CITY OF ROHNERT PARK

2005 URBAN WATER MANAGEMENT PLAN

Adopted August 28, 2007

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TABLE OF CONTENTS

LIST OF FIGURES (all Figures Follow Section 9.0)

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

This Urban Water Management Plan (Plan) was prepared by the City of Rohnert Park (City) in accordance with California Water Code Division 6, Part 2.6, Sections 10610 through 10657 (the Urban Water Management Planning Act, hereinafter Act). The City provides municipal service to over 3,000 customers and meets the definition an urban water supplier as outlined in the Act. This section provides background information on the Plan, an overview of coordination with other agencies, and a description of public participation and Plan adoption.

1.1 Urban Water Management Planning Act

This Plan has been prepared in accordance with the Act, which became part of the California Water Code with the passage of Assembly Bill 797 during the 1983-1984 regular session of the California legislature. The Act requires every urban water supplier that provides water for municipal purposes to more than 3,000 connections, or supplying more than 3,000 acre-feet (AF) of water annually, to adopt and submit a plan every five years to the California Department of Water Resources (DWR). Subsequent legislation has amended the Act. This Plan serves as a long-range planning document for the City's water supply.

Historically the City has adopted a regional Urban Water Management Plan prepared by the Sonoma County Water Agency (Agency). The City participated in the development of the Agency's 2005 Urban Water Management Plan (the Agency's 2005 Plan), but at this point in time finds it appropriate to prepare its own Plan. The Agency's 2000 Urban Water Management Plan (the 2000 Regional Plan) is the most immediate predecessor to this Plan. As indicated in Section 1.3, below, this Plan was prepared in coordination with the Agency and other neighboring water contractors. Section 1.5 discusses the relationship of this Plan to other water supply planning documents previously adopted by the City.

Table 1-1, on the following page, includes an index of the Act's requirements and directs the reader to the Section of the Plan where the requirements are addressed.

Table 1-1 Index of the Requirements of the Act (All Citations Are to the Water Code)

Required Element	Citation	Location in Plan
Coordinate Preparation with Other Agencies to the Extent Practical	10620(d)	Section 1.3
Tools to Maximize Resources and Minimize Imports from Other Regions	10631(a)	Section 1.2
Service Area Description	10631(a)	Section 2
Current and Projected Population (5-year increments)	10631(a)	Table 2-1
Climate	10631(a)	Section 2.2.1
Other Factors	10631(a)	Section 2.2.2, 2.2.3, 2.2.4
Existing and Planned Sources of Water (5-year increments)		
Reliability & Vulnerability	10631(c)	Section 3.7, 4.7.5 and 5.5
Average Water Year Availability	10631(c)	Tables 3-3, 4-9 and 5-9
Single Dry Year Availability	10631(c)	Tables 3-3, 4-9 and 5-9
Multiple Dry Year Availability	10631(c)	Tables 3-3, 4-9 and 5-9
Plans for Replacing Inconsistently Available Sources	10631(c)	Section 3.1, 4.7.5 and 5.5
Opportunities for Water Exchanges or Transfers	10631(d)	Section 3.5.2.1, 4.1.3, 5.4.1
Water Quality and Effect of Quality on Supply Management Strategies	10634	Section 3.6, 4.5.5 and 5.3
Past, Current & Projected Water Use	10631(e)	Section 6
Description of Demand Management Measures	10631(f)	Section 6.3
Evaluation of Demand Management Measures Currently Not Being Implemented	10631(g)	Section 6.3
Description of all Water Supply Projects & Program Being Undertaken to Meet Demand	10631(h)	Section 3.9, 4.1.5 and 5.6
Description of Desalinization Opportunities	10631(i)	Section 8-1
Supply and Demand Data Exchange with Wholesalers in 5-Year Increments	10631(k)	Table 8-3
Water Shortage Contingency Analysis		
Actions to be Undertaken in Response to Water Supply Shortages	10632(a)	Section 7.1
Estimate of the Maximum Amount of Water Available during the Next 3 Years Based on Driest 3-Year Historic Sequence	10632(b)	Table 8-16
Actions to be Undertaken in Response to Catastrophic Interruptions	10632(c)	Section 7.1
Additional Mandatory Prohibitions Against Specific Water Uses	10632(d)	Section 7.3
Consumption Reduction Methods for the Most Restrictive Stages	10632(e)	Section 7.2
Penalties and Charges for Excessive Use if Applicable	10632(f)	Section 7.4
Analysis of Water Shortage Contingency Methods on Revenues & Expenditures	10632(g)	Section 7.5
Draft Water Shortage Contingency Ordinance	10632(h)	Section 7.6
Mechanism for Determining Actual Reductions	10632(i)	Section 7.7
Assessment of Reliability in the Normal, Single Dry and Multiple Dry Years (5-year Increments)	10635	Section 8
Additional Requirements for Groundwater		
Discussion of groundwater management plans/authority	10631(b)(1)	Section 4.1.4
Description of adjudications or legal rights to pump	10631(b)(2)	Section 4.1.6
Descriptions of DWR determinations related to groundwater	10631(b)(2)	Section 4.1.7
Description of the groundwater basin	10631(b)(2)	Section 4.2 – 4.5
Description and analysis of the location, amount & sufficiency of groundwater pumped in the last 5-years by the City	10631(b)(3)	Section 4.6.1; 4.7
Description and analysis of the amount and location of groundwater projected to be pumped by the City	10631(b)(4)	Section 4.6.2; 4.7.6.2
Additional Requirements for Recycled Water		
Description and Quantification of Wastewater Systems	10633(a)	Section 5.1.1
Description of Current Recycled Water Use in the Service Area	10633(b)	Section 5.1.2
Description and Quantification of Potential Recycled Water Uses	10633(c)	Section 5.1.3
Projected Use in the Service Area (5-year Increments)	10633(d)	Section 5.1.3
Descriptions of Actions Taken to Encourage the Use of Recycled Water	10633(e)	Section 5.1.4
Plan of Optimizing the Use of Recycled Water	10633(f)	Section 5.1.4

1.2 Resource Maximization and Import Minimization

The City is committed by its General Plan policies to wise management and stewardship of its water supply resources.

- Neither the City nor any of its wholesale suppliers import water from outside of the North Coast Hydrologic Region. This minimizes resource importation.
- Recycled water currently comprises over 10% of the City's water supply portfolio. The City plans to expand this to approximately 12%. This maximizes the use of resources and minimizes demands on the potable water supply.
- The City participates with the Agency in the implementation of water conservation measures, which maximizes the use of resources and minimizes demands on the potable water supply.
- The City balances its various supplies and allows recycled water and local groundwater resources to augment other water supplies during periods of peak demand and/or hydrologic dry years.
- The City is signatory to the California Urban Water Conservation Council's Memorandum of Understanding (MOU) and is implementing the 14 Best Management Practices.

1.3 Coordination

The Act requires the City to coordinate the preparation of its Plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies. In accordance with the requirements of Section 10631(k), the City coordinated the preparation of its Plan with the Agency (wholesale potable water supplier), the Agency's other Prime Contractors and the Santa Rosa Subregional Water Reuse System (the Subregional System), which provides recycled water service within the City. The City's methods for interagency coordination included:

- Participation in the development of Agency's 2005 Plan;
- Participation in the Agency's Technical Advisory Committee and Water Advisory Committee, two standing Brown Act committees that advise the Agency's Board of Directors on water issues;
- Participation in the Subregional System's Technical Advisory Committee, which advises the Santa Rosa Board of Public Utilities on wastewater treatment and recycled water issues.

This Plan was completed in close consultation with the City's Community Development staff, which is processing a number of planned development proposals. In addition, the City coordinated the preparation of the water demand projections in this Plan with the Association of Bay Area Government's (ABAG) demographic projections.

1.4 Public Participation and Plan Adoption

The City encouraged community and public interest involvement in the Plan through public hearings and inspection of the draft document. Public hearing notifications were published in the local newspaper, *The Press Democrat* on August 14 and August 27, 2007. A copy of the published Notice of Public Hearing is included in Appendix A. Notices of Availability were provided to the Agency, the Subregional System, other Agency Prime Contractors and members of the public who had made requests.

The hearing provided an opportunity for all residents and employees in the service area to learn and ask questions about their water supply and the City's plans for providing a reliable, safe, high-quality water supply. The draft Plan was made available for public inspection at the City Clerk's office, at the public library and on the City's website.

This Plan was adopted by the City Council on August 28, 2007. A copy of the adopting resolution is provided in Appendix A.

Table 1-2 provides a summary of the City's coordination and public information activities.

Table 1-2 (DWR Table 1) Coordination with Appropriate Agencies

	Wholesale Water Supplier	**Recycled Water Supplier**	**Other**	**Other**
	Sonoma County Water Agency	**Santa Rosa Subregional Water Reuse System**	**Neighboring Water Agencies**	**Public Involvement**
Participated in developing the Plan	✓	✓	✓	
Commented on the draft Plan				✓
Attended public meetings				✓
Was contacted for assistance	✓	✓	✓	
Was sent a notice of intention to adopt	✓	✓	✓	✓
Not involved/No information				

1.5 Previous Water Supply Management and Planning Documents

The City has adopted long-range water supply planning documents prior to this Plan. Specifically the City has adopted:

- The Agency's 2000 Regional Plan, which was also relied upon in the City's 2000 General Plan; and
- The City's 2005 Citywide Water Supply Assessment.

In addition, the Agency has adopted its 2005 Plan in accordance with the requirements of the Act.

For reasons more fully explained below, each of these documents includes slightly different numerical representations of the Agency's wholesale supply and the demand upon that supply. There are similar differences reflected in the City's water supply and its water demand. The information the City has relied upon in preparing this Plan is the City's best, current understanding of its water demands and its water supply.

1.5.1 Previous Water Demand Projections in Relationship to This Plan

The Agency's 2000 Regional Plan relied on data from supply meters (i.e., meters on the Agency's turnouts and meters on the City's wells) because the City did not install residential water meters until 2003. The City has observed reductions in demand, since 2003, as a result of residential meter installation and commodity pricing.

The 2005 Citywide Water Supply Assessment (WSA) utilized both the Agency's 2000 Regional Urban Water Management Plan and an analysis of the available metered use data. The WSA also assumed a ten-percent reduction in single-family residential unit demand would occur between 2005 and 2025 as a result of water conservation efforts. This assumption was consistent with the City's water conservation policy, which seeks to achieve a ten percent reduction from voluntary conservation efforts.

In addition to reviewing and analyzing the previous work, the preparers of this Plan utilized the results of new demand modeling, which the City undertook with the Agency. This new effort, which is described in detail in Chapter 6, quantifies both existing per capita demands and a range of conservation savings in order to project future demands.

The difference in demands between the WSA and the results of the newer modeling used in this Plan is between three and six percent. These modest numerical differences do not substantively impact the City's long-term planning.

1.5.2 Previous Water Supply Projections in Relationship to This Plan

The City has three sources of water supply: Agency water, local groundwater and recycled water.

Both the 2000 Regional Plan and the Agency's 2005 Plan assume completion of the Agency's Water Supply Transmission System and Reliability Project (the Water Project). The Water Project will increase the capacity of the Agency's transmission system and includes an expansion of the Agency's water rights from 75,000 AFY to 101,000 AFY. In addition, the Agency's 2005 Plan includes the use of a modest amount groundwater to augment the Agency's wholesale water supply. Both the Agency's 2000 Regional Plan and its 2005 Plan represent City's allocation of Agency supply as approximately 7,500 AFY after 2020. Section 10631(k) of the Act allows the City to rely upon the Agency's Plan. However, when preparing this Plan the City assumed, as it did in its WSA, that it would not receive its full Agency allocation. Rather the City assumed that it would receive its share of the Agency's currently permitted 75,000 AFY water right. In the WSA, the City calculated its share of the Agency's currently permitted water right as 6,476 AFY based on available data.

Since the City adopted the WSA, the Agency has adopted a mathematical Water Shortage Allocation Model and has updated its hydrologic model of the Russian River System, each of which is discussed in detail in Section 3. These have provided the City with updated information about the Agency water supply, and that is incorporated into this Plan. The Water Shortage Allocation Model indicates that the City's share of the Agency's currently permitted water rights is 6,372 AFY or within two percent of estimates included in the WSA. This allocation is approximately fifteen percent (15%) less than Agency outlines in its own Plan, and the City believes this conservative estimate is the appropriate one on which to base this Plan.

This Plan assumes that the City will have 2,577 AFY of local groundwater available to it, which is consistent with its technical analysis and its local Water Policy Resolution. This Plan assumes that the City will manage this groundwater resource in accordance with its local groundwater management policies as codified in its Resolution No. 2004-95 (the Water Policy Resolution), which was adopted on April 27, 2004. The Water Policy Resolution specifies that new development outside of the current City limits will not be approved if it would contribute to the City exceeding an average annual pumping rate of approximately 2,577 AFY. This Plan is consistent with the 2005 WSA with respect to groundwater.

This Plan assumes that the Subregional System will continue to deliver recycled water in accordance with its agreements. This Plan assumes that the City will provide funding for a 300 AFY expansion to the recycled water system consistent with the Subregional System's approved Incremental Recycled Water Program Environmental Impact Report (IRWP EIR). This Plan is generally consistent with both the WSA (which projected a 302 AFY expansion of the recycled water system) and the Subregional System's IRWP EIR with respect to recycled water. The City has made slight adjustments to the planned recycled water system expansion volume based on the Subregional System's on-going planning activities.

1.6 Assumptions

The analysis in this Plan is based in part upon assumptions including:

1. The City's future development pattern will be consistent with its General Plan.
2. The City will be able to achieve continued demand reductions through implementation of Best Management Practices (BMPs), Plumbing Code changes and natural fixture replacements.
3. The City will not receive more than its share of the Agency's current 75,000 AFY water rights. The City's share will be calculated in accordance with Section 3.5 of the Restructured Agreement for Water Supply and the Water Shortage Allocation Model adopted by the Agency's Board of Directors.
4. The Subregional System will expand its recycled water deliveries within the City in accordance with IRWP EIR, which was certified in 2004. Chapter 5 provides additional detail on the regulatory environment around this assumption.

The City recognizes that the Agency is planning its Water Project as described in the Notice of Preparation for its EIR. While the Agency's 2005 Plan assumes completion of the Water Project and Chapter 3 provides additional detail on the regulatory environment around the Water Project, the City has not relied upon completion of the Water Project in this Plan. As the City considers updates to this Plan in the future, it will reevaluate the reliability and likelihood of the completion of the Water Project.

The City recognizes that the Agency's 2005 Plan assumes a modest use of groundwater to augment the supply available after the Water Project is completed. As stated above, the City's 2005 Plan assumes that the only available water supply to the City from the Agency is its calculated share of the 75,000 AFY Russian River water supply currently permitted to the Agency from the State Water Resources Control Board.

1.7 Findings

The City recognizes that regulatory agencies may make different decisions or take different actions than is assumed and that this could affect the availability and reliability of its water supply. The City has endeavored to base its projections only upon clearly entitled or reasonably anticipated supply sources and demand projections.

The City finds, given the facts currently available, that the assumptions in this Plan are reasonable. The City will update this Plan on a regular basis, in accordance with the Act, in order to reflect any changes that occur.

1.8 Plan Organization

The remainder of this Plan is organized as follows:

- Section 2 provides a description of the service area, climate, and other demographic factors affecting water management and planning;
- Section 3 describes the City's water supply from the Agency including water supply projects and programs under consideration by the Agency;
- Section 4 describes the City's groundwater supply including basin wide groundwater conditions, the 5-year regional groundwater study being performed by the Agency and the United States Geological Survey with financial support from the City and other stakeholders, and local programs related to groundwater management;
- Section 5 describes the City's recycled water supply from the Subregional System including water supply projects and programs under consideration by the Subregional System;
- Section 6 presents historical and projected water use and includes a discussion of the City's current and planned demand management program;
- Section 7 addresses the City's water shortage contingency plan;
- Section 8 provides a comparison of water supplies and demands under a range of hydrologic conditions;
- Appendices A through I provide relevant supporting documents.

2.0 SERVICE AREA DESCRIPTION

This section describes the City's water service area including its current and projected population, its climate, and other demographic factors affecting water management and planning. Chapters 3, 4 and 5 provide details on the potable and recycled water sources that supply the City.

2.1 Description of Service Area

The water service area under consideration is bounded by the City's Sphere of Influence as outlined in its 2000 General Plan. This Sphere of Influence includes six Specific Plan Areas. All but the Canon Manor Specific Plan Area are anticipated to annex to the City and utilize the City's water supply. The Canon Manor Specific Plan Area has contracted with the Penngrove Water Company for water supply and its demands are not considered demands on the City supply. In addition, the Sphere of Influence includes Sonoma State University, which has its own water system and is not served by the City[1]. Figure 2-1 illustrates the water service area including the Specific Plan Areas described in the General Plan.

2.2 Current and Projected Population

The 2000 General Plan sets land-use patterns and population goals. The City's 2005 population was estimated at 41,640[2]. At build-out, the City anticipates a population of 50,400. Jobs in the City are expected to increase from 21,900 in 1999 to 27,300 at build-out.[3]

The City has an adopted Growth Management Ordinance that is intended to provide for orderly build-out of residential development over the General Plan planning horizon. In its simplest form, the Growth Management Ordinance has the effect of limiting the number of residential building permits issued to 225 per year. There are exceptions for affordable housing and infill development projects and there are provisions to carry over building permits (i.e., if 50 are issued in one year, 400 may be issued the following year, providing a 2-year average of 225 per year). The City's Growth Management Ordinance outlines implementation procedures for the Growth Management Program.

Table 2-1, below presents the population in 5-year increments from 2005 until 2030. The population projections in Table 2-1 reflect the rate of development allowed by the Growth Management Ordinance. Because the City's General Plan horizon extends through 2020, population estimates for 2025 and 2030 reflect General Plan build-out.

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[1] While the Canon Manor Area and Sonoma State University do not place direct demands on the City's water system, their demands are considered in the regional groundwater analysis. See Section 4.

[2] 2005 Urban Water Management Plan Sonoma County Water Agency, Table 3-2 (December 2006).

[3] City of Rohnert Park General Plan, Table 2.3-3: General Plan Build-out: Population and Jobs, General Plan

Table 2-1 (DWR Table 2) Population – Current and Projected[4]

Year	Population
2005	41,640
2010	44,560
2015	47,480
2020	50,400
2025	50,400
2030	50,400

2.2.1 Climate

The City is located in the Russian River watershed. The climate and hydrology of the Russian River watershed directly affect the City because its wholesale supply from the Agency is drawn from the Russian River. The climate of the Russian River watershed is tempered by its proximity to the Pacific Ocean and is characterized by seasonal rainfall patterns. Approximately 93 percent of the total annual precipitation falls between October and May, with a large percentage of the rainfall typically occurring during three or four major winter storms.

There is no predictable snow in the Russian River watershed and a snow pack does not contribute to runoff in the watershed. The hydrology of the Russian River system is not influenced by snow packs or snowmelt; it is influenced by rainfall and runoff. Current climate change models are unsuitable for predicting climate impacts on non-snow pack watersheds in the coastal regions of California. These models do not predict any conclusive trends for watersheds, like the Russian River watershed, that are influenced by rainfall and runoff.[5]

Average annual precipitation is 29.6 inches with a range from 22-inches to 80-inches annually. Table 2-2 summarizes monthly average evapotranspiration rates (ETo), rainfall, and temperatures.

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[4] *Customer Water Demand Projections* City of Rohnert Park *Summary of Data Inputs, Assumptions and Results* Table 3-1 (page 12 of 13).

[5] Sonoma County Water Agency Agenda Item Transmittal Report, 12-12-06 Attachment A1, page A1-3, paragraph I.

Table 2-2 (DWR Table 3) Climate

	Standard average ETo[a], inches	Average rainfall[b], inches	Average temperature[b], °F
January	0.82	6.44	47.23
February	1.44	5.26	51.27
March	2.87	3.89	53.56
April	4.31	1.83	56.56
May	5.26	0.69	61.48
June	6.14	0.25	67.07
July	6.30	0.03	70.10
August	5.76	0.11	69.80
September	4.25	0.31	68.06
October	3.10	1.58	62.23
November	1.38	4.03	53.14
December	0.86	5.20	47.33
Annual	42.49	29.63	58.95

Notes:
a Data recorded from Santa Rosa station 83, CIMIS database (January 1990 – October 2005). ETo, or evapotranspiration, is the loss of water from evaporation and transpiration from plants.
b 1952-2005 data recorded at Sonoma Station from NOAA website www.wrcc.dri.edu

2.2.2 Water Distribution Facilities

The City maintains its potable water retail distribution system. The Subregional System maintains a recycled water distribution system within the City limits, which is discussed in Section 5. A map of the existing water distribution system facilities, including tanks, wells, pumping stations and major potable and recycled water pipelines is presented on Figure 2-2.

2.2.3 Potable Water Distribution System

The City receives potable water from twelve turnouts on the Agency's Petaluma Aqueduct and Russian River-Cotati Intertie and from 26 active water supply wells. Potable water, from the Agency turnouts and City wells, is delivered to customers through the potable distribution system.

The City maintains 4.5 million gallons of storage capacity consisting of one 1.3 million gallon reservoir, two 1 million gallon reservoirs, and four 0.3 million gallon reservoirs located throughout its service area. Table 2-3 summarizes the City's storage capacity information.

Table 2-3 Rohnert Park Tank Information

Tank No.	Status	Location	Storage capacity, MG
1	Active	Well 4	0.3
2	Active	Well 9	0.3
3	Active		0.3
4	Active	Well 26	0.3
5	Active	Well 27	1.0
6	Active		1.3
7	Active	Well 24	1.0

The City uses seven booster pump stations to deliver water to two pressure zones.

The City's potable water distribution system is divided into two pressure zones: the primary pressure zone that includes most of the City and the Snyder pressure zone, which is supplied by its own Agency turnouts and isolated from the rest of the system by closed valves. The hydraulic grade line in the Snyder pressure zone is maintained higher than in the primary pressure zone. Most of the distribution mains are six to eight inches in diameter. A small number of pipes with diameters of ten and twelve inches are also used.

2.2.4 Recycled Water Distribution System

Recycled water is delivered to customers in the City from the Subregional System. The Subregional System operates a low-pressure and high-pressure distribution system within the City. There is currently no recycled water storage in the City.

2.2.4.1 Low Pressure Recycled Water Distribution System

Recycled water from the Subregional System's Laguna Water Reclamation Plant (Laguna WRP) is delivered through an 18-inch-diameter low-pressure distribution system that runs along Wilfred Avenue and Golf Course Drive and dead-ends at the Foxtail Golf Course near the northern City limits. This low-pressure system delivers approximately 500 acre feet per year (AFY) to 5 customers, each of which uses private pumping facilities to achieve irrigation pressure on site.

2.2.4.2 High Pressure Distribution System

The high-pressure distribution system begins at the Rohnert Park Pump Station, located at the intersection of Stony Point Road and Rohnert Park Expressway. The Rohnert Park Pump Station includes screen filters and chlorination facilities and pressurizes a 24-inch-diameter transmission main that extends along Copeland Creek to Snyder Lane and continues to Sonoma State University. The high-pressure system delivers approximately 500 AFY to 27 customers.

3.0 SONOMA COUNTY WATER AGENCY SUPPLY

The Agency supply is one of three supply sources available to the City. This section describes the Agency supply, its hydrologic availability, its water quality, various contracts that affect its use including provisions for transfers and exchange, its reliability and vulnerability, and the water supply plans and programs being undertaken by the Agency. This information is used to project the Agency supply that is reasonably available to the City under all hydrologic conditions.

This Plan projects that 6,372 AFY of Agency supply will be available to the City based on analysis of the legal and hydrologic constraints on the Agency's system.

3.1 Summary of Analysis

The water supply available to the City from the Agency is measured in two ways, hydrologic availability, and legal availability.

Hydrologic availability is a measure of how much water is available because of rainfall, runoff, and storage in the Russian River watershed. Normal Year, Single Dry Year and Multiple Dry Year are ways to describe the hydrologic availability of water supply under a variety of rainfall conditions. The Agency's hydrologic models, described in detail below, indicate that its water supply is most constrained under the Single Dry Year condition when between 85,000 and 86,000 acre feet per year (AFY) are available to the system.

Legal availability is a measure of how much water the Agency is allowed to divert under the water rights permits it receives from the State Water Resources Control Board (SWRCB). The Agency currently has permits to divert and re-divert 75,000 AFY. At the present time, legal availability is the largest constraint on the Agency supply because current water rights are less than even the Single Dry Year supply. This means that even in the driest of years, the Agency is not legally able to divert all the water that is available to its Russian River System.

Because legal availability, not hydrologic availability, presents the greatest constraint to the Agency's supply, the City has analyzed its Agency water supply using 75,000 AFY as the maximum available supply. This supply will be available under all hydrologic conditions because even in the driest years, there is more than 75,000 AFY in the Russian River system and available for diversion by the Agency.

3.2 Description of the Agency Supply

The Agency provides wholesale water service primarily from its Russian River System. Groundwater from the Santa Rosa Plain subbasin can be used to supplement the Russian River System. The Agency supplies water to eight prime contractors (the cities of Santa Rosa, Rohnert Park, Cotati, Petaluma, and Sonoma; the Town of Windsor; North Marin Water District and Valley of the Moon Water District, hereinafter the Contractors) under the Restructured Agreement for Water Supply, and to other customers.

The Russian River System includes Lake Mendocino, Lake Sonoma, six Raney collectors and seven conventional wells located in the gravels of the Russian River, generally between Windsor and Forestville. Lake Sonoma, which provides the principal supply to the Agency's Contractors, has a water supply pool capacity of 245,000 AFY. Water is released from Lake Sonoma and carried through Dry Creek and the Russian River. The Raney collectors and wells re-divert Russian River underflow for potable supply. Water is delivered through the Agency's Transmission System, which is a network of pipelines, pump stations and storage tanks extending through central and south Sonoma County into Marin County. Figure 3-1 illustrates the Russian River System and the Agency's Transmission System. These facilities are more specifically detailed in the Agency's 2005 Plan.

The Agency is currently planning its Water Project to expand the capacity of various Agency storage and transmission system facilities and increase its diversion rights from 75,000 AFY to 101,000 AFY. The Agency's 2005 Plan indicates that the Water Project facilities will be available after 2020.[6]

3.3 Hydrologic Availability of the Russian River Supply

The Agency currently maintains an operations model called the Russian River System Model (RRSyM) which performs water balance routing through the Russian River System and is used as a planning tool to simulate the effects of hydrology, demand and operational criteria on the amount of water available in the Russian River System. To determine the relationship between the hydrologic capacity of the Russian River system and the demands upon that system, the RRSyM was run using hydrologic data from statistically selected Normal, Single Dry and Multiple Dry years and all demands in the Santa Rosa sub-unit of the Russian River System, which includes demands on the Agency's system, agricultural demands and demands by other public purveyors.

The RRSyM output includes the minimum storage in Lake Sonoma for each hydrologic condition under a range of demand scenarios. The Agency's water rights permits require it to maintain a minimum storage volume in Lake Sonoma and to restrict diversions, if necessary to maintain that minimum storage volume. Table 3-1 below summarizes the RRSyM output. This output indicates that Russian River System has the hydrologic capacity to meet all demands in all cases except for the Single Dry Year condition after 2020, when the Agency's planned permitted diversions reach 101,000 AFY.

