into a non-potable source due to contamination concerns. A new non-potable well is under construction and expected to be operational by mid 2011.

Other significant improvements made to the City's water supply program include implementation of a tiered rate structure with high (> 70%) volumetric basis, installing magnetic flow meters at its sources (wells) for more accurate production accounting, and replacing several booster and well pump motors with higher efficient models.

The City has also been involved in regional planning efforts in an attempt to collaborate with other water purveyors in the area regarding long-term water supply issues. In 2010, the City was the lead agency in preparation of an Integrated Regional Water Management Proposition 84 Grant (IWRM Grant) proposal, seeking funding for local water supply planning studies. Although the grant attempt was unsuccessful, the City will continue to pursue funding for this effort, and invite other local water purveyors to participate. The City will likely be reapplying for the IRWM Grant in the next round of submittals to DWR, anticipated in fall of 2011.

The City's sole water supply source remains local groundwater, and is expected to continue using local groundwater for the near-term. Development projects yet to be completed were previously approved on the basis of available groundwater capacity, as determined geo-hydrologic studies. The General Plan Update approved by the City in 2010 (GPU) identifies a significant increase in area and population. The population is predicted to more than double by 2030 raising from 21,229 currently, to over 47,000 by 2030, in addition commercial and industrial square footage both near 2,800,000 square feet currently will increase to over 10,000,000 and 15,000,000 respectively.

According to growth projections, local groundwater capacity will likely provide for all growth through the UWMP planning horizon (20 years, or 2030). However, as discussed in the 2010 Water Supply Analysis prepared for the GPU (WSA), alternative water sources will be required for full build-out of the GPU planning area. Alternative sources identified in the GPU include surface water, reclaimed wastewater, and conservation. Since groundwater is proposed as the sole source of supply through 2030, alternative sources will not be addressed in this UWMP update. It is the City's intention to begin making progress toward securing these alternative sources immediately, thus reports on progress should be anticipated in subsequent UWMP updates.

In 2008, the City approved a non-potable water program for the purpose of using lower quality water for irrigation of public and commercial landscaping. Public and commercial landscaping is estimated to account for as much as 25% of the City's total annual water use, and over 40% of the peak month demands. The City's Non

Potable Water Program (NPWP) is proceeding, with construction currently in Phase 2 of a 5 phase program. The NPWP is currently using lower quality groundwater for irrigation, but is being designed and constructed to receive recycled/reclaimed water at some point in the future. Several thousand feet of pipe have been installed, and irrigating some of the City's largest landscapes. This City intends to continue with construction of additional NPWP phases, with final completion scheduled for 2014.

Conservation does and will increasing play a key role in the City's water supply program. It is important to recognize that the City of Patterson is presently a "water conserving community." The California Department of Water Resources (DWR) estimates that the San Joaquin River Region has demands of 248 gallons per capita/day (gpcd), with a demand reduction goal to 174 gpcd by 2020.[1] In comparison, the City's 169 gpcd 10-year average demand is already lower than the Water Conservation Act of 2009's (20x2020) goal, and the City will see further reductions in per capita demand over the next 10 years due to a combination of existing City conservation programs and mandatory water conservation codes.

However, the City has determined that meeting all provisions of the California Urban Water Conservation Council's 14 BMP's is not cost-effective at this time, and has requested exemptions for several measures. If and when the City's water supplies change (i.e. surface water purchases, use of recycled water, etc.), and or water/building codes change, the City will reevaluate water conservation measures for cost effectiveness.

[1] 20x2020 Water Conservation Plan, Table ES-1, Regional Urban Water Use Patterns in 2005, Feb., 2010.

Purpose of the Urban Water Management Plan

The purpose of preparing an Urban Water Management Plan (UWMP) is to satisfy the requirements of Division 6 of the California Water Code. Established in 1983,[2] the Urban Water Management Plan Act was adopted to formalize the state's policy that management of urban water demands and efficient use of water shall be a guiding criterion in public decisions, and urban water users shall develop plans to actively pursue the efficient use of water supplies.

The UWMP Act requires all water suppliers with at least 3,000 customers prepare and adopt a plan every five (5) years. According to the act, the content of the plan shall include a description of water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions. Specifically, the plan must:

- Provide current and projected population, climate, and other demographic factors affecting the supplier's water management planning;
- Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier;
- Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage;
- Describe plans to supplement or replace that source with alternative sources or water demand management measures;
- Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis (associated with systems that use surface water);
- Quantify past and current water use;
- Provide a description of the supplier's water demand management measures, including schedule of implementation, program to measure effectiveness of

[2] AB 797, Klehs

measures, and anticipated water demand reductions associated with the measures;

- Assessment of the water supply reliability.

UWMP's are required to provide projections of water program data and information for a 20 year horizon, or "*as far as data is available.*" Plans shall be adopted by the water supplier, and copies submitted to the DWR.

The act has been amended several times since its creation, including SB 610 in 2001.[3] Numerous changes to relevant State law have occurred since the 2005 UWMP's were required. Changes occurred to the UWMP Act (CWC §10610 et seq., included as Part II, Section K) with enactment of the Water Conservation Bill of 2009 (CWC §10608) and other legislation. The Water Conservation Bill of 2009 requires that certain information be included in an urban retail water supplier's UWMP. The City's Conservation Program and calculation of methods to set conservation targets are provided in Appendix A.

The overall intent of the UWMP Act and its requirements are similar to previous years—to describe an urban water supplier's water supplies and conservation efforts. Primary changes to UWMP requirements since 2005 address water conservation (through the Water Conservation Act of 2009) and Demand Measurement Measures (DMMs through AB 1420), but there are several other changes, with the most notable including:

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[3] Requires that water assessments be furnished to local governments for inclusion in any environmental documentation (CEQA) for certain projects when absent from UWMP's.

- 10621(b): Provide at least 60 days notification to any city or county within which the supplier provides water for the public hearing required by Section 10642.

- 10631(j): Members of the CUWCC will be considered in compliance with the DMM evaluation (10631 (f) and (g)) if they comply with all the provisions of the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated December 10, 2008 and by submitting their CUWCC annual reports.

- 10631.1*:* Water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households (Health and Safety Code Section 50079.5) will be provided. These water use projections are to assist a supplier in complying with Government Code Section 65589.7 to grant priority of the provision of service to housing units affordable to lower income households.

- 10631.5(a)*:* After January 1, 2009, eligibility for state-funded grants or loans will be conditioned on the implementation of Section 10631 DMMs. If a DMM is not currently being implemented, then the urban water supplier submits to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement. If a DMM is not locally cost-effective (the present value of the local benefits is less than the present value of local costs to implement the DMM), then the water supplier will submit supporting documentation and the DWR will provide a determination within 120 days of UWMP submittal.

- 10631.5(e)*:* The water supplier may submit copies of its annual reports and other relevant documents to assist DWR in determining implementation or scheduling of the water suppliers DMMs. Water suppliers that are signatories of the CUWCC MOU may submit its annual reports to support its DMM activities.

- 10608.20(e): Include the baseline daily per capita water use, urban water use target, interim water use target, and compliance daily per capita water use. Provide basis for determination and supporting data references.

- 10608.20(g): The 2015 UWMP can update the 2020 urban water use target.

- 10608.20(h) (2): An urban retail water supplier shall use the methods developed by the department in compliance [with methodologies and criteria developed by DWR.

- 10608.20(j): Deadline for adoption of a UWMP is extended to July 1, 2011 to allow use of the technical methodologies developed to establish baseline, target, interim target, and compliance daily per capita water use.

- 10608.36: Wholesale suppliers will provide an assessment of their present and proposed future measures, programs, and policies to achieve water use reduction required in SBX7 7.

- 10608.40: Urban water suppliers will report progress toward meeting urban water use targets in their UWMPs using a standardized form to be developed by DWR. *Note: This applies only to 2015 and 2020 UWMPs because they will report "progress" toward meeting targets established in this, the 2010 UWMP.*

- 10608.42: DWR will review the 2015 UWMPs and report to the Legislature the progress toward achieving a 20-percent reduction in urban water use by December 31, 2020.

DWR provides a list of standard data tables to be completed by water purveyors as part of the UWMP. To maintain the DWR format, these tables are located in Appendix D, however they are each referenced in the plan. Throughout this document reference to the DWR tables are shown with "(D)" after the table number to indicate the table may be found in the appendices.

Agency Coordination

In accordance with requirements the UWMP Act, and in conjunction with development of the WSP, the City has maintained contact with local water purveyors and agencies, discussing its water and civic planning efforts, and possible options for regional water programs.

Meetings and discussions with local water purveyors have included 1) opportunities for regional water planning, including groundwater management plans and programs, 2) options for sharing and/or transfers of water supplies to: a) minimize the need to import water to the area, and b) enhance the overall reliability of supplies in the area for periods when imported water is limited or unavailable. Topics such as groundwater banking, protection of water quality, use of recycled water, and long-term impacts of groundwater pumping were discussed.

Coordination with Appropriate Agencies (§ 10620 (d))

Coordination with most or all of these water purveyors are expected to continue while City of Patterson develops and implements its water supply program.

Agencies that the City has directly coordinated with are shown in Table 1-1(D). [4] Additional information regarding these districts and current coordination efforts are included in Section 3.

In early 2006, the City and the County of Stanislaus agreed to jointly study opportunities for a regional water supply program. These studies examined source supply and treatment options for meeting the demands of the City and future County of Stanislaus developments on the west side (west of the San Joaquin River), near the City.

The status of County developments is pending, but discussions regarding regional water programs are expected to continue upon County approval of the developments. Each participating agency, as shown in Table 1-1(D), had access to a draft of the UWMP.

City and County Notification and Participation (§ 10621 (b))

More than 60 days in advance of adoption of the UWMP, the City provided notification to Stanislaus County, inviting comments and participating in the process. A copy of the Notification Letter is shown in Appendix B.

Changes or Amendments to UWMP (§ 10621 (c))

In the event there are significant changes, impacts or new information that would require the UWMP to be updated or amended prior to the next required plan update in 2015, the City will follow the procedures set forth in Water Code Sections 10640 through 10645.

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[4] Tables including "(D)" indicate they are DWR format tables found in Appendix D of the plan.

Adoption and Implementation

A presentation regarding conservation elements in the draft UWMP was provided on April 17, 2011, at the City of Patterson City Council regular public meeting. After two (2) consecutive advertisements in the Patterson Irrigator on May 19th and 26th, 2011, a draft study was presented to the City Council on June 7, 2011. A public hearing and the subsequently adoption of the UWMP by the City occurred on June 21, 2011, per Resolution No. 2011-38. A copy of the public notice and resolution are included in Appendix C. After adoption of the UWMP, the City provided copies to DWR; agencies listed in Table 1-1(D), California State Library, and have made a copy of the UWMP available to the public and other interested parties at City Hall.

In accordance with California Water Code and the UWMP Act, DWR reviewed Patterson's 2010 UWMP and submitted formal comments to the City on July 5, 2012. Comments were as follows:

"DWR's review of the City of Patterson's 2010 plan has found that the plan has not addressed elements required by the UWMP Act. The elements not addressed or included are listed below:

1.) *The City of Patterson's 2009-2010 Best Management Practices Coverage Report from the California Urban Water Conservation Council showing all practices to be "on track". CWC 10631 (j).*
2.) *Water use projections for lower income households as identified in the City's general plan. CWC 10631.1*
3.) *Please rewrite the paragraph on page 4-12 starting with, "Full use of the existing water system capacity …." The paragraph is confusing and is unclear as to whether the city can meet future demand through a sustainable use of groundwater.*
4.) *Please revise any land use or water use tables if updated information is available.*

The addition of the elements listed represents a significant change to the plan and requires that the plan go through the amendment process of public notice, a public hearing and re-adoption by the City's governing board."

DWR's comments are addressed in this version of the 2010 UWMP, dated July, 2012. Land use and water demand projections were updated as approved on February 23, 2012, by Patterson City Council for the City's master planning process. CUWCC BMP Reporting compliance is included as provided by CUWCC on June 4, 2012.

In accordance with DWR requirements, the City of Patterson City Council re-adopted the 2010 UWMP at its regular meeting on August 14, 2012. A separate public hearing was held to allow public comment regarding the plan. Public notices prior to the hearing were posted in the local newspaper in accordance with DWR requirements. Copies of the adoption, staff report, and public notice are provided in Appendix C.

Section 2 System Description

The City is a community with a rich agricultural heritage. It is among many diverse communities in the Central Valley of California that was established through the hard work and dedication of many individuals committed to a common vision of prosperity and opportunity. It is proud of its provincial setting and strong sense of community. The City is located on Highway 33, along the Interstate 5 corridor, 280 miles north of Los Angeles, 92 miles south of Sacramento, 89 miles southeast of San Francisco and 45 miles southeast of Livermore.

Service Area (§ 10631 (a))

In 1909, Thomas Patterson subdivided 18,462 acres held by the Patterson Ranch Company into ranches of various sizes and plotted the design of the town of Patterson. Determined to make Patterson different from most, he modeled his town after the radiating street designs of Washington D.C. and Paris, France, designed by the famous French architect and engineer Pierre Charles L'Enfant. Major streets were planted with Palms, Eucalyptus and Sycamore trees. The City was incorporated in 1919.

With a current population of approximately 21,000 residents, Patterson is a small rural community surrounded by productive agricultural lands. With agriculture as its primary economic base, orchards of apricots, almonds and walnuts, as well as row crops of dry beans, tomatoes, broccoli, spinach, peas and melons play an important role in the City's history. It is commonly referred to as the "Apricot Capital of the World."

In recent years, the City has become a bedroom community for residents that chose to work in nearby urban centers but live in a quieter setting. In response, the City has made adjustments in its land use, providing for more residential development as well as the creation of more commercial and industrial opportunities.

In 2010 the City updated its General Plan. The approved land use map is shown in Appendix I.

Service Area Population

The City's water service boundaries are congruent with its service area boundaries. The City provides water service to a population of approximately 21,000, through 6,100 metered connections, consisting of residential, commercial, industrial, and institutional uses. Table 2-1(D) provides a summary of the City service area populations. Table 2-2 provides a summary of the water service connections by land use type.

Table 2-2 City of Patterson Water Service Connections, 2010

Land Use/Demand Type	Service Connections
Residential	5,761
Multifamily	27
Commercial	206
Industrial	5
Institutional	121
Total	**6,120**

The City water system consists of water wells for production and a piping network for distribution. Local groundwater is the sole source of production/source supply. The distribution system has been constructed over many years as the City developed. A large portion of the City's infrastructure construction occurred after 2000 with rapid development, whereby the population increased from 11,606 to over 21,000 residents. In 2009, the City began replacing aging water infrastructure in its Old Town area. This work is expected to be completed in 3 phases, with Phase 1 to be complete in 2011, and subsequent phases expected to be completed by 2014.

In 2008, the City approved construction of a non-potable water program for the purpose of delivering lower quality water for irrigation of public and commercial landscapes. The City does not currently use surface water or recycled water, nor does the City provide any water treatment, other than the addition of chlorine for disinfection. A detailed discussion of the City water production facilities is provided in Section 5.

Future Planning

Beginning in 2007, the City embarked on an extensive 3 year effort to update its General Plan. In December, 2010, the City approved the 2010 General Plan Update (GPU), which identifies future expansion areas of the City, population estimates, land use designations, public services, etc. According to the GPU, build-out of the new General Plan area will result in an estimated population of approximately 67,000 persons, and include 11,794 total acres, as shown in Table 2-3. [5] As part of the GPU, a Water Supply Analysis was prepared. The water supply analysis addressed current water use factors and defined anticipated water demands.

The 2010 General Plan update resulted in the need for simultaneous updates of numerous City's infrastructure master plans, including a water master plan. As part of the master plan process, the City refined the land use growth projections assumed in the 2010 General Plan. The land use and growth projections for all master plans were approved by Patterson City Council on February 23, 2012. The 2030 GPU values for development and population, as adopted, were used for 2030 water demand projections in this report.

[5] Build out population of the prior General Plan was 35,000.

**Table 2-3: City of Patterson 2010 General Plan Update—
Development Holding Capacity**

Attributes	Total at 2030	Total at Build-out
Dwelling Units	8,521	18,944
Population	26,048	66,673
Commercial Floor Area	3,761,823	13,647,225
Industrial Floor Area	18,364,205	41,036,134
Jobs	29,099	81,414
Ratio of Jobs to Housing	3.42	4.30
Total Acres:	**4,425**	**11,794**

The large percentage of land designated by the City's adopted General Plan is for Low Density Residential development which is intended to support complete neighborhoods with a range of housing products and a complementary range of neighborhood-serving commercial and public uses (See Figure 1). Residential density estimates per the GPU are shown in Table 2-4.

Table 2-4: City of Patterson 2010 General Plan Update—Assumptions for Persons Per Dwelling Unit

Land Use Designation	Average Units per Acre	Average # of Persons per Dwelling Unit
Estate Residential	0.5	3.0
Low Density Residential	4.0	3.0
Medium Density Residential	6.0	2.5
High Density Residential	12.0	2.5
Downtown Residential	6.0	2.75

Since the City water service area and sphere are congruent, the City is a “Category 1 Water Supplier (*water suppliers whose actual distribution area overlaps substantially (≥95%) with city boundaries during baseline and compliance years*), for determining current and future populations. Table 2-1 provides current and projected population estimates, based on the City 2010 GPU.

Industrial land occupies about 2,200 acres of the GPU Plan area. The bulk of this land is located in the *West Patterson Business Park Master Plan* area and land to the northwest of the Business Park. Land designated for commercial development occupies about 800 acres. Commercial land is concentrated in the downtown circle, in a strip on the west side of Second Street/Highway 33, at the intersection of Ward Avenue and Sperry Avenue, at the Sperry Avenue/I-5 interchange, and in the long-term, at the westerly terminus of Zacharias Road where a new interchange may be established. Land west of Interstate 5 is designated for a mix of commercial and housing uses. Land use categories and associated acres are shown in Table 2-5.

Table 2-5: Summary of Gross Acres by General Plan Land Use Category

General Plan Land Use Category	Gross Acres1
Mixed-Use Hillside Development[2]	575
Estate Residential	912
Low Density Residential	3,915
Medium Density Residential	338
High Density Residential	46
Downtown Residential	128
Downtown Core	40
Regional Commercial	0
General Commercial	635
Highway Service Commercial	91
Neighborhood Commercial	46
Medical/Professional Office	31
Light Industrial	1,640
Heavy Industrial	452
Public/Quasi-Public[3]	1,003
Parks and Recreation[4]	401
Other[5]	1,544
Total Acres:	**11,798**

Source: Land Use Tables for City Infrastructure Master Plan Updates 2012

1. Gross acres refer to the total area inclusive of streets.
2. The Mixed-Use Hillside Development land use designation includes the range of uses and percentage of uses prescribed by Policy LU-1.4.
3. Includes 145 acres associated with the wastewater treatment plant.
4. Includes parkland required within residential expansion areas or Mixed-Use Hillside Development required by policies LU-1.3 and LU1.4, respectively.
5. Land not classified by a land use designation. Includes canals, Interstate 5 right-of-way, utility rights-of-way, storm drainage basins and canals, and other land.

Special development areas include a large commercial/distribution area on the west side of the City (See Figure 2-1), titled "West Patterson Business Park Master Development". The West Patterson Master Development Plan was adopted in 2002 to supplement the City's General Plan by establishing development standards and design guidelines that will apply to all new development within an 820 acre industrial park west of Baldwin Road. All development proposals within the Plan area must be found to be consistent with the Master Development Plan, which in turn must be consistent with the City's General Plan. Although this area (and proposed areas to the north and west) is zoned light industrial, the majority of development in this area is, and expected to continue as, "warehouse/distribution" type development. This development includes large storage and distribution centers for retail businesses, such as Kohl's Department Store, CVS, Grainger, etc. This type of development is not water intensive since in consists primarily of product storage as opposed to production or manufacturing.

In accordance with Health and Safety Code 50079.5, Patterson has identified 1960 low income housing units in the 2010 General Plan Housing Element, with 686 units to be built between 2007 and 2014. California Water Code states:

(a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier, and

(b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under Section 65589.7 of the Government Code to <u>grant a priority for the provision of service to housing units affordable to lower income households.</u>

Patterson's 2014 proposed low income housing requirement of 686 units equates to an annual demand increase of approximately 380 ac-ft/yr, and will grant priority to said housing demands, should they occur. The UWMP demand projections account for low income housing for 2014 requirements (686 units) and General Plan build-out (1980 units) as provided in Table 3-6(D).

Section 3 System Demands (§ 10631(e))

Water use in the state of California varies depending on the location, as expected. Those areas where the climate is warmer and have less rainfall use more water than colder, wetter locations. For example, households in the Bay Area and San Diego use less water than those in Sacramento and Bakersfield.

Due to the local climate (hot and dry), it would be expected that the City would have higher demands that are similar to other communities in the Central Valley. However, the City of Patterson is a "water conserving community," since it uses significantly less water per capita than the average urban water purveyor in the San Joaquin River region. According to DWR, the average urban use in the region is 248 gpcd, and has set the 2020 target at 174 gpcd. The City of Patterson is at 169 gpcd current (see summary below and Tables 3-9(D) through 3-11(D)), already below the region target. In accordance with the *Water Conservation Act of 2009* (SB x7-7), the City has set their conservation target at 160 gpcd (see Appendix A for methods and calculations).

Calculation of Conservation Targets per SB x7-7

Year	2020	2015
Base Daily per capita water use (10 years)	*169*	
Maximum Target Amount	**160**	**165**
Method 1 - 80% of Base Daily Water Use	135	
Method 2 - Performance Standards	167	
Method 3 - 95% of Regional Target (174 gpd/person)	165	
Method 4 – Water Savings	134	

Part of the reason water use lags behind population is that the City has an effective water conservation program. The City meters nearly all of its services, and has an increasing tiered rate schedule to encourage efficient water use. The City ordinances discourage water waste, including odd-even watering, and penalties for irrigation "run-off." In 2008, the City began replacing its oldest water pipes, which had the highest frequency of leaks and repairs.

The City supplies potable groundwater for residential, industrial, and commercial uses through a combination of groundwater wells, storage tanks, and network of piping. Each water service is equipped with a water meter for accounting and billing. The City is responsible to operate and maintain the water system up to the water meter. Water meters for residential services range from 5/8" to 1" in diameter. Commercial services are typically 1" or greater, depending on the type of use. The largest connection is 6" in diameter.

The amount of water used by a property owner is a function of several factors. These include the price of water, income, demographics, conservation measures, and climate. Since a large portion of water goes to outside use to irrigate landscaping, communities located in warmer areas typically consume more water during the year. Although price is a deterrent, it does not always result in sustained reductions in water use.

There are three main water use values that must be considered when planning and designing water supply programs. These include annual demand, maximum day demand, and peak hour demand, as described below:

- *Annual Demand* – The total amount of water a community uses during the year. This value determines the water needed from source supplies, such as groundwater and/or surface water. Communities must plan to secure long-term water availability based on annual demand projections.

- *Maximum Day Demand* – The highest amount of water used in one 24-hour period. This value determines the capacity of water treatment facilities. Although this condition may only occur a few days each year, communities should plan to size treatment facilities (and storage) to meet maximum day conditions assuming an unscheduled maintenance event removes a portion of the treatment capacity from service.

- *Peak Hour Demand* – The highest amount of water the system will move at any given moment. This value determines the storage and pipe (distribution) capacity of the system. [6] This condition is assumed to last for approximately 4 hours during a maximum day demand.

Groundwater production has increased with population growth, but not in direct proportion, as shown in Figure 3-1. From 1980 to 2010, groundwater production increased by 444%, whereas the population increased by 520%.[7] From 2005 to 2010, relative increases were 119% production and 128% population. Hence, water production has not historically increased in direct proportion to population growth.

Mandatory conservation measures associated with SBx7-7, SB407, AB1881, and California Green Building Code will further increase conservation efforts, resulting in at least 5% additional reduction in per capita water use by 2020. New development is expected to use nearly 20% less water than existing development, due to existing and mandatory water conservation programs. The City also plans to

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[6] Emergency flow conditions (e.g. fire demands) are also taken into account when designing these facilities.

[7] Sources: City of Patterson, 2000 Urban Water Management Plan, City well production records, City planning and Census data.

implement a retrofit program for the approximately 2,300 connections that were constructed before 1994.

Tables 3-1(D) through 3-5(D) provide the City water deliveries for 2005 and 2010 and the projected deliveries for 2015, 2020, 2025, and 2030. The project water uses reflect the future reductions in use associated with conservation programs discussed above.

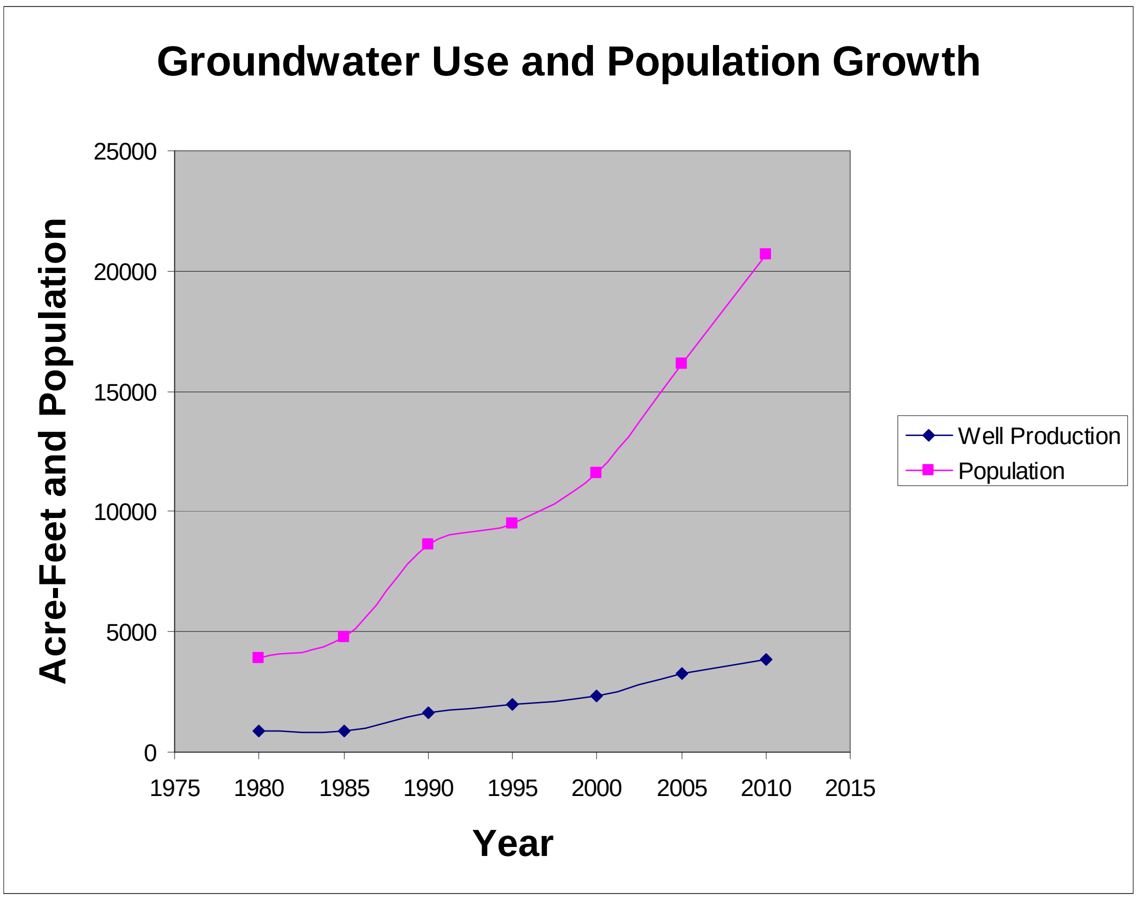

Figure 3-1 - Relationship between Groundwater Use and Population Growth

Approximately 32.7 percent of the city's households (1,960 dwelling units) fall into the category of low income. The percentage is expected to remain the same into the future. Table 3-6(D) provides the estimated water use tied to low income housing.

The numbers included in Table 3-6(D) are also included in Tables 3-1(D) through 3-5 (D).

Additional Water Uses and Losses are shown in Table 3-7(D). The City's non potable water system deliveries in 2010 are shown in this table. Lastly the table provides the estimated unaccounted for water volume for each year. The unaccounted for water for future years was estimated at 7% of total production. Table 3-8(D) presents total water use for the City of Patterson on five year increments from 2005 through 2030.

The City last 10 years and last 5 year water use averages, and corresponding water conservation targets were summarized above are shown in Appendix A. Table 3-9(D) defines the base period ranges for the conservation target calculations. Tables 3-10(D) and 3-11(D) provide the 10 year and 5 year per capita water use numbers for the City. The 10-year average per capita water use is 169 gpcd. The City conservation target for the year 2020 is 160 gpcd, with a target for the year 2015 of 165 gpcd.

Section 4 Water Supply Sources (§ 10631 (b))

The City currently uses groundwater as its sole source of water supply. Traditional water supplies for municipal development in the Central Valley consist of groundwater and surface water. Surface water sources include local rivers, reservoirs, and state/federal water project conveyance systems. In California, all surface water is allocated, hence acquiring surface water entitlements require that the water be obtained from a current holder of the entitlement through purchase, exchange, dedication, etc. Surface waters on the west side of the Central Valley are supplied through man-made canals owned and operated by the U.S. Bureau of Reclamation (Central Valley Project), state of California (State Water Project), or from the San Joaquin River.

Opportunities for the delivery of water from state or federal water projects are limited for non-federal or non-state water contractors. The City is neither a state nor a federal contractor. Irrigation districts surrounding the City are federal contractors and receive water from the Central Valley Project through the Delta Mendota Canal, including areas within the City GP boundaries. Some local surface water is pumped directly from the San Joaquin River, but only for irrigation since the state prohibits its use as a source for drinking water. The complexities of securing new non-regional water sources are identified in the City's "Water Supply Planning Study", 2006 (Appendix D).

In contrast to surface supplies, groundwater use does not require a right or entitlement. The State of California does not enforce groundwater management statutes, thereby placing groundwater management at the local level. The City uses groundwater, claiming legal access through California groundwater law which allows an appropriator the right to pump and use the local groundwater for beneficial use. Appropriative rights are second only to "overlying" rights of property owners. The City has well ordinances that protect the groundwater and minimize impacts of the pumping activities on private wells. The City and other local water purveyors are steadily increasing activity directed at management of the local groundwater basin, including the potential of recharge programs.

Recently, numerous cities and water purveyors in California have initiated programs to use non-potable water sources for outdoor irrigation since traditional sources are either unavailable or too costly. In 2008, the City approved and adopted a non-potable water supply plan and began implementation of a non-potable water system. Construction of a non-potable system will allow the City to expand their source water options, including non-potable water deliveries for irrigation, and the option to use recycled (reclaimed) wastewater in the future.

Conservation is expected to play an increasing role in the City's future water supply program. Mandatory water conservation measures, such as SBx7-7, SB407, AB 1881, California Green Building Code, and other elected programs initiated by the City are expected to significantly decrease the City's water demands.

Source Water Options

Until 2008, the only options for source water available to the City included local groundwater, or state and federal contract water. With implementation of a non-potable water system, the City can now consider use of San Joaquin River and recycled wastewater since these can only be used for irrigation uses, regardless of the level of treatment. Conservation is also considered a "source supply," and will be compared with other options as the City looks at options for future water supplies (See Appendix E, City of Patterson GPU Water Supply Assessment, 2010).

Although the City plans to make continuous progress toward securing additional water for its "water portfolio", local groundwater is proposed as the primary source through 2030. During that time, increasing conservation efforts due to mandatory state water and building codes will continue to lower unit demands, and use of non-potable or recycled wastewater is likely. However, this UWMP assumes groundwater as the sole source of supply for the planning horizon.

Groundwater

Presently, the City uses groundwater to meet all of its municipal and industrial water demands. The yield available from the local groundwater appears to be of sufficient yield to meet the 2030 water demands as defined in the GPU, based on recent groundwater studies conducted by the City. [8] Background salinity and nitrates in the local groundwater are of concern, and could force the City to add one or more forms of treatment to meet drinking water standards. Total dissolved salts are currently under the acceptable limit, but could rise as higher rates of groundwater are used. Wells with higher nitrates are to be used for landscape irrigation, where feasible.

The City is located on the west side of Stanislaus County, near Interstate 5, approximately 30 miles south of the City of Tracy, just west of the San Joaquin River. It is within the San Joaquin River Hydrologic Region, as defined by the California Department of Water Resources (DWR). DWR has studied and monitored groundwater conditions in the Central Valley for over 60 years. DWR Bulletin 118, first released in 1952, and updated 5 times since, provides historical information on groundwater characteristics, well data, and issues of concern regarding groundwater use and management.

According to DWR, the region is heavily groundwater reliant, with groundwater accounting for about 30 percent of the annual supply used for agricultural and urban purposes in the region. The aquifers are generally quite thick in the San

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[8] Three (3) studies of local basins groundwater quality and quantity were conducted by Ken Schmidt & Associates in 2002, 2006, and 2010.

Joaquin Valley sub-basins, with groundwater wells commonly extending to depths of up to 800 feet. Aquifers include unconsolidated alluvium and consolidated rocks, with unconfined and confined groundwater conditions. Typical well yields in the San Joaquin Valley range from 300 to 2,000 gpm with yields of 5,000 gpm possible.[9]

The City is located within the Delta-Mendota Sub-basin, as defined by DWR, with the following description:

- Groundwater Sub-basin Number: 5-22.07
- County: Stanislaus, Merced, Madera, Fresno
- Surface Area: 747,000 acres (1,170 square miles)

An excerpt from Bulletin 118 defining groundwater conditions in this area states:

> ***"Basin Boundaries and Hydrology***
> *The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley.*
>
> ***Groundwater Level Trends***
> *Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by Quarter Township and computed through a custom DWR computer program using geo-statistics. On average, the sub-basin water level has increased by 2.2 feet from 1970 through 2000. The period from 1970 through 1985 showed a general increase, topping out in 1985 at7.5 feet above the 1970 water level. The nine-*

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[9] Per DWR Bulletin 118, 2003 update.

year period from 1985 to 1994saw general declines in groundwater levels, reaching back down to the 1970groundwater level in 1994. Groundwater levels rose in 1995 to about 2.2 feet above the 1970 groundwater level. Water levels fluctuated around this value until 2000." [10]

The geologic units that comprise the ground water reservoir in the Delta-Mendota sub-basin consist of the Tulare Formation, terrace deposits, alluvium, and flood-basin deposits. The Tulare Formation is composed of beds, lenses, and tongues of clay, sand, and gravel that have been alternately deposited in oxidizing and reducing environments. The Corcoran Clay Member of the formation underlies the basin at depths ranging about 100 to 500 feet and acts as a confining bed. Groundwater in the Delta-Mendota sub-basin [11] occurs in three water-bearing zones. These include the lower zone, which contains confined fresh water in the lower section of the Tulare Formation, an upper zone which contains confined, semi-confined, and unconfined water in the upper section of the Tulare Formation.

Of note, DWR has recorded that sub-basin 5-22.07 is relatively stable, with no indication of long-term decline or cone-of-depression. The most recent groundwater contour map provided by DWR based on well data show that 2006 groundwater levels did not change markedly from 1996 levels (Figures 4-1 and 4-2).

Recent data (DWR 2000) show the subbasin groundwater gradient falling to the north-northeast. Based on current and historical groundwater elevation maps, groundwater barriers do not appear to exist in the subbasin. An analysis of historical changes in groundwater levels for the subbasin is based on annual water level measurements by DWR and other cooperators. According to DWR, the average subbasin water level has actually increased by 2.2 feet from 1970 through 2000.

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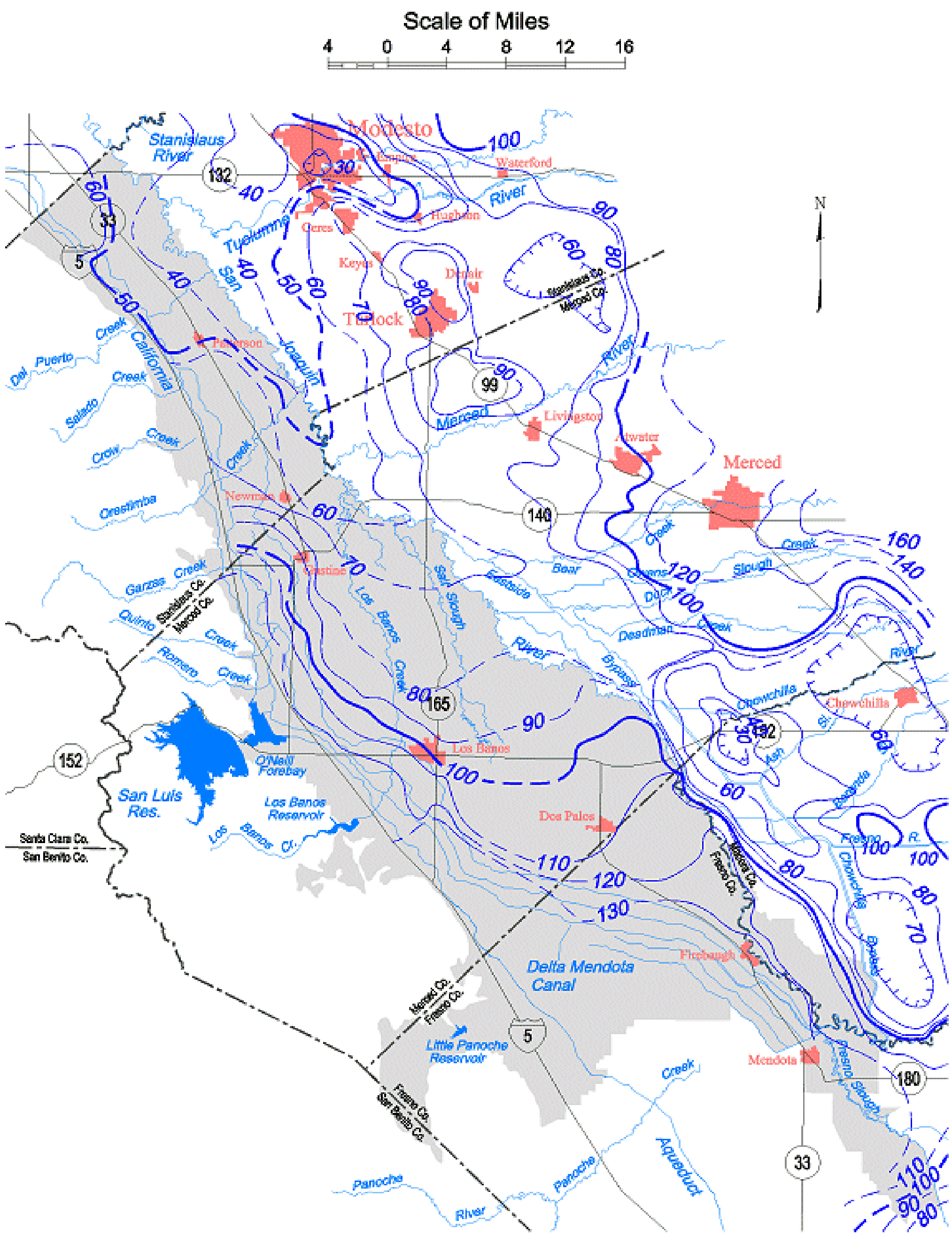
[10] DWR Bulletin 118, *"San Joaquin River Hydrologic Region (5-22.07), San Joaquin Valley Groundwater Basin*", January, 2006

[11] Subbasin 5-22.07, consisting of 747,000 acres.

Delta Mendota Groundwater Basin

Spring 1996, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer

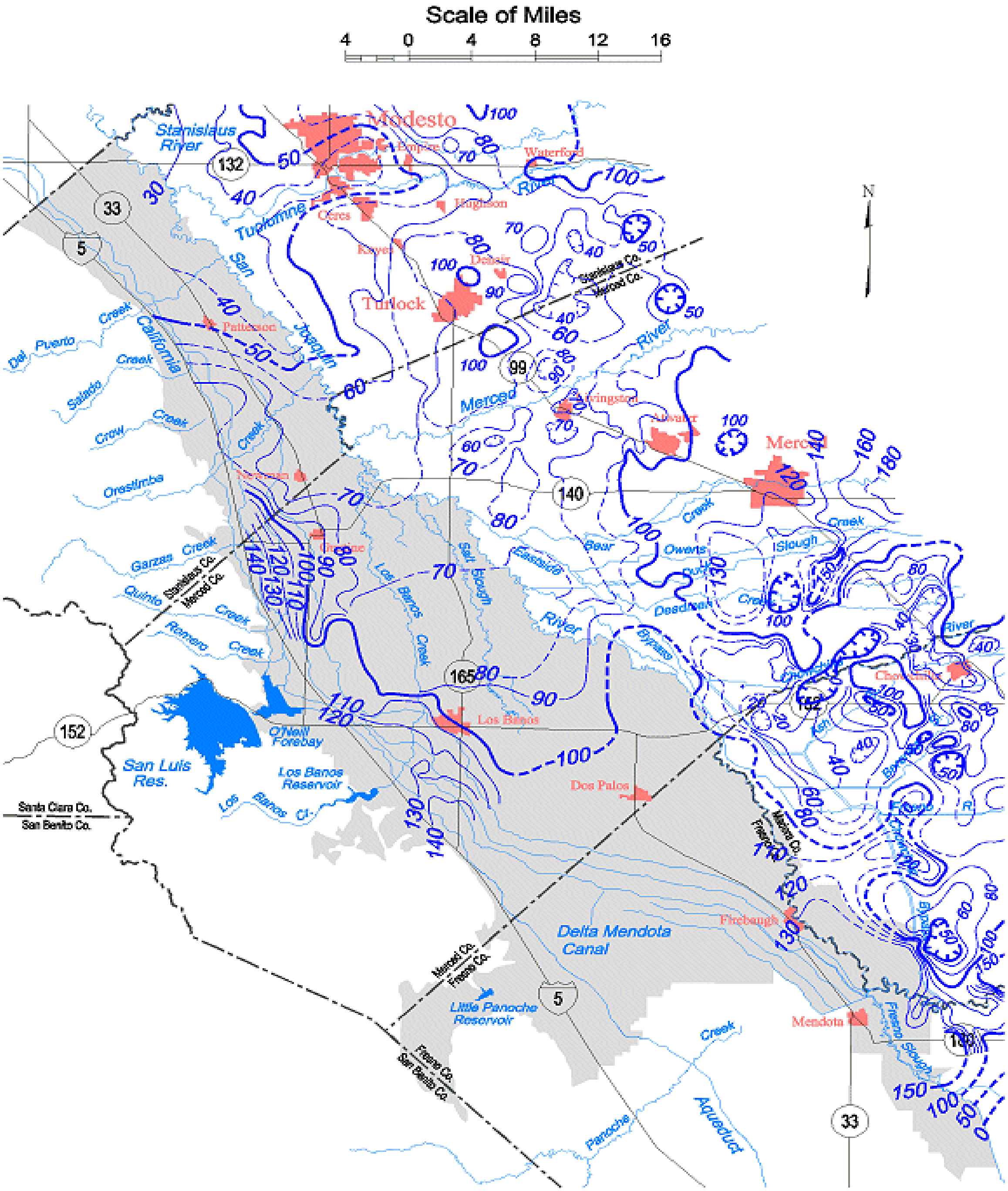


Contours are dashed where inferred. Contour interval is 10 and 20 feet.

Figure 4-1

Delta Mendota Groundwater Basin

Spring 2006, Lines of Equal Elevation of
Water in Wells, Unconfined Aquifer



Contours are dashed where inferred. Contour interval is 10, 20 and 50 feet.

Figure 4-2

Regular users of local groundwater include the City of Patterson, local irrigation districts, and private land owners, though the irrigation districts use mostly surface water and rely on groundwater primarily for a backup supply. Currently there are no known problems in the local area due to groundwater use, such as lowering of the perpetual lowering groundwater table or land subsidence. Records do show that increases in normal pumping during drought cause lowering of the groundwater table.

Groundwater studies of the local basin from 2002 through 2010, conducted by Kenneth D. Schmidt and Associates, Groundwater Consultants (KSA) based in Fresno, California, state: "*Groundwater is present in two aquifers beneath the City of Patterson …water levels in both aquifers have apparently been relatively stable of the long term*". [12] The studies concluded that there are essentially two aquifers underlying the City; a lower confined zone, and an upper unconfined zone. The two aquifers are separated by the thick, semi-impermeable Corcoran Clay layer. Due to the importance of understanding the sustainability of groundwater for future planning, a 6 day aquifer test was conducted by KSA during the week of February 21, 2006. In summary, the new testing efforts resulted in the following conclusions:

1. The lower aquifer (below Corcoran Clay) transmissivity is 80,000 gpd/ft, with a storage coefficient of 0.0003 (as opposed to 100,000 gpd/ft and 0.001 respectively from 2002 report);
2. No significant downward leakage was found between the upper and lower aquifers (through the Corcoran Clay);
3. Groundwater flow is in a northwesterly direction, as opposed to a northeasterly direction as previously suspected;
4. Total sustainable production from the lower aquifer was higher than estimated in the 2002 study.

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[12] *Groundwater Conditions in the Vicinity of the City of Patterson*, Ken Schmidt & Associates, June 2010.

Natural inflows to the two basins were estimated by KSA at 3,500 ac-ft/yr (upper) and 8,900 ac-ft/yr (lower), based on basin hydraulic conductivity, transmissivity, and gradients.[13] Additional recharge to the upper aquifer is expected from canal seepage, percolation of applied irrigation water, and stream flow seepage. Hence, total inflow to the local basin underlying the City is upwards of 12,500 ac-ft/year.

City Groundwater Facilities

The City owns and operates nine (9) water production wells, with a total production capacity of approximately 13 MGD. Two (2) of the production wells are dedicated for non-potable use. Characteristics of each well are provided in Table 4-1.

Table 4-2

Summary of City of Patterson Groundwater Wells

Well	Type	Year Built	Depth	Screens	Flow (gpm)
2	Production	1947	360’	170’- 356’	750
4	Production (Non Potable)	1971	433’	204’- 433’	850
5	Production	1986	565’	390’- 565’	1,400
6	Production	1994	365’	225’-255’ 345’-355’	500
7	Production	1999	597’	342’- 597’	1,400
8	Production	2004	470’	340’- 390’ 444’-460’	1,000
9	Production	2009	480’	320’ – 470’	850
10	Monitor	2001	550’	310’- 530’	NA
11	Production	2007	540’	320’- 450’	1,200
	Keystone (Non Potable)	2011	286’	176’ – 272’	1,200
	Total City Well Production				**9,150**

Note: Well No. 1 was destroyed in 1998; Well No. 3 was placed in “inactive” status by the City in 1998 due to excessive sand production.

[13] Groundwater studies performed in 2002 and 2006.

Additional wells will constructed as needed to provide source supply for development. The total number of wells needed is unknown since each well has a different production rate.

Table 4-2 presents the last 5 years of the City's groundwater pumping. Table 4-3(D) presents the anticipated groundwater pumping through the year 2030. Note that these tables reflect that groundwater is the sole source of water to the City through the year 2030.

Groundwater Management

The state of California does not enforce state groundwater management statutes, thereby placing groundwater management at the local level. The City claims legal access to its groundwater through California groundwater law, which allows an appropriator the right to pump and use the local groundwater for beneficial use. Appropriative rights are second to "overlying" rights of property owners. The amount of groundwater use is generally restricted to the point at which one users actions cause adverse impact to another user.

The City has well ordinances that protect the groundwater and minimize impacts of the City's pumping activities on private wells. However, a formal and comprehensive groundwater management program for the area has yet to be implemented. Groundwater management can be defined as the planned and coordinated monitoring, operation, and administration of a groundwater basin or portion of a groundwater basin with the goal of long-term sustainability of the resource. Thus, primary objectives include prevention of significant depletion of groundwater in storage, and preventing significant degradation of groundwater quality. Each management plan should be tailored to fit local conditions and needs, with the flexibility to adjust objectives as more is understood about the basin with time. This effort will be an important component of a sustainable water supply program for the City.

The San Luis Delta Mendota Water Authority has developed a groundwater management plan for the larger west-side area, but its application for managing local groundwater near Patterson has not been realized. [14] Though the Water Authority and its members are proposing a more active monitoring program, the plan only meets the minimum as required by DWR, and the City may join with other Westside water purveyors to develop a more comprehensive groundwater management program.

There are various ways communities have implemented groundwater management. Options include: (1) local government through adoption of ordinances, (2) local agency granted authority per the California Water Code, and (3) use of court adjudication. There are no laws that require that any of these methods by used or applied to a basin. Adjudication results in a loss of some control by local agencies, and the court directed process can be time consuming and costly. Generally, adjudication is used only when landowners and other parties feel that resolution to groundwater problems are only achievable through the courts.

Starting in 2009, the City introduced a series of "water workshops", whereby local water stakeholders are meeting periodically to discuss water issues associated with Westside Stanislaus County. Participating members include municipalities and irrigation districts. Members have expressed the need and willingness to participate in a program to actively manage local groundwater through additional monitoring, sharing of data, and other activities that may protect local groundwater. One result of the workshops was a collaborative effort to prepare and submit a proposal for a Proposition 84 Planning Grant in 2010, for conducting integrated

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[14] AB3030 GMP, developed by SLDMWA in 1995, and currently being updated in 2011.

water planning, including groundwater management. Workshops are expected to continue for the indefinite future, with the goal of developing a regional groundwater management program for responsible groundwater use, monitoring, and stewardship.

Full use of the existing water system capacity is anticipated to meet approved development. Groundwater use beyond this amount may still be available since: (1) the sustainable groundwater yield may support additional production for City growth, (2) there are many existing private wells within the General Plan Alternatives areas that will be abandoned, allowing current production from these wells to be used by the City, and 3) groundwater recharge programs sought by the City and other Westside water purveyors may substantially increase sustainable yields. Hence, sustainable groundwater yield is assumed at this juncture to be at or near the values as calculated in recent groundwater studies. The City is expected to require the use of recycled wastewater for non potable demands by 2030.

However, accurate predictions of future groundwater availability for the City are difficult. Sufficient information is not currently available (e.g. groundwater models, etc.) to identify with confidence what the total demand for groundwater will be in the region, what long term sustainable yields will be, and to what portion of groundwater the City will be entitled.

In 2010, the City held a series of meetings with local stakeholders (i.e. developers, land owners, City Council members, local irrigation districts, etc.) to discuss the water supply planning and engineering studies necessary to support the proposed general plan effort, should it be approved. As part of those discussions, the City explained that additional groundwater studies were required in order for developments to proceed. Many of these studies are yet to be completed, and as such, accurate impacts to local groundwater availability due to urbanization of agricultural lands are still not quantified.

The only known quantitative groundwater studies conducted specific to City of Patterson were performed between 2002 and 2010 by Ken Schmidt & Associates (KSA) of Fresno, California. KSA specializes in groundwater hydrology in the central valley, including extensive work in Stanislaus County. In summary, KSA determined that the City of Patterson area, roughly defined by the City's east-west sphere width (perpendicular to the direction of groundwater flow) has approximately 12,400 acre-feet per year inflow. [15] According to KSA, "inflow" is not the same as "safe yield", a term often used to describe that amount of water that can be safely pumped without significant adverse impacts to the groundwater (excessive pumping costs, damage to local wells, loss of water quality, etc.). Inflow represents a basis for determining an upper limit of safe or sustainable yield. Inflow is not a fixed value, and can change depending on recharge conditions, such as hydrologic patterns, reduction in applied irrigation water, etc.

Although an inflow value was calculated by KSA, a safe or sustainable yield value for local groundwater that the City of Patterson may have access to (e.g. how much of the 12,400 ac-ft/yr can Patterson use) has not been accurately determined due to several factors as discussed herein.

(1) Other Groundwater Users – In addition to City of Patterson, there are numerous users of groundwater that access the 12,400 ac-ft/yr "inflow", including Patterson Irrigation District, which claims as much as 5,000 ac-ft/yr of total groundwater use. There are also over 200 private wells, some which are high production commercial users. Although the total amount of groundwater used by others has yet to be defined, it is significant. Gross

[15] "Inflow" defined as that amount of water that passes through a vertical section running along the south side of the City (lower aquifer) or vertical and horizontal (top) section of the study area (upper aquifer) since the upper aquifer is influenced by surface activity. Inflow is not the same as safe yield, or sustainable yield.

estimates of current groundwater users other than the City of Patterson range from 3,000 ac-ft/yr to 7,000 ac-ft/yr.[16]

(2) Inflow Value Is Subject To Change - Pumping data analyzed by KSA in 2006 were used to calculate the 12,400 ac-ft/yr inflow value. According to KSA, loss of applied water from surface irrigation of crops as lands urbanize will result in a decrease in inflow. Removing lands will also result in fewer private wells (not eliminate entirely) which may increase available water for the City of Patterson or other local groundwater users. Hence, the 12,400 ac-ft/yr value is not fixed, and may decrease. Graphs of groundwater levels (City of Patterson, 2010 General Plan Water Supply Analysis) illustrate the sensitivity of the groundwater table during drought periods (less surface water is applied and more groundwater is used during a drought). Although the groundwater table is currently relatively stable, it clearly shows signs of stress when groundwater pumping increases in combination with less applied surface water.

(3) No Claim/Right Prior To Beneficial Use - The City of Patterson currently uses approximately 4,000 ac-ft/yr of groundwater. The City cannot claim a right to local groundwater prior to using the water. Groundwater law requires a user of groundwater to establish a beneficial use of the water in order to establish a right to the water. However, groundwater rights are based on first come, first serve basis. Thus, if other users have put local groundwater to beneficial use prior to the City (i.e. City limited to increasing its use by only 2% - 4% per year), surplus groundwater available today will not be available in the future. For example, Patterson Irrigation District has publicly stated

[16] Assuming: 3,000 ac-ft/yr PID (use in study area), 1,000 ac-ft/yr Patterson Foods, 200 private wells at 2 ac-ft/yr each totaling 400 ac-ft/yr, and other miscellaneous groundwater use at 300 ac-ft/yr. If it is assumed that approximately 4,000 ac-ft/yr, for example, is used by others, a total of 8,400 ac-ft/yr of the inflow would remain available for City of Patterson or other new users.

its intention to use as much as 10,000 ac-ft/yr of local groundwater, County developments south of Patterson could greatly impact the City's available groundwater, etc. Planning assumptions that assume the City of Patterson will have access to all unused local groundwater may be unrealistic.

(4) <u>Adverse Impacts Prior to Full Use of Inflow</u> – Even if it is assumed the full 12,400 ac-ft/yr will remain accurate into the future, adverse responses to additional groundwater pumping may limit the available yield. For example, as each additional "increment" of local groundwater is pumped, the water table will respond by either declining, changing direction of flow, etc. As the groundwater declines or direction changes, deepen private wells/pumps, the cost of pumping water increases, water quality will likely deteriorate, ground subsidence may occur, etc. At some point, even though additional groundwater may still be "available", the adverse impacts of pumping additional increments of water becomes too costly.

The net result of these constraints was KSA's recommendation that the City of Patterson assume approximately 8,000 ac-ft/yr total local groundwater use as a "safe or sustainable" yield. For planning purposes, the City of Patterson 2010 General Plan assumed 7,500 ac-ft/yr of total use, with additional groundwater availability through active recharge activities. All City planning documents approved to date consistently limit City's local groundwater use to near or less than 8,000 ac-ft/yr. KSA also recommended that a water budget be performed to identify the net impact on groundwater resulting from build-out of the General Plan area. To account for the uncertainties in future groundwater availability, the 2010 General Plan Water Supply Analysis recommended an active groundwater recharge program, whereby surface water could be applied to City owned spreading basins, and artificially increase capacity to the groundwater. The surplus water would come from the purchase of surface water entitlements from federal or state water projects, or recycled water. Recharge allows the City to have more control of the quantity and quality of its groundwater sources, and remove some of the uncertainty associated with groundwater capacity.

Thus, based on most recent aquifer tests and hydrological analysis conducted, sustainable yields from the local aquifers have been confirmed at rates that exceed the City's projected build-out population, assuming *groundwater represents a portion of the City's total demands*, as defined and quantified in the City's 2010 General Plan, including implementation of a groundwater recharge program to account for uncertainties in future groundwater availability. Further studies of groundwater capacity and coordination with other users of local groundwater will be essential activities for Patterson to ensure adequate source water.

San Luis Delta-Mendota Water Authority Groundwater Management Plan and Pumping Analysis

In 1995, the agencies that comprise the San Luis Delta-Mendota Water Authority (SLDMWA) entered into an agreement to jointly fund the preparation of a coordinated regional groundwater management plan (GMP). According to the Central Valley Project Improvement Act (1992) federal water contractors are required to prepare a GMP in accordance with AB 3030 for water conservation purposes. The study included a thorough analysis of the Delta-Mendota Sub-Basin, which includes the City.[17] This is the only groundwater management plan or other specific authorization for groundwater management for the basin that includes aquifers used by the City. However, since the City is not a participant in the plan, the plan does not directly affect the City's use of the basin

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[17] Stoddard & Associates, "Groundwater Management Plan for the Northern Agencies in the Delta-Mendota Canal Service Area and a Portion of San Joaquin County", 1995.

Due to the size of the Delta-Mendota Sub-Basin and changes in basin characteristics along its length, the study divided the basin into three areas for analysis; north, central, and south. The City is located in the north basin. According to the GMP, the study consisted of: 1) a detailed hydrologic analysis to estimate the changes in groundwater storage from 1986 through 1994, 2) estimate of sustainable yield, 3) estimate the total basin-wide groundwater pumping during the 1986 – 1994 period, and 4) determine any potential impacts of DMC export on the overall water resources balance.

The study used two separate approaches to determine the impacts of groundwater pumping in the sub-basin, including: 1) the *Specific Yield Method*, and 2) the *Water Balance Method*. Each are commonly used methods for analysis and projecting groundwater use and impacts.

The Specific Yield Method uses changes in piezometric head in confined and unconfined aquifers and hydrologic theory to estimate changes in basin storage. Groundwater tables respond in accordance to accepted laws and principals when basin storage is increased or decreased (as when groundwater is pumped from the basin).

The Water Balance Method consists of a general accounting of inflows and outflows of basin water. The analysis consists of quantifying water that flows into the basin (through surface recharge from applied water or precipitation, canal leakage, and subsurface inflow), or out of the basin (from crop use, pumping, or subsurface outflow).

According to the study, the northern section of the Delta-Mendota Subbasin is in "a hydrologically balanced condition".[18] Changes in storage capacity did not change

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[18] Stoddard & Associates, "Groundwater Management Plan for the Northern Agencies in the Delta-

significantly during the 8-year study period. Variations in water levels were attributed to reductions in surface water supplies during drought years and changes in precipitation. Under normal conditions, the study projected an increase in storage of 35,000 acre-feet annually, and that that amount of additional pumping could occur without impacting the basin's present water storage.[19]

An important finding of the study is that subsurface outflow (from groundwater basin to the San Joaquin River) varied from 73,000 acre-feet per year to 185,000 acre-feet per year. In other words, water leaves the sub-basin because the water table is higher in elevation than the river. This is likely due to an artificially raised groundwater table resulting from applied surface water from federal and state water projects. Typically, when groundwater basins are in decline, adjacent rivers would add to, or flow into the basin.

This is not the case in the northern Delta-Mendota Sub-Basin. Significant volumes of water continuously flow out of the basin into the San Joaquin River. This suggests that even more than the 35,000 acre-feet annual increase in pumping could occur without causing an "overdraft" condition. By pumping more than 35,000 acre-feet annually, the basin water table would be stable, but marginally lower than its current elevation, thereby further reducing the outflow. Thus, according to the study, additional pumping of approximately 85,000 acre-feet annually could occur without lowering the water table below natural conditions.

Based on the SLDMWA study, it is clear that the City's anticipated increase in pumping of approximately 6,000 acre-feet annually (from 2,000 acre-feet/year[20] to 8,200 acre-feet/year) will be far below the safe yield of the groundwater available in the Delta-Mendota Sub-Basin.

Mendota Canal Service Area and a Portion of San Joaquin County", 1995, page 24.

[19] Stoddard & Associates, "Delta-Mendota Canal Groundwater Pumping Analysis", pages 51, 52.

[20] 1995 groundwater use per City of Patterson utility records.

Surface Water and Transfer Opportunities

Surface water options available to the City include state and federal water from the San Joaquin River, Delta Mendota Canal, and California Aqueduct. Surface water from one of all of these sources will be used by the City in some combination of ways, including direct use (untreated for non potable demands), treated for drinking water, or used to recharge groundwater using spreading basins. Water from the San Joaquin River and Delta Mendota Canal cannot be used for drinking water, according to California Department of Public Health (CDPH) due to contamination concerns, but can be used for groundwater recharge and/or direct non-potable use.

The City proposes to develop a water program master plan over the next two years which will identify these options, including capacities, locations, costs, treatment systems, conveyance systems, reliability, and other characteristics. However, specific information regarding the use of surface water is not required or provided in this update.

Presently, no formal agreements have been executed by the City for surface or groundwater transfers. The GPU identifies surface water as an important part of the City's future water supply program once the use of local groundwater supplies are maximized. Landowners that desire to annex into the City will be conditioned to provide a water supply for their development, as stated in the GPU. As required by DWR as part of the UWMP ("*Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis", per 10631(d))*, it was recommended in the GPU Water Analysis that existing surface water entitlements remain with the land when annexed, either through transfer of entitlement or through a wholesale agreement with the current entitlement holder.

In September, 2010, formal statements were sent to the City from local irrigation districts expressing various degrees of concerns with this concept. The Patterson Irrigation District (PID) expressed a willingness to collaborate with the City through continued discussions of water agreements that would be fair and mutually beneficial to both parties. The City plans to accept this invitation for discussions with PID in the near future.

At this time, opportunities for surface water entitlement transfers with other local water purveyors do not appear promising based on initial responses provided to the City, though the City will continue discussions with all local water purveyors, seeking mutually beneficial agreements for water transfer opportunities. Regardless, landowners are ultimately responsible to provide water entitlements for their developments whether the water is from local water purveyors or others.

Local water purveyors near the City hold water entitlements of various types, and may present opportunity for sharing or transfer agreements. A description of these local water purveyors is provided herein.

State Water Project Contractors

There are two (2) local users of SWP water near the City that receive water from the California Aqueduct. These include Western Hills Water District and the Oak Flat Irrigation District.

Western Hills Water District

The Western Hills Water District (WHWD) supplies water to the Diablo Grande community, located approximately 10 miles west of the City, for M&I use. WHWD is not a SWP contractor, but a sub-contractor of the Kern County Water Agency (KCWA).

In June, 2000, an agreement was executed among WHWD, KCWA, and DWR for delivery of 8,000 ac-ft to WHWD for use by Diablo Grande. The water entitlement originated from a pre-1914 Lower Kern River water right that was purchased from the Berrenda Mesa Water District, and banked in the Pioneer Groundwater Banking Project. The agreement allows for a portion of KCWA's annual Table A amounts to be delivered from the California Aqueduct (mile 42.90, Reach 2A, 30 cfs maximum capacity), in exchange for water from the groundwater bank. WHWD petitioned and was approved by the State Water Resources Control Board for annexation of the new service area into the SWP place-of-use to allow delivery of SWP water to Diablo Grande. [21]

The agreement between KCWA and WHWD allows for deliveries of the water under most conditions. KCWA is free to use its Table A water deliveries as it sees appropriate, and could agree to make Diablo Grande a first-priority. According to representatives of Diablo Grande, the development is subject to the same reductions in deliveries as all other KCWA's Table A water.

Although the WHWD water is delivered through the SWP, it is not considered SWP water by the state of California. According to DWR staff, the delivery to Diablo Grande is a 2nd *priority* water, and subject to reductions if they have difficulty meeting obligations with SWP contractors. In 2002, the California Aqueduct underwent repairs and Diablo Grande was denied water for a period of approximately 2 months. DWR believes that Diablo Grande needs a reliable "back up" source of supply to ensure reliable deliveries when surface water is unavailable. Diablo Grande currently has access to groundwater via a well located east of the California Aqueduct, and pipeline that can provide approximately 3,000 gpm of untreated groundwater to the development for emergency conditions. Opportunities may exist for sharing of source supplies with Diablo Grande to make both systems more stable during periods of limited surface water availability.

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[21] SWPAO #01001, April 21, 2000.

Oak Flat Water District

The Oak Flat Water District is a small irrigation district located approximately 4 miles southwest of the City. The district is a SWP contractor, and has 5,700 ac-ft of Table A water for irrigating approximately 1,700 acres of land.

In many years the district does not receive enough water for full operations, due to reductions in deliveries. According to William Harrison, General Manager of Oak Flat Water District, the district does not have surplus water and is in need of additional supplies in many years. The district has no groundwater backup source and distribution system, though some private wells may provide small amounts of supplemental water when needed. The City anticipates that it will continue to have discussions with the Oak Flat Water District to seek exchange opportunities that could benefit both parties.

Central Valley Project (USBR)

There are three (3) local federal water contractors with entitlements to water from the Central Valley Project (CVP) that receive water from the Delta Mendota Canal. These include the Patterson Irrigation District, Del Puerto Water District, and West Stanislaus Irrigation District.

Patterson Irrigation District

The Patterson Irrigation District (PID) consists of approximately 13,500 acres, and is located adjacent to the City, primarily to the east. The district was formed in 1955, originally the Patterson Water District, but later changed its name. PID has 425 landowners, and over 600 water users. PID maintains several miles of lined and unlined canals, pumps, and small storage basins for distribution of water to its users.

PID has an agreement with the BOR for 6,000 acre-feet of exchange, or replacement water. In 1967, PID entered into a long-term contract with the

BOR for 16,500 acre-feet of CVP water. [22] According to the BOR, 1,000 acre-feet of this water is classified as M&I water. [23] A long-term renewal contract[24] was executed on March 9, 2005, and is in effect for 25 years.

The City has had discussions with the Patterson Irrigation District regarding the sale and/or exchange of CVP water, though no formal discussions have occurred for the past 5 years.

Del Puerto Water District

Del Puerto Water District (DPWD) was originally formed in 1947, and is located on the west side of the City. In 1995, the district reorganized and consolidated with ten other districts, increasing its size to approximately 47,400 acres. The district area is about 50 miles long, but is relatively narrow since it stays within 2 miles of the DMC footprint. The district boundaries span Stanislaus, San Joaquin, and Merced Counties.

The district receives its CVP supply directly through turnouts on the Delta-Mendota Canal. DPID does not have any distribution facilities and does not own any pumps, pipelines, or canals to transport the CVP supply. All turnouts, pumps, pipelines, and canals in the district are privately owned, maintained, and operated.

In 1953, DPWD signed a long-term contract with BOR for 10,000 acre-feet of CVP water. [25] After the 1995 consolidation, the water service contracts of the other ten districts were assigned to Del Puerto Water District and were renegotiated as a single contract, bringing its total CVP service contract entitlements to 140,210 acre-feet. DPID water can be used for irrigation or

[22] Contract 14-06-200-3598A, executed 12/18/67.

[23] Based on classification of water prior to release of the BOR 1995 draft "M&I Water Shortage Policy," thereby subject to lesser reductions during dry periods as compared to irrigation water.

[24] Contract No. 14-06-200-3598A-LTR1

[25] Contract 14-06-200-922

M&I, however, only 20 acre-feet are classified at M&I.[26] A long-term renewal contract was executed on February 25, 2005, and is in effect for 25 years.[27]

The City has discussed options for the exchange of water with representatives of the DPWD. Although no apparent opportunities exist at this time, both water districts have agreed to maintain open communication to look for regional solutions to water shortages.

West Stanislaus Irrigation District

The West Stanislaus Irrigation District (WSID) is located to the northwest of the City's boundaries. WSID was formed in 1920, with the first water deliveries made in 1929. The current size of the district is 24,800 acres, but only a portion (19,700 acres) is irrigated. WSID has a distribution system of lined canals and laterals to distribute water. The main canal carries water supplied by six pumping plants.

In 1953, WSID signed a long-term contract with BOR for 20,000 acre-feet of CVP service contract water.[28] The contract amount was increased to 50,000 acre-feet in 1976. The contract has no provisions for M&I use. The contract expired in 1994, but a series of interim renewal contracts have been executed since that time. A long-term renewal contract was executed on February 25, 2005, and is in effect for 25 years.[29]

Non-Potable/Recycled Water

The City is actively implementing a non-potable/recycled water program. The City is currently installing a non-potable, dual water system for irrigation of large public and commercial landscapes using either non-potable water from wells, canals, or a

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[26] Per discussions on 1/30/06 with William Harrison, GM, DPWD.
[27] Contract No. 14-06-200-922-LTR1
[28] Contract 14-06-200-1072
[29] Contract No. 14-06-200-1072-LTR1

recycled wastewater program, with an expected completion date of 2014. This program is based on the *"City of Patterson, Non Potable Water Master Plan and Feasibility Study"* adopted in 2008. The City is currently in Phase 2 of a 5 phase program, constructing piping and shallow groundwater wells for an interim supply source.

The 2010 Water Supply Assessment completed by the H2O Group for the City's 2010 General Plan Update indicates that recycled water, either from a the City treatment facility (the City owns and operates its own wastewater treatment facility), or through purchase of recycled water from another community, will make up approximately 1/5 of its total supplies. All future development will be conditioned to use non-potable/recycled water for outdoor demands, including residential properties, according to the City's General Plan. Initially, water for the non-potable system will be from shallow wells, typically of lower quality, but the system is being installed using recycled water standards for the future (2030).

Use of Recycled Water (§ 10633 (d-g))

The City collects and treats all wastewater generated with City limits, and also receives wastewater from a small development approximately 6 miles west of the City, called Diablo Grande. The collection and transport of wastewater consists of a gravity system that conveys influent to the City wastewater plant, located approximately 2.5 miles east of the City.

The current treatment facility operates three treatment systems. The first is an activated sludge treatment process consisting of an oxidation ditch and two clarifiers constructed in 1979 and 1986 (north oxidation ditch). The second is an advanced integrated ponds system (AIPS) built in 1999-2000, and the third is an activated sludge process with an oxidation ditch and one clarifier (south oxidation ditch) constructed in 2005. The original design capacity of the three treatment systems is currently:

- North Oxidation Ditch 0.80 mgd
- AIPS 0.50 mgd
- South Oxidation Ditch 1.25 mgd

Excess biosolids (sludge) from the two oxidation ditches receive additional digestion in four aerobic digesters. Digested sludge is then dewatered using chemically enhanced plastic media drying beds.