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[6] 2005 Urban Water Management Plan Sonoma County Water Agency, Table 4-9

Table 3-1 Summary of Lake Sonoma Storage and Agency Water Rights under a Range of Hydrologic Conditions[7]

Scenario Year	Lake Storage (AFY)			Agency Water Right (AFY)	
	Normal Year	Single Dry Year	Multiple Dry Year	Current	Proposed
2010	206,028	75,083	132,893	75,000	
2015	205,741	70,587	131,596	75,000	
2020	202,599	58,773*	121,510	75,000	101,000
2025	197,958	48,933*	100,236		101,000
2030	196,560	50,483*	94,038		101,000
*Lake Sonoma Storage is below permitted minimum. Potential for curtailed diversions					

The Agency's 2005 Plan indicates that the Single Dry Year Supply available in 2030 is 85,520 AFY, which, as noted earlier, is greater than the Agency's currently permitted rights.[8] Additional detail on the RRSyM and the modeling effort is found in the Agency's 2005 Plan.

3.4 Hydrologic Availability of the Agency's Groundwater Supply

The Agency's three groundwater supply wells are located in the Santa Rosa Plain, a subbasin of the Santa Rosa Valley Basin and generally north, east and southeast of the City of Sebastopol. As detailed in its 2005 Plan, the Agency monitors groundwater levels in seventeen dedicated monitoring wells in order to assess the effects of these wells on local groundwater conditions. There are no physical constraints on the ability of the Agency's wells to continue to provide this groundwater supply. The Agency's 2005 Plan indicates it will utilize 3,870 AFY of groundwater annually through 2030. This amount of projected groundwater use is less than the Agency's recent historical pumpage (i.e., pumpage during 2003-2005 was 4,701 AF in 2003, 4,585 AF in 2004 and 5,906 AF in 2005). As discussed in Section 4.5, the updated analysis of basin wide groundwater conditions finds that the basin remains about in balance.

In estimating its allocation of Agency water supply for this Plan, the City has assumed that Agency groundwater is not available.

3.5 Water Rights and Contracts for Agency Supply

The City's use of Agency supply is subject to a number of decisions and contracts. This section describes the water rights held by the Agency and the various agreements and issues that influence the water supply. The Restructured Agreement for Water Supply and the Temporary Impairment MOU, which are the City's contracts for Agency supply, are also described.

3.5.1 Agency's Water Rights

The Agency currently diverts and re-diverts water from the Russian River System under four permits issued by the SWRCB. These permits (Numbers 12947A, 12949, 12950 and 16596)

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[7] 2005 Urban Water Management Plan Sonoma County Water Agency , Table 4-6 through 4-8

[8] 2005 Urban Water Management Plan Sonoma County Water Agency, Table 4-14

provide the Agency with the rights to divert and re-divert up to 75,000 AFY, and to store water in Lake Mendocino and Lake Sonoma. These permits also set minimum in-stream flow requirements to protect fish and wildlife and maintain recreation in the Russian River. The SWRCB's Decision 1610 provides for varying minimum in-stream flow requirements under different hydrologic cycles (i.e., in-stream flow requirements are lower in dry water years than in normal water years). The Agency works with the SWRCB on a regular basis to implement the various in-stream flow requirements of its permits based on hydrologic conditions at the time. The Agency's current water rights are secure and there is currently no activity pending before the SWRCB that would affect the Agency's ability to divert and re-divert water under its current permits[9].

However, there are a number of issues that could affect the Agency's proposed Water Project. The issues that could affect the cost and schedule for implementing the Water Project are described below. Because of these issues, the City has assumed that the Water Project will not be completed until after 2030.

3.5.1.1 The Section 7 Consultation[10]

The Russian River watershed is designated as critical habitat for threatened stocks of Coho salmon, Chinook salmon, and steelhead. The Agency and the U.S. Army Corps of Engineers are undertaking a Section 7 Consultation under the Federal Endangered Species Act with the National Oceanic and Atmospheric Administration to evaluate affects of their various operations and maintenance activities on fish production and passage. The Biological Assessment prepared as part of this consultation recommends modifications to the minimum in-stream flow requirements contained in the Agency's water rights permits. These modifications do not affect the Agency's existing water rights.

For the purposes of preparing its 2005 Plan, the Agency assumed that the Section 7 Consultation would not reduce the amount of water it could supply, principally from Lake Sonoma, under both its current and proposed permits. The City has assumed that the Section 7 Consultation will not reduce current permitted diversions principally because there are no actions before the SWRCB that would affect the Agency's current permits. The City has assumed that proposed additional permitted diversions will not be implemented within the horizon of this Plan.

3.5.1.2 Friends of the Eel River et al. v. Sonoma County Water Agency (108 Cal. App. 4th 859)

On May 16, 2003, the California First District Appellate Court issued a decision that the EIR prepared for the Agency's Water Supply and Transmission System Project (a predecessor to the Water Project) provided inadequate information on the project and its impacts. This decision directly affected the Agency's ability to increase its water right above the currently permitted 75,000 AFY and to make improvements to its Transmission System because it required revisions

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[9] Personal Communication, Erica Phelps, Sonoma County Water Agency, November 22, 2004.
[10] Sonoma County Water Agency Web site, www.scwa.ca.gov.

to the Agency's EIR. The decision, however, does not affect the Agency's current water rights in any way.

For the purposes of preparing its 2005 Plan, the Agency assumed that this decision would not reduce the amount of water it could supply, principally from Lake Sonoma under both its current and proposed permits, because it believed it could prepare and certify a new EIR that addressed the Court's concerns and implement the Water Project by 2020. The City has assumed that this decision will not effect current permitted diversions principally because there are no actions before the SWRCB that would affect the Agency's current permits. The City has assumed that proposed additional permitted diversions will not be implemented within the horizon of this Plan.

3.5.1.3 Federal Energy Regulatory Commission June 2004 Order on Rehearing and January 28, 2004 Order Amending License

This decision by the Federal Energy Regulatory Commission (FERC) affects the way Pacific Gas and Electric Company operates its Potter Valley Project. This operation is relevant to the Agency's water supply because water is diverted from the Eel River to the Russian River through the Potter Valley Project. The FERC decision reduces the amount of water diverted from the Eel to the Russian, where it becomes available to the Agency's Russian River System. The RRSyM modeled the re-operation of the Potter Valley Project, required by this decision and the effects that this re-operation has had on the hydrologic availability of the Agency supply in Normal, Single Dry and Multiple Dry Years.

For the purposes of preparing its 2005 Plan, the Agency assumed that the January 28, 2004 Order Amending License would not be substantially modified in a way that would reduce the amount of water available for diversion by the Agency through its Russian River System, beyond that which it had already modeled. This assumption is reasonable and supported by substantial evidence, which is described in Section 1.6 of the Agency's 2005 Urban Water Management Plan. The City has utilized the Agency's RRSyM modeling effort as a basis for the hydrologic analysis in this Plan.

3.5.2 <u>The Restructured Agreement for Water Supply</u>

The Restructured Agreement for Water Supply (the Restructured Agreement) is the contractual document that outlines how the Agency's proposed 101,000 AFY water right is allocated among the Agency's Contractors and other customers. The Restructured Agreement was executed on June 20, 2006 and has a term of at least forty years[11]. The Restructured Agreement allocates 7,500 AFY to the City, with an average day maximum month pumping rate of 15.0 mgd under Normal Year conditions.

Section 3.5 of the Restructured Agreement (the Water Shortage Provisions) defines how the water supply and transmission system capacity would be allocated in case of shortage. Shortages

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[11] Section 1.3 of the Restructured Agreement describes the Term of the Agreement. The term is for at least forty years or until all outstanding revenue bonds have been paid. The language includes provisions for renewal agreements.

could occur as a result of hydrologic conditions (such as those predicted by RRSyM for Single Dry Years after 2020) or legal or physical constraints on the Agency's supply and transmission system. On April 18, 2006, the Agency's Board of Directors adopted a Water Shortage Allocation Methodology that provides a mathematical quantification of the Water Shortage Provisions. This allows the Contractors to calculate their reasonably expected Agency allocation under a range of supply scenarios.

3.5.2.1 Transfers and Exchanges

Currently, the City does not transfer and/or exchange water with other entities. While it is not anticipated that transfers or exchanges will occur in the future, such transfers are authorized under the Restructured Agreement. Such transfers and exchanges between Agency Contractors have occurred in the past and may be necessary in the future to improve water reliability.

3.5.3 The Temporary Impairment MOU

As indicated in Section 3.2, the Agency is planning but has not yet undertaken upgrades to its Transmission System. These upgrades would allow the Contractors to receive their full "average day maximum month" allocations from the Agency. The Memorandum of Understanding Regarding Water Transmission System Capacity Allocation during Temporary Impairment (the Temporary Impairment MOU), which is effective through September 30, 2008, outlines each Contractor's voluntary allocation of Transmission System capacity during the peak usage periods of June through September. Under the Temporary Impairment MOU, the City agreed to use its best efforts to limit its demand during Periods of Temporary Impairment to 5.4 million gallons per day. The Temporary Impairment MOU affects only transmission system capacity and in no way modifies the City's annual volume entitlement of 7,500 AFY.

3.6 Quality of the Agency Supply

The Agency supply meets all primary and secondary drinking water standards established by the California Department of Public Health (CDPH) and is suitable for potable use. There are not water quality constraints that would limit supply.

3.7 Reliability and Vulnerability of the Agency Supply

3.7.1 Hydrologic Reliability and Vulnerability

The RRSyM analysis confirms that the Agency's current water supply is very reliable from a hydrologic perspective. The Agency's current rights of 75,000 AFY can be supported, without constraint, in the Normal, Single Dry and Multiple Dry Years. The RRSyM analysis indicates that Single Dry Year reliability would constrain the Agency's proposed 101,000 AFY diversion rights to approximately 85,500 AFY.

The City has based its analysis only upon current water diversion rights, which provides a high degree of hydrologic reliability.

3.7.2 Contractual Reliability and Vulnerability

The Agency's current water rights are highly reliable and, as stated above, there are no actions pending before the SWRCB that would in any way modify the Agency's current diversion rights. However, the Agency's current water rights will not allow it to meet all of the water allocation commitments in the Restructured Agreement, which is based on a total Agency water right of 101,000 AFY.

Because of this contractual vulnerability, the City's analysis is based not upon 101,000 AFY of proposed permitted diversions but rather the current 75,000 AFY of current permitted diversions.

3.8 City's Existing and Projected Agency Supply

The City's water supply allocation from the Agency is described in the Restructured Agreement and includes two limits: an annual maximum entitlement and an "average day maximum month" entitlement. The City's annual maximum entitlement from the Agency is 7,500 AFY (approximately 6.8 million gallons per day). The City's "average day maximum month" entitlement is 15 million gallons per day. The "average day maximum month" entitlement is higher than the average of the annual maximum entitlement. This allows the City to meet peak demands, as long as it does not exceed its annual entitlement. Currently, the Temporary Impairment MOU asks that the City voluntarily limit its "average day maximum month" entitlement to 5.4 million gallons per day during the months of June through September. The Temporary Impairment MOU does not affect the City's annual maximum entitlement or its "average day maximum month" entitlement outside of the June through September period. Table 3-2 presents prior year deliveries from the Agency to the City.

Table 3-2 – Prior Year Agency Deliveries

2000	2001	2002	2003	2004	2005	2006
2,713 AF	2,976 AF	2,870 AF	3,194 AF	5,126 AF	4,697 AF	5,163 AF

The City is aware of schedule delays affecting the Agency's ability to implement the Water Project and acknowledges that these delays are likely to impact the Agency's ability to deliver its full allocation under the Restructured Agreement. The City has, since 2004, made estimates of the Agency allocation it can reasonably expect assuming that the Water Project is not completed.

In 2004, the City used the Agency's 2004 Summary Report – Expected Future Water Demands for Existing and Proposed Development Projects, to estimate that it could reasonably expect to receive 6,476 AFY in Agency supply given the current constraints on water rights, the documented needs of other Contractors, and the potential for additional recycled water use in the City.

On April 18, 2006 the Agency's Board of Directors adopted a Water Shortage Allocation Methodology in order to "inform each of its customers of the water available in the event of reasonably anticipated shortages".[12] The Water Shortage Allocation Methodology is attached as Appendix B of this Plan.

In its 2005 Plan, the Agency utilized the Water Shortage Allocation Methodology to estimate the water supply available to each contractor under a variety of planning scenarios. In order to prepare this Plan, the City also used the Water Shortage Allocation Methodology to estimate the amount of water it could expect if the Agency's water rights remain limited to 75,000 AFY and Agency groundwater was not used. This analysis yielded an expected Agency supply of 6,372 AFY, which is within two percent of the estimates that the City used in its previous planning.

Notwithstanding the City's contractual allocation of 7,500 AFY, the Agency's physical facilities and current water rights are likely to limit the amount of water that can be delivered to the City and other Contractors. The adopted Water Shortage Allocation Methodology provides the City with a reasonable estimate of the water supply available to it from the Agency under legal or hydrologic constraints.

Table 3-3 below summarizes the City's projections of water supply available from the Agency.

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[12] Resolution of the Board of Directors of the Sonoma County Water Agency Approving a Water Shortage Allocation Methodology, April 18, 2006.

Table 3-3 Summary of City's Anticipated Supply from Agency

Hydrologic Condition	Water Supply Available to Agency (AFY)				Water Supply Available to City (AFY)	
	Russian River System		Groundwater ***	Agency Supply Used to Estimate City Supply	City Supply Available from Agency ****	Percentage of Contract *****
	Hydrologic*	Permitted**				
Normal Year	101,000	75,000	0	75,000	6,372	85%
Single Dry Year	85,520	75,000	0	75,000	6,372	85%
Multiple Dry Year 1	101,000	75,000	0	75,000	6,372	85%
Multiple Dry Year 2	101,000	75,000	0	75,000	6,372	85%
Multiple Dry Year 3	101,000	75,000	0	75,000	6,372	85%

* Based on RRSyM Analysis and Table 4-14 of the Agency's 2005 Plan.
** Based on Agency's Current Permitted Rights.
*** City has assumed that Agency's groundwater supply is only for emergency use.
**** Based on the Water Shortage Allocation Model with 75,000 AFY of Agency Supply available.
*****Presented as a percentage of the City's allocation in the Restructured Agreement for Water Supply

3.9 Water Supply Plans and Programs Related to the Agency Supply [13]

In February 2005, the Agency released a Notice of Preparation for its Water Project EIR. The objective of the Water Project is to provide a reliable water supply to meet the defined current and future needs in the Agency's service area. The Water Project EIR will include the analysis necessary to document the construction of Transmission System Improvements and the increase of the Agency's water rights under the California Environmental Quality Act (CEQA).

For the purposes of preparing its 2005 Plan, the Agency assumed that it would be able to implement the Water Project including the increase in permitted diversions by 2020.

The City has assumed that proposed improvements will not be implemented within the horizon of this Plan.

[13] Sonoma County Water Agency, Diversion Alternatives Status Update.

4.0 GROUNDWATER SUPPLY

This section describes the City's groundwater supply, its hydrologic availability, its water quality, whether the City has contracts that affect its use including provisions for transfers and exchange, its reliability and vulnerability, and plans and programs being undertaken related to groundwater.

This Plan projects that 2,577 AFY of groundwater will be available to the City.

4.1 Requirements for Groundwater Sources

Since groundwater is a source of supply, the City must meet the requirements of the Act detailed in Water Code Section 10631(b) (1-4) as outlined below. Where noted in italics, the item is not applicable to the City's Plan.

> "(b) If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:
>
> > (1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management. *The City has not adopted a groundwater management plan.*
> >
> > (2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. 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. *The Santa Rosa Valley Groundwater Basin has not been adjudicated, and no overdraft condition has been reported by the California Department of Water Resources (DWR; DWR is the "department" referenced in the Code). This Plan describes DWR's characterization of the groundwater basin in the most current DWR bulletin. Also, as suggested by DWR (2005), this Plan includes groundwater hydrographs for the basin, and describes groundwater level trends in the basin.*
> >
> > (3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records."

The locations where the required items for groundwater are found in Chapter 4 are summarized in Table 4-1.

Table 4-1 Index of Additional Reporting Requirements for Groundwater Supply

Requirement	Water Code Citation	Location in Document
Discussion of groundwater management plans/authority	10631(b)(1)	Section 4.1.4
Description of adjudications or legal rights to pump	10631(b)(2)	Section 4.1.6
Descriptions of DWR determinations related to groundwater	10631(b)(2)	Section 4.1.7
Description of the groundwater basin	10631(b)(2)	Section 4.2 – 4.5
Description and analysis of the location, amount & sufficiency of groundwater pumped in the last 5-years by the City	10631(b)(3)	Section 4.6.1; 4.7
Description and analysis of the amount and location of groundwater projected to be pumped by the City	10631(b)(4)	Section 4.6.2; 4.7.6.2

4.1.1 Definition of Terms

4.1.1.1 Sufficiency

Water Code Section 10631(b) requires "an analysis of the location, amount and sufficiency of the groundwater pumped by the urban water supplier for the past five years."

The City understands the relevant Government and Water Codes sections to mean that the analysis of the sufficiency of groundwater applies to the availability of water supplies to meet the projected water demands during Normal, Single Dry and Multiple Dry years within a 20-year projection. The area from which groundwater will be withdrawn to meet the City's projected demands and other public, agricultural, and industrial uses is the future public water system service area that overlies a portion of the Santa Rosa Plain Subbasin of the Santa Rosa Valley Groundwater Basin.

4.1.1.2 Overdraft

The statutes discussed above include evaluation of the condition of the groundwater basin, including whether DWR has identified the basin to be in overdraft or projected to become overdrafted. The word "overdraft" is defined in Bulletin 118 as follows (DWR, 2003b):

> "[T]he condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions (DWR, 1998)."

Bulletin 118 also states, "overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. Water level declines without full recovery to historically high water levels do not represent overdraft. Groundwater levels can stabilize at a lower level such that the lowered levels are not exhibiting chronic decline or leading to groundwater depletion. Further, lowered groundwater levels are often necessary to create storage capacity and increase the yield of a basin. If overdraft is determined and continues for a number of years, “significant adverse impacts may occur, including increased extraction costs, costs of well deepening or replacement, land subsidence, water quality degradation, and environmental impacts” (DWR, 2003b).

A review of DWR’s findings relative to whether an overdraft condition exists in the groundwater basin is discussed below along with an independent analysis based on historical groundwater level and pumpage data.

4.1.2 Description of the Groundwater Supply

The City has developed 42 groundwater wells, 26 of which are currently active. The active wells have a total rated production capacity of 6.3 mgd. The City has no emergency use wells. Table 4-2 outlines the status and production capacity of each well. The City’s wells are shown in Figure 4-1.

Table 4-2 City Well Site Information

Well No.	Status	Production, gpm
1	Active	210
2	Active	100
3	Abandoned/monitoring well	0
4	Out-of-Service	0
5	Active	160
6	Active	100
7	Active	200
8	Out-of-Service	0
8A	Active	95
9	Active	200
10	Active	100
11	Active	150
12	Active	130
13	Active	130
14	Active	120
15	Out-of-Service	230
16	Active	280
17	Disconnected/monitoring well	0
18	Active	150
19	Disconnected/monitoring well	0
20	Active	100
21	Out-of-Service	150
22	Active	120
24	Disconnected/monitoring well	0
26	Disconnected/monitoring well	0
27	Active	240
29	Active	130
30	Active	220
31	Active	65
33	Active	135
34	Active	50
35	Active	120
37	Out-of-Service	0
39	Active	300
40	Active	90
41	Active	230
42	Out-of-Service	0

4.1.3 Contracts for the Groundwater Supply

There are no contracts in effect related to the groundwater supply. The City has not transferred or exchanged any groundwater produced from its service area. As noted in Section 3.4, the City has assumed that it will not rely on the Agency's groundwater.

4.1.4 Discussion of Groundwater Management Plans and Authority

There are no groundwater management plans in effect for the Santa Rosa Plain Subbasin of the Santa Rosa Valley Groundwater Basin. As described in both the Agency's 2005 Plan and in Section 4.1.5 below, the City is participating with the Agency and the United States Geological Survey (USGS) in a multi-year study of the Santa Rosa Plain Subbasin.

The City has adopted local policies related to groundwater management. Resolution No. 2004-95 (the Water Policy Resolution; see Appendix C), which was adopted on April 27, 2004, specifies that new development outside of the current City limits will not be approved if it would contribute to the City exceeding an average annual pumping rate of approximately 2,577 AFY.

4.1.5 Plans and Programs Related to the Groundwater Supply

Consistent with its General Plan, and as noted above, the City has adopted local policies related to groundwater management.

Groundwater basin studies are being conducted within Sonoma County by the Agency and the USGS, in conjunction with other stakeholders, including the City. The five-year cooperative study is designed to improve understanding of the groundwater resources, and began in December 2005 (Sonoma County Water Agency, 2004).

4.1.6 Description of Adjudications or Legal Rights to Pump

Neither the Santa Rosa Valley Basin nor the Santa Rosa Plain Subbasin (SRP Subbasin) has been adjudicated. Thus, currently there are no legal limits on the right to pump water from the basin.

4.1.7 Descriptions of DWR Determinations Related to Groundwater

DWR (1982a) described groundwater levels in the SRP Subbasin as "about in balance, with increased ground water levels in the northeast contrasting with decreased ground water levels in the south." (The SRP Subbasin was originally referred to as a "basin" in DWR 1982a.) DWR's most current bulletin (DWR, 2004, see Appendix D) cites to its 1982 study to describe groundwater basin conditions. As further discussed below, more than 100 hydrographs in the Santa Rosa Valley Groundwater Basin were reviewed to update the groundwater conditions reported by DWR in 1982, and these show no indication of overdraft conditions anywhere in the basin. DWR has not made a finding of an overdraft condition of the SRP Subbasin in any of its bulletins, including its most current bulletin (DWR; 1975, 1982a, 1987, and 2004.)

4.2 Groundwater Basin Description

The City is located in the southern portion of the Santa Rosa Valley (SRV) Groundwater Basin, which drains to the northwest toward the Russian River and then to the Pacific Ocean. All of the City's water supply wells are located in the SRV Groundwater Basin (Figure 4-2), and no City wells are planned to be constructed outside the SRV Basin. Figure 4-2 also shows other nearby groundwater basins including the Petaluma Valley Groundwater Basin, which is located immediately south of the SRV Groundwater Basin and drains to the southeast toward San Pablo Bay. The basin and subbasin boundaries displayed on Figure 4-2 are from DWR's web site.

This section contains a summary of hydrogeologic conditions in the SRV Groundwater Basin based in part on DWR's online basin and subbasin descriptions (DWR, 2004). The basin description is also based on review of more than 20 previous studies in the SRP Subbasin (see also References in W&K, 2005). Additional data reviewed for this analysis included historical groundwater levels; historical pumpage; historical precipitation; groundwater quality data;

geological information, including driller's reports and geophysical logs; and published and unpublished reports and maps.

4.2.1 Santa Rosa Valley Groundwater Basin

The SRV Groundwater Basin encompasses an area of 158 square miles. There are three subbasins within this basin: the Santa Rosa Plain (SRP) Subbasin, the Healdsburg Area Subbasin, and the Rincon Valley Subbasin (DWR, 2004). DWR's descriptions from its most recent bulletin (DWR, 2004) are included in Appendix D. The City pumps groundwater from the SRP Subbasin, which has an area of 125 square miles; this is the largest of the three subbasins. The Healdsburg Area Subbasin has an area of 24 square miles, and the Rincon Valley Subbasin contains 9 square miles. The Russian River plain forms the boundary between the Healdsburg Area Subbasin and the SRP Subbasin. The Rincon Valley Subbasin is separated from the SRP Subbasin by a narrow constriction in the bedrock of the Sonoma Volcanics east of Santa Rosa. There is no finding of overdraft in this basin in any DWR report or online basin description.

4.2.1.1 Santa Rosa Plain Subbasin

The SRP Subbasin extends from the City in the south to the Russian River, south of Healdsburg, in the northwest. The subbasin is approximately 22 miles long and up to nine miles wide. It is drained by the Laguna de Santa Rosa, which flows north to the Russian River. The subbasin contains three primary water-bearing units: the Wilson Grove Formation, Quaternary alluvial fan deposits, and Quaternary alluvium. Groundwater quality in these formations is generally good (DWR, 2004).

As noted above, DWR (1982) described groundwater levels in the SRP Subbasin as "about in balance, with increased ground water levels in the northeast contrasting with decreased ground water levels in the south." During the period from 1990 to 2003, groundwater levels in the northern part of the subbasin continued to increase, and groundwater levels in the south showed marked increases in recent years primarily in response to decreased municipal pumping by the City. As further discussed below, more than 100 hydrographs in the SRV Groundwater Basin were reviewed to update the groundwater conditions reported by DWR in 1982, and these show no indication of overdraft conditions anywhere in the basin.

Storage capacity for the Santa Rosa Plain Subbasin was estimated at 948,000 acre-feet (AF) based on an average specific yield of 7.8 percent at depths of 10 to 200 feet (DWR, 2004; Cardwell, 1958). Average annual natural recharge from 1960 to 1975 for the entire subbasin was estimated to be 29,300 AF and average annual pumping during the same time was estimated at 29,700 AF (DWR, 1982a). Section 4-7 provides current updated estimates of natural recharge and pumping in the upper Laguna watershed of the SRV Basin.

4.2.1.2 Healdsburg Area and Rincon Valley Subbasins

The Healdsburg Area Subbasin is located northwest of the SRP Subbasin and includes the flood plain of the Russian River. Quaternary alluvium, alluvial fan deposits, terrace deposits, and the Wilson Grove Formation are the principal water bearing units in the subbasin. The Quaternary alluvium is highly permeable and receives recharge from the Russian River and its tributaries.

The City of Healdsburg uses wells perforated in the alluvium for most of its groundwater supply. DWR monitors groundwater levels in eight wells in this subbasin, and water levels in all but one well have remained stable for the last 10 years (DWR, 2004).

The Rincon Valley Subbasin is located east of the City of Santa Rosa and consists of a valley approximately seven miles long and up to 2.5 miles wide. The valley is bounded by the Sonoma Mountains except where it connects with the SRP Subbasin. The Rincon Valley Subbasin drains to Brush Creek, which flows south to Santa Rosa Creek. Quaternary alluvium and alluvial fan formations are the principal water bearing units in the subbasin, and groundwater quality in these formations is generally good. DWR (2004) states that water levels remained relatively constant in the Rincon Valley Subbasin between 1951 and 2000 and that the subbasin is nearly full.

4.2.2 Petaluma Valley Groundwater Basin

The Petaluma Valley Groundwater Basin encompasses an area of 72 square miles (DWR, 2003) and is not divided into subbasins. The northwestern boundary of the basin is formed by a groundwater divide located just south of the cities of Rohnert Park and Cotati. This divide separates the basin from the SRV Groundwater Basin to the north. The Petaluma Valley Groundwater Basin extends southeast to San Pablo Bay and is bordered by the Sonoma Mountains on the east and the Mendocino Range on the west. The basin is within the watershed of the Petaluma River, which flows south to San Pablo Bay. DWR's website does not include a description of the Petaluma Valley Basin, but a 1982 report (DWR, 1982b) contains a detailed description of hydrogeologic conditions in the basin.

The primary water bearing units in the Petaluma Valley Basin include Quaternary alluvium and alluvial fan deposits especially in the northern and eastern portions of the basin. Wells completed in these units have moderate to high yields. The other major water-bearing unit is the Wilson Grove Formation, which underlies much of the valley at a depth of about 250 feet (Cardwell, 1958). The Wilson Grove Formation is exposed in the uplands along the northwestern edge of the valley. Wells completed in this formation generally have high yields (DWR, 1982b). DWR's most current bulletin for the Petaluma Valley Ground water Basin is its 1982 study (DWR, 1982b); DWR does not have an updated basin description for this basin posted on its web site. As of the 1982 study, DWR reported:

> "Since the ground water reservoirs are therefore essentially "full", an artificial recharge program to increase the volume of ground water in storage is not needed at this time." …. Hydrographs of wells monitored during the 1976-1977 drought indicate that more surface water could be stored underground if more storage were made available. This suggests that if ground water pumping were increased, more surface water could be retained as ground water recharge. At present, much water runs off the land surface as rejected recharge."

As discussed in Section 4.5.3, and as shown in Appendix E, recent water level data for most wells monitored by DWR in the northern portion of Petaluma Valley Groundwater Basin show stable to increasing water levels. The City expects no effects on groundwater conditions in this adjacent basin due to its projected pumpage.

DWR (1982b) states that groundwater quality in the basin is generally poor due to several factors. Native groundwater quality in the alluvium and alluvial fan deposits is excellent, but much of the shallow groundwater northwest of Petaluma is contaminated with nitrates due to livestock management practices and septic systems. Groundwater near the base of the Wilson Grove Formation has naturally occurring high salinity. In the southern portion of the basin near San Pablo Bay, naturally occurring high salinity has been exacerbated by seawater intrusion. Seawater intrusion has also occurred in areas adjacent to the tidal portion of the Petaluma River (DWR, 1982b).

4.3 Geology of the Santa Rosa Valley Groundwater Basin

4.3.1 Regional Geologic Setting

Many investigations pertaining to the geology in Sonoma County and more specifically to the SRV area have been conducted. Early works include those of Osmont (1905), Dickerson (1922), and Morse and Bailey (1935). Much of the early works are summarized in Cardwell's pioneering hydrogeologic investigation of the Santa Rosa and Petaluma Valley areas (Cardwell, 1958). DWR has also conducted a series of investigations in the Santa Rosa Valley area (DWR; 1975, 1982a, and 1987); see Figure 4-3. Todd (2004) developed a detailed water budget for the upper Laguna Hydrologic Subarea, which is illustrated in Figure 4-3, that included estimates of all municipal and non-municipal (domestic, agricultural, and commercial) pumpage along with other water budget components (see additional discussion in Section 4.7). Numerous geologic maps have been generated from the various investigations. Early mapping was summarized in Weaver (1949) and subsequent maps include Fox and others (1973), Huffman and Armstrong (1980), Allen (2003), and Clahan et al. (2004). Wagner and Bortugno (1982) is probably the most readily available large area map. Continued evaluation and interpretation of the stratigraphic and structural complexities of the geology of the area present uncertainties with even the most recent geologic maps. A brief synopsis of the major geologic formations occurring in the SRV area is provided below.

The surficial exposure of geologic units in Santa Rosa Valley consists mostly of Quaternary alluvium and alluvial fan deposits (W&K, 2005; Clahan, 2004; Allen, 2003; and DWR, 1982a). The valley is bordered by the Rodgers Creek fault to the east and the Sebastopol and Meacham Hill faults to the west. In the vicinity of the Rodgers Creek fault, the low hills and mountain ranges are predominantly composed of mafic rocks of the Sonoma Volcanics and the Petaluma Formation. West of the Sebastopol fault, the Petaluma Formation has been uplifted and is exposed along the southwestern edge of the SRP. West of the Meacham Hill fault, a broad, low topographic area contains exposures of the Wilson Grove Formation and fragments of the Franciscan complex.

The basement complex in the SRV Basin is formed by the Mesozoic Franciscan complex, which is the oldest geologic unit in the area. The Franciscan consists largely of clastic and chemical sediments of marine origin intercalated with pillow basalts and more basic igneous rock, and weakly metamorphosed marine sedimentary rocks.

Unconformably overlying the Franciscan basement complex are sequences of volcanic and volcano-clastic rocks of late Tertiary age (late Miocene and Pliocene) known as the Tolay and Sonoma Volcanics. The Tolay Volcanics have been described by Morse and Bailey (1935) as a series of lava flows, breccia, tuff, and agglomerate that extends beneath the southern Santa Rosa Plain at a depth of about 2,100 feet (DWR, 1982a). The Sonoma Volcanics consist of a Pliocene age series of lava flows, agglomerates, tuffs, and intercalated sediments of volcanic debris forming a very complex assemblage of flows, dikes, plugs, mudflows, breccias, pumice beds, and stratified (volcanic in origin) materials. Rocks have been folded, intensely faulted, and eroded causing considerable differences in the formation between adjacent areas. The Sonoma Volcanics are exposed in the Sonoma Mountains east of the SRP.

Interbedded and interfingered with the Tolay and Sonoma Volcanics are non-marine, transitional marine and marine sedimentary rocks of the Wilson Grove Formation (formerly known as the Merced Formation), the Petaluma Formation, and the Cotati Formation. The Wilson Grove Formation is a late Miocene marine deposit consisting predominantly of massive beds of coarse to fine-grained sandstone and thin interbeds of clay and silty clay, lenses of gravel and pebbles. Material is largely derived from the Franciscan Formation and to a much lesser extent from the Sonoma Volcanics. The Petaluma Formation is late Miocene to Pliocene in age and largely consists of strongly folded continental and shallow marine to brackish-water deposits of clay, shale, and sandstone, some conglomerate and nodular limestone. Clay is particularly abundant in this unit. The Cotati Formation is similar in age to the upper Petaluma Formation and is classified as Petaluma Formation on older maps. It consists of marine transitional deposits, primarily massive sandstone and conglomerate.

A Quaternary (Pliocene and Pleistocene) sequence of alluvial deposits, described as primarily consolidated alluvial fan deposits but also containing fluvial and lacustrine deposits, overlies and interfingers with the Tertiary units in the Cotati Valley. This sequence was formerly known as the Glen Ellen Formation, and some reports still use this terminology. In the southern portion of the SRP, the consolidated alluvial fan deposits are overlain by largely unconsolidated Quaternary (Pleistocene and Holocene) alluvium, including alluvial fan deposits.

The stratigraphic relationship between the western and eastern areas remains obscure due to poor exposures and because it is covered by the younger deposits in the Santa Rosa Plain. A generalized relationship of interfingering and interbedding of the western marine deposits with transitional marine and non-marine deposits is believed to occur beneath the Valley. Allen (2003) mapped a region just west of the City of Cotati that contains interbedded Wilson Grove and Petaluma Formation, which extend beneath the Valley.

Surface geophysical survey interpretations indicate that up to 2.5 to 3 kilometers of Tertiary and younger deposits underlie the SRP (Allen, 2003; Mclaughlin & Sarna-Wojcicki, 2003). Investigators (Cardwell, 1958; DWR, 1978 and 1982a; and Allen, 2003) have developed various interpretations of the depositional relationships. These interpretations tend to show an interfingering and/or interbedding relationship between the Wilson Grove Formation to the west with the Petaluma Formation and Sonoma Volcanics to the east. Interpretation of these relationships are largely based on limited deep borehole information from a few oil and gas test holes, deep water wells, and/or projections of measured angles of dip at surface exposures (Allen, 2003) and need further study to better understand this complex environment.

As noted above, the USGS is working with the Agency and other participating agencies and water companies, including the City, to complete an update to the Santa Rosa Plain Subbasin Study (USGS, 2003 and 2007).

4.3.2 Faults

The SRV Groundwater Basin is in the northwest trending structural province of the Coast Ranges. Folds and faults have deformed or displaced all formations with the exception of the younger alluvium. The syncline forming the Santa Rosa Valley was named the Windsor syncline by Gealey (1951). The northwest trending faults at the margins of the Santa Rosa Valley have displaced the formations and, therefore, control much of the shape of the valley and the thickness of the water-bearing deposits. One of the primary faults in the area is the Rodgers Creek fault, located between the valley and Sonoma Mountain to the east. In the northern portion of the groundwater basin, the Healdsburg fault is generally considered a continuation of the Rodgers Creek fault. The Meacham Hill and Tolay faults are located west of the valley in the Wilson Grove Formation Highlands Groundwater Basin. There are often multiple smaller faults in the vicinity of these major faults, and these areas are described or mapped as "fault zones" in some reports.

Several buried faults have been mapped within the valley, most notably the Sebastopol fault, which extends from the southern portion of the subbasin northwest to Sebastopol. Although the Sebastopol fault is mapped near the southwestern boundary of the City, its location is approximate because the fault trace is not exposed at the surface. The Petaluma Valley fault was first proposed by Collins (1992) and Wright and Smith (1992). It is located primarily in the Petaluma Valley Groundwater Basin but is shown on some maps intersecting the Sebastopol fault just west of the City.

DWR (1982a and 1987) investigated the hydraulic properties of the Sebastopol fault, but the results were inclusive. Water level hydrographs of the City's wells show similar trends to, and response to pumpage as, nearby City of Cotati wells located on opposite sides of the mapped location of the fault. This suggests that the Sebastopol fault does not act as a significant barrier to groundwater flow. Data are not available to determine the hydraulic properties of faults in the Rohnert Park area, but water level data shown on hydrographs and contour maps indicate there is flow across the faults. There is no evidence that faults in the vicinity of Rohnert Park act as significant barriers to groundwater flow.

4.3.3 Groundwater Production Zones

In the southern SRP Subbasin, groundwater is produced largely from the upper 800 feet of the sedimentary deposits. For the evaluation of local hydrogeologic conditions, two geologic cross sections were prepared, and the cross-section locations are shown on Figure 4-4. Cross-section A-A' (Figure 4-5) has a southwest to northeast orientation and is roughly perpendicular to the longitudinal axis of the valley. Cross-section B-B' (Figure 4-6) has a northwest to southeast orientation and is roughly parallel to the valley's longitudinal axis. The cross sections were originally developed based on review of water well driller's reports for the City of Rohnert Park and available geophysical electric logs (W&K, 2005).

Local hydrogeology was evaluated by constructing vertical profiles of water supply wells operated by the Cities of Rohnert Park and Cotati and some nearby private wells in addition to the geologic cross sections. The well profiles show the geologic materials as recorded on individual water well driller's reports, an interpreted profile of the geophysical electric log for each well or borehole where available, and the depth of perforated or screened intervals in the well casing. The cross sections show geologic materials and perforated intervals for wells that lie along or near the cross section location. Six working cross sections were prepared for the area, and two of these are included in this Plan.

The well profiles and cross sections provide a generalized depiction of the subsurface geologic conditions that was used to divide the aquifer into depth zones to facilitate the analysis of groundwater levels. These zones do not represent laterally extensive aquifers but are strictly depth based for purposes of evaluating hydrogeologic conditions. These designations are based on an approximate correlation to the geologic units and on water well completion depths. The vertical zones of the aquifer system were designated:

- Shallow (0 to 200 foot depth),
- Intermediate (200 to 600 foot depth, comprised of upper and lower sequences as described below),
- Deep (600 to 800 foot depth), and
- Lower (depths greater than 800 feet).

Information about the construction of the City's wells is summarized in Appendix E. This Appendix includes a table outlining the perforated interval of the wells along with the capacities (pumping rates) and other information. The City's wells pump predominantly from the intermediate zone, but several wells are also completed partially in the deep and lower zones of the aquifer system.

4.3.3.1 Shallow Zone

The shallow zone appears to consist largely of clays and sandy clays with a few thin sand to gravel beds (Figure 4-5). The sands appear to occur largely towards the margins of the Valley in the northern part of the southern SRP Subbasin. Somewhat more sand occurs further south possibly deposited by alluvial fan sources in the Copeland and Lichau Creek areas. The depositional system appears to have been small alluvial fans grading into a fluvial plain or possibly lacustrine area.

4.3.3.2 Intermediate Zone

Water supply wells operated by the Cities of Rohnert Park and Cotati are constructed primarily in the intermediate zone, with perforated intervals between depths of 200 to 600 feet. Based on review of well profiles and geologic cross sections, this zone consists of a complex sequence of largely thin (and rare occurrences of thick) sand and sand to gravel deposits interbedded with deposits of sandy clay to clay (Figures 4-5 and 4-6). The correlation of individual sand and gravel beds between wells is generally poor. The intermediate zone appears to be the most complex stratigraphically of the four zones, and it is difficult to identify specific formations based on individual drillers' logs. Geologic cross sections prepared by DWR (1982a) suggest that the Rohnert Park wells are completed primarily in Quaternary alluvial fan formations. Deeper wells may also be completed partially in the underlying Wilson Grove Formation, especially in the northern portion of Rohnert Park.

An upper sand sequence in the upper intermediate zone (between depths of about 200 to 400 feet) occurs in the northern portion of the southern SRP Subbasin (Figure 4-5). In general, the sand to sand and gravel beds in this zone appear to be slightly thicker and more numerous than in the lower intermediate zone (400 to 600 feet). Some clay is present in almost all strata between depths of 400 and 600 feet. Although bed correlation remains poor, the character of the geophysical log responses appears to be more of an alluvial plain or fluvial nature. The sandy deposits of this upper sequence appear to be concentrated along the Valley axis (Figure 4-6); and, these deposits may be lacking east of Rohnert Park (Figure 4-5). In addition, the base of the upper sand sequence appears to rise somewhat to the southeast (Figure 4-6). It is unclear whether this rise is related to a southeastern sourced depositional pattern or basin tectonics.

A sand sequence consisting of many thin sand beds occurs in the lower intermediate zone (400 to 600 feet) in the northern half of the southern SRP Subbasin. The sequence may be either upper interbedded Wilson Grove-Petaluma Formation or Quaternary alluvial fan deposits. East of Rohnert Park, a thicker sequence of high-resistivity beds may represent a marginal-fault trapped area (Figure 4-6). In the central southern SRP Subbasin, this sandy sequence tends to be thinner and finer grained. In the south, a thicker, high-resistivity, gravelly sequence is present (Figure 4-6), and it is unknown whether it correlates with the Tertiary "Sands and Gravels of Cotati" mapped by Clahan and others (2004).

4.3.3.3 Deep Zone

Underlying the intermediate zone, the deep zone is defined as occurring at depths between 600 to 800 feet. The deep zone is best defined in the northern portion of the southern SRP as an approximately 100 to 150 foot interval of thin to thicker sand and gravel beds with interbeds of clays (Figure 4-5). These beds appear to rapidly thin or pinch out to the south. Correlation of the deep zone to surficial map units is difficult. It is unclear whether the deposits in the deep zone represent Tertiary sedimentary deposits (interbedded Wilson Grove-Petaluma) or Quaternary non-marine deposits.

4.3.3.4 Lower Zone

Underlying the deep zone, the lower zone is defined as occurring at depths between 800 to 1,500 feet. The three deepest wells (in the southern SRP Subbasin (RP-14, RP-15, and RP-16) encountered low resistivity, fine-grained clays at these depths. The units encountered by the wells constructed to depths greater than 800 feet are believed to be older Tertiary sedimentary units, probably Petaluma Formation or interbedded Wilson Grove-Petaluma Formation or equivalent. Because of the limited deep borehole information, it is difficult to correlate the lower zone laterally beneath the City. Because of the fine-grained nature of this zone, and the limited potential aquifer thickness, it appears the lower zone represents a poor target for groundwater production.

4.3.4 Well Yields and Aquifer Characteristics

Aquifer characteristics refer to the ability of aquifers to transmit and store groundwater. Aquifer characteristics are generally estimated using data from long-term constant rate pumping tests. The ability of the aquifer to transmit water is referred to as transmissivity (permeability times saturated thickness).

Specific capacity can be used to estimate aquifer transmissivity using the following empirical equation for a confined aquifer:

$$T = Q/s * 2000$$

Where: T = transmissivity of the well, in gallons per day/ft (gpd/ft)

Q = yield of the well, in gpm

s = drawdown in the well, in ft.

The Rohnert Park municipal wells have yields ranging from about 50 to 300 gpm (W&K, 2005). Specific capacity data from well efficiency tests of 31 Rohnert Park wells show that the specific capacities vary over an order of magnitude, ranging from 0.6 to 6.1 gpm/ft of drawdown. Based on the above empirical formula, the transmissivity of the intermediate zone in the vicinity of Rohnert Park is estimated to range from about 1,000 to 12,000 gpd/ft. The average transmissivity of the Rohnert Park wells is about 5,000 gpd/ft.

Overall, the specific capacity and transmissivity values calculated from tests conducted in the Rohnert Park wells are indicative of low yielding formation materials. The data suggest that the intermediate zone, from which the majority of the municipal groundwater extraction occurs, has a transmissivity of less than 15,000 gpd/ft. Well yields are correspondingly low, averaging about 180 gpm for the Rohnert Park wells.

DWR addressed well yields and aquifer characteristics in the SRP Subbasin in various studies (DWR; 1975, 1979, 1982a, and 1987). DWR's first report on groundwater resources in Sonoma County contains descriptions of well yields for various formations in the County (DWR, 1975). Specific capacity data were also provided for some formations. Wells completed in the Petaluma Formation typically are low-yielding (5 to 300 gpm). For the Merced Formation, which is one of the primary water-bearing units in the subbasin, DWR (1975) reported yields of 20 to 1,000 gpm. For the overlying Quaternary alluvial fan deposits (previously known as the Glen Ellen Formation), DWR (1975) reported yields of 3 to 500 gpm and specific capacities of 0.5 to 20 gpm/ft of drawdown.

DWR (1987) contains results of five aquifer tests conducted in the SRP Subbasin. Transmissivities estimated from the test results ranged from about 6,000 gpd/ft for a well completed in the Merced Formation near the City of Windsor to more than 80,000 gpd/ft for a well completed primarily in Quaternary alluvial fan deposits in the City of Santa Rosa. Aquifer storativity was estimated for three of these tests, and estimates ranged from 0.0010 to 0.0017.

The southernmost test was conducted in the Agency's Todd Road well located in the southern SRP Subbasin about three miles southeast of Sebastopol. This well is completed primarily in Quaternary alluvial fan deposits, and the transmissivity was estimated to be 10,000 to 15,000 gpd/ft based on the test results. This is similar to the highest transmissivities estimated for the Rohnert Park wells.

Cardwell (1965) and DWR (1983) addressed well yields and aquifer characteristics in the Healdsburg Area Subbasin. Groundwater is produced primarily from alluvium and river channel deposits that have relatively high yields of 200 to 1,000 gpm (Cardwell, 1965). Some groundwater is also produced from lower-yielding Quaternary alluvial fan deposits, and many domestic wells in the Healdsburg area are completed in this formation (DWR, 1982a). Yields of 1 to 140 gpm and a specific capacity of 2 gpm/ft of drawdown were reported by Cardwell (1965).

The geology of the SRV Groundwater Basin is stratigraphically and structurally complex. Prior analyses of groundwater level responses to local groundwater extraction have reported on the semi-confined to confined nature of the deeper aquifers in the southern SRP. Particularly, DWR (1982a) notes that there are differences in the water level declines observed in three piezometers completed to different depths and also that there are confining layers between the perforated intervals of the piezometers. The deepest of the three piezometers was further noted as similar in depth to most of the City wells; the water level difference in this zone was attributed to the response of "pressure aquifers" (i.e., confined aquifers).

4.4 Precipitation

The City lies within the watershed of the Laguna de Santa Rosa, which is a tributary of the Russian River. The City lies in a region that has a "Mediterranean" climate, meaning the normal weather pattern is a dry summer season with little or no rain. Typically, over 96 percent of the region's annual precipitation falls during the months of October through April.

An isohyetal map showing mean annual precipitation contours in the vicinity of the City is presented on Figure 4-7. This map was obtained from an Agency (1983) report, and the associated period of record and gauge locations are unknown. The mean annual precipitation is about 30 inches near the City and increases in an easterly direction to more than 45 inches at Sonoma Mountain.

Sonoma County precipitation gauges with long periods of record are located north and northwest of the City. Annual precipitation data from 1905 to 2005 (Figure 4-8) are from the Santa Rosa gauge, which is located north of the City of Santa Rosa at an elevation of 174 feet.[1] The lowest annual rainfall during this period was 12.78 inches during the 1977 water year (October 1, 1976 to September 30, 1977), and the highest annual rainfall was 55.68 inches in the 1983 water year. The mean annual precipitation was 29.99 inches, which is similar to the annual mean precipitation for the City shown on Figure 4-8. This represents an annual precipitation volume of 2.5 AF/acre.

The long-term precipitation characteristics at the Santa Rosa gauge are shown by plotting the cumulative departure from the mean annual precipitation (Figure 4-9). This plot shows alternating wet, average, and dry periods of various durations, which are indicated by the slope of the cumulative departure curve. An upward slope indicates a wet period, and a downward slope indicates a dry period on the cumulative departure curve.

4.5 Groundwater Conditions

DWR evaluated historical groundwater level data for its 1982 investigation of the SRP area and concluded that the "Santa Rosa Plain groundwater basin as a whole is about in balance, with increased groundwater levels in the northeast and decreased groundwater levels in the south" (DWR, 1982a). It appears that this statement refers to the area now known as the SRP Subbasin, but historical data suggest that groundwater conditions in all subbasins of the SRV Basin were "in balance" in 1982. Since DWR's 1982 study (DWR, 1982a), groundwater levels in the north increased, and groundwater levels in the south (including the Rohnert Park area) show large increases in recent years primarily in response to decreased municipal pumping. In this section, historical groundwater level data are used to assess groundwater conditions since 1982 in order to determine if the basin is still "in balance."

In order to update DWR's evaluation of groundwater resources in the basin and subbasin and assess groundwater level trends and conditions, all available water level data were obtained from DWR and other sources, including the Cities of Rohnert Park and Cotati, the Agency, the USGS, and Todd. Water level data for monitoring wells located at leaky underground fuel tank (LUFT) sites within the City's UGB were also downloaded from the State Water Resources Control Board (SWRCB) Geotracker system (http://geotracker.swrcb.ca.gov).

As summarized in Table 4-3, hydrographs were reviewed for 147 wells, including 133 wells in the SRV Basin and 14 wells in the northern portion of the Petaluma Valley Basin. This included 123 wells in the SRP Subbasin, two wells in the Rincon Valley Subbasin, and eight wells in the Healdsburg Area Subbasin. Figures 4-10 and 4-11 show the locations of wells with water level hydrographs. The individual hydrographs for 147 of these wells are included in Appendix E and are summarized below. The data reviewed includes more than 100 wells owned and/or operated by others than the City. Many of these wells are located in the neighboring basin or subbasins,

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[1] The period of record for the Santa Rosa gauge is generally from 1905 to the present, but there are missing data for portions of the 1937, 1979, 2000, and 2001 water years. Precipitation for these years was estimated using data from the Graton station, located west of Santa Rosa.

but were reviewed (as suggested in DWR's guidance (DWR, 2005)) to provide an updated evaluation of groundwater conditions that affect the City.

The water level hydrographs were also categorized according to zone(s) of predominant completion and monitoring entity. Most wells have perforation data that allow them to be classified by zone. As indicated in Table 4-3, 59 wells are classified as shallow, 24 as intermediate, and two as deep. There are also 34 wells classified as shallow and intermediate and 12 as intermediate and deep. Because most municipal and agricultural pumpage is from the intermediate zone, wells that are partially completed in the intermediate zone typically have hydrographs similar to wells completed exclusively in the intermediate zone.

Table 4-3 Hydrographs Reviewed for City of Rohnert Park UWMP

Groundwater Basin or Subbasin		No. of Wells by Aquifer Designation[1]						No. of Wells by Monitoring Entity							Total
Basin	Sub-basin	Shallow Zone	Shallow & Intermediate Zone	Intermediate Zone	Intermediate & Deeper Zones	Deep Zone	Unknown	DWR	SWRCB[2]	City of Cotati	City of Rohnert Park	SCWA	Todd	USGS	
Santa Rosa Valley	Santa Rosa Plain	46	32	22	12	2	8	49	9	3	43	6	1	11	*123*
	Rincon Valley	1	0	1	0	0	0	2	0	0	0	0	0	0	*2*
	Healds-burg	1	0	0	0	0	7	8	0	0	0	0	0	0	*8*
Subtotal		*48*	*32*	*23*	*12*	*2*	*15*	*59*	*9*	*3*	*43*	*6*	*1*	*11*	*133*
Petaluma Valley	--	11	2	1	0	0	1	11	1	0	0	0	0	3	*14*
Total		**59**	**34**	**24**	**12**	**2**	**16**	**70**	**10**	**3**	**43**	**6**	**1**	**14**	**147**

1. Aquifer zonation:

Shallow Zone	<200 feet
Shallow and Intermediate Zone	<600 feet
Intermediate Zone	200 - 600 feet
Intermediate and Deeper Zones	>200 feet (Includes three wells completed partially in the shallow zone)
Deep Zone	600-800 feet

2. There are ten LUFT sites within the City of Rohnert Park UGB and City of Cotati UGB, each with multiple monitoring wells. Hydrographs were generated for one representative well from each site.

Wells with water level data have varying periods of record, and a few hydrographs show historical data dating back to the 1940s. The period of record for most of the wells begins in the 1970s or 1980s. A number of wells were monitored by the USGS in the early 1950s on a one-time basis (Cardwell, 1958). Although slightly more than half of the wells have current data, water level measurements have apparently been discontinued in the other wells. In the SRV Basin, for example, 77 hydrographs (53% of the total) have water level data to the present.

4.5.1 Water Level Hydrographs for Santa Rosa Plain Subbasin

Most of the water level data available for the SRV Groundwater Basin are from wells within the SRP Subbasin, and water level hydrographs in this subbasin are discussed by zone.

4.5.1.1 Shallow Zone

Hydrographs for most shallow zone wells in the SRP Subbasin exhibit relatively stable long-term groundwater levels, indicating little response to changes in pumpage or variations in climatic conditions (Figure 4-12). Regardless of increases or decreases in pumpage or the occurrence of dry, normal, or wet years, spring water levels in the shallow zone are essentially stable for all of the historical monitoring record. There are a few exceptions to this general trend.

Most shallow zone wells in the SRP Subbasin have periods of records beginning in 1989 and exhibit stable or increasing groundwater level trends. One shallow well with a longer period of record (6N/8W-15J3) shows historical water level declines similar to those of some intermediate zone wells but has had stable water levels since the late 1980s and water level increases since 2003.

4.5.1.2 Intermediate Zone

Water levels measured in intermediate zone wells typically reflect confined conditions with lower depths to water and greater seasonal fluctuations. Water levels in these wells are influenced by municipal and agricultural pumping from the intermediate zone. Prior analyses of groundwater level responses to local groundwater extraction have reported on the semi-confined to confined nature of the deeper aquifers in the southern SRP. DWR (1982a) reported differences in water levels (pieziometric heads) were observed in three piezometers completed at different depths in the aquifer system. The deepest of the three piezometers was further noted by DWR (1982a) as similar in depth to most of the City wells; the water level difference in this zone was attributed to the response of "pressure aquifers" (i.e., confined aquifers).