Current and projected wastewater flow rates are shown in tables 4-4(D) through 4-6(D).

Flow rate at 2030 is anticipated to average approximately 6.40 mgd. This flow rate is based upon 55 gallons per capita per day for residential and 562 gallons per acre per day commercial/industrial. The Diablo Grande development, located west of the City of Patterson, has contracted with the City to treat its wastewater. Estimates of flow from Diablo Grande for 2030 are 0.50 mgd.

Table 4-4(D) presents the City's historic and projected wastewater flows. Table 4-5(D) shows that 100% of the wastewater is currently being disposed of and not reused. Table 4-6(D) shows the use of recycled water toward the end of the 20 year planning horizon, with groundwater continuing to be the City's only source of water through the year 2030.

Recycled water use is projected by the City as reflected in Tables 4-1(D) and 4-7(D). The City will continue its efforts to expand the non-potable/recycled water system, including requirements for dual plumbing of all new development areas. The long-term potential volumes of water associated with these measures are shown in the DWR Tables.

The City of Modesto has a recycled water program, and plans to expand the program over the next few years. The City has expressed interest in participating in Modesto's program when recycled water becomes available. Modesto is working with other water purveyors west of the San Joaquin River near the City, so including an extension to the City is possible in the near term. The City may also seek to send its wastewater to Modesto for full or tertiary treatment, and have the recycled water returned for use in its non-potable system. Recycled water is considered a reliable and stable water supply source for Patterson. Options and costs for treating and use of recycled water are being identified in the City's current master planning process, with completion anticipated in late 2012.

Desalination Water (§ 10631(i))

As part of the City's water supply program, treatment of groundwater for high levels of TDS is included in all feasible alternatives. Since groundwater provides the City with its most reliable source supply, some treatment of groundwater is anticipated in the future. Treatment options include membranes, ion exchange, lime softening, and blending.

As a result of TDS reduction in the wastewater supplies, the levels of salinity in the City's wastewater is expected to decrease significantly due to upstream removal of salt and elimination or reduction of private water softeners. It is expected that the wastewater effluent will be adequate for irrigation or landscaping and crops, so a future water recycling programs would benefit from treatment of the potable water supply.

In 2009, the City of Patterson submitted a "Salinity Evaluation and Minimization Plan" to the California Regional Water Quality Control Board (RWQCB) for review and comment. The plan included recommendations to reduce the overall salinity load to the Patterson area through treatment of potable water, elimination of self-generating water softeners, and development of the non potable program. To date, the RWQCB has not responded to the City's proposed action plan.

Future Water Supply Projects

The City of Patterson has recently embarked on two potential future water supply projects, 1) West Stanislaus County Groundwater Banking Study and 2) Acquisition of Recycled Water. Both of which are in there infancy and are briefly described below. Subsequent updates of the UWMP will address these projects in greater detail in they come to fruition.

<u>West Stanislaus County Groundwater Banking Study</u>

As discussed above City of Patterson has recently begun discussion with other water purveyors on the west side of Stanislaus County to discuss the potential of doing groundwater banking in western Stanislaus County. There is no storage in this area of the state for state or federal water supplies and competition for future groundwater supplies is anticipated. The study being proposed builds on the study completed by the San Luis Delta Mendota Water Authority in 2000 which looked at the possibility of local groundwater banking projects to help with season fluctuations in water project deliveries, and to make better use of local supplies. 14 agencies put together initial project concepts and submitted a project to DWR for planning Grant Funding in summer 2010. No funding was received by a re-submittal of the grant application is anticipated in the summer of 2011.

<u>Acquisition of Recycled Water</u>

The City has recently entered discussions with the City of Modesto about the possibility of Modesto treating the City's wastewater and returning for use and disposal the recycled water.

City of Modesto (east of Patterson) is already planning on providing nearly 30,000 ac-ft per year of recycled water to the Del Puerto Water District (West of Patterson) and has begun planning and construction of facilities to do so.

The water is anticipated to be able to be delivered by 2016. The City of Patterson would like to make use of the Modesto / Del Puerto recycled water facilities and potential become part of the project for at least the conveyance and treatment of the City of Patterson wastewater flows.

Table 4-9(D) shows both of these two potential future water supply projects and the anticipated yields that each may bring to the City of Patterson.

Section 5 Water Supply Reliability and Water Shortage Contingency Planning (§ 10631(c))

The California Department of Water Resources requires the Urban Water Management Plan address water supply reliability and water shortage contingency plans. Even though the City does not foresee future water shortages, this section details the City's efforts in the event of interruption in water supply.

Water Supply Reliability

The following addresses the reliability of supply and impacts due to supply inconsistencies for the City based on the sole use of groundwater, as stated previously. This is subject to change as the City's water program evolves. For example, it is probable the City will implement use of recycled water before 2030, though it is not critical in order for the City to meet demands at that date.

The City's water supplies are addressed for normal, single dry and multiple dry water years. The historical years that were used as the basis for this analysis are shown in Table 5-1(D). Table 5-2(D) shows, that historically, the City has never had a shortage in supplies, which are currently made up 100% from groundwater. Table 5-3(D) shows that there have not been any disruptions in deliveries or supplies to date. Table 5-4(D) presents the potential water supply impacts that may occur during the 20 year horizon of this study. Table 5-5(D) shows anticipated supply reliability 100% of the time, for both single dry and multiple dry years

Table 5-6(D) compares the projected demands for the City from 2010 to 2030 to the anticipated supplies for a single dry year event. The table shows that there is a surplus of supplies in all water years. Table 5-7(D), compares the project demands to the supplies for a multiple dry year event. Table 5-8(D) provides additional detail on the multiple dry year events. Both tables show that adequate water supplies are projected in all years.

Water Shortage Contingency Planning

The City has a reliable supply of source water, and is not vulnerable to reductions in deliveries similar to other communities that rely on local or imported surface water, for reasons described below:

1. The City has sufficient groundwater to meet the needs of the planning horizon build-out population, and the local groundwater table is not subject to significant impacts due dry or critically dry hydrologic periods; [30]

2. The current UWMP assumes sole use of groundwater to meet current and future M&I demands through 2030;

3. Problems associated with groundwater use are associated with quality, and are addressed in the City's Water Planning Study (2006);

4. The City is implementing a non potable water program, consisting of a dual distribution system to convey either recycled water, untreated groundwater, or untreated surface water for landscape irrigation and other possible industrial uses. Since the City owns and operates the wastewater treatment facility, the plant effluent is a reliable source supply once tertiary treatment is installed.

In the event the City were to experience a water supply shortage the mandatory water reduction methods referenced in Table 5-9(D) (defined in the Drought

[30] Local groundwater basin is in equilibrium, and is not expected to experience decline due to proposed pumping increase for 2025 population demands, based on groundwater studies by DWR and City of Patterson.

Contingency Plan in Appendix G) are summarized in Table 5-11(D). Table 5-12(D) defines consumption reduction methods that the City will use. Table 5-13(D) defines the penalties and charges that they City will administer for non-compliance with mandatory water reductions.

Stages of Action (§ 10632(a))

The City has adopted a Drought Contingency Plan ("DCP") in the event an extended drought has an adverse impact on the local groundwater table, or during a catastrophic supply interruption. The DCP consists of three stages, progressively requiring greater reductions in water use. Table 5-9(D) summarizes the DCP.

Implementation of the DCP is determined by the city council, as they deem appropriate. It should be noted that the City may implement water rationing (Stage 1 or Stage 2) even during drought periods when there is no apparent impact to the water table to show support of other Central Valley communities struggling with water shortages.

Catastrophic Supply Interruption Plan (§ 10632 (c))

Scenarios causing catastrophic interruptions to the City source supply are limited due to the City's direct access to groundwater, and having multiple wells in the system. The probability of an event that could leave the City without water is extremely low. Catastrophic failures of the water supply could include the following scenarios:

A. Declining Groundwater Table – Under this scenario, the groundwater table begins to show signs of overdraft. This event occurs slowly over time, and does not require immediate action on the part of the City. Trends in groundwater levels suggesting an overdraft condition will need to be addressed with long-term regional water planning and groundwater management efforts. Immediate and severe reductions in groundwater use are not required to address this scenario.

B. Loss of a Groundwater Pumping Facility – Under this scenario, a single well may go out of production due to mechanical failure, well casing failure, fire in the control building, etc. All the City wells are capable of utilizing portable or dedicated generators to operate in the event of power failure.

A well could also go out of production due to water quality issues, such as bacteriological contamination or exceeding a primary drinking water limit (MCL). The State Department of Public Health requires that all public water systems maintain production to meet the highest single day demand in the past 10 years. The City complies with this requirement, so loss of any single well does not adversely impact the City's ability to meet demands. The City is also implementing a non potable water program, allowing a well with poor water quality to be used for non potable demands. For example, in 2007, one of the City's wells tested high in nitrates. This well has since been converted to a source for the non potable system. The City is also planning to blend well source waters in the future to address the possibility of high primary or secondary water quality occurrences, such as TDS, nitrates, chromium, etc.

Therefore, as the City population increases in the near term (through 2030), additional wells will be constructed to account for those demands, regardless of any decision by the City to implement other sources in its water program. Currently, the City has nine (9) operational wells (2 are dedicated as non potable), with plans to construct an additional well in the one to two years. All water planning activities will continue to assume that the largest producing well is out of production during a maximum day condition.

Probable events that could limit the City's ability to pump groundwater are discussed above. Widespread loss of water production due to "brown or black out" conditions, whereby electricity is lost across the area, could be mitigated with use of the numerous generators owned by the City. These types of conditions are generally very short in nature, lasting a few hours, and would not require implementation of a water shortage emergency plan. The City maintains dedicated emergency power generators at five (5) of its seven (7) potable well sites.

The other failure events are mostly isolated to an individual well facility. The longest repair duration is associated with a well casing or screen failure. Depending on the failure, it could take months to mitigate. However, this is accounted for due to public water permitting requirements, as discussed.

Table 5-10 provides a summary of potential catastrophic events that could impact source production, and the City plans for mitigation.

Table 5-10

Catastrophic Source Water Failures and Mitigation

Failure Event	**Probability**	**Duration of Outage**	**Mitigation**
Power	High	5 minutes to 1 day	• On-site or mobile generators for several wells.
Mechanical	Medium	1 to 10 days	• Maintain a spare motor(s) • On-call contract with pump repair service
Control	Medium	1 hour to 10 days	• Capability to operate all wells manually • Spare programs for SCADA/starters • On-call contract with programmer
Well casing or screen	low	1 week to 6 months	• One redundant well in system

The City has backup generators at all well sites in the event of a power failure. The City also presently maintains 4.5 million gallons of storage and plans to construct additional storage as system demands increase. There are no potable water systems directly adjacent to City, so opportunities for emergency interties are not available.

Table 5-11(D) shows the City of Patterson Water Shortage Contingency – Mandatory Prohibitions. Table 5-12(D) shows the Water Shortage Contingency - Consumption Reduction Methods. Table -13(D) shows the City's Water Shortage Contingency – Penalties and Charges tied to non-compliance with mandatory water consumption reductions.

Revenue Impacts during Shortages (§ 10632 (g))

The City recently adopted a new water service rate structure that includes a "fixed" component to account for a significant portion of the base operational costs (i.e. labor, administration, meter reading and billing, etc.). Variable costs, such as power and chemicals, are included in the metered rate. Thus, although reductions in water use will also reduce revenues, it is not expected to have any significant impacts on the water program budget. The increasing block multi-tier rate structure based on volumetric use is expected to encourage water conservation and reduce the City overall water demands.

Water Quality

Although the local groundwater supplies do not contain any chemicals or compounds that pose health concerns[31], salt levels in water pumped from the City wells are relatively high, and may eventually reach concentrations that will require treatment.[32] The source of the salt is erosion of naturally occurring marine and continental deposits found to the east in the Coastal Range. Salts create objectionable aesthetic and taste concerns, and many residents have installed water

[31] Groundwater from Patterson's wells meets all primary state and federal drinking water standards.
[32] State Department of Public Health requires treatment for salts when concentrations exceed 1,000 mg/l. Salt concentrations in City of Patterson wells range from 450 mg/l to 1,000 mg/l..

softeners to reduce the adverse impacts from the salts. The ubiquitous use of softeners adds a significant salt loading to the City's wastewater plant.
As an interim step to treatment, the City has proposed to blend water from its wells in a storage tank prior to distribution. Blending of water from wells would address high levels of primary or secondary constituents detected in any single well, should they occur. For example, if the salt in a single well has an unacceptable concentration (exceed 1,000 mg/l TDS), blending this water with water from other wells with lower salinity will result in acceptable concentrations for the potable drinking water supply. Wells with higher concentrations of constituents could also be used for non potable demands by connecting the well to the non potable distribution system, thereby preserving well production for City demands.

Recognizing that salts could exceed the upper drinking water standard at some time in the future, all feasible alternatives in the City's water supply program include treatment of groundwater for salts and other constituents by either membrane filtration, ion exchange, lime softening, or other proven technology. The plan recommends a blending of treated and untreated groundwater to maintain salts below the recommended secondary drinking water standards. [33]

The implementation of a non potable water program significantly reduces the need to treat high volumes of water for potable demands, thereby reducing the higher quality source water needed, the capacity of any water treatment facilities, and residual management and processing (i.e. brine production from membranes, etc.).

Recently, the City began designing potable wells to yield water from deeper aquifers, below the Corcoran Clay, to provide added protection of source water from surface contaminants, and capture water lower in salinity. All future potable wells will be designed accordingly.

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[33] 500 mg/l total dissolved solids

Climate

The City and surrounding Stanislaus County area averages 11.0 inches of rainfall annually. Temperatures range from an average low of 38° F in the winter to an average high in the upper 90's during summer months. Spring and fall are mild with an average high in the low 80's. Mean monthly rates for evapo-transpiration and precipitation, and mean temperatures are shown in Table 5-13(D).

Table 5-14 Mean Climate Data for City of Patterson [34]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
ET [35]	1.59	2.20	3.66	5.08	6.83	7.80	8.67	7.81	5.67	4.03	2.13	1.59	57.06
Precipitation	2.43	2.04	1.60	0.84	0.34	0.04	0.01	0.02	0.22	0.47	1.31	1.70	11.04
Temperature	45.6	50.9	55.4	60.2	67.3	73.8	77.9	76.4	72.4	64.7	53.4	45.8	NA

[34] Precipitation and temperature based on nearest Western Regional Climate Center station in Newman, CA. Actual precipitation is expected to be slightly less that shown.

[35] California Irrigation Management Information System, Department of Water Resources

Section 6 Demand Management Measures (DMMs) (§ 10631(f-j))

The City is a member of the California Urban Water Conservation Council (CUWCC), and submits annual reports to the council annually in accordance with the *"Memorandum of Understanding Regarding Urban Water Conservation in California,"* dated September 1991. According to the DWR Guidebook for Preparing a 2010 UWMP:

"CUWCC members have the option of submitting their annual reports in lieu of describing the DMMs … CUWCC members who are in full compliance with the CUWCC's memorandum of understanding can submit their 2009-2010 reports in lieu of describing the DMMs.

The most recent BMP Activity Reports for reporting years 2009 and 2019 were submitted to the CUWCC. Copies of said reports for all years submitted by the the City can be viewed on http://bmp.cuwcc.org/bmp/default.htm, under "View Submitted Report Data, BMP Reports by Water Supplier," under the City Reporting Units.

As part of the UWMP, the City reviewed the various water conservation codes and programs mandated by the State of California, and determined what conservation efforts are mandatory, and which "elected" efforts may be cost effective.[36] Although the City of Patterson has an effective water conservation program, new water and building codes will require the City to implement mandatory water conserving programs. The purpose of the conservation study was to evaluate mandatory and elected water conservation programs and activities applicable to the City of Patterson, and recommend a conservation program that is cost effective and compatible with the City's long-term water resource goals. A list of recent codes and programs are shown below with a brief description.

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[36] City of Patterson, Water Conservation Program Study, 2011 (See Appendix F)

A. **The Water Conservation Act of 2009** (SBx7-7, approved November 10, 2009) – This legislation calls for a 20% reduction in urban water use statewide by 2020, with each urban water purveyor to establish a “target” water use for its service area;

B. **The Water Conservation in Landscaping Act (**AB 1881, approved September 28, 2006) – This legislation mandates the adoption of a model water conserving landscaping ordinance with specific provisions for landscape design, construction, and maintenance of public and private developments (with landscapes greater than 2,500 sq. ft.) for the purpose of conserving water;

C. **2008 California Green Building Standards Code** (California Building Standards Code, Title 24, adopted July, 2008) – These changes to the California Building Code include adoption of mandatory water conservation measures for residential and non-residential development, requiring the use of water conserving building practices, including but not limited to, low-flow rate plumbing fixtures (to achieve a 20% reduction of indoor water use), and moisture sensing irrigation controllers; and

D. **Property Transfers: Replacement of Plumbing Fixtures** (SB 407, adopted October 12, 2009) – This legislation requires that all existing commercial, residential and multi-family buildings in California built before 1994 be retrofit to meet high efficiency water use standards by January 1, 2017 or 2019, depending on the type of structure.

E. **Water Demand: Water Management Grant and Loan Eligibility** (AB1420, adopted February 7, 2007) – This legislation requires proof of compliance with, or commitment to implement, 14 various Best Management Plan (BMP) water conservation programs or activities, if a public agency is seeking state grants or loans.

The study found that the City of Patterson is a “water conserving community”, since it uses significantly less water per capita than the average urban water purveyor in the San Joaquin River region. According to DWR, the average urban use in the region is 248 gpcd, where the City of Patterson is approximately 1/3 less, at about 169 gpcd. Consequently, the City should achieve compliance with SB7x-7 (20x2020), consisting of a 5% reduction in base demand, by simply complying with current mandatory conservation codes. Electing to implement conservation activities beyond the mandatory measures will likely be based on discretionary cost-benefit decisions by the City overtime as it grows, and as it retains new source waters.

Mandatory conservation measures the City must address include:

- AB 1881 (Model Landscaping Design, Construction and Maintenance)
- SB 407 (Retrofit of Pre-1994 Plumbing Fixtures)
- California Green Building Code (Low Water Use Plumbing Fixture and Landscape Standards)

Although SBx7-7 is a mandatory water code, the City currently complies due to its current conservation efforts. The only mandatory component of SBx7-7 is to provide justification for exemptions of those BMP’s not implemented in the 2010 UWMP Update.

SBx7-7 Methods and Analysis for setting Water Conservation Targets

Four (4) methods for calculating the amount of conservation needed by the City of Patterson to meet state conservation requirements by the year 2020 are evaluated, in accordance with SBx7-7. The state requires that each municipality define water use targets for the years 2015 and 2020, which will be reported back to the state in the 2015 and 2020 Urban Water Management Plans (UWMP). The method for setting the target will be defined in the 2010 UWMP. The state has four methods for setting the targets which are:

- Method 1: Eighty percent of the water supplier's baseline per capita water use
- Method 2: Per capita daily water use estimated using the sum of performance standards applied to indoor residential use; landscaped area water use; and commercial, industrial, and institutional uses
- Method 3: Ninety-five percent of the applicable state hydrologic region target as stated in the State's April 30, 2009, draft 20x2020 Water Conservation Plan
- Method 4: Water Savings

Each of the Standard Methods has set methodologies that DWR wants each urban retailer to use in calculating the numbers used in the 4 methods. Each of the Methodologies and how they apply to Patterson are shown in the background information provided below[1]. The calculations for each of the 4 methods are discussed at the end of this memo.

Table 1 summarizes the results. Method 3 is the least restrictive method for the City of Patterson.

Table 1 – Calculation of Conservation Targets

Year	2020	2015
Base Daily per capita water use (10 years)	169	
Maximum Target Amount	160	165
Method 1 - 80% of Base Daily Water Use	135	
Method 2 - Performance Standards	167	
Method 3 - 95% of Regional Target (174 gpd/person)	165	
Method 4 – Water Savings	134	

Background and Data

Methodology 1 - Calculation of Base Water Use

[1] Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use *(For the Consistent Implementation of the Water Conservation Act of 2009)* October 1, 2010. California Department of Water Resources Division of Statewide Integrated Water Management Water Use and Efficiency Branch

Methodology 1 - Calculation of Base Water Use

DWR defines how each municipality is to calculate per capita water use. Patterson does not use recycled water so a ten year period is needed.

Step 1 *Define the 12 month period*. The City provided annual water sales from 2000 through 2010. The period from 2001 to 2010 was used.

Step 2 *Define the Distribution System Boundary.* The boundary is being defined by the addresses that were supplied water and billed by the City. The water service area stayed consistent throughout the 10 year period. However, two areas were annexed into the City during that time, The Villages of Patterson (2006 population 115) and the Southeast Industrial Annexation (2010 population 38)[2]. Water service to these areas has not occurred so the population estimates for each area were subtracted from the total population starting in the year of annexation.

Step 3 *Compile Water Volumes from Own Sources*. Annual water meter readings for each well between the years 2000 and 2010 were reviewed. The volumes are summarized shown in Table 2.

Step 4 *Compiled Imported Water Volumes.* City of Patterson does not import any water.

Step 5 *Compile Exported Water Volumes.* City of Patterson does not export any water.

Step 6 *Calculate Net Change in Distribution System Storage*. Patterson does not have any storage within the distribution system.

Step 7 *Calculate Gross Water Use before Indirect Recycled Water Use Deductions.* The gross water use for the City is presented in Table 2, which for Patterson is the same volume total calculated in Step 3.

Step 8 *Deduct Recycled Water Used for Indirect Potable Reuse from Gross Water Use.* The City does not currently provide recycled water to any customer or use recycled water for groundwater or surface water recharging.

Step 9 *Calculate Gross Water Use after Deducting Indirect Recycled Water Use.* Same number as Step 7, shown in Table 2.

Step 10 *(Optional): Deduct from Gross Water Use the Volume of Water Delivered for Agricultural Use.* City of Patterson does not supply any water for agricultural use.

Step 11 *(Optional): Deduct Volume of Water Delivered for Process Water Use.* This is water use associated with big industry. Process water for the larger industries in town is provided by on-site wells. Private wells are not included in this analysis, so no process water was deducted from these calculations.

Step 12 *Calculate Gross Water Use after Optional Deductions.* Same as Step 9 and as shown in Table 2.

[2] Email with Joel Andrews, City of Patterson March 2, 2011

Methodology 2 – Service Area Population

Population projections for each of the years are shown in Table 2. The numbers are from the census data for both 2000 and 2010. The number of residential connections from the City meter data was compared to both years population data. The number of persons per connection was then straight-line between 2000 and 2010. The persons per connection numbers were multiplied by the number of residential connection in each year to estimate the population for the years 2001 to 2009.

Populations numbers associated with two annexation areas were deducted from the total populations numbers for the City since water service into the annexation areas has yet to occur. The areas, Villages of Patterson and the Southeast Industrial Annexation, years of annexation and population are shown in Table XX and discussed in Step 2 of Methodology 1.

Also shown in the table are the number of metered connections by land use type and their corresponding water use.

Methodology 3 – Base Daily Per Capita Water Use

DWR defines base daily per capita water use as:

> *"Base Daily Per Capita Water Use is defined as average gross water use, expressed in GPCD, for a continuous, multiyear base period. The Water Code specifies two different base periods for calculating Base Daily Per Capita Water Use under Section 10608.20 and Section 10608.22:*
>
> *• The first base period is a 10- to 15-year continuous period, and is used to calculate baseline per capita water use per Section 10608.20.*
>
> *• The second base period is a continuous five-year period, and is used to determine whether the 2020 per capita water use target meets the legislation's minimum water use reduction requirement per Section 10608.22.*
>
> *Unless the urban retail water supplier's five year Base Daily Per Capita Water Use per Section 10608.12 (b) (3) is 100 GPCD or less, Base Daily Per Capita Water Use must be calculated for both baseline periods."*

The maximum per capita water target goal for Patterson for the year 2020 is 160 gallons per capita per day and is shown in Table 2. Both Method three and the sample calculation for Method 2 produce numbers greater than this target. City must set their target at this number. This corresponds to a 2015 per capita water use goal of 165 gallons per day.

Methodology 4: Compliance Daily Per Capita Water Use

The following methodology addresses estimation of compliance daily per capita water use (in GPCD) in the years 2015 and 2020.

DWR defines Compliance Daily Per Capita Use Section 10608.12(e) states:

> *"… means the gross water use during the final year of the reporting period, reported in gallons per capita per day."*

The City of Patterson is not planning on annexing or de-annexing any *developed areas* to their current water service areas, so no adjustments to per capita water use numbers are needed. Annexation of undeveloped areas does not affect this calculation.

Methodology 5 – Indoor Residential Use

The state standard for indoor water use is 55 gallons per person per day. This number will be reviewed by the state and adjusted after submittals of the 2015 UWMP so state mandates can be adjusted to help meet the 20% reduction per capita by 2020. This is used in the calculation of Method 2 to set the standard. For Method 4 a standard drop of 15 gallons per person per day for indoor use is assumed.

Methodology 6 -- Landscaped Area Water Use

There is a detail method to determine landscape water use throughout the service area the sets include the following:

1. Identify applicable Model Water Efficient Landscape Ordinance (MWELO) (1992 or 2010) for each parcel.
2. Estimate irrigated landscaped area for each parcel.
3. Determine reference evapotranspiration for each parcel.
4. Use the Maximum Applied Water Allowance (MAWA) equation from the applicable MWELO to calculate annual volume of landscaped area water use.
5. Convert annual volume to GPCD.

However, if the estimated outdoor use is used from the general plan that calculated water use for each land use and apply it to the data use in this study. The billing department data separates land uses into residential, commercial, irrigation and multi-family. The landscaping percentage calculated in the general plan general conforms to the following percentages for the land use in the billing system:

- Residential 62% of total annual water use is outside.
- Commercial 59% of total annual water use is outside.
- Irrigation 100% of total annual water use is outside.
- Multi-family 59% of total annual water use is outside.

Table 2 shows the calculation of outdoor use for each land use category. To estimate the landscape areas for each property type a water demand factor for landscaping of 3.5 ac-ft per ac was used to estimate the landscaped area (LA). The estimated Maximum Applied Water Allowance if determined by the steps below:

Maximum Applied Water Allowance (MAWA) = (ETo) (0.62) (0.8 x LA)

Maximum Applied Water Allowance (MAWA) is in gallons per year
ETo = Reference Evapotranspiration (inches per year). Reference Evapotranspiration values for each location can be found on page 38.10 of the Model Water Efficient Landscape Ordinance.
0.62 = Conversion Factor (from inches/year to gallons/sq ft/year)
0.8 = ET Adjustment Factor (ETAF). When applied to reference evapotranspiration, the ETAF "adjusts for plant factors and irrigation efficiency, two major influences upon the amount of water that needs to be applied to the landscape."
LA = Landscaped area includes the entire parcel less the building footprint, driveways, non-irrigated portions of parking lots, landscapes such as decks and patio, and other non-porous areas. Water features are included in the calculation of the landscaped area. Areas dedicated to edible plants, such as orchards or vegetable gardens are not included.

The calculation of the MAWA for Patterson is shown in Table 3. The ETo for Patterson is 57.3 based on California Irrigation Management System (CIMIS) data for City of Patterson.

Methodology 7 -- Baseline Commercial, Industrial, and Institutional Water Use

Section 10608.12 defines Baseline CII Water Use and related concepts as follows:

(c) "Baseline commercial, industrial, and institutional water use" means an urban retail water supplier's base daily per capita water use for commercial, industrial, and institutional users.
(d) "Commercial water user" means a water user that provides or distributes a product or service.
(h) "Industrial water user" means a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.
(i) "Institutional water user" means a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.

The baseline daily water use estimated for the City of Patterson for Commercial, Industrial and Institutional are shown in Table 2.

The City can further reduce this number if there is a known user who has large process water demands that are meet by City water services. There are large industrial customers who are known to have private wells, which are assumed to be used for process water applications. This report does not assume a reduction for process water at this time.

The City can also reduce the CII number further by identifying Multifamily, dormitories, and other higher population density uses and removing them from the calculation, with corresponding reductions in landscape area and population. This work is only needed if Method 2 is chosen to set the City target, and can be done at that time. In this calculation no reduction to the CII for Multi-family uses were assumed.

Methodology 8 -- Criteria for Adjustments to Compliance Daily Per Capita Water Use

Section 10608.24(d) states:

> *(1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:*
>
> > *(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.*
> > *(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.*
> > *(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.*
>
> *(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.*

DWR has not yet stated how the calculation for this credit will occur. However, the City of Patterson, with their meter installation program has seen over a 300 percent increase in annual metered irrigation demands from 2005 to 2010. Growth patterns in the City suggest that the irrigation demands will continue to trend upward. DWR intends to have the credit calculation available sometime in early 2011.

Note the City had a lot of construction related water use during the reference time period. Most of these uses were individually metered. This may be a likely candidate for an adjustment to compliance daily per capita water use.

Methodology 9 -- Regional Compliance

The City of Patterson is not partnering with others at this time to put together a document for the region. They are only preparing a document for the City's water service area, so this Methodology does not apply to Patterson.

Calculation of Conservation Targets

Below are the calculations for conservation targets under each of the four DWR methods. The results are summarized in Table 4.

<u>Daily Per Capita Water Use</u> = 169 gpcd
<u>Maximum Target Amount</u> = 95% of daily per capita water use = 169gpcd * 95% = 160 gpcd
<u>Method 1 – 80% of 10 year daily per capita water use average.</u> = 80% of 169 gpcd = 135
<u>Method 2 Performance Standards</u> =55 gpcd + MAWA for 10 year period (101 gpcd) + 90% of CII (.9*12.04 gpcd) = 167 gpcd
<u>Method 3 = 95% of Regional Target</u> which is 174 gpcd = 165
<u>Method 4 Savings</u> = Daily per capita water use - Metered Connection Savings – indoor savings (assumed to be 15 gpcd) – 10% savings on CII use – Savings on Landscape and water loss (21.6% of of Daily per capita less indoor use (70 gpcd per DWR) and CII. = 169 gpcd – 15 gpcd – 1.3 gpcd – 21.6% (169 gpcd – 70 gpcp – 12.04 gpcd) = 134 gpcd

City of Patterson
Department of Public Works

1 Plaza
P.O. Box 667
Patterson, CA 95363
Phone (209) 895-8060   Fax (209) 895-8069

April 4, 2011

To: All Interested Parties

From: Mike Willett, Director of Public Works

Subject: 2010 Urban Water Management Plan Update

The City of Patterson is preparing its 2010 Urban Water Management Plan Update (UWMP). The UWMP is required to be updated and submitted to the California Department of Water Resources every five years (Water Code Sections 10610-10657). The law requires a water agency notify the county in which it serves water 60 days in advance of adopting the UWMP. It also requires the water agency to solicit input from other water purveyors in the area that may have an interest in the plan.

If you have interest in the UWMP process or would like to provide comments, please do so in writing no later than April 15, 2011, as we will be working to complete the plan in the next 6 weeks. At this time, the City is planning to present the UWMP to Council for review and adoption on June 7, 2011.

If you have any question or comments regarding this process, please contact City Water Engineer Cort Abney of the H2O Group at (916) 686-1598 x 102 or me at:

Mike Willett
City of Patterson
PO Box 667
Patterson, CA 95363
(209) 895-8065
mwillett@ci.patterson.ca.us

Sincerely,

Department of Public Works

Mike Willett
Director

The City Council of the City of Patterson
Action Agenda Summary

DEPT.:__________Public Works Department________ AGENDA ITEM:_14.1 Public Hearing

URGENT:________ ROUTINE: __X____ AGENDA DATE:__ August 14, 2012

City Manager Rod B. Butler Concurs with Recommendation YES_X_ NO____ 5-0 Vote Required: YES_____ NO _X_

SUBJECT: 14.1 Public Hearing: Consider Adoption of Revised 2010 Urban Water Management Plan.

PROJECT DESCRIPTION: (Please See Attached City of Patterson City Council Agenda Report dated August 14, 2012 Item No. 14.1)

RECOMMENDATION: Review Revised 2010 Update to the Urban Water Management Plan, take any final comments during the Public Hearing, Close the Hearing, and Adopt the 2010 Urban Water Management Plan.

CITY COUNCIL ACTION

On motion by _Councilmember Dominic Farinha_, Seconded by_Councilmember Annette Smith_, and unanimously approved by the following 5-0 vote:

AYES:	Councilmembers Deborah Novelli, Annette Smith, Larry Buehner, Dominic Farinha and Mayor Luis I. Molina
NOES:	None
EXCUSED:	None
ABSENT:	None
ABSTAIN:	None

1)_X_ Approved as Recommended
2)_____ Denied
3)_____ Approved as Amended

I hereby certify that the foregoing is a full, correct, and true copy of an action passed by the City Council of the City of Patterson, a Municipal Corporation of the County of Stanislaus, State of California, at a special meeting held on the 14th day of August 2012, and I further certify that said action is in full force and effect and has never been rescinded or modified.

DATED: August 20, 2012

City Clerk of the City of Patterson, California
Maricela L. Vela

CITY COUNCIL AGENDA REPORT

TO: Mayor Molina and Members of the City Council

FROM: Rod B. Butler, City Manager RB

BY: Mike Willett, Director of Public Works MW

MEETING DATE: August 14, 2012

ITEM NO: 14.1

SUBJECT: Consider Adoption of Revised 2010 Urban Water Management Plan.

RECOMMENDATION

Review Revised 2010 Update to the Urban Water Management Plan, take any final comments during the Public Hearing, Close the Hearing, and adopt the 2010 Urban Water Management Plan.

BACKGROUND

In accordance with California Water Code, the City of Patterson prepared and subsequently submitted a 2010 Urban Water Management Plan (UWMP) to the Department of Water Resources (DWR) in June 2011 after a public hearing. At that time only two comments had been received. One was from Chevron noting the presence of abandoned oil pipelines in portions of the community and the other was from City of Modesto (via email) stating praise for the plan.

However, the UWMP Act states that DWR must review each UWMP submitted for compliance with the Act, and that an agency's UWMP is not found complete and accepted by the State of California until found so by DWR. Should a plan have not addressed or met specific requirements of the Act, according to DWR, DWR will list requirements that are missing or need to be revised to the agency. In accordance with the UWMP Act, DWR reviewed Patterson's 2010 UWMP and submitted formal comments to the City on July 5, 2012. A copy of that letter is an attachment to this report. DWR provided a letter identifying four items that the city needs to address, providing a second public hearing of the revised document, and formal adoption by the City Council.

ANALYSIS

DWR's review of the City of Patterson's 2010 Plan has found that the plan has not addressed certain elements required by the UWMP Act. The elements not addressed or requiring amendment are listed below:

1. The City of Patterson's 2009-2010 Best Management Practices Coverage Report from the California Urban Water Conservation Council (CUWCC) showing all practices to be "on track". CWC 10631 (j).

   ***City Response**:* Acceptance of these reports were not available from CUWCC until June, 2012, thus the reports were referenced in the original document, but could not be included. DWR requested that the reports be shown in the document, and are now provided in the appendices of the revised document.

2. Water use projections for lower income households as identified in the City's General Plan. CWC 10631.1 states:

   (a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier, and

   (b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under Section 65589.7 of the Government Code to grant a priority for the provision of service to housing units affordable to lower income households.

   City Response: In accordance with Health and Safety Code 50079.5, Patterson has identified 1960 low income housing units in the 2010 General Plan Housing Element, with 686 units to be built between 2007 and 2014. Patterson's 2014 proposed low income housing requirement of 686 units equates to an annual demand increase of approximately 380 ac-ft/yr, and will grant priority to said housing demands, should they occur. The UWMP demand projections account for low income housing for 2014 requirements (686 units) and General Plan build-out (1960 units).

3. Provide clarification of water source supplies, specifically related to City of Patterson's proposed water availability for growth during the 20-year planning horizon.

   ***City Response**:* Full use of the existing water system capacity is anticipated to meet approved development. Groundwater use beyond this amount may still be available since: (1) the sustainable groundwater yield may support additional production for City growth, (2) there are many existing private wells within the General Plan Alternatives areas that will be abandoned, allowing current production from these wells to be used by the City, and 3) groundwater recharge programs sought by the City and other Westside water purveyors may substantially increase sustainable yields. Hence, sustainable groundwater yield is assumed at this juncture to be at or near the values as calculated in recent groundwater studies. The City is expected to require the use of recycled wastewater for non potable demands by 2030. However, accurate predictions of future groundwater availability for the City are difficult. Sufficient information is not currently available (e.g. groundwater models, etc.) to identify with confidence what the total demand for groundwater will be in the region, what long term sustainable yields will be, and to what portion of groundwater the City will be entitled. Past study recommendations assume approximately 8,000 ac-ft/yr total local groundwater use as a "safe or sustainable" yield. For planning purposes, the City of Patterson 2010 General Plan assumed 7,500 ac-ft/yr of total use, with additional groundwater availability through active recharge activities. To account for the uncertainties in future groundwater availability, the 2010 General Plan Water Supply Analysis recommended an active groundwater recharge program, whereby surface water could be applied to City owned spreading basins, and artificially increase capacity to the groundwater. Recharge allows the City to have more control of the quantity and quality of its groundwater sources, and remove some of the uncertainty associated with groundwater capacity. Thus, based on most recent aquifer tests and hydrological analysis conducted, sustainable yields from the local aquifers have been confirmed at rates that exceed the City's projected build-out population, assuming *groundwater represents a portion of the City's total demands*, as defined and quantified in the City's 2010 General Plan, including implementation of a groundwater recharge program to account for uncertainties in future groundwater availability. Further studies of groundwater capacity and coordination with other users of local groundwater will be essential activities for Patterson to ensure adequate source water.

4. Update land and water use tables as available. City Response: As part of the current master plan process, the City refined the land use growth projections assumed in the 2010 General Plan, and used in the original 2010 UWMP. The land use and growth projections for all master plans were approved by Patterson City Council on February 23, 2012. Thus, the 2030 values for development and population, as adopted, were used for 2030 water demand projections in the revised report.

Although Council adopted the previous (June 2011) edition of the plan, DWR stated in its letter that "*The addition of the elements listed represents a significant change to the plan and requires that the plan go through the amendment process of public notice, a public hearing and re-adoption by the City's governing board.*"

In conformance with the DWR requirements, a Public Hearing was advertised on August 2nd and August 9th prior to the August 14, 2012 hearing date. All DWR comments were addressed and included in the revised document. Upon completion of the public hearing and re-adoption, as requested by DWR, the revised 2010 UWMP will be submitted to DWR for acceptance. DWR is expected to provide a formal letter to the City of Patterson upon completion of the submittal recognizing acceptance of the document and compliance with the UWMP Act.

Since the size of the document is nearly 400 pages and over 80 MB, the plan itself is not attached to this staff report, but is available for viewing on the city's website at http://www.ci.patterson.ca.us/Default.aspx?pi=20&ni=29 in the documents library. After clicking on the link, go to Public Works Department and click on UWMP 2010 Final July 2012.

FISCAL IMPACT

There will be some additional printing costs, staff and consulting time to perform the updates, estimated at approximately $3,000. Funding is available in the Water budget.

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

July 5, 2012

Mr. Mike Willett
Director of Public Works
City of Patterson
1 Plaza
Patterson, California 95636

Dear Mr. Willett:

The Department of Water Resources (DWR) has reviewed the City of Patterson's 2010 Urban Water Management Plan (UWMP) received on July 21, 2011. The California Water Code (CWC) directs DWR to report to the legislature once every five years on the status of submitted plans. In meeting this legislative reporting requirement, DWR reviews all submitted plans.

DWR's review of the City of Patterson's 2010 plan has found that the plan has not addressed elements required by the UWMP Act. The elements not addressed or requiring amendment are listed below:

1.) The City of Patterson's 2009-2010 Best Management Practices Coverage Report from the California Urban Water Conservation Council showing all practices to be "on track". CWC 10631 (j).
2.) Water use projections for lower income households as identified in the City's general plan. CWC 10631.1
3.) Please rewrite the paragraph on page 4-12 starting with, "Full use of the existing water system capacity ….". The paragraph is confusing and is unclear as to whether the City can meet future demand through a sustainable use of groundwater.
4.) Please revise any land use or water use tables if updated information is available.

The addition of the elements listed represents a significant change to the plan and requires that the plan go through the amendment process of public notice, a public hearing and re-adoption by the City's governing board.

If you have any questions, please feel free to contact me. Please consider sending us drafts of the revised sections for review before readopting the plan.

Sincerely,

Peter Brostrom
UWMP Program Manager
(916) 651 7034
brostrom@water.ca.gov

JUL 0 9 2012

PROOF OF PUBLICATION
(2015.5 C.C.P)

STATE OF CALIFORNIA
County of Stanislaus

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years and not a party to or interested in the above-entitled matter. I am the principal clerk of the printer of the Patterson Irrigator, a newspaper of general circulation, printed and published once a week on Thursdays, in the city of Patterson, California, County of Stanislaus, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court, of the County of Stanislaus, State of California, under the date of June 23, 1952, Case Number 47304; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to -wit:

8/2, 9

all in the year 2012

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Patterson, California, this 9 day of August 2012

[signature]

Signature

This space is for the County Clerk's Filing stamp

RECEIVED
AUG 20 2012
CITY OF PATTERSON

Proof of Pu

LEGAL NOTICE

CITY OF PATTERSON

NOTICE OF PUBLIC HEARING
NOTICE IS HEREBY GIVEN THAT THE CITY OF PATTERSON CITY COUNCIL will hold a Public Hearing in the City Council Chambers, 1 Plaza, CA on Tuesday, August 14, 2012 at 7:00 p.m. to review and consider for adoption the following:

The City of Patterson, Final Urban Water Management Plan 2010 Update is available for public review. Under the California Water Code, the Urban Water Management Planning Act requires urban water purveyors (with more than 3,000 connections) to prepare a document describing its current and planned water supply program to ensure they will continue to provide their customers with an adequate and reliable water supply. This plan was submitted to Department of Water Resources (DWR) for review in July, 2011. Comments were provided by DWR in June, 2012, and incorporated.

To view the Final Urban Water Management Plan, please visit the City's Web site. Public comments can be forwarded to Mike Willett, Public Works Director, or email to mwillett@ci.patterson.ca.us. A public hearing on the final plan will be held at the City Council's regular 7:00 p.m. meeting on August 14, 2012.

NOTICE IS ALSO HEREBY GIVEN that these documents will be available for public review at the City of Patterson City Hall, City Clerk's Office during normal business hours. City Hall is located at 1 Plaza in the City of Patterson. All interested parties are invited to review the documents prior to the August 14, 2012 Public Hearing.

ALL INTERESTED PARTIES are invited to attend the hearing and express opinions or submit evidence for or against the plan. At the above noted time and place, testimony from interested persons will be heard by the City Council and duly considered prior to taking action. Any material submitted to the City Council for consideration (letters, comments, protests, etc) will be retained by the City and cannot be returned. On request, the agenda and the documents in the agenda packet can be made available to persons with a disability.

FURTHER INFORMATION on the proposed plan may be obtained at the City of Patterson City Hall, City Clerk's Office or by calling (209) 895-8014. Meeting facilities are accessible to persons with disabilities. Any person requiring special assistance to participate in the meeting should notify the City Clerk's Offi[illegible] at (209) 895-8014 at least forty-eight (48) hours prior to the meeting.

BY ORDER OF THE CITY COUNCIL OF THE CITY OF PATTERSON.

DATE PUBLISHED:
August 2, 9, 2012.

Maricela L. Vela, City Clerk of the City of Patterson

PUBLIC NOTICE

The City of Patterson, draft Urban Water Management Plan 2010 Update is available for public review. Under the California Water Code, the Urban Water Management Planning Act requires urban water purveyors (with more than 3,000 connections) to prepare a document describing its current and planned water supply program to ensure they will continue to provide their customers with an adequate and reliable water supply. The plan must be updated every 5 years.

To view the Urban Water Management Plan public review draft, please visit the City's Web site. Public comments can be forwarded to Mike Willett, Public Works Director, or email to MWillett@ci.patterson.ca.us. A public hearing on the plan will be held at the City Council's regular 7:00 p.m. meeting on June 7, 2011.

RESOLUTION NO. 2011-38

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF PATTERSON ADOPTING THE 2010 URBAN WATER MANAGEMENT PLAN

WHEREAS, the California Legislature enacted Senate Bill 553 during the 2000 Session of the California Legislature (California Water Code Section 10610, et seq.); and

WHEREAS, the Urban Water Management Plan (UWMP) has been prepared consistent with the requirements under Water Code Sections 10610 through 10656 of the Urban Water Management Planning Act (Act), which were added by Statue 1983, Chapter 1009, and became effective on January 1, 1984; and

WHEREAS, The Act requires "every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually" to prepare, adopt, and file an UWMP with the California Department of Water Resources (DWR) every five years; and

WHEREAS, the City of Patterson is an urban supplier of water providing water to more than 3,000 customers, and has, therefore, prepared an Urban Water Management Plan in compliance with the requirements of the Act and the City Council has considered any and all evidence presented at a duly noticed public hearing regarding said Plan held by the City Council on the 21st day of June 2011.

NOW, THEREFORE, BE IT RESOLVED that the City Council of Patterson as follows:

SECTION 1. The Urban Water Management Plan on file with the City is hereby adopted and order filed with the City Clerk.

SECTION 2. The City Manager is hereby authorized and directed to file a copy of the City's adopted Urban Water Management Plan with the California Department of Water Resources.

The foregoing resolution was passed by the City Council at a regular meeting held on the 21st day of June 2011, by Councilmember Smith, who moved its adoption, which motion was duly seconded by Councilmember Buehner, and the resolution adopted by the following vote:

AYES: Councilmembers Farinha, Smith, Novelli, Buehner and Mayor Molina

NOES: None

EXCUSED: None

APPROVED:

Luis I. Molina, Mayor of the City of Patterson

ATTEST:

Maricela L. Vela, City Clerk of the City of Patterson

I hereby certify that the foregoing is a full, correct and true copy of a resolution passed by the City Council of the City of Patterson, a Municipal Corporation of the County of Stanislaus, State of California, at a regular meeting held on the 21st day of June 2011, and I further certify that said resolution is in full force and effect and has never been rescinded or modified.

DATED:

City Clerk of the City of Patterson

Recommended UWMP Data Tables

Table 1-1
Coordination with Appropriate Agencies

Coordinating Agencies[1,2]	Participated in developing the plan	Commented on the draft	Attended public meetings	Was contacted for assistance	Was sent a copy of the draft plan (link to on-line posting	Was sent a notice of intention to adopt	Not involved / No information
Other water suppliers							
Stanislaus County (Crows Landing)	No			Yes	Yes	Yes	
City of Modesto (for Town of Grayson)	No			Yes	Yes	Yes	
Western Hills Water District	No			Yes	Yes	Yes	
Patterson Irrigation District	No			Yes	Yes	Yes	
West Side Irrigation District	No			Yes	Yes	Yes	
Del Puetro Water District	No			Yes	Yes	Yes	
Water mgmt agencies							
San Luis Delta Mendota Water Agency	No			No	Yes	No	
Relevant public agencies							
Stanislaus County	No			Yes	Yes	Yes	
General public			Yes	Yes	Yes	Yes	
Other							

[1] Indicate the specific name of the agency with which coordination or outreach occurred.
[2] Check at least one box in each row.

Table 2-1
Population — Current and Projected

	2010 (1)	2015	2020	2025	2030 (2)	2035 - optional	Data source
Service area population[1]	20,260	21,667	23,074	25,888	26,048		See Below

1. 2010 Census data.
[2] City's 2012 Master Plan Land Use - Linear interpolation for years 2010 through 2030.

Table 3-1
Water Deliveries — Actual, 2005

	2005				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	4,977	104,349,800			104,349,800
Multi-family	27	3,314,600			3,314,600
Commercial	180	9,806,400			9,806,400
Industrial					0
Institutional/governmental					0
Landscape [1]	72	13,775,100	25	7,319,519	21,094,619
Agriculture					0
Other	6	126,900			126,900
Total	5,262	131,372,800	25	7,319,519	138,692,319

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***
1. Not metered landscape number is estimated.

Table 3-2
Water Deliveries — Actual, 2010

	2010				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	5,761	111,104,500			111,104,500
Multi-family	27	2,199,700			2,199,700
Commercial	201	10,172,000			10,172,000
Industrial					0
Institutional/governmental					0
Landscape [1]	121	28,357,900	12	3,659,759	32,017,659
Agriculture					0
Other	6	99,100			99,100
Total	6,116	151,933,200	12	3,659,759	155,592,959

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***

Table 3-3
Water Deliveries — Projected, 2015

	2015				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	6,096	115,258,404			115,258,404
Multi-family	469	46,704,923			46,704,923
Commercial	399	20,009,829			20,009,829
Industrial					0
Institutional/governmental					0
Landscape [2]	0	0			0
Agriculture					0
Other	5	0			0
Total	6,968	181,973,157	0	0	181,973,157

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***
[1] Table 3-5 2030 numbers are calculated from land use data adopted by City Council for the 2012 Master Plans (also shown on Land Use Projections Tab in this workbook). Data for other year is calculated based on a linear progression.
2 Landscape demand will be switched over to a raw water source, numbers are picked up in Additional Water Uses and Losses table below.

Table3-4
Water Deliveries — Projected, 2020

	2020				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	6,342	113,897,400			113,897,400
Multi-family	630	68,069,158			68,069,158
Commercial	559	27,307,702			27,307,702
Industrial					0
Institutional/governmental					0
Landscape	0	0			0
Agriculture					0
Other	4	0			0
Total	7,536	209,274,260	0	0	209,274,260

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***
[1] Table 3-5 2030 numbers are calculated from land use data adopted by City Council for the 2012 Master Plans (also shown on Land Use Projections Tab in this workbook). Data for other year is calculated based on a linear progression.

Table 3-5
Water Deliveries — Projected 2025 and 2030 [1]

	2025		2030		2035 - optional	
	metered		metered		metered	
Water use sectors	# of accounts	Volume	# of accounts	Volume	# of accounts	Volume
Single family	6,639	116,234,199	6,948	118,540,953		
Multi-family	996	104,820,687	1,573	161,308,778		
Commercial	719	33,968,849	880	40,104,814		
Industrial						
Institutional/governmental						
Landscape	0	0	0	-		
Agriculture						
Other	1	0	0	-		
Total	8,355	255,023,735	9,401	319,954,545	0	0

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***
1 Table 3-5 2030 numbers are calculated from land use data adopted by City Council for the 2012 Master Plans (also shown on Land Use Projections Tab in this workbook). Data for other year is calculated based on a linear progression.

Table 3-6
Low-Income Projected Water Demands

Low Income Water Demands[1]	2015	2020	2025	2030	2035 - opt
Single-family residential	31,726,985	29,625,586	26,276,184	20,707,878	
Multi-family residential	46,704,923	68,069,158	104,820,687	161,308,778	
Total	78,431,908	97,694,744	131,096,871	182,016,656	0

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***

[1] *Table 3-6 2030 numbers are calculated from land use data presented in the general plan from the Jobs land use plan for 2030 (also shown on Land Use Projections Tab in this workbook). Data for 2015-2025 is calculated based on a linear progression from the 2010 numbers to the 2030 numbers nd assume that 32.7% of residential connections are low income.*

Table 2-9
Sales to Other Water Agencies - Not Applicable to Patterson

Water distributed	2005	2010	2015	2020	2025	2030	2035 - opt
name of agency							
name of agency							
name of agency							
Total	0	0	0	0	0	0	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 3-7
Additional Water Uses and Losses

Water use[1]	2005	2010	2015	2020	2025	2030	2035 -opt
Saline barriers							
Groundwater recharge							
Conjunctive use							
Raw water[2]			30,438,430	27,279,883	28,050,289	28,746,213	
Recycled water							
System losses	13,508,285	15,092,974	11,599,466	11,793,949	12,477,734	13,117,439	
Other (define) - Metered Construction Water	1,386,923	1,555,930	1,819,732	2,092,743	2,550,237	3,199,545	
Total	14,895,208	16,648,903	43,857,628	41,166,574	43,078,260	45,063,197	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year

[1] *Any water accounted for in Tables 3 through 7 are not included in this table.*

[2] *Raw water (non-potable water system) these are the converted landscape demands from water use tables above.*

Table 3-8
Total Water Use

Water Use	2005	2010	2015	2020	2025	2030	2035 - opt
Total water deliveries (from Tables 3 to 7)	138,692,319	155,592,959	181,973,157	209,274,260	255,023,735	319,954,545	
Sales to other water agencies (from Table 9)	0	0	0	0	0	0	
Additional water uses and losses (from Table 10)	14,895,208	16,648,903	43,857,628	41,166,574	43,078,260	45,063,197	
Total	153,587,527	172,241,863	225,830,784	250,440,835	298,101,995	365,017,742	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 2-12
Retail Agency Demand Projections Provided to Wholesale Suppliers - Does not apply to Patterson

Wholesaler	Contracted Volume[3]	2010	2015	2020	2025	2030	2035 -opt

Table 3-9
Base Period Ranges

Base	Parameter	Value	Units
10- to 15-year base period	2008 total water deliveries	168,600,310	*ft^3/year*
	2008 total volume of delivered recycled water	-	*ft^3/year*
	2008 recycled water as a percent of total deliveries	-	ft^3/year
	Number of years in base period[1]	10	years
	Year beginning base period range	2001	
	Year ending base period range[2]	2010	
5-year base period	Number of years in base period	5	years
	Year beginning base period range	2006	
	Year ending base period range[3]	2010	

Units (circle one): acre-feet per year million gallons per year ***cubic feet per year***

[1] *If the 2008 recycled water percent is less than 10 percent, then the first base period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first base period is a continuous 10- to 15-year period.*

[2] *The ending year must be between December 31, 2004 and December 31, 2010.*

[2] *The ending year must be between December 31, 2007 and December 31, 2010.*

Table 3-10
Base Daily per Capita Water Use — 10- to 15-Year Range

Base period year		Distribution System Population	Daily system gross water use (mgd)	Annual daily per capita water use (gpcd)
Sequence Year	**Calendar Year**			
Year 1	2001	13,759	2.13	154
Year 2	2002	14,092	2.68	190
Year 3	2003	14,568	2.53	174
Year 4	2004	16,307	2.53	155
Year 5	2005	19,843	3.00	151
Year 6	2006	21,474	3.64	170
Year 7	2007	21,609	3.72	172
Year 8	2008	21,130	3.92	185
Year 9	2009	20,662	3.42	166
Year 10	2010	20,260	3.45	170
Year 11				
Year 12				
Year 13				
Year 14				
Year 15				
			Base Daily Per Capita Water Use[1]	169

[1] *Add the values in the column and divide by the number of rows.*

Table 3-11
Base Daily per Capita Water Use — 5-Year Range

Base period year		Distribution System Population	Daily system gross water use (mgd)	Annual daily per capita water use (gpcd)
Sequence Year	**Calendar Year**			
Year 1	2006	21,474	3.64	170
Year 2	2007	21,609	3.72	172
Year 3	2008	21,130	3.92	185
Year 4	2009	20,662	3.42	166
Year 5	2010	20,260	3.45	170
			Base Daily Per Capita Water Use[1]	173

[1] *Add the values in the column and divide by the number of rows.*

Table 4-1
Water Supplies — Current and Projected

Water Supply Sources		2010	2015	2020	2025	2030	2035 - opt
Water purchased from[1]:	Wholesaler supplied volume (yes/no)						
Wholesaler 1 (enter agency name)	no	0					
Wholesaler 2 (enter agency name)	no	0					
Wholesaler 3 (enter agency name)	no	0					
Supplier-produced groundwater[2] Potable		168,545,506	169,373,088	187,830,626	223,576,496	273,763,306	
Supplier-produced groundwater[2] Non-Potable			56,457,696	62,610,209	74,525,499	91,254,435	
Supplier-produced surface water		0	0	0	0	0	
Transfers in		0	0	0	0	0	
Exchanges In		0	0	0	0	0	
Recycled Water		0	0	0	0	0	
Desalinated Water		0	0	0	0	0	
Other							
Other							
	Total	168,545,506	225,830,784	250,440,835	298,101,995	365,017,742	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] Volumes shown here should be what was purchased in 2010 and what is anticipated to be purchased in the future. If these numbers differ from what is contracted, show the contracted quantities in Table 17.
[2] Volumes shown here should be consistent with Tables 17 and 18.

Table 2-17
Wholesale Supplies — Existing and Planned Sources of Water - Does not apply to Patterson

Wholesale sources[1,2]	Contracted Volume[3]	2015	2020	2025	2030	2035 - opt
(source 1)		0	0	0	0	0
(source 2)						
(source 3)						

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] Water volumes presented here should be accounted for in Table 16.
[2] If the water supplier is a wholesaler, indicate all customers (excluding individual retail
[3] Indicate the full amount of water

Table 4-3
Groundwater — Volume Pumped

Basin name(s)	Metered or Unmetered[1]	2006	2007	2008	2009	2010
Tracy groundwater basin 5-22.15, San Joaquin River Region	metered	177,853,498	181,756,641	191,708,125	167,102,294	168,545,506
Total groundwater pumped		177,853,498	181,756,641	191,708,125	167,102,294	168,545,506
Groundwater as a percent of total water supply		100.0%	100.00%	100.00%	100.00%	100.00%

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] Indicate whether volume is based on volumetric meter data or another method

Table 4-4
Groundwater — Volume Projected to be Pumped

Basin name(s)	2015	2020	2025	2030	2035 - opt
Tracy groundwater basin 5-22.15, San Joaquin River Region	225,830,784	250,440,835	298,101,995	365,017,742	
Total groundwater pumped	225,830,784	250,440,835	298,101,995	365,017,742	
Percent of total water supply	100.00%	100.00%	100.00%	100.00%	

Units (circle one): acre-feet per year million gallons per year cubic feet per year
Include future planned expansion

Table 2-20 - does not apply to patterson yet
Transfer and Exchange Opportunities

Transfer agency	Transfer or exchange	Short term or long term	Proposed Volume
Total			

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 4-5
Recycled Water — Wastewater Collection and Treatment

Type of Wastewater	2005 (b)	2010 (a)	2015 (b)	2020 (b)	2025 (b)	2030 (b)	2035 - opt
Wastewater collected & treated in service area	0	68,315,508	0	0	0	0	
Volume that meets recycled water standard	0	0	0	0			

Units (circle one): acre-feet per year million gallons per year cubic feet per year
(a) Data from 2010 General Plan Appendix 5.5 Wastewater master plan 201, Lee Ro & Associates
(b) Values calculated from water production data multiplied by the ratio of wastewater flow to production from 2010, i.e. wastewater flows were 40.53% of water production number.

Table 4-6
Recycled Water — Non-Recycled Wastewater Disposal

Method of disposal	Treatment Level	2010	2015	2020	2025	2030	2035 - opt
Activated Sludge Oxidation Ditch and pond system	secondary / nitrogen removal	68,315,508	0	0	0	0	
	Total	68,315,508	0	0	0	0	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 4-7
Recycled Water — Potential Future Use

User type	Description	Feasibility[1]	2015	2020	2025	2030	2035 - opt
Agricultural irrigation							
Landscape irrigation[2]	non potable Water distribution System	feasible			28,050,289	28,746,213	
Commercial irrigation[3]	New commercial development	feasible			21,919,687	28,055,652	
Golf course irrigation	NA						
Wildlife habitat							
Wetlands							
Industrial reuse							
Groundwater recharge		being studied at this time			(49,969,976)	(56,801,865)	
Seawater barrier							
Geothermal/Energy							
Indirect potable reuse							
Other (user type)							
Other (user type)							
	Total	0	0	0	0	0	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] Technical and economic feasibility.
[2] Includes parks, schools, cemeteries, churches, residential, or other public facilities)
[3] Includes commercial building use such as landscaping, toilets, HVAC, etc) and commercial uses (car washes, laundries, nurseries, etc)

Table 4-8
Recycled Water — 2005 UWMP Use Projection Compared to 2010 Actual

Use type	2010 actual use	2005 Projection for 2010[1]
Agricultural irrigation	0	0
Landscape irrigation[2]	0	0
Commercial irrigation[3]	0	0
Golf course irrigation	0	0
Wildlife habitat	0	0
Wetlands	0	0
Industrial reuse	0	0
Groundwater recharge		0
Seawater barrier	0	0
Geothermal/Energy	0	0
Indirect potable reuse	0	0
Other (user type)	**0**	0
Other (user type)	**0**	0
Total	0	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] From the 2005 UWMP. There has been some modification of use types. Data from the 2005 UWMP can be left in the
[2] Includes parks, schools, cemeteries, churches, residential, or other public facilities)
[3] Includes commercial building use such as landscaping, toilets, HVAC, etc) and commercial uses (car washes, laundries,

Table 4-9
Methods to Encourage Recycled Water Use

Actions	Projected Results					
	2010	2015	2020	2025	2030	2035 - opt
Financial incentives						
Dual Plumbing of all new development areas				21,919,687	28,055,652	
Continued expansion of the Non-potable Water Distribution System				28,050,289	28,746,213	
Total	0	0	0	49,969,976	56,801,865	0

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 4-10
Future Water Supply Projects

Project name[1]	Projected start date	Projected completion date	Potential project constraints[2]	Normal-year supply[3]	Single-dry year supply[3]	Multiple-dry year first year supply[3]	Multiple-dry year second year supply[3]	Multiple-dry year third year supply[3]
West Stanislaus County Ground Water Banking Study	2011	2030	Environmental approvals, groundwater quality issues, location of potential recharge areas, funding, local agency participation	9000	9,000	9,000	9,000	9,000
Recycled Water - non-potable water system	2011	2025	Treatment capacity, winter storage, San Jaquin River crossing, funding, other agency participation.	7000	7,000	7,000	7,000	7,000
			Total	0	16,000	16,000	16,000	16,000

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] Water volumes presented here should be accounted for in Table 16.
2Indicate whether project is likely to happen and what constraints, if any, exist for project implementation.
[3] Provide estimated supply benefits, if available.

Table 5-1
Basis of Water Year Data

Water Year Type	Base Year(s)
Average Water Year	1981
Single-Dry Water Year	1989
Multiple-Dry Water Years	1987-1990

Table 5-2
Supply Reliability — Historic Conditions

Average / Normal Water Year	Single Dry Water Year	Multiple Dry Water Years			
		Year 1	Year 2	Year 3	Year 4
Percent of Average/Normal Year:	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5-3
Factors Resulting in Inconsistency of Supply

Water supply sources[1]	Specific source name, if any	Limitation quantification	Legal	Environmental	Water quality	Climatic	Additional information
Groundwater - Potable		None	None	None	None	None	
Groundwater - non-potable		None	None	None	None	None	

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] From Table 16.

Table 5-4
Water Quality — Current and Projected Water Supply Impacts

Water source	Description of condition	2010	2015	2020	2025	2030	2035 - opt
Groundwater - Potable	Water quality	None	None	None	None	None	
Groundwater - Non-potable	None	None	None	None	None	None	

Units (circle one): acre-feet per year million gallons per year cubic feet per year

Table 5-5
Supply Reliability — Current Water Sources

Water supply sources[1]	Average / Normal Water Year Supply[2]	Multiple Dry Water Year Supply[2]		
		Year 2011	Year 2012	Year 2013
Groundwater - Potable	100%	100%	100%	100%
Groundwater - Non Potable	100%	100%	100%	100%
Percent of normal year:	100.0%			

Units (circle one): acre-feet per year million gallons per year cubic feet per year
[1] From Table 16.
[2] See Table 27 for basis of water type years.

Table 5-6
Supply and Demand Comparison — Normal Year

	2015	2020	2025	2030	2035 - opt
Supply totals (from Table 16)	225,830,784	250,440,835	298,101,995	365,017,742	
Demand totals (From Table 11)	225,830,784	250,440,835	298,101,995	365,017,742	
Difference	0	0	0	0	
Difference as % of Supply	0.0%	0.0%	0.0%	0.0%	
Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	

Units are in acre-feet per year.

Table 5-7
Supply and Demand Comparison — Single Dry Year

	2015	2020	2025	2030	2035 - opt
Supply totals[1,2]	225,830,784	250,440,835	298,101,995	365,017,742	
Demand totals[2,3,4]	225,830,784	250,440,835	298,101,995	365,017,742	
Difference	0	0	0	0	
Difference as % of Supply	0.0%	0.0%	0.0%	0.0%	
Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	

Units are in acre-feet per year.

[1] Consider the same sources as in Table 16. If new sources of water are planned, add a column to the table and specify the source, timing, and amount of water.

[2] Provide in the text of the UWMP text that discusses how single-dry-year water supply volumes were determined.

[3] Consider the same demands as in Table 3. If new water demands are anticipated, add a column to the table and specify the source, timing, and amount of water.

[4] The urban water target determined in this UWMP will be considered when developing the 2020 water demands included in this table.

Table 5-8
Supply and Demand Comparison — Multiple Dry-Year Events

		2015	2020	2025	2030	2035 - opt
Multiple-dry year first year supply	**Supply totals**[1,2]	225,830,784	250,440,835	298,101,995	365,017,742	
	Demand totals[2,3,4]	225,830,784	250,440,835	298,101,995	365,017,742	
	Difference	0	0	0	0	
	Difference as % of Supply	0.0%	0.0%	0.0%	0.0%	
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	
Multiple-dry year second year supply	**Supply totals**[1,2]	225,830,784	250,440,835	298,101,995	365,017,742	
	Demand totals[2,3,4]	225,830,784	250,440,835	298,101,995	365,017,742	
	Difference	0	0	0	0	
	Difference as % of Supply	0.0%	0.0%	0.0%	0.0%	
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	
Multiple-dry year third year supply	**Supply totals**[1,2]	225,830,784	250,440,835	298,101,995	365,017,742	
	Demand totals[2,3,4]	225,830,784	250,440,835	298,101,995	365,017,742	
	Difference	0	0	0	0	
	Difference as % of Supply	0.0%	0.0%	0.0%	0.0%	
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	

Units are in acre-feet per year.

[1] Consider the same sources as in Table 16. If new sources of water are planned, add a column to the table and specify the source, timing, and amount of water.

[2] Provide in the text of the UWMP text that discusses how single-dry-year water supply volumes were determined.

[3] Consider the same demands as in Table 3. If new water demands are anticipated, add a column to the table and specify the source, timing, and amount of water.

[4] The urban water target determined in this UWMP will be considered when developing the 2020 water demands included in this table.

Table 5-9
Water Shortage Contingency — Rationing Stages to Address Water Supply Shortages

Stage No.	Water Supply Conditions	% Shortage
#1	Voluntary Water Rationing	10%
#2	Manatory Water Rationing	20%
#3	Mandatory Water Rationing and Water Allocations	50%

[1] One of the stages of action must be designed to address a 50 percent reduction in water supply.

Table 5-11
Water Shortage Contingency — Mandatory Prohibitions

Examples of Prohibitions	Stage When Prohibition
No use of any water after 5 days notification of defective spinklers	Stage I, II, & III
No flooding or runoff into gutter or street	Stage I, II, & III
No use of hose for washing vehicles or other without automatic shut-off	Stage I, II, & III
No use of hose for washing sidewalk, driveways, patios, parking areas, etc.	Stage I, II, & III
No use of water for decorative fountains	Stage I, II, & III
No use of water for construction backfill compaction if other sources are available	Stage I, II, & III
No use of water for landscape irrigation from November through February	Stage I, II, & III
No use of water from fire hydrants for anything but fire suppression	Stage I, II, & III
No irrigation of landscaping from 10:00 a.m. and 7:00 p.m.	Stage I, II, & III
Odd/Even watering	Stage I, II, & III
Water rationing	Stage III

Table 5-12
Water Shortage Contingency — Consumption Reduction Methods

Consumption Reduction Methods	Stage When Method Takes Effect	Projected Reduction (%)
City Ordinance 13.24.240 - Negligent waste of water	Continuous	5%
Volumetric Billing including Increasing Tier Rates	Continuous	10%
Stage I - Voluntary with minor fines, encourage conservation through public outreach	Loss of Well	10%
Stage II - Public outreach, greater enforcement with fines	Loss of Well	20%
Stage III - Extensive public outreach, extensive enforcement with higher fines and rates, water rationing	Multiple Failures	50%

Table 5-13
Water Shortage Contingency — Penalties and Charges

Penalties or Charges	Stage When Penalty Takes Effect	
First Offense $25, Second Offense $50, Third Offense $100	Stage I and II	
In addition to fines, surcharge of $2 per 100 cubic foot for water use over allocation	Stage III	
Educational letter, citations, penalties, shut off and reconnection for non compliance	All	

the H_2O group

City of Patterson

Water Supply Analysis for General Plan Update

Final Draft
June 2010

City of Patterson
Water System

the H2O group
water engineering, planning & design

June 29, 2010

Dave Moran
CMCA
846 Higuera Street, Suite 11
San Luis Obispo, CA 93401

Subject: **City of Patterson**
Water Supply Analysis – Final Draft
General Plan Update

Mr. Moran,

Please find attached the final draft of the *City of Patterson, Water Analysis for the General Plan Update,* in accordance with our scope of services for said project. The analysis provides feasible options for the City of Patterson to develop a reliable water supply program for any of the three proposed general plan land use plans. A planning level estimate of probable costs for major facility infrastructure is also included.

The H2O Group will continue to be available to provide support as the process continues by addressing questions from the City or public. We would also be willing to assist with development of the tasks and requirements necessary to move the water program from concept to implementation.

If you have questions, please contact me at (916) 806-3970.

Very Truly Yours,

Cort Abney, P.E.
Water Engineer

4661 Golden Foothill Parkway, Suite 206
El Dorado Hills, CA 95762
(916) 686-1598
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Acknowledgments

Special appreciation goes to those persons who were instrumental in the development of this document, including City of Patterson Public Works and Planning Departments, Ken Schmidt & Associates, Del Puerto Water District, West Stanislaus Irrigation District, and Patterson Irrigation District.

Report prepared on:
June 29, 2010

by:
The H20 Group

Cort Abney, P.E.
William J. (Jim) Miller, Jr., P.E.

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Appendices

Section 1 Introduction

The City of Patterson incorporated in 1919 and operates as a general law city. Since then, the City has grown from a mostly farming/service center into a suburban city of 21,000 residents with stable and attractive neighborhoods, shopping, schools and a growing business park.