In the southern portion of the SRP Subbasin, water levels in intermediate zone wells generally follow the trend of the City's pumping, with lower water levels during years of increased pumping and higher water levels during years of reduced pumping (Figures 4-12 and 4-17). This means that water levels were lowest in the late 1980s, stabilized in the 1990s, and have increased significantly in recent years. Notably, groundwater levels in the intermediate zone in the southern portion of the SRP Subbasin have increased to elevations significantly above those observed in the early 1980's (the time of DWR's 1982 study). Where historical records are available, current groundwater levels also appear to be higher than those recorded in the 1970's. For example, the groundwater elevations observed in January 1972 and March 1980 in City of Rohnert Park Well No. 8 were 89 and 79 feet, mean sea level (msl), respectively, whereas in March 2006, it was 105 feet, msl (Figure 4-12).

As previously reported by DWR (1982a), the basin is "in balance"; the updated analysis shows no evidence of overdraft conditions occurring in the groundwater basin.

4.5.2 Rincon Valley and Healdsburg Area Subbasins

Water level data are much more limited for the Rincon Valley and Healdsburg Area Subbasins. As indicated on Table 4-3, data from DWR were only available to prepare hydrographs for two wells in the Rincon Valley Subbasin and eight wells in the Healdsburg Area Subbasin. These hydrographs are included in Appendix E and described below.

In the Rincon Valley Subbasin, hydrographs were prepared for one shallow-zone and one intermediate-zone well. Both wells have periods of record from 1989 to 2006. The shallow well (well 7N/7W-06H2) is 100 feet deep and had a spring depth to water ranging from 15 to 27 feet. During most of the 1990s, the spring depth to water was about 20 feet, with seasonal fluctuations of about 15 feet. From 2000 to 2004, spring water levels declined to about 27 feet, and seasonal fluctuations increased to more than 20 feet. In 2006, the spring depth to water had recovered to 20 feet. Overall, water levels appear to be stable in this well.

The intermediate zone well in Rincon Valley (well 7N/7W-09P1) is 296 feet deep and had a spring depth to water of about 82 feet in 1990. Water levels have increased considerably since that time (to about 46 feet in 2003), and have been stable since 2003 with a recent rise of three feet in 2006. Seasonal fluctuations have decreased from about 20 feet in the early 1990s to about 5 feet in recent years.

In the Healdsburg Area Subbasin, hydrographs were prepared for one shallow zone well and seven wells of unknown depth. The shallow zone well (8N/9W-22E1) is 45 feet deep and has a period of record from 1989 to 2006. The spring depth to water in this well was about 31 feet in 1990 and rose to six feet by 1999. The spring depth had increased to five feet by 2006. Seasonal fluctuations are typically about 15 feet in this well.

The hydrographs of wells of unknown depth in the Healdsburg Area Subbasin all show stable to increasing water levels in recent years. Only one well (9N/10W-12C1) northeast of Healdsburg shows evidence of historical water level declines. This well has the longest period of record (1964 to 2006) and shows that the spring depth to water declined from about 12 feet in the mid 1960s to about 25 feet in 2003. By 2006, the spring depth to water was 15 feet. The other wells have shorter periods of record but show generally stable water levels prior to 2006 and relatively large water level increases in 2006.

4.5.3 Petaluma Valley Groundwater Basin

Hydrographs for 14 wells in the northern portion of the Petaluma Valley Groundwater Basin (north of the City of Petaluma) are included in Appendix E. As indicated on Table 4-3, this includes eleven shallow zone wells, two shallow and intermediate zone wells, one intermediate zone well, and one well of unknown depth. Eleven of these wells have recent water level data until at least 2004, and eight of these show stable to increasing water levels in recent years.

Well 5N/7W-20B2, located in the northern portion of the City of Petaluma, is a shallow well with a depth of 158 feet and has a very long period of record (1953-2006). The spring depth to water in this well declined from 8 feet in the mid 1950s to about 70 feet in the early 1960s. Water levels have increased since that time and have been stable at 20 to 30 feet, msl since 1999.

Although the City's urban growth boundary extends slightly into the Petaluma Valley Groundwater Basin, none of the City's wells are located in this basin. Consequently, the City expects no effects on future groundwater conditions in this basin due to its projected pumpage.

4.5.4 Groundwater Elevation Contours

Historical groundwater elevation contours are available from USGS and DWR reports. Cardwell (1958) prepared a spring 1951 contour map for the SRP and Rincon Valley Subbasins and the northern portion of the Petaluma Valley Groundwater Basin. More data were available for this period than any other historical or recent period because the USGS conducted a one-time round of water level measurements in approximately 450 wells in April 1951. The majority of these wells are shallow, and the shapes of the contours on the Cardwell map primarily reflect groundwater conditions in the shallow zone. The portion of the Cardwell map showing the southern SRP Subbasin is shown on Figure 4-13. The overall direction of groundwater flow in the SRP was westerly toward the Laguna de Santa Rosa in the valley trough and ultimately to the northwest. West of the valley trough, there was a steeper gradient for groundwater flow toward the Laguna de Santa Rosa from the hills west of the valley.

Groundwater elevations and flow directions in 2004 were similar to those shown on Cardwell's 1951 contour map. Contours of equal groundwater elevation in the shallow zone for spring 2004 (Figure 4-14) show that the direction of groundwater flow in the southern portion of the SRP Subbasin is generally westerly toward the Laguna de Santa Rosa, and the gradient for flow in the valley is relatively flat. At the eastern and western margins of the SRP Subbasin, there is a much steeper gradient for groundwater flow into the valley.

In the northern portion of the Petaluma Valley Basin, the direction of groundwater flow is generally to the south toward the City of Petaluma and away from the groundwater divide that separates the two groundwater basins. The 2004 contours shown on Figure 4-14 indicate that the approximate location of the groundwater divide is similar to the southern boundary of the SRP Subbasin as mapped by DWR. Based on groundwater elevation contours on either side of the divide, the location of the divide appears to be essentially the same as it was in 1951 based on Cardwell's map (Figure 4-13). The lack of movement of the groundwater divide is supported by water level hydrographs for shallow wells near the divide, which indicate that shallow groundwater levels have generally been stable for at least the last 15 years. Hydrographs for wells near the divide such as T6N/R7W-30R1, T5N/R8W-02H1, and T5N/R8W-01L2 are included in Appendix E.

Contours of equal groundwater elevation for the intermediate zone for spring 2004 (Figure 4-15) in the southern portion of the SRP Subbasin show that the direction of groundwater flow beneath the City was generally to the northwest, but a cone of depression was present beneath the western portion of the City. Due to the semi-confined nature of the portion of the aquifer system from which the City's wells produce water, groundwater elevations in the intermediate zone are lower than in the shallow zone, especially in the central and western portions of the City. A spring 2006 contour map (Figure 4-16) prepared for the City of Cotati Urban Water Management Plan (W&K, 2006) shows that groundwater levels have risen significantly since 2004 and the cone of depression beneath the western portion of the City had largely disappeared by 2006.

4.5.5 Groundwater Quality

Groundwater produced by the City is tested for a total of 139 constituents, including bacteria, pesticides, herbicides, fungicides, organic chemicals, inorganic chemicals, nitrates, radioactivity, corrosivity, trihalomethanes, iron, and manganese.

Groundwater produced from the City's wells meets primary state drinking water standards. Overall mineral content for all zones, as indicated by specific conductance (electrical conductance; EC), ranges from 270 to 620 µmhos/cm. The average EC levels are 300 µmhos/cm in intermediate zone wells and 434 µmhos/cm in wells completed in multiple zones. EC values are below the recommended secondary Maximum Contaminant Level (MCL) of 900 µmhos/cm. Other water quality concerns in the Rohnert Park area include elevated nitrate, arsenic, iron, and manganese concentrations in some wells. Nitrate concentrations in City wells perforated in the intermediate zone or in multiple zones range from non-detect to 23 mg/L, which is less than the primary MCL of 45 mg/L. Samples collected from five wells in 1997 exceeded secondary MCLs for iron and manganese, which do not pose health hazards but are considered nuisance pollutants. However, treatment can be used to reduce iron and manganese to levels that meet the secondary MCLs (Dyett & Bhatia, 2000).

Arsenic is naturally occurring in the area, and concentrations in City wells range from 2 to 12 µg/L with an average of about 5 µg/L. Arsenic concentrations at the upper end of the range of detected concentrations occur in City wells completed in the northwestern area in the deep and lower zones (well depths greater than 600 feet). Arsenic concentrations in these deeper wells are at levels near or above the federal MCL of 10 µg/L.

Organic chemicals introduced through known point sources could influence groundwater quality conditions in the future. No serious or widespread issues that affect community water supplies due to organic chemical sources are known to be present in the City.

4.6 City's Groundwater Supply

4.6.1 Historical City Pumpage

Historically, the City's primary water source was groundwater. In 2003, the City began a shift toward greater use of Agency water and reduced groundwater pumping. The Act requires that an agency proposing to utilize groundwater provide a description of the proposed pumpage[14] and the historic sufficiency of the supply based on information that is readily available[15].

The City has revised its operational strategy from one of relying largely upon groundwater for supply to a strategy that balances Agency supply, groundwater, and recycled water. Historical pumpage data for the City were reviewed from 1970 to through 2005 (Figure 4-17). Table 4-4 illustrates the City's historical groundwater use for the five-year period from 2001-2005. Raw

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[14] Water Code Section 10631(b) (4).
[15] Water Code Section 10631(b) (3).

data for 2006 is available but has not yet been correlated with data from other wells, and so it not included in this Plan. The next Plan update will include this information.

Table 4-4 (DWR Table 6) Amount of Groundwater Pumped by the City (2001-2005)

Basin Name (s)	2001 AFY	2002 AFY	2003 AFY	2004 AFY	2005 AFY
Santa Rosa Plain Subbasin	4,482	4,212	3,556	1,520	846
% of Total Water Supply	52.4%	52.4%	45.6%	19.5%	12.7%

The City's pumpage has decreased significantly since reaching a high of 5,487 acre-feet (AF) in 1995. City pumpage had decreased to 3,556 AF by 2003 and further decreased to 1,520 AF in 2004 and to 846 AF in 2005. The 2005 pumpage is similar to the City's pumpage in 1970. The 2004 and 2005 pumpage volumes are less than the average pumping rate of 2.3 million gallons per day (mgd) (total of 2,577 AFY) specified in the City's 2004 Water Policy Resolution. In 2003, the City began to reduce its use of groundwater as a source of supply to meet its water demands due to implementation of its General Plan commitments to secure a greater percentage of its supply from the Agency.

4.6.2 Projected City Pumpage

Table 4-5 illustrates the groundwater usage proposed for the future. The City’s groundwater use through 2030 is projected in accordance with its Water Policy Resolution. The City will balance groundwater, recycled water, and Agency supply in accordance its voluntary commitments outlined in the Temporary Impairment MOU. Actual use under all circumstances will be in accordance with the Water Policy Resolution.

Table 4-5 (DWR Table 7) Amount of Groundwater Projected to be Pumped by the City

Basin Name(s)	2005 AFY	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Santa Rosa Plain Subbasin	846	2,577	2,577	2,577	2,577	2,577
% of Total Water Supply	12.7%	25.4%	25.1%	25.1%	25.1%	25.1%

4.7 Groundwater Supply Sufficiency

4.7.1 Setting

The upper Laguna watershed, located in the southern portion of the SRV Groundwater Basin and above the USGS gauge at Stony Point Road, was selected for purposes of analyzing the sufficiency of groundwater (Figure 4-18). This 25,000-acre area is considerably larger than the City's existing service area (about 5,600 acres), as shown on Figure 4-18. This area is located within a nationally-recognized hydrologic unit, the Russian River Hydrologic Unit; the Russian River Unit is comprised of numerous CalWater Hydrologic Units. CalWater is a spatial dataset of watersheds in California, developed by the Interagency Watershed Mapping Committee (IWMC), often referred to as the "CalWater Committee”. Similar to a subbasin, watershed areas are often selected for the purpose of collecting and analyzing data[16]. As discussed further below, the area was selected in part because it had previously been used by Todd (2004) for purposes of developing a water budget. The upper Laguna watershed is considered to be an appropriate area for calculating a water budget because the watershed boundaries best represent the true hydrologic boundaries of the groundwater system in the foothill areas (Todd, 2004). The direction of groundwater flow in a basin is usually similar to that of surface water, which follows the topography of the ground surface. Todd (2004) states: "[a]n important assumption is that the surface water drainage divides that define the watershed also generally represent groundwater divides." Todd also notes: "local groundwater flow is parallel to and generally does not cross the surface watershed divide/study area boundary". The watershed boundaries thus generally serve as groundwater divides, and groundwater flow across these divides can be assumed to be zero. If basin boundaries had been used for the water budget, an estimate of groundwater inflow across these boundaries would have been required. This subsurface inflow has not been previously estimated for the entire basin. Therefore, it is more accurate in this Plan to use the upper watershed area described above that has been previously evaluated for water budget analysis purposes (Todd, 2004).

4.7.2 Water Budget Estimate of Groundwater Recharge

A water budget provides a means to estimate inflows to and outflows from a study area and assess the change in groundwater storage occurring during a selected period of analysis. A water budget is one method that can be employed to estimate groundwater recharge or basin yield. Todd (2004) developed a detailed water budget for the upper Laguna hydrological area that included estimates of all municipal and non-municipal (domestic, agricultural, and commercial) pumpage along with other water budget components. For purposes of estimating the average annual rate of groundwater recharge in this area during the 1987-2001 period, a modified version of the Todd (2004) water budget was used for this Plan. This estimated recharge rate was then compared with current and historical pumpage to evaluate the sufficiency of groundwater from the basin to meet historical water demands.

The primary inflow components of the water budget (shown below on Table 4-6) are rainfall, imported surface water, subsurface inflow, and return flows from pumped groundwater. The primary outflow components are evapotranspiration, stream outflow, consumption of imported water, and groundwater pumpage. Subsurface outflow was assumed to be zero due to the use of watershed boundaries to define the water budget analysis area. Groundwater recharge was

[16] For many years, State and Federal agencies have been working through the committee to map the watersheds and hydrologic units in the State of California. The North Coast is defined by CalWater as Hydrologic Region (HR) 1. Each Hydrologic Region is broken up into Hydrologic Units, with each unit indicating an entire major river basin. Large tributaries of major rivers are designated as Hydrologic Areas (HA). In turn, HAs are subdivided into Hydrologic Sub-Areas (HSA) (North Coast Regional Partnership et al., 2007). As related to the above analysis, and using the area descriptors as used by CalWater, the Russian River is the main Hydrologic Unit, the "Middle Russian River" is the Hydrologic Area, and the "Laguna" is the Hydrologic Subarea, or "Super Planning Watershed." CalWater identifies the "Laguna de Santa Rosa" is a "Planning Watershed" within the Laguna Hydrologic Subarea. Previously, Todd (2004) referred to its water budget area as the "southern watershed of the Laguna de Santa Rosa"; similarly W&K (2005) refers to essentially the same water budget analysis area as the upper Laguna de Santa Rosa watershed. In this Plan, for purposes of consistency with the CalWater nomenclature, the water budget analysis area is referred to as the upper Laguna watershed.

estimated to be about 8,300 AFY based on the water budget (Table 4-6). As shown in Table 4-6, there is a positive change in groundwater storage. Table 4-7 shows the total estimated groundwater recharge of 8,264 AFY for the water budget period. The Todd (2004) water budget and the empirical analysis of pumpage and groundwater levels provide similar estimates of recharge that resulted in a positive change in groundwater storage. The observed groundwater level trend with stable to slightly increasing levels during 1990 to 1997 supports the computation of a positive change in groundwater storage (W&K, 2005).

Table 4-6 Revised Water Budget for Water Years 1987-2001 (Modified from Todd, 2004)

		Estimate (AFY)
Inflows		
Rainfall		73,908
Imported Water		2,604
Subsurface Inflow		355
Return Flows from Pumped Groundwater		
	Sewered	372
	Septic	701
	Agriculture	193
Total Inflows		**78,133**
Outflows		
Evapotranspiration		44,074
Stream Outflow		22,557
Subsurface Outflow		0
Phreatophytes, etc ET		455
Imported Water Consumed/Exported		2,428
Groundwater Pumped		
	Sewered	5,913
	Septic	1,077
	Agriculture	1,478
Total Outflows		**77,982**
Computed Change in Storage		**151**

Table 4-7 Groundwater Recharge Estimated from Water Budget for Water Years 1987-2001

Deep Percolation from Precipitation and Streams	
Rainfall (includes streamflow)	73,908 AFY,
Evapotranspiration	-44,074 AFY
Stream Outflow	-22,557 AFY
Phreatophytes etc. ET	-455 AFY
Subtotal	**6,822 AFY**
Deep Percolation from Imported Water	
Imported Water	2,604 AFY
Imported Water Consumed/Exported	2,428 AFY
Subtotal	**176 AFY**
Return Flows from Pumped Groundwater	
Sewered	372 AFY
Septic	701 AFY
Agriculture	193 AFY
Subtotal	**1,266 AFY**
Total Estimated Recharge	**8,264 AFY**

4.7.3 Empirical Analysis of Groundwater Conditions

In addition to evaluating the minimum of 5 years of historical City pumpage as required by Water Code Section 10631(b)(3), City pumpage data from 1970 through 2005 and pumpage data and estimates for other pumpers in the study area were evaluated to determine the relationship between historical pumpage and groundwater level trends. Annual pumpage data were obtained for Sonoma State University (SSU) and the City of Cotati. Metered data were not available for private, commercial, and agricultural pumpers, and pumpage estimates were derived by Todd (2004) based on population census data, planned land use, and/or water use estimates. These estimates were subsequently extended to cover the 1970 through 2005 period (Table 4-8).

Table 4-8 Summary of Historical, Current and Future Groundwater Pumpage for the Study Area

Entity		Pumpage in AFY[1]						
		1970	1980	1990	2003[2]	2004[3]	2005[3]	Future (2025)[4, 5]
City of Rohnert Park		907	3,978	5,222	3,556	1,520	846	2,577
Cotati and Sonoma State University	City of Cotati	201	492	562	273	102	47	382
	Sonoma State Univ.	38	51	70	139	139	139	220
Private and Commercial	Multifamily Dwelling Units (Todd's sewered & septic from Todd, 2004)	177	220	253	274	274	274	274
	Single Family Dwelling Units (sewered & septic from Todd, 2004)[6]	750	933	1,073	1,145	1,145	1,145	2,044
	Commercial Parcels	162	202	232	248	248	248	310
	Accommodations	21	26	30	32	32	32	32
	Graton Rancheria Casino							100
Agricultural	Agricultural pumpage (based on irrigated acres)	1,735	1,224	1,488	1,411	1,411	1,411	1,411
Total pumpage		3,992	7,126	8,929	7,078	4,871	4,142	7,350

1 For 1970, 1980, 1990 City pumpage is metered.

2 Pumpage values for SSU and the Cities of Rohnert Park and Cotati are metered and are for the 2003 calendar year; private and commercial and agricultural pumpage values are estimated.

3 Pumpage values for the Cities of Rohnert Park and Cotati are metered for the 2004 and 2005 calendar year; SSU, private and commercial, and agricultural pumpage use 2003 pumpage estimates.

4 Rohnert Park pumpage is 2.3 mgd (2577 AFY) from the 2004 Water Policy Resolution. Non-City pumpage is estimated by Todd (2004, Table 12 and the text) except for agricultural. Agricultural is kept constant from 2003 to 2025 (personal communications, Lex McCorvey, Sonoma County Farm Bureau, January 2005 and August 2007). The total increase of Non-City pumpage from 2003 to 2025 is 36%.

5 While the City is not required by Section 10631(b) to project pumpage for a 20-year horizon for the area outside the City's service area, projected pumpage for 2030 in the upper Laguna area is likely to be similar to that shown for 2025. Specifically, the projected pumpage for the City would remain at 2,577 AF. Agricultural pumpage is expected to remain at 1,411 AF or less. The City of Cotati projected a groundwater use of 90 AFY in 2030 (W&K, 2006). Most other projections for 2030 (commercial, SSU, casino, and accommodations groundwater use) are expected to be about the same as estimated for 2025. The projected groundwater use for single-family dwelling units located outside the City's SOI is not expected to significantly increase beyond that estimated for 2025.

6 Pumpage for single-family dwelling units is calculated based on an estimated number of dwelling units and a water demand of 0.53 AFY per unit in the upper Laguna watershed area. Although the current Penngrove Water Company (PWC) well is located outside this area, the PWC well pumpage (avg. 37 AFY historical pumpage for 1991-2002) is included in the total historical and current pumpage as shown (1970 – 2005). The 2025 total pumpage includes 163 AFY estimated to be produced from a replacement PWC well; the location of this planned well is unknown, but it is assumed that it would be located within the Canon Manor area in the upper Laguna watershed area.

The City provided monthly pumpage data for 2004 and 2005, but metered pumpage was not available for the City of Cotati, SSU, or non-municipal wells (i.e., private, commercial and agricultural wells) in the study area. Therefore, the 2003 pumpage estimate for non-City wells in the study area was also used for 2004 and 2005. Table 4-8 summarizes the historical and current metered and unmetered annual pumpage. Figure 4-17 shows the historical and current pumpage from 1970 to 2005 for the City and other entities along with the total estimated non municipal pumpage in the study area. Total estimated pumpage in the study area decreased from 7,078 AF in 2003 to 4,871 AF in 2004 and to 4,142 AF in 2005. City pumpage accounted for about 50% of the total pumpage in 2003, about 31% in 2004, and about 20% in 2005.

Based on data provided by other public agencies, future pumpage by the City of Cotati and SSU was projected to increase from approximately 412 in 2003 to 602 AFY by 2025. Based on the Sonoma County Land Use Audit (2003) and communications with the Sonoma County Farm Bureau (January 2005 and August 2007), an increase in agricultural land use in the area south of Santa Rosa and in the vicinity of Rohnert Park is not expected. The Land Use Audit indicates that by 2025 urban growth is expected to extend beyond the current Urban Growth Boundaries. The North Coast Integrated Regional Water Management Plan (July 2007) also reports "the trend for agricultural land in the past few decades has been one of transformation to urban uses." Although future agricultural pumpage could decrease by 2025, it was conservatively assumed to remain at 2003 levels (about 1,400 AFY). Future private and commercial pumpage are projected to experience the largest increase, from about 1,700 to 2,760 AFY. The total 2025 projected pumpage for the study area (City and non-City) ranges from 6,099 to 7,350 AFY depending on assumptions about future non-City pumpage (Table 4-8). Based on evaluation of historical groundwater extraction and water level trends primarily for data from 1990 to 1997 (see Appendix E; see also W&K, 2005), groundwater recharge is estimated to be somewhat less than 8,400 AFY (i.e., total recharge must be greater than the total pumpage of 8,722 AFY minus the groundwater inflow of 355 AFY, or at least 8,400 AFY; however, because this was a wetter than normal period, recharge is expected to be somewhat less that 8,400 AFY). During 1990 to 1997 when groundwater levels were stable to slightly increasing, a positive change in groundwater storage was exhibited with inflows exceeding outflows, and the pumpage was sustainable.

4.7.4 Hydrologic Availability of the Groundwater Supply

The City's groundwater supply has not historically been subject to hydrologic variability.

As discussed in Section 4.5, groundwater levels in the shallow zone have generally been stable except for small responses to changes in precipitation. In the intermediate zone, larger responses or fluctuations in water levels occur in direct response to pumpage. Groundwater levels in the intermediate zone show little response to changes in precipitation; most of the water level changes that have been observed in the Rohnert Park area are associated with pumpage rather than climatic conditions. Correspondingly, the City's management strategy, which further reduces groundwater utilization by the City, provides an additional buffer against hydrologic variability because the City's groundwater resource can be managed in conjunction with other water sources to maximize reliability.

4.7.5 Reliability and Vulnerability of the Groundwater Supply

There are no physical constraints to groundwater pumping. The City has more than adequate capacity from its well field to pump the 2,577 AFY it anticipates utilizing.

4.7.6 Summary of Groundwater Supply and Sufficiency

4.7.6.1 Summary of the City's Groundwater Supply

The City has revised its operational strategy from one of relying largely upon groundwater for supply to a conjunctive use strategy, which balances Agency supply, groundwater and recycled water. Table 4-9 illustrates the availability of the groundwater supply under a range of hydrologic conditions.

Table 4-9 Summary of City's Anticipated Groundwater Use

Hydrologic Condition	Through 2030 (AFY)	Comment
Normal Water Year	2,577	Groundwater supply will be use to enhance reliability. Use will consistent with the Water Policy Resolution
Single Dry Water Year	2,577	
Multiple Dry Water Year 1	2,577	
Multiple Dry Water Year 2	2,577	
Multiple Dry Water Year 3	2,577	

4.7.6.2 Summary of Groundwater Sufficiency

Maintaining sustainable groundwater supplies is one of the primary goals of groundwater management. As described above, DWR (1982a) described groundwater levels in the SRP Subbasin as "about in balance, with increased ground water levels in the northeast contrasting with decreased ground water levels in the south." In order to update DWR's 1982 (DWR, 1982a) evaluation of groundwater resources in Sonoma County and provide a current assessment of groundwater level trends and conditions, more than 100 water level hydrographs for wells in the SRV Groundwater Basin were prepared and reviewed. The updated analysis of groundwater levels showed an overall improvement in groundwater conditions compared to DWR's 1982 study. Groundwater levels were generally stable in the northeast but show significant improvement in the south. These water level trends reflect the basin's response to recharge and discharge (including pumpage). Although historical pumpage has not been expressly quantified for the SRP Subbasin since DWR's 1982 study, groundwater level trends within the basin indicate that historical pumpage has been sustainable. Thus, as previously reported by DWR (1982a), the basin is "in balance"; the updated analysis shows no evidence of overdraft conditions occurring in the groundwater basin.

Following the updated analysis of basin-wide groundwater conditions, and finding that groundwater supplies within the basin had been sufficient to meet historical water groundwater demands, the upper Laguna watershed, located in the southern portion of the SRV Groundwater Basin was selected for purposes of analyzing the future sufficiency of groundwater to meet the City's projected demands. A water budget was one of the analyses employed to evaluate the sufficiency of the groundwater supply, based on a 20-year projection. As discussed above, the watershed was determined to be an appropriate area for calculating a water budget (i.e., an accounting of all inflows and outflows to assess the change in groundwater storage) because the watershed boundaries provided the best available representation of true hydrologic boundaries. Accordingly, inflow and outflow across most of the upper watershed boundaries were assumed to be zero. In summary, this water budget analysis area allowed for a more accurate and reasonable analysis of future groundwater supply sufficiency to meet the City's projected demands than was possible for the entire SRV Groundwater Basin.

Future pumpage for the City and also pumpage by others (including other entities such as the City of Cotati and SSU and also private domestic, agricultural, and commercial wells) for the surrounding area was projected to 2025, including build out of Specific Plan areas that are in the planning stages. The maximum City pumpage in 2025 was assumed to be 2,577 AFY. As a result, future pumpage by the City is expected to be significantly less than the City's historical pumpage, which reached a high of 5,487 AF in 1995.

As a complement to the water budget analysis, an empirical analysis of the historical groundwater level and pumpage data resulted in an estimated range of pumpage within which the City and other pumpers in the southern portion of the SRP Subbasin could operate without causing persistent groundwater level declines. On the whole, groundwater levels within the SRP Subbasin have remained in balance and significantly increased in the southern portion of the SRP Subbasin since DWR's 1982 study (DWR, 1982a). As described in Sections 4.7.2 and 4.7.3, the City's as well as other projected pumpage for a 20-year horizon falls within a range that is historically demonstrated to have been sustainable. Thus, groundwater supplies from the basin are sufficient to meet the City's projected groundwater demands and also those of other pumpers.