The Patterson General Plan last underwent a comprehensive revision in 1992. The 1992 General Plan was intended to provide guidance for the growth and development of the City through the year 2012. Although the Plan was revised and updated in 2004, the area covered by the plan and its vision for the future remained largely unchanged through 2007.

In 2007, the City initiated a comprehensive revision of its 1992 General Plan and retained a multi-disciplinary consulting team to assist the City with this effort. The first step was a public outreach and participation program consisting of two public workshops where participants were asked to share their vision of the future for the City. The input received from these workshops was utilized to derive a list of planning principles that served to guide the preparation of a draft general plan.

To help guide the formulation of a draft general plan, the City Council appointed an 11-member General Plan Advisory Committee (GPAC) representing the diverse interests of residents, property owners and other stakeholders as well as the Patterson Unified School District and the Del Puerto Health Care District. The Advisory Committee met for more than a year, from the summer of 2007 to the fall of 2008, to consider a diverse range of issues and options for addressing those issues in the General Plan. Those issues included:

- The timeframe and population holding capacity of the new General Plan;
- Residential densities to be assumed for new neighborhoods, and the qualities that should be incorporated into those neighborhoods; and
- Appropriate locations for additional urban development beyond the 1992 General Plan.

These issues and options were based largely on the findings of the public workshops and the Background Report. They were, however, also the result of extensive discussions among consulting team members and with City officials, other public agencies, industry groups, property owners, developers, community groups, and individual citizens. For each issue, the GPAC selected one or more options, in some cases combining options and in other cases modifying the options.

Based on the committee's direction and in cooperation with City staff, the consultants prepared the draft goals, policies, and implementation programs and three alternative land use and circulation diagrams constituting the Policy Document of the Draft General Plan. Land use alternatives included:

- Compact Development Alternative
- Jobs Emphasis Alternative
- Planning Commission (PC) Alternative

These alternatives were considered by the City's Planning Commission in February 2009 and produced the three development alternatives being considered in the General Plan Update EIR.

Purpose

The purpose of this Water Supply Analysis (WSA) is to provide an assessment of the water demands associated with the project alternatives, feasible water supply options for meeting said demands, and description the infrastructure associated with the water supply options. The document is intended to act as a support document for the General Plan Update CEQA process. Specifically, the WSA addresses:

- An estimate of cumulative future potable water demand by land use category for each alternative for both the year 2030 and 2050 (build-out);
- Sources of water supply and potential impacts of acquiring/providing those sources;
- A description of the backbone infrastructure necessary to serve these alternatives (wells, water tanks and conveyance lines);
- State of the local groundwater basin, and opportunities for expanded use of the groundwater for meeting future demands;
- Treatment of water supplies, and probable by-products associated with treatment;
- The use of recycled water; and
- Need for surface water, reliability issues and concerns, and entitlement availability.

Alternatives Description

The General Plan land use alternatives vary in size, boundaries, proposed dwelling units, and population at both years 2030 and build-out. A description of the land use alternatives is provided in the land use section of the General Plan and is summarized in Table 1-1 by gross acre.

Table 1-1 - City of Patterson General Plan Land Use Alternatives

Land Use Designation	2009 (existing developed Land Use) Acres	Compact Plan		Jobs Emphasis Plan		PC Plan	
		2030 Acres	Build out Acres	2030 Acres	Build out Acres	2030 Acres	Build out Acres
Residential							
Mixed Use Hillside Development	-	-	-	-	650	-	650
Neighborhood Village	-	1,344	2,141	2,043	3,644	3,646	4,569
Estate Residential	27	176	176	176	1,038	485	1,027
Low Density Residential	1,168	1,303	1,303	1,303	1,303	1,303	1,303
Medium Density Residential	68	369	369	369	369	369	369
High Density Residential	44	58	58	58	58	139	139
Downtown Residential	203	203	203	203	203	203	203
Subtotal	**1,510**	**3,453**	**4,250**	**4,152**	**7,265**	**6,145**	**8,260**
Non-Residential							
Downtown Core	82	69	69	69	69	69	69
Regional Commercial	-	-	-	-	-	-	-
General Commercial	62	415	481	712	792	421	487
Highway Service Commercial	53	52	70	52	113	52	113
Neighborhood Commercial	-	-	-	-	-	-	-
Medical/Professional Office	2	6	6	6	6	6	6
Light Industrial	311	1,648	1,875	1,701	1,701	2,033	2,124
Heavy Industrial	132	153	153	153	153	153	153
Public/Quasi-Public	325	410	422	410	444	410	443
Parks and Recreation	167	258	258	258	258	258	258
Open Space							
Agriculture							
Other (streets, lakes, canals, etc.)	36	36	79	157	664	292	533
Subtotal	**1,170**	**3,047**	**3,413**	**3,518**	**4,200**	**3,694**	**4,186**
Total	**2,680**	**6,500**	**7,663**	**7,670**	**11,465**	**9,839**	**12,446**

Note: all data provided by CMCA Plans, December 2009

Existing Area and Use

Incorporated in 1919, the City of Patterson is a small town located in the Central Valley of California, in the west side of Stanislaus County. The surrounding area is mainly comprised of agricultural activity, with the City acting as a hub for commerce. Current population is approximately 21,000 residents.

The City of Patterson consists mostly of residential housing, with minor commercial development. The City has large areas planned for commercial/distribution on the west near I-5. Industrial development is very limited, and no high water use industries using City water is anticipated.

The topography of the City of Patterson varies. The area near the town center is relatively flat, with elevation of approximately 100 feet. Areas closer to the I-5 begin to rise sharply, reaching over 200 feet. West of I-5, elevations climb quickly to over 600 feet due to influence from the coastal range. North-south elevations throughout the area are relatively consistent, paralleling the coastal range, I5 and Highway 33.

Rainfall in Patterson averages about 12 inches per year, with evaporative loss of approximately 60 inches per year. Average annual air temperature is approximately 62°F. Temperatures can drop below freezing on winter nights, and raise well above 100°F on summer days.

Soils in the general plan areas vary widely, from tight clays to coarse gravels. Generally, soils are coarser on the west/northwest side of the planning areas than on the east/southeast side. This is largely due to the deposition of materials as it is transported from the coastal range. Heavier, larger material is quickly deposited, whereby fine grained materials are transported farther downstream as runoff travels toward the San Joaquin River.

One special area of interest is near Del Puerto Creek. Soil studies performed by the National Resource Conservation Service (NRCS) shows a mixture of soil types and texture where the creek exits the hillside, forming a well defined alluvial fan. NRCS developed a soils delineation map, indicating areas dominated by one or more major types of soil. The NRCS testing ranged from the surface to as deep as 66 inches. In general, all soils in this area (See Appendix A) were considered to be "moderately well drained" to "somewhat excessively well drained," due to coarse alluvium in the area. Approximately 1,000 acres within the general plan areas consist of soils with gravelly or sandy texture, indicating high permeability and an affinity for groundwater recharge.

Discussions with local irrigation district representatives, land owners, and City staff have confirmed that some areas in the Del Puerto Creek area are difficult to irrigate due to the high porosity of the soils. In 2009, the City of Patterson constructed a new well near the northwest side of the City limits, the closest City well to Del Puerto Creek. Soils found during construction included an abundance of sands and gravels from 0 to 400 feet deep. According to City staff, detention basins near the new well do not retain water well due to the high porosity of the soils in the area. Due to the apparent affinity of soils in the northwest areas for recharge, this area became a focus in the report for managing groundwater use and production.

Existing Irrigation Districts

The general plan area encompasses lands that have private wells and lands within the Patterson Irrigation District (PID), the West Stanislaus Irrigation District (WSID) and the Del Puerto Water District (DPWD). The current district water deliveries to the general plan area are discussed in greater detail in Section 3 water supplies. The City's water supply assessment assumes that the waters these districts currently deliver to the general plan areas will continue to be delivered to those areas in the future.

Existing Water Supply Conditions

Local groundwater has sustained the City of Patterson and other activities in the region, and it is anticipated that local groundwater will continue to be a critical component of the City's water supply program indefinitely. The groundwater basin that underlies the City of Patterson has been used as its sole water supply. The City currently has nine water supply wells with a total capacity of 9,300 gpm, with projected annual production of 7,500 ac-ft. Private wells also provide water to select areas in the City. Current annual water production of wells within the existing City sphere of influence is approximately 6,000 ac-ft annually.

Table 1-2 provides a summary of the City's existing groundwater production facilities. The list includes two non-potable wells for non-potable use (such as landscape irrigation).

Local irrigation districts have surface water entitlements for water from the Delta Mendota Canal and the San Joaquin River. The reliability of water from the canal is less than river sources due to environmental concerns associated with pumping water from the Delta. Surface water used for irrigation is directly beneficial to the local groundwater basin since it provides a source of artificial recharge. Thus, changes in surface water application due to removal of agricultural lands will need to be addressed. The City currently has no entitlement to surface water from any local source. According to the California Department of Public Health, the only local surface water of sufficient quality for use as a drinking water source is the California Aqueduct, which also has a lower degree of reliability due to Delta environmental issues.

Table 1-2 - Summary of City of Patterson Groundwater Wells [a]

Well	Type	Year	Depth	Screens	Flow (gpm)
Potable					
2	Production	1947	360	170-356	800
5	Production	1986	565	390-565	1400
6	Production	1994	365	225-255 345-355	600
7	Production	1999	597	342-597	1500
8	Production	2004	470	340-390 444-460	1000
9	Production	2001	440	350-435	800
10	Monitoring	2001	550	310-530	NA
11	Production	2001	540	360-390 520-540	1200
			Total		7300
Non-potable					
Keystone	Production	2010	350	200-300	1200
4	Production	1971	433	204-433	800
			Total		2000

(a) Source: Table 2-1 "City of Patterson Water Supply Study," August 2006 by H20 Group, updated

Note: Well No. 1 was destroyed in 1998; Well No. 3 was given "inactive" status by the City in 1998 due to excessive sand production. Well No.4 has been converted into a non-potable supply well. Well No.15, "Keystone" is a dedicated non-potable well.

Groundwater quality is also of concern. In 2001, the City received a letter from the California Department of Health Services stating that "... *all of the City's wells are above the recommended levels for TDS and ... hovering around the upper containination limits",* and subsequently encourages the City to address the water quality concern before it impacts the City's ability to add services. In 2002 and 2003, water studies associated with development projects indicated that there may be a limited quantity of groundwater, and treatment of the groundwater could be required between 2008 and 2012. [1] Thus, addressing water quality concerns is expected to be an important objective for the City, regardless of future growth.

Due to the importance of local groundwater, the City has recently initiated efforts to protect and manage the groundwater. These efforts will focus on working with other groundwater users in the region to quantify and develop strategies for sustainable groundwater yields, protection of water quality, innocuous well designs, and monitoring of water tables. Data collected from these efforts will be combined with historical data developed by the State of California to better understand basin characteristics.

Department of Water Resources (DWR) has studied and monitored groundwater conditions in the Central Valley for more than 60 years. DWR Bulletin 118, first released in 1952, and updated five times since, provides historical information on groundwater characteristics, well data, and issues of concern regarding groundwater use and management.

DWR divides the Central Valley into groundwater basins and sub-basins for analysis. The City lies within the "San Joaquin Valley Groundwater Basin - Delta-Mendota Subbasin" area, with the following description:

- Groundwater Subbasin Number: 5-22.07
- County: Stanislaus, Merced, Madera, Fresno
- Surface Area: 747,000 acres (1,170 square miles)

An excerpt from Bulletin 118 defining groundwater conditions in this area states:

> ***"Basin Boundaries and Hydrology***
> *The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley.*
>
> ***Groundwater Level Trends***
> *Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics. On average, the subbasin water level has increased by 2.2 feet from 1970 through 2000. The period from 1970 through 1985 showed a general increase, topping out in 1985 at 7.5 feet above the 1970 water level. The nine-year period from 1985 to 1994 saw general declines in groundwater levels, reaching back down to the 1970 groundwater level in 1994.*

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[1] Water Supply Assessment for West Patterson Business Park (2002), and Water Verification for Patterson Gardens (2003).

groundwater levels rose in 1995 to about 2.2 feet above the 1970 groundwater level. Water levels fluctuated around this value until 2000." [2]

Of note, DWR has recorded that sub-basin 5-22.07 is relatively stable, with no indication of long-term decline or cone-of-depression. The most recent groundwater contour map provided by DWR based on well data show that 2006 groundwater levels did not change markedly from 1996 levels (See Figures 1-1 and 1-2). DWR Bulletin 118 also makes reference to how the document can be used in planning efforts, as follows:

> *"Recently enacted legislation requires developers of certain new housing projects to demonstrate an available water supply for that development. If a part of that proposed water supply is groundwater, urban water suppliers must provide additional information on the availability of an adequate supply of groundwater to meet the projected demand and show that they have the legal right to extract that amount of groundwater. SB 610 (2002) amended the Water Code to require, among other things, the following information (Section 10631(b)(2)):*
>
> *For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.*
>
> *Therefore, although SB 610 refers to groundwater basins identified as overdrafted in Bulletin 118, it would be prudent for local water suppliers to evaluate the potential for overdraft of any basin included as a part of a water supply assessment. Persons interested in collecting groundwater information in accordance with the Water Code as amended by SB 221 and SB 610 may start with the information in Bulletin 118 ..."*

Regular users of local groundwater include the City of Patterson, local irrigation districts, and private land owners. There are no known problems in the local area due to groundwater use, such as lowering of the groundwater table or land subsidence. It is anticipated that purveyors other than the City of Patterson will continue to use local groundwater in the future, so significant expansion of the City's groundwater use cannot be assumed without including measures to ensure long-term sustainability.

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[2] DWR Bulletin 118, *"San Joaquin River Hydrologic Region (5-22.07), San Joaquin Valley Groundwater Basin"*, January, 2006

The State of California does not enforce state groundwater management statutes, thereby placing groundwater management at the local level. The City claims legal access to its groundwater through California groundwater law, which allows an appropriator the right to pump and use the local groundwater for beneficial use. Appropriative rights are second to "overlying" rights of property owners. The amount of groundwater use is generally restricted to the point at which one user actions cause adverse impact to another user.

The City has well ordinances that protect the groundwater and minimize impacts of the City's pumping activities on private wells. However, a formal and comprehensive groundwater management program for the area has yet to be implemented. The San Luis Delta Mendota Water Authority has developed a water management plan for the larger western side of the San Joaquin River Valley area, but its application for managing local groundwater near Patterson has not been realized, and may not be a proper vehicle for local groundwater management. [3]

There are various ways communities have implemented groundwater management. Options include: (1) local government through adoption of ordinances, (2) local agency granted authority per the California Water Code, and (3) use of court adjudication. There are no laws that require any of these methods be used or applied to a basin. Adjudication results in a loss of some control by local agencies, and the court-directed process can be time-consuming and costly. Generally, adjudication is used only when landowners and other parties feel that resolution to groundwater problems are only achievable through the courts.

In 2009, the City of Patterson introduced a series of "water workshops", whereby local water stakeholders are meeting periodically to discuss water issues associated with the west side of Stanislaus County. Participating members include municipalities and irrigation districts. Members have expressed the need and willingness to participate in a program to actively manage local groundwater through additional monitoring, sharing of data, and other activities that may protect local groundwater. Water workshops will continue for the indefinite future, with the goal of developing a regional groundwater management program for responsible groundwater use, monitoring, and stewardship.

Groundwater management can be defined as the planned and coordinated monitoring, operation, and administration of a groundwater basin or portion of a groundwater basin with the goal of long-term sustainability. Thus, primary objectives include prevention of significant depletion of groundwater in storage, and preventing significant degradation of groundwater quality. Each management plan should be tailored to fit local conditions and needs, with the flexibility to adjust objectives as more is understood about the basin with time. This effort will be an important component of a sustainable water supply program for the City.

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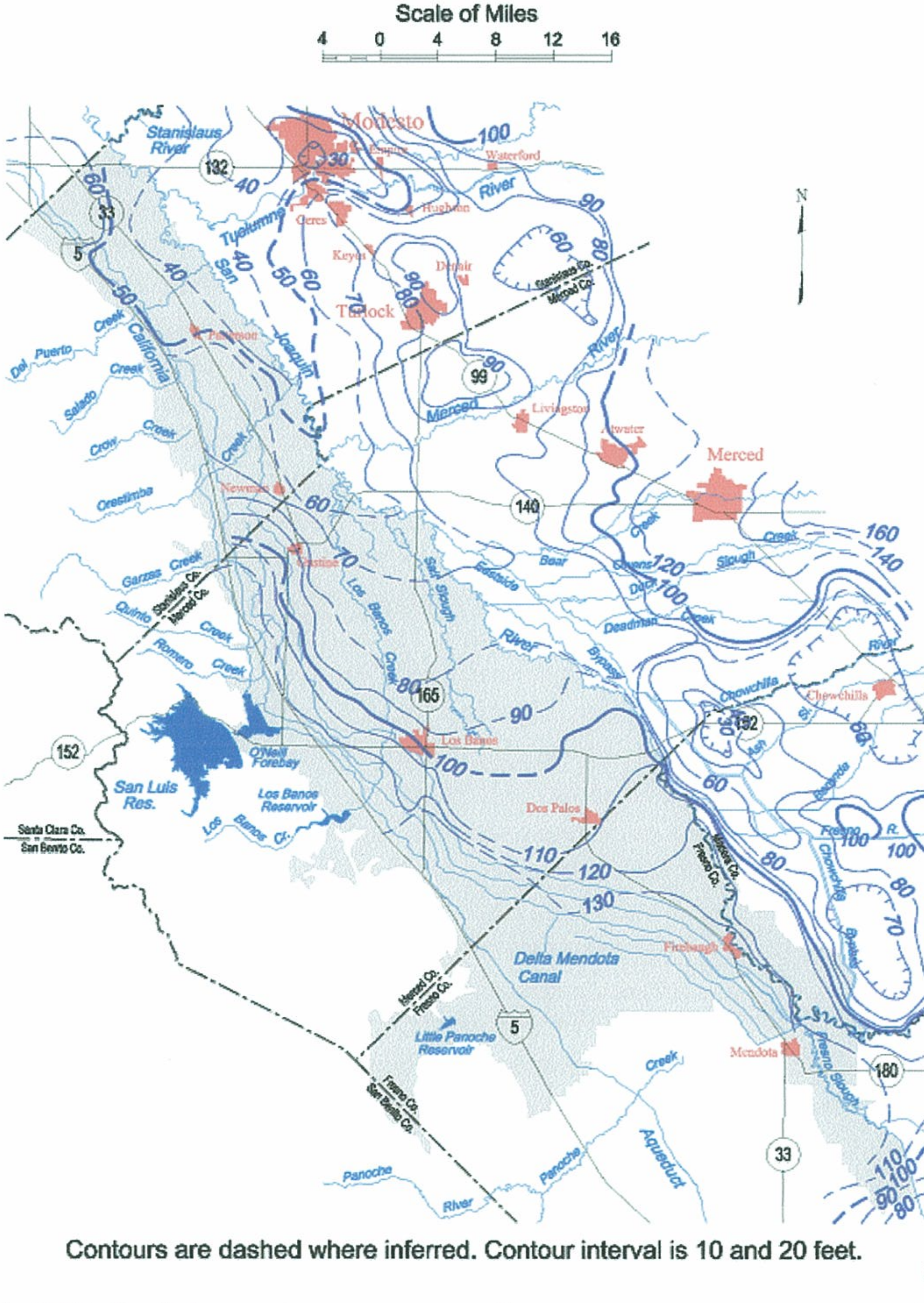
[3] AB3030 GMP, developed by SLDMWA in 1995.

Delta Mendota Groundwater Basin

Spring 1996, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer

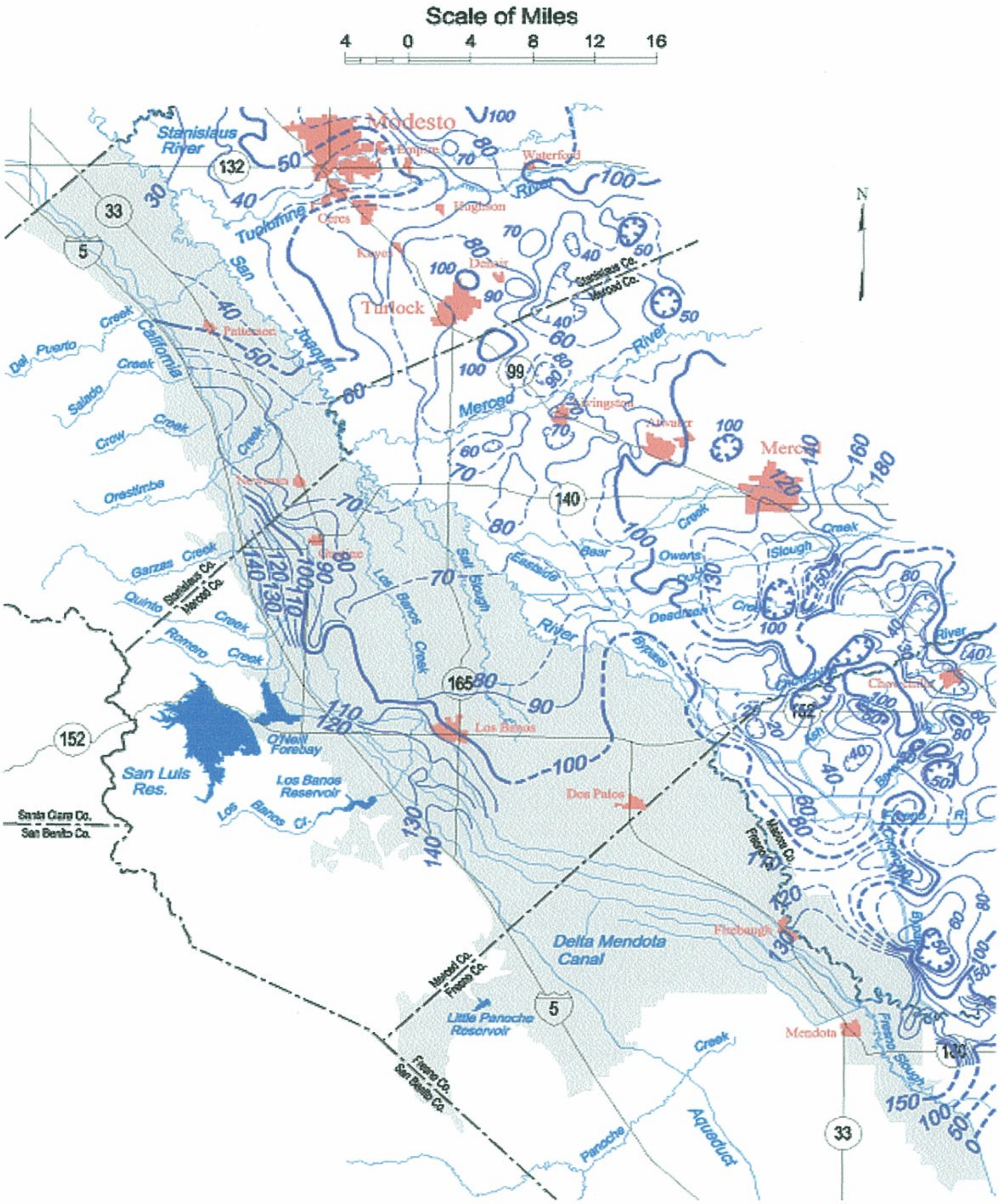


Contours are dashed where inferred. Contour interval is 10 and 20 feet.

Figure 1-1

Delta Mendota Groundwater Basin

Spring 2006, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer



Contours are dashed where inferred. Contour interval is 10, 20 and 50 feet.

Figure 1-2

Accurate predictions of future groundwater availability for City of Patterson growth are difficult to project since the City does not control the use of the local groundwater basin by other users. Sufficient information is not currently available to identify with certainty what the total demand of groundwater will be in the region, and what portion of the sustainable groundwater to which the City of Patterson will be entitled. However, the City has an extended history of local groundwater use, has constructed wells and systems for groundwater production, has approved development based on quantified groundwater availability, and will protect its right to continue use of the local groundwater.

Water Supply Analysis

This water supply analysis provides a quantitative evaluation of water demands associated with the proposed general plan alternatives, potential solutions for providing a sustainable water supply for said alternatives, key intra-agency arrangements necessary to implement the solutions, and a general description of the facilities required.

Full use of the existing system capacity is anticipated. Groundwater use beyond this amount may still be available since: 1) the sustainable groundwater yield may support additional production for City growth, and 2) there are many existing private wells within the general plan alternatives areas that will be abandoned, allowing current production from these wells to be used by the City of Patterson. Unfortunately, the current production from these wells is unknown. Hence, for purposes of this study, groundwater production is assumed to be limited to current system capacity, and additional groundwater capacity will occur through implementation of an artificial recharge program.

Section 2 Water Demands

In this section, the existing and anticipated water demands for the years 2030 and 2050 (build-out) are estimated for each of the land use alternatives presented in the General Plan. Both potable and non-potable water demands are defined for each land use category.

The City's Urban Water Management Plan (UWMP) will be updated this year as required by the State (California Water Codes Section 10621). The 2005 UWMP analyzed the City's demands based on the 1994 General Plan land uses. The 2010 UWMP will be updated by the City to reflect the water planning efforts in this report.

Land Use

Three land use alternatives are considered in the General Plan Update: 1) Compact Plan, 2) Jobs Emphasis Plan, and 3) PC Plan. The land uses and acreage associated with each alternative were shown in Table 1-1.

Water Demand Factors

Water demand factors represent the typical amount of water that would be used by a given land use in a given amount of time. The water demand factors in this study are based on gross acres of land annual water use, measured in acre-feet, and are presented for each of the land use categories that are presented in the General Plan.

Not all of the land use categories presented in the General Plan exists in the city today. For those land uses that do exist, historical water use was reviewed to determine typical demands. Table 2-1 and Figure 2-1 present a summary of the neighborhoods that were used to represent each existing land use category. The monthly water sales by gross acre for each existing general plan land use area are shown in Figures 2-2 through 2-10.

After review of the data, several land uses had abnormal results; in that they produced numbers that were lower than typically found. These land uses include: Downtown Residential, Downtown Core, Heavy Industrial, Public, and Parks. For the Downtown Residential and the Downtown Core land use areas, the low numbers may have been associated with vacancies due to the poor economy during the data period from November 2007 to December 2009. The Heavy Industry site picked was found to have supplemental water source (on-site well) that is meeting some of the demands. For Public Lands, no explanation was found, but the number is low given the amount of turf area land use is presented in Table 2-4. Figures 2-2 through 2-10 show the water use curves for each land-use. There is no figure for parks, because water use data was not available.

Demands

Tables 2-5 through 2-7 present the estimated water demands for each land use alternative. Table 2-8 summarizes the demands by land use alternative. The tables assume that all existing demands use potable water for their services. All future demands assume both potable and non-potable water services will be available. The conversion of existing customers' irrigation demands to the non-potable distribution system is discussed more in the water supply and infrastructure sections.

Table 2-1 - Historical Water Use Sample Areas for Existing General Plan Land Use Categories in the City of Patterson 2009

Land Use Category		Address Area representing Land Use	Gross Acres from aerial photo (a)	Approximate Lot Count (a)	Calculated Density Units/ac
Mixed Use Hillside Development		NA	NA	NA	NA
Neighborhood Village		NA	NA	NA	NA
Estate Residential		NA	NA	NA	NA
Low Density Residential	Area A	Ward Ave between Sperry and Mackilhaffy Place (likely 0 addresses) Sperry Ave between Ward and Clower Ave (likely zero addresses) Miraggio Drive - all addresses Tuscany Court - all addresses Orkney Drive - all addresses Pitscottie Lane - all addresses McMurphy Court - all addresses Mackilhaffy Place - all addresses Philomena Court - all addresses Moray Court - all addresses Moray Way - all addresses Kirkwall Way - all addresses Tarlnad Lane - all addresses Tiree Place - all addresses	35.3	168	4.8
	Area B	Beck Creek Lane - all addresses Snow Creek - all addresses Jake Creek Drive - all addresses Dylan Creek Drive - all addresses Carly Creek Drive - all addresses Creek Lane - all addresses Samantha Creek Drive - all addresses Stone Creek Lane - all addresses Mallard Creek Court - all addresses Cougar Creek Drive - all addresses Rock Creek Lane - all addresses Skimmer Drive - all addresses Swan Drive - all addresses Flicker Lane - all addresses Woodcreeper Court - all addresses Roadrunner Drive 600-800	67.2	321	4.8
Medium Density Residential		NA	NA	NA	NA
High Density Residential		Walnut Court - all addresses Eureka Street - all addresses Chase Street - all addresses Payne Street - all addresses Mayette Street - all addresses Franquette Street - all addresses	19.4	284	14.7
Downtown Residential		N. 3rd Street (200-599) N. 4th Street (200-599)	36.6	100	2.7

Downtown Core	N 3Rd Street (0-199) N El Circulo Ave (0-199) N. 5th Street (0-99) N. Salado Ave (0-99)	11.1		
Regional Commercial	NA	NA	NA	NA
General Commercial	I Street (200-300) J Street (200-300) K Street (200-300) L Street (200-300) N. 2nd Street (200-499)	9.5		
Highway Service Commercial	Rogers Road (15000-15099) Speno Drive - all addresses Renzo Lane - all addresses Carmen Way - all addresses Annamarie Ave - all addresses	14.0		
Neighborhood Commercial	NA	NA	NA	NA

Table 2-1 Historical Water Use Sample Areas for Existing General Plan Land Use Categories in the City of Patterson 2009 *continued*

Land Use Category	Address Area representing Land Use	Gross Acres from aerial photo (a)	Approximate Lot Count (a)	Calculated Density Units/ac
Medical/Professional Office	NA	NA	NA	NA
Light Industrial	N. 1st Street (0-479)	14.1		
Heavy Industrial	S. 1st Street (0-500)	57.9		
Public/Quasi-Public	5th Street (500-598 even numbers only) L Street (500-699 odd numbers only) N 7th (0-499 even numbers only) N 9th Street (all Odd numbers) Ward Ave (between 9th and M Street. - Likely no addresses) M Street (500-698)	56.8		
Parks and Recreation	Ward Ave (big Park 16501-16701 odd numbers only)	24.6		
Open Space	NA	NA	NA	NA
Agriculture	NA	NA	NA	NA

(a) Numbers were estimated from the Google Earth Figure

Rogers Rd
5
West Side Fwy
Sperry Ave
Baldwin Rd
American Eagle Ave
Ward Ave
N Salado Ave
Patterson
M St
33
2nd St
S 2nd St
E Las Palmas Ave

Figure 2-2 Graph of Monthly Water Demands - Typical Low Density Residential City of Patterson Water Sales November 2007 to December 2009

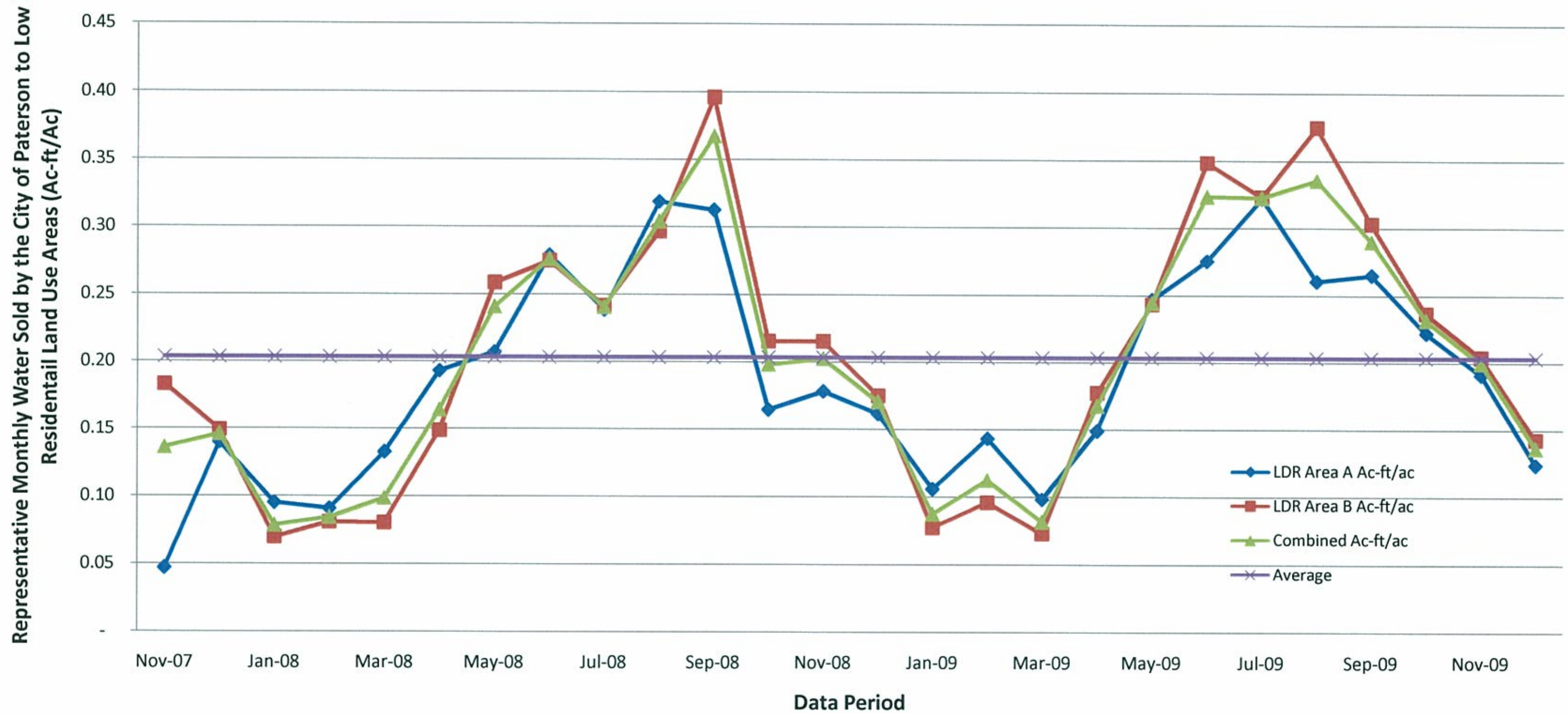
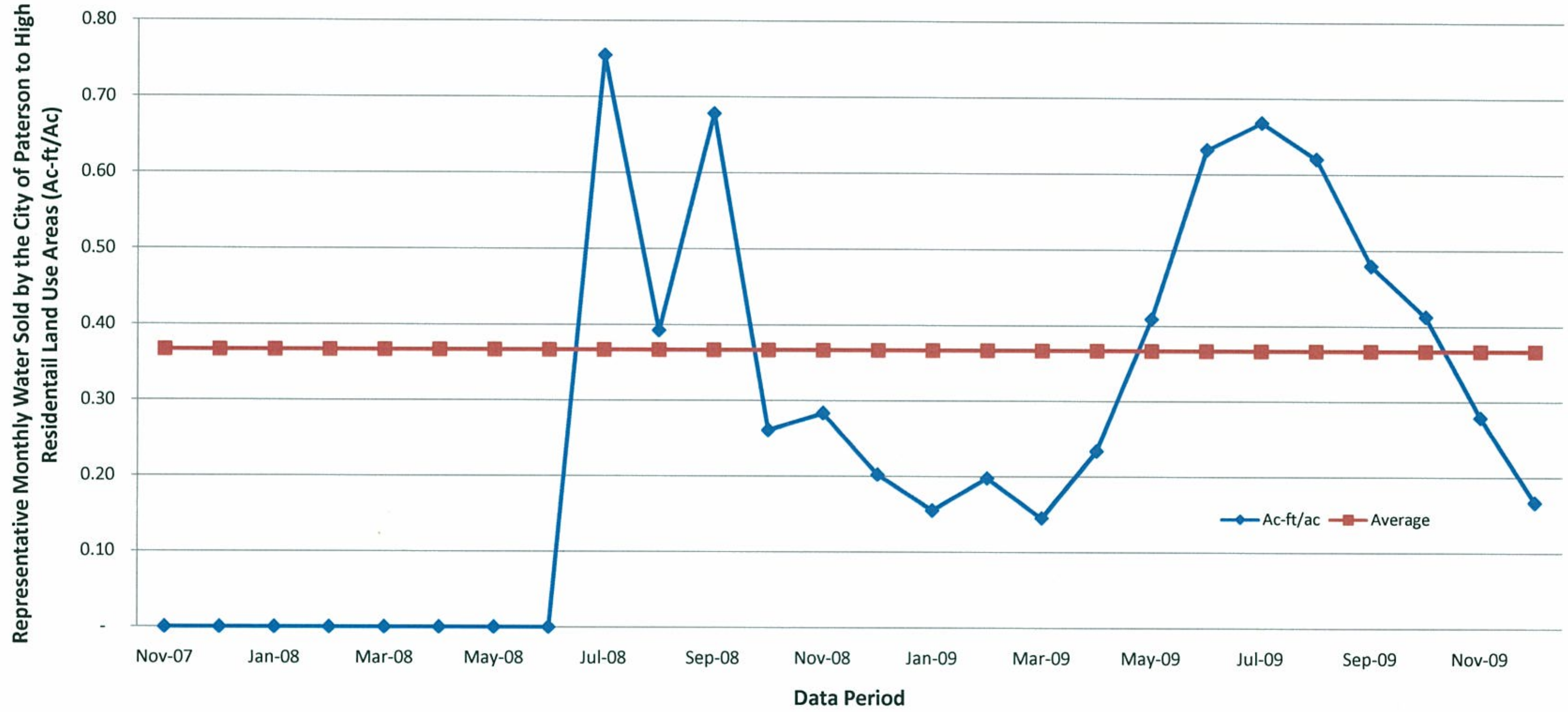


Figure 2-3 Graph of Monthly Water Demands - Typical High Density Residential City of Patterson Water Sales November 2007 to December 2009



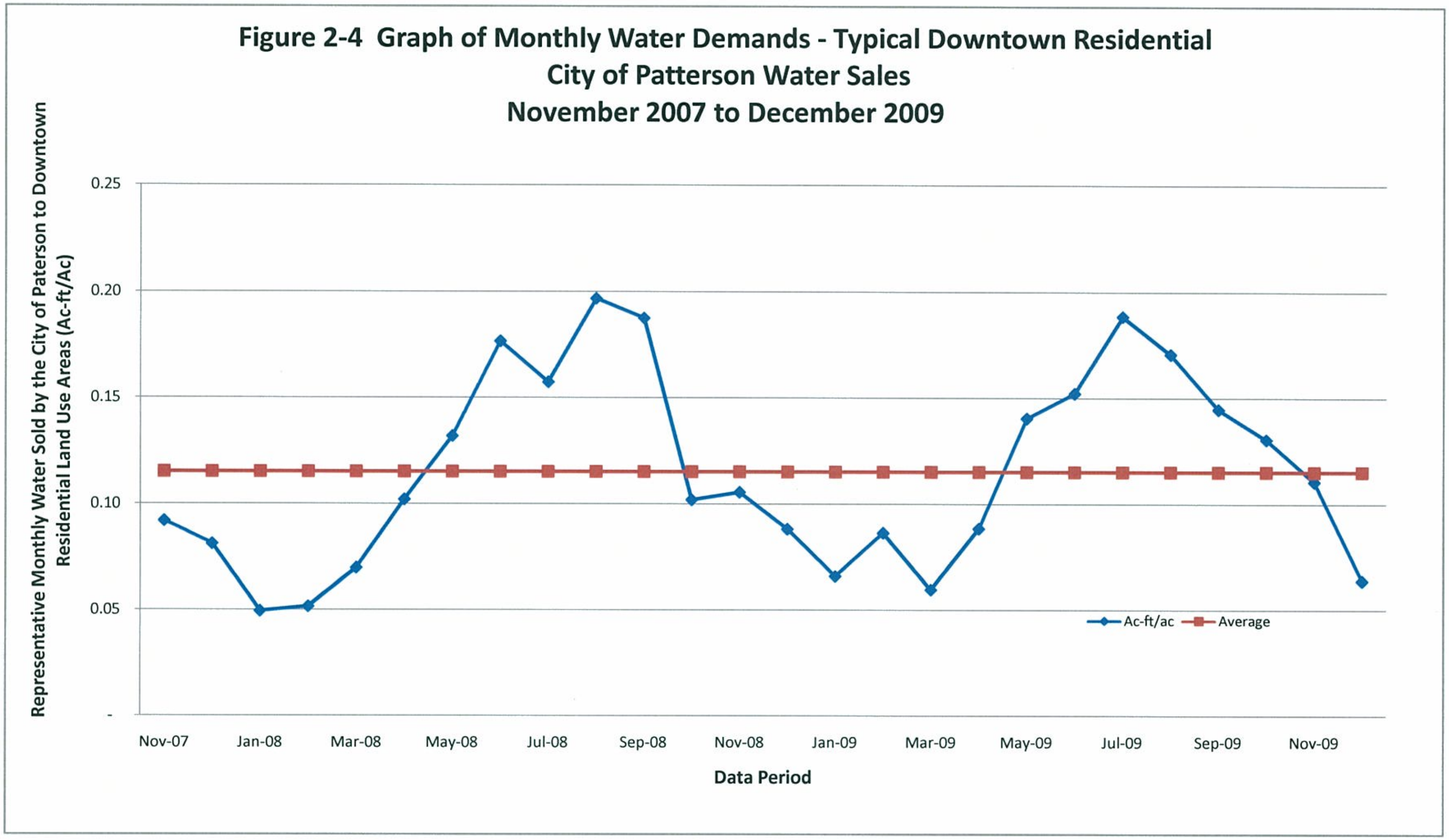
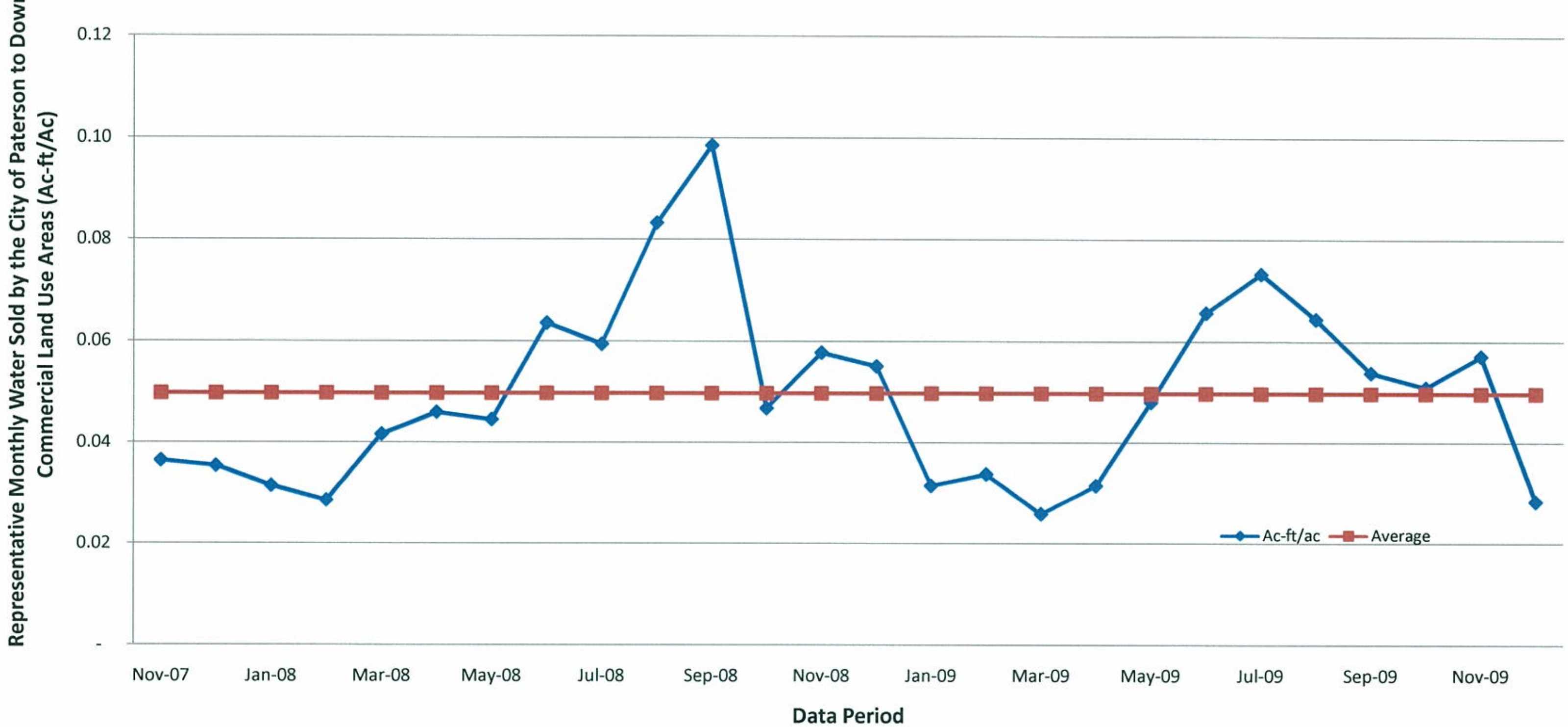


Figure 2-4 Graph of Monthly Water Demands - Typical Downtown Residential
City of Patterson Water Sales
November 2007 to December 2009
Representative Monthly Water Sold by the City of Paterson to Downtown Residential Land Use Areas (Ac-ft/Ac)
0.25
0.20
0.15
0.10
0.05
-
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Data Period
Ac-ft/ac
Average

Figure 2-5 Graph of Monthly Water Demands - Typical Downtown CoreBitmap
City of Patterson Water Sales
November 2007 to December 2009



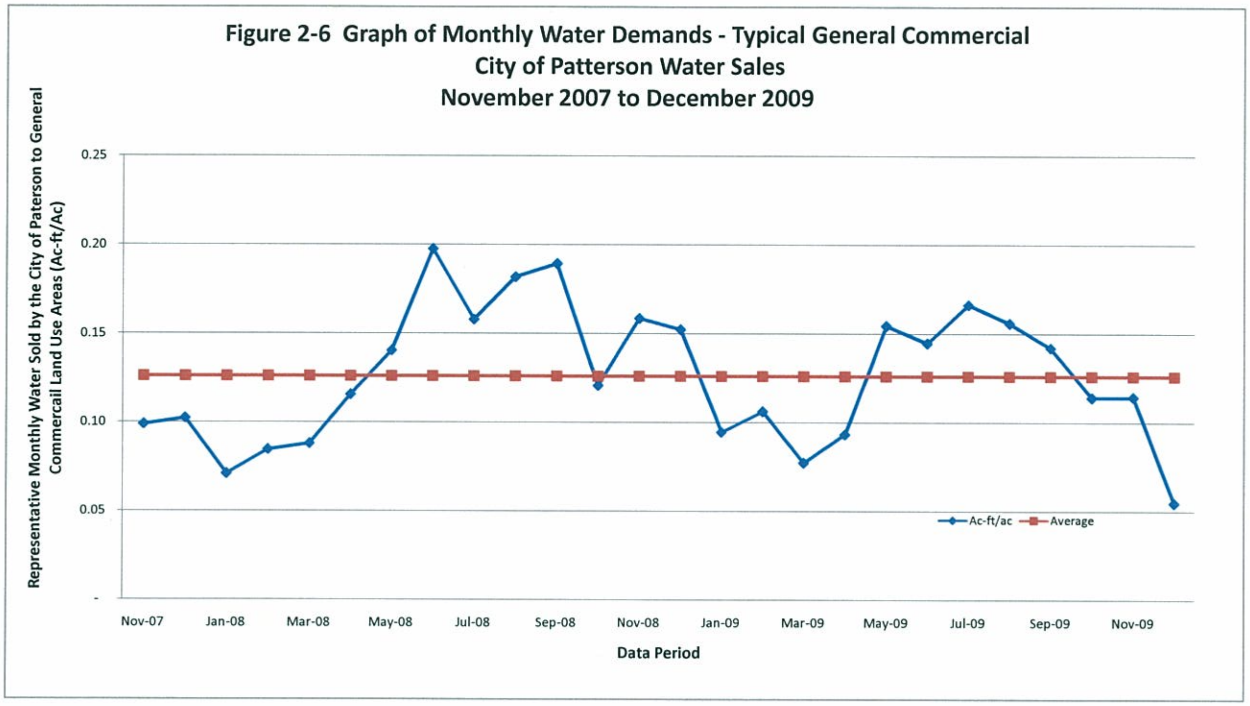


Figure 2-6 Graph of Monthly Water Demands - Typical General Commercial
City of Patterson Water Sales
November 2007 to December 2009
Representative Monthly Water Sold by the City of Paterson to General Commercail Land Use Areas (Ac-ft/Ac)
0.25
0.20
0.15
0.10
0.05
-
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Data Period
Ac-ft/ac
Average

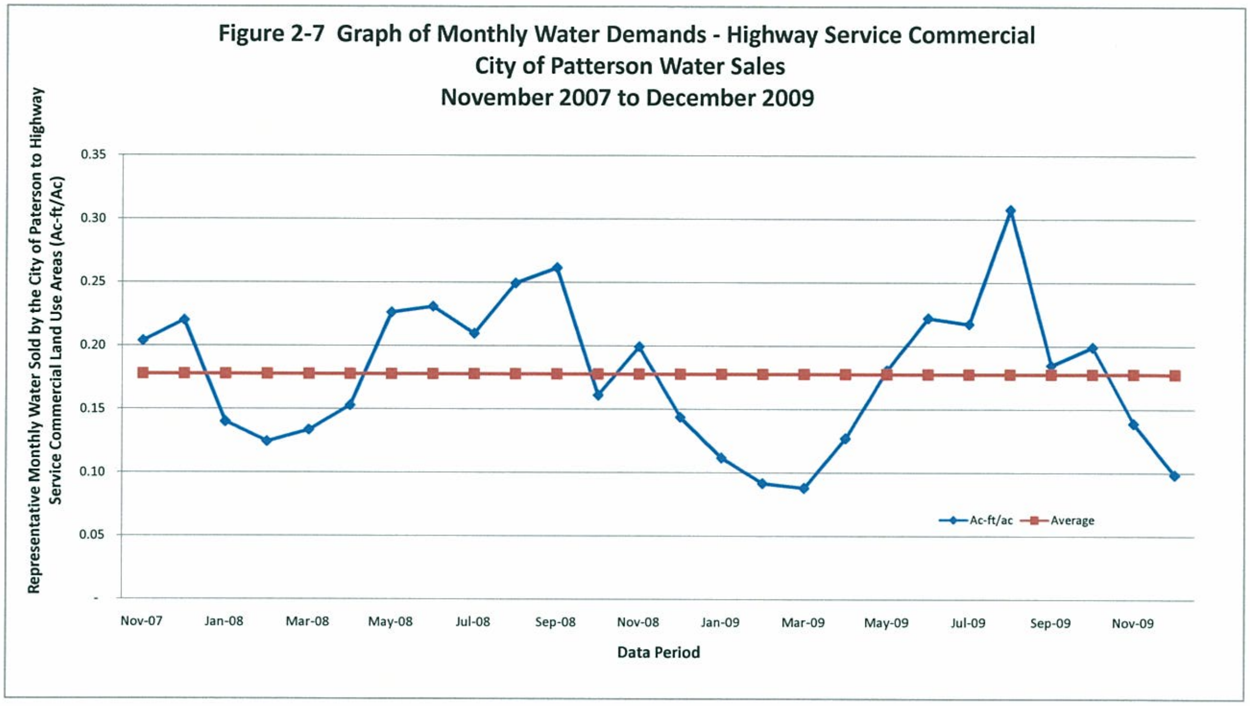
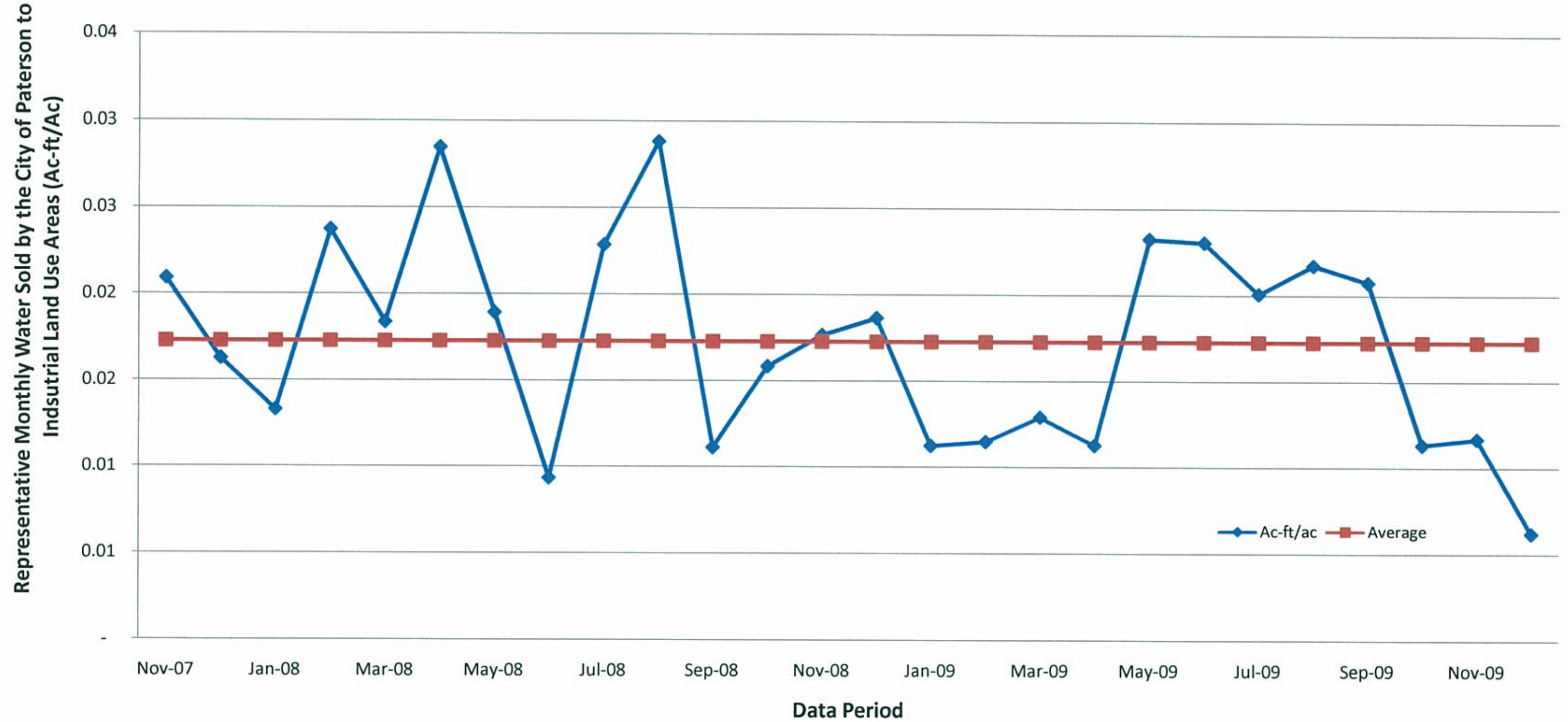


Figure 2-7 Graph of Monthly Water Demands - Highway Service Commercial
City of Patterson Water Sales
November 2007 to December 2009
Representative Monthly Water Sold by the City of Paterson to Highway Service Commercial Land Use Areas (Ac-ft/Ac)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Data Period
Ac-ft/ac
Average

Figure 2-8 Graph of Monthly Water Demands - Light Industrail
City of Patterson Water Sales
November 2007 to December 2009

Figure 2-9 Graph of Monthly Water Demands - Heavy Industrail City of Patterson Water Sales November 2007 to December 2009



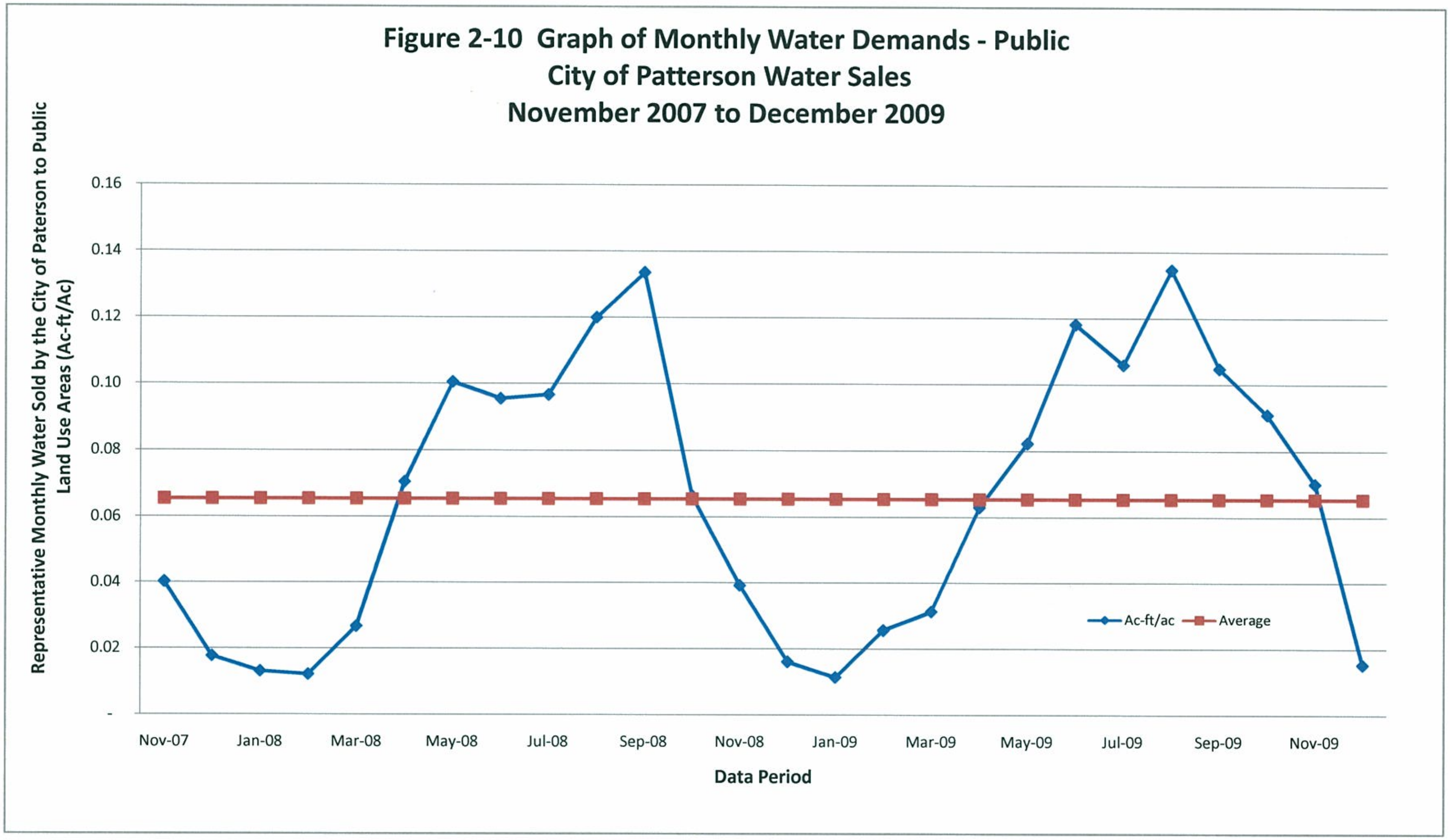


Figure 2-10 Graph of Monthly Water Demands - Public
City of Patterson Water Sales
November 2007 to December 2009
Representative Monthly Water Sold by the City of Paterson to Public Land Use Areas (Ac-ft/Ac)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
Nov-08
Jan-09
Mar-09
May-09
Jul-09
Sep-09
Nov-09
Data Period
Ac-ft/ac
Average

Table 2-2 - Water Demand Factors for Existing City of Patterson Land Uses

Land Use Designation	Annual water sales (gross acres) (a)	Unaccounted for water percentage (b)	Annual Water Demands (gross acres)	Indoor water use percentage (c)	Potential Demand Split: Potable	Potential Demand Split: Non-Potable	Existing Acreage	Estimated Existing Annual Water Demand (ac-ft/yr)
	af-ft/ac/yr		af-ft/ac/yr		af-ft/ac/yr	af-ft/ac/yr	Ac	
Residential								
Mixed Use Hillside Development	NA						-	-
Neighborhood Village	NA						-	-
Estate Residential (c)	NA		1.25	39%	0.48	0.77	27.00	**33.75**
Low Density Residential	2.72	15%	3.12	39%	1.21	1.92	1,168.00	**3,647.97**
Medium Density Residential	NA						68.00	**206.46**
High Density Residential	4.49	15%	5.16	37%	1.93	3.23	44.00	**227.09**
Downtown Residential (c)	1.47	15%	1.69	43%	0.73	0.96	203.00	**507.50**
Non- Residential			-		-	-	-	-
Downtown Core (c)	0.66	15%	2.40	52%	1.25	1.15	82.00	**196.56**
Regional Commercial	NA						-	-
General Commercial	1.70	15%	1.96	43%	0.85	1.11	62.00	**121.41**
Highway Service Commercial	2.31	15%	2.66	50%	1.32	1.34	53.00	**141.02**
Neighborhood Commercial	NA						-	-
Medical/Professional Office	NA						2.00	**4.00**
Light Industrial	1.48	15%	1.70	24%	0.41	1.30	311.00	**529.33**
Heavy Industrial (c)	0.23	15%	2.47	36%	0.88	1.58	132.00	**325.67**
Public/Quasi-Public (c)	0.85	15%	2.59	17%	0.45	2.14	325.00	**842.47**
Parks and Recreation (c)	NA		3.77	15%	0.57	3.20	167.00	**629.22**
Open Space	NA							
Agriculture	NA							
				Total			2,644.00	**7,412.45**

(a) Water sales data was available from November of 2007 through December of 2009. This number represents the largest 12 consecutive months of water usage per acre from the sample neighborhood data provided by the City.
(b) Unaccounted for water would include water lost during operations of the wells, fire hydrant usage for items such as system flushing or fires, system leaks, etc. This is assumed to be consistent across all land uses. 15% was used as a place holder until further analysis on total water sales and production numbers can be completed. 15% unaccounted for water is typical of distributions system of this type and age.
(c) The estimated existing water demand uses the demand factors from Table 2-4 for this land use, the existing data reflects abnormally low water use.

Table 2-3 Water Demand Factors Used by Other Municipalities in the Patterson Area

Land Use Designation	Water demand Factors Used by Other Agencies				Average
	City of Modesto (a)	City of Tracy (b, c)	Los Banos (e)	Santa Nella SUDP (d)	
	af/ac/yr	af/ac/yr	af/ac/yr	af/ac/yr	af/ac/yr
Residential					
Mixed Use Hillside Development	2.8				**2.8**
Neighborhood Village	2.5	2.0			**2.3**
Estate Residential		1.5		1.0	**1.3**
Low Density Residential	3.0	2.0	1.9	3.2	**2.5**
Medium Density Residential	3.0	3.0	2.9	3.2	**3.0**
High Density Residential		3.5	4.0	4.2	**3.9**
Downtown Residential	2.5				**2.5**
Non- Residential					
Downtown Core	2.5	2.0	2.7		**2.4**
Regional Commercial	2.0	2.0	2.2	1.7	**2.0**
General Commercial	2.0	2.0	2.2	1.7	**2.0**
Highway Service Commercial	2.0	2.0	2.2	1.7	**2.0**
Neighborhood Commercial	2.0	2.0	2.2	1.7	**2.0**
Medical/Professional Office	2.0		2.2		**2.0**
Light Industrial		2.0	2.2	1.7	**2.0**
Heavy Industrial	2.8		2.2		**2.5**
Public/Quasi-Public			2.2	3.0	**2.6**
Parks and Recreation		4.5	4.5	2.3	**3.8**
Open Space				2.6	**2.6**
Agriculture					

a Engineer's Report "Justification and Cost Allocations for Proposed Water System Improvements" Prepared for the City of Modesto by West Yost & Associates September 2, 2004, Attachment 2 "revised Tables from the March 2003 Water Demand TM", Craig Scott Memo to File 9/1/04.

b Residential and commercial demands - Water Supply Assessment for the Surland Development Agreement and Ellis Specific Plan Final Report, Prepared for City of Tracy by West host Associates March 2008, Table 2 "City of Tracy Standard Water Use Factors"

c Industrial demands - Northeast Industrial Area Infrastructure Finance and Implementation Plan, Prepared for the City of Tracy by Harris and Associates , 1995.

d Santa Nella County Water District SUDP, Water Equivalent Dwelling Units Table, Merced County, April, 2006.

e Existing Water Demand Coefficients, Water Distribution System Master Plan, City of Los Banos, September 2008, Table 4.3 by Carrollo Engineers. Numbers were reduced by 22% to reflect the change from net acre demands to gross acre demands per footnote number 2 on the Carrollo table.

f Total 2009 demand is on Comparison Worksheet. 200 gpcd from Table 2-2 City of Patterson Water Supply Planning Study, by H2O group , August 2006.

Table 2-4 Recommended Water Demand Factors for City of Patterson - Before Conservation

Land Use Designation	Existing Land Uses (a)			Others Land Uses (b)			Recommended Demand Factors Before Conservation		
	Annual Demand ac-ft/ac	Potable ac-ft/ac	Non-Potable ac-ft/ac	Annual Demand ac-ft/ac	Potable ac-ft/ac	Non-Potable ac-ft/ac	**Annual Demand ac-ft/ac**	**Potable ac-ft/ac**	**Non-Potable ac-ft/ac**
Residential									
Mixed Use Hillside Development (c)				2.75			**2.75**	**1.06**	**1.69**
Neighborhood Village (c)				2.25			**2.25**	**0.87**	**1.38**
Estate Residential (c)				1.25			**1.25**	**0.48**	**0.77**
Low Density Residential	3.12	1.21	1.92	2.53	0.97	1.55	**3.12**	**1.21**	**1.92**
Medium Density Residential (c)				3.04			**3.04**	**1.17**	**1.86**
High Density Residential	5.16	1.93	3.23	3.89	1.46	2.44	**5.16**	**1.93**	**3.23**
Downtown Residential (d)	1.69	0.73	0.96	2.50	1.07	1.43	**2.50**	**1.07**	**1.43**
Non- Residential									
Downtown Core (d)	2.40	1.25	1.15	2.40	1.25	1.15	**2.40**	**1.25**	**1.15**
Regional Commercial	-	-	-	1.97			**-**	**-**	**-**
General Commercial	1.96	0.85	1.11	1.97	0.86	1.11	**1.96**	**0.85**	**1.11**
Highway Service Commercial	2.66	1.32	1.34	1.97	0.98	1.00	**2.66**	**1.32**	**1.34**
Neighborhood Commercial (f)				1.97	0.86	1.11	**1.97**	**0.86**	**1.11**
Medical/Professional Office (f)				2.00	0.87	1.13	**2.00**	**0.87**	**1.13**
Light Industrial	1.70	0.41	1.30	1.96	0.47	1.49	**1.70**	**0.41**	**1.30**
Heavy Industrial (d)	2.47	0.88	1.58	2.47	0.88	1.58	**2.47**	**0.88**	**1.58**
Public/Quasi-Public (d,c)	2.59	0.45	2.14	2.59	0.45	2.14	**2.59**	**1.00**	**1.59**
Parks and Recreation (d,e)	3.77	0.57	3.20	3.77	0.57	3.20	**3.77**	**0.57**	**3.20**
Open Space									
Agriculture									

(a) From Table 2-2
(b) From Table 2-3
(c) Other land uses split between potable and non-potable is based on Low Density Residential percentage which is 39% potable - See Table 3.
(d) Recommended useing the data from others, existing data appears abnormal, likely do to vacancy or other onsite water source.
(e) assumes that 15% of total water use of a park and recreational facility will be potable water use (drinking fountains and bathrooms).
(f) The split between potable and non-potable is based on the value from Table 2-2 for General Commercial .

Table 2-5 City of Patterson Compact Plan Land Use Alternative - Estimated Water Demands

Land Use Designation	2009 (existing Land Use)	Compact Plan		Recommended Demand Factors			Demands (a)				
		2030	Build out	Annual Demand	Potable	Non-Potable	Existing	2030 ac-ft/year		Build out (ac-ft/year)	
	Acres	Acres	Acres	ac-ft/ac	ac-ft/ac	ac-ft/ac	af-ft/year	Potable	Non-potable	Potable	Non-potable
Residential											
Mixed Use Hillside Development	-	-	-	2.8	1.1	1.7	-	-	-	-	-
Neighborhood Village	-	1,344	2,141	2.3	0.9	1.4	-	1,167.0	1,857.0	1,859.0	2,958.3
Estate Residential	27	176	176	1.3	0.5	0.8	33.8	105.6	114.4	105.6	114.4
Low Density Residential	1,168	1,303	1,303	3.1	1.2	1.9	3,648.0	3,810.7	258.9	3,810.7	258.9
Medium Density Residential	68	369	369	3.0	1.2	1.9	206.5	559.1	561.2	559.1	561.2
High Density Residential	44	58	58	5.2	1.9	3.2	227.1	254.1	45.2	254.1	45.2
Downtown Residential	203	203	203	2.5	1.1	1.4	507.5	507.5	-	507.5	-
Non- Residential											
Downtown Core	82	69	69	2.4	1.2	1.1	196.6	180.3	(14.9)	180.3	(14.9)
Regional Commercial	-	-	-	0.0	0.0	0.0	-	-	-	-	-
General Commercial	62	415	481	2.0	0.9	1.1	121.4	421.9	390.8	478.1	463.8
Highway Service Commercial	53	52	70	2.7	1.3	1.3	141.0	139.7	(1.3)	162.8	22.2
Neighborhood Commercial	-	-	-	2.0	0.9	1.1	-	-	-	-	-
Medical/Professional Office	2	6	6	2.0	0.9	1.1	4.0	7.5	4.5	7.5	4.5
Light Industrial	311	1,648	1,875	1.7	0.4	1.3	529.3	1,073.1	1,731.8	1,165.4	2,025.9
Heavy Industrial	132	153	153	2.5	0.9	1.6	325.7	344.2	33.2	344.2	33.2
Public/Quasi-Public	325	410	422	2.6	1.0	1.6	842.5	927.5	135.3	939.5	154.4
Parks and Recreation	167	258	258	3.8	0.6	3.2	629.2	680.6	291.4	680.6	291.4
Open Space											
Agriculture											
					Totals		**7,412.4**	**10,178.9**	**5,407.6**	**11,054.6**	**6,918.6**
							Total 2030		**15,586.5**		
							Total Build out				**17,973.2**

(a) The calculation of future demands assumes that all existing demands will remain solely supplied by potable water. It is assumed that the cost to bring a dual system into the already developed areas would be prohibitive. The split as shown assumes that all future development will have dual plumbing systems (Potable and Irrigation).