5.0 RECYCLED WATER SUPPLY

The recycled water supply is one of three supply sources available to the City. This section describes the City's recycled water supply, its hydrologic availability, its water quality, various contracts that affect its use including provisions for transfers and exchange, its reliability and vulnerability, and water supply plans and programs being undertaken related to recycled water.

This Plan projects that 1,300 AFY of Agency supply will be available to the City based on analysis of the existing and planned recycled water system.

Section 10633 of the Act requires that this Plan include specific discussions related to the recycled water source. These are found in Section 5.1 Description of the Recycled Water Supply and summarized in the Table 5-1, below.

Table 5-1 Index of Additional Reporting Requirements for Recycled Water Supply

Requirement	Location in Document
Description and Quantification of the Wastewater System	Section 5.1.1
Description of Current Recycled Water Use in the Service Area	Section 5.1.2
Description and Quantification of Potential Recycled Water Uses	Section 5.1.3
Projected Use in the Service Area (5-year Increments)	Section 5.1.3
Description of Actions Taken to Encourage the Use of Recycled Water	Section 5.1.4
Plan of Optimizing the Use of Recycled Water	Section 5.1.4

Section 10633 of the Act also requires inter-agency coordination within the Service Area on the development of recycled water plans and projections. Table 5-2, below summarizes the agencies and interest groups that participate in coordinated recycled water planning within the City's service area.

Table 5-2 (DWR Table 32) Participating Agencies Table

Agency Type	Agency Name	Plan Development Role
Wholesale Water Supplier	Sonoma County Water Agency	Provided recycled water supply and demand information
Regional Wastewater Agency and Recycled Water Purveyor	Santa Rosa Subregional Water Reuse System	Provided recycled water supply and demand information
Local Water Supplier	City of Rohnert Park	Provided recycled water supply and demand information
Local Land Use Authority	City of Rohnert Park	Provided current and projected land uses
Public Constituency	Northeast Specific Plan Area Proponents	Provided land use and recycled water demand information
Public Constituency	University District Specific Plan Area Proponents	Provided land use and recycled water demand information
Public Constituency	Southeast Specific Plan Area Proponents	Provided land use and recycled water demand information
Public Constituency	Stadium Lands Development Plan Area Proponents	Provided land use and recycled water demand information

5.1 Description of the Recycled Water Supply

"Recycled water" is defined in the California Water Code as "water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur." CDPH sets the water quality criteria for specific uses of recycled water in Title 22 of the California Code of Regulations. The City currently utilizes recycled water as part of its water supply portfolio and plans to expand recycled water use concurrent with the implementation of its General Plan land use program.

5.1.1 Description and Quantification of the Wastewater System

The City currently provides wastewater collection service and is a partner in the Subregional System's wastewater treatment, disposal and water recycling system. The Subregional System is operated and managed by the City of Santa Rosa and includes:

- The Laguna Water Reclamation Plant (WRP), a tertiary wastewater treatment plant that utilizes aeration, clarification, conventional filtration, and ultraviolet disinfection;
- A permitted wet weather discharge to the Russian River of up to 5% of the river flow under the NPDES Permit CA 0022764;
- The forty-mile long Geysers Pipeline that delivers 11 mgd of recycled water, year round, to the Geysers Steamfield; and
- Approximately 62 miles of recycled water distribution piping that deliver recycled water to approximately 675 parcels for agricultural reuse and impoundment and approximately 100 parcels for urban reuse, largely in the cities of Rohnert Park and Santa Rosa.[17] This recycled water distribution system includes approximately 1,480 million gallons of storage[18] in open ponds.

The Subregional System's facilities have a rated dry weather capacity of 21.4 million gallons per day (mgd) and the City is allotted 3.43 mgd of the total capacity. The Subregional System facilities, including the existing Rohnert Park Reuse System, are illustrated in Figure 5-1.

Table 5-3 illustrates the current and projected volume of wastewater that is collected and treated at the Laguna WRP. The calculation is based on average dry weather flow rates.

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[17] Engineering Report for Master Water Recycling Permit for the City of Santa Rosa Water Reclamation System.
[18] Santa Rosa Incremental Recycled Water Program, Technical Memorandum No. 16 – Water Balance Modeling Summary

Table 5-3 (DWR Table 33-modified) Wastewater Collection and Treatment[19]

Type of Wastewater	2000 Volume (AFY)	2005 Volume (AFY)	2010 Volume (AFY)	2015 Volume (AFY)	2020 Volume (AFY)	2025 Volume (AFY)	2030 Volume (AFY)
Total volume of wastewater collected and treated by the Subregional System	19,600	20,250	22,700	25,000	29,000	30,600	31,700
Total quantity that meets recycled water standard	19,050	19,700	22,150	24,450	29,000	30,600	31,700
Volume of wastewater generated within the service area	3,950	4,350	4,790	5,200	5,650	6,050	6,500
Volume of recycled water used in the service area	976	1,135	1,200	1,300	1,300	1,300	1,300

While a great deal of the Subregional System's recycled water is used for urban, agricultural or industrial purposes, the Subregional System maintains a permitted discharge to the Russian River. The Subregional System is committed to supplying recycled water users first and its permitted discharge is used primarily to manage variations in hydrologic conditions (for example, in a cool wet year when rainfall is high and irrigation demand is low, the Subregional System will discharge more water than in a warm dry year when irrigation demand is high). Table 5-4 illustrates how discharges vary based on hydrologic cycles and summarizes analysis developed by the Subregional System in its Water Balance Model. A portion of these volumes is contributed by the City.

Table 5-4 (DWR Table 34 - modified) Disposal of Wastewater (Non-Recycled) by Subregional System[20]

Method of disposal	Treatment Level	Driest Year	10th percentile	Median (50th percentile)	90th percentile	Wettest
Modeled Discharge in AFY	Tertiary	4,800	5,400	7,200	12,900	13,500
Percentage of 2020 Flow that is Discharged		17%	19%	25%	45%	47%

5.1.2 Current Recycled Water Use in the City

The City hosts the largest urban recycled water system in Sonoma County. This system was installed in the 1990s and recycled water is used for irrigation of parks and school grounds, various commercial and industrial sites, and the Foxtail Golf Course. Recycled water use offsets historic demands on the City's potable water system and demands on irrigation wells. Recycled water use averages just over 1,000 AFY as illustrated in Table 5-5. The use is relatively constant,

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[19] Projections from 2000 through 2020 are sourced from the Incremental Recycled Water Program Master Plan (2004, CH2M Hill with Winzler & Kelly). Projections beyond 2020 are straight-line projections of current trends to assist in long range planning. These projections do not reflect General Plan projections or land use entitlements anticipated by any of the Subregional System partners.

[20] IBID

however because recycled water is used almost exclusively for irrigation purposes the demand can fluctuate with local rainfall patterns and attendant irrigation demands.

Table 5-5 (DWR Table 37-modified) Recycled Water Uses

Type of Use	2000 Use (AFY)	2001 Use (AFY)	2002 Use (AFY)	2003 Use (AFY)	2004 Use (AFY)	2005 Use (AFY)
Agriculture	0	0	0	0	0	0
Landscape	976	1,090	950	1,057	1,165	1,135
Wildlife Habitat	0	0	0	0	0	0
Wetlands	0	0	0	0	0	0
Industrial	0	0	0	0	0	0
Groundwater Recharge	0	0	0	0	0	0
Other (type of use)	0	0	0	0	0	0
Total	976	1,090	950	1,057	1,165	1,135

Note: No projections were made in the 2000 Urban Water Management Plan.

5.1.3 Potential and Projected Recycled Water Use

In 2004 the Subregional System completed its Incremental Recycled Water Program (IRWP) Master Plan and certified a programmatic EIR for the Master Plan. The 2004 IRWP Master Plan identified up to 6,600 AFY in potential urban and agricultural recycled water uses throughout Sonoma County. The 2004 IRWP Master Plan defined urban reuse as recycled water use that occurs within the Urban Growth Boundaries of the cities of Santa Rosa, Rohnert Park and Cotati or at the Santa Rosa Golf and Country Club. The 2004 IRWP Master Plan set a 1,500 AFY "Target" for urban reuse and established a programmatically approved range from 0 to 6,600 AFY to allow for the development of cost-effective systems from both the water and wastewater perspective. In 2007, the Subregional System updated its IRWP Master Plan and identified up to 3,000 AFY of urban reuse potential currently under study.[21]

Review of the City's planned development indicates that an additional 300 AFY of recycled water could be used for urban use, primarily in areas of new growth. Recycled water would be used for landscape irrigation in a variety of settings as authorized by California's Title 22 Code of Regulations.

The volume of actual and potential recycled water use is shown in Table 5-6. These projections are based upon the City's current practices, the IRWP analysis of available recycled water and the City's projections of future land uses and water needs. These projections are slightly different from the projections includes in the WSA, which projected 1,256 AFY available in 2010 and 1,302 AFY available in 2015. These slight differences are a result of ongoing planning activities by the Subregional System. Table 5-7 presents the projected future uses of recycled water in 5 year increments as required by the Act.

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[21] 2007 Update to the Recycled Water Master Plan, Table S-5.

Table 5-6 (DWR Table 35) Recycled Water Uses – Actual and Potential

Type of Use	Treatment Level	2005 Use (AFY)	2010 Use (AFY)	2015 Use (AFY)	2020 Use (AFY)	2025 Use (AFY)	2030 Use (AFY)
Agriculture							
Landscape	Tertiary	1,000	1,200	1,300	1,300	1,300	1,300
Wildlife Habitat							
Wetlands							
Industrial							
Groundwater Recharge							

Table 5-7 (DWR Table 36) Projected Future Use of Recycled Water in Service Area

Type of Use	2010 Use (AFY)	2015 Use (AFY)	2020 Use (AFY)	2025 Use (AFY)	2030 Use (AFY)
Agriculture	0	0	0	0	0
Landscape	1,200	1,300	1,300	1,300	1,300
Wildlife Habitat	0	0	0	0	0
Wetlands	0	0	0	0	0
Industrial	0	0	0	0	0
Groundwater Recharge	0	0	0	0	0
Total	1,200	1,300	1,300	1,300	1,300

5.1.4 Actions Taken and Plans for Optimizing the Use of Recycled Water

5.1.4.1 City Promotion of Recycled Water Use

The City has fully integrated recycled water use with its land use planning. Specifically within the Water Supply and Conservation Section of its 2000 General Plan, the City has adopted the following goals and policies

Goal PF-G: Continue to encourage water conservation through the use of reclaimed water and reduction of water consumption and discharge for both existing and new development.

Policy PF-21: Continue to use reclaimed water to irrigate parks, recreation facilities and landscapes.

On October 29, 2004, the City adopted its Ordinance 723, a Water Waste Ordinance. This Ordinance requires the use of recycled water when it is available and of appropriate quality. This Ordinance will assure that the recycled water supply is fully utilized where appropriate. A copy of the City's Water Waste Ordinance is included in Appendix F. This Ordinance provides City staff with the authority necessary to condition new development to install the infrastructure required to deliver recycled water.

On June 13, 2006 the City adopted its 2006 Public Facilities Finance Plan Update and revised its Public Facilities (PF) Fees. The PF Fees were established to provide a funding source for the infrastructure required to serve new development. The IRWP Master Plan and EIR have identified new seasonal storage as necessary to serve new urban reuse projects. The City's PF

Fees provide a funding mechanism for the construction of 300 AFY of new recycled water storage.

5.1.4.2 Subregional System Promotion of Recycled Water Use

The Subregional System's IRWP Master Plan and EIR provide critical programmatic guidance and planning support for an expanded recycled water system. The Subregional System's has historically priced recycled water at 75% of the alternative supply. This financial incentive provides property owners with a reason to convert to recycled water use.

5.1.4.3 Agency Promotion of Recycled Water Use

The Agency encourages recycled water use by collecting, as part of its water rates, funds that are held in a special reserve for water recycling and Tier 2 water conservation projects that are carried out by its Contractors. This funding source provides an incentive to the Contractors to invest in local recycling and conservation projects because the Agency will contribute to the costs of these projects. Because the City is working with the Subregional System to study the expansion of the recycled water system, it has not yet developed an application for funding under this program. However, because the City is a Contractor, it will be eligible to utilize these funds to supplement its PF funding for the recycled water system expansion.

The Agency's Program has been effective in promoting local projects. A total of $4,187,464 has been disbursed between the program's inception on July 1, 2000 and June 30, 2005. It is anticipated another $8,812,536 will be disbursed in the next five years of program operation. Methods to encourage recycled water use and the projected amount of recycled water used are listed in Table 5-8.

Table 5-8 (DWR Table 38) Methods to Encourage Recycled Water Use

Actions	Additional AFY of use projected to result from this action				
	2010	2015	2020	2025	2030
City General Plan Policies	✓	✓	✓	✓	✓
City Mandatory Use Ordinance	✓	✓	✓	✓	✓
City PF Fee Funding	✓	✓	✓	✓	✓
Subregional System Planning Support	✓	✓	✓	✓	✓
Subregional System Financial Incentives	✓	✓	✓	✓	✓
Agency Financial Incentives	✓	✓	✓	✓	✓
Total Additional Use as a Result of Combined Incentives	200	100	0	0	0

5.2 Hydrologic Availability of the Recycled Water Supply

The recycled water supply available to the City is relatively drought-proof because of the operational nature of the Subregional System's recycled water program. The Subregional System facilities include extensive recycled water storage ponds, Subregional System owned land ("City Farms"), facilities to deliver recycled water to customers including urban and agricultural users and the Geysers Steamfield, and facilities to discharge recycled water under an NPDES permit.

The Subregional System treats and stores recycled water for reuse by its customers. The volume of wastewater recycled is relatively constant, but the total volume of water available to the System is influenced by rainfall on the open storage ponds. During periods of lower rainfall, the system can be operated to minimize discharges to the Russian River and delivery of water to the City Farms in order to assure delivery to paying recycled water customers first. The Subregional System's Water Balance Model helps guide operational decisions related to discharge versus reuse. Table 5-4, presented previously, illustrates how the volume of water discharged is reduced in drier years. The Subregional System has operational flexibility and the ability to meet recycled water demands under a range of hydrologic conditions. Expanding the recycled water system will require additional seasonal storage facilities in order to retain this level of flexibility. Section 5.6 discusses planned expansions.

5.3 Quality of the Recycled Water Supply

The Subregional System produces Title 22 Tertiary Recycled Water, which is suitable for unlimited irrigation uses and most industrial process water uses. Without additional treatment, the recycled water supply is not suitable for potable use.

5.4 Contracts for Recycled Water Supply

The Subregional System currently maintains a contract with each individual user of the Rohnert Park Urban Reuse system, including the City. These contracts are included in the Subregional System's Engineering Report for Master Water Recycling Permit for the City of Santa Rosa Water Reclamation System. The Contracts outline the acreage, which is committed to recycled water use, and generally provide for a 20-year term.

Recycled water service can only be suspended as a result of inadequate treatment of recycled water (a temporary situation) or regulatory directive (i.e., changes in the CDPH or Regional Board Regulations regarding the use of recycled water for landscape irrigation). These regulatory requirements are well established, well tested and have been the basis of recycled water use throughout the State for over 30 years

5.4.1 Transfers and Exchanges of Recycled Water

Because of the Title 22 requirements for site-specific documentation on recycled water use, the Subregional System's current contracts for recycled water use do not provide for transfers or exchanges of recycled water between users.

5.5 Reliability and Vulnerability of the Recycled Water Supply

As noted in Section 5.2 above, the recycled water supply is highly reliable under a range of hydrologic conditions. Because highly treated recycled water can always be drawn from the Subregional System's network of seasonal storage ponds, this supply is not vulnerable to interruption because of temporary issues related to the treatment of the recycled water.

5.6 Plans and Programs Related to the Recycled Water Supply

Planned recycled water use will reach 1,300 AFY. Expansion to the City's recycled water system has been documented in the IRWP EIR prepared by the Subregional Water Recycling System. The system expansions are anticipated to begin to be available in 2010. Recycled water use would increase over time as new development connects to the system.

Expansion of the recycled water system allows for additional irrigation with recycled water in order to offset new demands on the potable water system. Expansion of the recycled water system will require the addition of approximately 300 AFY of recycled water storage and modifications to the recycled water distribution facilities in the City. The IRWP EIR has provided an overview of these facilities and their potential impacts. The City is currently working with the Subregional System to develop project level proposals.

5.7 Summary of the Recycled Water Supply

The City benefits from established recycled water infrastructure and established contracts with the recycled water purveyor. The City has worked to support the development of additional recycled water supplies through its planning and policy documents. Because of the inherent flexibility of the Subregional System facilities, the recycled water is not subject to hydrologic variation. Table 5-9 below summarizes the City's projections of the recycled water supply available from the Subregional System.

Table 5-9 Summary of City's Anticipated Supply from Subregional System

Hydrologic Condition	Total 2020 Recycled Water Supply from the Subregional System (AFY)	Recycled Water Supply Available to City (AFY)
Normal Year	29,000	1,300
Single Dry Year	29,000	1,300
Multiple Dry Year 1	29,000	1,300
Multiple Dry Year 2	29,000	1,300
Multiple Dry Year 3	29,000	1,300

6.0 PAST, CURRENT AND PROJECTED WATER USE

This section presents information regarding demographics, current and past water use, and projections of future City water demands. This section also discusses the City's current and planned demand management strategies and the impact that these will have on overall water demands. The detailed analysis supporting this section is found in Appendix G.

Based on the analysis presented in this Section, the City anticipates a total annual water demands as follows:

2010	2015	2020	2025	2030
8,316.4 AFY	8,680.3 AFY	8,962.0 AFY	9067.3 AFY	9,131.3 AFY

6.1 Current and Projected City Land Uses

The City's General Plan describes the City's land use plans, projected growth and growth management strategies. The General Plan outlines a balanced land use strategy that provides for both housing and economic growth. The General Plan includes policies that implement the City's voter-approved Growth Management Ordinance. In 2004, the City utilized its General Plan to develop Table 6-1 below which outlines projected land uses consistent with the categories defined in Section 10631(e)(1) of the Act. In 2004, the City calculated that this land use pattern would result in a total annual water demand of 9,499 AFY in 2025.

Table 6-1 Projected Development Pattern

Land Use Class	Unit	2005	2010	2015	2020	2025
SFR Detached	EA	7,492	8,352	8,737	8,933	8,933
SFR Attached	EA	3,039	3,518	3,631	3,744	3,744
MFR & Mobile	EA	6,035	6,696	7,336	7,687	7,687
Commercial/ Retail	AC	322	407	437	467	467
Industrial	AC	328	371	436	500	500
Office	AC	47	54	68	77	77
Public	AC	93	93	93	93	93
Irrigation –potable	AC	70	28	28	28	28
Irrigation - recycled	AC	452	536	546	546	546

These land use classes are consistent with the General Plan but do not reflect the Customer Classes included in the City's billing database.

6.2 Base Water Use Projections

6.2.1 Past Water Use

Because the City installed single-family residential water meters in 2003, it does not have a long period of record for metered water use per customer class. However, the City does have data on total water use including well pumpage records and water sale records from both the Agency and the Subregional System. A weather-normalized, linear regression analysis was performed on the City's total potable water use in order to arrive at an estimate of per capita water use for the purposes of future planning. A summary of this analysis is included in Appendix G-1, which includes both residential and commercial demand factors (June 24, 2005 and October 26, 2005 Memorandum both by Maddaus Water Management).

The linear regression analysis indicates that between 1995 and 2005 the City's per capita consumption was reduced from approximately 175 gallons per capita per day (gpcd) to 146 gpcd. With the City's "average household size" of approximately 2.6 persons per household, this translates into an average residential demand of approximately 380 gallons per day per residential account. Four major factors have contributed to this reduction in demand including:

- The Rohnert Park Urban Reuse System became operational in the late 1990s. As a result, recycled water use offset potable water use and reduced the overall demand on the potable water system.
- The City replaced over 9,000 residential toilets with low-flow toilets resulting in reduced system demand.
- The City, with the assistance of a DWR grant, installed residential water meters and began commodity-based pricing of its water resulting in reduced system demand.
- The City experienced the loss of a major industrial land use, which resulted in temporarily reduced system demand. The City anticipates demand will recover as the land use is redeveloped. The demand projections are based on metered connections and, hence, will model recovery of this demand.

The results of the linear regression analysis were used to arrive at estimated base year water use factors for various Customer Classes included in the City's water billing database. These are presented in Table 6-2 below. The estimated base year water use factor for new single family residential uses was set higher than existing users. As described in Section 6.3, below, there is a class of Best Management Practices applied specifically to New Development that adjusts this demand based on conservation practices that are uniquely applicable to new construction.

Table 6-2 Base Year Water Use Factors

Customer Class	Water Use Factor (gpd/account)
Single Family	380
Multifamily [a]	2,740
Commercial[a]	1,980
Institutional/Industrial[a]	2,520
New Single Family	395

a Each Multifamily account includes multiple residential units therefore the Multifamily count will not correspond to Land Use based projections which make estimates based on individual units. Each Non-Residential account includes a single meter. The property served by the meter may be more or less than one acre in size, therefore the customer class count will not correspond to the land use projections, which are based on acreage.

6.2.2 Base Demand Projections

Working with the Agency, the City developed a Water Demand Model that projected future water use based on input data including past water use, planned land use patterns, and the effects of the Plumbing Code changes. This modeling effort is documented in a memorandum titled *Customer Water Demand Projections City of Rohnert Park Summary of Data Inputs,* *Assumptions and Results* (Maddaus Water Management, November 7, 2005 hereinafter the Water Demand Projections Memo), which is included as Appendix G-2.

The Water Demand Model used Customer Classes from the City's water billing database. These customer classes are based on actual metered water connections, which differ from the General Plan Land Use data for two principal reasons:

- The General Plan land use data accounts for individual multifamily residences. However, multifamily residences are not "sub-metered" therefore a single multifamily connection will include multiple units;
- The General Plan land use data accounts for non-residential land uses by acreage. However, non-residential land uses are individually metered and these connections may be more or less than 1 acre.

The General Plan growth projections were applied to the various Customer Classes in the water billing database to arrive at a reasonable projection of growth in Customer Classes. These projections are discussed in Appendix G-2 and presented in Table 6-3 below in accordance with Section 10631(e) (1) of the Act.

Table 6-3 Customer Classes – Current and Projected

	Number of Accounts per Customer Class [a]					
Year	Single-Family	Multifamily	Commercial	Institutional-Industrial	New Single Family	Total
2000	N/A	N/A	N/A	N/A	N/A	8,794
2005	7,655	438	623	24	166	8,907
2010	7,655	479	649	25	999	9,807
2015	7,655	511	675	26	1,604	10,471
2020	7,655	544	701	27	2,206	11,134
2025	7,655	544	771	30	2,206	11,206
2030	7,655	544	812	32	2,206	11,248

a Customer Classes from the water billing database will not conform to General Plan projections for multifamily and non-residential land uses for the reasons described above. The Single Family and New Single Family classes are consistent with the General Plan.

The Water Demand Projection Memo was used by the Agency to develop its 2005 Plan and during that process the model output was adjusted to account for inaccuracies created by rounding some of the input variables and results. This adjustment rounding resulted in an approximately 0.5% decrease in predicted demands. The adjustment is summarized by the *DSS Model Output in Graphical Form Spreadsheet* (Maddaus Water Management, March 26, 2006), which is also included in Appendix G-2. In the Agency's 2005 Plan, the adjustment was applied to the City's total demands and was not carried through to the individual customer classes. For this Plan, the City performed the calculations necessary to carry the rounding adjustments documented in the *DSS Model Output in Graphical Form Spreadsheet* back through the individual customer classes. This calculation is included in Appendix G-2.

Table 6-4 below presents demands by Customer Class. As noted above, because the City applied the rounding adjustments to each class, these demands are slightly lower than indicated in the

Water Demand Projections Memo, though the totals are consistent with the final conclusions presented in the Agency's 2005 Plan.

Table 6-4 (DWR Table 12) Past, Current, and Projected Water Deliveries

			Customer Classes					
			Single-Family	Multifamily	Commercial	Institutional-Industrial	New Single Family	Total
2000[a]	Un-metered	# of accounts	N/A	N/A	N/A	N/A	N/A	8,794
		Deliveries AFY	N/A	N/A	N/A	N/A	N/A	7,222
2005	Metered	# of accounts	7,655	438	623	24	166	8,907
		Deliveries AFY	3,256.0	1,368.0	1,380.0	68.0	74.0	6,146.0
2010	Metered	# of accounts	7,655	479	649	25	999	9,807
		Deliveries AFY	3,226.6	1,456.1	1,424.2	70.7	439.9	6,617.5
2015	Metered	# of accounts	7,655	511	675	26	1,604	10,471
		Deliveries AFY	3,203.0	1,516.4	1,474.6	73.6	706.5	6,974.1
2020	Metered	# of accounts	7,655	544	701	27	2,206	11,133
		Deliveries AFY	3,176.2	1,574.1	1,527.4	76.6	971.2	7,325.5
2025	Metered	# of accounts	7,655	544	771	30	2,206	11,206
		Deliveries AFY	3,151.4	1,556.8	1,673.2	83.6	971.5	7,436.5
2030	Metered	# of accounts	7,655	544	812	32	2,206	11,249
		Deliveries AFY	3,132.7	1,543.5	1,759.4	88.6	971.3	7,495.5

Source: "Customer Demand Projections, City of Rohnert Park Summary of Data Inputs, Assumptions, and Results", Maddaus Water Management, November 7, 2005 with adjustments to match DSS Model Output in Graphic Form, Maddaus Water Management, May 26, 2006.

6.2.3 Unaccounted-for Water and Additional Water Use

Unaccounted-for-water is un-metered water use, such as that used for fire protection and training, system and street flushing, sewer cleaning, construction, system leaks, as well as that used by unauthorized connections. Unaccounted-for water use can also result from meter inaccuracies. Finally, the City's unaccounted-for-water calculations include its recycled water use because this use was not accounted for in the demand projections developed from potable water system data. Table 6-5 provides the estimated quantity of unaccounted-for-water. More details on the assumptions made to estimate system losses are presented in Appendix G-2.

At this time, the City does not use water for groundwater recharge, to prevent salt water intrusion (saline barriers), or for other conjunctive uses. The City has a recycled water supply, described in Chapter 5. The existing demands on this supply average at approximately 1,000 AFY and this average demand is presented in Table 6-5. The City anticipates that some future irrigation demands will also be met by recycled water, and this future use is also accounted for in Table 6-5.

Table 6-5 (DWR Table 14) Additional Water Uses and Losses

Water Use	2000 AFY	2005 AFY	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Saline barriers	0	0	0	0	0	0	0
Groundwater recharge	0	0	0	0	0	0	0
Conjunctive use	0	0	0	0	0	0	0
Raw water	0	0	0	0	0	0	0
Recycled	1,000	1,000	1,200	1,300	1,300	1,300	1,300
Other	0	0	0	0	0	0	0
Unaccounted-for system losses	NA	633.0	717.6	757.2	795.0	804.3	814.0
Total	1,000	1,633.0	1,917.6	2,057.2	2,095.0	2,104.3	2,114.0

Source: "Customer Demand Projections, City of Rohnert Park Summary of Data Inputs, Assumptions, and Results", Maddaus Water Management, November 7, 2005

6.2.4 Water Sales to Other Agencies

The City does not currently sell water to other agencies.