Table 2-6 City of Patterson Jobs Emphasis Plan Land Use Alternative - Estimated Water Demands

Land Use Designation	2009 (existing Land Use) Acres	Jobs Emphasis Plan 2030 Acres	Jobs Emphasis Plan Build out Acres	Recommended Demand Factors Annual Demand ac-ft/ac	Recommended Demand Factors Potable ac-ft/ac	Recommended Demand Factors Non-Potable ac-ft/ac	Demands (a) Existing af-ft/year	Demands (a) 2030 ac-ft/year Potable	Demands (a) 2030 ac-ft/year Non-potable	Demands (a) Build out (ac-ft/year) Potable	Demands (a) Build out (ac-ft/year) Non-potable
Residential											
Mixed Use Hillside Development	-	-	650	2.8	1.1	1.7	-	-	-	689.8	1,097.7
Neighborhood Village	-	2,043	3,644	2.3	0.9	1.4	-	1,773.9	2,822.9	3,164.0	5,035.0
Estate Residential	27	176	1,038	1.3	0.5	0.8	33.8	105.6	114.4	521.4	776.1
Low Density Residential	1,168	1,303	1,303	3.1	1.2	1.9	3,648.0	3,810.7	258.9	3,810.7	258.9
Medium Density Residential	68	369	369	3.0	1.2	1.9	206.5	559.1	561.2	559.1	561.2
High Density Residential	44	58	58	5.2	1.9	3.2	227.1	254.1	45.2	254.1	45.2
Downtown Residential	203	203	203	2.5	1.1	1.4	507.5	507.5	-	507.5	-
Non- Residential											
Downtown Core	82	69	69	2.4	1.2	1.1	196.6	180.3	(14.9)	180.3	(14.9)
Regional Commercial	-	-	-	0.0	0.0	0.0	-	-	-	-	-
General Commercial	62	712	792	2.0	0.9	1.1	121.4	674.7	719.6	742.9	808.3
Highway Service Commercial	53	52	113	2.7	1.3	1.3	141.0	139.7	(1.3)	219.8	80.4
Neighborhood Commercial	-	-	-	2.0	0.9	1.1	-	-	-	-	-
Medical/Professional Office	2	6	6	2.0	0.9	1.1	4.0	7.5	4.5	7.5	4.5
Light Industrial	311	1,701	1,701	1.7	0.4	1.3	529.3	1,094.7	1,800.5	1,094.7	1,800.5
Heavy Industrial	132	153	153	2.5	0.9	1.6	325.7	344.2	33.2	344.2	33.2
Public/Quasi-Public	325	410	444	2.6	1.0	1.6	842.5	927.5	135.3	961.5	189.4
Parks and Recreation	167	258	258	3.8	0.6	3.2	629.2	680.6	291.4	680.6	291.4
Open Space											
Agriculture											
					Totals		**7,412.4**	**11,060.2**	**6,770.9**	**13,738.3**	**10,967.0**
							Total 2030		**17,831.1**		
							Total Build out				**24,705.4**

(a) The calculation of future demands assumes that all existing demands will remain solely supplied by potable water. It is assumed that the cost to bring a dual system into the already developed areas would be prohibitive. The split as shown assumes that all future development will have dual plumbing systems (Potable and Irrigation).

Table 2-7 City of Patterson PC Plan Land Use Alternative - Estimated Water Demands

Land Use Designation	2009 (existing Land Use)	PC Plan		Recommended Demand Factors			Demands (a)				
		2030	Build out	Annual Demand	Potable	Non-Potable	Existing	2030 ac-ft/year		Build out (ac-ft/year)	
	Acres	Acres	Acres	ac-ft/ac	ac-ft/ac	ac-ft/ac	af-ft/year	Potable	Non-potable	Potable	Non-potable
Residential											
Mixed Use Hillside Development	-	-	650	2.8	1.1	1.7	-	-	-	689.8	1,097.7
Neighborhood Village	-	3,646	4,569	2.3	0.9	1.4	-	3,165.7	5,037.8	3,967.1	6,313.1
Estate Residential	27	485	1,027	1.3	0.5	0.8	33.8	254.7	351.6	516.1	767.6
Low Density Residential	1,168	1,303	1,303	3.1	1.2	1.9	3,648.0	3,810.7	258.9	3,810.7	258.9
Medium Density Residential	68	369	369	3.0	1.2	1.9	206.5	559.1	561.2	559.1	561.2
High Density Residential	44	139	139	5.2	1.9	3.2	227.1	410.6	306.8	410.6	306.8
Downtown Residential	203	203	203	2.5	1.1	1.4	507.5	507.5	-	507.5	-
Non- Residential											
Downtown Core	82	69	69	2.4	1.2	1.1	196.6	180.3	(14.9)	180.3	(14.9)
Regional Commercial	-	-	-	0.0	0.0	0.0	-	-	-	-	-
General Commercial	62	421	487	2.0	0.9	1.1	121.4	427.0	397.4	483.2	470.5
Highway Service Commercial	53	52	113	2.7	1.3	1.3	141.0	139.7	(1.3)	219.8	80.4
Neighborhood Commercial	-	-	-	2.0	0.9	1.1	-	-	-	-	-
Medical/Professional Office	2	6	6	2.0	0.9	1.1	4.0	7.5	4.5	7.5	4.5
Light Industrial	311	2,033	2,124	1.7	0.4	1.3	529.3	1,229.7	2,230.5	1,266.7	2,348.4
Heavy Industrial	132	153	153	2.5	0.9	1.6	325.7	344.2	33.2	344.2	33.2
Public/Quasi-Public	325	410	443	2.6	1.0	1.6	842.5	927.5	135.3	960.5	187.8
Parks and Recreation	167	258	258	3.8	0.6	3.2	629.2	680.6	291.4	680.6	291.4
Open Space											
Agriculture											
	2,644	9,547	11,913		**Totals**		**7,412.4**	**12,644.9**	**9,592.5**	**14,603.9**	**12,706.7**
							Total 2030		**22,237.4**		
							Total Build out				**27,310.7**

(a) The calculation of future demands assumes that all existing demands will remain solely supplied by potable water. It is assumed that the cost to bring a dual system into the already developed areas would be prohibitive. The split as shown assumes that all future development will have dual plumbing systems (Potable and Irrigation).

Table 2-8 Estimated Water Demands by Land Use Alternative - City of Patterson 2010 General Plan Update

Land Use Alternative		Demands		
		Potable Ac-ft/yr	Non-Potable Ac-ft/yr	Total Ac-ft/yr
	Existing	7,412		
Comp (a)	2030	10,179	5,408	15,587
	Build out	11,055	6,919	17,973
Jobs Emphasis (b)	2030	11,060	6,771	17,831
	Build out	13,738	10,967	24,705
PC (c)	2030	12,645	9,592	22,237
	Build out	14,604	12,707	27,311

(a) From Table 2-5
(b) From Table 2-6
(c) From Table 2-7

Section 3 Water Supplies

In this section, the existing water supplies and potential supplies available to meet the years 2030 and 2050 (build-out) demands are presented. Both potable and non-potable water supplies are addressed for each land use plan. Using the local water resources, potential supplies to serve all three land use development scenarios under all water year conditions have been identified.

Introduction

Traditional water supplies for municipal development in the Central Valley consist of groundwater and surface water. Surface water sources include local rivers, reservoirs, and state/federal water project conveyance systems. In California, all surface water is allocated, hence acquiring surface water entitlements require that the water be obtained from a current holder of the entitlement through purchase, exchange, dedication, etc. Surface waters on the Westside of the Central Valley are supplied through man-made canals owned and operated by the U.S. Bureau of Reclamation (Central Valley Project) and State of California (State Water Project) or from the San Joaquin River.

Delivery of water from state or federal water projects is limited for non-federal or non-state water contractors. The City is neither a state nor a federal contractor. However, all three water and irrigation districts that currently serve the general plan area are federal contractors and receive water from the Central Valley Project through the Delta Mendota Canal. These water sources and their potential uses in the future are discussed in more detail below.

Some local surface water is pumped directly from the San Joaquin River, but only for irrigation since the state prohibits its use as a source for drinking water. Both irrigation districts serving the general plan area have rights to water from the San Joaquin River. These water sources are discussed below in more detail.

The City has limited ability to bring water into the City from sources outside of local water providers without the construction of significant conveyance facilities. The supply plan discussed in this memo does not require the City to seek new, reliable surface water sources. Additionally, delivery of new water supplies to the City through existing facilities such as the California Aqueduct or the Delta Mendota Canal, outside of those supplies currently serving the general plan area, may be unrealistic at this time due to the complexities of the water pumped from the Delta, competing interests, environmental constraints, capacity, reliability, costs, etc. Similar downstream constraints affect additional deliveries from the river. The complexities of securing new outside water sources are defined in greater detail in the City's "Water Supply Planning Study" completed by H_2O Group in August 2006.

In contrast to surface supplies, groundwater use does not require a right or entitlement. The State of California does not enforce groundwater management statutes, thereby placing groundwater management at the local level. The City uses groundwater, claiming legal access through California groundwater law which allows an appropriator the right to pump and use the local groundwater for beneficial use. Appropriative rights are second only to "overlying" rights of property owners. The City has well ordinances that protect the groundwater and minimize impacts of the pumping activities on private wells. This water supply plan calls for the City to increase its role in the management of the local groundwater basin and discusses programs to help the recharge of the basin to increase production levels.

Recently, numerous cities and water purveyors in California have initiated programs to use non-potable water sources for outdoor irrigation since traditional sources are either unavailable or too costly. In 2008, the City approved and adopted a non-potable water supply plan and began implementation of a non-potable water system. Construction of a non-potable system allows the City to expand their source water options, including non-potable water deliveries for irrigation, and the option to use recycled (reclaimed) wastewater in the future.

Conservation will also play a key role in the City's future water supply program. Senate Bill 7 was passed in November 2009 that seeks a 20 percent reduction in per capita water use state-wide by the year 2020. This water plan depends on both conservation within the existing service area and the requirement that future development use less water than land use demand factors defined earlier in Table 2-4.

Background and Assumptions

A primary objective for meeting future water supplies is to maximize local control and minimize variables controlled by regional water interests. In addition, ample supplies currently serve the general plan area (explained in greater detail below), enough to meet water demands for all land use alternatives in all water years, so the very difficult process of securing new water supplies from outside the area is not necessary at this time.

The water supply strategy for the City's general plan area is based on the conjunctive use of groundwater augmented by surface water supplies that currently serve the area, and a much greater reliance on conservation and recycled water to offset traditional potable water uses.

The City currently uses groundwater as the only source of water. In the future, the projected growth will fill in vacant lands within the City and will extend into the current boundaries of another water district, two irrigation districts and some private land. This report summarizes the current deliveries by each of the water purveyors that serve the areas within the general plan boundaries.

Several key assumptions make up the basis for the approach to meeting future water demands, which are defined below and discussed in more detail in the following pages:

- At least some of the water currently serving the proposed general plan land use alternative areas will continue to serve these areas. Essentially, local irrigation and water districts will continue supplying surface water to those areas they have served historically. Prior to annexing to the City, agreements will be made between the City, property owners, and irrigation/water districts how existing water supplies will be retained and delivered to the City for serving those properties. One alternative to retaining the water currently serving those areas is for properties to remain within local irrigation and water districts service areas when annexed into the City. Eliminating application of existing surface water supplies to irrigation district properties could adversely impact the availability of groundwater due to a reduction in recharge.

- Future development will be required to put in dual plumbing systems so that, as a minimum, all new outdoor use of water can be met with non-potable supplies, including residential.

- Senate Bill 7 (passed November 2009) requires the state to reduce urban per capita water use by 20 percent by the year 2020. This memo assumes the City, as an urban water provider, will meet this reduction in their existing (2010) service area. This 20 percent reduction does not include the use of recycled water or existing conservation efforts. Recycled water represents an additional reduction beyond the 20 percent.

- Future development will also be required to promote less water use per state water code, a 20 percent reduction from the proposed water demand factors. This 20 percent reduction is independent of the use of recycled water.

- The City will use recycled water from its own wastewater treatment plant to meet a portion of the overall outdoor demands. By the Year 2050, and depending on both the land plan alternative and the success of the groundwater recharge program discussed below, the City may need to extend recycled water to all outdoor water use areas currently (2010) receiving potable water.

- Year-to-year reliability of surface water may require a greater dependency on groundwater, so groundwater management will be a primary objective of the City's water program.

Table 3-1 summarizes the estimated demands for each land use alternative. The PC land use plan produces the largest water demands for the City in the future.

Existing Water Purveyors in General Plan Area

Three water purveyors exist in the general plan area other than the City. These include the Patterson Irrigation District (PID), West Stanislaus Irrigation District (WSID) and the Del Puerto Water District (DPWD). Currently, some land located west of Interstate 5 does not currently fall in any districts' service area. In addition, two areas within the existing City boundaries overlap with irrigation district boundaries: DPWD near Interstate 5, and PID in a large triangular parcel located on the northeast corner of Sperry and Ward. Figure 3-1 presents each district's boundary overlaid on the PC land use plan map. Table 3-2 shows the total acreage within each water service area.

It is assumed in this document that the City will require all future property owners requesting annexation to secure the continued delivery of the existing water entitlements associated with their properties. The general characteristics of each of the water purveyors are discussed below. Their existing water rights are discussed in the following section.

Patterson Irrigation District PID is located on the east side of the City, primarily east of Highway 33. Depending on the land use scenario, as many as 3,500 acres of land currently in the PID service area, fall within the general plan area boundaries. The water demands generated by general plan land uses with PID service area can be as high as 7,600 ac-ft per year.

PID has multiple sources of water which include: 1) Central Valley Project water from the Delta Mendota Canal, 2) groundwater, 3) pre-1914 water rights to the San Joaquin River, and 4) a drainage reclamation and groundwater recharge program. Due to the multiple water rights, PID has a reliable water supply program capable of meeting most or all demands under all water year scenarios.

PID is governed by registered voters within the district boundary. PID was switched from a water district to an irrigation district in 1999 so they could provide electrical power to customers and extend the delivery outside district boundaries.

West Stanislaus Irrigation District WSID is located north of the City, west of Hwy 33. It is bordered on the east by PID and on the west by DPWD. WSID has approximately 2,100 acres of land that falls within the general plan land use plans. The water demands generated by the land uses within WSID service area can be as high as 4,175 ac-ft per year.

Table 3-1 Projected City of Patterson Water Demands by Water Year Type and by Land Use Plan

Water Year Type	Percent Reduction	Water Demand Per Year and Land Use Plan (Ac-ft)											
		Comp Plan				Jobs				PC			
		2030		Build-out		2030		Build-out		2030		Build-out	
		Potable	Total	Potable	Total	Potable	Total	Potable	Total	Potable	Total	Potable	Total
Normal	0%	10,179	15,587	11,055	17,973	11,060	17,831	13,738	24,705	12,645	22,237	14,604	27,311
Dry	0%	10,179	15,587	11,055	17,973	11,060	17,831	13,738	24,705	12,645	22,237	14,604	27,311
Multiple Dry	0%	10,179	15,587	11,055	17,973	11,060	17,831	13,738	24,705	12,645	22,237	14,604	27,311
Extremely Dry (a)	10%	9,161	14,028	9,949	16,176	9,954	16,048	12,364	22,235	11,380	20,014	13,144	24,580

(a) 10% reduction is in response to mandatory conservation and is in addition to any convservation practices in place at the time.

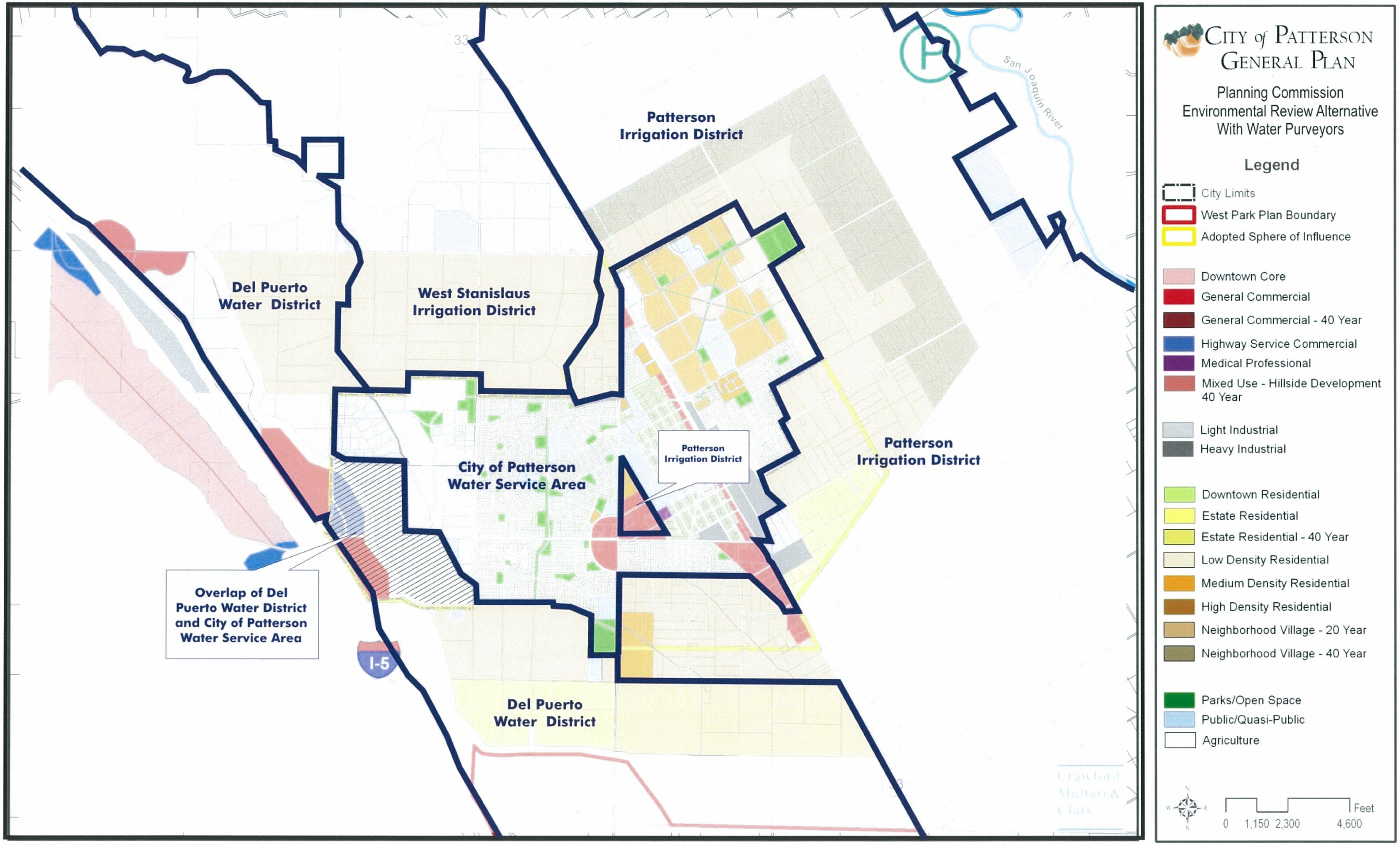

City of Patterson
General Plan
Planning Commission
Environmental Review Alternative
With Water Purveyors
Legend
City Limits
West Park Plan Boundary
Adopted Sphere of Influence
Downtown Core
General Commercial
General Commercial - 40 Year
Highway Service Commercial
Medical Professional
Mixed Use - Hillside Development 40 Year
Light Industrial
Heavy Industrial
Downtown Residential
Estate Residential
Estate Residential - 40 Year
Low Density Residential
Medium Density Residential
High Density Residential
Neighborhood Village - 20 Year
Neighborhood Village - 40 Year
Parks/Open Space
Public/Quasi-Public
Agriculture
0 1,150 2,300 4,600
Feet
Patterson Irrigation District
Del Puerto Water District
West Stanislaus Irrigation District
City of Patterson Water Service Area
Patterson Irrigation District
Patterson Irrigation District
Overlap of Del Puerto Water District and City of Patterson Water Service Area
Del Puerto Water District
San Joaquin River
I-5

Table 3-2 Water Purveyor Allocations of Water to Lands Within the City of Patterson's General Plan Land Use Areas

Land Use Plan		Water District Allocations of Water for General Plan Areas		
		West Stanislaus Irrigation District	Del Puerto Water District	Patterson Irrigation District
		Acres	Acres	Acres
Compact Plan				
	2030	1,066	676	988
	Build-out	1,066	1,334	1,430
Jobs Emphasis Plan				
	2030	1,471	1,326	982
	Build-out	1,471	2,637	2,224
PC Plan				
	2030	1,807	1,756	2,273
	Build-out	1,807	2,365	3,195

WSID has multiple sources of water which include: 1) Central Valley Project water from the Delta Mendota Canal, 2) groundwater, and 3) state rights to the water they take from San Joaquin River. Due to the multiple water rights, WSID has a reliable water supply program capable of meeting most or all demands under all water year scenarios. WSID, like PID, is also governed by registered voters within the district.

Del Puerto Water District DPWD extends nearly 50 miles primarily along the east side of Interstate 5 from the City of Tracy to Santa Nella. DPWD currently serves the lands west of the City and west of Hwy 33 on the south side of the City. Approximately 1,845 acres of land in the City's general plan area are currently in DPWD.

DPWD currently has access only to Central Valley Project water from the Delta Mendota Canal. They recently received a federal grant to install 20 wells within their service area. They are also working on an agreement with the City of Modesto for the use of recycled water. DPWD does not have reliable water supplies for all water year types and is actively working to increase reliably and secure additional water supplies. DPWD is governed by land owners within the district.

Table 3-3 summarizes the water demands generated by the general plan land use alternatives for both 2030 and build-out within each water district.

Table 3-3 Summary of the City of Patterson General Plan Land Water Demands (Ac-ft) by Water Purveyor - Normal Water Year

Land Use Plan	WSID			DPWD			PID			Private			City of Patterson		
	Potable (ac-ft)	Non-Potable (ac-ft)	Total (ac-ft)	Potable (ac-ft)	Non-Potable (ac-ft)	Total (ac-ft)	Potable (ac-ft)	Non-Potable (ac-ft)	Total (ac-ft)	Potable (ac-ft)	Non-Potable (ac-ft)	Total (ac-ft)	Potable (ac-ft)	Non-Potable (ac-ft)	Total (ac-ft)
Compact Plan															
2030	811	1,420	**2,230**	330	850	**1,180**	797	1,234	**2,032**	-	-	**-**	8,483	1,564	**10,047**
Build-out	811	1,420	**2,230**	798	1,716	**2,514**	1,181	1,845	**3,026**	-	-	**-**	8,507	1,589	**10,095**
Jobs Emphasis Plan															
2030	1,284	2,001	**3,285**	743	1,638	**2,381**	792	1,226	**2,018**	-	-	**-**	8,483	1,566	**10,049**
Build-out	1,284	2,001	**3,285**	1,549	2,892	**4,441**	1,870	2,942	**4,812**	690	1,098	**1,788**	8,587	1,684	**10,271**
PC Plan															
2030	1,234	2,402	**3,636**	1,193	2,155	**3,349**	2,008	3,149	**5,157**	-	-	**-**	8,472	1,548	**10,021**
Build-out	1,234	2,402	**3,636**	1,512	2,645	**4,156**	2,808	4,423	**7,232**	690	1,098	**1,788**	8,623	1,801	**10,423**

Existing Water Supplies to the General Plan Area

The following describes the water supplies, both potable and non-potable, that currently serve the general plan land use areas. The reliability of each supply for a variety of water year types is also addressed.

The entitlement/allocation of water currently available to each land use area is based on acreage and, thus, changes depending on the land use scenario and is summarized in Table 3-4. This table indicates how much water could potentially be provided based on current deliveries by existing purveyors. Due to reliability probabilities, there are very few years when all of the water shown would be available. Table 3- 5 defines the reliability in percentage of each supply in any given type water year. Tables 3-6, 3-8, 3-10 and 3-12 summarize the amount of water the City can safely anticipate utilizing in any given water year at build-out. Tables 3-7, 3-9, 3-11, and 3-13 shows the further breakdown of supplies between potable and non-potable for each water year type at build-out. For this study, four water year types were evaluated:

- **Wet or Normal** - Normal or wet water years are those water years that match or exceed median rainfall and runoff levels. The reliability of each of the City's current and future water supplies and their projected availability during normal and wet years is presented in Table 3-5.
- **Single Dry** - A single dry year is generally considered to be the lowest annual runoff for a watershed recorded since the 1903-04 water year. Based on review of past studies, discussion with the water districts and San Luis Delta Mendota Water Authority (Central Valley Project operators), the reliability of each of the general plan's areas current and future water supplies and their projected availability during a single dry year are defined in Table 3-5.
- **Multiple Dry**- A multiple dry year period is generally considered to be the lowest average runoff recorded over a consecutive multiple year period (three years or more) for a watershed since 1903. For example, 1928-1934 and 1987-1992 were the two multi-year periods of lowest average runoff during the 20th Century in the Central Valley Basin. The reliability of each of the current and future water supplies serving the general plan area and their projected availability during a multiple dry year period is defined in Table 3-5.
- **Extremely Dry** – Historically, on the Central Valley Project, agricultural-reliability water could be cut to as little as 13 percent of its contractual allotment. However, now the challenges between Delta pumping and endangers species can potentially reduce deliveries to zero. The reliability of each of the City's current and future water supplies and their projected availability during an extreme dry year are defined in Table 3-5.

Table 3-4 Estimated Water Allocations for Supplies that each Agency has for Lands within the General Plan

	Water Right or Available Supply Quantity			Has Water Ever Been Used in General Plan Area	Has the water Ever Been Used by the City	Anticipated Potable or Non-Potable Supply
	Compact Plan Ac-ft/yr	Jobs Plan Ac-ft/yr	PC Plan Ac-ft/yr			
EXISTING						
Patterson Irrigation District						
Groundwater (a)	-	-	-	Yes	No	Non-Potable
River Water (c)	4,289	6,671	9,585	Yes	No	Non-Potable
CVP Water	2,860	4,447	6,390	Yes	No	Non-Potable
Subtotal PID	**7,149**	**11,118**	**15,974**			
West Stanislaus Irrigation District						
Groundwater (a)				Yes	No	Non-Potable
River Water (c)	3,199	4,412	5,421	Yes	No	Non-Potable
CVP Water	2,459	3,392	4,168	Yes	No	Non-Potable
Subtotal WSID	**5,658**	**7,804**	**9,589**			
Del Puerto Water District						
Groundwater (a)				Yes	No	Non-Potable
CVP Water	4,252	8,402	7,537	Yes	No	Non-Potable
Subtotal DPWD	**4,252**	**8,402**	**7,537**			
City of Patterson						
Groundwater (a)	7,500	7,500	7,500	Yes	Yes	Potable
Subtotal City	**7,500**	**7,500**	**7,500**			
Total Existing Supplies For General Plan Area	**24,559**	**34,824**	**40,600**			
FUTURE						
Recycled Water (b)	4,706	5,562	6,346	No	No	Both
Conservation	3,595	4,941	5,462	No	No	Both
Spreading Basins (d)	6,651	8,121	9,838	No	No	Both
Subtotal Future	**14,951**	**18,624**	**21,646**			
Total All Supplies	**39,511**	**53,447**	**62,246**			

a Studies completed in the City suggested that groundwater supplies in the area are limited. City of Patterson is estimating that 7,500 ac-ft/yr may be used for potable supplies. Relying on additional groundwater supplies in the Patterson General Plan areas without augmentation seems unreasonable.

b Provided by Lee Ro - based on wastewater generation rates and estimated treatment plant flows. Reduced by 5% to account for indoor water use conservation, and it assumes that use will only occur when irrigation demands exist, so 2/3 of the year. The rest of the year the recycled water will be used inthe spreading basin groundwater recharge program.

c Equals 3 ac-ft per acre per year.

d The spreading basins will also be used augment the groundwater basin recharge. They will make use of storm drainage runoff, winter recycled water production, and supplies that have a lower reliability by using them to augment the groundwater basins when they are available. This augmentation will allow the City to utilize additional groundwater production to meet both potable and non-potable future general plan area demands. See Table 3-18 for Calculations

Table 3-5 Percent of Anticipated Deliveries form each Water Source per Water Year Type

EXISTING	Normal/Wet	Single Dry	Multiple Dry	Extremely Dry
Patterson Irrigation District				
Groundwater (a)	0	0	0	0
River Water (d)	100	85	75	50
CVP Water	50	25	10	0
West Stanislaus Irrigation District				
Groundwater (a)	0	0	0	0
River Water (e)	100	60	40	25
CVP Water (b)	50	25	10	0
Del Puerto Water District				
Groundwater (a)	0	0	0	0
CVP Water	50	25	10	0
City of Patterson				
Groundwater (a)	100	100	100	100
FUTURE				
Recycled Water (b)	100	100	100	100
Conservation	100	100	100	100
Spreading Basin (c)	100	100	100	100

a Studies completed in the City have suggested that groundwater supplies in the area are limited. Under existing conditions it does not appear reasonable that any of the three water districts will be able to establish reliable groundwater supplies in the City's General Plan Area.

b West Stanislaus CVP contract allows for deliveries of both M&I and Ag water. If some portion of WSID contract were to be designated as M&I for Patterson then the reliability percentages may be increased slightly from the numbers shown.

c Represents the anticipated average safe yield over a 10 year period from the program.

d Patterson Irrigation District has pre1914 river rights. Percentage reliability for this supply is unknown. Values shown are estimated.

e WSID river rights reliability is unknown. The single dry year assumes that the right is reduced by the same percentage as the change in SJR index between normal and dry years (reduction of 40%). Values for Multiple Dry and Extremely Dry were estimated.

Table 3-6 City of Patterson General Plan Area at Build-out Normal Water Year Supply vs. Demand

	Normal/Wet Water Year Source Reliability Percentage	Assumed Water Allocations			General Plan Area Normal to Wet Water Year Water Supplies		
		Compact Plan Ac-ft/yr	Jobs Plan Ac-ft/yr	PC Plan Ac-ft/yr	**Compact Plan Ac-ft/yr**	**Jobs Plan Ac-ft/yr**	**PC Plan Ac-ft/yr**
EXISTING							
Patterson Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	100	4,289	6,671	9,585	4,289	6,671	9,585
CVP Water	50	2,860	4,447	6,390	1,430	2,224	3,195
Subtotal PID		*7,149*	*11,118*	*15,974*	**5,719**	**8,894**	**12,779**
West Stanislaus Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	100	3,199	4,412	5,421	3,199	4,412	5,421
CVP Water	50	2,459	3,392	4,168	1,230	1,696	2,084
Subtotal WSID		*5,658*	*7,804*	*9,589*	**4,428**	**6,108**	**7,505**
Del Puerto Water District							
Groundwater	0	-	-	-	-	-	-
CVP Water	50	4,252	8,402	7,537	2,126	4,201	3,768
Subtotal DPWD		*4,252*	*8,402*	*7,537*	**2,126**	**4,201**	**3,768**
City of Patterson							
Groundwater	100	7,500	7,500	7,500	7,500	7,500	7,500
Subtotal City		*7,500*	*7,500*	*7,500*	**7,500**	**7,500**	**7,500**
Total Existing Supplies For		*24,559*	*34,824*	*40,600*	**19,774**	**26,703**	**31,553**
FUTURE							
Recycled Water	100	4,706	5,562	6,346	4,706	5,562	6,346
Conservation	100	3,595	4,941	5,462	3,595	4,941	5,462
Spreading Basins	100	6,651	8,121	9,838	6,651	8,121	9,838
Subtotal Future		*14,951*	*18,624*	*21,646*	**14,951**	**18,624**	**21,646**
Total All Supplies		*39,511*	*53,447*	*62,246*	**34,725**	**45,327**	**53,198**
Total all Demands at Build-out					**17,973**	**24,705**	**27,311**
Shortfall (excess water)					**(16,752)**	**(20,621)**	**(25,888)**

Table 3-7 Potable and Non-Potable Water Demands and Normal to Wet Year Water Supplies for each of the City of Patterson General Plan Land Use Alternatives

	General Plan Area Normal to Wet Water Year Water Supplies								
	Compact Plan (ac-ft)			Jobs Plan (ac-ft)			PC Plan (ac-ft)		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total	Potable	Non-Potable	Total
EXISTING									
Patterson Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		4,289	4,289		6,671	6,671		9,585	9,585
CVP Water		1,430	1,430		2,224	2,224		3,195	3,195
Subtotal PID	-	5,719	5,719	-	8,894	8,894	-	12,779	12,779
West Stanislaus Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		3,199	3,199		4,412	4,412		5,421	5,421
CVP Water		1,230	1,230		1,696	1,696		2,084	2,084
Subtotal WSID	-	4,428	4,428	-	6,108	6,108	-	7,505	7,505
Del Puerto Water District									
Groundwater		-	-		-	-		-	-
CVP Water		2,126	2,126		4,201	4,201		3,768	3,768
Subtotal DPWD	-	2,126	2,126	-	4,201	4,201	-	3,768	3,768
City of Patterson									
Groundwater	7,500		7,500	7,500		7,500	7,500		7,500
Subtotal City	**7,500**	-	7,500	**7,500**	-	7,500	**7,500**	-	7,500
Total Existing Supplies For General	7,500	12,274	19,774	7,500	19,203	26,703	7,500	24,053	31,553
FUTURE									
Recycled Water (a)	1,000	3,706	4,706	2,300	3,262	5,562	2,300	4,046	6,346
Conservation (b)									
Existing	1,482			1,482			1,482		
Future	865	1,247		865	2,594		995	2,985	
Conservation total	2,347	1,247	3,595	2,347	2,594	4,941	2,477	2,985	5,462
Spreading Basins (c)	220	-	6,651	1,600	-	8,121	2,350	-	9,838
Subtotal Future	**3,567**	**4,953**	14,951	**6,247**	**5,855**	18,624	**7,127**	**7,031**	21,646
Total All Supplies	**11,067**	**17,227**	34,725	**13,747**	**25,059**	45,327	**14,627**	**31,083**	53,198
Total all Demands at Build-out	**11,055**	**6,919**	17,973	**13,738**	**10,967**	24,705	**14,604**	**12,707**	27,311
Shortfall (excess water)	**(13)**	**(10,308)**	(16,752)	**(9)**	**(14,091)**	(20,621)	**(23)**	**(18,377)**	(25,888)

a Recycled water use in potable areas (existing City) is limited to outdoor water use after conservation. The need for extending the recycled water into the existing service area increases as the need for potable demands increases. This is an expensive water source. If the spreading basins yields for additional potable groundwater supplies are greater than small yields assumed here, then using the spreading basins as an alternative to constructing recycled water facilities to almost all existing homes, should be reviewed.

b "Existing" represents the water produced when the existing City reduces its use by 20%. All "Existing" conservation results in potable supplies since existing customers do not currently have alternative irrigation supplies available to them. Future conservation reflects the lower water use developments that will be constructed in the City. It reflects both a reduction in indoor use (potable) and outdoor irrigation needs (non-potable).

c The need for the spreading basin to produce potable water increases as the expansion of the development scenarios. The numbers shown for spreading basins under potable and non-potable are only the amount needed to balance the water supplies with the demands. The number shown in the total column is the amount that is available to the spreading basin program based on Table 3-18.

Table 3-8 City of Patterson General Plan Area at Build-out Single Dry Year Water Supply vs. Demand

		Assumed Water Allocations			General Plan Area Single Dry Year Water Supplies		
	Normal/Wet Water Year Source Reliability Percentage	Compact Plan Ac-ft/yr	Jobs Plan Ac-ft/yr	PC Plan Ac-ft/yr	**Compact Plan Ac-ft/yr**	**Jobs Plan Ac-ft/yr**	**PC Plan Ac-ft/yr**
EXISTING							
Patterson Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	85	4,289	6,671	9,585	3,646	5,670	8,147
CVP Water	25	2,860	4,447	6,390	715	1,112	1,597
Subtotal PID		*7,149*	*11,118*	*15,974*	**4,361**	**6,782**	**9,744**
West Stanislaus Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	60	3,199	4,412	5,421	1,919	2,647	3,252
CVP Water	25	2,459	3,392	4,168	615	848	1,042
Subtotal WSID		*5,658*	*7,804*	*9,589*	**2,534**	**3,495**	**4,295**
Del Puerto Water District							
Groundwater	0	-	-	-	-	-	-
CVP Water	25	4,252	8,402	7,537	1,063	2,101	1,884
Subtotal DPWD		*4,252*	*8,402*	*7,537*	**1,063**	**2,101**	**1,884**
City of Patterson							
Groundwater	100	7,500	7,500	7,500	7,500	7,500	7,500
Subtotal City		*7,500*	*7,500*	*7,500*	**7,500**	**7,500**	**7,500**
Total Existing Supplies For		*24,559*	*34,824*	*40,600*	**15,458**	**19,877**	**23,423**
FUTURE							
Recycled Water	100	4,706	5,562	6,346	4,706	5,562	6,346
Conservation	100	3,595	4,941	5,462	3,595	4,941	5,462
Spreading Basins	100	6,651	8,121	9,838	6,651	8,121	9,838
Subtotal Future		*14,951*	*18,624*	*21,646*	**14,951**	**18,624**	**21,646**
Total All Supplies		*39,511*	*53,447*	*62,246*	**30,409**	**38,501**	**45,069**
Total all Demands at Build-out					**17,973**	**24,705**	**27,311**
Shortfall (excess water)					**(12,436)**	**(13,796)**	**(17,758)**

Table 3-9 Potable and Non-Potable Water Demands and Single Dry Year Water Supplies for each of the City of Patterson General Plan Land Use Alternatives

	General Plan Area Single Dry Year Water Supplies								
	Compact Plan (ac-ft)			Jobs Plan (ac-ft)			PC Plan (ac-ft)		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total	Potable	Non-Potable	Total
EXISTING									
Patterson Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		3,646	3,646		5,670	5,670		8,147	8,147
CVP Water		715	715		1,112	1,112		1,597	1,597
Subtotal PID	-	4,361	4,361	-	6,782	6,782	-	9,744	9,744
West Stanislaus Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		1,919	1,919		2,647	2,647		3,252	3,252
CVP Water		615	615		848	848		1,042	1,042
Subtotal WSID	-	2,534	2,534	-	3,495	3,495	-	4,295	4,295
Del Puerto Water District									
Groundwater		-	-		-	-		-	-
CVP Water		1,063	1,063		2,101	2,101		1,884	1,884
Subtotal DPWD	-	1,063	1,063	-	2,101	2,101	-	1,884	1,884
City of Patterson									
Groundwater	7,500		7,500	7,500		7,500	7,500		7,500
Subtotal City	**7,500**	-	7,500	**7,500**	-	7,500	**7,500**	-	7,500
Total Existing Supplies For General	7,500	7,958	15,458	7,500	12,377	19,877	7,500	15,923	23,423
FUTURE									
Recycled Water (a)	1,000	3,706	4,706	2,300	3,262	5,562	2,300	4,046	6,346
Conservation (b)									
Existing	1,482			1,482			1,482		
Future	865	1,247		865	2,594		995	2,985	
Conservation total	2,347	1,247	3,595	2,347	2,594	4,941	2,477	2,985	5,462
Spreading Basins (c)	220	-	6,651	1,600	-	8,121	2,350	-	9,838
Subtotal Future	**3,567**	**4,953**	14,951	**6,247**	**5,855**	18,624	**7,127**	**7,031**	21,646
Total All Supplies	**11,067**	**12,911**	30,409	**13,747**	**18,233**	38,501	**14,627**	**22,954**	45,069
Total all Demands at Build-out	**11,055**	**6,919**	17,973	**13,738**	**10,967**	24,705	**14,604**	**12,707**	27,311
Shortfall (excess water)	**(13)**	**(5,993)**	(12,436)	**(9)**	**(7,266)**	(13,796)	**(23)**	**(10,247)**	(17,758)

a Recycled water use in potable areas (existing City) is limited to outdoor water use after conservation. The need for extending the recycled water into the existing service area increases as the need for potable demands increases. This is an expensive water source. If the spreading basins yields for additional potable groundwater supplies are greater than small yields assumed here, then using the spreading basins as an alternative to constructing recycled water facilities to almost all existing homes, should be reviewed.

b "Existing" represents the water produced when the existing City reduces its use by 20%. All "Existing" conservation results in potable supplies since existing customers do not currently have alternative irrigation supplies available to them. Future conservation reflects the lower water use developments that will be constructed in the City. It reflects both a reduction in indoor use (potable) and outdoor irrigation needs (non-potable).

c The need for the spreading basin to produce potable water increases as the expansion of the development scenarios. The numbers shown for spreading basins under potable and non-potable are only the amount needed to balance the water supplies with the demands. The number shown in the total column is the amount that is available to the spreading basin program based on Table 3-18.

Table 3-10 City of Patterson General Plan Area at Build-out
Multiple Dry Years Water Supply vs Demand

		Assumed Water Allocations			General Plan Area Single Dry Year Water Supplies		
	Normal/Wet Water Year Source Reliablility Percentage	Compact Plan Ac-ft/yr	Jobs Plan Ac-ft/yr	PC Plan Ac-ft/yr	**Compact Plan Ac-ft/yr**	**Jobs Plan Ac-ft/yr**	**PC Plan Ac-ft/yr**
EXISTING							
Patterson Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	75	4,289	6,671	9,585	3,217	5,003	7,188
CVP Water	10	2,860	4,447	6,390	286	445	639
Subtotal PID		*7,149*	*11,118*	*15,974*	**3,503**	**5,448**	**7,827**
West Stanislaus Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	40	3,199	4,412	5,421	1,279	1,765	2,168
CVP Water	10	2,459	3,392	4,168	246	339	417
Subtotal WSID		*5,658*	*7,804*	*9,589*	**1,525**	**2,104**	**2,585**
Del Puerto Water District							
Groundwater	0	-	-	-	-	-	-
CVP Water	10	4,252	8,402	7,537	425	840	754
Subtotal DPWD		*4,252*	*8,402*	*7,537*	**425**	**840**	**754**
City of Patterson							
Groundwater	100	7,500	7,500	7,500	7,500	7,500	7,500
Subtotal City		*7,500*	*7,500*	*7,500*	**7,500**	**7,500**	**7,500**
Total Existing Supplies For		*24,559*	*34,824*	*40,600*	**12,954**	**15,892**	**18,666**
FUTURE							
Recycled Water	100	4,706	5,562	6,346	4,706	5,562	6,346
Conservation	100	3,595	4,941	5,462	3,595	4,941	5,462
Spreading Basins	100	6,651	8,121	9,838	6,651	8,121	9,838
Subtotal Future		*14,951*	*18,624*	*21,646*	**14,951**	**18,624**	**21,646**
Total All Supplies		*39,511*	*53,447*	*62,246*	**27,905**	**34,515**	**40,312**
Total all Demands at Buildout					**17,973**	**24,705**	**27,311**
Shortfall (excess water)					**(9,932)**	**(9,810)**	**(13,001)**

Table 3-11 Potable and Non-Potable Water Demands and Multiple Dry Year Water Supplies for each of the City of Patterson General Plan Land Use Alternatives

	General Plan Area Multiple Dry Years Water Supplies								
	Compact Plan (ac-ft)			Jobs Plan (ac-ft)			PC Plan (ac-ft)		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total	Potable	Non-Potable	Total
EXISTING									
Patterson Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		3,217	3,217		5,003	5,003		7,188	7,188
CVP Water		286	286		445	445		639	639
Subtotal PID	-	3,503	3,503	-	5,448	5,448	-	7,827	7,827
West Stanislaus Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		1,279	1,279		1,765	1,765		2,168	2,168
CVP Water		246	246		339	339		417	417
Subtotal WSID	-	1,525	1,525	-	2,104	2,104	-	2,585	2,585
Del Puerto Water District									
Groundwater		-	-		-	-		-	-
CVP Water		425	425		840	840		754	754
Subtotal DPWD	-	425	425	-	840	840	-	754	754
City of Patterson									
Groundwater	7,500		7,500	7,500		7,500	7,500		7,500
Subtotal City	**7,500**	-	7,500	**7,500**	-	7,500	**7,500**	-	7,500
Total Existing Supplies For General	7,500	5,454	12,954	7,500	8,392	15,892	7,500	11,166	18,666
FUTURE									
Recycled Water (a)	1,000	3,706	4,706	2,300	3,262	5,562	2,300	4,046	6,346
Conservation (b)									
Existing	1,482			1,482			1,482		
Future	865	1,247		865	2,594		995	2,985	
Conservation total	2,347	1,247	3,595	2,347	2,594	4,941	2,477	2,985	5,462
Spreading Basins (c)	220	-	6,651	1,600	-	8,121	2,350	-	9,838
Subtotal Future	**3,567**	**4,953**	14,951	**6,247**	**5,855**	18,624	**7,127**	**7,031**	21,646
Total All Supplies	**11,067**	**10,407**	27,905	**13,747**	**14,247**	34,515	**14,627**	**18,197**	40,312
Total all Demands at Build-out	**11,055**	**6,919**	17,973	**13,738**	**10,967**	24,705	**14,604**	**12,707**	27,311
Shortfall (excess water)	**(13)**	**(3,488)**	(9,932)	**(9)**	**(3,280)**	(9,810)	**(23)**	**(5,490)**	(13,001)

a Recycled water use in potable areas (existing City) is limited to outdoor water use after conservation. The need for extending the recycled water into the existing service area increases as the need for potable demands increases. This is an expensive water source. If the spreading basins yields for additional potable groundwater supplies are greater than small yields assumed here, then using the spreading basins as an alternative to constructing recycled water facilities to almost all existing homes, should be reviewed.

b "Existing" represents the water produced when the existing City reduces its use by 20%. All "Existing" conservation results in potable supplies since existing customers do not currently have alternative irrigation supplies available to them. Future conservation reflects the lower water use developments that will be constructed in the City. It reflects both a reduction in indoor use (potable) and outdoor irrigation needs (non-potable).

c The need for the spreading basin to produce potable water increases as the expansion of the development scenarios. The numbers shown for spreading basins under potable and non-potable are only the amount needed to balance the water supplies with the demands. The number shown in the total column is the amount that is available to the spreading basin program based on Table 3-18.

Table 3-12 City of Patterson General Plan Area at Build-out
Single Dry Year Water Supply vs. Demand

		Assumed Water Allocations			General Plan Area Single Dry Year Water Supplies		
	Normal/Wet Water Year Source Reliability Percentage	Compact Plan Ac-ft/yr	Jobs Plan Ac-ft/yr	PC Plan Ac-ft/yr	**Compact Plan Ac-ft/yr**	**Jobs Plan Ac-ft/yr**	**PC Plan Ac-ft/yr**
EXISTING							
Patterson Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	50	4,289	6,671	9,585	2,145	3,335	4,792
CVP Water	0	2,860	4,447	6,390	-	-	-
Subtotal PID		*7,149*	*11,118*	*15,974*	**2,145**	**3,335**	**4,792**
West Stanislaus Irrigation District							
Groundwater	0	-	-	-	-	-	-
River Water	25	3,199	4,412	5,421	800	1,103	1,355
CVP Water	0	2,459	3,392	4,168	-	-	-
Subtotal WSID		*5,658*	*7,804*	*9,589*	**800**	**1,103**	**1,355**
Del Puerto Water District							
Groundwater	0	-	-	-	-	-	-
CVP Water	0	4,252	8,402	7,537	-	-	-
Subtotal DPWD		*4,252*	*8,402*	*7,537*	**-**	**-**	**-**
City of Patterson							
Groundwater	100	7,500	7,500	7,500	7,500	7,500	7,500
Subtotal City		*7,500*	*7,500*	*7,500*	**7,500**	**7,500**	**7,500**
Total Existing Supplies For		*24,559*	*34,824*	*40,600*	**10,444**	**11,938**	**13,647**
FUTURE							
Recycled Water	100	4,706	5,562	6,346	4,706	5,562	6,346
Conservation	100	3,595	4,941	5,462	3,595	4,941	5,462
Spreading Basins	100	6,651	8,121	9,838	6,651	8,121	9,838
Subtotal Future		*14,951*	*18,624*	*21,646*	**14,951**	**18,624**	**21,646**
Total All Supplies		*39,511*	*53,447*	*62,246*	**25,396**	**30,562**	**35,293**
Total all Demands at Build-out					**16,176**	**22,235**	**24,580**
Shortfall (excess water)					**(9,220)**	**(8,327)**	**(10,714)**

Table 3-13 Potable and Non-Potable Water Demands and Extremely Dry Year Water Supplies for each of the City of Patterson General Plan Land Use Alternatives

	General Plan Area Multiple Dry Years Water Supplies								
	Compact Plan (ac-ft)			Jobs Plan (ac-ft)			PC Plan (ac-ft)		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total	Potable	Non-Potable	Total
EXISTING									
Patterson Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		2,145	2,145		3,335	3,335		4,792	4,792
CVP Water		-	-		-	-		-	-
Subtotal PID	-	2,145	2,145	-	3,335	3,335	-	4,792	4,792
West Stanislaus Irrigation District									
Groundwater		-	-		-	-		-	-
River Water		800	800		1,103	1,103		1,355	1,355
CVP Water		-	-		-	-		-	-
Subtotal WSID	-	800	800	-	1,103	1,103	-	1,355	1,355
Del Puerto Water District									
Groundwater		-	-		-	-		-	-
CVP Water		-	-		-	-		-	-
Subtotal DPWD	-	-	-	-	-	-	-	-	-
City of Patterson									
Groundwater	7,500		7,500	7,500		7,500	7,500		7,500
Subtotal City	**7,500**	-	7,500	**7,500**	-	7,500	**7,500**	-	7,500
Total Existing Supplies For General	7,500	2,944	10,444	7,500	4,438	11,938	7,500	6,147	13,647
FUTURE									
Recycled Water (a)	1,000	3,706	4,706	2,300	3,262	5,562	2,300	4,046	6,346
Conservation (b)									
Existing	1,482			1,482			1,482		
Future	865	1,247		865	2,594		995	2,985	
Conservation total	2,347	1,247	3,595	2,347	2,594	4,941	2,477	2,985	5,462
Spreading Basins (c)	220	-	6,651	1,600	700	8,121	2,340	-	9,838
Subtotal Future	**3,567**	**4,953**	14,951	**6,247**	**6,555**	18,624	**7,117**	**7,031**	21,646
Total All Supplies	**11,067**	**7,898**	25,396	**13,747**	**10,994**	30,562	**14,617**	**13,178**	35,293
Total all Demands at Build-out	**11,055**	**6,919**	17,973	**13,738**	**10,967**	24,705	**14,604**	**12,707**	27,311
Shortfall (excess water)	**(13)**	**(979)**	(7,422)	**(9)**	**(27)**	(5,857)	**(13)**	**(471)**	(7,983)

a Recycled water use in potable areas (existing City) is limited to outdoor water use after conservation. The need for extending the recycled water into the existing service area increases as the need for potable demands increases. This is an expensive water source. If the spreading basins yields for additional potable groundwater supplies are greater than small yields assumed here, then using the spreading basins as an alternative to constructing recycled water facilities to almost all existing homes, should be reviewed.

b "Existing" represents the water produced when the existing City reduces its use by 20%. All "Existing" conservation results in potable supplies since existing customers do not currently have alternative irrigation supplies available to them. Future conservation reflects the lower water use developments that will be constructed in the City. It reflects both a reduction in indoor use (potable) and outdoor irrigation needs (non-potable).

c The need for the spreading basin to produce potable water increases as the expansion of the development scenarios. The numbers shown for spreading basins under potable and non-potable are only the amount needed to balance the water supplies with the demands. The number shown in the total column is the amount that is available to the spreading basin program based on Table 3-18.

Groundwater The groundwater basin that underlies the City of Patterson has been used for a water supply for municipal and agricultural activities for many years, including the City of Patterson. The City's sole source of water is currently groundwater and will continue to be a potable water supply to the general plan area. Historical groundwater production in the City is shown in Table 3-14. The City currently has nine water supply wells with a total capacity of 9,300 gpm (approx 15,000 ac-ft per year), with projected annual production of 7,500 ac-ft. Current annual City water production is approximately 4,500 ac-ft annually. Full use of the existing groundwater system capacity (7,500 ac-ft) is anticipated. Groundwater use beyond this amount may still be available since: 1) the sustainable groundwater yield may support additional production for City growth, and 2) there are many existing private wells within the general plan alternatives areas that will be abandoned, allowing current production from these wells to be used by the City of Patterson. Unfortunately, the current production from these wells is unknown since pumping data is not available, nor has the recharge benefit of applied water been quantified. Hence, for purposes of this study, groundwater production is assumed to be limited to current system capacity, and additional groundwater capacity will occur through implementation of an artificial recharge program.

PID and WSID both currently have groundwater wells and can augment their current supplies. WSID and DPWD both have received federal grant money and will be constructing more wells, 7 for WSID, and 20 for DPWD.

Table 3-14 City of Patterson Historical Groundwater Production (ac-ft)

Year	2005	2006	2007	2008	2009
Total City of Patterson Groundwater Production (ac-ft)	3,502	3,750	3,272	4,401	3,836

(a) Number only reflect the production by the City. There are other groundwter users within the City limits (private wells) that are not reflected in these numbers.

The local groundwater basin has production limitations. It is estimated that an average of 7,500 acre feet/year of groundwater is available for the City's use. [1] Previous studies of the groundwater basin have indicated as much as 11,500 acre-feet/year is readily available from natural recharge. [2] Due to competing users of local groundwater, additional groundwater use by the City beyond 7,500 acre feet/year may require artificial recharge of supplementary sources through spreading basins or direct injection. Recharge programs could be performed by the City or done in cooperation with other water suppliers.

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[1] Net long-term use of 7,500 ac-ft/yr based on current use, development of groundwater pumping facilities, and previous groundwater studies. Groundwater use may vary year-to-year based on water year type, surface water availability, etc.

[2] Groundwater Pump Tests conducted 2006, Ken Schmidt & Associates, Groundwater Consultants, Fresno, Ca.

A more extensive overview of the local groundwater basin and its characteristics was conducted for this analysis by Ken Schmidt & Associates, Groundwater Hydrologists, and is provided in Appendix A.

Developing regional groundwater management programs that include local water stakeholders will be an important subsequent action to adoption of a new general plan. This process will be needed regardless to protect and manage local groundwater resources.

Central Valley Project Water All three of the irrigation and water districts serving the general plan area are federal water contractors with entitlements to water from the Central Valley Project (CVP). This federal water project was constructed to help meet the water needs of the lower San Joaquin Valley. The water Project's facilities are operated by the San Luis Delta Mendota Water Authority.

CVP deliveries have historically been subject to limitations. The current conflicts in the San Joaquin River Delta between pumping and fish populations have further reduced the project deliveries. Additionally, the Department of Health Services has historically opposed the use of this water for potable needs, because of the drainage flows that enter the system upstream of the City. Under current conditions, this water cannot be relied on by the City to meet future potable demands, but this water could be used to help augment groundwater supplies, and help meet non-potable demands during particular years. The City should take the necessary steps to ensure the continued delivery of this water to the general plan area in the future. Table 3-5 presents the estimated reliability of the CVP supplies in each water year.

San Joaquin River Water Both WSID and PID have the rights to water from the San Joaquin River. WSID can take up to 545 ac-ft a day when available, and PID is limited at their intake at around 340 ac-ft/day.

PID water rights were established prior to 1914, which allows them to use the water in almost all water years without restrictions. WSID has rights to divert water from State's Department of Water Resources and is subject to some pumping restrictions based on time of year and river flows; however, they have not had restrictions placed upon them in the last 30 years.

For both PID and WSID, the volume of water available to serve the areas within the general plan was estimated at 3.0 acre feet of water per acre of land. In reality, a much greater volume is likely available. The reliability of this amount of water was reduced dependent on water year type even though pumping restrictions have not occurred. In reality, PID and WSID can likely deliver the water every year, but reductions are shown just in case they have limitations that are unknown to us at this time.

WSID reliability to the river water was shown to be less than that shown for PID, to reflect WSID's junior water right. The reduction is arbitrary, but is based on San Joaquin River Index (see Table 3-15)[3]. The index shows a 40 percent reduction between a normal water year and dry years. It was assumed that WSID would also see this reduction in supplies (even though they never have). Further reductions for multiple dry and extremely dry years were estimated and are very conservative.

In both cases, the City would use this water in the future to help meet non-potable demands and as a source to the groundwater recharge program. These uses do not require the water to have a high reliability even though it does. Table 3-5 presents the percentage reliability assumed for each water source during each type of water year.

Table 3-15 San Joaquin River Index

Type Year	San Joaquin River Basin Index (ac-ft) (a)	Frequency of Occurrence Years 1904-	Frequency of Occurrence Percent	Percent Reduction in Index
Wet	3,800,000	35	34	
Normal	3,500,000	19	18	
Below Normal	2,800,000	17	17	40
Dry	2,100,000	15	15	
Extremely Dry	<2,100,000	17	17	

(a) Index is based on 60% of unimpaired runoff flows in Arpil though July, 20% of unimpaired runoff flows Oct to Mar, and 20% of last years' total flow capped at 4,500,000 ac-ft.

Water Conservation Water conservation is a key component in the City's future water supplies. The State of California passed Senate Bill 7 in November of 2009. The bill declares water a precious resource of the state and requires all water purveyors within the state to reduce water use by 20 percent by the year 2020. For the City, conservation measures include both for the existing service area and in future development.

The conservation that occurs within the existing service area produces additional potable water supplies by reducing current potable water uses. All water use, in-door and out-door, in the existing service area is currently potable.

Future land use conservation results in a reduced water use factor, and it has been assumed the developments will proceed with planning that requires 20 percent less water than what is shown based on the current demand factors (See Table 2-4 in Section 2 Water Demands). Please note this reduction is independent of water source. The state wants overall demands, whether with potable or non-potable water sources, to be reduced. In the state program, a credit towards meeting the 20 percent reduction in demand is given for the use of reclaimed or recycled water.

[3] Source: San Joaquin River Group Authority "Integrated Report - 2008 List of Impaired Waters and Surface Water Quality Assessment [303 (d)/ 305 (b)]," prepared by O'Laughlin & Paris LLP, Chico, CA, February 2007.

In this study, we are assuming the 20 percent reduction can be achieved independent of the use of recycled water. In this study, recycled water, discussed more below, represents an additional savings over and above the 20 percent reduction from conservation. Achieving the 20 percent conservation goal will be defined in the 2010 Urban Water Management Plan (2010 UWMP). The 2010 UWMPs completed throughout the state will define specific programs and actions of how each purveyor will reach target conservation goals.[4] The penalty for non-compliance could be ineligibility for future state funding until compliance is achieved.

The state is trying to determine a consistent method that can be used by all to calculate water use and demands. The determination on how to present data in the 2010 UWMPs is expected from the state in October of 2010. The deadline for submitting the UWMPs has been extended from the end of 2010 to June 2011, so that the statewide approach will be uniform. UWMPs are updated statewide every five years.

The state has defined 14 Best Management Practices (BMPs) to help achieve the 20 percent reduction in use goal. The 14 BMPs are shown in Table 3-16. The City's application of each will be defined in the 2010 UWMP.

Table 3-16 Water Conservation Best Management Practices

Best Management Practice	Definition
BMP 1	Water Survey Programs for Single-Family Residential and Multi-family Residential Customers
BMP 2	Residential Plumbing Retrofit
BMP 3	System Water Audits, Leak Detection and Repair
BMP 4	Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections
BMP 5	Large Landscape Water Audits and Incentives
BMP 6	High-efficiency Washing Machine Rebate Programs
BMP 7	Public Information Programs
BMP 8	School Education Programs
BMP 9	Commercial and Industrial Water Conservation
BMP 10	Wholesale Agency Assistance
BMP 11	Conservation Pricing
BMP 12	Conservation Coordinator
BMP 13	Water Waste Prohibition
BMP 14	Residential ULFT Replacement Programs

Achieving the state's goal of 20 percent reduction in current demands is assumed in this study, and used in supply calculations. The reason the City can achieve this goal is that approximately

[4] UWMP per California Water Code 10617

60 percent of City's annual residential water use is for outside / irrigation demands, and is consistent with other communities in this hydrologic zone (California Hydrologic Zone 6). Reductions in outdoor water use are easier to achieve than reductions in indoor water use. This study assumes that the City can reduce existing water use by 20 percent by the year 2030, 10 years after the state deadline.[5] The numbers presented in the study assume, for both existing and future water uses, that 5 percent of the total water reduction will occur indoors (potable) and the remaining 15 percent reductions will occur outdoors (non-potable). Table 3-17 shows demands factors for each future land use after consideration of conservation.

Reclaimed Water Reclaimed (recycled) water is tertiary treated municipal wastewater, and is proposed as a significant component of the City's water supply solution. The amount of reclaimed water available for use by the City is being determined as part of the General Plan Update. The recycled water potentially available to the City is shown in the attached Figure 3-2.[6]

In this study, projected wastewater volumes were reduced to account for projected reduction in existing and future indoor water use (5%), and use of reclaimed water during the irrigation season only 8 of 12 months (33%). It is assumed the City will use its current disposal methods for the treated wastewater when irrigation demands are low or potentially use these winter flows to support the groundwater recharge program discussed herein. With utilization of the winter flows, there is the potential for additional reclaimed supplies. However, storage of the winter flows in a lake or reservoir for subsequent use during the irrigation season is not considered feasible at this time due to the size of the storage facility (as large as 200 acres, 10 feet deep and lined to prevent leakage).

Depending on future availability of groundwater through the recharge program (discussed below), the need to extend recycled water service into the existing (2010) service area may arise. Recycled water delivered within the existing City limits offsets the potable water that is currently being used for that purpose and frees it up to be used by others elsewhere. The potential need for this recycled water/ potable water "exchange" increases as the demands increase. The need for exchanging potable water for recycled water has been adjusted to match the demands and is shown in Tables 3-6 through 3-13. In theory, after conservation, there will be 2,725 ac-ft of non-potable residential and commercial demands occurring within the currently City limits. This is the limit of potable water that can be exchanged for recycled water and is reflected in Tables 3-6 through 3-13. All additional recycled water use above 2,725 ac-ft per year is solely used to meet future non-potable demands.

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[5] The general plan is only looking at the years 2030 and build-out (2050). The conservation reduction goal of 20% per capita for the state is set for the year 2020. Since this study does not address the year 2020, it is assumed that the City will have met the conservation goal of 20% by 2030. In reality the City plans to meet the 20% reduction before the year 2020.

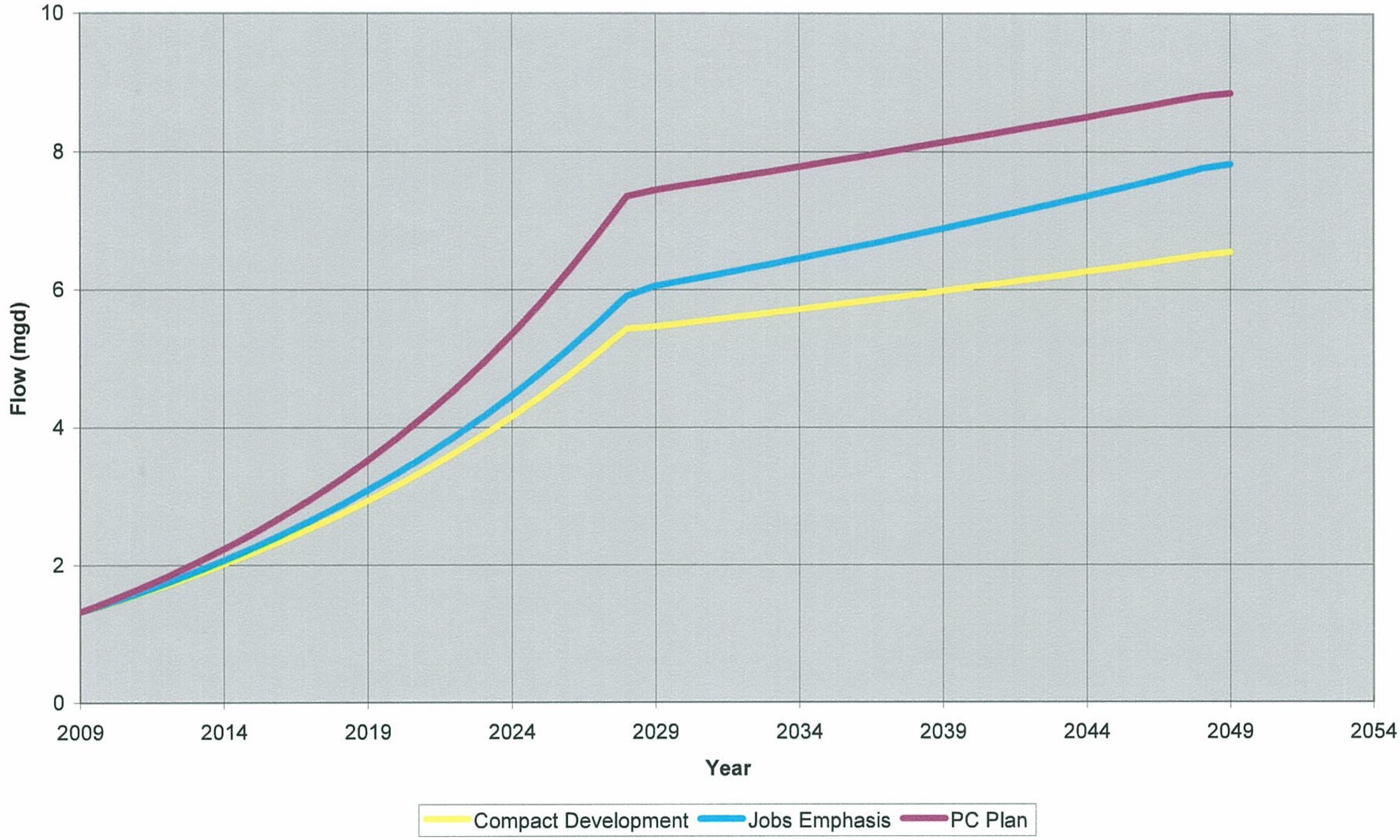
[6] Discussions with Lee & Ro, Inc. associated with GPU.

Table 3-17 City of Patterson Future Demand Factors (Existing Demands after 20% Conservation)

Land Use Designation	Demand Factors (b)			Recommended Future Demands Factors After Conservation (a)		
	Annual Demand ac-ft/ac	Potable ac-ft/ac	Non-Potable ac-ft/ac	Annual Demand ac-ft/ac	Potable ac-ft/ac	Non-Potable ac-ft/ac
Residential						
Mixed Use Hillside Development	2.75	1.06	1.69	2.20	0.92	1.28
Neighborhood Village	2.25	0.87	1.38	1.80	0.76	1.04
Estate Residential	1.25	0.48	0.77	1.00	0.42	0.58
Low Density Residential	3.12	1.21	1.92	2.50	1.05	1.45
Medium Density Residential	3.04	1.17	1.86	2.43	1.02	1.41
High Density Residential	5.16	1.93	3.23	4.13	1.67	2.46
Downtown Residential	2.50	1.07	1.43	2.00	0.95	1.05
Non- Residential						
Downtown Core	2.40	1.25	1.15	1.92	1.13	0.79
Regional Commercial	-	-	-	-	-	-
General Commercial	1.96	0.85	1.11	1.57	0.75	0.81
Highway Service Commercial	2.66	1.32	1.34	2.13	1.18	0.94
Neighborhood Commercial	1.97	0.86	1.11	1.58	0.76	0.82
Medical/Professional Office	2.00	0.87	1.13	1.60	0.77	0.83
Light Industrial	1.70	0.41	1.30	1.36	0.32	1.04
Heavy Industrial	2.47	0.88	1.58	1.97	0.76	1.21
Public/Quasi-Public	2.59	1.00	1.59	2.07	0.87	1.20
Parks and Recreation	3.77	0.57	3.20	3.01	0.38	2.64
Open Space	-	-	-	-	-	-
Agriculture	-	-	-	-	-	-

(a) Conservation reflects a 20% drop in water use. It is assumed that 25% of total conservation will be in potable demands and the other 75% would be in outdoor demands.
(b) Table 2-4 from Section 2 Water Demands.

City of Patterson Wastewater Production
Annual Flow Projections



The City of Modesto is actively planning a regional recycled water program that may include use of Modesto recycled wastewater on the west side of the valley. Modesto is currently in discussions with DPWD for the use of several thousand acre feet a year of recycled water deliveries. The City may find benefit in participating in the Modesto program by purchasing recycled water since the non-potable demands at build-out exceed the City's own recycled water production abilities. Continued discussions with the City of Modesto and Del Puerto Water District regarding this potential source of supply will be an important subsequent action to adoption of a new general plan.

Non-Potable Water The non-potable water demands for the City will exceed the amount of recycled water that will be generated by future development. Surface water from the local water and irrigation districts will be needed in the future to meet irrigation demands and provide a key source for the groundwater recharge program.

The City is presently implementing a non-potable water program to provide water for high irrigation demands, such as parks, schools, etc. Expansion of the non potable distribution system is required so that outdoor water demands can be served independent of the potable water system. This will reduce the total potable demand. The construction of this system is discussed more in Section 5 Infrastructure.

The non-potable water system will be supplied by both irrigation water from the surrounding districts and recycled water from the City's WWTP, or other source. The system could be operated in such a way as to keep the two sources of water isolated from each other.

The amounts of water needed from the irrigation districts as well as the amounts available are shown in Tables 3-6 through 3-13.

The responsibility of securing surface water for meeting future demands will be a shared responsibility between the landowners, City, and irrigation/water districts. Historically, the irrigation districts have de-annexed lands when the City annexed them. When the irrigation districts de-annexed lands, they have taken water with them. It will be in the best interest of the City and the land owners to retain historical water supplies to those lands annexed. The other option is to not de-annex from the irrigation districts and let them continue supplying water to the area as a wholesaler. The City would then take the water and deliver it to the customers. The two agencies would have overlapping service areas in this case.