6.3 Demand Management

6.3.1 Current Demand Management Practices

The City is a member of the California Urban Water Conservation Council (CUWCC) and a signatory to the Memorandum of Understanding Regarding Urban Water Conservation (MOU). As signatory to the MOU, the City has pledged its good faith effort towards implementing 14 Best Management Practices (BMPs) related to urban water conservation. The City signed the CUWCC MOU on June 12, 2002. The City implements BMPs and submits reports with assistance from the Agency.

Urban water suppliers that are members of the CUWCC may submit their most recent BMP Annual Report for reporting years 2003-04 to meet the requirements of DWR Water Code Section 10631 (f). It is also recommended that urban water suppliers include the Coverage Reports identifying the water supplier's progress on meeting the coverage requirement for quantifiable BMPs. The City's annual BMP Reports and Coverage Reports are included in Appendix H.

6.3.2 Projected Savings from Planned Water Conservation and New Development Standards

Together with the Agency, the City and the other Contractors developed three major conservation strategies that could result in savings beyond that modeled for BMP implementation for existing customers and plumbing code savings. This effort is discussed in detail in a memorandum titled *FINAL Tier Two and New Development Conservation Measure Evaluation Summary of Data Inputs, Assumptions and Results* (Maddaus Water Management, November 2, 2006), which is included as Appendix G-3. These methods are briefly described below and the predicted additional water savings are outlined in Table 6-6.

- Tier 1 Conservation for New Development: As noted above, the base demand factor for new development is higher than that for existing development. The Tier 1 Conservation for New Development savings are the water savings that are estimated to occur from the implementation of the 14 Best Management Practices by new development.
- Tier 2 Water Conservation: Tier 2 Water Conservation Measures include thirteen additional water management practices, which go beyond the 14 BMPs. These management practices could be employed by all development within the City and include such strategies as rebates and incentives for landscape irrigation upgrades, rebates and incentives for certain Commercial, Industrial and Institutional customers and rebates and incentives for high-efficiency residential appliances.
- New Development Standards: New development standards include eight water management strategies which can be incorporated by design for development. The standards include both indoor fixture standards and irrigation and landscape standards.

Table 6-6 Savings-Related Tier 2 Water Conservation and New Development Standards

	2005 AFY	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Tier 1 Water Conservation for Future	69.2	128.3	131.7	130.6	128.0	125.7
Tier 2 Water Conservation Measures	0	31.9	91.8	132.2	149.8	156.8
New Development Standards	0	58.5	127.5	195.7	195.7	195.7
Total	69.2	218.7	351.0	458.5	473.5	478.2

Source: “Final Tier Two and New Development Conservation Measure Evaluations Summary of Data Inputs, Assumptions, and Results”, Maddaus Water Management, November 2, 2006.

6.4 Total Water Use

Total water use for the system is calculated by adding the demands presented in Table 6-4 to the unaccounted-for water presented in Table 6-5 and subtracting the additional water conservation savings presented in Table 6-6. This calculation is summarized in Table 6-7.

The City is managing its water supply portfolio in a manner consistent with the Temporary Impairment MOU. It is using local groundwater and recycled water supplies to meet peak demands and reduce the impacts on the Agency’s system.

Table 6-7 (DWR Table 15) Total Water Use

Water Use	2000 AFY*	2005 AFY	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Single Family		3,256.0	3,226.6	3,203.0	3,176.2	3,151.4	3,132.0
Multi Family		1,368.0	1,456.1	1,516.4	1,574.1	1,555.8	1,543.5
Commercial		1,380.0	1,424.2	1,474.6	1,528.0	1,673.2	1,759.4
Institutional-Industrial		68.0	70.7	73.6	76.6	83.6	88.6
New Single Family		74.0	439.9	706.5	971.2	971.5	971.3
Subtotal	**7,222.0**	**6,146.0**	**6,617.5**	**6,974.1**	**7,325.5**	**7,436.5**	**7,495.5**
Additional Water Uses & Losses	1,000	1,633.0	1,917.6	2,057.2	2,095.0	2,104.3	2,114.0
Tier 2 & New Development		(69.2)	(218.7)	(351.0)	(458.5)	(473.5)	(478.2)
Total water use	**8,222.0**	**7,709.8**	**8,316.4**	**8,680.3**	**8,962.0**	**9,067.3**	**9,131.3**

*City did not have residential water meters in 2000, so water use data by demand class is not available. Demand on Wholesale Supply

7.0 WATER SHORTAGE CONTINGENCY PLAN

This section presents information regarding the City's Water Shortage Contingency Plan. The City's policies are codified in Section 13.66 of the Municipal Code, included as Appendix I.

7.1 Actions in Response to Water Supply Shortages & Catastrophic Interruptions

The City Council has the authority to declare a water shortage emergency by Resolution. Emergencies are declared in three stages with specific reduction methods used for each stage as described in Section 7.2 below.

7.2 Consumption Reduction Methods

The consumption reduction methods used to achieve Stage 1 Voluntary Conservation are outlined Section 13.66.050(A) and include:

- Application of irrigation water only during the evening and early morning hours;
- Inspection of all irrigation systems, repair of leaks, and adjustment of spray heads;
- Reduction of irrigation run-times consistent with fluctuations in weather;
- Reduction of irrigation run-times if water begins to run off the irrigation site;
- Utilization of water conservation information, incentive, rebate and giveaway programs offered by the City.

The consumption reduction methods used to achieve Stage 2 Mandatory Compliance Water Alert are outlined in Section 13.66.050(B) and include:

- Prohibitions against filling of swimming pools, noncommercial washing of privately-owned motor vehicles, use of water from a fire hydrant (except for essential needs), use of water for dust control at construction sites;
- Mandatory twenty percent reductions for vehicle washing facilities; and
- Mandatory twenty percent reductions for non-residential uses.

The consumption reduction methods for Stage 3 Mandatory Compliance Water Emergency are outlined in Section 13.66.050(C) and include:

- All Stage 2 Prohibitions;
- Prohibitions against watering residential or non-residential lawns;
- Prohibitions against new landscaping plantings except for designated drought resistant landscaping;
- Prohibitions against all but hand-held irrigation.

7.3 Additional Prohibitions against Specific Water Uses

In addition to the emergency stage consumption reduction methods, the Municipal Code specifies other prohibited water uses. Specifically these include:

- Washing of sidewalks, walkways, driveways, parking lots and other hard-surfaced areas by direct hosing, except in specific circumstances (Section 13.62.030(A));
- The escape of water through breaks or leaks within the customer's plumbing or private distribution system (Section 13.62.030(B));
- Irrigation in a manner or to an extent which allows excessive runoff (Section 13.62.030(C));
- Washing cars, boats, trailers or other vehicles with a hose not equipped with a shutoff nozzle (Section 13.62.030(D));
- Water for non-recycling decorative water fountains (Section 13.62.030(E));
- Water for single pass evaporative cooling systems for air conditioning (Section 13.62.030(F));
- Water for new non-recirculating conveyor car wash systems (Section 13.62.030(G));
- Water for new non-recirculating industrial clothes washing systems (Section 13.62.030(H)); and
- Use of potable water when recycled water of adequate quality is available (Section 13.62.040).

7.4 Penalties and Charges for Excessive Use

Section 13.66.070 of the Municipal Code outlines the City's enforcement authority. Steps and penalties that the City will employ include:

- Personal contact with the customer
- Delivery of written notice
- Installation of a flow restricting device
- Imposition of water waste fees.

7.5 Effect on Revenues and Expenditures

The City manages its Water Enterprise to maintain cash reserves. The City's FY 2006-2007 Budget indicates that annual revenues are approximately $ 6,600,000 and annual operational expenses (i.e., all expenses except capital project construction) are approximately $6,200,000. Annual revenues exceed base operational costs by approximately $400,000. Because of this, the City's Water Enterprise Fund currently has a cash reserve balance of approximately $3,200,000, which is over 50% of the City's annual operational expenses.

Should the City experience a drop in revenues as a result of a water shortage emergency, it would defer capital projects as necessary and use available reserves to cover operational expenses.

7.6 Water Shortage Contingency Ordinance

As noted above, the City has adopted a Water Shortage Emergency Plan which was codified by Ordinance in Section 13.66 of the Municipal Code and which is attached as Appendix I.

7.7 Mechanisms for Determining Actual Reductions

The City's wells and Agency supply turnouts are all equipped with water meters. In addition, each potable and recycled water customer is metered. Non-residential landscape irrigation is metered separately from indoor use at the site. The City reads meters on a monthly basis and is able to document both demand reductions and a-typically high water use. The City contacts individual customers to resolve issues related to a-typically high water use.

8.0 WATER SUPPLY VERSUS DEMAND COMPARISON

This section synthesizes the water supply information developed in Chapters 3, 4 and 5 and compares this to the City's projected demands which were developed in Chapter 6. Comparisons are provided under DWR's required range of hydrologic conditions including the Normal, Single Dry and Multiple Dry Year scenarios.

8.1 Summary of Supply

The City has three sources of water supply: Agency supply, groundwater, and recycled water. Opportunities for the use of desalinated water were not evaluated because neither the ocean nor San Pablo Bay is in close proximity to the City and because neither brackish nor impaired groundwater is present. Table 8-1 summarizes the City's supplies.

The City is able to balance these supplies as necessary to meet demands and minimize impacts. For example, the City currently reduces its use of Agency supply between June and September in accordance with the Temporary Impairment MOU. During these months the City includes groundwater and recycled water in its supply mix. Outside the months of June to September, the City minimizes its use of groundwater, drawing primarily on the Agency supply, in accordance with its General Plan policies.

Table 8-1 (DWR Table 4) Current and Planned Water Supplies

Water Supply Sources	2005 AFY	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Sonoma County Water Agency	6,372.0	6,372.0	6,372.0	6,372.0	6,372.0	6,372.0
Supplier produced groundwater	2,577.0	2,577.0	2,577.0	2,577.0	2,577.0	2,577.0
Supplier surface diversions	0.0	0.0	0.0	0.0	0.0	0.0
Transfers in or out	0.0	0.0	0.0	0.0	0.0	0.0
Exchanges in or out	0.0	0.0	0.0	0.0	0.0	0.0
Recycled water	1,000.0	1,200.0	1,300.0	1,300.0	1,300.0	1,300.0
Desalination	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0
Total	9,949.0	10,149.0	10,249.0	10,249.0	10,249.0	10,249.0

The Subregional System is planning a project that will result in the supply expansions outlined in Table 8-1. Table 8-2 summarizes the future recycled water supplies that would result from this planning.

Table 8-2 (DWR Table 17) Future Water Supply Projects

Project Name	Projected Start Date	Projected Completion Date	Normal Year Yield to City (AFY)	Single Dry Year Yield To City (AFY)	Multiple Dry Year Yield to City		
					Year 1 (AFY)	Year 2 (AFY)	Year 3 (AFY)
Subregional System's IRWP[a]	2008	2015	300.0	300.0	300.0	300.0	300.0
Total			300.0	300.0	300.0	300.0	300.0

[a] The Subregional System has completed a Program EIR and is beginning community specific feasibility studies related to expanded urban water recycling.

The City has two wholesale water suppliers: the Agency and the Subregional System. Table 8-3 illustrates the projected amount of water that the City expects to purchase from these suppliers to meet water demands in the future. The City has existing contracts for up to 7,500 AFY of Agency supply and 1,000 AFY of Subregional System recycled water supply. As described in Chapter 3, the City does not believe it is prudent to rely on its full contractual allocation from the Agency. As described in Chapter 5, the City believes it is reasonable to assume that the planned recycled water system expansion will occur because: 1) it is within the scope of the Subregional System's IRWP Master Plan, 2) documentation under CEQA is complete, and 3) funding mechanisms have been established and predesign efforts are underway.

Table 8-3 (DWR Table 19) City Demand Projections to Wholesale Suppliers

Wholesaler	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Sonoma County Water Agency	6,372.0	6,372.0	6,372.0	6,372.0	6,372.0
Subregional System IRWP	1,200.0	1,300.0	1,300.0	1,300.0	1,300.0

8.2 Water Supply Reliability

The reliability of the City's water sources is summarized in Tables 8-4a and 8-4 b and supported by data presented in Tables 8-5 and 8-6. These tables are a comprehensive presentation of the City's supply and include wholesaler information from both the Agency and the Subregional system. The City's analysis relies upon the Agency's existing permitted water rights, which are more restrictive than any hydrological conditions.

Table 8-4a (DWR Table 8- modified) Current Supply Reliability Percent of Normal

			Multiple Dry Water Years		
Sources	**Normal Water Year**	**Single Dry Water Year**	**Year 1**	**Year 2**	**Year 3**
Sonoma County Water Agency	6,372.0	6,372.0	6,372.0	6,372.0	6,372.0
Groundwater	2,577.0	2,577.0	2,577.0	2,577.0	2,577.0
Recycled Water	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
Totals	9,949.0	9,949.0	9,949.0	9,949.0	9,949.0
Percent of Normal	100%	100%	100%	100%	100%

Table 8-4b (DWR Table 8- modified) Year 2030 Supply Reliability Percent of Normal

			Multiple Dry Water Years		
Sources	**Normal Water Year**	**Single Dry Water Year**	**Year 1**	**Year 2**	**Year 3**
Sonoma County Water Agency	6,372.0	6,372.0	6,372.0	6,372.0	6,372.0
Groundwater	2,577.0	2,577.0	2,577.0	2,577.0	2,577.0
Recycled Water	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0
Totals	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of Normal	100%	100%	100%	100%	100%

Table 8-5 lists the years upon which the data in Table 8-4a and 8-4b are based.

Table 8-5 (DWR Table 9) Basis of Water Year Data

Water Year Type	Base Year(s)	Historical Sequence
Normal Water Year	1962	Slightly dry and preceded by 2 similar years
Single-Dry Water Year	1977	Single driest year on record
Multiple-Dry Water Years	1990-1992	Driest 3 year period with full operation of the Russian River System[22]

Note: Sonoma County Water Agency, 2005 Urban Water Management Plan, page 3-4

Factors resulting in inconsistency of supply are summarized in Table 8-6. The City's current Agency supply, groundwater supply and recycled water supply are all highly stable.

The Agency's proposed supply increase is not predictable, particularly with respect to the schedule upon which it can be delivered. While the Agency anticipates the increased supply will be available after 2020, the City has assumed that the supply will not be available until after 2030. The anticipated increase in recycled water deliveries is highly predictable as discussed in Chapter 5 of this Plan.

Table 8-6 (DWR Table 10) Description of the Factors Resulting in Inconsistency of Supply

Name of supply	Legal	Environmental	Water Quality	Climatic
Sonoma County Water Agency	Current supply is stable with regard to these factors. Future supply increase may not be stable due to delays in construction, approval of water rights application, or in environmental documentation		None	Current supply is stable with respect to climate and hydrology. Future supply increase could be curtailed by drought conditions.
Groundwater	None	None	None	None
Recycled water	None	None	None	None

8.3 Water Quality Impacts on Future Water Supply

The quality of the City's water deliveries is regulated by the CDPH, which requires regular collection and testing of water samples to ensure that the quality meets regulatory standards for potable and recycled water. The City, the Agency and the Subregional System perform water quality testing, which has consistently yielded results within the acceptable regulatory limits (Dyett & Bhatia, 2000).

The quality of existing surface water, groundwater, and recycled water supply sources over the next 25 years is expected to be adequate. Surface and groundwater water will continue to be treated to drinking water standards, and no surface water, groundwater, or recycled water quality deficiencies are foreseen to occur in the next 25 years. Table 8-7 summarizes the current and projected water supply changes due to water quality.

[22] The 1990-1992 dry period occurred after the construction of Lake Mendocino and Lake Sonoma and at a time when the Agency's permitted water rights were 75,000 AFY.

Table 8-7 (DWR Table 39) Current and Projected Water Supply Changes due to Water Quality – Percentage

Water Source	2005	2010	2015	2020	2025	2030
Sonoma County Water Agency	0	0	0	0	0	0
Groundwater	0	0	0	0	0	0
Recycled water	0	0	0	0	0	0
Total	0	0	0	0	0	0

8.4 Normal Year Water Supply vs. Demand Comparison

The analysis compares the projected Normal Year water supply available to the City and projected customer demands from 2010 to 2030, in five-year increments. The projected available Normal Year supply and demands are presented in Tables 8-8 and 8-9, respectively. The comparison of projected water supply and demand is presented in Table 8-10.

Table 8-8 (DWR Table 40) Projected Normal Year Water Supply

(from DWR Table 4)	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Supply[a]	10,149.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of year 2005	102%	103%	103%	103%	103%

Table 8-9 (DWR Table 41) Projected Normal Year Water Demand

(from DWR Table 15)	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Demand	8,316.4	8,680.3	8,962.0	9,067.3	9,131.3
Percent of year 2005	108%	113%	116%	118%	118%

Table 8-10 (DWR Table 42) Projected Normal Year Supply and Demand Comparison

	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Supply totals	10,149.0	10,249.0	10,249.0	10,249.0	10,249.0
Demand totals	8,316.4	8,680.3	8,962.0	9,067.3	9,131.3
Difference	1,832.6	1,568.7	1,287.0	1,181.7	1,117.7
Difference as Percent of Supply	18.1%	15.3%	12.6%	11.5%	10.9%
Difference as Percent of Demand	22.0%	18.1%	14.3%	13.0%	12.2%

8.5 Single Dry Year Water Supply vs. Demand Comparison

Tables 8-11 through 8-13 provide a comparison of a Single Dry Year water supply with projected total water use over the next 25 years, in five-year increments. Because the City has based its planning on the Agency's current water rights and because those rights are more restrictive than any hydrologic condition, including the Single Dry Year condition, this comparison is identical to the Normal Year Comparison.

Table 8-11 (DWR Table 43) Projected Single Dry Year Water Supply

	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Supply	10,149.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-12 (DWR Table 44) Projected Single Dry Year Water Demand

	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Demand	8,316.4	8,680.3	8,962.0	9,067.3	9,131.3
Percent of projected normal	100%	100%	100%	114%	115%

Table 8-13 (DWR Table 45) Projected Single Dry Year Supply and Demand Comparison

	2010 AFY	2015 AFY	2020 AFY	2025 AFY	2030 AFY
Supply totals	10,149.0	10,249.0	10,249.0	10,249.0	10,249.0
Demand totals	8,316.4	8,680.3	8,962.0	9,067.3	9,131.3
Difference	1,832.6	1,568.7	1,287.0	1,181.7	1,117.7
Difference as Percent of Supply	18.1%	15.3%	12.6%	11.5%	10.9%
Difference as Percent of Demand	22.0%	18.1%	14.3%	13.0%	12.2%

8.6 Multiple Dry Year Water Supply vs. Demand Comparison

Tables 8-14 through 8-28 compare the total water supply available in Multiple Dry Years with projected total water use over the next 25 years, in one-year increments. Because the City has based its planning on the Agency's current water rights and because these current water rights are more restrictive than any hydrologic condition, including the Multiple Dry Year condition, this comparison is generally similar to the Normal Year comparison, although the year-by-year comparison provides additional detail.

Table 8-14 (DWR Table 46) Projected Supply during Multiple Dry Year Period Ending in 2010

	2006 AFY	2007 AFY	2008 AFY	2009 AFY	2010 AFY
Supply	9,949.0	9,949.0	9,949.0	9,949.0	10,149.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-15 (DWR Table 47) Projected Demand Multiple Dry Year Period Ending in 2010

	2006 AFY	2007 AFY	2008 AFY	2009 AFY	2010 AFY
Demand	7,831.1	7,952.4	8,073.8	8,195.1	8,316.4
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-16 (DWR Table 48) Projected Supply and Demand Comparison during Multiple Dry Year Period Ending in 2010

	2006 AFY	2007 AFY	2008 AFY	2009 AFY	2010 AFY
Supply totals	9,949.0	9,949.0	9,949.0	9,949.0	10,149.0
Demand totals	7,831.1	7,952.4	8,073.8	8,195.1	8,316.4
Difference	2,117.9	1,996.6	1,875.2	1,753.9	1,832.6
Difference as Percent of Supply	21.3%	20.1%	18.6%	17.6%	18.0%
Difference as Percent of Demand	27.0%	25.1%	23.2%	21.4%	22.0%

Table 8-17 (DWR Table 49) Projected Supply during Multiple Dry Year Ending in 2015

	2011 AFY	2012 AFY	2013 AFY	2014 AFY	2015 AFY
Supply	10,149.0	10,149.0	10,149.0	10,149.0	10,249.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-18 (DWR Table 50) Projected Demand Multiple Dry Year Period Ending in 2015

	2011 AFY	2012 AFY	2013 AFY	2014 AFY	2015 AFY
Demand	8,389.2	8,462.0	8,534.7	8,607.5	8,680.3
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-19 (DWR Table 51) Projected Supply and Demand Comparison during Multiple Dry Year Period Ending in 2015

	2011 AFY	2012 AFY	2013 AFY	2014 AFY	2015 AFY
Supply totals	10,149.0	10,149.0	10,149.0	10,149.0	10,249.0
Demand totals	8,389.2	8,462.0	8,534.7	8,607.5	8,680.3
Difference	1,759.8	1,687.0	1,614.3	1,541.5	1,568.7
Difference as Percent of Supply	17.3%	16.6%	15.9%	15.2%	15.3%
Difference as Percent of Demand	21.0%	19.9%	18.9%	17.9%	18.1%

Table 8-20 (DWR Table 52) Projected Supply during Multiple Dry Year Period Ending in 2020

	2016 AFY	2017 AFY	2018 AFY	2019 AFY	2020 AFY
Supply	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-21 (DWR Table 53) Projected Demand Multiple Dry Year Period Ending in 2020

	2016 AFY	2017 AFY	2018 AFY	2019 AFY	2020 AFY
Demand	8,736.6	8,793.0	8,849.3	8,905.7	8,962.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-22 (DWR Table 54) Projected Supply and Demand Comparison during Multiple Dry Year Period Ending in 2020

8462.0 8534.7	2016 AFY	2017 AFY	2018 AFY	2019 AFY	2020 AFY
Supply totals	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Demand totals	8,736.6	8,793.0	8,849.3	8,905.7	8,962.0
Difference	1,512.4	1,456.0	1,399.7	1,343.3	1,287.0
Difference as Percent of Supply	14.8%	14.2%	13.7%	13.1%	12.6%
Difference as Percent of Demand	17.3%	16.6%	15.8%	15.1%	14.3%

Table 8-23 (DWR Table 55) Projected Supply during Multiple Dry Year Period Ending in 2025

	2021 AFY	2022 AFY	2023 AFY	2024 AFY	2025 AFY
Supply	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-24 (DWR Table 56) Projected Multiple Dry Year Period Ending in 2025

	2021 AFY	2022 AFY	2023 AFY	2024 AFY	2025 AFY
Demand	8,983.1	9,004.1	9,025.2	9,046.2	9,067.3
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-25 (DWR Table 57) Projected Supply and Demand Comparison during Multiple Dry Year Period Ending in 2025

	2021 AFY	2022 AFY	2023 AFY	2024 AFY	2025 AFY
Supply totals	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Demand totals	8,983.1	9,004.1	9,025.2	9,046.2	9,067.3
Difference	1,265.9	1,244.9	1,223.8	1,202.8	1,181.7
Difference as Percent of Supply	12.4%	12.2%	11.9%	11.7%	11.5%
Difference as Percent of Demand	14.1%	13.8%	13.6%	13.3%	13.0%

Table 8-26 Projected Supply during Multiple Dry Year Period Ending in 2030

	2026 AFY	2027 AFY	2028 AFY	2029 AFY	2030 AFY
Supply	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-27 Projected Multiple Dry Year Period Ending in 2030

	2026 AFY	2027 AFY	2028 AFY	2029 AFY	2030 AFY
Demand	9,080.1	9,092.9	9,105.7	9,118.5	9,131.3
Percent of projected normal	100%	100%	100%	100%	100%

Table 8-28 Projected Supply and Demand Comparison during Multiple Dry Year Period Ending in 2030

	2026 AFY	2027 AFY	2028 AFY	2029 AFY	2030 AFY
Supply totals	10,249.0	10,249.0	10,249.0	10,249.0	10,249.0
Demand totals	9,080.1	9,092.9	9,105.7	9,118.5	9,131.3
Difference	1,168.9	1,156.1	1,143.3	1,130.5	1,117.7
Difference as Percent of Supply	11.4%	11.3%	11.2%	11.0%	10.9%
Difference as Percent of Demand	12.9%	12.7%	12.6%	12.4%	12.2%

8.7 Summary of Comparative Analysis

As indicated in Section 1 the City, often in cooperation with the Agency, has previously prepared water supply planning documents. This document is a regular update to the City's Urban Water Management Plan as anticipated by the Act. The regular update process allows water suppliers to provide current information regarding their projected water supplies and demands. While this document is generally consistent with previous work, it incorporates information that became available after the completion of the City's previous comprehensive analysis in January 2005.

Highlights of this analysis include:

1. The City is basing its projections of available Agency supply on the Agency's current water rights, which are more restrictive than hydrologic constraints. The City projects

that 6,372 AFY of Agency supply will be available over the horizon of this Plan. This projection is consistent with the Agency's adopted Water Shortage Allocation Model and is within 2% of the projections the City made in its 2005 City-wide Water Supply Assessment.

2. The City is basing its projections of groundwater availability upon the findings of its local policy documents and an ongoing analysis of groundwater pumping and levels in the basin from which it pumps. The City projects that 2,577 AFY of groundwater supply will be available over the horizon of this Plan. This projection is consistent with legal decisions and is sustainable based on analysis of the City's demands and other demands in the area and is identical to the projections the City made in its 2005 City-wide Water Supply Assessment.

3. The City is basing its projections of available recycled water on existing contracts for supply and a planned expansion. The City projects that a total 1,300 AFY of recycled water will be available over the horizon of this Plan. This includes 1,000 AFY of currently contracted supply and 300 AFY of planned expansions. This projection is consistent with Subregional System's adopted IRWP Master Plan and EIR and is identical to the projections the City made in its 2005 City-wide Water Supply Assessment.

4. The City is basing its demand projections on a detailed demand model developed in partnership with the Agency. The demand model utilizes the City's current billing records as the basis for projections and includes allowances for Plumbing Code changes and a variety of demand management measures. This method of analysis is different from that employed in the 2005 City-wide Water Supply Assessment, which was based on land use. By way of comparison, this Plan projects a 2025 water demand of 9,067.3 AFY, which is within 5% of the demand projected in 2005 City-wide Water Supply Assessment. The major difference between the two analyses is a more rigorous documentation in this Plan of future demand management potential.

5. The City's combined projected water supplies, for all 5-year increments through 2030, are sufficient to meet its projected demands. For example in 2030, the projected combined water supplies are 10,249 AF while the projected demands are 9,131 AF. The City's projected water supply portfolio, consisting of a mix of surface water, groundwater and recycled water, is highly stable because it relies largely on current contracted and permitted water supplies that are not subject to hydrologic constraints.