Regardless, surface water deliveries to the proposed areas in the GPU are critical. It will be in the landowner and City's best interest to retain existing water entitlements as opposed to finding "new" water.[7] Although new water is an option, it is expected to be significantly more expensive, not as reliable, and expose the City to greater environmental and legal challenges.

Groundwater Management and Recharge "Groundwater management, as defined in DWR Bulletin 118, Update 2003, is the planned and coordinated monitoring, operation, and administration of a groundwater basin or portion of a groundwater basin with the goal of long-term sustainability of the resource."[8]

Groundwater is the sole source for potable water supplies in the City. The City is actively participating in regional water supply planning efforts currently, and will need to become part of a region-wide groundwater management program in the near future.

The DWR put together a bulletin on state groundwater. The bulletin is referred to as Bulletin 118. The latest update of the Bulletin 118 occurred in 2003. Within Bulletin 118 are case studies called "Boxes." Three case studies which apply to the programs outlined in this memo and of interest to the City are appended to this report (Appendix C).

- Box G - Managing a Basin through Integrated Water Management – Orange County
- Box H - Managing Groundwater using both Physical and Institutional Solutions – United Water Conservation District
- Box J - Managing Groundwater Quantity and Quality - DWR

The state is actively supporting the creation of groundwater management programs. A part of the City's program will be recharging of the groundwater basin to increase its reliability, assure its water quality and increase production quantities.

The City has multiple sources of water that could be used to recharge the groundwater basin and increase groundwater availability. Depending on the general plan land use selected, the City may need to increase annual groundwater basin production for potable use by 1,000 to 1,500 ac-ft during critically dry years at build-out. The various sources of water available to the City for groundwater recharge are described below in more detail.

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[7] "New" water would require the City to identify a seller of water outside of the local area, purchase the water, determine how the water could be conveyed to the City, and address all environmental impacts associated with the project.

[8] California State Department of Water Resources "Groundwater Management Center" http://www.water.ca.gov/groundwater/# . The document is located at http://www.water.ca.gov/pubs/groundwater/bulletin_118/california's_groundwater__bulletin_118_-_update_2003_/bulletin118_entire.pdf

The groundwater flows in the City are from the southeast towards the northwest, basically parallel to Highway 33 northbound. The ground slope is from the west down towards the San Joaquin River in the east. Thus, drainage is perpendicular to groundwater flows. Ideally, recharge would occur in the southern part of the City. However, the best soils for recharge are generally in areas of coarse alluvium, often found where drainage courses exit the coastal range. The most probable location for effective groundwater recharge basins is in the northwest area near where the DMC crosses Del Puerto Creek.

The City needs to proactively explore groundwater recharge and confirm assumptions prior to preparing specific plans for the new general plan areas. Under all development scenarios, the current supplies serving the general plan area exceed the demand, even at the reduced levels assumed in this memo and with the use of conservative reliability factors. If this source of water proves to be as viable as it appears, it may be a more cost-effective solution to increasing potable water demands than the expansion of the recycled water system into the existing City service areas. Table 3-18 provides an estimated 10 year average annual water production increase from the area if all available water sources were utilized. The table shows the recharge program could produce annual increases in groundwater production by 7,500 to 13,000 ac-ft per year. The City only needs about 10 percent of these totals to balance the water program.

PID is actively looking to establish a more extensive groundwater production program within or near the City's general plan area. PID has recently installed three high producing wells near the southeast portion of the general plan area along their main canal. Given the apparent limitations to groundwater production in the local area and corresponding surplus of surface supplies, PID might have interest in exploring cooperative groundwater recharge programs in this area. They are currently developing recharge systems using drainage water in other parts of their service area.

Drainage Water—The City's storm drainage water system should be designed as part of a groundwater basin recharge program. It is anticipated that with proper storm drain and drainage basin system designs, 2,500 to 4,500 ac-ft/year of storm runoff could be captured from groundwater recharge. This is based on a 10-year average and assumes: 60 percent of the annual rainfall actually turns into runoff, 50 percent of runoff is captured and put it into a spreading basin rather than letting it flow to the river, and that 50 percent of the water entering the basin will enter the groundwater table and be captured by a City well. Table 17 shows the estimated numbers for each water year type.

Table 3-18 Calculation for 10 year Average Estimated Production from Proposed City of Patterson Ground Water Recharge Program at build-out of Each Land Use Alternative

	Compact Plan			Jobs Plan			PC Plan		
Recharge Water Available	**ac-ft**	**Percentage (e)**	**10 year total**	**ac-ft**	**Percentage (e)**	**10 year total**	**ac-ft**	**Percentage (e)**	**10 year total**
Normal / Wet year (a)	10,101	52%	52,957	12,500	52%	65,535	16,050	52%	84,146
Below Normal (b,f)	5,785	17%	9,549	5,675	17%	9,366	7,920	17%	13,072
Dry year (c,f))	3,281	15%	4,778	1,689	15%	2,460	3,164	15%	4,607
Critically Dry (d)	2,569	17%	4,240	206	17%	340	876	17%	1,446
	Subtotal	**100%**	**71,524**	**Subtotal**	**100%**	**77,702**	**Subtotal**	**100%**	**103,271**
Storm Water Runoff	**Annual Rainfall (in) (h)**	**Percentage (e)**	**10 year total (g)**	**Annual Rainfall (in)**	**Percentage (e)**	**10 year total (g)**	**Annual Rainfall (in)**	**Percentage (e)**	**10 year total (g)**
Normal / Wet year	12	52%	15,325	12	52%	22,930	12	52%	24,892
Below Normal (b,f)	9	17%	11,494	9	17%	17,198	9	17%	18,669
Dry year (c,f))	6	15%	7,663	6	15%	11,465	6	15%	12,446
Critically Dry (d)	3	17%	3,831	3	17%	5,733	3	17%	6,223
	Subtotal		**38,313**	**Subtotal**		**57,325**	**Subtotal**		**62,229**
Recycled Water	ac-ft		10 year total	ac-ft		10 year total	ac-ft		10 year total
Winter Flows	2,318	100%	23,178	2,739	100%	27,393	3,126	100%	31,256
	Total		133,015			162,419			196,756
Recapture Rate		50%	66,508		50%	81,210		50%	98,378
Annual Average from GW Recharge at Build-out			**6,651**			**8,121**			**9,838**

a Table 3-6 - shortage less spreading basin
b Table 3-8 - shortage less spreading basin
c Table 3-10 - shortage less spreading basin
d Table 3-12 - shortage less spreading basin
e Table 3-15
f For purposes of this calculation Table 8 for Dry Year numbers were used for Below Normal in this table and Table 10 Multiple Dry Year was used as the Dry Year numbers in this table. This is a very conservative approach since the values in Tables 8 and 10 actually represent more extreme conditions than the Below Normal and Dry Year categories used in this table.
g 10 year rainfall runoff total assumes an average city wide runoff rate of 40%

Recycled Water—The recycled water program discussed above did not utilize the recycled water flows when irrigation demands are low during the winter. The City could utilize this water in a spreading or recharge basin. Utilizing the winter flows at build-out and assuming the recharge is only 50 percent effective would yield an additional 1,000 to 1,500 ac-ft per year. This water could also be used in exchange for other supplies from one of the local irrigation districts or to support a regional groundwater recharge program.

Irrigation Supplies San Joaquin River Water and Central Valley Project Water—This supply assessment relies on both the San Joaquin River water and the CVP water to meet future irrigation demands and for the recharge program. Recharge from these sources can conservatively produce between 4,500 and 6,500 ac-ft each year, assuming a capture rate of 50 percent, as shown in Table 3-18.

Groundwater recharge can occur in several different ways. The most common methods are spreading basins, pits, or through well injection. The City may find that a combination of these methods works best for them. Of these, three alternative spreading basins will likely be the easiest for the City. Conservatively, infiltration rates for waters applied to the spreading basins will be about 3 inches per day. If the basins are operated 8 months out of the year (not used in summer months) then each acre of spreading basin would produce 60 ac-ft of water per year.

This means if the City wanted to fully utilize its groundwater recharge potential the City may ultimately need up to 250 acres of land for recharge, if a 50 percent capture rate of the water applied to the spreading basin is assumed. Storm water detention basins can be used to meet some of the recharge acreage. To meet their long term needs though, the City will only need 25 to 40 acres of land of which the storm basins may be able to provide by themselves.

The City will need to ensure that future development plans account for the recharge areas needed to support the project's water demands. It is important the recharge basin be located in an area where recharge rates are optimized. Soil conditions are very important. The City may find the best place for storm drain basins is not necessarily in a good location for the recharge basin. If this is the case, then recharge basin land will be needed independent of acreage met by the storm drainage basins.

Regional Efforts

Several regional water-related efforts are occurring in which the City should participate:

West Stanislaus County The City has recently begun participating with others in the area that have an interest in water through a series of meetings and workshops to gain a better understanding of the available water resources.

The City should continue to take an active role in this program and explore regional projects that can help increase the supply reliability in the area. The City would greatly benefit from a regional groundwater management plan and this would be a logical group from which to initiate that document.

The City has the right to commence groundwater management (public utility code 11501), however, it would be better accomplished on a regional level with the two irrigation districts and water district. However the City chooses to proceed, locally or regionally, they should take an active role in the study and formation of a regional groundwater plan, looking at water quality and water quantity studies, recharge areas and sources. All who use water from the same basin as the City will benefit from a much broader understanding of the groundwater system.

Developers Meeting the water demands of growth in the general plan area will require a combination of new source development and conservation. The City will need to require that new developments design and build lower water-using projects, use reclaimed or non-potable water by installing dual plumbing systems, and secure water sources for new developments. This will represent a change in development conditions and responsibilities. However, expansion of the current City boundary may be limited and/or cost prohibitive without these programs.

Integrated Water Resource Management Plan The San Luis Delta Mendota Water Authority (SLDMWA) operates the Delta Mendota Canal which is part of the federal government's Central Valley Project. The Water Authority has developed an Integrated Water Resources Management Plan (IRWMP) for the Westside area. Although the City is not currently a Central Valley Project customer, water from this project is serving the proposed general plan area through each of the three irrigation/water districts.

SLDMWA has recently extended an invitation to the City to participate in this effort. The state's eligibility requirements for funding water projects include participation in regional planning efforts. The City may benefit from participating should they ever seek state funding. Other options may be available to the City, including a new eastside IRWMP proposed by City of Modesto that could also include Westside water stakeholders.

Recycled Water The City of Modesto's wastewater treatment plant is located northeast of the City along the San Joaquin River. Modesto is looking into a program to supply recycled water to DPWD, north of the City, to supplement their Project's supplies. This program can be expanded in the future. Modesto also has a regional recycling program with the City of Turlock.

Given that recycled water will be a key component to helping increase the reliability of future water supplies to the area, the City may want to look into starting discussions with other recycled water generators and users in the area to look for innovative ideas and regional benefits.

Groundwater Recharge PID is conducting groundwater tests in the area and is looking for both partners and data. A regional understanding of the groundwater basin is in the City's best interest; working with PID towards that cause is recommended.

Section 4 Water Quality and Treatment

Expansion of City boundaries will require use of new water sources to meet the additional demands. Most, or all of the proposed source waters will require treatment if used as a potable supply. Local groundwater currently used by the City has elevated salinity and hardness, and will likely require some level of treatment in the future. Surface waters available to the City from state and federal projects must be treated for microbial contamination and other constituents that create health concerns. The use of wastewater for non-potable demands will require tertiary treatment. Water treatment facilities are generally expensive to build and operate.

As discussed in Section 2, nearly 60 percent of the general plan area's projected water demands will be outdoor and irrigation use. Implementation of a non-potable program, whereby untreated water can be used for irrigation, significantly reduces the amount of high quality drinking water needed to serve the area resulting in smaller, less expensive treatment plants and associated operating costs (i.e. solids, residuals, and brine processing), and greater source reliability. Hence, the non-potable system is an essential and inextricable complement to the water supply and treatment options.

The proposed conjunctive use water program recommended in this study will consist of using a combination of source waters, with varying availability year to year. Treatment type and capacity will depend on the type and quality of source waters available to the City. Treatment of potable water could consist of both surface water and groundwater treatment, or groundwater treatment alone.

> *Patterson's future water program must include treatment as an integral part of the overall solution. Treatment requirements and costs can be significantly reduced through expansion of the existing non-potable water program, new conservation efforts, and possibly through groundwater recharge of low salinity surface water.*

Regardless of any action by the City regarding the a new general plan, groundwater quality is marginal, and treatment of groundwater is likely in the near-term. The City is currently implementing programs to best manage water quality, including a non-potable water program and "blending" systems. However, it is anticipated that treatment of groundwater will be required prior to build-out of the current general plan. Alternatives for treatment in this section compliment the currently proposed water supply program.

The following section discusses water quality characteristics of potable sources and treatment alternatives. No treatment of non-potable ground or surface water is assumed, regardless of the source, excluding minor sediment-type filters that could be required if raw surface water is used. Tertiary treatment to produce reclaimed water is a wastewater activity, thus it will not be addressed in this report.

Water Quality

The City will need to address water quality issues for drinking water use regardless of source supply. Both groundwater and surface water sources available to the City have contaminants. Surface water is of greater concern due to the presence of microbes. Groundwater has elevated salinity, above the recommended level established by the state, though these salinity levels pose no known health threat to the public.

Water quality goals include the following:

1. Meet all state and federal drinking water regulations;
2. Provide water of adequate quality to remove or limit objectionable characteristics, such as taste, odor, scaling, etc.; and
3. Reduce salinity to reduce or eliminate use of self-generating water softeners.

A salinity reduction plan should be established for the City once sources of water have been identified, since some reduction could come in the form of blending surface and groundwater. Removal of select ions may be the best approach (i.e. Ca and Mg to reduce hardness), rather than an overall TDS goal. However, for purposes of this report salinity goals of 400 mg/l TDS and 150 mg/l hardness are assumed.

Recently, the City was forced to remove one of its drinking water wells from use due to high nitrates. The presence of nitrates may be from agricultural activities in the area. Nitrates may continue to be a problem for the City when using groundwater as a drinking water source. However, new wells being constructed by the City are designed to produce water from deeper zones below the Corcoran Clay, thus minimizing nitrate contamination. All new wells should be designed with nitrate avoidance as a consideration.

Groundwater In general, local groundwater has high alkalinity, hardness, and TDS concentrations. The TDS levels ranged from 450 to 1,110 mg/L. A large component of TDS is represented by the sum of calcium, sulfate and chloride concentrations. The City has a goal of 400 mg/L TDS and/or 150 mg/l hardness, based on an objective to reduce salts so that the community does not need private self-generating softening units. The salt reduction goal was set below the state's recommended maximum contaminant level (MCL) of 500 mg/l to enhance both drinking water quality and wastewater disposal. Controlling salts will also reduce maintenance of the City's distribution system, and increase the longevity of water infrastructure. Sulfate levels are also important factors in considering treatment processes for other contaminants. For example, ion exchange processes for arsenic and nitrate control are impacted by the presence of high sulfate levels. Based on past sampling, a summary of groundwater constituents of concern is shown in Table 4-1 and described as follows:

- Antimony has been detected in Well 6 at 2 µg/l and in Wells 7, 8, 9, and 11 at 5 ug/l. The water quality goal for antimony is 4.8 ug/l, and therefore the groundwater could require treatment for antimony removal.

- Arsenic levels in the groundwater range from 1.2 ug/l in Well 6 to 10 ug/l in Well 2. While the majority of samples have arsenic in the range of 3 ug/l to 4 ug/l, the 90th percentile level has been estimated at 8.4 ug/l.

- Iron levels range from 0.02 mg/L in Well 11 to 0.3 mg/L in Well 1. The 90th percentile level is estimated at 0.24 mg/L, which is equal to the goal (e.g., the secondary MCL). While the 90th percentile level for manganese is 0.038 mg/L, one of two Well 6 samples showed a level of 0.09 mg/L. The treatment objective for manganese, based on the secondary MCL, is 0.04 mg/L.

- Nitrate levels range from 2 mg/L in Well 6 to 48 mg/L in Well 7, and varies considerably among the different wells. The 90th percentile value of 48 mg/L is higher than the treatment level objective of 36 mg/L (as NO_3).

Table 4-1 Groundwater Quality Summary

Parameter	Unit	Samples	Min	Max	Ave	90th Percentile	Water Quality Goal
Alkalinity	mg/L	16	0	260	141.9	196	no goal
Alpha Particles	pCi/L	14	0.0	5.4	2.6	4.7	12
Aluminum	ug/L	14	11	1600	169	230	800
Antimony	ug/L	14	2	5	4.6	5	4.8
Arsenic	ug/L	16	1.2	10	4.0	8.4	8
Barium	mg/L	16	0.014	0.5	0.1	0.33	1.6
Bentazon	ug/L	1	5.0	5.0	5.0	5.0	14
Beryllium	ug/L	14	0.3	1	0.5	0.5	3.2
Cadmium	mg/L	16	0.00018	0.001	0.0009	0.001	0.004
Calcium	mg/L	16	52	110	74.3	90.2	150 (as total hardness

Table 4-1 Groundwater Quality Summary *continued*							
Parameter	**Unit**	**Sample s**	**Min**	**Max**	**Ave**	**90th Percentile**	**Water Quality Goal**
Chloride	mg/L	17	24	280	124	211	250
Chromium VI	ug/L	7	3.7	17.2	9.3	14.5	40
Color	units	16	0	5	3.1	4.2	15
Conductivity	umho/c	21	710	1600	1294	1600	no goal
Copper	ug/L	16	0.05	30	13.9	20	1
Cyanide	ug/L	7	0.2	0.5	0.3	0.5	0.12
Fluoride	mg/L	16	0.1	0.77	0.2	0.6	2
Hardness	mg/L	16	270	490	392.3	476	150
Iron	mg/L	16	0.02	0.3	0.1	0.24	0.3
Lead	mg/L	16	0.001	0.005	0.004	0.005	0.015
Magnesium	mg/L	16	31	64	50.3	63	150 (as hardness)
Manganese	mg/L	16	0.010	0.090	0.021	0.038	0.5
Mercury	mg/L	16	0.000	0.001	0.000	0.001	0.0016
Methane	ug/L	1	1.0	1.0	1.0	1.0	no goal
Metolachlor	ug/L	1	0.6	0.6	0.6		no goal
MTBE	ug/L	2	3.0	5.0	4.0	4.8	5
Nickel	ug/L	14	5	5	5	5	80
Nitrate	mg/L(N	22	2	48	20.8	48	40
Nitrite	ug/L	10	100	100	100	100	400
Odor	TON	16	1	1	1.0	1	15
o-propane	ug/L	1	0.5	0.5	0.5	0.5	
pH	units	16	7.5	8	7.8	7.9	6.5-9.5
Selenium	mg/L	17	0.001	0.006	0.005	0.006	0.04
Silver	mg/L	16	0.0004	0.005	0.002	0.005	0.1
Sodium	mg/L	16	22	160	108.3	150	250
Sulfate	mg/L	16	170	560	302	488	250
TDS	mg/L	22	450	1100	854.3	1000	400
Thallium	ug/L	13	1	2	1.9	2	0.0016

Table 4-1 Groundwater Quality Summary *continued*							
Toluene	ug/L	4	0.5	1.7	0.9	1.4	120
Total	mg/L	16	0.006	0.026	0.01	0.021	0.040
Turbidity	NTU	16	0.1	9.4	1.7	2.8	no goal
Zinc	mg/L	16	0.01	0.81	0.29	0.62	5

Like surface water, groundwater quality can change over time, thus it is not possible to accurately describe all future groundwater treatment requirements for the City of Patterson. For the purposes of the treatment assessment presented herein, nitrate, hardness, sulfate, TDS and potentially, arsenic, were considered as the constituents of concern. However, a number of groundwater contaminants (e.g., antimony, arsenic and iron) were detected above their respective goals in the historical data set. Based on the current data set and the observations, treatment processes have been identified. These processes can be adjusted, prior to final design, as needed to reflect the results of additional sampling and investigation, and/or changes in groundwater quality over time.

Surface Water The City can obtain surface water from either the California Aqueduct (the Aqueduct), part of the State Water Project (SWP), operated by the State of California, or from the Delta-Mendota Canal (DMC), part of the Central Valley Project (CVP), operated by the United States Bureau of Reclamation.[1] Both of these sources receive their water from the Sacramento-San Joaquin Delta (Delta). As shown in Figure 4.1, the Sacramento, San Joaquin and Mokelumme Rivers combine in the Delta which supplies potable and agricultural water for areas south of the Delta. Water is pumped into the canal systems by the Tracy Pumping Plant (CVP) and the Banks Pumping Plant (SWP).

There are several sources of Delta water contamination. Recreational activities in the Delta include motor vehicle sports, like boating, water skiing, and other water craft activities. These activities can introduce gasoline related contaminants such as methyl-tert-butyl ether (MTBE) into Delta waters. Effluents from wastewater treatment facilities (approximately 23 major facilities in the Delta basin) have potential to add organic and microbial contaminants. Runoff from farmed lands also adds sediments, nutrients, organic contaminants and microbes to the Delta source water.

Similarly, urban runoff can add sediment, nutrients, road salts, heavy metals, petroleum hydrocarbons, and microbes. Seawater intrusion can also increase salinity, bromide, and total dissolved solids content of Delta water.

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[1] CVP water pumped into the CA per Department of Health requirements.

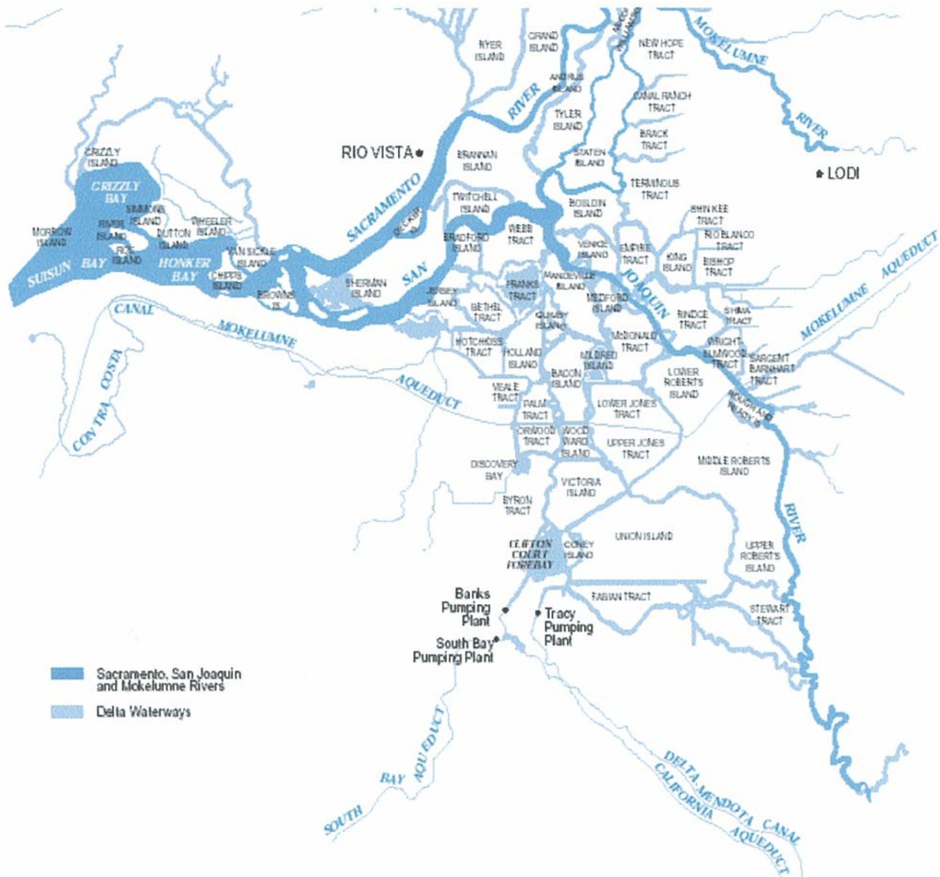

Figure 4-1 ***Surface Water Sources for the City of Patterson*** [Reference: California Department of Water Resources, "California State Water Project Watershed - Sanitary Survey Update 2001", December 2001]

The design and operation of the DMC allows for surface water runoff and agricultural return water to enter the canal. In the section between the Tracy Pumping Plant and where the City would take water (Mile Post 40), there are approximately 87 locations where surface water can enter the canal and one location where agricultural return water can be pumped into the canal. [2]

A number of dairy and agricultural operations (e.g., confined animal feeding operations) discharge into the DMC downstream of the Tracy Pumping Station, potentially contributing to further degradation of source water quality. As a result, the California Department of Public Health has stated that use of *DMC is not a viable option for drinking water, regardless of the treatment provided.* Thus, the study does not assume assumes the use any surface water that is directly treated and delivered to customers for drinking water. If such water was to be used it will be diverted from the California Aqueduct CA, not the DMC.

[2] San Luis and Delta-Mendota Canal Water Authority

The City performed water quality sampling of the CA and DMC as part of a 2006 study.[3] See Table 4-2 below. Both CA and DMC source waters consist of low turbidity, higher than neutral pH, relatively high TDS, and moderate hardness. These source waters are also expected to contain low level organic contaminants, representative of watershed activities such as recreation, agriculture, treated effluents from wastewater treatment plants, urban runoff, and confined animal feeding operations. These discharges may also contribute to microbial contamination. Due to a large number of agricultural returns to the DMC, a higher incidence of agricultural chemicals and microbes can be expected.

While not identified in these DWR databases, SWP also contains taste and odor causing chemicals. The major issue with both surface waters is the potential for disinfection by-products formation due to high precursor levels (both organic and inorganic). The observed TDS levels in the DMC appear to be higher than in the CA, but the 75th percentile levels are below the primary goal of 400 mg/L.

The recommended alternatives in this analysis do not include a surface water treatment facility. However, should source water from either the state or federal systems become a feasible alternative for water supply, additional evaluation should be conducted.

Table 4-2 CA/DMC Water Quality near City of Patterson

WQ Parameter	Unit	CA Banks P.S.	DMC2	CA Patterson	Water Quality Goal
Alkalinity	mg/L as CaCO3	70	105	65	none
Antimony	mg/L	<0.001	<0.001	ND	0.048
Arsenic	mg/L	0.002	0.002	0.002	0.008
Beryllium	mg/L	<0.001	<0.001		0.0032
Boron	mg/L	0.1	0.3		no goal
Bromide	mg/L	0.3	0.29	0.36	0.08 (as bromate)
Calcium	mg/L	17	31	17	150 as total hardness
Dissolved Organic Carbon	mg/L as C	2.3	3	2.3	1.5
Total Organic Carbon	mg/L as C	2.8	3.6	2.9	1.5
Chloride	mg/L	91	93		250
Chromium	mg/L	0.003	0.003		0.04

[3] City of Patterson, Water Supply Planning Study", 2006

Table 4-2 CA/DMC Water Quality near City of Patterson *continued*					
WQ Parameter	**Unit**	**CA Banks P.S.**	**DMC2**	**CA Patterson**	**Water Quality Goal**
Copper	mg/L	0.002	0.002		1.0
Fluoride	mg/L	<0.1	<0.1	ND	2
Hardness	mg/L as CaCO3	92	143	100	150
Iron	mg/L	0.022	0.007		0.3
Lead	mg/L	<0.001	<0.001		0.012
Magnesium	mg/L	12	16	14	150 (as total hardness)
Manganese	mg/L	0.01	<0.005		0.05
Nitrite + Nitrate	mg/L as N	0.58	NR	0.7	8
Phosphate-Ortho	mg/L as P	0.04	NR		0.3
Phosphorus-Total	mg/L	0.08	NR		0.3
Selenium	mg/L	0.001	0.002		0.04
Sodium	mg/L	59	72		150
Specific Conductance	mS/cm	490	670		no goal
Sulfate	mg/L	26	74	31	250
SUVA	m.L/mg			3.83	no goal
Total Dissolved Solids	mg/L	270	371	310	400
Turbidity	N.T.U.	6	15		0.24
UV Absorbance (254 nm)	1/cm			0.088	no goal
Zinc	mg/L	<0.005	<0.005		5

Note: The CA Banks P.S and DMC2 samples were taken in November 2005.
The CA Patterson sample was taken on December 5, 2005.
NR - not reported. ND - not detected.
Blank cells indicate that data is not available for the particular contaminant at the specific location

Treatment

As discussed above, water treatment required for City will depend on the source and quality. To date, the California Department of Public Health will only allow water from the CA for use as a potable source, but not the DMC or San Joaquin River due to contamination concerns. Recommended options in this study may not require surface water treatment, but a discussion is provided herein since it remains as a possible solution. Groundwater is expected to always be a primary component of the City's water supply program and treatment of this source is anticipated.

The U.S. EPA and State of California Department of Public Health (CDPH) set minimum water quality requirements for drinking water that City will be required to meet, which will dictate water treatment requirements. In 1974, Congress passed the Safe Drinking Water Act, which requires the United States Environmental Protection Agency (USEPA) to establish regulations on limiting contaminants that may be present in public water supplies and represent potential health risks. The Safe Drinking Water Act was amended by Congress in 1986 and again in 1996. The USEPA sets legal limits for contaminants based on public health protection and the ability of utilities to meet the standards using the best available technology.

In addition, USEPA rules dictate water-testing schedules and procedures, and list acceptable technologies for treating contaminated water. The Safe Drinking Water Act allows states to set and enforce their own regulations, providing they are at least as stringent as those set by USEPA. "Primary standards" address acute and chronic health concerns, and must be met. "Secondary standards" are typically associated with taste, odor, or scaling problems. Since secondary standards are not usually health related, the community can decide which level is acceptable. Surface water treatment requirements are generally more stringent due to the presence of microbial contamination and organic matter that can form cancer-causing byproducts when combined with disinfection chemicals.

Groundwater The City has used local groundwater as a drinking water source for more than 50 years. The quality of local groundwater is healthy and reliable. The only treatment the City currently provides is the addition of a simple disinfectant. Problems with local groundwater include moderate salinity, and only recently, higher levels of nitrates were found in one City well. Nitrate is of great concern since it is a primary drinking water standard with acute health impacts. Depending on the location and depth of the well, salinity can range from 450 mg/l to 3,500 mg/l TDS.

Treatment objectives for a groundwater treatment plant include:

- Disinfection for general microbial quality
- Control of hardness and TDS (400 mg/L TDS and 150 mg/L hardness)
- Control of nitrates
- Control of specific organic contaminants

The primary goal of groundwater treatment will be removal of salinity. Salinity consists of several positive and negative ions including calcium, magnesium, sulfides, bicarbonates, iron, manganese, chlorides, and sodium that naturally occur in local groundwater. Together, these minerals are called "total dissolved solids", or TDS. The State of California limits TDS to 1,000 mg/l, but has a "recommended" limit of 500 mg/l.

However, individual minerals at high concentrations can create concerns. For example, salts of calcium and magnesium create "hardness" which causes scale and water spots. The groundwater has very high hardness (270 to 490 mg/l as $CaCO_3$) and alkalinity (91 to 260 mg/L as $CaCO_3$). Sulfate levels are also elevated. Sulfides can cause water to taste bitter and create a laxative effect when consumed in high concentrations.

Currently, many residents use home water softeners to reduce hardness levels. These "self-generating" water conditioners use regular table salt (NaCl) to remove hardness ions. Two problems with softeners include: (1) overall salinity is not reduced since as hardness is removed (Ca and Mg ions), sodium is added, (2) salt used in the softeners is discharged to the City's wastewater treatment system, creating restrictions of wastewater discharge, and (3) softeners do not necessarily remove sulfides. [4]

The State Regional Water Quality Control Board will be aggressively addressing salinity in wastewater discharge in the future. The community's use of water softeners makes the City a "net importer" of salinity to the area, since salt tablets are used to recharge the units. The City is pursuing alternatives to reduce salinity in its waste discharge, including restrictions on the use of water softeners. [5]

Ideally, the City will provide treatment of water for salinity at a central facility. The advantages of a central treatment facility operated by the City include: 1) provide higher quality water to its residents that meet recommended goals set by the state, 2) to reduce the salinity loads imposed by softeners on the wastewater system, and 3) increase the longevity of the distribution system. A number of treatment options are available to reduce TDS in the groundwater including lime softening, RO membrane treatment, ion-exchange, electrodialysis/electrodialysis reversal (ED/EDR) and distillation.

Lime Softening—Lime softening is a chemical precipitation process in which dissolved constituents contributing to hardness are converted to insoluble salts which then are clarified and filtered. Hard water develops scale in distribution system piping and household plumbing and also created aesthetic issues. Lime softening also removes pathogens, organic precursors to DBPs, and other contaminants such as arsenic and radionuclides. To remove non-carbonate hardness (e.g., sulfate, chloride), lime softening is enhanced by using soda ash. Water can be softened using caustic soda instead of lime and soda ash.

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[4] Home water treatment devices are available to address sulfides, and some residents may have devices to remove sulfides, as well as other salts. A typical home water softener only removes hardness.

[5] A salinity management plan was presented to RWQCB in 2009.

After softening, recarbonation (addition of carbon dioxide) of water is generally required to stabilize the water. Lime softening creates a mineral sludge (twice the calcium and 2.6 times magnesium levels reported as $CaCO_3$). The 90th percentile calcium level in the City's groundwater is 226 mg/L as $CaCO_3$ and the resultant residuals are estimated at 452 mg/L. The 90th percentile magnesium level is 260 mg/L as $CaCO_3$ and the resultant residuals are estimated at 5,600 lbs. of dry solids per million gallons of water treated. Based on a conservative industry standard of 1.0 ac-ft/100 mg/l drying ponds for each 1.0 MGD treated, approximately 25 to 40 acres would be required for lime softening sludge processing.

Reverse Osmosis/Nanofiltration—Reverse osmosis (RO) and nanofiltration (NF) are both a membrane filtration treatment process used extensively for removal of contaminants, including salts. NF is generally effective for hardness, TDS, arsenic and bromide. RO can reduce TDS, hardness, arsenic, nitrate, bromide, iron, manganese, thallium (and other metals), organic precursors to DBP's and individual volatile and synthetic organic chemicals.

The difference between NF and low pressure RO membranes is their pore size. The majority of principles which apply to NF membranes also apply to RO membranes. RO membranes operate at 150 to 600 psi versus NF membranes which operate between 80 and 150 psi. The water recovery for RO membranes ranges from 30 to 85 percent and, therefore, much larger volume of residuals is produced. Residual treatment and disposal option for RO membrane will be similar to NF membranes. Both RO and NF are feasible treatment processes for control of a number of water contaminants including TDS and nitrate, and should be further evaluated in comparison to other feasible treatment technologies and treatment trains.

Approximately 15 to 20 percent of concentrate (brine reject) is produced in the process. Several options and technologies are available to the City for handling and discharge of brine solutions. Depending on the system design (non-potable vs. potable demands, blending, etc.), approximately 1.5 MGD of brine could be produced from use of a membrane facility. Brine processing can be accomplished through drying beds, mechanical dewatering, and/or blending with other wastewaters. Use of evaporative drying beds and lagoons alone would require many acres of land (350 acres to 400 acres). In lieu of an ocean discharge, membrane reject is often treated to reduce the volume of brine residuals, or in combination with other processing solutions to minimize land use, operating expenses, and meet discharge requirements.

A common process is to concentrate the brine through use of additional mechanical and non-mechanical processes. Based on experience of other similar projects, a cost-effective membrane residuals treatment process could consist of mechanical processes, including (additional) high-pressure reverse osmosis (HPRO) or electrodialysis reversal (EDR), followed by mechanical vapor recompression evaporators or crystallizers. Non-mechanical processes may include solar or wind induced evaporation and chemical precipitation. The end process would include a highly concentrated brine solution with lined-pond evaporation. The dried solids would be hauled off every 10 to 20 years to a municipal landfill.

It is proposed that some of the lagoon space at the City's wastewater treatment plant could be used for membrane concentrate processing (around 20 to 40 acres). The City is also in discussions with the Regional Water Quality Control Board regarding brine disposal and salt management solutions, including brine reject from proposed groundwater treatment processes. Emerging technologies may also offer solutions to brine handling.

Currently, the Westlands Water District is performing a pilot study of a system to process brine. According to Department of Water Resources, the system will recycle high salinity drainage water into fresh water for irrigation while converting about five tons of leftover brine salts into financially valuable byproducts including acid, caustic soda and solid carbonates such as limestone and soda ash. The system is expected to also trap 2.8 tons of carbon dioxide daily. Regional solutions for brine treatment or disposal using this technology or other options are also worth pursuing.

Since problems with salinity concentrations in the Central Valley is wide-spread, more efficient and/or regional solutions for salinity management are likely over time. Regardless, the City has land and technologies available to address brine handling and disposal today. Adding groundwater treatment as proposed in this study for removal of salinity can result in a net reduction in salinity, since it will reduce the need for home water softeners and the associated import of salt to the region.

Ion Exchange Treatment Processes—Ion exchange (IX) can remove inorganic contaminants such as hardness, sulfate, and nitrate. Some level of TDS reduction can also be expected. Two types of IX system exist, cation exchange and anion exchange. Anion exchange systems remove nitrate and sulfate (negatively charged particles in water) while cation exchange systems remove calcium and magnesium (positively charged). IX use synthetic resins in which a presaturant ion on the solid phase, the adsorbent, is exchanged for an unwanted ion in the water. In order to accomplish the exchange reaction, a packed bed of IX resin is used. The source water is continually passed through the bed in either a downflow or upflow mode until the IX bed is exhausted, as evidenced by the appearance of a contaminant ion at an unacceptable concentration in the effluent. Anion exchange of chloride (presaturation) is one of the cost-effective processes for control of nitrate and sulfate from groundwater.

Typical anion resins prefer sulfate anions over nitrate for exchange, which results in shorter service run times for waters with high sulfate levels. Since the sulfate levels in the City's groundwater range between 200 and 300 mg/L a short run length of 100 bed volumes (BVs) is anticipated before the resin is regenerated (approximately three hours of continuous operation). For control of hardness, a strong acid cation (SAC) IX resin is used. Except for a different resin, the operations and facilities required for an IX system for TDS control is similar to those utilized for nitrate and sulfate.

A typical IX facility operates in the following cycles: 1) service 2) regeneration 3) slow rinse 4) fast rinse, and 5) return to service. Service is in a downflow mode, backwash is in an upflow mode, and regeneration and rinsing is in a downflow mode. When the capacity of the IX bed is exhausted, the column is removed from service and regenerated. Regeneration is performed with sodium chloride solution.

The disposal of spent brine (high concentrations of nitrate, arsenic, TDS and other contaminants) is an important issue for all IX applications in water treatment. The spent brine can generally be evaporated using a lined brine pond or be disposed off-site using a non-hazardous liquid waste hauler.

For the City of Patterson, pressure vessels containing SAC resins would be followed by pressure vessels containing SBA resins for treatment train using IX only. SBA IX resin may also be used after lime softening process to remove hardness. Both these trains are feasible and will be compared with the RO train in terms of their advantages and disadvantages. IX with anion resin will also be considered as a nitrate removal; process, when needed.

The disposal of spent brine is an important issue for all IX applications in water treatment. Options for processing brine were previously discussed in this section.

Treatment Facilities—Groundwater treatment can be performed at each well (wellhead treatment), a single location (central treatment), or at more than one central location (satellite). Many well locations are fixed, since they exist presently. New wells will likely be located closer to areas of groundwater recharge. Locating treatment close to wells reduces the cost of pipe and pumping water.

Wellhead treatment is not a feasible option, since the type of treatment will require support facilities (e.g. chemical storage, residuals handling, etc.). Even if sufficient area is available at each well, constructing treatment and support facilities at each site is not cost-effective. Central treatment is generally more cost-effective, and is the City's preferred option. Property was purchased by the City for the purpose of central treatment of its existing wells. Water from future wells located near groundwater recharge areas can either be pumped to the proposed water treatment facility location, or treated at a satellite facility near the wells. It may be advantageous for the City to construct a satellite facility to: 1) reduce the need to pump water from the northwest side of the City to the southeast side for treatment, and then back to the northwest side for use, and 2) water quality may be different in the new wells than in existing wells, so treatment requirements may also differ.

It is possible that water in the northwest side of the City requires nitrate removal, but not as much salinity removal, for example, due to the effects of the groundwater recharge activities. For purposes of this study, it was assumed that two smaller satellite groundwater treatment facilities will be constructed.

Surface Water Recommended water supply solutions do not include surface water treatment. However, the City of Patterson may find a feasible surface water source in the future; hence the use of treated surface water for potable use is not excluded as a potential component of the future water supply program. Use of treated surface water could become a viable option if the CDPH allows DMC as a drinking water source, if CA water becomes available to the City, etc.

The Surface Water Treatment Rule was promulgated in 1989 by USEPA to safeguard against microbial pathogens for all surface water systems. The Surface Water Treatment Rule emphasized treatment techniques (e.g., filtration, disinfection) as conditions for compliance, rather than maximum contaminant levels, as conditions for compliance for microorganisms. The main aspects of the Surface Water Treatment Rule are summarized below:

- Treatment (combined physical removal and chemical inactivation) for 3-logs control of *Giardia*, and 4-logs control of viruses;
- Combined filter effluent water turbidity requirements of 0.5 NTU in (95% of monthly samples) with a maximum allowable limit of 5 NTU in any one sample;[6]
- Maintenance of a disinfectant residual in the distribution system; and
- Specified filtration avoidance criteria and watershed protection requirements for unfiltered systems.

Additional requirements to the rule will continue to make surface water treatment more stringent over time. The Interim Enhanced Surface Water Treatment Rule (IESWTR) was promulgated in 1998, for systems that serve more than 10,000 people. The IESWTR strengthened the Surface Water Treatment Rule by adding additional treatment requirements for control of *Cryptosporidium,* a potentially deadly and ubiquitous microbe. The IESWTR reduced combined filtered effluent water turbidity limits and required additional monitoring for individual filtered water turbidity in water from individual filters. Specifically, the IESWTR included:

- Maximum Contaminant Level Goal of zero for *Cryptosporidium;*
- Combined filter effluent turbidity should be less than 0.3 NTU in 95 percent of monthly samples monitored every 4 hours, with a maximum value of 1 NTU in any one sample;

[6] Superseded in 1998 by a lower turbidity standard under the Interim Enhanced Surface Water Treatment Rule (IESWTR)

- Additional requirements if consecutive turbidity values monitored every 15 minutes from individual filters exceeds 0.5 NTU;

- Disinfection profiling and benchmarking provisions for water systems exceeding 80 percent of Stage 1 regulated disinfection by-products levels;

- Inclusion of *Cryptosporidium* in the watershed control requirements for unfiltered public water systems;

- Requirements for covers on new finished water reservoirs (placed in service after February 1999;

- Requirements for sanitary surveys, conducted by states, for all surface water systems.

In general, treatment objectives for a surface water treatment plant include:

- Turbidity and pathogen control
- Disinfection for potability of water
- Control of organic precursors for disinfection by-products control
- Control of specific organic contaminants and taste and odor causing compounds

Treatment of surface water is a multi-staged process designed to remove contamination that can result in acute and chronic illness, taste and odor, and water characteristics that can cause water system corrosion. State and federal guidelines require a "multi-barrier" approach to provide greater reliability and safety. Failure in one process would not necessarily place the public at risk. These "safety nets" consist of a combination of physical and chemical treatment. Altogether, these processes are commonly called the "treatment train".

Processes in a typical treatment train for federal or state project water consist of the following:

- Pretreatment
- Clarification (Coagulation/Flocculation/Sedimentation)
- Filtration
- DBP Precursor Removal
- Disinfection
- pH Adjustment

Pretreatment—Pretreatment processes are included in a surface water treatment plant (WTP) to remove large objects, debris, and heavier suspended solids. Generally, screens are constructed at the source water intake to exclude larger materials like trash, branches, etc. Many water treatment plants construct a presedimentation basin to store raw water and remove solids which can be easily removed due to their size and weight, like sand, gravel, etc. Chemicals can be added before or after the presedimentation basin to aid in the removal of organic contaminants and suspended solids.

Clarification—Clarification processes are utilized to remove the majority of the suspended solids, colloids, and some dissolved constituents. Clarified water is filtered prior to further treatment in advanced treatment processes and disinfection. A number of clarification processes are feasible for treating federal and state project water, including:

- Conventional Sedimentation: Consists of rapid mix, flocculation and clarification in long, rectangular basins providing sufficient time for solids to settle by gravity;

- Dissolved Air Flotation (DAF): Consists of a clarification process with chemical addition, rapid mixing, flocculation, followed by a flotation tank where flocs are floated with the aid of air bubbles and skimmed off the top of the water surface;

- Enhanced Clarification: Consists of a clarification process that may include either high-rate contact or adsorption processes (i.e. Actiflo, DesaDeg, Microfloc) to remove solids and organic matter.

Filtration—Filtration processes remove suspended matter in the water and formed during the clarification process. Filtration consists of granular media filters of one material, such as granular activated carbon (GAC) or anthracite, or mixed materials such as anthracite over sand, or sand and garnet. Use of GAC as a filter medium is more expensive but may be required since it provides effective filtration of solids but also provides a barrier for seasonal organic contaminants (such as taste and odor causing compounds and pesticides). GAC also provides a bioactive media which aids in removal of disinfection bi-products (DBP) (cancer-causing) precursors.

DBP Precursor Removal—Given the total organic content that is typically present the CA and DMC waters, significant potential exists for the treated water to exceed the drinking water requirements for disinfection bi-products, chemicals that can cause cancer. Several surface water systems treating CA water have been experiencing DBP compliance issues. Therefore, to meet the DBP requirements, several strategies have been identified, which may be used independently on in various combinations:

- Preoxidants: Use of preoxidants such as chlorine dioxide can reduce the formation of DBPs after treatment.

- Alternate disinfectants: Use of chloramines can result in lower formation of DBPs when compared to chlorine.

- Maximize removal of precursors (TOC): Advanced treatment processes may be included in the treatment train if enhanced coagulation does not result in compliance.

- Removal of preformed DBPs: Treatment processes such as aeration or GAC adsorption may be used at distribution system locations, at strategic locations to reduce DBPs formed in the distribution system.

- Blending treated surface water and groundwater may also result in overall compliance with the DBP regulations for the City.

For surface water sources, if enhanced coagulation, clarification and filtration with GAC media does not result in overall compliance with the DBP regulations, two options are available for DBP compliance: 1) convert to chloramines as a disinfectant or 2) use additional treatment processes such as post filtration GAC adsorption, or use nanofiltration (NF) to remove TOC.

Disinfection—Oxidants, chemicals that react with contaminants in water, are utilized to disinfect water, and treat organic contaminants (such as taste and odor causing contaminants), algae, and inorganic contaminants (such as iron and manganese). In addition, oxidants can improve performance of solids removal processes such as granular media filtration. Oxidants generally used in water treatment include chlorine, chlorine dioxide, ozone and potassium permanganate. In water treatment, chlorine is the most widely used and cost-effective oxidant, used extensively for the past 100 years to effectively disinfect drinking water. It is an effective disinfectant for viruses, bacteria and some protozoa (e.g., Giardia lamblia). It is also effective in controlling algal growths in warmer environments. It is not effective for disinfection of Cryptosporidium.

Chlorination of water can result in formation of regulated halogenated DBPs when organic material is present. Organic matter is present in CA and DMC water, thus treatment for organics or alternative disinfectants will be required should state or federal water be used as a drinking water source.

pH Adjustment—Several chemicals are used during water treatment. Coagulants such as alum, ferric salts, and inorganic and organic polymers are used to destabilize the negative charge on suspended solids and dissolved organic matter. Chemicals such as acids and bases are used to adjust pH for effective coagulation and corrosion control. Treatment of state or federal project surface water will include pH reduction prior to clarification (sulfuric acid or carbon dioxide), and pH increase prior to distribution to reduce corrosion (caustic soda). The exact types of chemicals, chemical feed rates, and feed locations in the treatment train will be based on the outcome of bench/pilot scale studies once a water source is selected.

Section 5 Infrastructure

The goal of this chapter is to evaluate the major facilities or "backbone infrastructure" that would be required under each land use alternative for both the years 2030 and at build-out (2050). Major facilities are defined as those improvements that benefit the overall water supply system, such as treatment facilities, storage tanks (reservoirs), and transmission mains. Major facilities are often paid for through impact fees. Minor facilities, such as distribution piping, services, fire hydrants, backflow preventers, etc. are not included in the costs developed herein, and assumed to be installed by the developer.

This chapter also provides estimated costs for major facilities, and estimates the cost burden per acre of land use. These costs are not intended to be the basis of an impact fee program, but to determine the magnitude of cost for proposed water supply and corresponding infrastructure, and if the water supply program is economically feasible.

The actual size, capacity, and location of all major facilities will depend on the actual "mix" or combination of source supplies that is decided upon as the City's water program evolves. Future studies and negotiations with local water and irrigation districts will determine the proportions of various sources of water, and under what conditions these water sources will be required. As discussed in Section 3, source waters will consist of local groundwater, Central Valley Project and San Joaquin River surface water, City recycled wastewater, conservation, and possibly regional recycled wastewater. Upon completion of this effort, design criteria for the major facilities can be size and located. However, planning level criteria were developed for this analysis to develop conceptual infrastructure requirements.

Existing Infrastructure

The City currently has two distribution systems. One system is a potable water system, and the second is the newly implemented non-potable system. A description and summary of the existing systems are provided below.

The potable water system is defined as treatment facilities, transmission pipelines, pumps, wells, pressure reducing valves and storage facilities, used for the purpose of producing, distributing, and storing drinking water. The non-potable water system includes transmission pipelines, pumps, wells, pressure reducing valves and storage facilities, used for the purpose of producing, distributing, and storing non-potable water for irrigation or outdoor use. A description of and the criteria used to size each of the facilities are defined in the following paragraphs.

Potable Water System The City supplies potable water through a combination of groundwater wells, storage reservoirs, and network of piping within the existing City limits. Until recently, all the water demands served by the City are with potable water. There are portions of the City served by private wells (limited landscaping and industrial uses), PID and DPWD (irrigation).

Wells—The City's existing potable system extends from seven groundwater pumping stations (wells). The City's wells were summarized in Table 1-2. The potable wells pump groundwater from aquifers as deep as 600 feet. Each well produces water at rates ranging from 600 to 1600 gallons per minute (gpm). Total production from existing well facilities is approximately 6,700 gpm. With one exception, all of the wells pump directly into the water system. Well No.8 pumps into a 1.0 MG steel water reservoir on site, and water is then pumped through two booster pumps into the system.

The well system is sized to meet maximum day demands. The maximum day demand is the demand on the largest water-using day of the year and usually corresponds to multiple hot days during the summer when irrigation demands increase significantly. In most water systems, the maximum day demand is usually about 2.0 times the average daily annual demand. The increase is primarily tied to irrigation. In the future, irrigation demands on the potable system will decline significantly as the non-potable system is expanded. With the removal of the irrigation demands from the potable system, the maximum day multiplier is expected to decline as well. The criteria used to size the future potable facilities assumes that the maximum day demand will be approximately 1.5 times the average daily demands.

Pressure Zones—There are three pressure zones currently serving the City. Table 5-1 shows the elevation bands (zone cut-off boundaries) that each pressure zone serves, and the bands which will be expanded to serve in the future.

Table 5-1 City of Patterson Pressure Zone Elevations for both the Potable and Non-Potable Water Systems

	Current Elevations		Future Elevations		Recommended Storage Base Elevation for Gravity System in Future
Zone	Low	High	Low	High	
	Ground surface elevation (feet above Sea Level)				
1	0	120	0	120	220
2	120	200	120	240	340
3	200	220	240	420	520

Fire Flows—Sizing of the water system infrastructure is influenced by fire flows. The City of Patterson uses the California Fire Code (California code of regulations Title 24, Part 9, 2007 California Fire Code (CFC)). Figure 5-1 presents Table b105.1—Minimum Required Fire-flow and Flow Duration for Buildings. The City also requires sprinklers on buildings exceeding 5,000 square feet. Sprinklers allow for a 50 percent reduction in the flow rates per the CFC. For Patterson, the fire flows are assumed to be met by both storage and the groundwater pumping facilities. In addition, fire flows will only be provided by the potable water system. Table 5-2 shows the estimated fire flow and duration for each land use in the City.

Table 5-2 City of Patterson Fire Flow Requirements by Land Use

	Fire Flows and Durations		
Land Use Designation	**Flow Rate gpm**	**Duration Hrs**	**Storage Volume (a) gal**
Residential			
Mixed Use Hillside Development	3,000	3	540,000
Neighborhood Village	2,000	2	240,000
Estate Residential	2,000	2	240,000
Low Density Residential	1,000	2	120,000
Medium Density Residential	1,000	2	120,000
High Density Residential	2,500	2	300,000
Downtown Residential	1,000	2	120,000
Non- Residential			
Downtown Core	3,500	4	840,000
Regional Commercial	3,500	4	840,000
General Commercial	3,500	4	840,000
Highway Service Commercial	3,500	4	840,000
Neighborhood Commercial	3,500	4	840,000
Medical/Professional Office	3,500	4	840,000
			- -
Light Industrial	4,500	4	1,080,000
Heavy Industrial	4,500	4	1,080,000
			-
Public/Quasi-Public	4,500	4	1,080,000
Parks and Recreation	-	-	-
Open Space			-
Agriculture			-

(a) This report assumes that half of the fire flow will be delivered from groundwater pumping stations or other pressures zones.

Figure 5-1 Section B105 Fire-flow Requirements for Buildings

B105.1 One- and two-family dwellings.

The minimum fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min). Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5 m^2) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire flow of 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system.

TABLE B105.1 MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS[a]

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[c]	FLOW DURATION (hours)
Type IA and IB[b]	Type IIA and IIIA[b]	Type IV and V-A[b]	Type IIB and IIIB[b]	Type V-B[b]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	
22,701- 30,200	12,701- 17,000	8,201- 10,900	5,901-7,900	3,601-4,800	1,750	
30,201- 38,700	17,001- 21,800	10,901- 12,900	7,901-9,800	4,801-6,200	2,000	2
38,701- 48,300	21,801- 24,200	12,901- 17,400	9,801-12,600	6,201-7,700	2,250	
48,301- 59,000	24,201- 33,200	17,401- 21,300	12,601- 15,400	7,701-9,400	2,500	
59,001- 70,900	33,201- 39,700	21,301- 25,500	15,401- 18,400	9,401-11,300	2,750	
70,901- 83,700	39,701- 47,100	25,501- 30,100	18,401- 21,800	11,301- 13,400	3,000	
83,701- 97,700	47,101- 54,900	30,101- 35,200	21,801- 25,900	13,401- 15,600	3,250	
97,701- 112,700	54,901- 63,400	35,201- 40,600	25,901- 29,300	15,601- 18,000	3,500	3
112,701- 128,700	63,401- 72,400	40,601- 46,400	29,301- 33,500	18,001- 20,600	3,750	
128,701- 145,900	72,401- 82,100	46,401- 52,500	33,501- 37,900	20,601- 23,300	4,000	
145,901- 164,200	82,101- 92,400	52,501- 59,100	37,901- 42,700	23,301- 26,300	4,250	
164,201- 183,400	92,401- 103,100	59,101- 66,000	42,701- 47,700	26,301- 29,300	4,500	
183,401- 203,700	103,101- 114,600	66,001- 73,300	47,701- 53,000	29,301- 32,600	4,750	
203,701- 225,200	114,601- 126,700	73,301- 81,100	53,001- 58,600	32,601- 36,000	5,000	4
225,201- 247,700	126,701- 139,400	81,101- 89,200	58,601- 65,400	36,001- 39,600	5,250	
247,701- 271,200	139,401- 152,600	89,201- 97,700	65,401- 70,600	39,601- 43,400	5,500	
271,201- 295,900	152,601- 166,500	97,701- 106,500	70,601- 77,000	43,401- 47,400	5,750	

Figure 5-1 Section B105 Fire-flow Requirements for Buildings *continued*						
FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[c]	FLOW DURATION (hours)
Type IA and IBb	Type IIA and IIIA[b]	Type IV and V-A[b]	Type IIB and IIIB[b]	Type V-B[b]		
295,901- Greater	166,501- Greater	106,501- 115,800	77,001- 83,700	47,401- 51,500	6,000	
—	—	115,801- 125,500	83,701- 90,600	51,501- 55,700	6,250	
—	—	125,501- 135,500	90,601- 97,900	55,701- 60,200	6,500	
—	—	135,501- 145,800	97,901- 106,800	60,201- 64,800	6,750	
—	—	145,801- 156,700	106,801- 113,200	64,801- 69,600	7,000	
—	—	156,701- 167,900	113,201- 121,300	69,601- 74,600	7,250	
—	—	167,901- 179,400	121,301- 129,600	74,601- 79,800	7,500	
—	—	179,401- 191,400	129,601- 138,300	79,801- 85,100	7,750	
—	—	191,401- Greater	138,301- Greater	85,101- Greater	8,000	

For SI: 1 square foot = 0.0929 m2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R.
b. Types of construction are based on the California Building Code.
c. Measured at 20 psi.

Storage Tanks—The City has three storage tanks, one in each of the 3 existing pressure zones. Gateway Storage Tank, the highest pressure zone (3) consists of 1.3 million gallons (MG), and serves the travel/commercial land use that currently exists at the Sperry Road exit off of I-5. Zone II Storage Tank, the middle zone, consists of 2.0 MG, serving residential and commercial land uses. Well 8, located in the lowest zone (1) includes a 1.0 MG storage reservoir, and serves residential and commercial land uses. All water in storage reservoirs of each zone is pumped from the tank into the system.

Water supply facilities and pump stations are sized to meet maximum day demands. The storage facilities meet the daily fluctuations in the demands allowing for more predictable operations of the pump facilities. They also provide water during emergencies and fires.

As the City develops towards the west (west of I-5), development will occur at higher elevations. Developments in elevated areas relative to other parts of the water system are conducive to storage facilities that can gravity-feed the distribution system rather than pumping, as currently exist. This is a significant advantage during emergency situations when power is interrupted. The criteria used by other agencies that have hillside developments are shown in Table 5-3. Also shown in Table 5-3 is the storage sizing criteria recommended for the City.

Pressure Reducing Valves (PRV) —Pressure reducing valves are large valves that are located at the boundary between two pressure zones. The PRV allows water to move from the higher pressure zone into the lower pressure zone. There are currently six PRV's in the City's potable water system.

Piping—The potable water distribution system is made up of a network of pipes ranging in diameter from 4 to 24 inches. The system has pipes that were installed prior to 1950. Table 5-4 summarizes the 12" diameter and larger pipes that currently serve the City. The piping system was developed using the criteria presented in Table 5-5.

Figures 5-2 through 5-4 show the back bone potable water facilities that are anticipated to serve each of the land use plans. Actual tanks, wells, treatment plants and PRV locations, as well as, future pipeline sizes and alignments will be determined as the City's water program evolves, source water supplies are confirmed, and with actual development and associated demands .

Non-Potable Water System The existing non-potable water system is in its infancy. City Well 4 no longer meets the City's water quality standards, so the City decided to convert the well for non-potable water needs within the existing City limits. Ten thousand feet of transmission main have been constructed and irrigation demands converted where possible.

Table 5-3 Reservoir Sizing Criteria used by Local Agencies with Hillside Development

Potable

City or Agency	Operational	Emergency	Fire
City of Brentwood	0.4 X avg	1.0 X Avg.	4000 gpm x 10 hr (a)
City of Vacaville	0.25 x max	0.75 X max	max F.F. rate x duration
City of Vallejo	0.25 x max	0.75 x max	max F.F. rate x duration
CCWD	0.25 x max	0.75 X max	max F.F. rate x duration
City of Livermore	0.5 x max	1.0 x avg	5000 gpm x 2 hr
City of Milpitas	0.25 x max	0.50 X max	max F.F. rate x duration
DSRSD	0.5 x max	0.5 x max	max F.F. rate x duration
City of Folsom	0.25 x max	0.75 x max	max F.F. rate x duration
EBMUD pumped zones	0.5 x max	1.0 x max	max F.F. rate x duration
EBMUD gravity zones	0.5 x max	1.0 x max	NA
City of Pleasanton	0.25 x max	0.5 x max	max F.F. rate x duration
ACWD/ City of Fremont	2.1 x max	NA	NA
American Canyon	0.25 x max	1.0 X Avg.	max F.F. rate x duration
City of Sunnyvale	(b)	0.5 x max	(b)
AWWA Manual 32 (c)	0.25 x max	(d)	max F.F. rate x duration
City of Antioch	0.25 x max	1.33 x sum of opp and fire	max F.F. rate x duration
City of Tracy	0.3 x max	2.0 x Avg	max F.F. rate x duration
City of Patterson - Proposed	**0.3 x max**	**0.5 x max**	**max F.F. rate x duration**

(a) Spread between both zones
(b) Supplies from SFWD, SCWD and wells can meet 100 percent of operational and fire storage needs
(c) Distribution system modeling guide states that fire flow is best provide in the zone of service.
(d) no criteria given

Figures 5-5 through 5-7 show the back bone non-potable water facilities that are anticipated to serve each of the land use plans. Actual tanks, wells, and PRV locations, as well as, future pipeline sizes and alignments will be determined as development occurs.

Source Water Initially, the non-potable water system will be supplied by shallow wells which produce water that may not meet the City's drinking water standards, but are acceptable for non-potable water needs. In the future, the non-potable system will also be supplied by recycled water from the City's wastewater treatment plant and/or possibly from other sources, such as the City of Modesto.

Previously, Table 1-2 shows the wells and production rates currently serving the non-potable system. Average daily water use of the non-potable system varies significantly from the maximum day demand predicted throughout the year. Typical multipliers to estimate maximum day demands can be as high as 6.5 times the average annual daily demand where they may only be 1.25 to 2.2 for a potable water system. Monthly water production data from the City was reviewed as part of the study, and the maximum month irrigation numbers were calculated at approximately 2.5 times the average monthly values.

Past studies of City water supply assumed that the maximum day event is 1.5 times the average daily use. Thus, this study assumes a max-day multiplier for the non-potable system that is equal to 3.75 (2.5x1.5) times the average daily use throughout the year. For purposes of sizing the storage facilities, this study is assuming that most all of the maximum day demand will occur during a 12-hour period, with minimal irrigation during the hottest parts of the day.

Water supply facilities and pump stations for the non-potable water system are sized to meet maximum day demands over a 24-hour period. The storage facilities meet the daily fluctuations in the demands allowing for more predictable operations of the pump facilities. Thus, the storage facilities are sized to meet 1/3 of the max-day demand, plus 10% of the max-day amount in case of emergencies.

Pipelines Pipelines within the existing non-potable distribution system are summarized in Table 5-4. Future pipelines will be constructed with purple pipe (pipe that is colored purple to indicate it carries non-potable water) and will meet the state's requirements associated with the use of recycled water.

Future Infrastructure

In this section, the infrastructure needed to serve the future land uses within the general plan areas is estimated. The City has a hydraulic model of their existing potable and non-potable water systems. These models were expanded to estimate the size and location of future facilities.

The criteria used to evaluate the distribution systems are shown in Table 5-5. Since road configurations within the general plan areas have not yet been determined, pipeline layout in this effort followed property lines. The pipeline and facilities layouts are representative only. Actual locations for facilities and alignments for pipes will be determined as development progresses.

Storage Requirements The criteria used to size storage facilities were presented in Table 5-5. Tables 5-6 through 5-11 present the demands that were input into the hydraulic models by pressure zones. The corresponding storage requirements for each zone for both the potable and the non-potable systems for the year 2030 and build-out are calculated and also shown on the tables.

The highway commercial area that currently exists at Sperry Avenue and I-5 is an isolated area of the City's water distribution system. The area is Pressure Zone 3 of the existing distribution system. In the future, it is assumed that this area will be combined with existing City pressure zone 2. The storage reservoir that currently serves the area will be converted to a Zone 2 tank. All other new storage for both distribution systems were assumed to be located at sites in which elevations would allow for gravity operations and maintain minimum operating pressures. The base elevations desired for the storage facilities are shown in Table 5-5.