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FIGURES

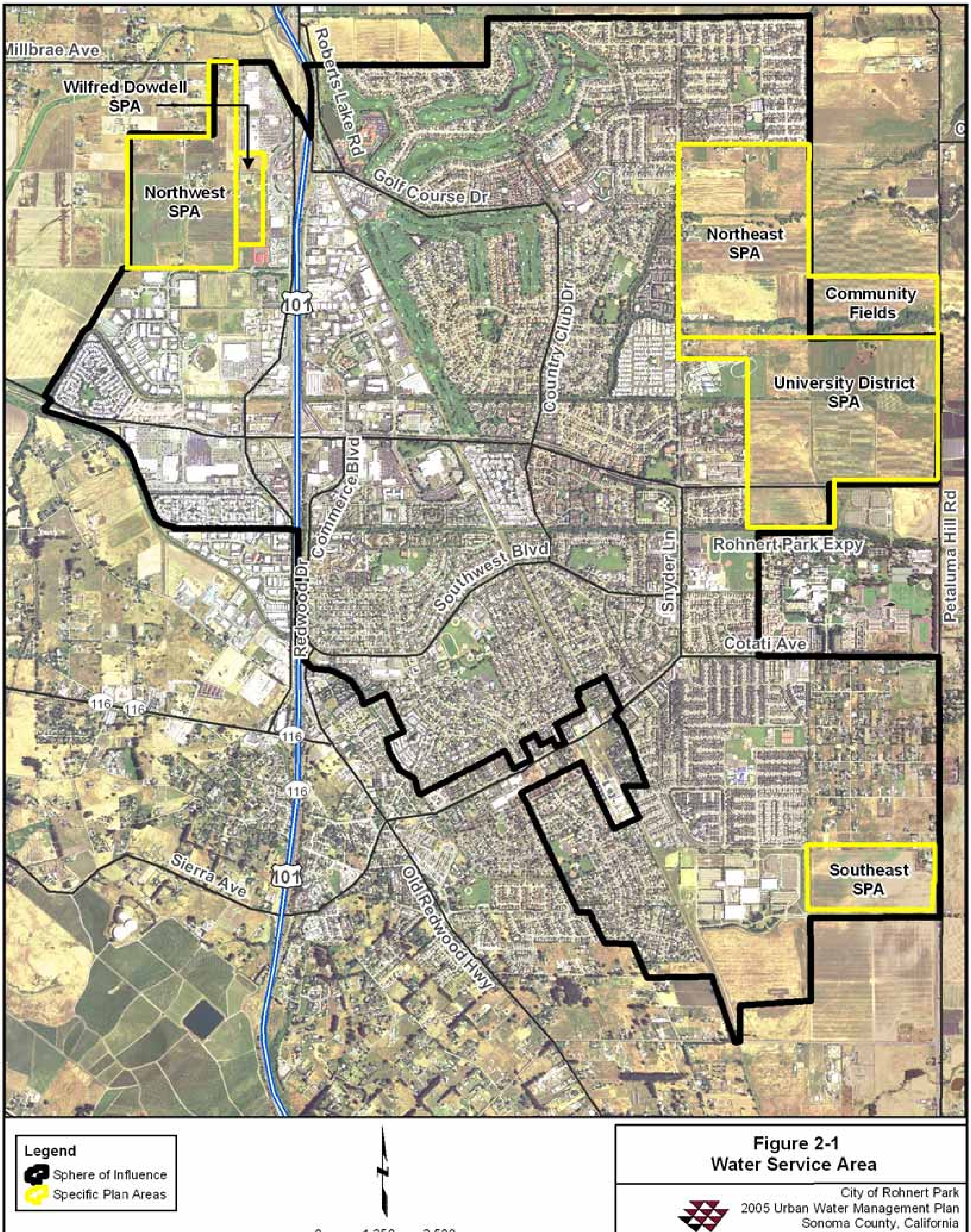

Figure 2-1
Water Service Area

City of Rohnert Park
2005 Urban Water Management Plan
Sonoma County, California
04205627
August 2007

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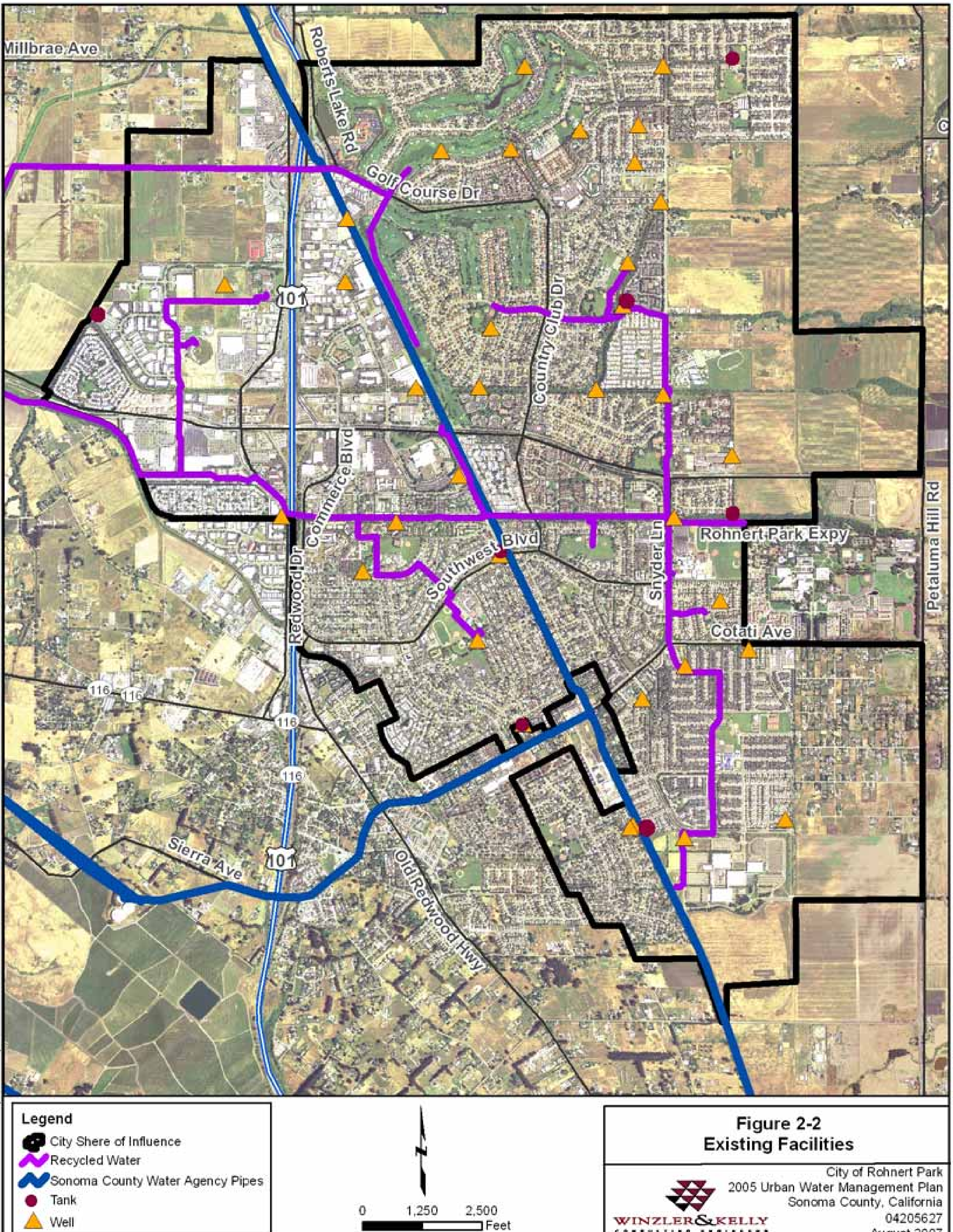

Figure 2-2
Existing Facilities

City of Rohnert Park
2005 Urban Water Management Plan
Sonoma County, California
04205627
August 2007

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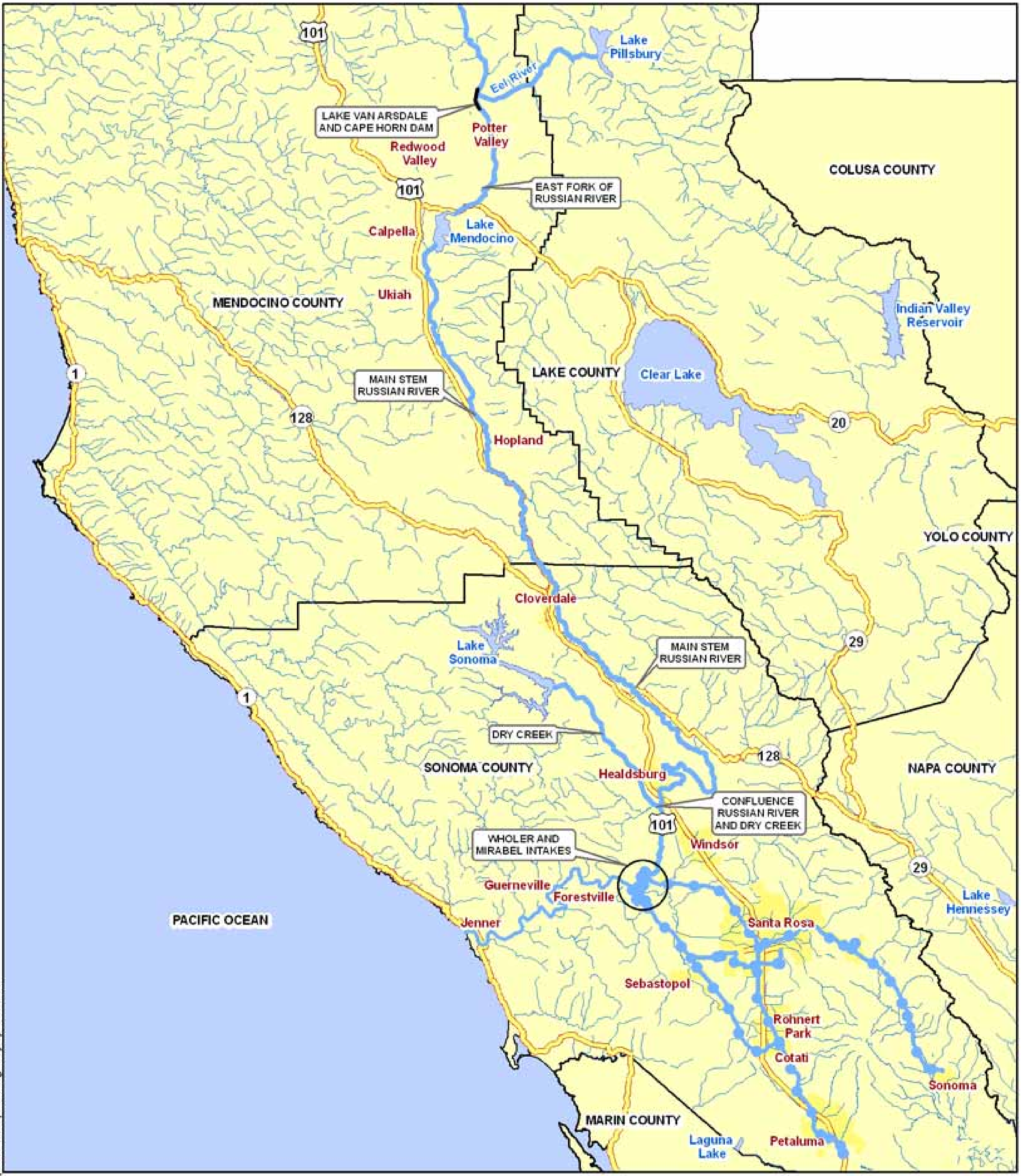

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Legend

- Rivers
- Lakes
- StreamChannels Used for Public Water Supply
- SCWATransmission Pipelines
- Highway

0 25,000 50,000 Feet

Figure 3-1
Agency System

City of Rohnert Prk
2005 Urban Water Management Plan
Sonoma County, California
04205627
August 2007

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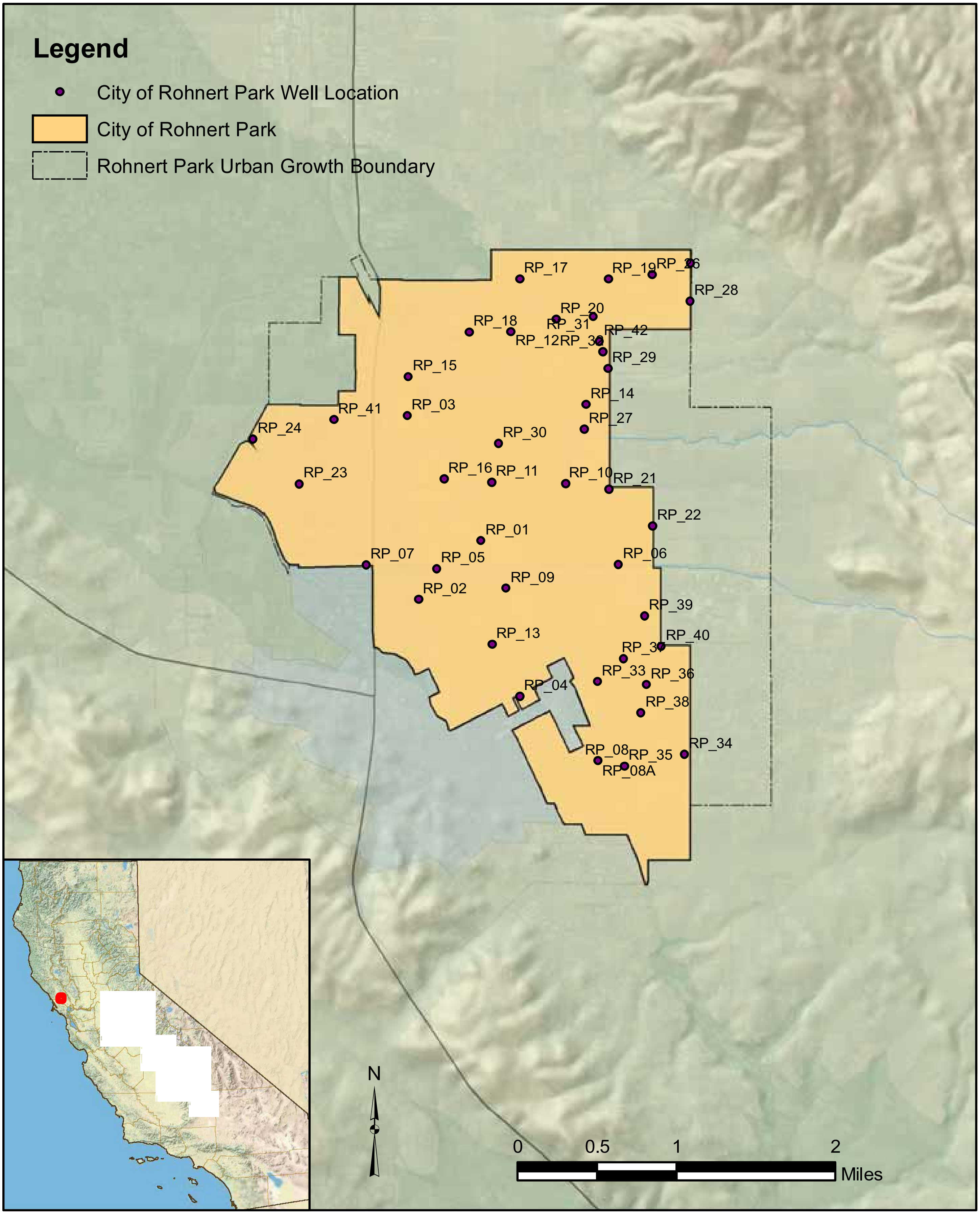

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Figure 4-1
Location Map
City of Rohnert Park and City Wells

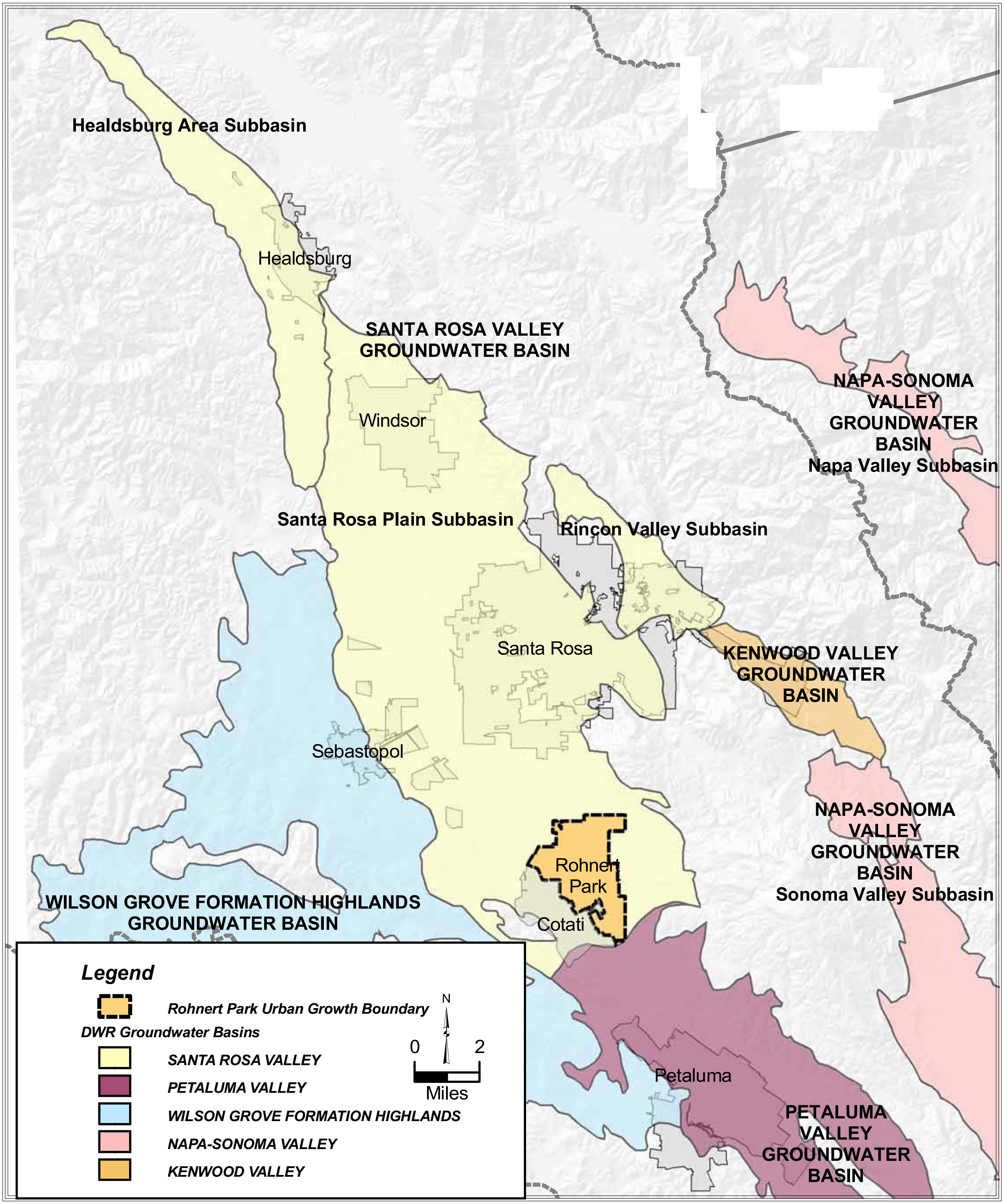

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Figure 4-2
Groundwater Basins and Subbasins
Rohnert Park and Vicinity

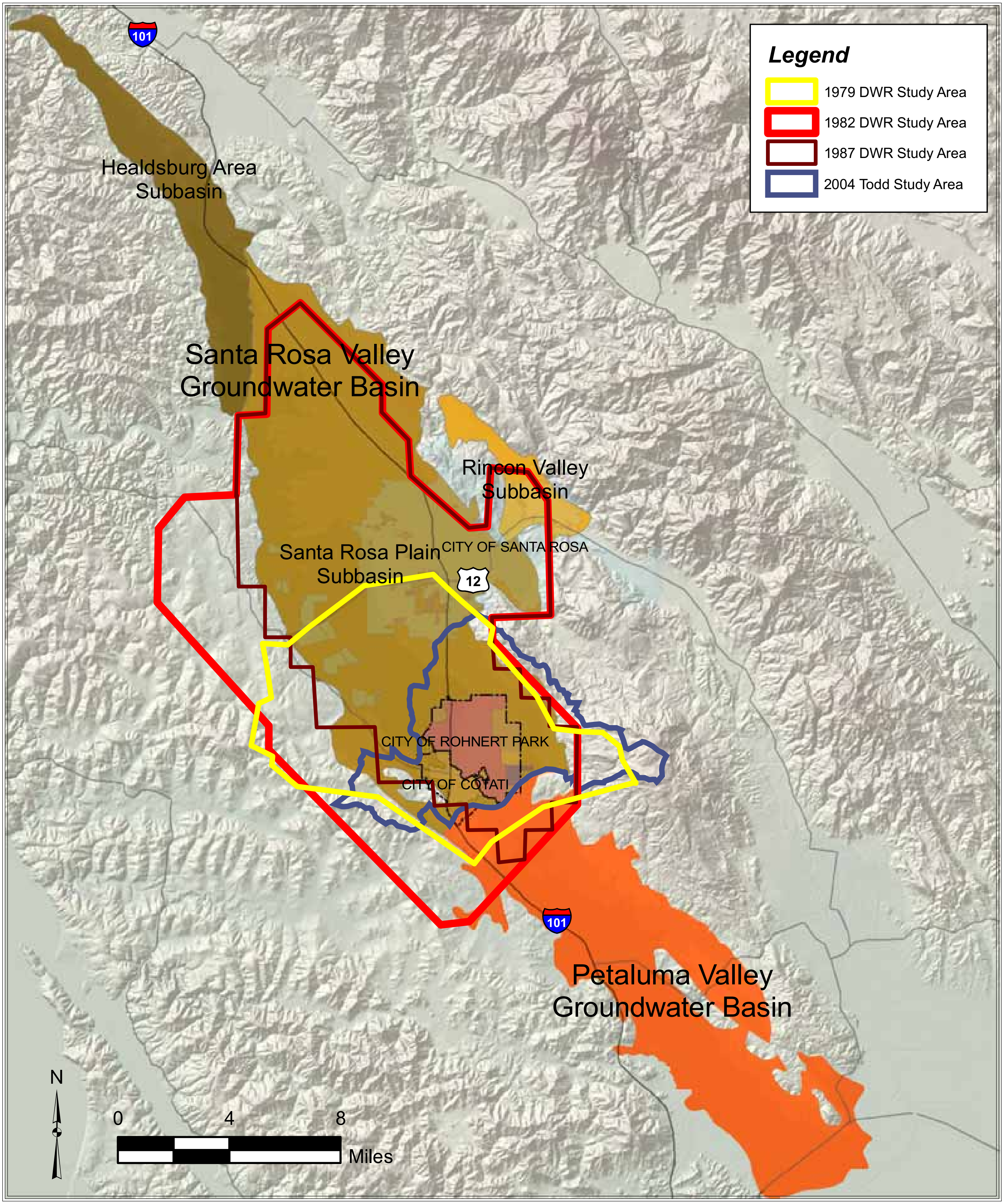

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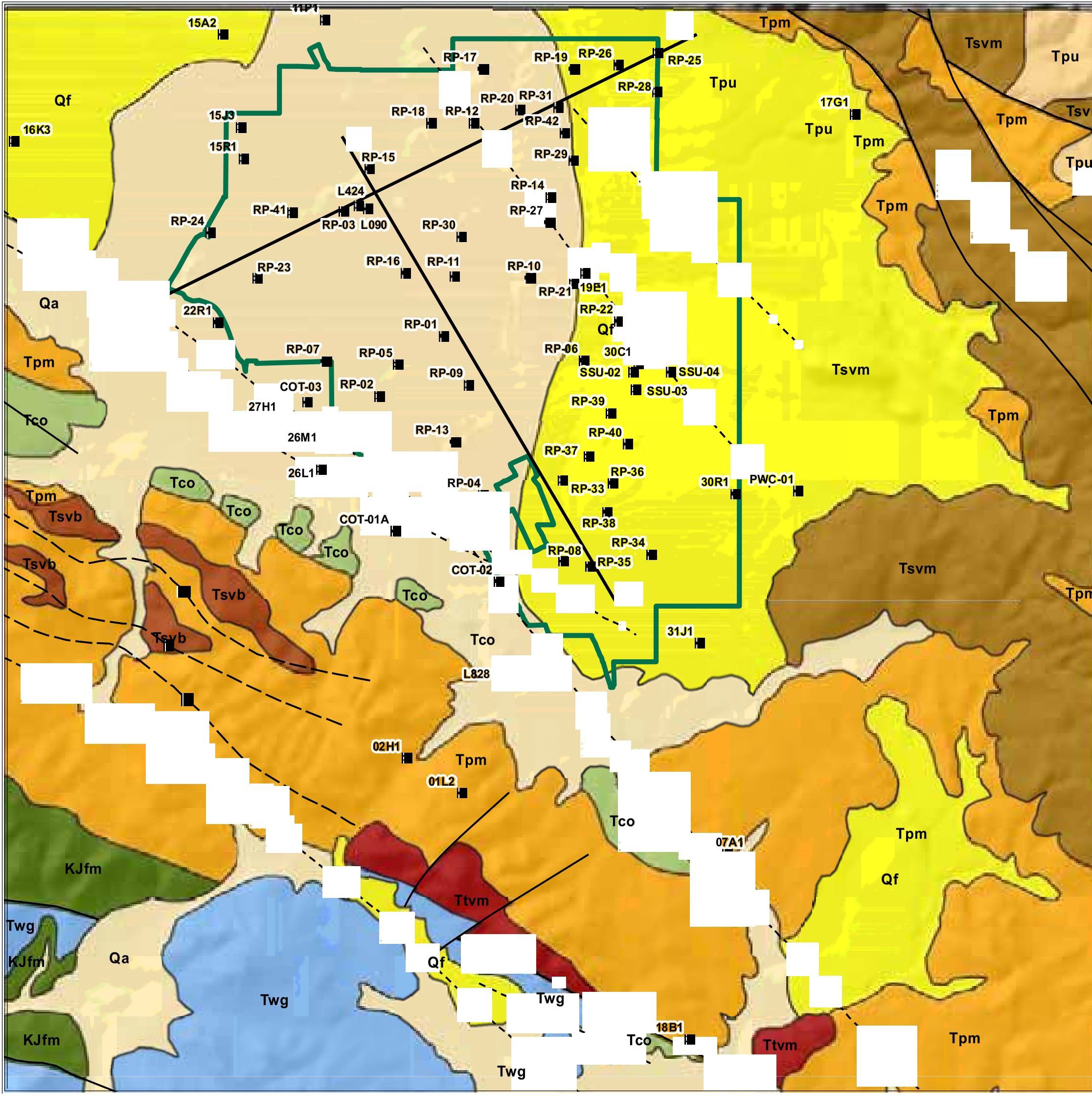
Figure 4-3
DWR and Todd Study Areas



Legend

Geologic Unit

- Qa - Alluvium
- Qf - Alluvial Fans
- Tpu - Petaluma Formation (Upper)
- Tco - Cotati Formation
- Tpm - Petaluma Formation (Middle)
- Twg - Wilson Grove Formation
- Tsvb - Sonoma Volcanics - Basalt
- Tsvm - Sonoma Volcanics - Mafic
- Ttvm - Tolay Volcanics
- KJfm - Franciscan Complex

- Fault
- Thrust Fault
- Buried Fault
- Syncline
- Anticline
- Cross Section Location A A'
- U = Upthrown Side
- D = Downthrown Side
- Well Location
- Rohnert Park UGB

Note: Due to uncertainty about the Sebastopol fault, two locations are shown based on DWR (1982) and Allen (2003). DWR (1982) does not show the Petaluma Valley fault.