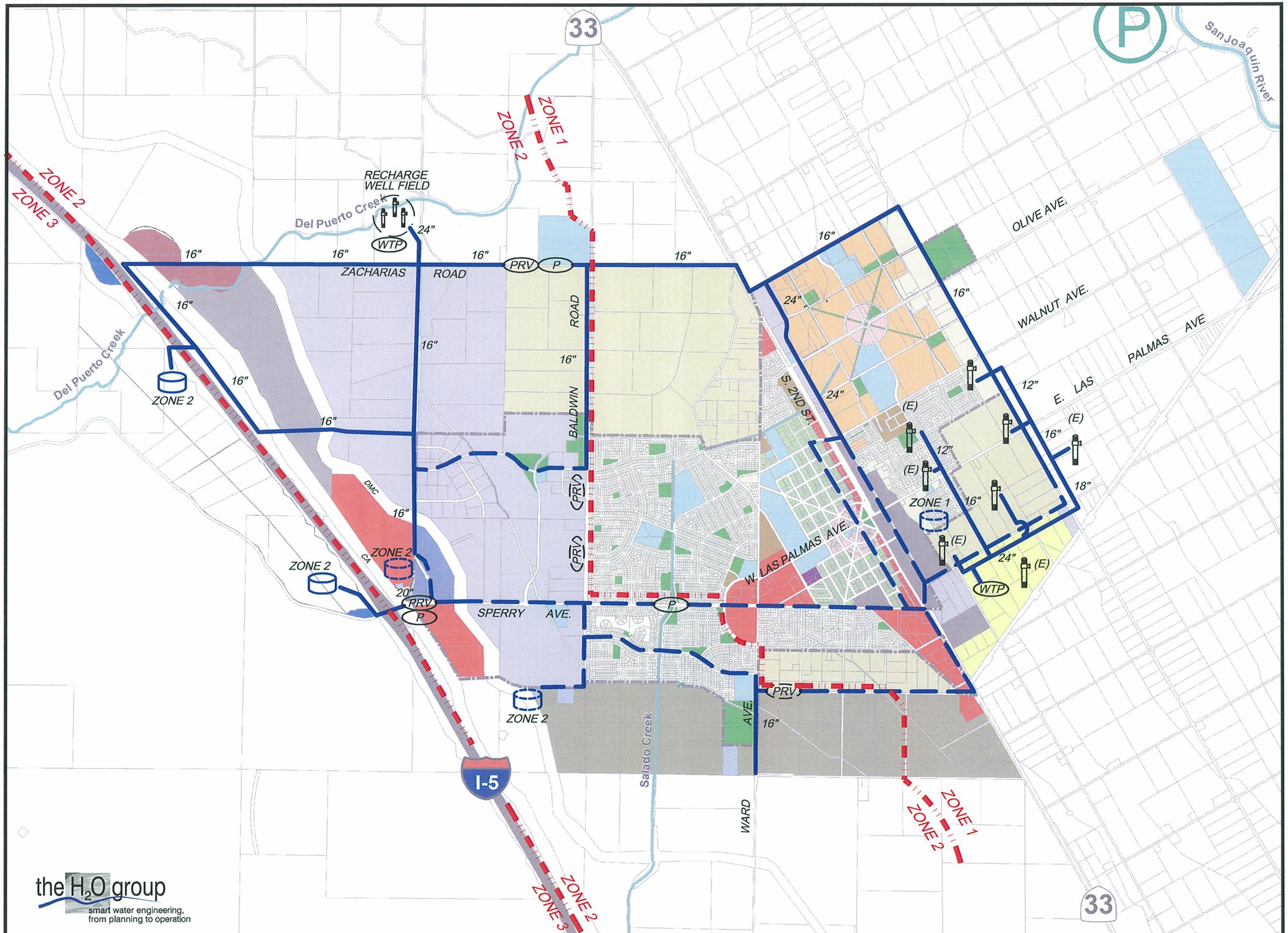
Table 5-4 City of Patterson Summary of Existing Potable and Non-Potable Water Distribution System Transmission Mains

Water System	Pipe Diameter	Feet
Potable		
	12	
	16	
	18	
	20	
	24	
	Total	0
Non-potable		
	8	
	10	
	12	
	14	
	20	
	Total	0

Table 5-5 Distribution System Design and Operational Criteria

Potable Water System	Value	Units
Pipe Velocity		
Maximum in Transmission Mains	5	ft/sec
Maximum During Fire	7	ft/sec
System Pressure		
minimum at service connection	40	psi
maximum w/o prv	80	psi
maximum with prv	120	psi
minimum during fire	20	psi
Storage		
zone 1 elevation	220	ft
zone 2 elevation	340	ft
zone 3 elevation	520	ft
Zone storage sizing	(0.8 x max day) + (largest fire flow in zone x duration)	
Non-Potable Water System	**Value**	**Units**
Pipe Velocity		
Maximum in Transmission Mains	5	ft/sec
System Pressure		
minimum at service connection	30	psi
maximum w/o prv	100	psi
Storage		
zone 1 elevation	200	ft
zone 2 elevation	340	ft
zone 3 elevation	500	ft
Zone storage sizing	(0.43 x max day)	

PRV = pressure reducing valve



CITY of PATTERSON GENERAL PLAN

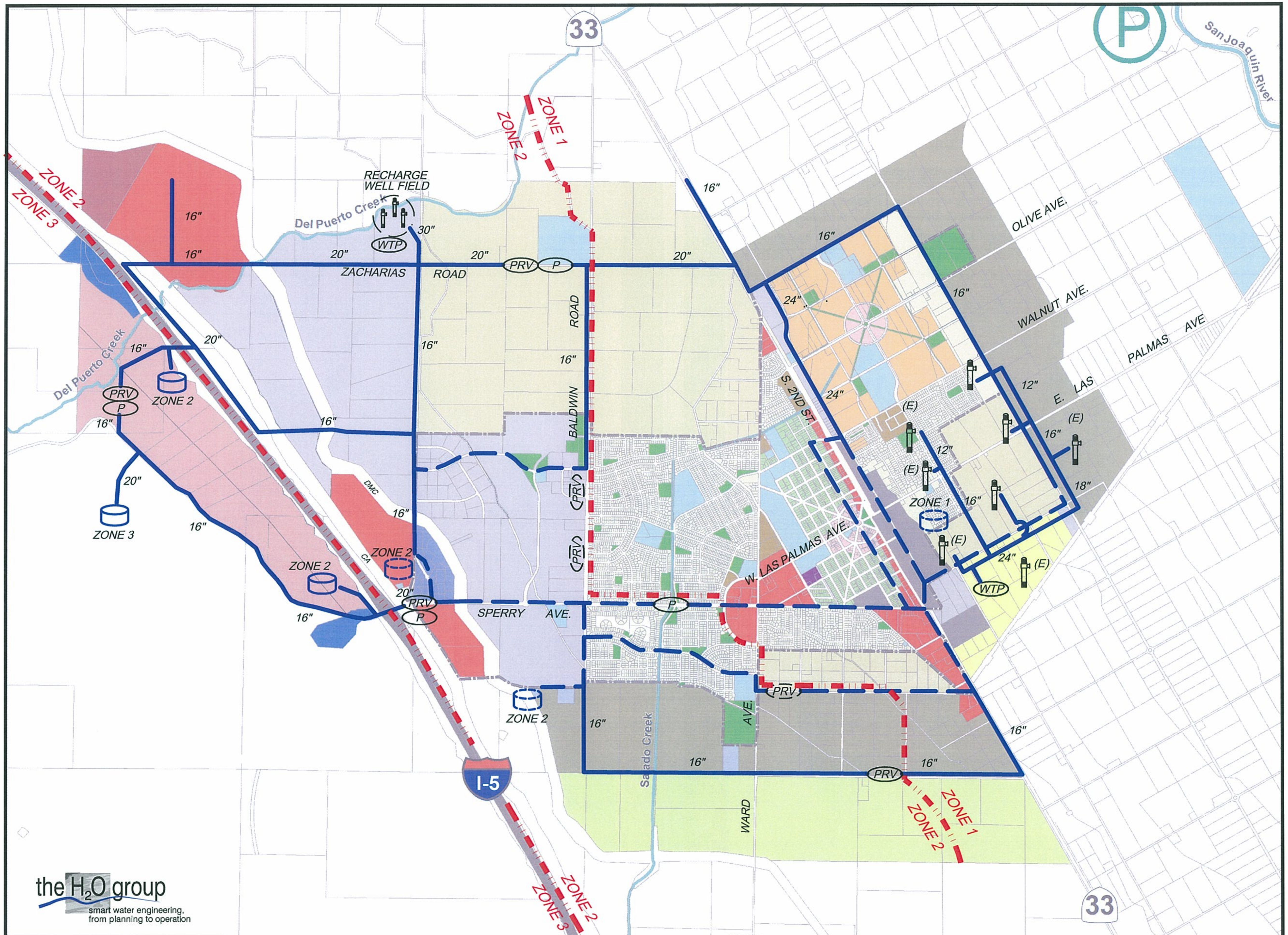
POTABLE WATER COMPACT LAND USE PLAN

LEGEND

- ZONE 1 PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE
- ZONE 1 EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE
- PROPOSED WATER LINE
- EXISTING WATER LINE
- GROUNDWATER WELL
- PRESSURE ZONE BOUNDARY
- P BOOSTER PUMP
- WTP WATER TREATMENT PLANT
- PRV PRESSURE REDUCING VALVE

Revised June 2010

FIGURE 5-2



CITY of PATTERSON GENERAL PLAN

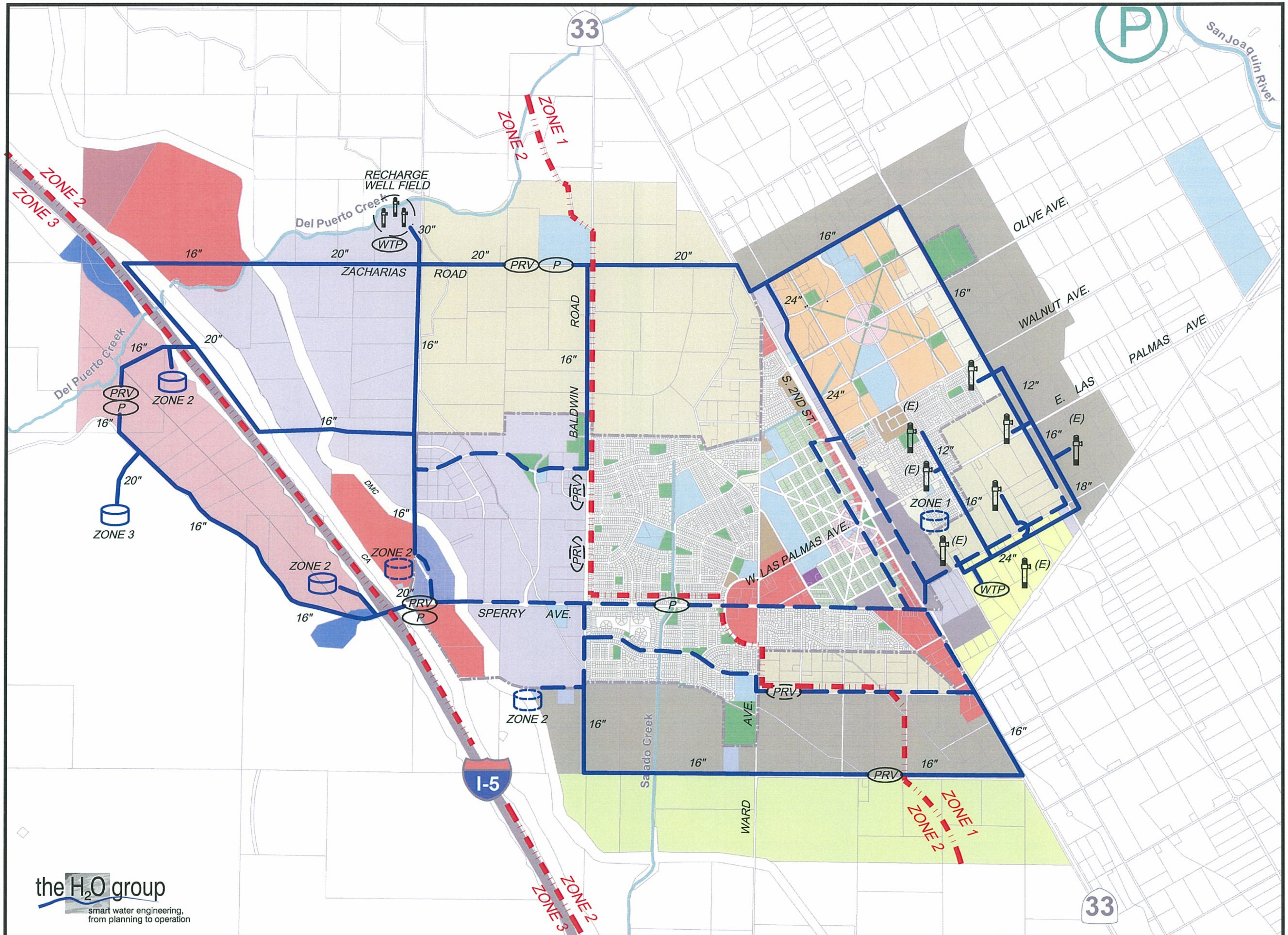
POTABLE WATER JOBS LAND USE PLAN

LEGEND

- ZONE 1 — PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE
- ZONE 1 — EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE
- PROPOSED WATER LINE
- EXISTING WATER LINE
- GROUNDWATER WELL
- PRESSURE ZONE BOUNDARY
- P — BOOSTER PUMP
- WTP — WATER TREATMENT PLANT
- PRV — PRESSURE REDUCING VALVE

Revised June 2010

FIGURE 5-3



City of Patterson General Plan

Potable Water PC Land Use Plan

Legend

ZONE 1 — PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE

ZONE 1 — EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE

PROPOSED WATER LINE

EXISTING WATER LINE

GROUNDWATER WELL

PRESSURE ZONE BOUNDARY

P — BOOSTER PUMP

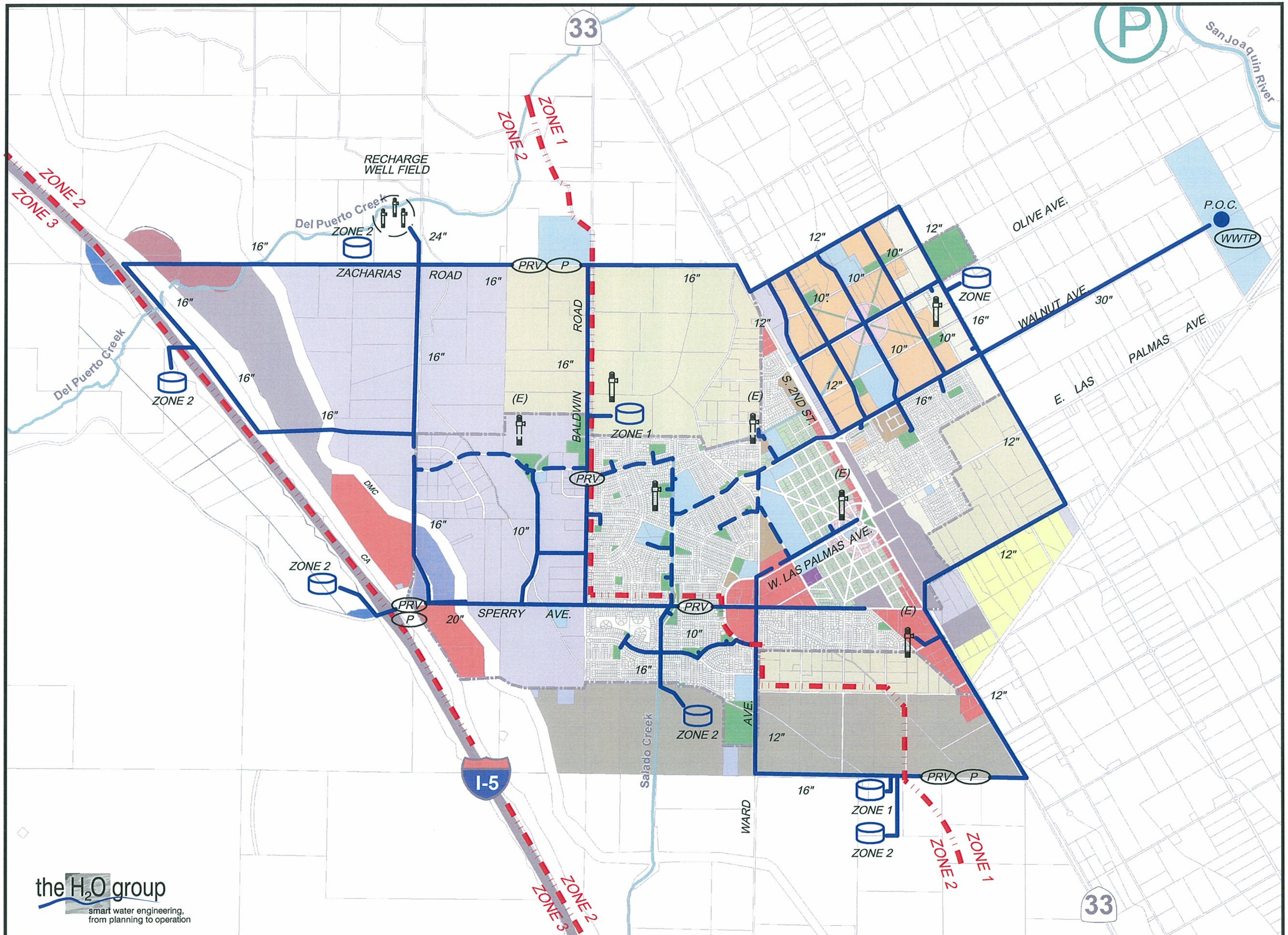
WTP — WATER TREATMENT PLANT

PRV — PRESSURE REDUCING VALVE

N E S W

Revised June 2010

FIGURE 5-4



CITY of PATTERSON GENERAL PLAN

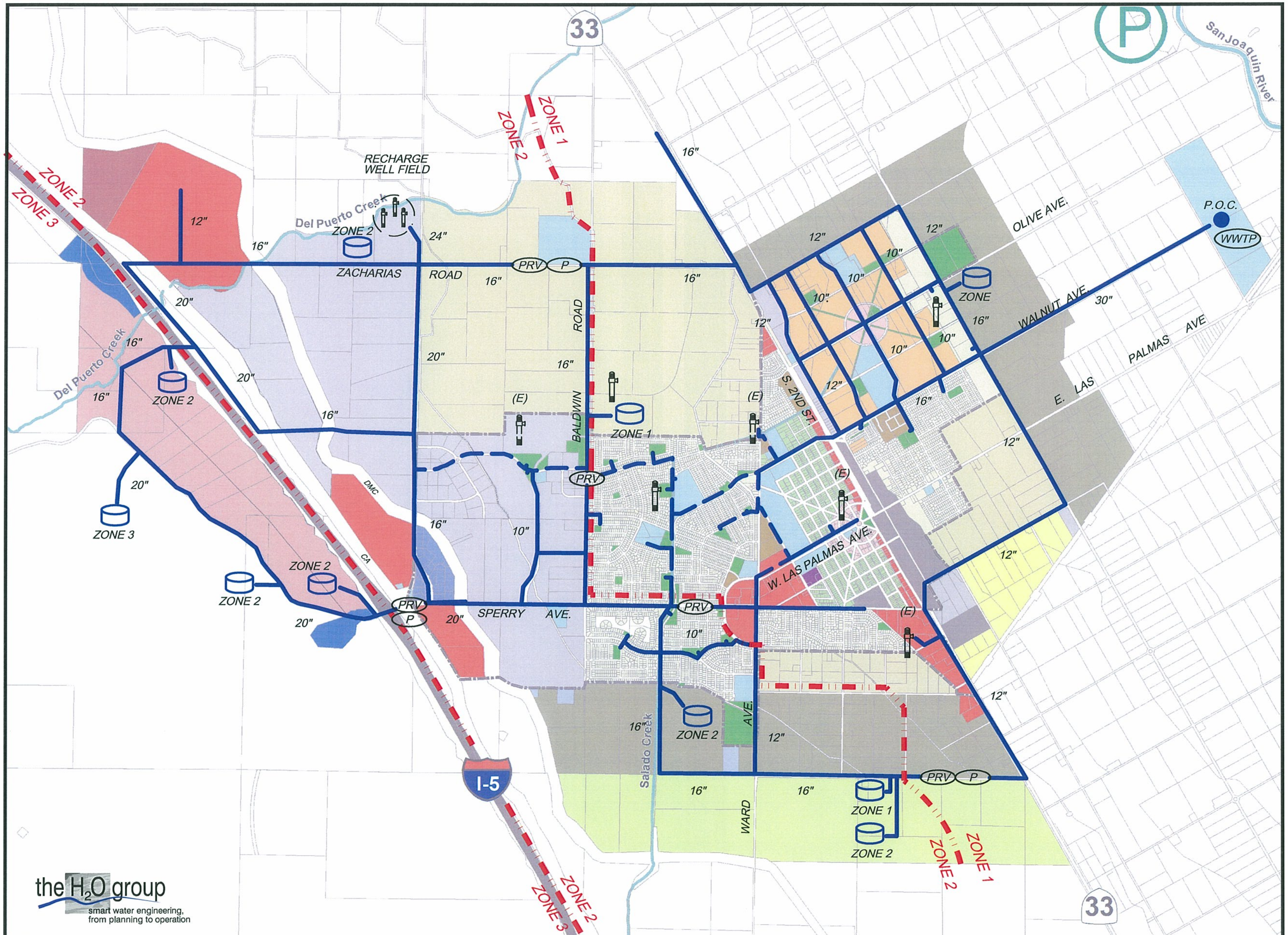
NONPOTABLE WATER COMPACT LAND USE PLAN

LEGEND

- ZONE 1 — PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE
- ZONE 1 — EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE
- PROPOSED WATER LINE
- EXISTING WATER LINE
- GROUNDWATER WELL
- PRESSURE ZONE BOUNDARY
- P — BOOSTER PUMP
- WTP — WATER TREATMENT PLANT
- PRV — PRESSURE REDUCING VALVE
- WWTP — WASTE WATER TREATMENT PLANT
- P.O.C. POINT OF CONNECTION (FUTURE RECYCLED WATER)

Revised June 2010

FIGURE 5-5



CITY of PATTERSON GENERAL PLAN

NONPOTABLE WATER JOBS LAND USE PLAN

LEGEND

- ZONE 1 — PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE
- ZONE 1 — EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE
- PROPOSED WATER LINE
- EXISTING WATER LINE
- GROUNDWATER WELL
- PRESSURE ZONE BOUNDARY
- P — BOOSTER PUMP
- WTP — WATER TREATMENT PLANT
- PRV — PRESSURE REDUCING VALVE
- WWTP — WASTE WATER TREATMENT PLANT
- P.O.C. POINT OF CONNECTION (FUTURE RECYCLED WATER)

Revised June 2010

FIGURE 5-6

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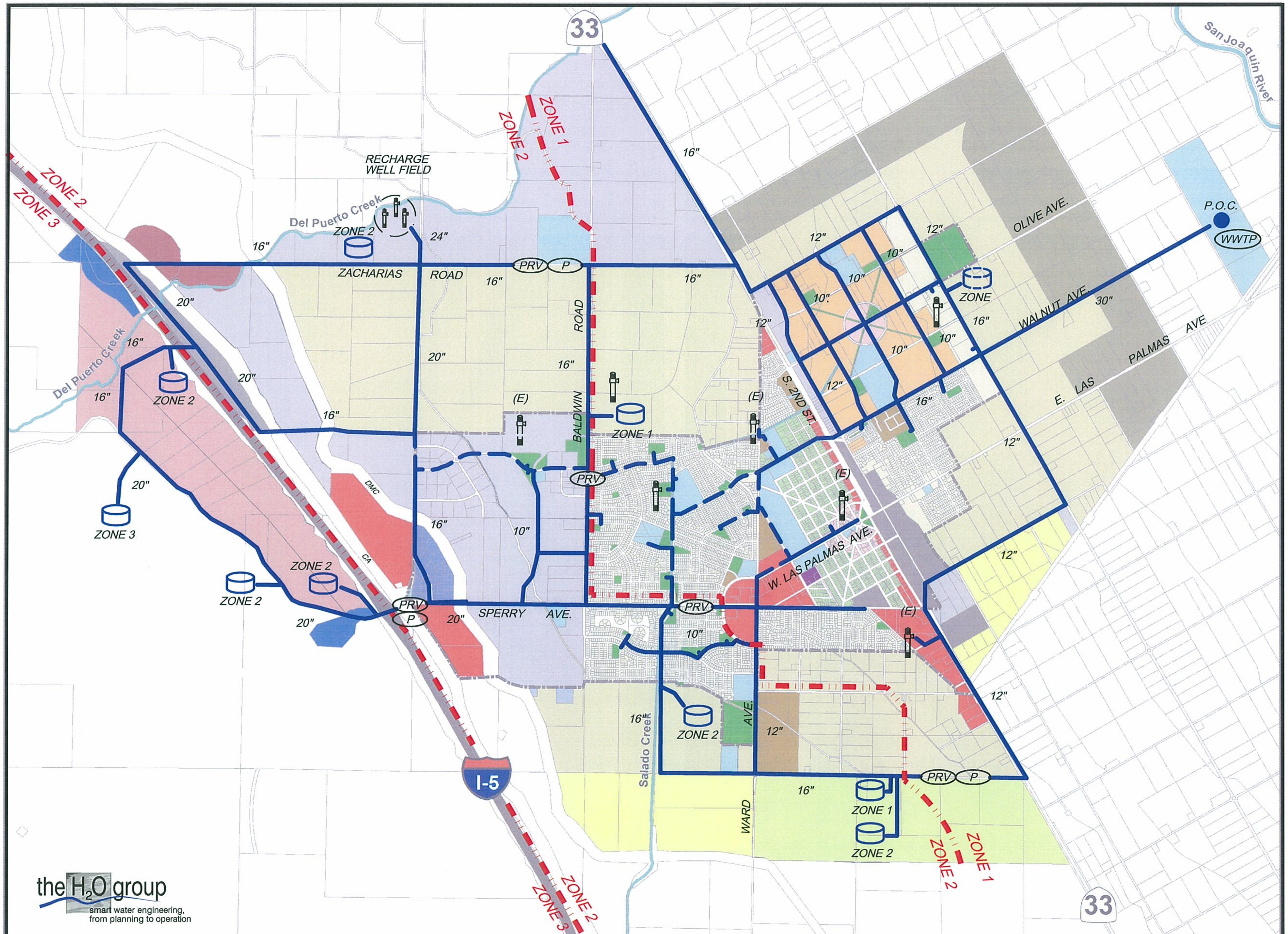


CITY of PATTERSON GENERAL PLAN

NONPOTABLE WATER PC LAND USE PLAN

LEGEND

- ZONE 1 — PROPOSED STORAGE TANK W/ INTENDED PRESSURE ZONE
- ZONE 1 — EXISTING STORAGE TANK W/ INTENDED PRESSURE ZONE
- PROPOSED WATER LINE
- EXISTING WATER LINE
- GROUNDWATER WELL
- PRESSURE ZONE BOUNDARY
- P — BOOSTER PUMP
- WTP — WATER TREATMENT PLANT
- PRV — PRESSURE REDUCING VALVE
- WWTP — WASTE WATER TREATMENT PLANT
- P.O.C. POINT OF CONNECTION (FUTURE RECYCLED WATER)

Revised June 2010

FIGURE 5-7

H:\Jobs\City of Patterson\General Plan EXH\Non Potable Water Exh GP Exp PC Land 2010-06.dwg Keith 06-29-10 12:09:28

Table 5-6 City of Patterson 2010 General Plan Update Compact Land Use Alternative Water Demands by Pressure Zone-Potable

		Pressure Zone			
		1	2	3	Total
2030					
	Potable	5,552	1,366	-	6,918
	Non-potable	3,013	1,571	-	4,584
	Total	**8,565**	**2,938**	**-**	**11,503**
Build-out					
	Potable	6,020	2,116	21	8,157
	Non-potable	3,485	2,396	17	5,898
	Total	**9,505**	**4,512**	**38**	**14,055**

	1	2	3	Total
Potable Storage - 2030				
avg day demand mgd	4.96	1.22	-	
Largest Fire Flow volume	0.84	0.84	-	
Max day (=1.5 * Avg) (a)	7.43	1.83	-	9.26
Operations (0.3 * max day)	2.23	0.55	-	
Emergency (=1.0 * max day)	3.72	0.91	-	
Fire	0.84	0.84	-	
Zone Storage Requirements	6.79	2.30	-	9.09
Existing Storage (mg)	**1.00**	**3.30**	**-**	
Additional Storage (mg)	**5.79**	**-**	**-**	**5.79**

	1	2	3	Total
Potable Storage - Buildout				
avg day demand mgd	5.37	1.89	0.02	
Largest Fire Flow volume	1.08	1.08	0.12	
Max day (=1.5 * Avg) (a)	8.06	2.83	0.03	10.92
Operations (0.3 * max day)	2.42	0.85	0.01	
Emergency (=0.5 * max day)	4.03	1.42	0.01	
Fire (b)	0.54	0.54	0.06	
Zone Storage Requirements	6.99	2.81	0.08	9.88
Existing Storage (mg)	**1.00**	**3.30**	**-**	
Additional Storage (mg)	**5.99**	**-**	**0.08**	**6.07**

(a) Max day multiplier is lower because irrigation demand has been removed from the potable system.

Table 5-7 City of Patterson 2010 General Plan Update Compact Land Use Alternative Water Demands by Pressure Zone - Non-potable

	Pressure Zone			
Recycled Water Storage - 2030	1	2	3	
avg day demand mgd	2.69	1.40	-	
Max day (=4.5 * Avg)	12.10	6.31	-	18.41
Operations (0.33 * max day)	3.99	2.08	-	
Emergency (=0.10* max day)	1.21	0.63	-	
Zone Storage Requirements	5.20	2.71	-	7.92
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**5.20**	**2.71**	-	**7.92**
Recycled Water Storage - Build-out				
avg day demand mgd	3.11	2.14	0.02	
Max day (=4.5 * Avg)	14.00	9.63	0.07	23.69
Operations (0.33 * max day)	4.62	3.18	0.02	
Emergency (=0.10 * max day)	1.40	0.96	0.01	
Zone Storage Requirements	6.02	4.14	0.03	10.19
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**6.02**	**4.14**	**0.03**	**10.19**

Water Sources Currently, the water sources to the City's existing distribution systems are through groundwater pumping stations (wells). In the future, these well fields will be expanded primarily with the groundwater recharge program. Additional recycled water will be available in the future from the City's wastewater treatment plant.

For modeling purposes, the City's groundwater recharge program extraction wells were assumed in the northwestern area of the sphere of influence for both the non-potable and potable distribution systems. This location was used for helping to estimate infrastructure. The groundwater recharge and recovery program will need to be studied in greater detail to identify where optimal locations would be for these wells. This work will need to occur immediately following the adoption of a new general plan so that those properties that are most conducive to groundwater recharge can be identified and reserved prior to additional planning efforts. Said planning efforts is estimated to take 12 to 18 months to complete, in part due to required coordination of land owners, local irrigation districts, Bureau of Reclamation, State Regional Water Quality Control Board, State Department of Health Services, and others. Table 5-12 shows the maximum day demands and the additional flows and corresponding numbers of wells needed in the future for each land use alternative. In all cases, the future wells were assumed to have a production rate of 1,500 gpm.

Table 5-8 City of Patterson 2010 General Plan Update Jobs Land Use Alternative Water Demands by Pressure Zone - Potable

		Pressure Zone			
		1	2	3	Total
2030					
	Potable	5,786	2,503	-	8,289
	Non-potable	3,118	2,018	-	5,135
	Total	**8,904**	**4,520**	**-**	**13,424**
Build-out					
	Potable	5,355	2,950	606	8,911
	Non-potable	5,969	3,675	803	10,447
	Total	**11,324**	**6,625**	**1,410**	**19,358**

Potable Storage - 2030				
avg day demand mgd	5.17	2.23	-	
Largest Fire Flow volume	0.84	0.84	-	
Max day (=1.5 * Avg) (a)	7.75	3.35	-	11.10
Operations (0.3 * max day)	2.32	1.01	-	
Emergency (=0.5 * max day)	3.87	1.68	-	
Fire (b)	0.84	0.84	-	
Zone Storage Requirements	7.04	3.52	-	10.56
Existing Storage (mg)	**1.00**	**3.30**	**-**	
Additional Storage (mg)	**6.04**	**0.22**	**-**	**6.26**
Potable Storage Build-out				
avg day demand mgd	4.78	2.63	0.54	
Largest Fire Flow volume	1.08	1.08	0.24	
Max day (=1.5 * Avg)	7.17	3.95	0.81	11.93
Operations (0.3 * max day)	2.15	1.19	0.24	
Emergency (=0.5 * max day)	3.59	1.98	0.41	
Fire (b)	1.08	1.08	0.12	
Zone Storage Requirements	6.82	4.24	0.77	11.83
Existing Storage (mg)	**1.00**	**3.30**	**-**	
Additional Storage (mg)	**5.82**	**0.94**	**0.77**	**7.53**

(a) Max day multiplier is lower because irrigation demand has been removed from the potable system.
(b) Assumes half of largest fire flow comes from storage, other half comes from pumping stations or wells.

Table 5-9 City of Patterson 2010 General Plan Update Jobs Land Use Alternative Water Demands by Pressure Zone - Non-potable

	Pressure Zone			
Recycled Water Storage - 2030	1	2	3	
avg day demand mgd	5.17	2.23	-	
Max day (=4.5 * Avg) (a)	23.24	10.05	-	33.30
Operations (0.33 * max day)	7.67	3.32	-	
Emergency (=0.10 * max day)	2.32	1.01	-	
Zone Storage Requirements	9.99	4.32	-	14.32
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**9.99**	**4.32**	-	**14.32**

Recycled Water Storage Build-out				
avg day demand mgd	5.33	3.28	0.72	
Max day (=4.5 * Avg)	23.98	14.76	3.23	41.97
Operations (0.33 * max day)	7.91	4.87	1.07	
Emergency (=0.10 * max day)	2.40	1.48	0.32	
Zone Storage Requirements	10.31	6.35	1.39	18.05
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**10.31**	**6.35**	**1.39**	**18.05**

The groundwater recharge and recovery program will identify suitable areas for the recharge, conveyance facilities, placement of recovery wells, etc. The acreage needed for recharge basins is based on largest demand that would be needed in any given year. In reality, the recharge area will be smaller than this since recharge can occur over a multi-year period. The assumptions on area can be refined as the future studies related to the recharge program are completed.

The City's wastewater treatment plant is located east of the City adjacent to the San Joaquin River. The recycled water facilities were modeled as originating from the treatment plant.

Transmission Mains Tables 5-13, 5-14, and 5-15 summarize the results of the modeling effort for linear feet of transmission mains. The pipes lineal footage by diameter and are shown for both the potable and the non-potable systems.

Water Treatment Treatment of groundwater to meet drinking water requirements will be required for all future and existing potable water sources within the City, as discussed in Section 4. This project assumes that two separate treatment facilities will be constructed, each needing approximately 10-15 acres of land. The first treatment facility will gather and treat the water

Table 5-10 City of Patterson 2010 General Plan Update PC Land Use Alternative Water Demands by Pressure Zone - Potable

		Pressure Zone			
		1	2	3	Total
2030					
	Potable	7,118	2,688	-	9,806
	Non-potable	4,546	3,062	-	7,608
	Total	**11,664**	**5,750**	**-**	**17,414**
Build-out					
	Potable	6,594	2,892	606	10,092
	Non-potable	6,789	3,722	803	11,314
	Total	**13,382**	**6,614**	**1,410**	**21,406**
Potable Storage - 2030					
avg day demand mgd		6.35	2.40	-	
Largest Fire Flow volume		1.08	1.08	-	
Max day (=1.5 * Avg) (a)		9.53	3.60	-	13.13
Operations (0.3 * max day)		2.86	1.08	-	
Emergency (=0.5 * max day)		4.77	1.80	-	
Fire (b)		1.08	1.08	-	
Zone Storage Requirements		8.71	3.96	-	12.66
Existing Storage (mg)		**1.00**	**3.30**	**-**	
Additional Storage (mg)		**7.71**	**0.66**	**-**	**8.36**
Potable Storage - Build-out					
avg day demand mgd		5.89	2.58	0.54	
Largest Fire Flow volume		1.08	1.08	0.54	
Max day (=1.5 * Avg) (a)		8.83	3.87	0.81	13.51
Operations (0.3 * max day)		2.65	1.16	0.24	
Emergency (=0.5 * max day)		4.41	1.94	0.41	
Fire (b)		1.08	1.08	0.54	
Zone Storage Requirements		8.14	4.18	1.19	13.51
Existing Storage (mg)		**1.00**	**3.30**	**-**	
Additional Storage (mg)		**7.14**	**0.88**	**1.19**	**9.21**

(a) Max day multiplier is lower because irrigation demand has been removed from the potable system.

(b) Assumes half of largest fire flow comes from storage, other half comes from pumping stations or wells.

Table 5-11 City of Patterson 2010 General Plan Update PC Land Use Alternative Water Demands by Pressure Zone - Non-Potable

Recycled Water Storage - 2030	Pressure Zone 1	Pressure Zone 2	Pressure Zone 3	
avg day demand mgd	4.06	2.73	-	
Max day (=4.5 * Avg)	18.26	12.30	-	30.56
Operations (0.33 * max day)	6.03	4.06	-	
Emergency (=0.10 * max day)	1.83	1.23	-	
Zone Storage Requirements	7.85	5.29	-	13.14
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**7.85**	**5.29**	-	**13.14**

Recycled Water Storage -Build-out	1	2	3	
avg day demand mgd	6.06	3.32	0.72	
Largest Fire Flow volume	-	-	-	
Max day (=4.5 * Avg)	27.27	14.95	3.23	45.45
Operations (0.33* max day)	9.00	4.93	1.07	
Emergency (=0.10 * max day)	2.73	1.50	0.32	
Zone Storage Requirements	11.73	6.43	1.39	19.54
Existing Storage (mg)	-	-	-	
Additional Storage (mg)	**11.73**	**6.43**	**1.39**	**19.54**

from existing City wells in Zone 1 and is assumed to be located at property owned by the City in the southeastern part of the City.

The second treatment facility is assumed to be located in the northwest part of the City near the groundwater recharge area. Water treatment options and alternatives are discussed in detail in Section 4.

Treatment facilities will be sized to meet the maximum potable day demands of the system. Figures 5-2 through 5-4 show the back bone potable water facilities that are anticipated to serve each of the land use plans. Actual tanks, wells, treatment plants and PRV locations, as well as, future pipeline sizes and alignments will be determined as the City water supply program evolves and as development occurs.

Table 5-12 Estimated Flows and Numbers of New Wells Needed to Meet Future Demands for All Land Use Alternatives

Land Plan	Compact				Jobs				PC			
Year	2030		Build-out		2030		Build-out		2030		Build-out	
Water Type	Potable	Non-potable	Potable	Non-potable	Potable	Non-potable	Potable	Non-potable	Potable	Non-potable	Potable	Non-potable
Max-Day Demand (mgd)	9.26	18.41	10.92	23.69	11.10	33.30	11.93	41.97	13.13	30.56	13.51	45.45
Max-Day Demand (gpm)	6,433	12,788	7,585	16,453	7,708	23,123	8,286	29,145	9,119	21,223	9,384	31,562
Sources												
Existing wells (a)	5,800	2,000	5,800	2,000	5,800	2,000	5,800	2,000	5,800	2,000	5,800	2,000
Future Recycled (gpm) (b)		3,647		4,376		3,579		5,172		3,817		5,901
Future Wells (gpm)	633	7,141	1,785	10,078	1,908	17,544	2,486	21,973	3,319	15,406	3,584	23,661
Number of wells needed (assumed Production of 1500 gpm)	1	4	2	4	2	8	2	10	3	7	3	11

(a) Supplies assume the largest groundwater pump station is out of service - potable system only
(b) Recycled water supplies shown are only associated with the City's wastewater treatment. IF additional recycled water is acquired fromteh City of Modesto then the number of non-potable wells can be reduced accordingly.

Table 5-13 City of Patterson Summary of Compact Land Use Plan Potable and Non-Potable Water Distribution System Transmission Mains

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Potable			
	12	29,040	34,320
	16	47,520	73,920
	20	7,920	10,560
	24	3,960	3,960
	Total	**88,440**	**122,760**

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Non-potable			
	8	26,400	36,960
	10	36,960	36,960
	12	34,320	34,320
	16	39,600	50,160
	20	5,280	5,280
	24	2,000	2,000
	30	7,920	7,920
	Total	**152,480**	**173,600**

Table 5-14 City of Patterson Summary of Jobs Land Use Plan Potable and Non-Potable Water Distribution System Transmission Mains

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Potable			
	12	34,320	55,440
	16	58,080	79,200
	20	23,760	26,400
	24	6,600	6,600
	30	2,000	2,000
	Total	**124,760**	**169,640**

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Non-potable			
	8	31,680	52,800
	10	36,960	36,960
	12	39,600	39,600
	16	50,160	50,160
	20	13,200	26,400
	24	2,000	2,000
	30	7,920	7,920
	Total	**181,520**	**215,840**

Table 5-15 City of Patterson Summary of PC Land Use Plan Potable and Non-Potable Water Distribution System Transmission Mains

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Potable			
	12	34,320	44,880
	16	47,520	79,200
	20	23,760	26,400
	24	6,600	6,600
	30	2,000	2,000
	Total	**114,200**	**159,080**

Water System	Pipe Diameter	Year 2030 (Feet)	Build-out (Feet)
Non-potable			
	8	26,400	52,800
	10	36,960	36,960
	12	29,040	39,600
	16	44,880	50,160
	20	13,200	26,400
	24	2,000	2,000
	30	7,920	7,920
	Total	**160,400**	**215,840**

Estimated Future Potable and Non-potable Infrastructure Costs

Planning level cost estimates of the facilities needed to implement the proposed water supply solution are calculated for each of the three land use alternatives for both the year 2030 and at build-out. The estimates are planning level and the purpose is to get a general understanding of the cost obligations per land use acre and see if those costs are reasonable. The unit costs used in this section reflect the pricing of construction in the year 2010.

Tables 5-16 and 5-17 present the costs for the potable water system for the compact plan for both the year 2030 and at build-out. Tables 5-18 and 5-19 are the compact plan non-potable water infrastructure costs estimates. Tables 5-20 through 5-23 are the estimates for the Jobs Plan land use alternative. Tables 5-24 through 5-27 are for the PC alternative.

Tables 5-28 through 5-34 allocate the costs by land use category for both plan years for each land use alternative.

Table 5-16 Compact Land Use Plan Estimated Potable Water System Costs for 2030

Potable 2030

		Diameter	Quantity	Unit	Unit Costs	Total Costs
Piping		**Diameter**	**Quantity**	**Unit**	**Unit Costs**	**Total Costs**
		12	29040	ft	$ 96	$ 2,787,840
		16	47520	ft	$ 128	$ 6,082,560
		20	7920	ft	$ 160	$ 1,267,200
		24	3960	ft	$ 192	$ 760,320
	Subtotal		**88440**			**$ 10,897,920**
Groundwater Recharge (d)						
	Land		4	ac	$ 125,000	$ 458,333
	Development		4	ac	$ 25,000	$ 91,667
	Subtotal					**$ 550,000**
Wells	well		1	ea	$ 1,000,000	$ 1,000,000
	land (a)		1	ac	$ 125,000	$ 125,000
	Subtotal					**$ 1,125,000**
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		9.3	gal	$ 3,000,000	$ 27,791,991
	Raw Water Pipes Size from 12 up to 30		15840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 30,446,231**
Storage	Tank		5.79	MG	$ 3,500,000	$ 20,255,890
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					**$ 22,130,890**
Subtotal						**$ 65,150,041**
Engineering, CM, Legal, admin (25%)						$ 16,287,510
Contingency (15%)						$ 9,772,506
Total Cost						**$ 91,210,057**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage - assume three sites, 2 pressure zones, each site 5 acres.

(c) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.

(d) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

Table 5-17 Compact Land Use Plan Estimated Potable Water System Costs for Build-out

Potable build-out

			Quantity	Unit	Unit Costs	Total Costs
Piping	**Diameter**					
		12	34320	ft	$ 96	$ 3,294,720
		16	73920	ft	$ 128	$ 9,461,760
		20	10560	ft	$ 160	$ 1,689,600
		24	3960	ft	$ 192	$ 760,320
	Subtotal		**122760**			**$ 15,206,400**
Groundwater Recharge (d)						
	Land		7	ac	$ 125,000	$ 916,667
	Development		7	ac	$ 25,000	$ 183,333
	Subtotal					**$ 1,100,000**
Wells	well		2	ea	$ 1,000,000	$ 2,000,000
	land (a)		2	ac	$ 125,000	$ 250,000
	Subtotal					**$ 2,250,000**
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		10.9	gal	$ 3,500,000	$ 38,226,994
	Raw Water Pipes Size from 12 up to 30		15840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 40,881,234**
Storage	Tank		6.07	MG	$ 3,000,000	$ 18,213,617
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					**$ 20,088,617**
Subtotal						**$ 79,526,251**
Engineering, CM, Legal, admin (25%)						$ 19,881,563
Contnguency (15%)						$ 11,928,938
Total Cost						**$ 111,336,751**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage at Buildout - assume three sites, 2 pressure zones, each site 5 acres.

(c) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.

(d) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

Table 5-18 Compact Land Use Plan Estimated Non-Potable Water System Costs for 2030

Non- Potable 2030

Piping	Diameter	Quantity	Unit	Unit Costs	Total Costs
	8	26,400	ft	$ 64	$ 1,689,600
	10	36,960	ft	$ 80	$ 2,956,800
	12	34,320	ft	$ 96	$ 3,294,720
	16	50,160	ft	$ 128	$ 6,420,480
	20	5,280	ft	$ 160	$ 844,800
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**163,040**	**ft**		**$17,491,200**
Groundwater Recharge (c)					
	Land	0	ac	$ 125,000	$ -
	Development	0	ac	$ 25,000	$ -
	Subtotal				**$ -**
Wells	well	4.00	ea	$ 700,000	$ 2,800,000
	land (a)	4.00	ac	$ 125,000	$ 500,000
	Subtotal				**$ 3,300,000**
Storage	Tank	7.92	MG	$ 2,000,000	$15,836,630
	Land (b)	5	ac	$ 125,000	$ 625,000
	Subtotal				**$16,461,630**
Subtotal					**$37,252,830**
Engineering, CM, Legal, admin (25%)					$ 9,313,208
Contingency (15%)					$ 5,587,925
Total Cost					**$52,153,962**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage tanks - only for zone 1 - assumed that all storage will fit on 5 acre site

(c) For the compact plan, non-potable demands are fully meet from recycled water flows, conservation, and available water from irrigation districts for all year types. Non-potable yields from the groundwater recharge program are not needed to meet demands.

Table 5-19 Compact Land Use Plan Estimated Non-Potable Water System Costs for Build-out

Non- Potable build-out

Piping	Diameter	Quantity	Unit	Unit Costs	Total Costs
	8	36,960	ft	$ 64	$ 2,365,440
	10	36,960	ft	$ 80	$ 2,956,800
	12	34,320	ft	$ 96	$ 3,294,720
	16	50,160	ft	$ 128	$ 6,420,480
	20	5,280	ft	$ 160	$ 844,800
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**165,680**	ft		**$16,266,240**
Groundwater Recharge (c)					
	Land	0	ac	$ 125,000	$ -
	Development	0	ac	$ 25,000	$ -
	Subtotal				**$ -**
Wells	well	4	ea	$ 700,000	$ 2,800,000
	land (a)	4	ac	$ 125,000	$ 500,000
	Subtotal				**$ 3,300,000**
Storage	Tank	10.19	MG	$ 2,000,000	$20,375,961
	Land (b)	15	ac	$ 125,000	$ 1,875,000
	Subtotal				**$22,250,961**

Subtotal	**$41,817,201**
Engineering, CM, Legal, admin (25%)	$10,454,300
Contingency (15%)	$ 6,272,580
Total Cost	**$58,544,082**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage at Buildout - assume three sites, 2 pressure zones, each site 5 acres.

(c) For the compact plan, non-potable demands are fully meet from recycled water flows, conservation, and available water from irrigation districts for all year types. Non-potable yields from the groundwater recharge program are not needed to meet demands.

Table 5-20 Jobs Land Use Plan Estimated Potable Water System Costs for 2030

Potable 2030

Piping		Diameter	Quantity	Unit	Unit Costs	Total Costs
		12	34320	ft	$ 96	$ 3,294,720
		16	58080	ft	$ 128	$ 7,434,240
		20	23760	ft	$ 160	$ 3,801,600
		24	6600	ft	$ 192	$ 1,267,200
		30	2000	ft	$ 240	$ 480,000
	Subtotal		**124760**			**$ 16,277,760**
Groundwater Recharge (d)						
	Land		27	ac	$ 125,000	$ 3,333,333
	Development		27	ac	$ 25,000	$ 666,667
	Subtotal					**$ 4,000,000**
Wells	well		2	ea	$ 1,000,000	$ 2,000,000
	land (a)		2	ac	$ 125,000	$ 250,000
	Subtotal					**$ 2,250,000**
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		11	gal	$ 3,500,000	$ 38,846,776
	Raw Water Pipes Size from 12 up to 30		15840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 41,501,016**
Storage	Tank		6.26	MG	$ 2,000,000	$ 12,518,526
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					**$ 14,393,526**
Subtotal						**$ 78,422,303**
Engineering, CM, Legal, admin (25%)						$ 19,605,576
Contingency (15%)						$ 11,763,345
Total Cost						**$109,791,224**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage - assume three sites, 2 pressure zones, each site 5 acres.

(c) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.

(d) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

Table 5-21 Jobs Land Use Plan Estimated Potable Water System Costs for Build-out

Potable build-out

Piping	Diameter		Quantity	Unit	Unit Costs	Total Costs
		12	55440	ft	$ 96	$ 5,322,240
		16	79200	ft	$ 128	$ 10,137,600
		20	26400	ft	$ 160	$ 4,224,000
		24	6600	ft	$ 192	$ 1,267,200
		30	2000	ft	$ 240	$ 480,000
	Subtotal		169640			$ 21,431,040
Groundwater Recharge (c)						
	Land		53	ac	$ 125,000	$ 6,666,667
	Development		53	ac	$ 25,000	$ 1,333,333
	Subtotal					**$ 8,000,000**
Wells	well		3	ea	$ 1,000,000	$ 3,000,000
	land (a)		3	ac	$ 125,000	$ 375,000
	Subtotal					$ 3,375,000
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		12	gal	$ 3,000,000	$ 35,796,039
	Raw Water Pipes Size from 12 up to 30		15840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 38,450,279**
Storage	Tank		7.53	MG	$ 3,500,000	$ 26,339,637
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					$ 28,214,637
Subtotal						**$ 99,470,956**
Engineering, CM, Legal, admin (25%)						$ 24,867,739
Contingency (15%)						$ 14,920,643
Total Cost						**$139,259,339**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage at Buildout - assume three sites, 2 pressure zones, each site 5 acres.

(c) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

(d) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.

Table 5-22 Jobs Land Use Plan Estimated Non-Potable Water System Costs for 2030

Non- Potable 2030

Piping	Diameter	Quantity	Unit	Unit Costs	Total Costs
	8	26,400	ft	$ 64	$ 1,689,600
	10	36,960	ft	$ 80	$ 2,956,800
	12	29,040	ft	$ 96	$ 2,787,840
	16	44,880	ft	$ 128	$ 5,744,640
	20	13,200	ft	$ 160	$ 2,112,000
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**160,400**	**ft**		**$ 17,575,680**

Groundwater Recharge					
	Land	11	ac	$ 125,000	$ 1,402,616
	Development	11	ac	$ 25,000	$ 280,523
	Subtotal				**$ 1,683,139**

Wells	well	8	ea	$ 700,000	$ 5,600,000
	land (a)	8	ac	$ 125,000	$ 1,000,000
	Subtotal				**$ 6,600,000**

Storage	Tank	14.32	MG	$ 2,000,000	$ 28,635,624
	Land (b)	15	ac	$ 125,000	$ 1,875,000
	Subtotal				**$ 30,510,624**

Subtotal	**$ 56,369,442**
Engineering, CM, Legal, admin (25%)	$ 14,092,361
Contingency (15%)	$ 8,455,416
Total Cost	**$ 78,917,219**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage - assume three sites, 2 pressure zones, each site 5 acres.

Table 5-23 Jobs Land Use Plan Estimated Non-Potable Water System Costs for Build-out

Non- Potable build-out

Piping	Diameter	Quantity	Unit	Unit Costs	Total Costs
	8	52,800	ft	$ 64	$ 3,379,200
	10	36,960	ft	$ 80	$ 2,956,800
	12	39,600	ft	$ 96	$ 3,801,600
	16	50,160	ft	$ 128	$ 6,420,480
	20	26,400	ft	$ 160	$ 4,224,000
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**215,840**	**ft**		**$ 23,066,880**

Groundwater Recharge					
	Land	22	ac	$ 125,000	$ 2,805,231
	Development	22	ac	$ 25,000	$ 561,046
	Subtotal				**$ 3,366,278**

Wells	well	10	ea	$ 700,000	$ 7,000,000
	land (a)	10	ac	$ 125,000	$ 1,250,000
	Subtotal				**$ 8,250,000**

Storage	Tank	18.05	MG	$ 2,000,000	$ 36,092,702
	Land (b)	30	ac	$ 125,000	$ 3,750,000
	Subtotal				**$ 39,842,702**

Subtotal	**$ 74,525,860**
Engineering, CM, Legal, admin (25%)	$ 18,631,465
Contingency (15%)	$ 11,178,879
Total Cost	**$ 104,336,204**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage at Buildout - assume six sites, 3 pressure zones, each site 5 acres.

Table 5-24 PC Land Use Plan Estimated Potable Water System Costs for 2030

Potable 2030

Piping	Diameter		Quantity	Unit	Unit Costs	Total Costs
		12	34,320	ft	$ 96	$ 3,294,720
		16	47,520	ft	$ 128	$ 6,082,560
		20	23,760	ft	$ 160	$ 3,801,600
		24	6,600	ft	$ 192	$ 1,267,200
		30	2,000	ft	$ 240	$ 480,000
	Subtotal		**114,200**			**$ 14,926,080**
Groundwater Recharge (d)						
	Land		39	ac	$ 125,000	$ 4,875,000
	Development		39	ac	$ 25,000	$ 975,000
	Subtotal					**$ 5,850,000**
Wells	well		3	ea	$ 1,000,000	$ 3,000,000
	land (a)		3	ac	$ 125,000	$ 375,000
	Subtotal					**$ 3,375,000**
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		13	gal	$ 3,500,000	$ 45,957,747
	Raw Water Pipes Size from 12 up to 30		15,840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 48,611,987**
Storage	Tank		8.36	MG	$ 2,000,000	$ 16,729,256
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					**$ 18,604,256**
Subtotal						**$ 91,367,322**
Engineering, CM, Legal, admin (25%)						$ 22,841,831
Contingency (15%)						$ 13,705,098
Total Cost						**$127,914,251**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage - assume three sites, 2 pressure zones, each site 5 acres.

(c) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.

(d) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

Table 5-25 PC Land Use Plan Estimated Potable Water System Costs for Build-out

Potable build-out

Piping	Diameter		Quantity	Unit	Unit Costs	Total Costs
		12	44,880	ft	$ 96	$ 4,308,480
		16	79,200	ft	$ 128	$ 10,137,600
		20	26,400	ft	$ 160	$ 4,224,000
		24	6,600	ft	$ 192	$ 1,267,200
		30	2,000	ft	$ 240	$ 480,000
	Subtotal		159,080			**$ 20,417,280**
Groundwater Recharge (d)						
	Land		78	ac	$ 125,000	$ 9,750,000
	Development		78	ac	$ 25,000	$ 1,950,000
	Subtotal					**$ 11,700,000**
Wells	well		3	ea	$ 1,000,000	$ 3,000,000
	land (a)		3	ac	$ 125,000	$ 375,000
	Treatment (c)		3.07	mgd	$ 3,000,000	$ 9,196,741
	Subtotal					**$ 12,571,741**
Water Treatment						
	Land		4	ac	$ 125,000	$ 500,000
	Treatment		14	gal	$ 3,500,000	$ 47,296,792
	Raw Water Pipes Size from 12 up to 30		15,840	ft	$ 136	$ 2,154,240
	Subtotal					**$ 49,951,032**
Storage	Tank		9.21	MG	$ 2,000,000	$ 18,421,391
	Land (b)		15	ac	$ 125,000	$ 1,875,000
	Subtotal					**$ 20,296,391**
Subtotal						**$114,936,444**
Engineering, CM, Legal, admin (25%)						$ 28,734,111
Contingency (15%)						$ 17,240,467
Total Cost						**$160,911,022**

(a) Land for Wells assumed to be 1 ac
(b) Land for storage at Buildout - assume three sites, 2 pressure zones, each site 5 acres.
(c) Quantity shown is only associated with vacant lands. Treatment costs for demands that exists today (2010) are not shown.
(d) Land for groundwater recharge is based on a percolation rate of 3 inches per day, and a recapture rate of 50%. Land is based on amount needed from spreading basin program to balance demands. 2030 land totals are equal to 1/2 of what is needed at buildout.

Table 5-26 PC Land Use Plan Estimated Non-Potable Water System Costs for 2030

Non- Potable 2030

Piping	**Diameter**	**Quantity**	**Unit**	**Unit Costs**	**Total Costs**
	8	26,400	ft	$ 64	$ 1,689,600
	10	36,960	ft	$ 80	$ 2,956,800
	12	29,040	ft	$ 96	$ 2,787,840
	16	44,880	ft	$ 128	$ 5,744,640
	20	13,200	ft	$ 160	$ 2,112,000
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**160,400**	**ft**		**$ 17,575,680**

Groundwater Recharge (c)					
	Land	0	ac	$ 125,000	$ -
	Development	0	ac	$ 25,000	$ -
	Subtotal				**$ -**

Wells	well	7.00	ea	$ 1,000,000	$ 7,000,000
	land (a)	7.00	ac	$ 125,000	$ 875,000
	Subtotal				**$ 7,875,000**

Storage	Tank	13.14	MG	$ 2,000,000	$ 26,282,642
	Land (b)	15	ac	$ 125,000	$ 1,875,000
	Subtotal				**$ 28,157,642**

Subtotal	**$ 53,608,322**
Engineering, CM, Legal, admin (25%)	$ 13,402,081
Contingency (15%)	$ 8,041,248
Total Cost	**$ 75,051,651**

(a) Land for Wells assumed to be 1 ac
(b) Land for storage - assume three sites, 2 pressure zones, each site 5 acres.
(c) For the PC plan, non-potable demands are fully meet from recycled water flows, conservation, and available water from irrigation districts for all year types. Non-potable yields from the groundwater recharge program are not needed to meet demands.

Table 5-27 PC Land Use Plan Estimated Non-Potable Water System Costs for Build-out

Non- Potable build-out

Piping	Diameter	Quantity	Unit	Unit Costs	Total Costs
	8	52,800	ft	$ 64	$ 3,379,200
	10	36,960	ft	$ 80	$ 2,956,800
	12	39,600	ft	$ 96	$ 3,801,600
	16	50,160	ft	$ 128	$ 6,420,480
	20	26,400	ft	$ 160	$ 4,224,000
	24	2,000	ft	$ 192	$ 384,000
	30	7,920	ft	$ 240	$ 1,900,800
	Subtotal	**215,840**	**ft**		**$ 23,066,880**

Groundwater Recharge (c)					
	Land	0	ac	$ 125,000	$ -
	Development	0	ac	$ 25,000	$ -
	Subtotal				**$ -**

Wells	well	11	ea	$ 1,000,000	$ 11,000,000
	land (a)	11	ac	$ 125,000	$ 1,375,000
	Subtotal				$ 12,375,000

Storage	Tank	19.54	MG	$ 2,000,000	$ 39,086,703
	Land (b)	30	ac	$ 125,000	$ 3,750,000
	Subtotal				**$ 42,836,703**

Subtotal	**$ 78,278,583**
Engineering, CM, Legal, admin (25%)	$ 19,569,646
Contingency (15%)	$ 11,741,787
Total Cost	**$ 109,590,016**

(a) Land for Wells assumed to be 1 ac

(b) Land for storage at Buildout - assume six sites, 3 pressure zones, each site 5 acres.

(c) For the PC plan, non-potable demands are fully meet from recycled water flows, conservation, and available water from irrigation districts for all year types. Non-potable yields from the groundwater recharge program are not needed to meet demands.

Table 5-28 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - Compact Plan Year 2030

Land Use Designation	2009 (existing developed Land Use)	Compact Plan 2030	Undeveloped	Potable System Costs $ 91,210,057 Potable Demand factor (a)	Potable Demand	Potable %	Potable cost	Undeveloped	Non- Potable System Costs $ 52,153,962 Non-Potable Demand factor (a)	Non- Potable Demand	Non-Potable %	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	-	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	1,344	-	0.76	-	0%	$ -	-	1.04	-	0%	-	$ -	
Estate Residential	27	176	1,344	0.42	564.31	20%	$ 18,107,718	1,344	0.58	779.69	19%	9,872,096	**$ 27,979,815**	**$ 20,818**
Low Density Residential	1,168	1,303	149	1.05	156.32	5%	$ 5,015,898	149	1.45	215.98	5%	2,734,603	**$ 7,750,501**	**$ 52,017**
Medium Density Residential	68	369	135	1.02	137.68	5%	$ 4,417,859	135	1.41	190.23	5%	2,408,560	**$ 6,826,419**	**$ 50,566**
High Density Residential	44	58	301	1.67	503.83	18%	$ 16,167,094	301	2.46	738.98	18%	9,356,607	**$ 25,523,701**	**$ 84,796**
Downtown Residential	203	203	14	0.95	13.28	0%	$ 426,283	14	1.05	14.72	0%	186,319	**$ 612,602**	**$ 43,757**
Subtotal	**1,510**	**3,453**	**1,943**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	415	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	52	353	1.18	418.04	15%	$ 13,414,069	353	0.94	333.37	8%	4,220,969	**$ 17,635,039**	**$ 49,958**
Neighborhood Commercial	-	-	-	0.76	-	0%	$ -	-	0.82	-	0%	-	$ -	
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	1,648	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,337	0.76	1,016.99	36%	$ 32,633,478	1,337	1.21	1,621.94	39%	20,536,315	**$ 53,169,793**	**$ 39,768**
Public/Quasi-Public	325	410	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	85	0.38	32.03	1%	$ 1,027,657	85	2.64	224.18	5%	2,838,493	**$ 3,866,150**	**$ 45,484**
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	36	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**3,047**	**1,775**											
Total	**2,680**	**6,500**	**3,718**		2,842.48	1.00	$ 91,210,057			4,119.08	1.00	52,153,962	**$ 143,364,020**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Table 5-29 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - Compact Plan - Build-out

Land Use Designation	2009 (existing developed Land Use)	Compact Plan Build-out	Compact Plan Undeveloped	Potable System Costs $ 111,336,751 Potable Demand factor (a)	Potable Demand	Potable %	Potable cost	Undeveloped	Non- Potable System ($ 58,544,082 Non-Potable Demand factor (a)	Non-Potable Demand	Non-Potable %	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	-	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	2,141	-	0.76	-	0%	$ -	-	1.04	-	0%	-	$ -	
Estate Residential	27	176	2,141	0.42	898.95	26%	$ 29,052,519	2,141	0.58	1,242.05	25%	14,647,425	**$ 43,699,944**	**$ 20,411**
Low Density Residential	1,168	1,303	149	1.05	156.32	5%	$ 5,051,861	149	1.45	215.98	4%	2,546,999	**$ 7,598,860**	**$ 50,999**
Medium Density Residential	68	369	135	1.02	137.68	4%	$ 4,449,534	135	1.41	190.23	4%	2,243,324	**$ 6,692,858**	**$ 49,577**
High Density Residential	44	58	301	1.67	503.83	15%	$ 16,283,008	301	2.46	738.98	15%	8,714,709	**$ 24,997,717**	**$ 83,049**
Downtown Residential	203	203	14	0.95	13.28	0%	$ 429,340	14	1.05	14.72	0%	173,536	**$ 602,876**	**$ 43,063**
Subtotal	**1,510**	**4,250**	**2,740**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	481	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	70	419	1.18	496.20	14%	$ 16,036,239	419	0.94	395.70	8%	4,666,443	**$ 20,702,683**	**$ 49,410**
Neighborhood Commercial	-	-	17	0.76	12.54	0%	$ 405,316	17	0.82	13.54	0%	159,680	**$ 564,996**	
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	1,875	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,564	0.76	1,189.66	35%	$ 38,447,788	1,564	1.21	1,897.32	38%	22,374,966	**$ 60,822,754**	**$ 38,889**
Public/Quasi-Public	325	422	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	97	0.38	36.55	1%	$ 1,181,147	97	2.64	255.83	5%	3,016,999	**$ 4,198,145**	**$ 43,280**
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	79	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**3,413**	**2,097**											
Total	**2,680**	**7,663**	**4,837**		3,445.01	1.00	$ 111,336,751			4,964.34	1.00	58,544,082	**$ 169,880,833**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Table 5-30 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - Jobs Plan - Year 2030

Land Use Designation	2009 (existing developed Land Use)	Jobs Plan 2030	Undevelop	Potable System Costs $ 109,791,224 Potable Demand factor (a)	Potable Demand	Potable %	Potable cost	Undeveloped	Non- Potable System C $ 78,917,219 Non-Potable Demand factor (a)	Non-Potable Demand	Non-Potable %	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	-	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	2,043	-	0.76	-	0%	$ -	-	1.04	-	0%	-	$ -	
Estate Residential	27	176	2,043	0.42	857.80	24%	$ 26,694,744	2,043	0.58	1,185.20	24%	19,208,375	$ 45,903,119	$ 22,468
Low Density Residential	1,168	1,303	149	1.05	156.32	4%	$ 4,864,538	149	1.45	215.98	4%	3,500,310	$ 8,364,848	$ 56,140
Medium Density Residential	68	369	135	1.02	137.68	4%	$ 4,284,545	135	1.41	190.23	4%	3,082,972	$ 7,367,518	$ 54,574
High Density Residential	44	58	301	1.67	503.83	14%	$ 15,679,236	301	2.46	738.98	15%	11,976,517	$ 27,655,753	$ 91,880
Downtown Residential	203	203	14	0.95	13.28	0%	$ 413,420	14	1.05	14.72	0%	238,489	$ 651,909	$ 46,565
Subtotal	**1,510**	**4,152**	**2,642**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	712	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	52	650	1.18	769.76	22%	$ 23,954,777	650	0.94	613.85	13%	9,948,623	$ 33,903,400	$ 52,159
Neighborhood Commercial	-	-	-	0.76	-	0%	$ -	-	0.82	-	0%	-	$ -	
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	1,701	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,390	0.76	1,057.31	30%	$ 32,903,317	1,390	1.21	1,686.24	35%	27,328,643	$ 60,231,960	$ 43,332
Public/Quasi-Public	325	410	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	85	0.38	32.03	1%	$ 996,647	85	2.64	224.18	5%	3,633,289	$ 4,629,936	$ 54,470
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	157	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**3,518**	**2,125**											
Total	**2,680**	**7,670**	**4,767**		3,528.00	1.00	$ 109,791,224			4,869.36	1.00	78,917,219	**$ 188,708,443**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Table 5-31 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - Jobs Plan - Build-out

Land Use Designation	2009 (existing developed Land Use)	Jobs Plan Build-out	Undevelop	Potable System Costs Potable Demand factor (a)	Potable Demand	Potable % ($ 139,259,339)	Potable cost	Undeveloped	Non- Potable System Costs Non- Potable Demand factor (a)	Non- Potable Demand	Non-Potable % ($ 104,336,204)	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	650	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	3,644	650	0.76	491.25	9%	$ 11,926,421	650	1.04	678.75	9%	9,020,159	$ 20,946,580	
Estate Residential	27	1,038	3,644	0.42	1,530.02	27%	$ 37,145,196	3,644	0.58	2,113.98	27%	28,093,555	$ 65,238,751	$ 17,903
Low Density Residential	1,168	1,303	1,011	1.05	1,060.64	18%	$ 25,749,773	1,011	1.45	1,465.45	19%	19,475,000	$ 45,224,772	$ 44,733
Medium Density Residential	68	369	135	1.02	137.68	2%	$ 3,342,502	135	1.41	190.23	2%	2,527,992	$ 5,870,494	$ 43,485
High Density Residential	44	58	301	1.67	503.83	9%	$ 12,231,840	301	2.46	738.98	9%	9,820,568	$ 22,052,408	$ 73,264
Downtown Residential	203	203	14	0.95	13.28	0%	$ 322,521	14	1.05	14.72	0%	195,557	$ 518,078	$ 37,006
Subtotal	**1,510**	**7,265**	**5,755**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	792	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	113	730	1.18	864.72	15%	$ 20,993,340	730	0.94	689.58	9%	9,164,137	$ 30,157,477	$ 41,301
Neighborhood Commercial	-	-	60	0.76	45.37	1%	$ 1,101,373	60	0.82	48.98	1%	650,906	$ 1,752,279	
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	1,701	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,390	0.76	1,057.31	18%	$ 25,668,859	1,390	1.21	1,686.24	21%	22,409,086	$ 48,077,945	$ 34,588
Public/Quasi-Public	325	410	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	85	0.38	32.03	1%	$ 777,514	85	2.64	224.18	3%	2,979,244	$ 3,756,758	$ 44,197
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	664	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**4,166**	**2,265**											
Total	**2,680**	**11,431**	**8,020**		5,736.12	1.00	$ 139,259,339			7,851.08	1.00	104,336,204	**$ 243,595,543**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Table 5-32 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - PC Plan - Year 2030

Land Use Designation	2009 (existing developed Land Use)	Jobs Plan 2030	Undevelop	Potable System Costs $ 127,914,251 Potable Demand factor (a)	Potable Demand	Potable %	Potable cost	Undeveloped	Non- Potable System ($ 75,051,651 Non-Potable Demand factor (a)	Non-Potable Demand	Non-Potable %	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	-	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	3,646	-	0.76	-	0%	$ -	-	1.04	-	0%	-	$ -	
Estate Residential	27	485	3,646	0.42	1,530.86	34%	$ 43,418,637	3,646	0.58	2,115.14	33%	24,572,432	$ 67,991,069	$ 18,648
Low Density Residential	1,168	1,303	458	1.05	480.49	11%	$ 13,627,713	458	1.45	663.87	10%	7,712,495	$ 21,340,208	$ 46,594
Medium Density Residential	68	369	135	1.02	137.68	3%	$ 3,904,873	135	1.41	190.23	3%	2,209,932	$ 6,114,804	$ 45,295
High Density Residential	44	139	301	1.67	503.83	11%	$ 14,289,829	301	2.46	738.98	11%	8,584,989	$ 22,874,818	$ 75,996
Downtown Residential	203	203	95	0.95	90.15	2%	$ 2,556,754	95	1.05	99.85	2%	1,160,040	$ 3,716,794	$ 39,124
Subtotal	**1,510**	**6,145**	**4,635**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	421	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	52	359	1.18	425.14	9%	$ 12,058,002	359	0.94	339.03	5%	3,938,703	$ 15,996,706	$ 44,559
Neighborhood Commercial	-	-	-	0.76	-	0%	$ -	-	0.82	-	0%	-	$ -	
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	2,033	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,722	0.76	1,309.84	29%	$ 37,150,114	1,722	1.21	2,088.99	32%	24,268,651	$ 61,418,765	$ 35,667
Public/Quasi-Public	325	410	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	85	0.38	32.03	1%	$ 908,330	85	2.64	224.18	3%	2,604,409	$ 3,512,738	$ 41,326
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	292	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**3,694**	**2,166**											
Total	**2,680**	**9,839**	**6,801**		4,510.01	1.00	$ 127,914,251			6,460.28	1.00	75,051,651	**$ 202,965,903**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Table 5-33 City of Patterson Estimated Cost per Acre for Potable and Non-potable Water Systems - PC Plan - Build-out

Land Use Designation	2009 (existing developed Land Use)	Jobs Plan Build-out	Undevelop	Potable System Costs Potable Demand factor (a)	Potable Demand	$ 160,911,022 Potable %	Potable cost	Undeveloped	Non- Potable System Costs Non- Potable Demand factor (a)	Non- Potable Demand	$ 109,590,016 Non-Potable %	Non-Potable cost	Totals Costs	Cost per Gross Acre
	Acres	Acres	Acres	Af-ft/ac	ac-ft			Acres	Af-ft/ac	ac-ft				
Residential														
Mixed Use Hillside Development	-	650	-	0.92	-	0%	$ -	-	1.28	-	0%	-	$ -	
Neighborhood Village	-	4,569	650	0.76	491.25	8%	$ 12,827,032	650	1.04	678.75	8%	8,482,747	**$ 21,309,779**	**$ 32,784**
Estate Residential	27	1,027	4,569	0.42	1,918.40	31%	$ 50,091,206	4,569	0.58	2,650.60	30%	33,126,214	**$ 83,217,420**	**$ 18,213**
Low Density Residential	1,168	1,303	1,000	1.05	1,049.10	17%	$ 27,392,918	1,000	1.45	1,449.51	17%	18,115,428	**$ 45,508,346**	**$ 45,508**
Medium Density Residential	68	369	135	1.02	137.68	2%	$ 3,594,907	135	1.41	190.23	2%	2,377,377	**$ 5,972,284**	**$ 44,239**
High Density Residential	44	139	301	1.67	503.83	8%	$ 13,155,514	301	2.46	738.98	8%	9,235,468	**$ 22,390,983**	**$ 74,389**
Downtown Residential	203	203	95	0.95	90.15	1%	$ 2,353,801	95	1.05	99.85	1%	1,247,936	**$ 3,601,736**	**$ 37,913**
Subtotal	**1,510**	**8,260**	**6,750**											
Non-Residential														
Downtown Core	82	69	-	1.13	-	0%	$ -	-	0.79	-	0%	-	$ -	
Regional Commercial	-	-	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
General Commercial	62	487	-	0.75	-	0%	$ -	-	0.81	-	0%	-	$ -	
Highway Service Commercial	53	113	425	1.18	503.30	8%	$ 13,141,673	425	0.94	401.36	5%	5,016,109	**$ 18,157,781**	**$ 42,724**
Neighborhood Commercial	-	-	60	0.76	45.37	1%	$ 1,184,542	60	0.82	48.98	1%	612,125	**$ 1,796,667**	**$ 30,030**
Medical/Professional Office	2	6	-	0.77	-	0%	$ -	-	0.83	-	0%	-	$ -	
Light Industrial	311	2,124	-	0.32	-	0%	$ -	-	1.04	-	0%	-	$ -	
Heavy Industrial	132	153	1,813	0.76	1,379.06	22%	$ 36,008,549	1,813	1.21	2,199.39	25%	27,487,134	**$ 63,495,682**	**$ 35,022**
Public/Quasi-Public	325	443	-	0.87	-	0%	$ -	-	1.20	-	0%	-	$ -	
Parks and Recreation	167	258	118	0.38	44.46	1%	$ 1,160,880	118	2.64	311.22	4%	3,889,479	**$ 5,050,359**	**$ 42,800**
Open Space														
Agriculture														
Other (streets, lakes, canals, etc.)	36	533	-	-	-	0%	$ -	-	-	-	0%	-	$ -	
Subtotal	**1,170**	**4,186**	**2,416**											
Total	**2,680**	**12,446**	**9,166**		6,162.60	1.00	$ 160,911,022			8,768.86	1.00	109,590,016	**$ 270,501,038**	

(a) Demand factors include reduction for conservation see Table 3-17 in water supply chapter

Section 6 Conclusions and Recommendations

Conclusions

Findings of the 2010 *City of Patterson General Plan Update Water Supply Analysis* include the following:

- Water of sufficient quality, quantity, and reliability is available to serve the Patterson General Plan area, if the recommendations proposed herein are followed.
- Year-to-year surface water deliveries to Westside communities are highly unreliable. The groundwater basin can act as a storage reservoir to span dry periods.
- Local groundwater cannot be relied upon to meet all future demands associated with any of the general plan areas. Limited natural recharge, competing interests, and subsidence potential will not provide for long-term, sustainable build-out of any general plan areas with local groundwater only. Hence, alternative sources of supply, including conservation, recycled wastewater and surface water will be required to supplement the groundwater supply.
- Several water purveyors rely on the local groundwater basin for water supply. Currently, no coordinated effort for proper management and stewardship of local groundwater to ensure sustainability of the basin is in place.
- Local groundwater quality is marginal, and treatment of groundwater is expected as part of the City's water program, regardless of any future general plan expansions.
- The water supply program should consist of a variety of source waters to meet demands, ensure reliability, and create a feasible program that is readily obtainable by the City of Patterson.
- Groundwater, conservation and recycled water are the most reliable sources of water available to the City. However, recycled water cannot be used directly for drinking water. Hence, a non-potable water distribution system is required for recycled water deliveries.

- Surface water is currently being delivered under existing contracts and water rights to the general plan areas. Retaining these current deliveries is feasible, realistic, and the most reliable and least controversial method of providing water supplies to the City of Patterson in the future.

- Surface water supplies currently being delivered to the general plan areas consist of water from either the federal DMC or San Joaquin River. At this time, neither of these source waters is approved for use as a drinking water source. The water from these sources can be used for non-potable demands and groundwater recharge.

- Outdoor water use makes up approximately 60 percent of the total projected demands. As such, non-potable water consisting of untreated surface water, recycled water, and/or non-potable groundwater can be used to supply the majority of the City's water demands. This will require construction of dual water systems in all new developments.

- The local groundwater basin can provide the best opportunities for storage of water to account for dry and critically dry conditions, as well as potential long-term climate change impacts.

- Extending development from the City core to the west will require three different pressure zones within the water distribution systems. It will also allow the City to have gravity storage facilities in the hills which will help regulate system pressures and provide increased system reliability.

- Costs associated with the recommendations of this report are shown for each land use plan. Costs appear to be reasonable and comparable to current City water development impact fees.

Recommendations

The recommendation is to implement a comprehensive water supply program with the following components:

1. Expand the existing non-potable water program, including a dual distribution system for all new developments, including residential, to allow use of non-potable water sources (i.e. surface water, recycled water, and groundwater) for irrigation of outdoor landscaping.

2. Require that land owners secure water supplies for their projects, and that upon annexation into the City, those supply entitlements and/or long-term water delivery agreements be transferred to the City. Long-term delivery agreements should include language to ensure reliable and affordable water for the City, and provisions should allow the transfer of federal water entitlements to City when existing federal contracts expire.

3. Embark on a study to identify those areas best suited for surface-spreading groundwater recharge, and incorporating these areas into the selected general plan alternative by reserving these properties for said use, and combining these areas with storm water detention, and recreation/open space where feasible.

4. Prior to development occurring in the future, the City should look at policy-related decisions to support the expansion of the non-potable water system into the existing City and as it relates to new development, depending on the results of groundwater recharge studies.

5. Develop a recycled water program, for tertiary treatment and delivery of wastewater for use as a water source for non-potable demands.

6. Open discussion with the City of Modesto about purchasing recycled water from them in the future.

7. Initiate and/or participate in local and regional water planning efforts, including but not limited to, groundwater management, integrated water management, and other water planning processes for coordination and cooperation with other water purveyors and stakeholders. This will help to ensure long-term, sustainable, and reliable water supply programs for the Westside area. The City should actively pursue the preparation of a groundwater management plan for their groundwater basin in concert with other local water stakeholders. The plan should include groundwater recharge programs and help define the parameters under which the basin should operate to ensure reliable quantities and quality of water into the future.

8. The state is actively supporting the types of water programs that have been identified in this memo. State funding is available for recycled water and groundwater projects. Funding is also available for the preparation of regional groundwater plans. The City should actively pursue this funding. Meet all DWR prerequisites for funding qualification.

9. Initiate an aggressive water conservation program to meet the requirements of SB 7 and achieve, at a minimum, a 20 percent overall water demand reduction by 2020, as required by California Water Code.

10. Provide treatment of water as required based on the final selection of source waters, the amount of each source water used, and source water quality. Look for opportunities to meet water quality goals while reducing residuals by blending source waters, partial or split-stream treatment, and/or treatment for select contaminants.

11. Water treatment solutions should compliment wastewater processing, where feasible, including the reduction or elimination of self-generating water softeners.

12. The costs estimates shown in the report do not include the purchase of water rights/entitlements. Securing water right/entitlement purchases, should be the responsibility of the land owners to satisfy the requirements of annexation and the mapping of the project.

13. The water supply assessment outlines steps that the City will need to take to insure reliable water supplies that support the anticipated growth for the selected land use plan. Several studies such as the conservation plan, the regional groundwater study, infrastructure master plan, and infrastructure financing plan will need to be completed to support any growth. Future development has a fair share cost associated with these studies. The City should discuss these costs with land owners and determine funding agreements for developer costs which will be realized before development impact fees will be collected.

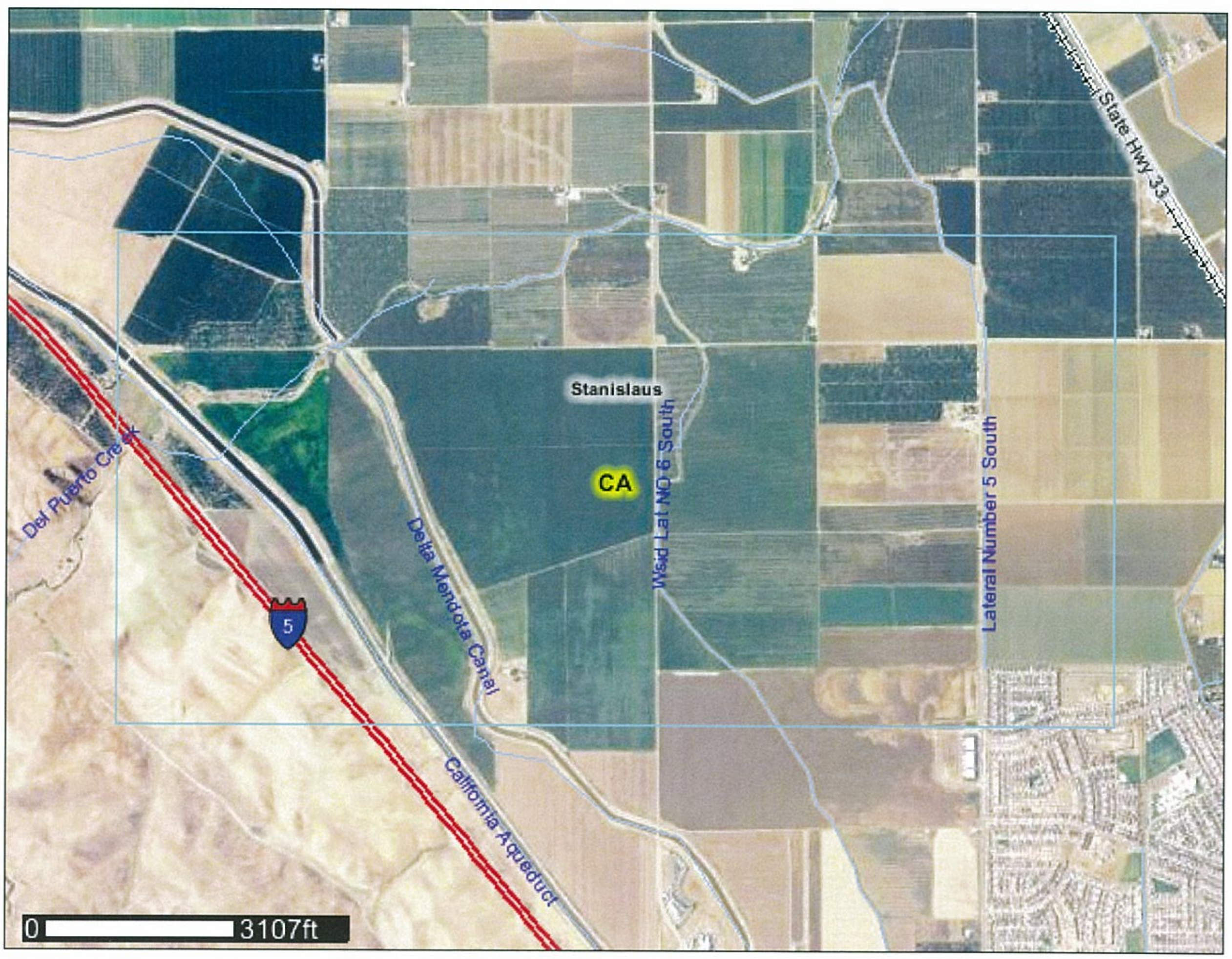
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Stanislaus County, California, Western Part



March 19, 2010

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:27,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Stanislaus County, California, Western Part
Survey Area Data: Version 6, May 11, 2009

Date(s) aerial images were photographed: 6/12/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Custom Soil Resource Report
Soil Map

Map Scale: 1:27,300 if printed on A size (8.5" x 11") sheet.

Map Unit Legend

Stanislaus County, California, Western Part (CA642)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
100	Capay clay, 0 to 2 percent slopes	529.1	17.8%
102	Capay clay, loamy substratum, 0 to 2 percent slopes	30.1	1.0%
106	Capay clay, 0 to 2 percent slopes, rarely flooded	17.6	0.6%
126	Vernalis-Zacharias complex, 0 to 2 percent slopes, rarely flooded	23.5	0.8%
127	Vernalis loam, 0 to 2 percent slopes, rarely flooded	214.7	7.2%
128	Water	334.9	11.3%
130	Stomar clay loam, 0 to 2 percent slopes	161.8	5.5%
140	Zacharias clay loam, 0 to 2 percent slopes	219.3	7.4%
142	Zacharias gravelly clay loam, 0 to 2 percent slopes	169.9	5.7%
144	Zacharias gravelly clay loam, 2 to 5 percent slopes	61.3	2.1%
145	Zacharias clay loam, 2 to 5 percent slopes	90.4	3.0%
147	Zacharias gravelly clay loam, 0 to 2 percent slopes, rarely flooded	462.9	15.6%
210	Cortina gravelly sandy loam, 0 to 5 percent slopes, rarely flooded	294.2	9.9%
255	Calla-Carbona complex, 30 to 50 percent slopes	138.6	4.7%
270	Elsalado fine sandy loam, 0 to 2 percent slopes, rarely flooded	63.7	2.1%
271	Elsalado loam, 0 to 2 percent slopes, rarely flooded	45.0	1.5%
500	Wisflat-Arburua-San Timoteo complex, 30 to 50 percent slopes	108.8	3.7%
Totals for Area of Interest		**2,965.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Stanislaus County, California, Western Part

100—Capay clay, 0 to 2 percent slopes

Map Unit Setting

Elevation: 40 to 250 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Capay and similar soils: 90 percent
Minor components: 10 percent

Description of Capay

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone-shale

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4s

Typical profile

0 to 20 inches: Clay
20 to 60 inches: Clay

Minor Components

Zacharias

Percent of map unit: 4 percent
Landform: Alluvial fans

Stomar

Percent of map unit: 3 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 3 percent
Landform: Alluvial fans

102—Capay clay, loamy substratum, 0 to 2 percent slopes

Map Unit Setting

Elevation: 20 to 180 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Capay and similar soils: 85 percent
Minor components: 15 percent

Description of Capay

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone-shale

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4s

Typical profile

0 to 20 inches: Clay
20 to 35 inches: Clay
35 to 45 inches: Clay loam
45 to 60 inches: Loam

Minor Components

Stomar

Percent of map unit: 5 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 5 percent
Landform: Alluvial fans

Zacharias

Percent of map unit: 5 percent
Landform: Alluvial fans

106—Capay clay, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 40 to 250 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Capay and similar soils: 90 percent
Minor components: 10 percent

Description of Capay

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone-shale

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4s

Typical profile

0 to 20 inches: Clay
20 to 60 inches: Clay

Minor Components

Stomar

Percent of map unit: 5 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 3 percent
Landform: Alluvial fans

Zacharias

Percent of map unit: 2 percent
Landform: Alluvial fans

126—Vernalis-Zacharias complex, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 30 to 400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Vernalis and similar soils: 45 percent
Zacharias and similar soils: 40 percent
Minor components: 15 percent

Description of Vernalis

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 4w

Typical profile

0 to 20 inches: Clay loam
20 to 62 inches: Clay loam

Description of Zacharias

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water capacity: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 4w

Typical profile

0 to 14 inches: Clay loam
14 to 66 inches: Clay loam

Minor Components

Capay

Percent of map unit: 8 percent
Landform: Basin floors

Stomar

Percent of map unit: 7 percent
Landform: Alluvial fans

127—Vernalis loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 100 to 150 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Vernalis and similar soils: 85 percent
Minor components: 15 percent

Description of Vernalis

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 4w

Typical profile

0 to 20 inches: Loam
20 to 62 inches: Clay loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Stomar

Percent of map unit: 5 percent
Landform: Alluvial fans

Zacharias

Percent of map unit: 5 percent
Landform: Alluvial fans

128—Water

Map Unit Composition

Water: 100 percent

130—Stomar clay loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 40 to 360 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Stomar and similar soils: 85 percent
Minor components: 15 percent

Description of Stomar

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from sedimentary rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2s

Land capability (nonirrigated): 4s

Typical profile

0 to 11 inches: Clay loam
11 to 38 inches: Clay
38 to 60 inches: Clay loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Vernalis

Percent of map unit: 5 percent
Landform: Alluvial fans

Zacharias

Percent of map unit: 5 percent
Landform: Alluvial fans

140—Zacharias clay loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 50 to 400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Zacharias and similar soils: 90 percent
Minor components: 10 percent

Description of Zacharias

Setting

Landform: Stream terraces, alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 2 percent
Available water capacity: High (about 9.7 inches)

Interpretive groups
Land capability classification (irrigated): 1
Land capability (nonirrigated): 4c

Typical profile
0 to 14 inches: Clay loam
14 to 66 inches: Clay loam

Minor Components

Capay
Percent of map unit: 5 percent
Landform: Basin floors

Stomar
Percent of map unit: 3 percent
Landform: Alluvial fans

Vernalis
Percent of map unit: 2 percent
Landform: Alluvial fans

142—Zacharias gravelly clay loam, 0 to 2 percent slopes

Map Unit Setting
Elevation: 50 to 400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition
Zacharias and similar soils: 90 percent
Minor components: 10 percent

Description of Zacharias

Setting
Landform: Stream terraces, alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4s
Ecological site: Loamy Fan Remnant 8-10" P.Z. (R017XE061CA)

Typical profile

0 to 14 inches: Gravelly clay loam
14 to 66 inches: Gravelly clay loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Stomar

Percent of map unit: 3 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 2 percent
Landform: Alluvial fans

144—Zacharias gravelly clay loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 50 to 400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Zacharias and similar soils: 90 percent
Minor components: 10 percent

Description of Zacharias

Setting

Landform: Stream terraces, alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 4e
Ecological site: Loamy Fan Remnant 8-10" P.Z. (R017XE061CA)

Typical profile

0 to 14 inches: Gravelly clay loam
14 to 66 inches: Gravelly clay loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Stomar

Percent of map unit: 3 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 2 percent
Landform: Alluvial fans

145—Zacharias clay loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 200 to 400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Zacharias and similar soils: 90 percent
Minor components: 10 percent

Description of Zacharias

Setting

Landform: Alluvial fans, stream terraces

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water capacity: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 4e
Ecological site: CLAYEY (R017XE001CA)

Typical profile

0 to 14 inches: Clay loam
14 to 66 inches: Clay loam

Minor Components

Alo

Percent of map unit: 2 percent
Landform: Mountains

Cortina

Percent of map unit: 2 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 2 percent
Landform: Alluvial fans

Stomar

Percent of map unit: 2 percent
Landform: Alluvial fans

Vaquero

Percent of map unit: 2 percent
Landform: Mountains

147—Zacharias gravelly clay loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 50 to 400 feet

Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Zacharias and similar soils: 90 percent
Minor components: 10 percent

Description of Zacharias

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability (nonirrigated): 4w
Ecological site: Loamy Fan Remnant 8-10" P.Z. (R017XE061CA)

Typical profile

0 to 14 inches: Gravelly clay loam
14 to 66 inches: Gravelly clay loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Stomar

Percent of map unit: 3 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 2 percent
Landform: Alluvial fans

210—Cortina gravelly sandy loam, 0 to 5 percent slopes, rarely flooded

Map Unit Setting

Elevation: 30 to 280 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Cortina and similar soils: 85 percent
Minor components: 15 percent

Description of Cortina

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 4s

Typical profile

0 to 6 inches: Gravelly sandy loam
6 to 38 inches: Stratified very gravelly loamy sand to very gravelly loam
38 to 60 inches: Stratified very gravelly sand to very gravelly loamy sand

Minor Components

Xerofluvents

Percent of map unit: 5 percent
Landform: Alluvial fans

Xerorthents

Percent of map unit: 5 percent
Landform: Alluvial fans

Stomar

Percent of map unit: 3 percent
Landform: Alluvial fans

Zacharias

Percent of map unit: 2 percent
Landform: Alluvial fans

255—Calla-Carbona complex, 30 to 50 percent slopes

Map Unit Setting

Elevation: 300 to 1,300 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Calla and similar soils: 50 percent
Carbona and similar soils: 35 percent
Minor components: 15 percent

Description of Calla

Setting

Landform: Terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium from calcareous sedimentary rock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: Loamy 6-8" P.Z. (R017XG043CA)

Typical profile

0 to 11 inches: Clay loam
11 to 30 inches: Clay loam

30 to 60 inches: Clay loam

Description of Carbona

Setting

Landform: Terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium from mixed rock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: CLAYEY (R017XE001CA)

Typical profile

0 to 15 inches: Clay loam
15 to 24 inches: Clay
24 to 50 inches: Clay
50 to 60 inches: Clay loam

Minor Components

Arburua

Percent of map unit: 5 percent
Landform: Hills

San timoteo

Percent of map unit: 5 percent
Landform: Mountains

Wisflat

Percent of map unit: 5 percent
Landform: Mountains

270—Elsalado fine sandy loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 40 to 270 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 270 days

Map Unit Composition

Elsalado and similar soils: 85 percent
Minor components: 15 percent

Description of Elsalado

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone-shale

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 4c

Typical profile

0 to 6 inches: Fine sandy loam
6 to 26 inches: Loam
26 to 60 inches: Loam

Minor Components

Capay

Percent of map unit: 5 percent

Landform: Basin floors

Zacharias

Percent of map unit: 5 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 5 percent
Landform: Alluvial fans

271—Elsalado loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

Elevation: 40 to 270 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 270 days

Map Unit Composition

Elsalado and similar soils: 85 percent
Minor components: 15 percent

Description of Elsalado

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone-shale

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 4c

Typical profile

0 to 6 inches: Loam

6 to 26 inches: Loam
26 to 60 inches: Loam

Minor Components

Capay

Percent of map unit: 5 percent
Landform: Basin floors

Zacharias

Percent of map unit: 5 percent
Landform: Alluvial fans

Vernalis

Percent of map unit: 5 percent
Landform: Alluvial fans

500—Wisflat-Arburua-San Timoteo complex, 30 to 50 percent slopes

Map Unit Setting

Elevation: 500 to 2,300 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 260 to 280 days

Map Unit Composition

Wisflat and similar soils: 35 percent
Arburua and similar soils: 30 percent
San timoteo and similar soils: 20 percent
Minor components: 15 percent

Description of Wisflat

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Sandstone

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock; 10 to 18 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.58 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 1.2 inches)

Interpretive groups

Land capability (nonirrigated): 7e
Ecological site: COARSE LOAMY (R015XE009CA)

Typical profile

0 to 5 inches: Sandy loam
5 to 10 inches: Sandy loam
10 to 13 inches: Weathered bedrock
13 to 17 inches: Unweathered bedrock

Description of Arburua

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Calcareous sandstone

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock; 20 to 36 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.3 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: Fine Loamy 9-13 (R015XE020CA)

Typical profile

0 to 6 inches: Loam
6 to 22 inches: Loam
22 to 24 inches: Weathered bedrock
24 to 28 inches: Unweathered bedrock

Description of San Timoteo

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Sandstone, calcareous

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.81 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Very low (about 2.9 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: COARSE LOAMY (R015XE009CA)

Typical profile

0 to 5 inches: Sandy loam
5 to 22 inches: Sandy loam
22 to 26 inches: Weathered bedrock

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Landform: Mountains

Ayar

Percent of map unit: 5 percent
Landform: Hills

Dark gray sandy soil less than 6 to more than 40 inches deep

Percent of map unit: 5 percent
Landform: Hills

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GROUNDWATER CONDITIONS IN THE VICINITY OF THE CITY OF PATTERSON

prepared for
H_2O Group
El Dorado Hills, California

by
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Groundwater Quality Consultants
Fresno, California

June 2010

June 24, 2010

Mr. Cort Abney
The H_2O Group
4661 Golden Foothill Pkwy
El Dorado Hills, CA 95762

Re: Groundwater Conditions in the
Vicinity of City of Patterson

Dear Cort:

Submitted herewith is our report on groundwater conditions in the vicinity of the City of Patterson.

Sincerely Yours,

Kenneth D. Schmidt
Geologist No. 1578
Certified Hydrogeologist
No. 176

KDS/pe

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OF THE CITY OF PATTERSON

INTRODUCTION

The City of Patterson is located in western Stanislaus County between I-5 and the San Joaquin River. The January 2009 City General Plan Area comprises 12,446 acres and extends west to and past I-5. The Plan Area is generally bounded by Del Puerto Creek and Lemon Avenue on the north and by Elm Avenue on the northeast. The H_2O Group (2006) prepared a water supply planning study for the City, including information on groundwater. Groundwater has been the sole source of water supply for the City. Both groundwater availability and quality are of concern in the future. This evaluation was conducted to provide an update on groundwater conditions beneath the City and vicinity. In addition, the availability of groundwater for full development of the planning area is evaluated.

EXISTING CONDITIONS

Regional Conditions

Hotchkiss and Balding (1971) provided information on regional groundwater conditions in the Tracy-Dos Palos area, which includes the Patterson area. There are two aquifers in the Patterson area, and they are separated by a widespread clay layer (the Corcoran Clay). This clay layer extends throughout much of the western part of the San Joaquin Valley. The Tulare Formation and overlying alluvial deposits comprise the major aquifers. Groundwater near Patterson generally moves to the north in both aquifers. Under predevelopment conditions the groundwater in both aquifers flowed to the northeast toward the San Joaquin River. Due to pumping, water levels in wells tapping the lower aquifer are now usually below those in the upper aquifer. This causes a tendency for downward flow of the groundwater. However, near the San Joaquin River, the direction of groundwater is still upward, due to a lack of pumping from the lower aquifer in that area.

Recharge from most west side streams and rainfall is generally small in the Patterson area. Most of the recharge to groundwater in the Patterson area is associated with canal water deliveries. Seepage from unlined canals and ditches and deep percolation from lands irrigated with canal water are the major sources of recharge. Well pumpage and groundwater outflow are the major sources of groundwater discharge. Long-term water-level measurements indicate that the groundwater in the upper aquifer has been approximately in balance. However, in recent years, surface water supplies have been diminished due to drought conditions and Delta water issues, pumping has increased, and water levels have declined. Groundwater in the lower aquifer is confined, and over pumpage from this aquifer has caused land subsidence over large areas, particularly south of Dos Palos. Such subsidence can be minimized by groundwater management activities.

The chemical quality of groundwater beneath much of the Patterson area has been influenced by recharge from west side streams. Many of these streams (such as Salado Creek) have moderate to high concentrations of sulfate and chloride. These constituents are also present in some of the west side alluvial deposits. Lower salinity groundwater is usually present in areas where relatively large streams are present. Other factors that influence groundwater quality are irrigation practices, which generally concentrate salts, and canal seepage, which generally decreases salt concentrations in the groundwater, due to the lower salinity of the canal water compared to the groundwater.

There are three water districts that deliver irrigation water to the Patterson area: Del Puerto Water District (WD), Patterson Irrigation District (ID), and West Stanislaus Irrigation District (ID). The Patterson ID primarily serves water to lands east of Ward Avenue. The Del Puerto WD primarily serves water to lands southwest of Lateral 6 south and northeast of the California Aqueduct. The West Stanislaus ID serves water to the lands between these two Districts (Figure 1). Each of these Districts has a CVP water entitlement from the Delta-Mendota Canal.

Subsurface Geologic Conditions

Kenneth D. Schmidt and Associates (KDSA) (2002) prepared a groundwater supply evaluation for the City of Patterson. Figure 1

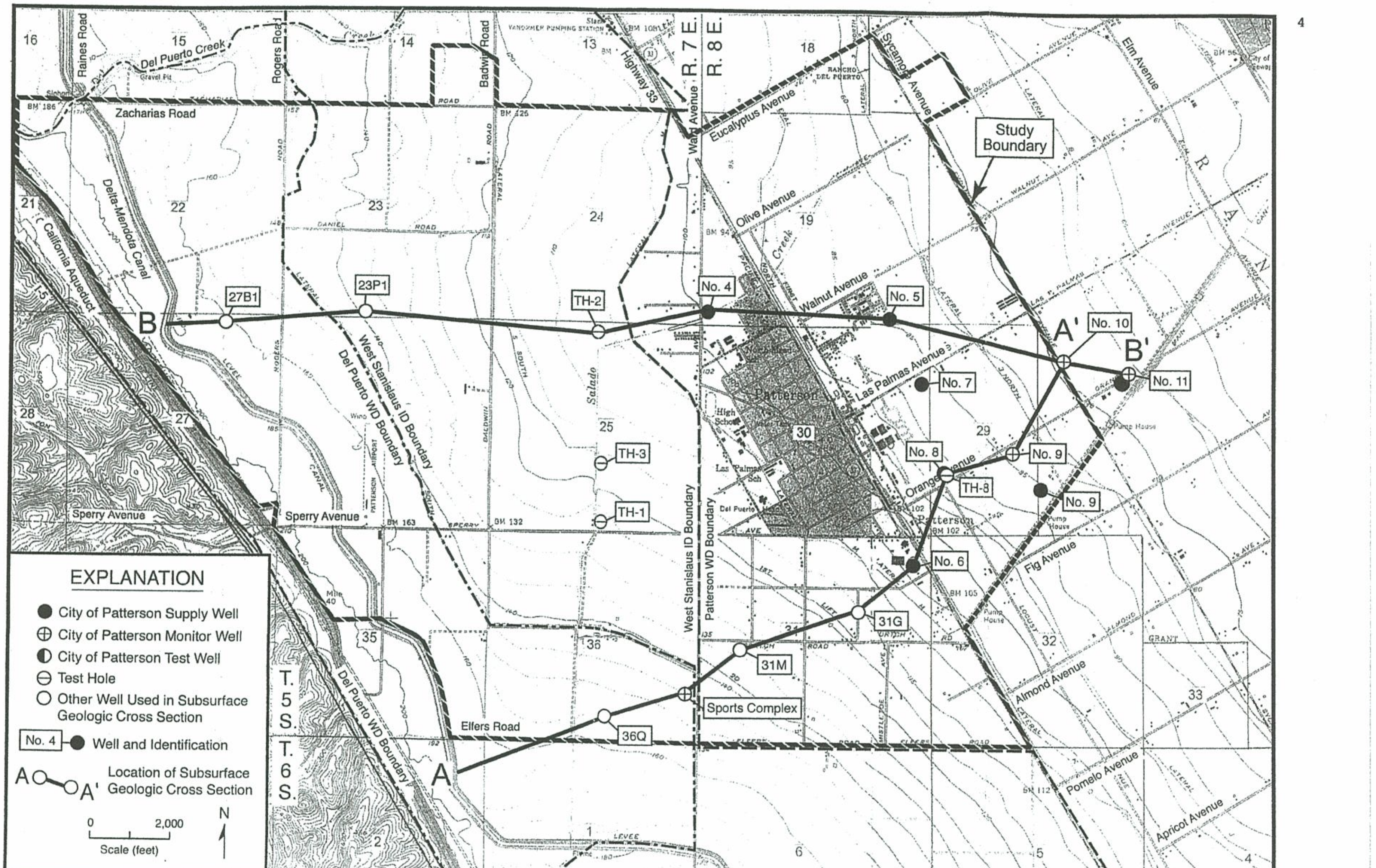

FIGURE 1 - LOCATION OF SELECTED SUPPLY WELLS, TEST WELLS, TEST HOLES AND SUBSURFACE GEOLOGIC CROSS SECTIONS

of that report was a map showing the top of the Corcoran Clay. The top of the clay was projected to be less than 100 feet deep near the DMC, and was about 270 feet deep near Highway 33 and about 330 feet deep near Sycamore Avenue. Thus the Corcoran Clay becomes progressively deeper to the northeast in the study area.

As part of this evaluation, two subsurface geologic cross sections were prepared (Figure 1). Cross Section A-A' extends from near Elfers Road and the DMC to the northeast, through the City Sports Complex Well, City Wells No. 6 and 8, MW-9, and City Well No. 10. Cross Section A-A' (Figure 2) shows the deepening and thickening of the Corcoran Clay to the northeast in the Patterson vicinity. The clay is about 30 feet thick near the southwest edge of the section and is about 70 feet thick near Highway 33. Near the northeast edge of this section, the clay is bifurcated into two layers, which is common in some parts of the valley. Deposits in the upper aquifer (above the Corcoran Clay) are predominantly clay east of Ward Avenue along this section. However, some coarse-grained stream channel deposits were encountered by all of the wells along this section. These deposits are thickest in the area east of Highway 33, where they overlie the Corcoran Clay. At City MW-10, these stream channel deposits are about 80 feet thick.

The deposits of the lower aquifer are predominantly fine-

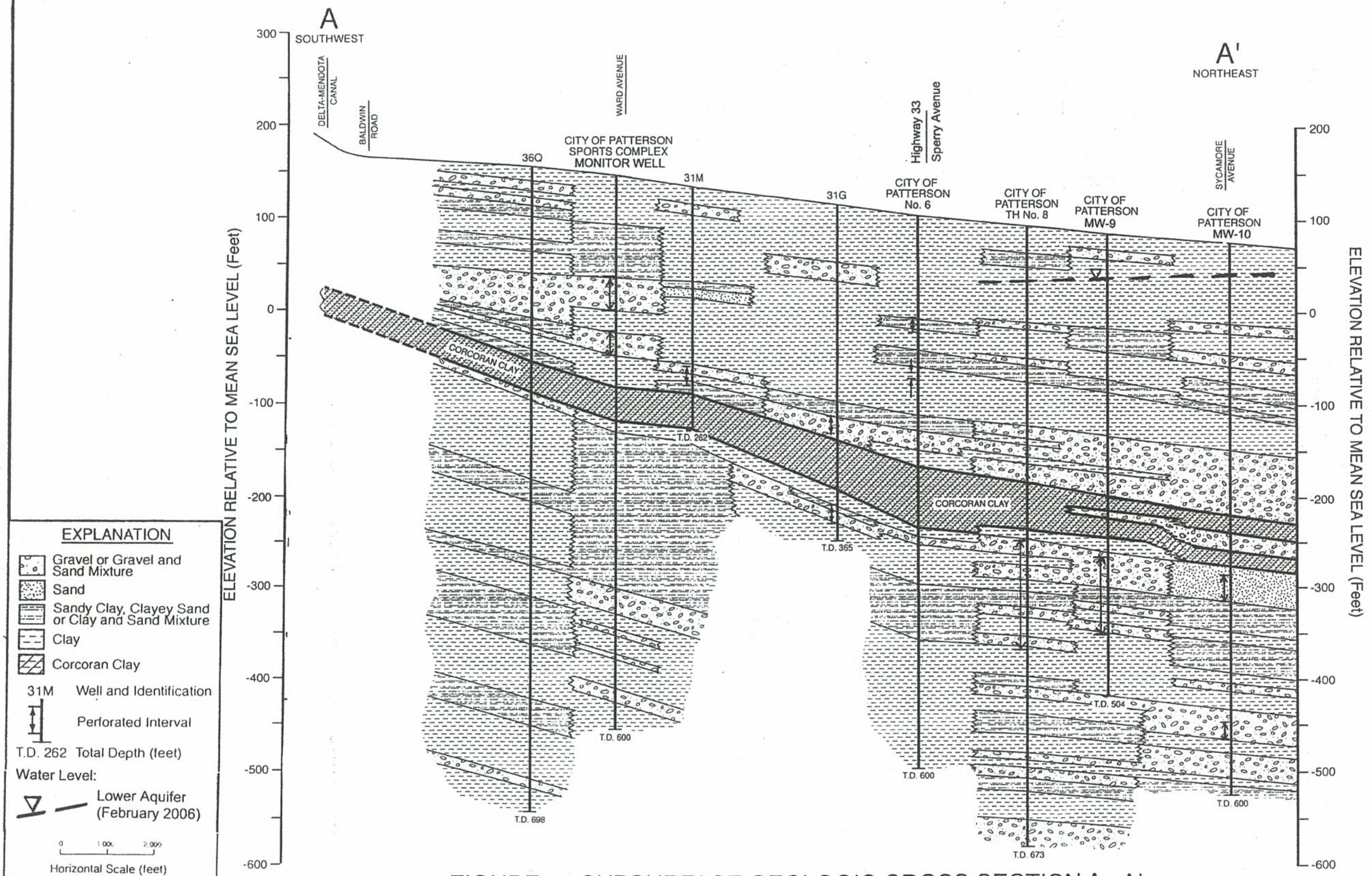

FIGURE 2 - SUBSURFACE GEOLOGIC CROSS SECTION A - A'

grained along the part of Cross Section A-A' that is southwest of Highway 33. However, some stream channel deposits are still present. Stream channel deposits are more common along the part of this section northeast of Highway 33, including just below the Corcoran Clay and below 500 feet in depth. The part of the section where City TH-8, MW-9, and MW-10 are located is considered representative of the City well field east of Highway 33, where coarse-grained strata in the lower aquifer and above a depth of about 600 feet are tapped.

Cross Section B-B' (Figure 3) extends from about a quarter mile west of Rogers Road and a mile south of Zacharias Road to the east, through a Patterson Ranch test hole, City Wells No. 4 and 5, and City MW-10 and MW-11. More coarse-grained stream channel deposits are indicated along this section west of Ward Avenue, compared to those shown in Cross Section A-A'. These coarse-grained deposits are more than 100 feet thick at Well 23P1. These deposits are likely associated with the ancestral Del Puerto Creek. Farther east along this section, clay is more predominant, and the stream channel deposits are deeper. At City MW-10 and MW-11, these deposits overlie the Corcoran Clay. The Corcoran Clay dips to the east along this section, and ranges in thickness from about 30 to 50 feet. Near the east edge of the section, the clay is bifurcated into two layers.

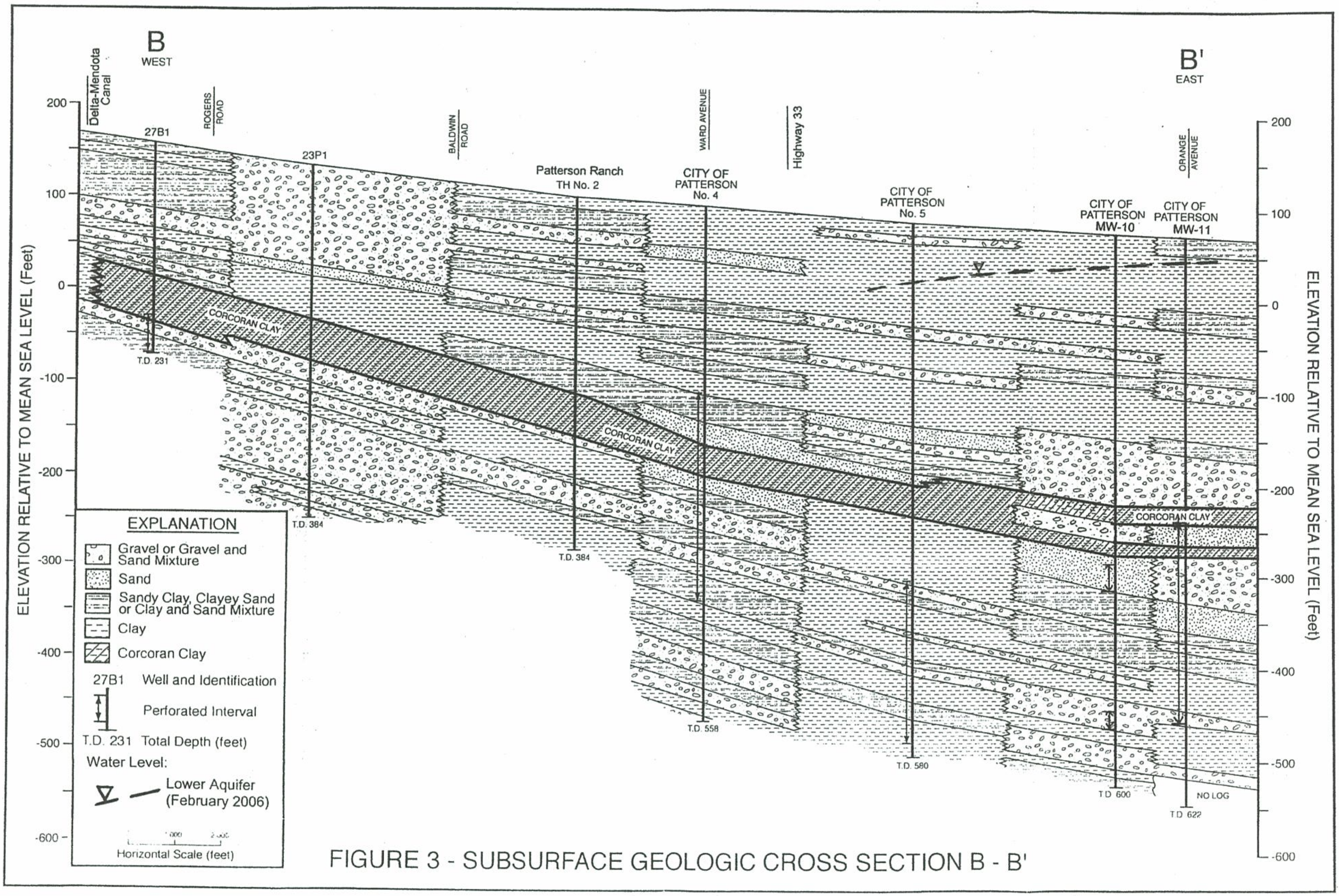

FIGURE 3 - SUBSURFACE GEOLOGIC CROSS SECTION B - B'

Deposits below the Corcoran Clay contain abundant stream channel deposits at most locations along this section. These deposits appear to be thickest along the part of the section west of Ward Avenue. Along the part of the section east of Ward Avenue, these deposits extend to a depth near 600 feet. City of Patterson Well No. 4 is perforated opposite strata both above and below the Corcoran Clay. City Well No. 5 and the two City monitor wells farther east are perforated only below the Corcoran Clay.

City Well Data

Table 1 provides construction data for the active City public supply wells. Cased depths of these wells range from 350 to 597 feet. Wells No. 2, 4, and 6 are perforated above and below the Corcoran Clay, whereas Wells No. 5, 7, 8, 9, and 11 are perforated only below the Corcoran Clay. Electric logs are available for Wells No. 4, 7, 8, 9, and 11 and a geologic log is available for Well No. 9. Annular seals are 100 feet deep or less in four of these wells. Only City Wells No. 9 and 11 are sealed off opposite all of the deposits above the Corcoran Clay. The City has two other wells that are only used for irrigation.

Table 2 provides construction data for four City monitor wells. MW-9, MW-10, and MW-11 range in cased depth from 440 to 550 feet, and are perforated below 310 feet in depth (below the Corcoran Clay). The City Sports Complex Well was a 600-foot deep test

TABLE 1-CONSTRUCTION DATA FOR CITY SUPPLY WELLS

No.	Date Drilled	Total Depth (feet)	Cased Depth (feet)	Casing Diameter (inches)	Perforated Interval (feet)	Annular Seal (feet)
2	1947	366	360	14	170-251, 328-360	0-50
4	11/71	558	202	16		0-62
			433	12	204-429	
5	1986	580	565	18	390-565	0-220
6	3/94	600	365	16	225-255, 345-355	0-100
7	11/98	620	597	16	342-378, 416-426 & 522-587	0-60
8	2004		470	16	340-460	
9	8/08	500	480	16	320-470	0-305
11	2007	540	540	16	360-390 & 520-540	

Data from well completion reports and DOHS records.

TABLE 2-CONSTRUCTION DATA FOR CITY MONITOR WELLS

No.	Date Drilled	Total Depth (feet)	Cased Depth (feet)	Casing Diameter (inches)	Perforated Interval (feet)	Annular Seal (feet)
9	5/01	500	440	4	350-435	0-310
10	5/01	600	540	4	360-360, 520-540	0-330
11	10/01	620	550	4	310-530	0-290
Sports Complex	6/07	600	210	8	110-146, 169-195	0-20

Data from well completion reports.

well that was subsequently converted to only tap strata above 210 feet in depth (above the Corcoran Clay). Electric logs are available for three of the City wells along this section, and a geologic log is available for the Sports Complex Well. Completion reports, electric logs, and geologic logs for City wells and test holes are provided in Appendix A.

Water Levels

Upper Aquifer

Water-Level Elevations. KDSA (2002) provided water-level maps for the upper aquifer in the City of Patterson vicinity for Spring 1986 and Spring 1989. The direction of groundwater flow was to the north during both of these periods. Water-level elevations ranged from about 75 to 80 feet above mean sea level near Elfers Road to about 55 to 60 feet near Zacharias Road. More recent water-level elevation maps are available from the California Department of Water Resources (DWR), San Joaquin District. In Spring 2006, the water-level elevation for wells tapping the upper aquifer near the center of Patterson was about 50 feet above mean sea level. The direction of groundwater flow was to the north-northeast beneath the study area. In Spring 2005, water-level elevations ranged from about 45 to 55 feet beneath the study area and the direction of groundwater flow was to the north.

Water-Level Trends. Water-level hydrographs for wells tapping the upper aquifer are provided in Appendix B. Frequent water-level measurements are available for five wells in or near the study area (Figure 4). Two of these are located north of Zacharias Road and Del Puerto Creek. Water levels in Wells T5S/R7E-14D1, 15G1, and 35G1 have been relatively stable, rising during wet periods and falling during dry periods. Depth to water in Well 14D1 has usually ranged from about 70 to 95 feet. Depth to water in Well 15G1 has normally ranged from about 95 to 115 feet. The completion report for this well indicates that it is perforated from 110 to 156 feet in depth. Depth to water in Well 35G1 rose between the late 1950's and late 1980's due to water imported into the Del Puerto Water District. Water levels then fell by the early 1990's, due to the prolonged drought at that time. After the drought, water levels recovered and have been relatively stable since then. Depth to water in this well has normally ranged from about 90 to 115 feet.

Figure 5 is a water-level hydrograph for Well T5S/R7E-24H1, which is located about half a mile north of City Well No. 4. The completion report for Well 24H1 indicates that it is only 87 feet deep. Depth to water has ranged from about 37 to 62 feet. The water level was relatively stable from 1957 to 1989, then fell substantially during the early 1990's, also associated with the

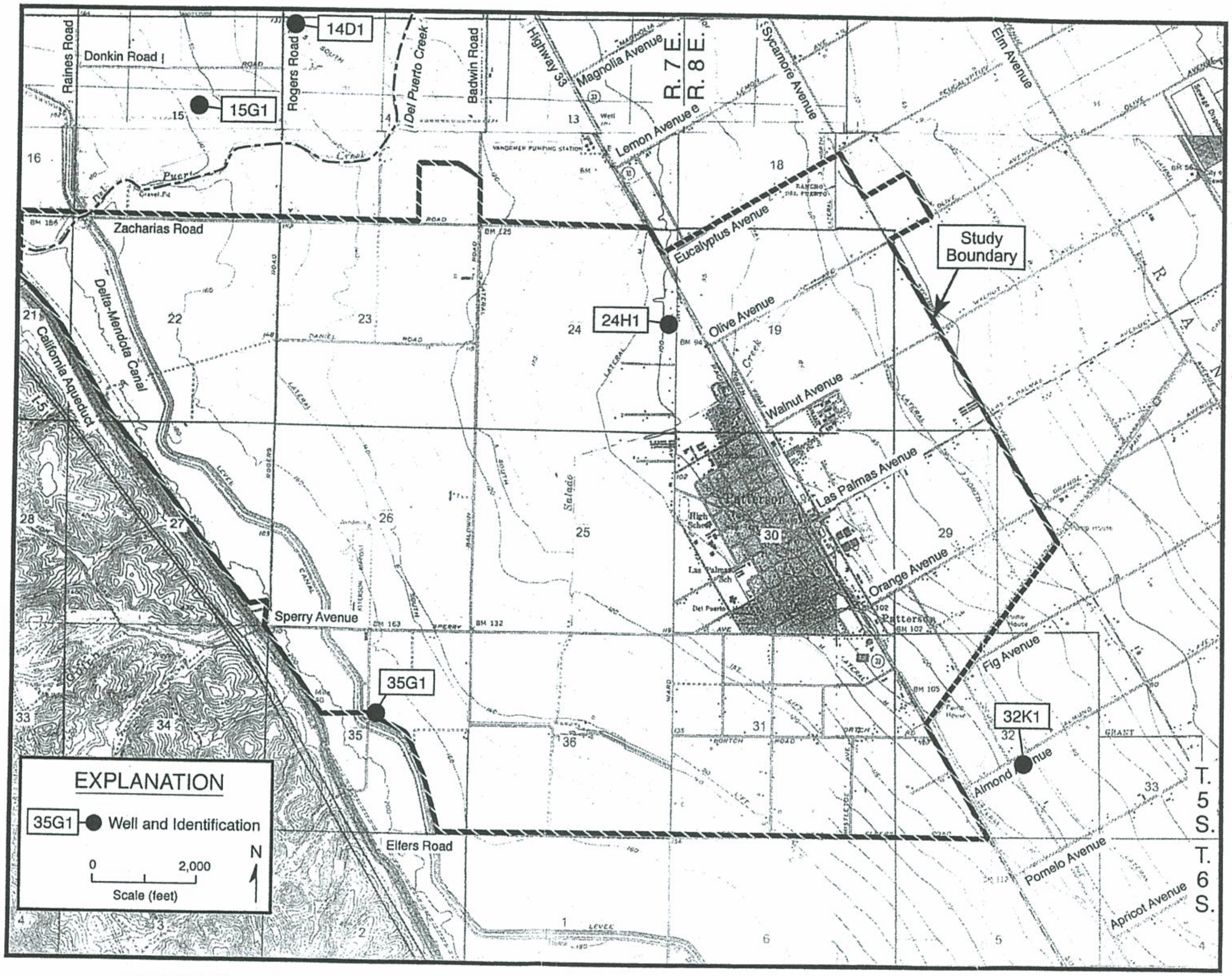

FIGURE 4 - LOCATIONS OF WELLS WITH WATER-LEVEL HYDROGRAPHS

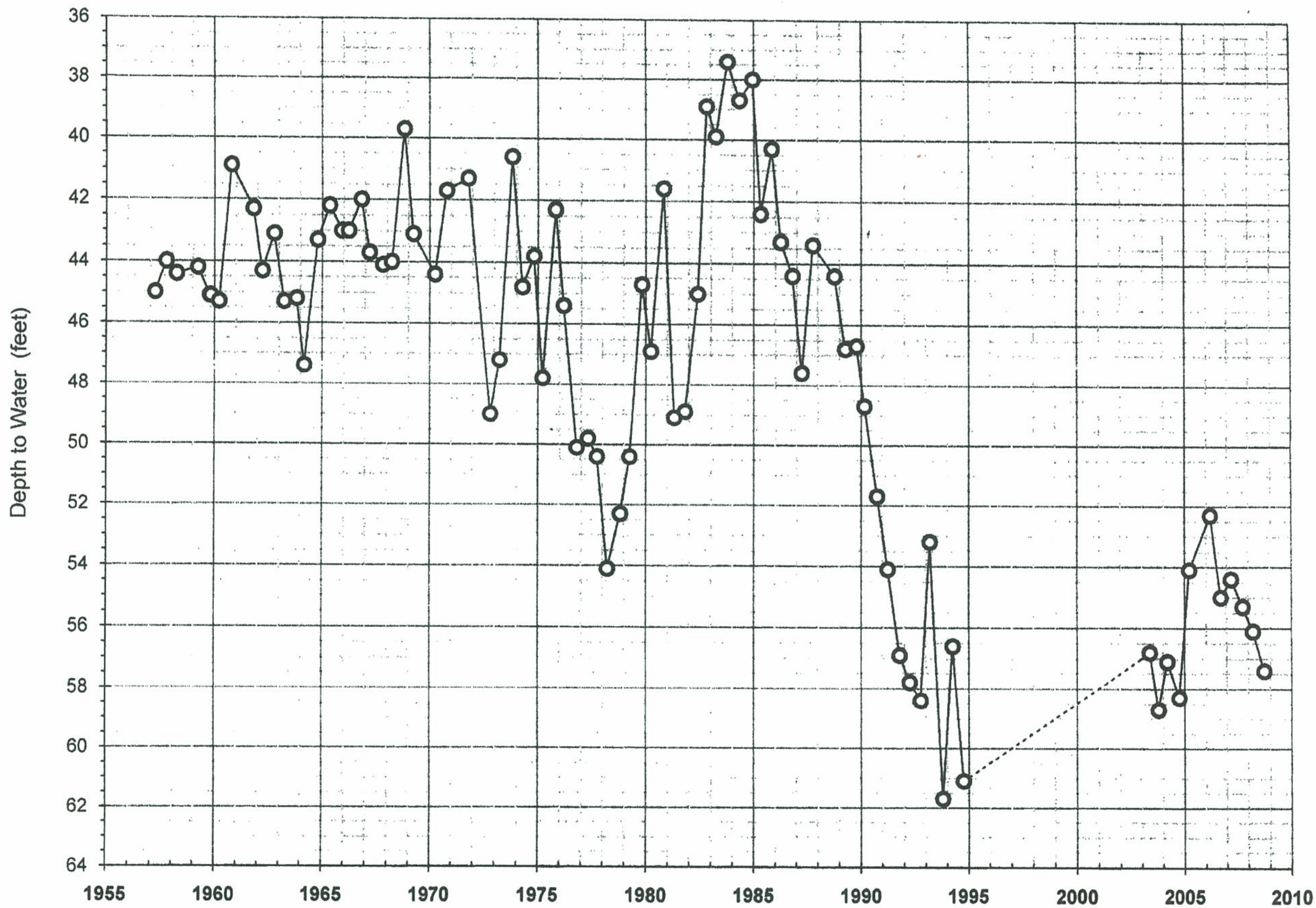

FIGURE 5 - WATER-LEVEL HYDROGRAPH FOR WELL T5S/R7E-24H1

prolonged drought. Water-level measurements for this well aren't available for 1995-2003. If such records were available, more water-level recovery may have been shown. The water level in this well also fell during a more recent dry period.

Lower Aquifer

Water-Level Elevations. The DWR no longer prepares water-level maps for the lower aquifer throughout the west side of the valley. As part of an aquifer test that was conducted for the City in February 2006, KDSA calculated water-level elevations for the lower aquifer (Table 3). Depth to Water on February 21, 2006 ranged from about 29 to 53 feet, and water-level elevations ranged from about 20 to 47 feet above mean sea level. Figure 6 is the most detailed map available for the lower aquifer at or near Patterson. A north-westerly direction of groundwater flow was indicated. The average water-level slope was about 25 feet per mile. This flow direction may have been influenced by pumping of some composite wells (tapping both aquifers) or lower aquifer wells in the area north of the City.

Water-Level Trends. Transducer records are available that provide continuous water-level measurements (static and pumping) for the active City wells. Frequent (weekly) water-level measurements were examined for 2007 to determine seasonal fluctuations. The static

TABLE 3-WATER-LEVEL DATA FOR LOWER AQUIFER FOR FEBRUARY 21, 2006

Well No.	Measuring Point Elevation (feet)	Depth to Water (feet)	Water-Level Elevation (feet)
5	72.9	52.6	20.3
7	81.5	50.1	31.4
8	93*	60.1	33
MW-9	87.7	49.8	37.9
MW-11	75*	28.5	46.5

*These elevations were estimated from a topographic map.

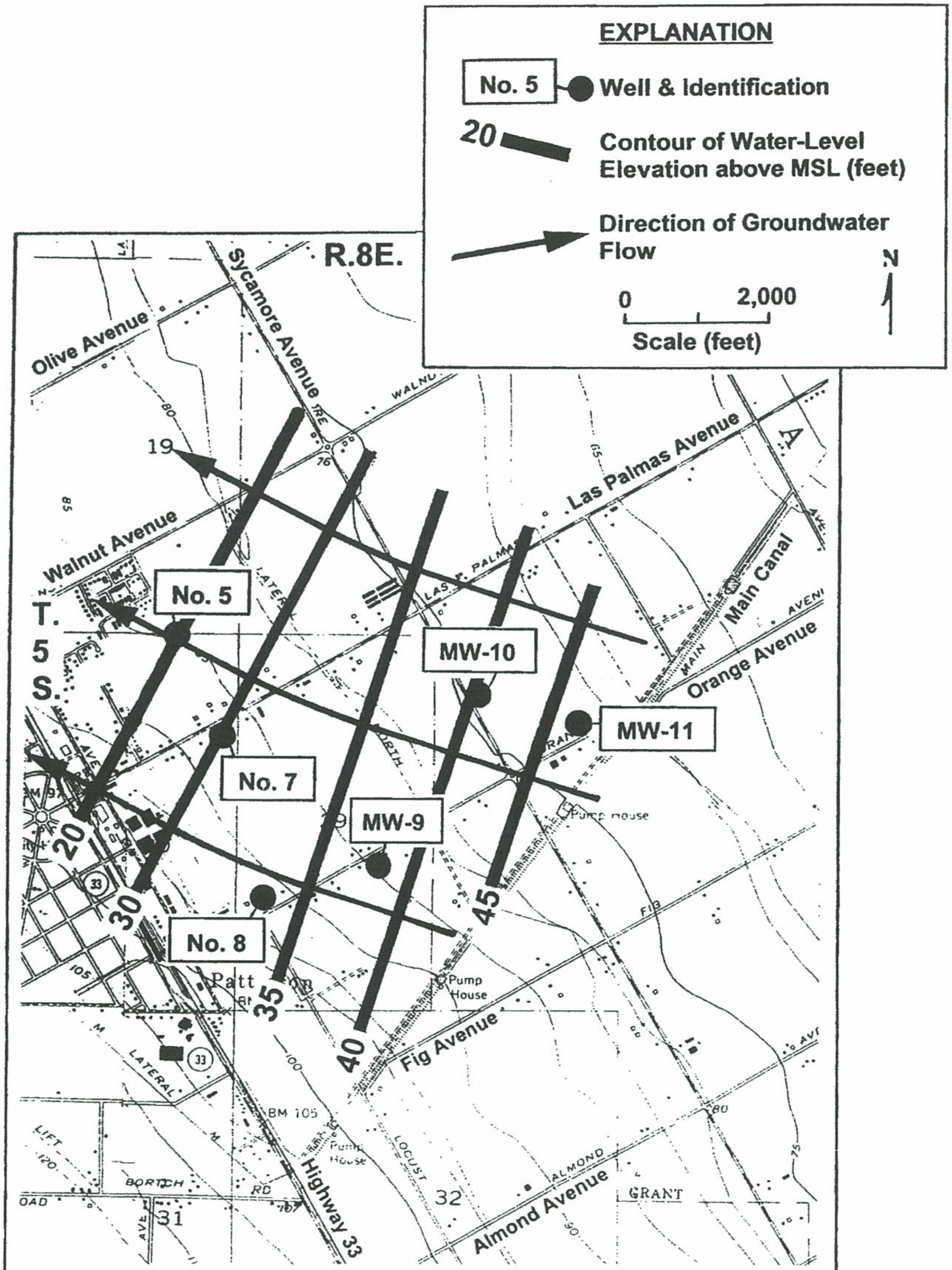

FIGURE 6-WATER-LEVEL ELEVATIONS AND DIRECTION OF GROUNDWATER FLOW FOR LOWER AQUIFER (FEBRUARY 2006)

water level in Well No. 5 ranged from 61.6 feet on January 24 to 92.1 feet on July 9. The static water level in Well No. 6 ranged from 78.3 feet on January 8 to 119.9 feet on May 21. The static water level in Well No. 7 ranged from 72.1 feet on January 2 to 90.2 feet on May 21. The static water level in Well No. 8 ranged from 105 feet on February 17 to 125.8 feet on June 1. The seasonal fluctuations in these wells thus ranged from about 20 to 40 feet. Water-level declines are expected during the summer due to increased pumping.

Pumpage

The H_2O Group (2006) indicated that the annual City pumpage was about 2,000 acre-feet in 1995 and had increased to about 3,600 acre-feet by 2005. City records indicate that about 4,400 acre-feet of water were pumped in 2008. There is other pumpage in the area, including from a private well used for food processing. This well is estimated to pump about 1,000 acre-feet per year. There is an estimated several hundred more acre-feet per year of pumpage for a small lake and other uses within the City limits.

Pump Tests

Table 4 shows recent pump test data for City wells. Pumping rates ranged from 600 to 1,400 gpm and specific capacities from 19 to 59 gpm per foot.

TABLE 4-PUMP TEST DATA FOR CITY WELLS

Well No.	Date	Pumping Rate (gpm)	Static Level (feet)	Pumping Level (feet)	Drawdown (feet)	Specific Capacity (gpm/ft)
2	6/08	800	107	126	19	42
4	6/08	800	77	119	42	19
5	6/08	1,300	80	111	31	42
6	6/08	600	113	152	39	15
7	6/08	1,400	77	143	66	21
8	6/08	1,000	124	141	17	59
9		800				
11	6/08	1,200	67	94	27	45

Data from City of Patterson.

Lower Aquifer

The H_2O Group and KDSA conducted a 72-hour Leaky Aquifer Test on City Well No. 7 during October 2006. Three other City wells were used as observation wells for the test. The best values for the test indicated a transmissivity of 80,000 gpd per foot, and storage coefficient of 0.0003 for the lower aquifer. The average hydraulic conductivity of the coarse-grained deposits in the lower aquifer northeast of Highway 33 was 1,200 gpd per square foot.

Land Subsidence

Land subsidence due to groundwater pumping has been recognized since at least the 1950's in parts of the San Joaquin Valley. Land subsidence occurs when clay layers are present in confined aquifers. If water levels in the confined aquifers are lowered sufficiently, water is expelled from those clays. The clays compact and this causes the land surface to subside. In general, long-term water-level declines ranging from about 50 to 70 feet in the lower confined aquifer have caused about a foot of subsidence in the San Joaquin Valley. In some locations in western Fresno County, up to 30 feet of land subsidence has occurred in certain areas. However this is where water-level declines have exceeded 400 feet due to over pumping. Reports on historical land subsidence in the San Joaquin Valley primarily covered the area south of Los Banos, because little subsidence has been recognized further north. Most of these reports described conditions through the 1960's. Most of the water became available from the California Aqueduct in the 1960's. Since the 1980's, land subsidence has become apparent in the area north of Los Banos, where canals and other features have been affected. Canal surface elevations have been determined along the DMC for a number of years. These surveys indicate that there has been about _____ foot of subsidence along the canal near the City of Patterson since _____. The deep City wells are located more than two miles east of the DMC, and more subsidence has likely occurred in the City well field than along the DMC. It is recommended that the City commence a routine monitoring program for elevations of the tops of their lower aquifer wells.

Suitability of Northwest Part of Study Area for Intentional Recharge

The area in and near the northwest part of the study area was evaluated in terms of subsurface geologic conditions important in implementing an intentional recharge project. Shallow fine-grained layers and hardpan at the surface or in the vadoze zone (above the water level) are usually a constraint to infiltration rates. For this preliminary evaluation, completion reports for wells were reviewed. The area evaluated included the south halves of Section 13, 14, and 15 and the north halves of Section 22, 23, and 24, T5S/

R7E (between the DMC and Highway 33). The alluvial deposits in much of this area are predominantly coarse-grained and are indicated to have been deposited by the ancestral Del Puerto Creek. Near the DMC, the Corcoran Clay appears to pinch out (Figure 3). Thus recharge in this part of the study area could benefit both the upper and lower aquifers. Completion reports for 14 wells in this area generally indicate favorable conditions for intentional recharge. These logs indicate that from several feet to as much as 15 feet of fine-grained or other low permeability deposits are present at the surface and overlie the coarse-grained deposits. These low permeability deposits would need to be removed prior to developing a recharge site. Obviously, target areas for intentional recharge would be where these deposits are the thinnest. Soil borings, extending to a depth of at least 50 feet, are recommended for further evaluation. Based on available information, the south half of Section 15 is indicated to be the most hydrogeologically favorable for further evaluation.

Del Puerto Creek Water Quality

Hotchkiss and Balding (1971) discussed the quality of streamflow in Del Puerto Creek. Table 5 summarizes results of chemical analyses of streamflow that are considered representative. The streamflow in the creek was of the magnesium bicarbonate type, and pH values ranged from 7.9 to 8.6. Total dissolved solids (TDS)

TABLE 5-RESULTS OF CHEMICAL ANALYSES
OF WATER FROM DEL PUERTO CREEK

Constituent (mg/l)	02/15/62	03/22/62	06/08/62	02/11/63
Calcium	18	31	7	20
Magnesium	17	87	131	35
Sodium	11	61	10	20
Potassium	3	2	1	2
Carbonate	0	24	24	0
Bicarbonate	122	397	628	207
Sulfate	27	146	10	44
Chloride	11	29	10	13
Nitrate	3	<1	1	5
pH	7.9	8.6	8.3	8.0
Electrical Conductivity (micromhos/cm @ 25°C)	265	943	-	413
Total Dissolved Solids	164	580	516	281
Boron	0.2	0.9	0.1	0.3

Results of analyses from Hotchkiss and Balding (1971).

concentrations ranged from about 160 to 580 mg/l. Lower TDS concentrations are generally associated with larger streamflows. Nitrate concentrations were 5 mg/l or less, below the MCL for public water supplies of 45 mg/l. Sulfate concentrations ranged from 10 to 146 mg/l and concentrations for most samples were less than 50 mg/l, well below the recommended MCL of 250 mg/l. Chloride concentrations ranged from 10 to 29 mg/l, well below the recommended MCL of 250 mg/l. To further evaluate the suitability as a source of recharge for the City, additional sampling and analysis are needed of water in the Del Puerto Creek in terms of constituents such as arsenic, chromium, and selenium.

Groundwater Quality

Hotchkiss and Balding (1971) described the regional quality of groundwater in the Tracy-Dos Palos area, which includes Patterson.

Upper Aquifer

TDS concentrations in most groundwater in the upper aquifer near Patterson ranged from about 400 to 1,200 mg/l in the 1960's. Groundwater near Del Puerto Creek was of the magnesium bicarbonate type, similar to that for creek water. Most groundwater in the Patterson area that was of the bicarbonate type had TDS concentrations ranging from about 400 to 600 mg/l, and TDS concentrations increased to the northeast. West of Patterson and south of Del

Puerto Creek, groundwater of the sulfate type was predominant. TDS concentrations ranged from about 700 to 1,200 mg/l. In the 1960's, nitrate concentrations in the upper aquifer at and near Patterson usually ranged from about 10 to 20 mg/l. Chloride concentrations usually ranged from about 100 to 250 mg/l. Sulfate concentrations at and near Patterson increased to the east and exceeded 250 mg/l in most of the area northeast of Highway 33.

The results of well sampling near Patterson by Stoddard and Associates in the 1990's indicated that some of the lowest TDS concentrations (about 460 to 740 mg/l) in the upper aquifer were in the area near Del Puerto Creek.

Prior to developing new City wells since the 1980's, test holes have been done and water samples collected from isolate depth intervals for chemical analyses. These results indicated that high sulfate and associated high TDS concentrations (exceeding MCLs) were common in the upper aquifer, including at Wells No. 5, 6, 7, and 9 and at the Patterson Ranch test holes west of Ward Avenue (Figure 1). Water samples were not collected from the upper aquifer at MW-10 and MW-11 for chemical analyses. In addition, nitrate concentrations exceeding the MCL were found in water samples from above a depth of about 190 feet at Patterson Ranch TH-3 and at the Sports Complex well.

Lower Aquifer

Regional data were lacking on the quality of groundwater in the lower aquifer near Patterson as of the 1960's. However, substantial data on the quality of lower zone groundwater is now available from City test holes and wells. City Wells No. 5, 7, 8, and 9 tap groundwater only in the lower aquifer. All of these wells are northeast of Highway 33. The H_2O Group (2006) summarized the chemical quality of water from City wells through 2003. TDS concentrations in water from City wells have ranged from 400 to 1,100 mg/l, and averaged about 850 mg/l. The highest values have been for composite wells that tap some strata above the Corcoran Clay. Sulfate concentrations in water from City wells have ranged from 170 to 560 mg/l and averaged 302 mg/l (exceeding the recommended MCL of 250 mg/l). Chloride concentrations have ranged from 24 to 280 mg/l and averaged 124 mg/l, compared to the MCL of 250 mg/l. Nitrate concentrations have ranged from 2 to 48 mg/l, and have averaged 21 mg/l, below the MCL of 45 mg/l. The highest nitrate concentrations in water from City wells have been for wells where perforations extend up above the Corcoran Clay. Arsenic concentrations in water from City wells have ranged from 1 to 10 ppb, and have averaged 4 ppb, less than the MCL of 10 ppb. Manganese concentrations in water from the City wells have ranged from 0.01 to 0.09 mg/l and averaged 0.02 mg/l, less than the recommended MCL of 0.05 mg/l. Hexavalent chromium concentrations have ranged from about 4 to 17 ppb and averaged 9 ppb. A new MCL is being considered for this constituent, and this could influence the ability of the City to meet the new MCL with water from wells.

Results of test hole depth sampling programs indicate that sulfate concentrations in water from the lower aquifer exceeded the MCL at the three Patterson Ranch test holes, the Sports Complex well, and City Well No. 6. These wells are all southwest of Highway 33. At City Well No. 8 and MW-11, sulfate concentrations in one or more depth intervals exceeded the MCL. In addition, high chloride concentrations were found in water samples collected from below a depth of about 550 feet at Wells No. 5 and 6 and MW-10 and MW-11.

Table 6 provides inorganic chemical analyses for active City wells. Total dissolved solids (TDS) concentrations ranged from 440 to 970 mg/l. The waters were of the sodium-magnesium mixed anion type. Nitrate concentrations ranged from 4 to 31 mg/l. Nitrate concentrations in water from City well that only tap strata below the Corcoran Clay ranged from 4 to 13 mg/l, well below the MCL of 45 mg/l. Nitrate concentrations in water from Well No. 2 and 4 have periodically been near or exceeded the MCL in recent years. Chloride concentrations ranged from 66 to 250 mg/l, compared to the recommended MCL of 250 mg/l. Sulfate concentrations ranged from

TABLE 6-RESULTS OF CHEMICAL ANALYSES OF WATER FROM CITY WELLS

Constituent (mg/l)	Well No. 2	Well No. 4	Well No. 5	Well No. 6
Calcium	74	66	73	76
Magnesium	8	60	55	58
Sodium	147	131	104	159
Potassium	2	3	3	3
Carbonate	<10	<10	<10	<10
Bicarbonate	220	200	140	230
Sulfate	330	362	191	370
Chloride	142	119	250	118
Nitrate	31	30	5	26
Fluoride	0.4	0.3	0.1	0.3
pH	7.9	7.1	7.3	8.0
Electrical Conductivity (micromhos/cm @ 25°C)	1,440	1,350	1,360	1,450
Total Dissolved Solids	950	940	900	976
Iron	<0.05	<0.05	0.10	0.08
Manganese	<0.01	<0.01	<0.01	<0.01
Arsenic (ppb)	<2	<2	<2	3
Chromium (ppb)	19	17	14	19
Alpha Activity (pCi/l)	2.2	1.9	0.5	2.0
Date	06/19/07	06/15/04	04/27/04	01/06/04
Perforated Interval (ft)	170-251 & 328-360	204-429	390-565	225-255 & 345-355

Continued:

TABLE 6-RESULTS OF CHEMICAL ANALYSES OF WATER FROM CITY WELLS
(Continued:)

Constituent (mg/l)	Well No. 7	Well No. 8	Well No. 9	Well No. 11
Calcium	79	69	42	55
Magnesium	58	52	33	38
Sodium	119	111	67	67
Potassium	3	2	3	3
Carbonate	<10	<10	<10	<10
Bicarbonate	160	200	183	170
Sulfate	288	330	160	165
Chloride	236	66	26	85
Nitrate	9	13		4
Fluoride	0.1	0.3	0.1	<0.1
pH	7.6	7.8	8.1	8.1
Electrical Conductivity (micromhos/cm @ 25°C)	1,440	1,220	710	877
Total Dissolved Solids	920	810	440	520
Iron	0.11	0.08	<0.05	<0.05
Manganese	<0.01	<0.01	<0.01	<0.01
Arsenic (ppb)	<2	3	4	5
Chromium (ppb)	18	28	20	16
Alpha Activity (pCi/l)	1.6	4.3	6.5	1.8
Date	08/30/05	05/09/08	10/17/08	2/18/10
Perforated Interval (ft)	342-378, 416-426 & 522-587	340-460	320-470	360-390 & 520-540

Laboratory analyses by FGL Environmental of Santa Paula and BSK Associates of Fresno.

160 to 370 mg/l and exceeded the recommended MCL of 250 mg/l in water from five of the wells. The sulfate concentrations in water from wells No. 5, 9, and 11 were below the MCL. Concentrations of iron, manganese, arsenic, and alpha activities were well below the respective MCL.

WATER BUDGET FOR EXISTING CONDITIONS

Pumpage

In 2009, the City pumpage was about 4,400 acre-feet. There were an estimated additional 1,300 acre-feet pumped by others within the City.

City Wastewater

The average amount of City wastewater in 2009 was about 1.27 mgd, or about 1,400 acre-feet per year.

Urban Consumptive Use

Deducting the City wastewater amount from the City pumpage, the outside urban water use was about 3,000 acre-feet per year as of 2009. Assuming an irrigation efficiency of about 70 percent in the urban area, the consumptive use of applied water was about 2,100 acre-feet per year as of 2009. This does not include consumptive use associated with pumpage by other entities.

CONCLUSIONS

Groundwater is present in two aquifers beneath most of the City of Patterson. Because of groundwater quality issues, most of the City pumpage is from the lower aquifer. Groundwater in this aquifer is confined by the Corcoran Clay, a regional confining bed beneath the west side of the San Joaquin Valley. Water levels in both aquifers have apparently been relatively stable over the long term. Water levels have temporarily declined during dry periods when local pumping has increased, then risen during wet periods. The major sources of recharge to groundwater are deep percolation of some of the water applied for irrigation and canal seepage. Beneath the north part of the City, seepage of streamflow in Del Puerto Creek has also been important.

If the area urbanizes and canal water is no longer used, an imbalance will be created in the groundwater budget. In general, the consumptive use of water needs to be balanced by surface water, for an area to have a sustainable groundwater supply that is not dependent on the activities of others.

The Del Puerto Creek area appears to be suitable for intentional recharge by basins or pits, based on a review of available data on subsurface geologic conditions and groundwater levels. To further evaluate that area near Del Puerto Creek, a soil boring program is recommended. Most borings would be done to a depth of

50 feet, and several would extend deeper to the water level. A geologist would log the borings and prepare a geologic log for each boring. Attention would be focused on identifying surficial fine grained deposits that would need to be excavated, if present, and/or shallow restricting layers that could hinder infiltration rates. Once a favorable area is found, a pilot infiltration test would be done using a small pond or pit (about one-quarter area in size) to determine the infiltration rates. The area needed for recharge ponds or pits could then be determined.

Depending on the source of water, varying levels of groundwater quality enhancement can be expected. Water from the California Aqueduct is expected to be of the best quality. The H_2O Group reported on the quality of water from the Aqueduct and the DMC. The TDS concentration of Aqueduct water is expected to average about 300 mg/l and sulfate concentrations are expected to average about 30 mg/l. Concentrations of other inorganic constituents in the Title 22 drinking water standards are expected to be below the MCLs. Thus recharge of this water would improve the quality of groundwater in the vicinity.

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Box G Managing a Basin through Integrated Water Management

Orange County Water District (OCWD) was established in 1933 by an uncodified Act (Water Code App. 40) to manage Orange County's groundwater basin and protect the Santa Ana River rights of water users of north-central Orange County. The district manages the groundwater basin, which provides as much as 75 percent of the water supply for its service area. The district strives for a groundwater-based water supply with enough reserves to provide a water supply through drought conditions. An integrated set of water management practices helps achieve this, including the use of recharge, alternative sources, and conservation.

Recharge The Santa Ana River provides the main natural recharge source for the county's groundwater basin. Increased groundwater use and lower-than-average rainfall during the late 1980s and early 1990s forced the district to rely on an aggressive program to enhance recharge of the groundwater basin. Programs used today to optimize water use and availability includes:

- Construction of levees in the river channel to increase infiltration.
- Construction of artificial recharge basins within the forebay.
- Development of an underwater basin cleaning vehicle that removes a clogging layer at the bottom of the recharge basin and extends the time between draining the basin for cleaning by a bulldozer.
- Use of storm water captured behind Prado Dam that would otherwise flow to the ocean.
- Use of imported water from the State Water Project and Colorado River.
- Injection of treated recycled water to form a seawater intrusion barrier.

Alternative Water Use and Conservation OCWD has successfully used nontraditional sources of water to help satisfy the growing need for water in Orange County. Projects that have added to the effective supply of groundwater are:

- Use of treated recycled water for irrigation and industrial use.
- In-lieu use to reduce groundwater pumping.
- Change to low-flow toilets and showerheads.
- Participation of 70 percent of Orange County hotels and motels in water conservation programs.
- Change to more efficient computerized irrigation.

Since 1975, Water Factory 21 has provided recycled water that meets all primary and secondary drinking water standards set by the California Department of Health Services. OCWD has proposed a larger, more efficient membrane purification project called the Groundwater Replenishment System (GWRS), which is scheduled to begin operating at 70,000 acre-feet per year in 2007. By 2020 the system will annually supply 121,000 acre-feet of high quality water for recharge, for injection into the seawater intrusion barrier, and for direct industrial uses.

This facility will use a lower cost microfiltration and reverse osmosis treatment process that produces water of near distilled quality, which will help reverse the trend of rising total dissolved solids (TDS) in groundwater caused by the recharge of higher TDS-content Santa Ana River and Colorado River waters. The facility will use about half the energy required to import an equivalent amount of water to Orange County from Northern California. The GWRS will be funded, in part, by a $30 million grant under Proposition 13 of 2000.

Source: Orange County Water District

Box H Managing Groundwater using both Physical and Institutional Solutions

Four agencies share responsibility for groundwater management in Ventura County. Coordination and cooperation between these agencies focus on regular meetings, attendance at each other's board meetings, joint projects, watershed committees, and ongoing personal contacts to discuss water related issues. The agencies and their areas of responsibility are:

- United Water Conservation District – physical solutions, monitoring, modeling, reporting, administering management plans and adjudication;
- Fox Canyon Groundwater Management Agency – pumping allocations, credits and penalties, abandoned well destruction, data for irrigation efficiency;
- County of Ventura – well permits, well construction regulations, tracking abandoned wells; and
- Calleguas Municipal Water District – groundwater storage of imported water.

In Ventura County 75% to 80% of the extracted groundwater is for agriculture; the remainder is for municipal and industrial use. Seawater intrusion into the aquifers was recognized in the 1940s and was the driving force behind a number of groundwater management projects and policies in the county's groundwater basins. As groundwater issues became more complicated at the end of the 20th century, these groundwater management projects and policies were useful in solving a number of problems.

Physical Solutions Physical solutions substitute supplemental surface water for groundwater pumping near coastal areas,
increase basin recharge, and increase the reliability of imported water. Projects include:

- Winter flood-flow storage for dry season release
- Wells and pipelines to move pumping for drinking water away from the coast
- Diversion structures to supply surface water to spreading grounds and irrigation
- Pipelines to convey surface water to coastal areas
- Las Posas Basin Aquifer Storage and Recovery project

Institutional Solutions Institutional solutions focus on developing and implementing effective groundwater management
programs, reducing pumping demands, tracking groundwater levels and water quality, managing groundwater pumping patterns, and destroying abandoned wells to prevent cross-contamination of aquifers. Solutions include:

Creation of Fox Canyon Groundwater Management Agency (GMA), which represents each major pumping constituency
Use of irrigation efficiency (agriculture), water conservation, and alternative sources of water (urban) to reduce pumping by 25%
Manage outside the GMA area through an AB 3030 plan and a court adjudication
Limit new permits for wells in specific aquifers to avoid seawater intrusion
Creation of a program to destroy abandoned wells
Creation of a database of historical groundwater levels and quality information collected since the 1920s

Development of a regional groundwater flow model and a regional master plan for groundwater projects

Creation of an irrigation weather station to assist in irrigation efficiency

Implementation of these physical and institutional management tools has resulted in the reversal of seawater intrusion in key coastal monitoring wells. These same tools are being used to mitigate saline intrusion (not seawater) in two inland basins and to reduce seasonal nitrate problems in the recharge area. Work is being expanded to help reduce loading of agricultural pesticides and nutrients. Without close coordination and cooperation of the county's water-related agencies, municipalities, and landowners, it would have been very difficult to implement most of these solutions. Although such coordination takes time, the investment has paid off in solutions that help provide a sustainable water supply for all water users in Ventura County.

Source: United Water Conservation District

Box J Managing Groundwater Quantity and Quality

When people hear the words "groundwater monitoring"' they may think either of measuring groundwater levels or of analyzing for groundwater quality. In reality, monitoring and management of groundwater quantity and groundwater quality are inseparable components of a management plan. Although the primary focus of the California Department of Water Resources (DWR) is on groundwater quantity and the measures taken by local agencies to manage supply, management must also consider groundwater quality. Natural or anthropogenic contamination and pumping patterns that are not managed to protect groundwater quality may limit the quantity of groundwater that is available for use in a basin.

Several State programs provide useful data as well as regulatory direction on groundwater quality that managers can use in managing their groundwater supply. One program is the Drinking Water Source Assessment and Protection Program prepared by the California Department of Health Services in response to 1996 amendments to the federal Safe Drinking Water Act. The DWSAP requires water purveyors to assess sources of drinking water, develop zones indicating time of travel of groundwater, and identify potentially contaminating activities around supply wells. The goal is to ensure that the quality of drinking water sources is maintained and protected. Other useful water quality data for groundwater managers is collected by the agencies within the California Environmental Protection Agency, including the State Water Resources Control Board, Department of Pesticide Regulation and the Department of Toxic Substances Control, which are discussed in more detail in Chapter 5. Each of these agencies has a specific statutory responsibility to collect groundwater quality information and protect water quality.

Protection of Recharge Areas

Groundwater recharge areas, and the human activities that can render them unusable, are an example of the need to coordinate land use activities to protect both groundwater quality and quantity. Protection of recharge areas, whether natural or man-made, is necessary if the quantity and quality of groundwater in the aquifer are to be maintained. Existing and potential recharge areas must be protected so that they remain functional, that is they continue to provide recharge to the aquifer and they are not contaminated with chemical or microbial constituents. Land-use practices should be implemented so that neither the quantity nor quality of groundwater is reduced. A lack of protection of recharge areas could decrease the availability of usable groundwater and require the substitution of a more expensive water supply.

Many potentially contaminating activities have routinely been practiced in recharge areas, leading to the presence of contaminants in groundwater. In many areas, groundwater obtained from aquifers now requires remediation. Recent studies in some areas show that recharge areas are contaminated, but down-gradient wells are not, indicating that it is only a matter of time before contaminants in wells reach concentrations that require treatment of the groundwater.

In addition to quality impacts, urban development, consisting of pavement and buildings on former agricultural land, lining of flood control channels, and other land use changes have reduced the capacity of recharge areas to replenish groundwater, effectively reducing the safe yield of some basins.

To ensure that recharge areas continue to replenish high quality groundwater, water managers and land use planners should work together to:

Identify recharge areas so the public and local zoning agencies are aware of the areas that need protection from paving and from contamination;
Include recharge areas in zoning categories that eliminate the possibility of contaminants entering the subsurface;
Standardize guidelines for pre-treatment of the recharge water, including recycled water;
Build monitoring wells to collect data on changes in groundwater quality that may be caused by recharge; and
Consider the functions of recharge areas in land use and development decisions.

Source: DWR Bulletin 118

the H_2O group

City of Patterson

Water Conservation Program Study

DRAFT
April 2011

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Introduction

In February 2008, Governor Schwarzenegger introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. The first element of the Governor's Delta plan is water conservation. In the Governor's words, California must have:

> ***"A plan to achieve a 20 percent reduction in per capita water use statewide by 2020.*** *Conservation is one of the key ways to provide water for Californians and protect and improve the Delta ecosystem. A number of efforts are already underway to expand conservation programs, but I plan to direct state agencies to develop this more aggressive plan and implement it to the extent permitted by current law. I would welcome legislation to incorporate this goal into statute."*

According to the Governor's office, Delta protection and restoration are not the only reasons to increase conservation efforts. Global climate change will affect water management in California, and water conservation will help the state not only mitigate climate change by reducing greenhouse gas emissions but also adapt to climate change by reducing water use. Approximately one-fifth of the electricity and one-third of the non-power plant natural gas consumed in the state are associated with water delivery, treatment and use, so efficient use also can reduce water related energy demands and associated greenhouse gas emissions.

Closer to home, water conservation is also an attractive water management strategy because it can yield multiple benefits. Reduced demand can reduce or delay the capital cost of new infrastructure to treat and deliver water. Reduced use also reduces the demand for wastewater treatment, including capital costs and ongoing treatment costs.

Every 5 years water purveyors in California are required to prepare an Urban Water Management Plan (UWMP). The City of Patterson prepared and submitted a plan for 2005, and is currently working on the 2010 update. The UWMP is mandated by law

(California Water Code §10610 et seq.), requiring urban water suppliers to report, describe, and evaluate:

- Water deliveries and uses;
- Water supply sources;
- Efficient water uses;
- Water conservation activities, including implementation strategy and schedule.

In addition, the *Water Conservation Bill of 2009* requires urban water suppliers to report in their UWMPs a detailed evaluation of historical water use and specific targets for use reduction. [1] The UWMP is intended to be a reference planning document for each water agency to ensure adequate water supplies are available to meet existing and future demands (CWC 10612 (b)). Urban water suppliers are required to assess current demands and supplies over a 20-year planning horizon and consider various drought scenarios, water shortage contingency planning, etc.

The 2010 UWMP will have a strong focus on conservation. However, there are other mandatory water conservation laws and requirements that will affect City of Patterson independent of UWMP requirements. The cost of both mandatory and elected water conservation efforts can be significant, financially impacting the City, its residents, and development. There is no “one size fits all” approach to water conservation that is appropriate for all California water purveyors. Some water conservation efforts may be cost effective, while others may not; some water conservation measures may be mandatory, while others may not. Selecting the proper water conservation program is important to ensure the City of Patterson is in compliance with California law, that the program is cost effective, and that conservation efforts are compatible with the City’s long-term water resource goals.

Purpose

The purpose of this report is to meet the requirements of the California Water Code, which requires the City to establish water use “targets” and conservation activities to meet these targets, and implement cost effective conservation measures. The study evaluates mandatory and elected water conservation programs and activities applicable to the City of Patterson, and recommends a conservation program that is cost effective and compatible with the City’s long-term water resource goals. The conservation program will be identified in the UWMP.

Water Conservation in California

Until the 1970’s, water supply programs in western U.S. states were focused on projects that would increase supplies. State and federal water projects included dams, canals, and other infrastructure necessary to expand the use and distribution of water. Water

[1] The goal of the Water Conservation bill of 2009 is to reduce urban water use 20% by 2020.

demands were rarely questioned or critically assessed. If water demands used available supplies, plans were made to find more water through a construction of a new dam, a larger canal, etc. Beginning in the 1970's, the approach to water supply (and other resources) began to change. The financial (cost-benefit) analysis of developing a new supply was prepared with more scrutiny. In addition, non-cost factors, such as environmental, cultural, and social costs, were used in the evaluation process.

The cost of water deliveries are also directly tied to energy use. At over 8 pounds per gallon, water is a heavy load when billions of gallons need to be lifted from rivers and canals to houses, parks, and crop fields. As a result, the largest share of energy to move it goes toward pumping. The longest, highest pumping systems in the United States are in the West, where water often travels great distances from source to user, nowhere more so than California. Nearly 8 percent of California's electricity is invested in simply transporting water from one point to another, according to the California Public Utility Commission (CPUC). If you add the energy used by end users to heat water, 19 percent of the state energy is tied to water use. Since California has and will struggle with energy shortages, water use becomes and important part of the energy equation.

As a result, federal and California law have regulated appliance efficiency since the mid 1970s and has standards covering an extensive array of commercial and residential products, including water fixtures. By 1994, strict regulations had been set to limit the amount of water that could be used by toilets, shower heads, sinks, and clothes washers. All buildings constructed after 1994 were required to meet these new standards. Starting in 1992, California required the installation of water meters on all new municipal and industrial service connections in a first attempt to begin charging customers for their use and to help gain a better understanding on how the water is being used. Subsequent law requires all connections to be metered and charged based on the metered use no later than 2025. [2]

In 2009, the State of California released it updated Water Plan. The plan's introduction summarizes concerns of the Department of Water Resources and numerous water agencies throughout the state, calling attention to a possible water crisis in our future:

"California is facing one of the most significant water crises in its history—one that is hitting hard because it has many aspects and consequences. Reduced water supplies and a growing population are worsening the effects of a multi-year drought. Climate change is reducing our snowpack storage and increasing the frequency and intensity of floods.

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[2] AB 2572, Kehoe. Water meters. Existing law generally requires the installation of a water meter as a condition of water service provided pursuant to a connection installed on or after January 1, 1992. Existing law declares that the state goal for measurement of water use is the achievement, on or before January 1, 1992, of the installation of water meters on all new water service connections after that date to systems owned or operated by a water purveyor. This bill, with certain exceptions, would require an urban water supplier, as defined, on or before January 1, 2025, to install water meters on all municipal and industrial water service connections that are located in its service area.

Court decisions and new regulations have resulted in the reduction of water deliveries from the Delta by about 20 to 30 percent. Key fish species continue to decline. In some areas of the state, our ecosystems and quality of underground and surface waters are unhealthy. The current global financial crisis will make it even more difficult to invest in solutions. We must act now to provide integrated, reliable, sustainable, and secure water resources and management systems for our health, economy, and ecosystems." [3]

The Department of Water Resources is rapidly moving California's approach to water from one that looked to increase supplies, to one that is sustainable by using supplies that are currently available. Included among the three foundational actions called for in the 2009 Water Plan, is using water more efficiently to gain maximum utility from existing supplies. Translated, this means aggressive water conservation through a combination of mandatory and incentive-based water laws and programs.

Through a coordinated effort among state agencies, California is implementing a comprehensive water conservation effort. The recent passage of a few notable state conservation laws will have immediate and long term impact on all water purveyors, including the City of Patterson. These include:

A. **The Water Conservation Act of 2009** (SBx7-7, approved November 10, 2009) **–** This legislation calls for a 20% reduction in urban water use statewide by 2020, with each urban water purveyor to establish a "target" water use for its service area;

B. **The Water Conservation in Landscaping Act (**AB 1881, approved September 28, 2006) **–** This legislation mandates the adoption of a model water conserving landscaping ordinance with specific provisions for landscape design, construction, and maintenance of public and private developments (with landscapes greater than 2,500 sq. ft.) for the purpose of conserving water;

C. **2008 California Green Building Standards Code** (California Building Standards Code, Title 24, adopted July, 2008) **–** These changes to the California Building Code include adoption of mandatory water conservation measures for residential and non-residential development, requiring the use of water conserving building practices, including but not limited to, low-flow rate plumbing fixtures (to achieve a 20% reduction of indoor water use), and moisture sensing irrigation controllers; and

D. **Property Transfers: Replacement of Plumbing Fixtures** (SB 407, adopted October 12, 2009) **–** This legislation requires that all existing commercial, residential and multi-family buildings in California built before 1994 be retrofit to meet high efficiency water use standards by January 1, 2017 or 2019, depending on the type of structure.

E. **Water Demand: Water Management Grant and Loan Eligibility** (AB1420, adopted February 7, 2007) **–** This legislation requires proof of compliance with, or commitment to implement, 14 various Best Management Practices (BMP) water

[3] California Water Plan Highlights, Integrated Water Management, 2009 Update, DWR.

conservation programs or activities, if a public agency is seeking state grants or loans.

Current City of Patterson Water Conservation Activities

Relative to other Central Valley communities, Patterson is an efficient user of water. Part of the reason is that the City of Patterson has had an active water conservation program for years. Nearly all service connections have water meters, water is billed at a tiered (increasing) rate to encourage efficient water use, and existing City ordinances discourage water waste, such as overwatering of landscaping, odd-even watering, use of automated irrigation timers, etc. A summary of Patterson's water conservation ordinances are provided in Appendix A.

The City's 2005 Urban Water Management Plan (UWMP) included implementation of certain water conservation measures where appropriate. [4] The City became a signatory member of the California Urban Water Conservation Council (CUWCC) in 2003 The CUWCC acts as an agent for DWR to track and oversee each water purveyor's progress toward water conservation as required by the UWMP. The CUWCC's Memorandum of Understanding (MOU) identifies and recommends 14 BMP's each signatory should implement for a comprehensive water conservation program. [5] The City prepares and reports on its water conservation activities and progress to the CUWCC every two years. Reporting to the CUWCC achieves compliance of the UWMP conservation reporting requirements by DWR. [6] The City also employs a Water Conservation Coordinator, one of the BMP requirements as listed in the CUWCC MOU.

Public and commercial landscaping is estimated to account for as much as 25% of the City's total annual water use, and over 40% of the peak month demands. In 2008, the City of Patterson approved a non-potable water program for the purpose of using lower quality water for irrigation of public and commercial landscaping. Use of non potable water greatly expands the City's source supply options. An important component of statewide water resource management efforts is to maximize the use of recycled wastewater. The Water Conservation Act of 2009 allows agencies a 1:1 credit for recycled water toward its conservation requirements. Eventually, the City can use recycled water for non-potable demands, and receive credit against state conservation mandates.

The City of Patterson's 2010 General Plan Update includes both conservation and non-potable/recycled water as an important supply source for future development. To ensure the City has reliable long-term supplies, conservation and recycled/non potable water

[4] Required of all public water purveyors with 3,000+ services, per California Water Code, Section 10610, with updates every 5 years.
[5] The CUWCC 14 BMP's are the same as those identified in AB1420, though CUCWW has recently restructured the BMP's into "foundational" and "programmatic" categories. The UWMP also identifies BMP's as "Demand Measurement Measures", or DMM's.
[6] DWR, UWMP checklist, Table I-2, page 7, Item 32.

combined will account for approximately 40% of future supplies. Most or all conservation will be achieved through existing and future regulatory requirements (i.e. California Building and Water Codes, AB 1881, metered water pricing, etc.). Recycled water is very reliable, since wastewater treatment facilities operate continuously regardless of drought conditions, and its use could be expanded as the need arises. As such, recycled water should be considered an important part of the City's water conservation program.

Mandatory and Elected Conservation Measures

Water conservation will remain a part of the City's normal operations for the indefinite future. Some water conservation programs are currently mandated, and others will likely follow. The City may voluntarily elect to implement certain conservation measures to minimize the cost of supplying water, reduce wastewater production, enhance source water reliability, address an environmental concern, etc. Normally, elected water conservation measures must first prove to be cost effective prior to implementation.

Mandatory water conservation programs can be divided into three (3) categories. The first include conservation programs that are integrated into California law, such as state building and water codes, or included in the City's water or wastewater permits. The second are required as part of a program which the City desires to be a participant, such as state grant or loan program. The third include conservation measures that are mandatory, whereby the City can implement in part to meet an overall conservation goal, or seek exemptions based on an unattractive cost-benefit evaluation. Obviously, the City could choose to implement certain water conservation measures or programs for other reasons than cost-benefit.

Because DWR provides "conservation credit" for the use of recycled wastewater, it will also be discussed within the context of conservation measures. It should be noted that recycled water was identified in the City of Patterson 2010 General Plan Update as a component of the City's source waters for meeting future demands. Use of recycled water will be an important and valuable source supply for future growth. Some or all of recycled water use could be used to off-set mandatory conservation measures in the future if necessary.

Current water conservation measures the City is affected by are described below.

A. **Water Conservation Act of 2009** (SBx7-7): – The overall goal of SBx7-7 is to reduce urban water use statewide by 20% in the next 10 years. This legislation also includes mandatory measures for agricultural conservation. The "mechanism" through which urban water purveyors are to use to accomplish the provisions of SBx7-7 is the UWMP, starting in 2010.

B. **Urban Water Management Plan (Demand Measurement Measures, or DMM's) –** All urban water purveyors serving at least 3,000 service connections must prepare, adopt, and submit to DWR, an Urban Water Management Plan in accordance with California Water Code §10610. As part of the 2010 UWMP Update, requires urban water suppliers to report, describe, and evaluate:

- Water deliveries and uses
- Water supply sources
- Efficient water uses
- DMMs, including implementation strategy and schedule

DMMs are specific actions a water supplier takes to support its water conservation efforts. Specifically, the UWMP Act identifies 14 DMMs (CWC 10631(f)) that are to be evaluated in each UWMP. The 14 DMMs are:

A. Water survey programs for single-family residential and multifamily residential customers
B. Residential plumbing retrofit
C. System water audits, leak detection, and repair
D. Metering with commodity rates for all new connections and retrofit of existing connections
E. Large landscape conservation programs and incentives
F. High-efficiency washing machine rebate programs
G. Public information programs
H. School education programs
I. Conservation programs for commercial, industrial, and institutional accounts
J. Wholesale agency programs
K. Conservation pricing
L. Water conservation coordinator
M. Water waste prohibition
N. Residential ultra-low-flush toilet replacement programs

These 14 DMM's correspond to the 14 BMP's listed and described in the CUWCC MOU that signatory water suppliers commit to implement as part of their urban water conservation programs. These 14 DMM's also correspond to the DMM's identified in DMM Implementation Compliance (AB 1420).

An urban water supplier's UWMP is to document its DMM implementation by either:

• Providing the required information for each DMM
• Submitting a copy of its 2009-2010 approved CUWCC BMP report, if the supplier is a signatory to the CUWCC MOU

An AB 1420 report submitted to DWR and determined by DWR to be eligible to receive funding, may have been prepared by an urban water supplier to document eligibility for grant and loan funding. However, this process does not fulfill all of the UWMP requirements. An urban water supplier may use the AB 1420 report as a part of its DMM reporting, but it must also provide:

• Descriptions of the specific actions the urban water supplier is taking to comply with the UWMP DMM requirements
• Additional economic documentation for any DMM the urban water supplier is not implementing

The UWMP Act clearly states that "all" DMM's are to be discussed (10631(f)); therefore, it is recommended that information on each DMM be presented, regardless of its implementation or potential for implementation.

In summary, an urban water purveyor's 2010 UWMP must either show compliance with the DMM's, a schedule of DMM implementation, or a quantitative cost-benefit justification that the DMM/BMP is not cost effective.

C. **The Water Conservation in Landscaping Act - Model Water Efficient Landscape Ordinance (**AB 1881) **–** The goal of AB 1881 is to establish a method to plan, design, and evaluate water conserving landscapes. Cities and counties in California were provided the option of either creating and adopting their own "*at least as effective*" ordinance, or simply adopting the state model ordinance. The City of Patterson adopted the state model ordinance on January 1, 2010, in accordance with state code. The Model Ordinance (California Code of Regulations Title 23, Waters Division 2, Department of Water Resources Chapter 2.7, Model Water Efficient

(1) new construction and rehabilitated landscapes for public agency projects and private development projects with a landscape area equal to or greater than 2,500 square feet requiring a building or landscape permit, plan check or design review;
(2) new construction and rehabilitated landscapes which are developer-installed in single-family and multi-family projects with a landscape area equal to or greater than 2,500 square feet requiring a building or landscape permit, plan check, or design review;
(3) new construction landscapes which are homeowner-provided and/or homeowner-hired in single family project landscape area equal to or greater than 5,000 square feet requiring a building or landscape permit, plan check or design review;
(4) existing landscapes limited to Sections 493, 493.1 and 493.2; and
(5) cemeteries.

The ordinance does not apply to:

(1) registered local, state or federal historical sites;
(2) ecological restoration projects that do not require a permanent irrigation system;
(3) mined-land reclamation projects that do not require a permanent irrigation system; or
(4) plant collections, as part of botanical gardens and arboretums open to the public.

In summary, the Model Ordinance establishes a water budget for the overall project, based on area and local hydrologic data, by which the landscape design must stay within through selection of low, moderate, and high water use plants and landscaping. Agencies are responsible to review the project landscape, irrigation, and grading designs and certify the installation. Certification of the project installation includes an audit of water use, and verifying the irrigation controller settings, and other miscellaneous items.

AB 1881 is included in Appendix E. The Model Ordinance is included in Appendix F.

D. **2008 California Green Building Standards Code** (California Building Standards Code, Title 24) – New building standards include provisions to reduce the use of water, energy, building materials, as well as reduce waste, pollution, etc. The code includes mandatory and volunteer provisions for residential and commercial building. Mandatory water

A stated goal of the mandatory water conservation measures is to reduce indoor water use of all new buildings by 20%, as described in Section 4 (Residential) and Section 5 (Non Residential) of the code. Each section is shown below:

4.303.1 *Twenty percent savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by at least 20 percent shall be provided. The reduction shall be based on the maximum allowable water use per plumbing fixture and fitting as required by the California Building Standards Code. The 20 percent reduction in potable water use shall be demonstrated …*

5.303.2 Twenty percent savings. *A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 20 percent shall be provided. The reduction shall be based on the maximum allowable water use per plumbing fixture and fittings as required by the California Building Standards Code. The 20 percent reduction in potable water use shall be demonstrated …*

Outdoor water use is also addressed with installation of "smart" irrigation controllers with rain/moisture sensors, following AB1881, etc.

2008 Green Building Standards will affect future development by significantly reducing indoor and outdoor water use. Since this law is mandatory, all new developments in the City of Patterson will be obligated to comply. A 20% reduction in future water use associated with new development was provided in the Water Supply Analysis/General Plan Update as part of the City's water supply program and determination of future demands. New building code provisions, in combination with other mandatory water conservation requirements (AB1881, SB407) are sufficient to achieve the water conservation goals identified in the 2010 General Plan Update without implementation of more aggressive volunteer measures.

Excerpts from the Green Building Code are provided in G.

E. **Property Transfers: Replacement of Plumbing Fixtures** (SB 407) **–** The goal of SB 407 is to retroactively replace plumbing fixtures in buildings that were built prior to the availability of water efficient models (1994). Specifically, language states:

“ *(g)… it is the intent of the Legislature to require that residential and commercial real property built and available for use or occupancy on or before January 1, 1994, be equipped with water-conserving plumbing fixtures, (h) It is further <u>the intent of the Legislature that retail water suppliers are encouraged to provide incentives, financing mechanisms, and funding to assist property owners with these retrofit obligations</u>. 1101.2. Except as provided in Section 1101.7, this article shall apply to residential and commercial real property built and available for use on or before January 1, 1994.*

The schedule for compliance is as follow:

2014: All residential/commercial building alterations or improvements must replace non-compliant fixtures for permit approval;

2017: All noncompliant plumbing fixtures in any single-family residential real property shall be replaced by the property owner with water-conserving plumbing fixtures, and on and after January 1, 2017, a seller or transferor of all residential properties must disclose requirements for replacing fixtures and whether the property is compliant upon sale or transfer;

2019: All multi-family and commercial properties must disclose requirements for replacing fixtures and whether the property is compliant upon sale or transfer, and all fixtures must be replaced by this date.

In effect, the intent of SB 407 is for water purveyors to create programs to ensure that all older buildings (pre-1994) be retrofitted with water conserving plumbing fixtures, regardless of the economic benefits. As such, the City will likely elect to initiate programs to retrofit those residential buildings equipped with old fixtures to be in compliance with the code. This is an example of a DMM/BMP that requires a program independent of cost-benefit analysis. The number of homes within the City of Patterson built prior to 1994 is approximately 2,300 units. Compliance with the law would require coverage of approximately 450 homes per year, assuming a program is developed by the end of 2011. SB 407 is included in Appendix H.

F. **Demand Measurement Implementation** (AB 1420) – This code requires that all water purveyors seeking state grant or loan funding complete an AB 1420 report, which is then submitted to DWR for review and determined by DWR that the water purveyor’s DMM/BMP activities are adequate to be eligible to receive funding. AB 1420 allows for proposed and exempted DMM/BMP’s. In summary, AB 1420 states that an urban water purveyor has obtained a determination of “compliant” from

DWR, it means that the urban water supplier has met one of the following four criteria:

• Has, in the past, implemented all BMPs at a coverage level determined by the CUWCC MOU; or
• Is currently implementing all BMPs at a coverage level determined by the CUWCC MOU; or
• Has submitted a schedule, budget, and finance plan to implement all BMPs at a coverage level determined by CUWCC and commencing within the first year of the agreement for which grant funds are requested; or
• Has demonstrated by providing supporting documentation that certain BMPs are "not locally cost effective."

G. **Recycled Water –** The use of recycled water can be used against SBx7-7 water conservation requirements in a 1:1 ratio. For example, if the City determined it needed to reduce overall demands by 5% to meet provisions of SB7x-7, it could substitute the use of recycled water in the non-potable system equivalent to that 5% water demand. Since recycled water is proposed for future use, and the City is moving forward with a non-potable system capable of distributing recycled water, it becomes a feasible option. Hence, recycled water is an elected conservation measure. However, the date which recycled water becomes available, either through expansion of the City's wastewater treatment facility or purchase from a wholesaler, could be more than 10 years away, and require a substantial investment to make recycled water available. Accelerating the timing of recycled water use could occur should the City find grant funding opportunities for a recycled water program or unique opportunity to participate in a recycled water program in the near future.

A summary of the water and building codes are provided in Table 1.

Table 1 – Summary of Water Conservation Codes

Code	Description	Applicability
SBx7-7	**Reduce urban water use 20% by 2020**	Mandatory w/exemptions
UWMP	**Address DMM's in 2010 UWMP**	Mandatory w/exemptions
AB 1881	**Water Conserving Landscape Ordinance**	Mandatory
Building Code	**Water Conserving Plumbing Fixtures**	Mandatory
SB 407	**Retrofit Fixtures in Pre-1994 Buildings**	Mandatory
Recycled Water	Use Recycled Water for Conservation	Elected

Water Conservation BMP Cost Benefit Analysis

An important step in developing the City's water conservation program is determining whether the City can claim an exemption for mandatory codes where they are allowed. As explained in the previous section, addressing both SBx7-7 target water demand and the UWMP DMM's are required, but compliance may be achievable by meeting the intent of the code without full implementation.   Each code is addressed herein.

SBx7-7

The goal of the Water Conservation Act of 2008 is to cumulatively reduce statewide urban water use 20% by 2020 (10% by 2015). However, DWR recognized that some communities are currently using less water than others, so a "flat", across the board reduction of 20% was not mandated. The code allows each urban water purveyor to select 1 of 4 Target Methods, as described:

- **Method 1**: Eighty percent of the water supplier's baseline per capita water use
- **Method 2**: Per capita daily water use estimated using the sum of performance standards applied to indoor residential use; landscaped area water use; and commercial, industrial, and institutional uses
- **Method 3**: Ninety-five percent of the applicable state hydrologic region target as stated in the State's April 30, 2009, draft 20x2020 Water Conservation Plan
- **Method 4**: A new approach developed by DWR, reported to the Legislature in December 2010, and subsequently released earlier this year.

As a minimum, all urban water purveyors must achieve at least a 5% reduction in their base demand by 2020.

Urban water suppliers are to select a single method to determine its target.   As part of this study, each method was analyzed to find which would be most appropriate to use for developing the City of Patterson's target demand value. The City's historical water use (2001-2010) was used to find the City's existing use (169 gallons per capita per day)for comparison against the target values. DWR has stated that the maximum target value that can be selected has to be at least 95% of the current use, for Patterson this value is 160 gallons per capita per day (gpcd). The target analysis for Patterson is shown in D. In the analysis both Methods 2 and 3 provided a target demands value that exceeds the maximum allowable value of 160 gpcd, so the maximum allowable target of 160 gpcd was selected for Patterson.

It is important to note that the City of Patterson is presently a "water conserving community". DWR estimates that the San Joaquin River Region has demands of 248 gpcd, with a demand reduction goal of 174 gpcd by 2020. [7] In comparison, the City of Patterson's 169 gpcd 10-year average demand is already lower than the 20x2020 goal, and Patterson will see further reductions in per capita demand over the next 10 years due to a combination of existing City conservation programs and mandatory water conservation codes.

BMP/DMM's

As part of this study, a cost-benefit analysis was performed to determine the value or benefit of implementing each of the 14 water conservation DMM/BMP's, as defined in the CUWCC MOU. Further, as signatory members of the CUWCC MOU, the City is obligated to conduct cost-benefit analysis of each BMP for which it is requesting exemption.

Conservation activity costs were prepared in collaboration with City staff to determine program start-up and annual cost estimates. "Start up" costs represent the City's one-time cost to prepare and initiate a new program. A "present value" cost was also used to directly compare the long-term (20 year) costs and benefits. These cost estimates are shown in Table 2. Some of the programs continue indefinitely, while others can be terminated after certain "coverage" is achieved, typically extending over 20 years or longer.

Conservation programs are generally composed of multiple activities, each targeting a specific area where a demand may be reduced. The CUWCC 14 BMP's are each focused on reducing water demands targeting a specific part of the water system (i.e. residential landscaping, commercial plumbing fixtures, public education, etc.). Each of these activities can be expected to reduce water demands by small, single-digit increments. For example, the State of California's 20x2020 plan estimates 3 gallons per person saved through a high-efficient clothes washing machine program, 3 gallons per person saved through residential irrigation controllers, 3 gallons per person saved for large landscape audits (BMP 5), etc. Since the City of Patterson has lower water use compared to other communities, it should expect to see a smaller reduction in demand with conservation activities compared to the average community.

The cost for the City to produce water is primarily based on three components: electricity (pumping water), chemicals (treatment), and labor. Any reduction in the amount of water pumped by the City directly reduces its electrical and chemical costs. Labor costs are not directly reduced, since all water facilities must be operated and maintained regardless independent of water production, and the City does not have dedicated operations personnel for production facilities. Even in the event the City could reduce its total demands, the City could not eliminate a production facilities (well) based on California Department of Public Health permit code. [8] Hence, labor cost reduction for each increment of water conservation is negligible.

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[7] 20x2020 Water Conservation Plan, Table ES-1, Regional Urban Water Use Patterns in 2005, Feb., 2010.
[8] CDPH requires system production based on 10 years prior use data.

Table 2 - BMP/DMM Program Cost Estimates

BMP/DMM	Description	Start-up Cost	Annual Cost	Present Value Cost
1 – Residential Audit	**Provide residential assistance with indoor/outdoor water conservation (audits, etc.)**	**15,000**	**15,000**	**202,000**
2 – Residential Outdoor	**Provide residential plumbing fixture assistance through distribution of conservation devices**	**15,000**	**15,000**	**202,000**
3 – Water Loss Control	**Find, fix leaky pipes, prepare audit program (AWWA 4 year Program), etc.**	**50,000**	**125,000**	**889,000**
4 - Metering	**All connections to be metered, including City services, on-going meter testing program**	**80,000**	**100,000**	**1,326,000**
5 – Landscape	**Audit large landscaping projects, prepare water budgets, provide reports with billing, etc.**	**15,000**	**30,000**	**389,000**
6 – High Efficiency Clothes Washers	**Prepare incentive program for washing machine replacement with WaterSense type units**	**15,000**	**20,000**	**264,000**
7 – Public Information Programs	**Multi-faceted outreach program (8 contacts/yr plus website), must have dedicated annual budget**	**25,000**	**25,000**	**337,000**
8 – School Education Program	**Multi-faceted outreach program for local schools K-6, with dedicated annual budget**	**25,000**	**25,000**	**337,000**
9 – Commercial, Industrial, Institutional	**Achieve water savings of 10%, address commercial laundry, car washes, etc.**	**15,000**	**30,000**	**389,000**
10 – Wholesale Agency	**Coordination with wholesale water supplier**	NA – No wholesale Agency		
11 – Retail Water Rates	**Develop ordinance for volumetric billing of at least 70% of total bill**	NA – City currently in compliance with this BMP		
12 – Conservation Coordinator	**Designated person responsible for water conservation program**	NA – City currently in compliance with this BMP		
13 – Water Waste Prevention	**Enact water waste prevention programs**	**15,000**	**25,000**	**312,000**
14 – Low Flush Toilet	**Prepare incentive program for low flush toilets**	**15,000**	**20,000**	**327,000**
Total		**255,000**	**455,000**	**5,236,000**

Note: Present value cost for i=5%, n=20 years. Item 3 includes 125K for first 4 years for AWWA program, then $50K/yr thereafter.

Based on 2010 City accounting records, the cost of electricity and chemicals associated with City of Patterson water production were calculated for cost-benefit analysis, as shown in Table 3.

Table 3 – City of Patterson Estimated Cost of Water Production

Item	Cost
Electricity Chemicals	$ 112/MG 11/MG
Total	$ 123/MG ($40.20/ac-ft)

For cost benefit analysis, the reduction in the cost of water production can be compared against the cost of various conservation activities, and necessary as part of completing the UWMP. However, for a general comparison a 1% annual reduction in water demands equates to approximately 12.7 MG, based on 2010 City water use. The cost savings associated with a 1% reduction in water demands is:

12.7 MG x $123/MG = $1,556/year

For gross evaluation, if it were assumed that full implementation of all BMPs were to achieve a 15% reduction in total water demand, the annual savings would be $23,340, with a present value of $290, 863 (@ *n=20 years*, *i=5%*), or 5% of the present value program costs, as shown in Table 2.

Based on the cost of each water conservation activity, it is evident that the cost-benefit of implementing and maintaining any BMP not currently part of the City's water conservation program will not prove cost effective at this time. Hence, exemption requests for all BMPs not currently implemented by the City appears appropriate.

Findings and Recommendations

The State of California has proposed aggressive statewide water conservation through a series of recent law and codes changes. Specifically, the State's goal is to achieve a 20% reduction in urban water use through mandatory building codes, landscape design criteria, plumbing retrofit programs, etc. The California Water Conservation Act of 2008 recommends methods for all communities to find "target" water demand values, and hit these targets through the mandatory measures and implementation of 14 specific BMPs as defined by DWR and CUWCC.

The City of Patterson is a "water conserving community", since it uses significantly less water per capita than the average urban water purveyor in the San Joaquin River region. According to DWR, the average urban use in the region is 248 gpcd, where the City of Patterson is approximately 1/3 less, at about 169 gpcd. DWR's target goal for the region is 174 gpcd. Consequently, the City should achieve compliance with SB7x-7 (20x2020), consisting of a 5% reduction in base demand, by simply complying with current mandatory conservation codes. Electing to implement conservation activities beyond the mandatory measures will likely be based on discretionary cost-benefit decisions by the City overtime as the population grows, and as it acquires new sources of water supply.

Mandatory conservation measures the City must address include:

- AB 1881 (Model Landscaping Design, Construction and Maintenance)
- SB 407 (Retrofit of Pre-1994 Plumbing Fixtures)
- California Green Building Code (Low Water Use Plumbing Fixture and Landscape Standards)

Each of these will require City staff to develop a program for implementation. These programs should minimize, to the extent possible, the cost and permitting requirements necessary to comply with the code provisions. Although SBx7-7 is a mandatory water code, the City will likely comply through current and mandatory conservation activities. The only mandatory component of SBx7-7 required at this time is to provide the target value/analysis, and justification for exemptions to CUWCC of those BMP's not implemented in the 2010 UWMP Update.

Recommendations

The following recommendations associated with water conservation are provided based on the findings of this study:

- Proceed with exemption requests through CUWCC for non-cost effective BMPs as part of the 2010 UWMP Update;

- Develop programs to implement mandatory water conservation measures, including landscape design and construction review, an incentive program for retrofitting approximately 2,300 older homes and businesses built prior to 1994;

- Adopt and incorporate new mandatory green building codes into City Ordinances;

- If and when the City's water source supplies change (i.e. surface water purchases, recycled water , etc.), and or water/building codes change, reevaluate water conservation measures for cost effectiveness;

- Look for opportunities to gain funding and/or participate in a recycled water program, participate if it seems cost effective and/or failure to participate could make future recycled water difficult to obtain.

City of Patterson

Public Works Department

DROUGHT CONTINGENCY PLAN

A. DEFINITIONS

As used in this water plan, the word:

1. **"Company"** means the City of Patterson.
2. **"Person"** means any individual, person, firm, partnership, association, corporation, company, organization or government entity;
3. **"Customer"** means any person who uses water supplied by the City of Patterson.
4. **"Water"** means water supplied by the City of Patterson.
5. "**Residential"** means one or two dwelling units per service.
6. **"Water shortage condition"** means the conditions which constitute a determination by the authorizing agency that deliveries of potable water supplies have reached a level such that all consumers are being requested to reduce the use of water by a given amount.
7. **"Authorizing agency"** means the City Council of the City of Patterson.
8. **"Base year"** means the percentage reduction for each customer will be based on the previous year **without** mandatory percent reductions.

B. WATER SHORTAGE CONDITIONS

This water conservation plan shall become effective following notification by the authorizing agency that a shortage of potable water supplies exists. The plan will be implemented in three stages.

STAGE I:
Stage I consists of voluntary water use restrictions and voluntary water conservation of less than or equal to 10% of normal base year. This phase becomes effective upon notification by the authorizing agency that water usage should be reduced by up to 10%.

STAGE II:
Stage II consists of mandatory water use restrictions and voluntary water allocations. This phase becomes effective upon notification by the authoring agency that water usage should be reduced by 20%.

STAGE III:
Stage III consists of mandatory water use restrictions and mandatory water allocations. This phase becomes effective upon notification by the authorizing agency that water usage should be reduced by more than 20%. The allocation of 500 to 350 gallons per day per household will be based on the authorizing agency's percentage reduction.

C. PROBHIBITION OF NONESSENTIAL OR UNAUTHORIZED WATER USE APPLICABLE TO STAGES AS DESGNATED BELOW

The following uses of water are determined to be, and are defined as, nonessential or unauthorized:

1. Any use of water in excess of the following allocations:

STAGE	**ALLOCATION**
I	**Voluntary**
II	**Voluntary**
III	

Residential:
500 to 350 gallons per day per household based on 3 persons per household and on authorizing agency's percentage reduction. 50 gallons per day will be allocated for each additional person in the household.

All other customers:

a. The allocation for each customer is based on the authorizing agency's percentage reduction of more than 20% and up to 50%. The percentage reduction for each customer will be based on the quantity of water used by such customer during the previous **base year**.

Commercial/Industrial:
100% minus authorizing agency's reduction

Irrigation:
90% minus authorizing agency's reduction

b. For any customer without a prior billing record, or where unusual circumstances dictate a change in allocation, the customer's monthly allocation shall be determined by the Public Works Director on the basis of usage by similar customers or on such other basis as may be fair and equitable under the circumstances.

STAGE I

- Use of water through any meter when the city has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and customer has failed to effect such repairs within 5 days after receipt of such notice.
- Use of water which results in flooding or runoff in gutters or streets.
- Use of water through a hose for washing cars, buses, boats, trailers, or other vehicles without a positive automatic shut-off valve on the outlet end of the hose.
- Use of water through a hose for washing buildings, structures, sidewalks, driveways, patios, parking lots, tennis courts, or other hard-surfaced areas, except as required for sanitary or safety purposes.
- Use of water to clean, fill or maintain levels in decorative fountains; unless such water is part of a recycling system.
- Use of water for construction purposes, such as consolidation of backfill; unless no other source of water or other method can be used.
- Use of water from fire hydrants except for fire fighting and related activities and other uses necessary to maintain the public health, safety, and welfare.
- There shall be no outdoor watering or irrigation whatsoever between the hours of 10:00 AM and 7:00 PM.

STAGE II

- Use of water for more than minimal landscaping in connection with any new construction.
- Use of water through any meter when the city has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and customer has failed to effect such repairs within 5 days after receipt of such notice.
- Use of water which results in flooding or runoff in gutters or streets.

- Use of water through a hose for washing cars, buses, boats, trailers, or other vehicles without a positive automatic shut-off valve on the outlet end of the hose.
- Use of water through a hose for washing buildings, structures, sidewalks, driveways, patios, parking lots, tennis courts, or other hard-surfaced areas, except as required for sanitary or safety purposes.
- Use of water to clean, fill or maintain levels in decorative fountains; unless such water is part of a recycling system.
- Use of water for construction purposes, such as consolidation of backfill; unless no other source of water or other method can be used.
- Service of water by any restaurant except upon the request of a patron.
- Use of water from fire hydrants except for fire fighting and related activities and other uses necessary to maintain the public health, safety, and welfare.
- There shall be no outdoor watering or irrigation whatsoever between the hours of 10:00 AM and 7:00 PM.
- Person shall water on designated days according to their house address.

STAGE III

- Use of water for more than minimal landscaping in connection with any new construction.
- Use of water through any meter when the city has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and customer has failed to effect such repairs within 5 days after receipt of such notice.
- Use of water which results in flooding or runoff in gutters or streets.
- Use of water through a hose for washing cars, buses, boats, trailers, or other vehicles without a positive automatic shut-off valve on the outlet end of the hose.
- Use of water through a hose for washing buildings, structures, sidewalks, driveways, patios, parking lots, tennis courts, or other hard-surfaced areas, except as required for sanitary or safety purposes.

- Use of water to clean, fill or maintain levels in decorative fountains; unless such water is part of a recycling system.

- Use of water for construction purposes, such as consolidation of backfill; unless no other source of water or other method can be used.

- Service of water by any restaurant except upon the request of a patron.

- Use of water for lawn irrigation during the months of November through February.

- Use of water from fire hydrants except for fire fighting and related activities and other uses necessary to maintain the public health, safety, and welfare.

- There shall be no outdoor watering or irrigation whatsoever between the hours of 10:00 AM and 7:00 PM.

- Person shall water on designated days according to their house address.

D. <u>PENALTY FOR WATER WASTE AND EXCESS WATER USE</u>

STAGE I and II

The City shall, after one written warning, fine the customer $25 for the first violation, $50 for the second violation within one year and a fine of $100 for each additional violation within one year for any nonessential or unauthorized uses defined in Section C above. The City, at its option may discontinue the service after the third violation after giving the customer written notice. In such latter event, a charge of $10 shall be paid to the City as a condition to restoration of service.

STAGE III – In addition to the penalty noted in Section D

1. For residential customers, an excess-use penalty of $2 per 100 cubic feet of water used in excess of the applicable allocation during each billing period shall be charged by the City for all service rendered on and after the effective date of this tariff, except that such excess-use penalty shall not apply to any customer whose total consumption to date during the period this plan has been in effect does not exceed his or her total allocated usage for said period.

2. For all customers except residential an excess-use penalty of $4 per 100 cubic feet of water used in excess of the applicable allocation during each billing period shall be charged by the City for all service rendered on and after the effective date of this tariff, except that such excess-use penalty shall not apply to any customer whole total consumption to the during the period this plan has been in effect does not exceed his or her total allocation usage for the said period.

CITY OF PATTERSON
DROUGHT CONTINGENCY PLAN

Phasing Criteria

65 feet Normal Well Water Level - 5 year average

Drought Stage		Drought Stage initiating conditions	Reduction Objective
I	78'	120% of normal well water level	Cutback water usage by 10%
II	91'	140% of normal well water level	Cutback water usage by up to 20%
III	130'	200% of normal well water level	Cutback water usage by more than 20% and up to 50%

City of Patterson

DROUGHT CONTINGENCY PLAN

Drought Stage	Public Agency Action	Penalties
I <u>Minimal</u> Up to 10 percent reduction	• Initiate public information campaign. • Implement voluntary water use restrictions. • Adhere to water waste ordinance.	<u>Water Waste Penalties</u> 1. Educational Letter 2. Written warning 3. Citation 4. Shutoff and reconnection fee
II <u>Moderate</u> Up to 20 percent reduction	• Notify public of drought condition. Stage II consists of mandatory water - use restrictions and voluntary water conservation of less than or equal to 20%.	<u>Water Waste Penalties</u> 1. Educational letter or visit 2. Written warning 3. Citation 4. Shutoff and reconnection fee
III <u>Severe</u> Up to 50 percent reduction	• Institute rationing program through fixed allocations of 500 to 350 gallons per day per household. • Adhere to water waste ordinance. • Implement rate changes to penalize use over allotment. • Establish drought surcharge rate.	1. Educational letter 2. Written warning 3. Citation 4. Shutoff and reconnection fee <u>Mandatory Programs</u> Excess use charges Flow Restrictors Fines

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

Agency: **City of Patterson** **District Name:** **City of Patterson** **CUWCC Unit #:** **73**
Retail

Primary Contact Mike Willett **Telephone** (209) 895-8060 **Email:** MWillett@ci.patterson.ca.us

Compliance Option Chosen By Reporting Agency:
(Traditional, Flex Track or GPCD)

Agency: **City of Patterson** District Name: **City of Patterson** CUWCC Unit #: **73**
Retail

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

Foundational BMPs
BMP 1.1 Operational Practices

		2009	2010	
1.Conservation Coordinator provided with necessary resources to implement BMPs?	Name	Monica Sandoval	Monica Sandoval	Conservation Coordinator provided with necessary resources to implement BMPs?
	Title	Conservation Coordinator	Conservation Coordinator	
	Email	MSandoval@ci.patterson.ca.us	MSandoval@ci.pa	
		On Track	**On Track**	
2. Water waste prevention documentation				
	Descriptive File	Sections 13.24.240, and		
	Descriptive File 2010		Sections 13.24.240, and 13.24.380	On Track if any one of the 6 ordinance actions done, plus documentation or links provided
	URL	http://codepublishing.com/ca/patterson/		
	URL 2010		http://codepublishing.com/ca/patterson/	
	Describe Ordinance Terms	Sections 13.24.240, and 13.24.380		
	Describe Ordinance Terms 2010		Sections 13.24.240, and 13.24.380	
		On Track	**On Track**	

Agency: City of Patterson
Retail

District Name: City of Patterson

CUWCC Unit #: 73

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

BMP 1.2 Water Loss Control

	2009		
Complete a prescreening Audit	**no**	**Exempt**	On Track if Yes
Metered Sales	**0**		
Verifiable Other Uses	**0**		
Total Supply	**0**		
(Metered Sales + System uses)/ Total Supply >0.89	0.00	**Exempt**	On Track if =>.89, Not on Track if No
If ratio is less than 0.9, complete a full scale Audit in 2009?	**No**	**Exempt**	On Track if Yes
Verify Data with Records on File?	**No**	**Exempt**	On Track if Yes
Operate a system Leak Detection Program?	**No**	**Exempt**	On Track if Yes

	2009		
Compile Standard Water Audit using AWWA Software?	No	**Exempt**	On Track if Yes, Not on Track if No
AWWA file provided to CUWCC?	No	**Exempt**	On Track if Yes, Not on Track if No
AWWA Water Audit Validity Score?	0		Info only until 2012
Completed Training in AWWA Audit Method?	No		
Completed Training in Component Analysis Process?	No		Info only until 2012
Complete Component Analysis?	0		Info only until 2012
Repaired all leaks and breaks to the extent cost effective?	Yes	**On Track**	On Track if Yes, Not on Track if No
Locate and repair unreported leaks to the extent cost effective.	Yes	**On Track**	On Track if Yes, Not on Track if No
Maintain a record-keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair.			Info only until 2012
Provided 7 types of Water Loss Control Info			Info only until 2012

Leaks Repaired	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost of Interventions	Water Saved
0	$ -	$ -	0	0	$ -	0

	2010		
Compile Standard Water Audit using AWWA Software?	No	**Exempt**	On Track if Yes, Not on Track if No
AWWA file provided to CUWCC?	No	**Exempt**	On Track if Yes, Not on Track if No
AWWA Water Audit Validity Score?	0		Info only until 2012
Completed Training in AWWA Audit Method?	no		
Completed Training in Component Analysis Process?	No		Info only until 2012
Complete Component Analysis?	No		Info only until 2012
Repaired all leaks and breaks to the extent cost effective?	Yes	**On Track**	On Track if Yes, Not on Track if No
Locate and repair unreported leaks to the extent cost effective.	Yes	**On Track**	On Track if Yes, Not on Track if No
Maintain a record-keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair.			Info only until 2012
Provided 7 types of Water Loss Control Info			Info only until 2012

Leaks Repaired	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost of Interventions	Water Saved
0	$ -	$ -	0	Off	$ -	0

Agency: City of Patterson **District Name:** City of Patterson **CUWCC Unit #:** 73
Retail

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

1.3 METERING WITH COMMODITY RATES FOR ALL NEW CONNECTIONS AND RETROFIT OF EXISTING CONNECTIONS

	2009		2010		
Exemption or 'At least as Effective As' accepted by CUWCC					If signed MOU prior to 31 Dec 1997, On Track if all connections metered; If signed after 31 Dec 1997, complete meter installations by 1 July 2012 or within 6 yrs of signing and 20% biannual reduction of unmetered connections.
Numbered Unmetered Accounts	Yes	**Exempt**	Yes	**Exempt**	On Track if no unmetered accounts
Metered Accounts billed by volume of use	Yes	**On Track**	Yes	**On Track**	Volumetric billing required for all connections on same schedule as metering
Number of CII accounts with Mixed Use meters	0		0		Info only until 2012
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	No		No		Info only until 2012
Feasibility Study provided to CUWCC?	No		No		Info only until 2012
Completed a written plan, policy or program to test, repair and replace meters	No		No		Info only until 2012

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

Agency: **City of Patterson** **District Name:** **City of Patterson** **CUWCC Unit #:** **73**

Retail Coverage Report Date: June 9, 2011

Primary Contact Mike Willett **Email:** MWillett@ci.patterson.ca.us

1.4 Retail Conservation Pricing

Metered Water Rate Structure

Date 2009 data received July 7, 2011

Date 2010 data received July 7, 2011

On Track if: Increasing Block, Uniform, Allocation, Standby Service; Not on Track if otherwise

Customer Class	2009 Rate Type	Conserving Rate?	Customer Class	2010 Rate Type	Conserving Rate?
Single-Family	Increasing Block	Yes	Single-Family	Increasing Block	Yes
Multi-Family	Increasing Block	Yes	Multi-Family	Increasing Block	Yes
Commercial	Increasing Block	Yes	Commercial	Increasing Block	Yes
	On Track			On Track	

Year Volumetric Rates began for Agencies with some Unmetered Accounts

Info only

Agencies with Partially Metered Service Areas: If signed MOU prior to 31 Dec. 1997, implementation starts no later than 1July 2010. If signed MOU after 31 Dec. 1997, implementation starts no later than 1July 2013, or within seven years of signing the MOU,

Agency: **City of Patterson** District Name: **City of Patterson** CUWCC Unit #: **73**
Retail Coverage Report Date: June 9, 2011

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

Adequacy of Volumetric Rates) for Agencies with No Unmetered Accounts

Customer Class	2009 Rate Type	2009 Volumetric Revenues $1000s	2010 Rate Type	2010 Volumetric Revenues $1000s
Single-Family	Increasing Block	$ 1,446	Single-Family	$ 1,338
Multi-Family	Increasing Block	$ 7	Multi-Family	$ 5
Commercial	Increasing Block	$ 963	Commercial	$ 902
		$ -		$ -
		$ -		$ -
		$ -		$ -
		$ -		$ -
	Total Revenue Commodity Charges (V):	$ 2,416		$ 2,246
	Total Revenue Fixed Charges (M):	$ 661		$ 691
	Calculate: V / (V + M):	79%		76%
		Info only until 2012		Info only until 2012

Agency Choices for rates:

A) Agencies signing MOU prior to 13 June2007, implementation starts 1 July2007: On Track if (V / (V + M) ≥ 70% x .8 = **56% for 2009** and 70%x0.90 = **63% for 2010**; Not on track if (V / (V + M)) < 70%;

B) Use Canadian model.

Agencies signing MOU after 13June2007, implementation starts July 1 of year following signing.

	2009	2010
Canadian Water & Wastewater Rate Design Model Used and Provided to CUWCC	**No**	**No**
If Canadian Model is used, was 1 year or 3 year period applied?		

Wastewater Rates

	2009		2010
Does Agency Provide Sewer Service?	**Yes**	If 'No', then wastewater rate info not required.	**Yes**

Customer Class	2009 Rate Type	Conserving Rate?	Customer Class	2010 Rate Type	Conserving Rate?
		No			No
		No			No
		No			No
		No			No
		No			No
		No			No
		No			No
	Exempt			**Exempt**	

On Track if: 'Increasing Block', 'Uniform', 'based on long term marginal cost' or 'next unit of capacity'

irrigation revenue not separated from commercial revenue.
r charges are based on water meter readings, $1.62 per 100 c.f. after 1,000 c.f., with $28.47 base rate.

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

BMP 2. EDUCATION PROGRAMS

BMP 2.1 Public Outreach Actions Implemented and Reported to CUWCC

	2009	2010	
Does a wholesale agency implement Public Outrach Programs for this unility's benefit?	**No**	**No**	Yes/No
Names of Wholesale Agencies			
1) Contacts with the public (minimum = 4 times per year)	0	0	
2) Water supplier contacts with media (minimum = 4 times per year, i.e., at least quarterly).	0	0	
3) An actively maintained website that is updated regularly (minimum = 4 times per year, i.e., at least quarterly).	No	No	All 6 action types implemented and reported to CUWCC to be 'On Track')
4) Description of materials used to meet minimum requirement.	Conservation brochures/mailers sent out periodically in billings.	Conservation brochures/mailers sent out periodically in billings.	
5) Annual budget for public outreach program.	$ -	$ -	
6) Description of all other outreach programs	The City provides water conservation information at City sponsored events, such as the Apricot Festival, Earth Day, and Fall Fest	The City provides water conservation information at City sponsored events, such as the Apricot Festival, Earth Day, and Fall Fest	
	Exempt	**Exempt**	

CUWCC BMP RETAIL COVERAGE REPORT 2009-2010

Foundation Best Management Practices for Urban Water Efficiency

2.2 School Education Programs Implemented and Reported to CUWCC

	2009	2010	
Does a wholesale agency implement School Education Programs for this unility's benefit?	No	No	
Name of Wholesale Supplier?	No	No	
1) Curriculum materials developed and/or provided by agency	No	No	Yes/ No
2) Materials meet state education framework requirements and are grade-level appropriate?	No	No	All 5 actions types implemented and reported to CUWCC to be
3) Materials Distributed to K-6?	No	No	
Describe K-6 Materials	No	No	Describe materials to meet minimum requirements
Materials distributed to 7-12 students?	No	No	Info Only
4) Annual budget for school education program.	$ -	$ -	
5) Description of all other water supplier education programs	No	No	
	Exempt	Exempt	

CUWCC BMP COVERAGE REPORT BMP 3 RESIDENTIAL

Agency: City of Patterson — **CUWCC Unit #:** 73

Date:

Primary Contact Mike Willett — **Email** MWillett@ci.patterson.ca.us

Compliance Option Chosen By Reporting Agency: n/a — **Initial 10 year period completed:** No — **If "Yes" , 50% credit for past BMP 9 Impleme** No

Completed Accounts SF Surveys: 0 **MF Surveys:** 0

SF historic 0

BMP 3 C 1) Residential Assistance

	2009 Single Family Accounts	2009 SF Target	2009 Multi Family Units	2009 MF Targets	2010 Single Family Accounts	2010 SF Target	2010 Multi Family Units	2010 MF Targets
Total Number of Customers	5,755		27		5,761		27	
Total Participants during Reporting Period								
Number of Leak Detection Surveys or Assistance on Customer Property		86		0		86		0
Number of Faucet Aerators Distributed								
Number of WSS Showerheads Distributed				Exempt				Exempt

"On Track" if annual number of surveys/assistance >= 1.5% of SF accounts and MF units

Agency: City of Patterson | **CUWCC Unit #:** 73

BMP 3 C2) Landscape Water Surveys	2009 SF		2010 SF			
Number of SF account landscape water surveys completed		86		86	NA	"On Track" if annual number of landscape surveys >= 1.5% of SF accounts
Surveys as Percent of SF Accounts	0.00%		1.50%			

BMP 3 C3) High Efficiency Clothes Washers	2009		2010		
Number Financial Incentives Provided to Customers		52		58	"On Track" if number of incentives for HECW (WF,=5.0) => 0.9% SF accounts in 2009 and 1.0 % in 2010
Percent	0.00%		0.00%		

BMP 3 C4) Water Sense Specification Toilets	2009		2010		
Retrofit 'On Resale' Ordinance exists	No		No		Ordinance must require replacement of toilets => 3.5 gpf when property is sold On Track if ordinance exists
75% Market Penetration Achieved If 'Yes' is documentation provided?	No		No		On Track if 75% penetration achieved and documentation provided
	SF	**MF Units**	**SF**	**MF Units**	**On Track If number of toilets installed => average resale rate X number toilets per residence (from Base Year Data)**
Number WSS Toilets Installed					
Ave Resale Rate X Toilets /residence					

Agency: **City of Patterson** **CUWCC Unit #:** **73**

BMP 3 C5) WSS for New Residential Development

	2009	2009	2010 SF	2010MF	
Does an Ordinance Exists Requiring WSS Fixtures and Appliances in new SF and MF	No	No	No	No	On Track if ordinance exists requiring WSS in new residential units and documentation is provided
If 'Yes' is documentation provided?	No	No	No	No	
Incentives					
Number of new SF & MF units built					If no ordinance, to be On Track, provide incentives and describe, Including:
		Exempt		**Exempt**	

CUWCC BMP COVERAGE REPORT

Traditional BMP 4 - Comercial Industrial Institutional

Agency: City of Patterson **District Name:** City of Patterson **CUWCC Unit #:** 73

Primary Contact Mike Willett **Email:** MWillett@ci.patterson.ca.us **Report Date:**

Compliance Option Chosen By Reporting Agency: n/a

Date Agency Signed MOU: 12/8/1997 **Initial 10 year period completed:** N **If "Yes" , 50% credit for past BMP 9 Implementation?** N

Water Savings Credit (AF) 0.0

CII Baseline Water Use (AF): 245.0 **Target CII Water Use Reduction (AF)** 24.5

2 year Target (AF) 1.2

Target Reduction is 10% of Baseline CII water use over 10 years.

Water Efficiency Measures	2009 Quantity Installed	2009 Water Savings AF	2010 Quantity Installed	2010 Water Savings AF	Type of Program	Other type of Program
1 High Efficiency Toilets (1.2 GPF or less)	0	0.0	0	0.0	Incentive	n/a
2 High Efficiency Urinals (0.5 GPF or less)	0	0.0	0	0.0	Incentive	
3 Ultra Low Flow Urinals	0	0.0	0	0.0	Incentive	Ultra Low Flow Toilet Tanks
4 Zero Consumption Urinals	0	0.0	0	0.0	Incentive	Waterless urinals
5 Commercial High Efficiency Single Load Clothes Washers	0	0.0	0	0.0	Incentive	
6 Cooling Tower Conductivity Controllers	0	0.0	0	0.0	Incentive	
7 Cooling Tower pH Controllers	0	0.0	0	0.0		
8 Connectionless Food Steamers	0	0.0	0	0.0		
9 Medical Equipment Steam Sterilizers	0	0.0	0	0.0		
10 Water Efficient Ice Machines	0	0.0	0	0.0		
11 Pressurized Water Brooms	0	0.0	0	0.0	Incentive	
12 Dry Vacuum Pumps	0	0.0	0	0.0		
Total Water Savings		0.0		0.0		**Exempt**

Guideline: 'On Track' if estimated savings as percent of baseline:
0.5% by the end of first reporting per
2.4% by end of yr 4,
6.4% by end of year 8
9 % by end of yr 10

CII List of Efficiency Measures from MOU Compliance Policies Tier 3, page 5, dated 10-06-09

CUWCC BMP COVERAGE REPORT

Traditional BMP 5 - Landscape

Agency: City of Patterson | **District Name:** City of Patterson | **CUWCC Unit #:** 73

Primary Contact Mike Willett | **Email:** MWillett@ci.patterson.ca.us | **Report Date:**

Compliance Option Chosen By Reporting Agency: n/a

Date Agency Signed MOU: 12/8/1997 | **Initial 10 year period completed:** N | **If "Yes" , 50% credit for past BMP 9 Implementation?**

50% of Completed Accounts: 0

Required Documentation

	2009		2010	
Number of dedicated irrigation meter accounts	121		121	
Number of dedicated irrigation meter accounts with water budgets.	0		0	
Percent of dedicated irrigation meters with water budgets	0.0%		0.0%	
Target Rate for Year 1	9%	Target Rate for Year 2	18%	**Exempt**
Aggregate water use for dedicated non-recreational landscape accounts with budgets				

ETo-based water use budgets developed for 90% of CII accounts with dedicated irrigation meters at an average rate of 9% per year over 10 years

Aggregate acreage assigned water budgets and average ET for dedicated non-recreational landscape accounts with budgets.

2009 Acres	2009 Average ET	2010 Acres	2010 Average ET

2009 Accounts ≥20% over-budget: Number of Accounts	Offered Technical Assistance	Accepting Technical Assistance	2010 Accounts ≥20% over-budget: Number of Accounts	Offered Technical Assistance	Accepting Technical Assistance

Offer site-specific technical assistance annually to all accounts that are 20% over budget within six years of the date implementation was to commence.

Aggregate acreage of recreational areas assigned water budgets and average ET for dedicated recreational landscape accounts with budgets.

2009 Acres	2009 Average ET	2010 Acres	2010 Average ET

Agency: City of Patterson **District Name:** City of Patterson **CUWCC Unit #:** 73

CII Accounts without Meters or with Mixed-Use Meters

	2009	2010
Number of mixed use and un-metered accounts.		

Incentive Type	2009 Incentives and Responses: Incentive Value $	2009: Number offered to Customers	2009: Number accepted by Customers	2010 Incentives and Responses: Incentive Value $	2010: Number offered to Customers	2010: Number accepted by Customers

Agency will implement and maintain a customer incentive program(s) for irrigation equipment retrofits.

	2009 Surveys: Number offered.	2009 Surveys: Number accepted	2010 Surveys: Number offered.	2010 Surveys: Number accepted
Landscape Irrigation Surveys				
Agregate acreage for Mixed Use and un-metered accounts				

Percent Surveys Complete

Complete irrigation water use surveys for not less than 15% of CII accounts with mixed-use meters and un-metered accounts within 10 years of the date implementation is to commence. (Note: CII surveys that include both indoor and outdoor components can be credited against coverage requirements for both the Landscape and CII BMPs.)

On Track if the percent of CII accounts with mixed-use meters receiving a landscape water use survey equals or exceeds the following: 1.5% by the end of the first reporting period (year two) following the date implementation is to commence; 3.6% by the end of year four; 6.3% by the end of year six; 9.6% by the end

	2009 Savings AF		2010 Savings AF
Estimated annual water savings by customers receiving surveys and implementing recommendations.		Exempt	


City of Patterson
General Plan
Legend
City Limits
Sphere of Influence
Agriculture Transition Areas
Estate Residential
Low Density Residential
Medium Density Residential
High Density Residential
Downtown Residential
Highway Service Commercial
Downtown Core
General Commercial
Mixed Use
Medical Professional
Light Industrial
Heavy Industrial
Public/Quasi-Public
Parks/Open Space
Lake
N
W
E
S
Miles
0
0.25
0.5
1
General Plan Adopted Nov. 2010
LEMON AVE
EUCALYPTUS AVE
OLIVE AVE
ELM AVE
WALNUT AVE
E LAS PALMAS AVE
SYCAMORE AVE
ORANGE AVE
HIGHWAY 33
ZACHARIAS ROAD
ROGERS ROAD
BALDWIN ROAD
WARD AVE
DEL PUERTO CANYON ROAD
Villages of Patterson
Master Development Plan
West Patterson
Business Park
Villa Del
Lago
SPERRY AVE
Master
Development
Plan
W LAS PALMAS AVE
BARTCH AVE
ELFERS ROAD
W MARSHALL ROAD
Lake