Modified from: Clahan, K.B., et al, 2004, Draft, Geologic map of the Cotati 7.5' Quadrangle, California Geological Survey.

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0 0.75 1.5 Miles

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Figure 4-4
Geologic Map, City of Rohnert Park and Vicinity

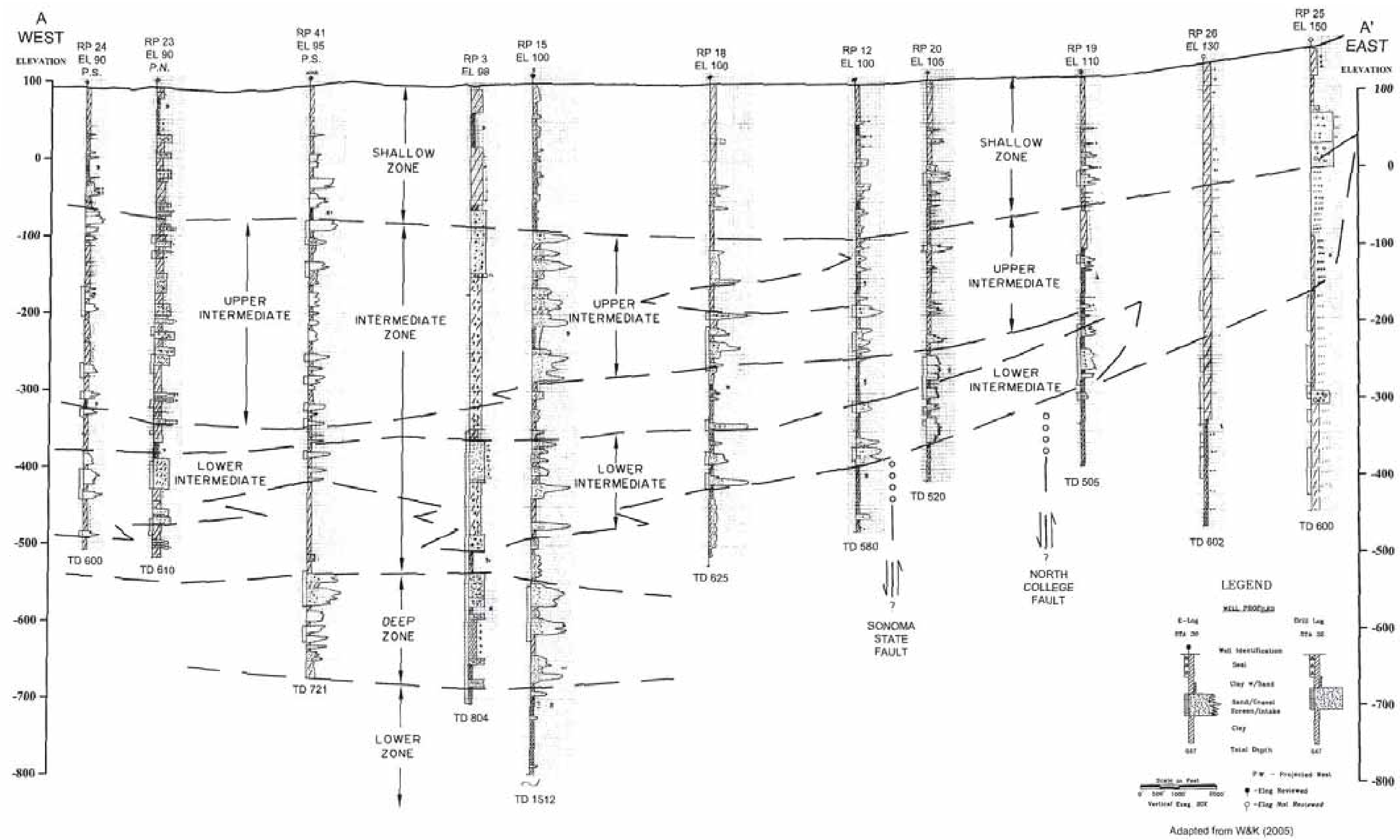

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Figure 4-5
Geologic Cross-Section A-A'

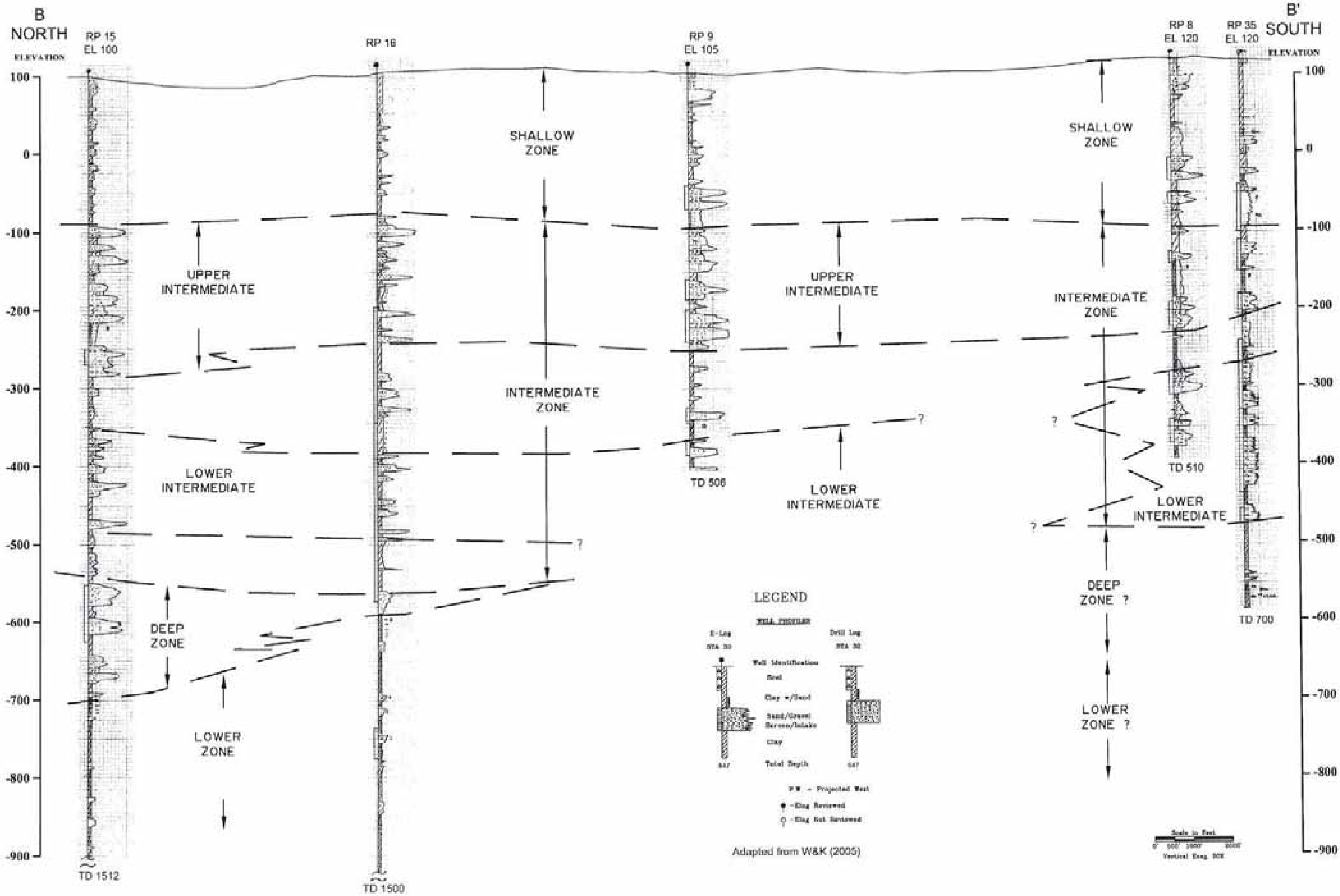

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Figure 4-6
Geologic Cross-Section B-B'

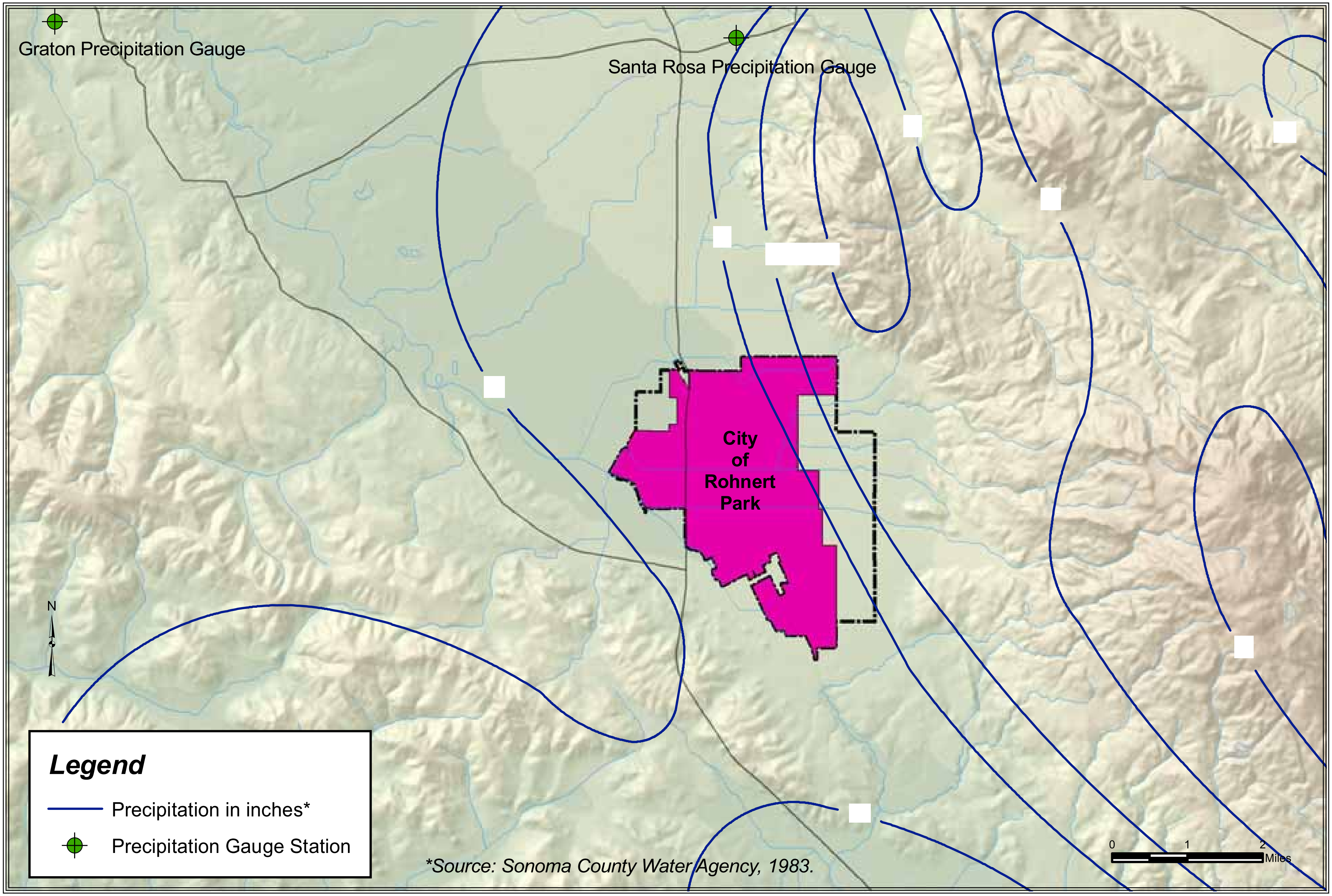

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Figure 4-7
Contours of Mean Annual Precipitation
City of Rohnert Park and Vicinity

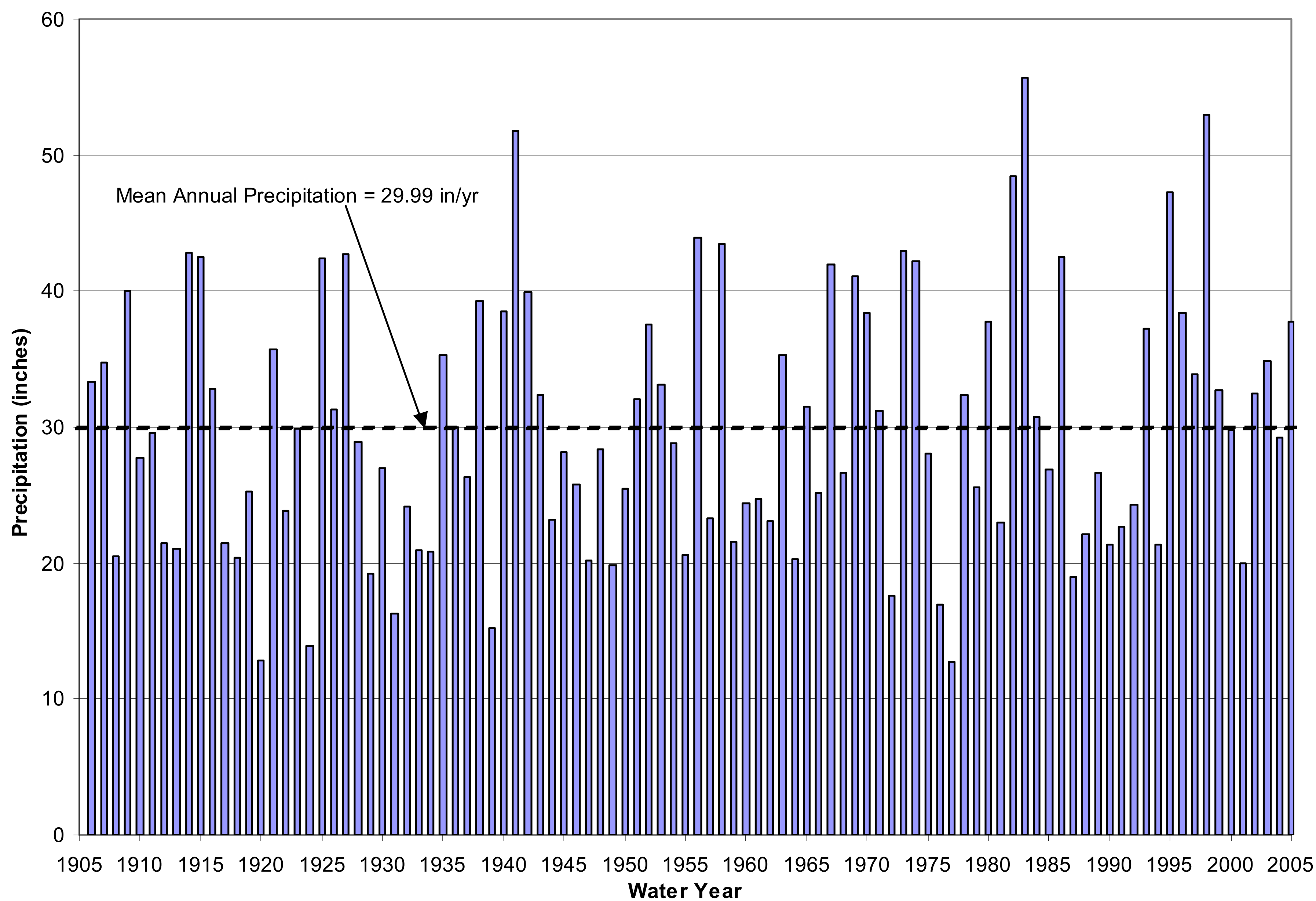

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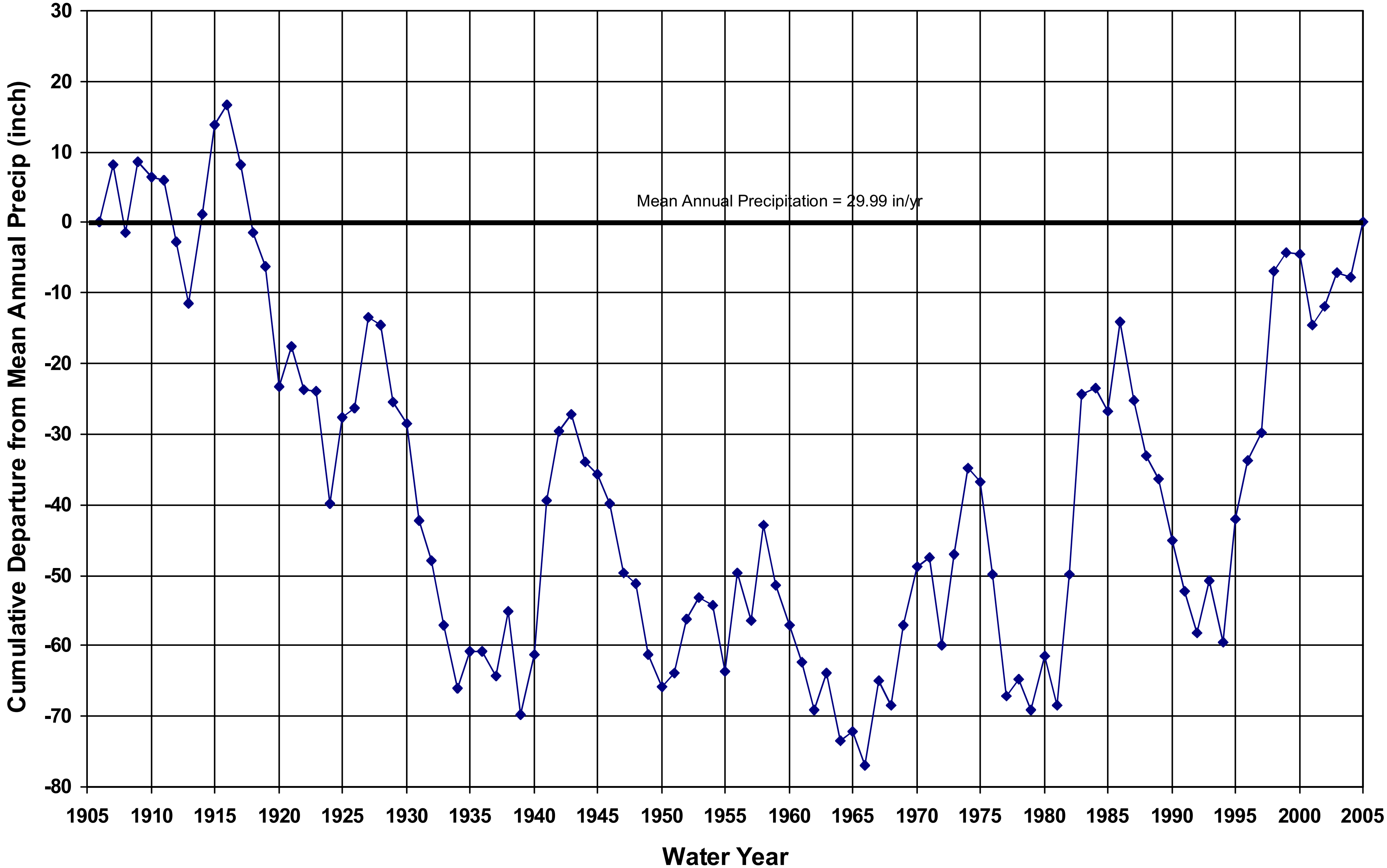
Figure 4-8
Annual Precipitation at Santa Rosa Gauge
Water Year 1906-2005



1906-1965 Santa Rosa Station monthly precipitation data from California Data Exchange Center (38°26.7'N / 122°45'W, 109 feet elev)
1965-2005 Santa Rosa Station (38°26'N / 122°42'W, 174 feet elev)
1931-2005 Santa Rosa Station monthly precipitation data from National Climatic Data Center. Missing data (Aug '37, Jan-May '79, Apr-May '00 and Mar-May '01) approximated using correlation wit Graton Station (38°26'N / 122°52'W, 200 feet elev)

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Figure 4-9
Cumulative Departure from Mean Annual Precipitation at Santa Rosa Gauge

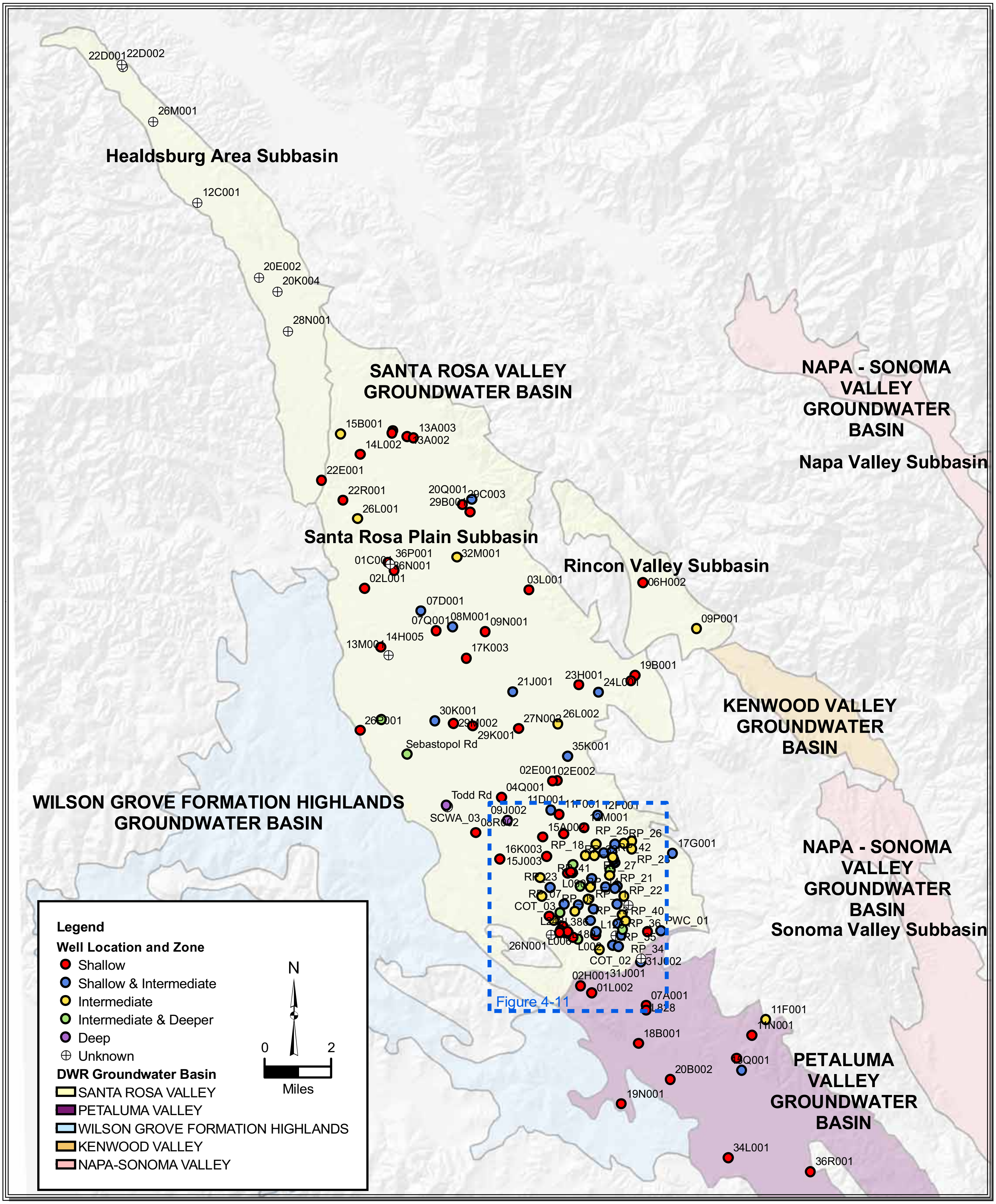

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Figure 4-10
Location of Wells with Water Level Hydrographs

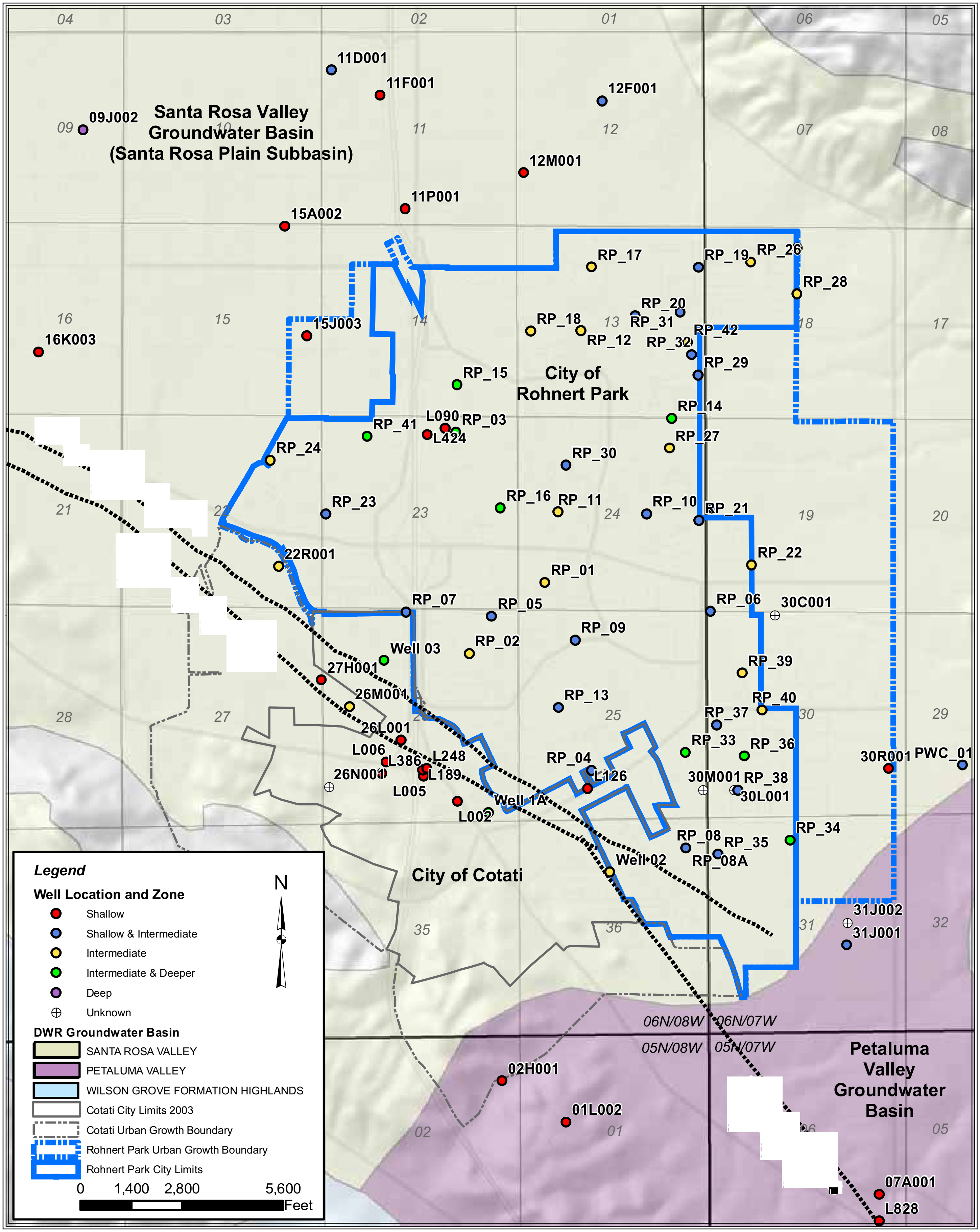

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Figure 4-11
Location of Wells with Water Level Hydrographs in City of Rohnert Park/Cotati Area

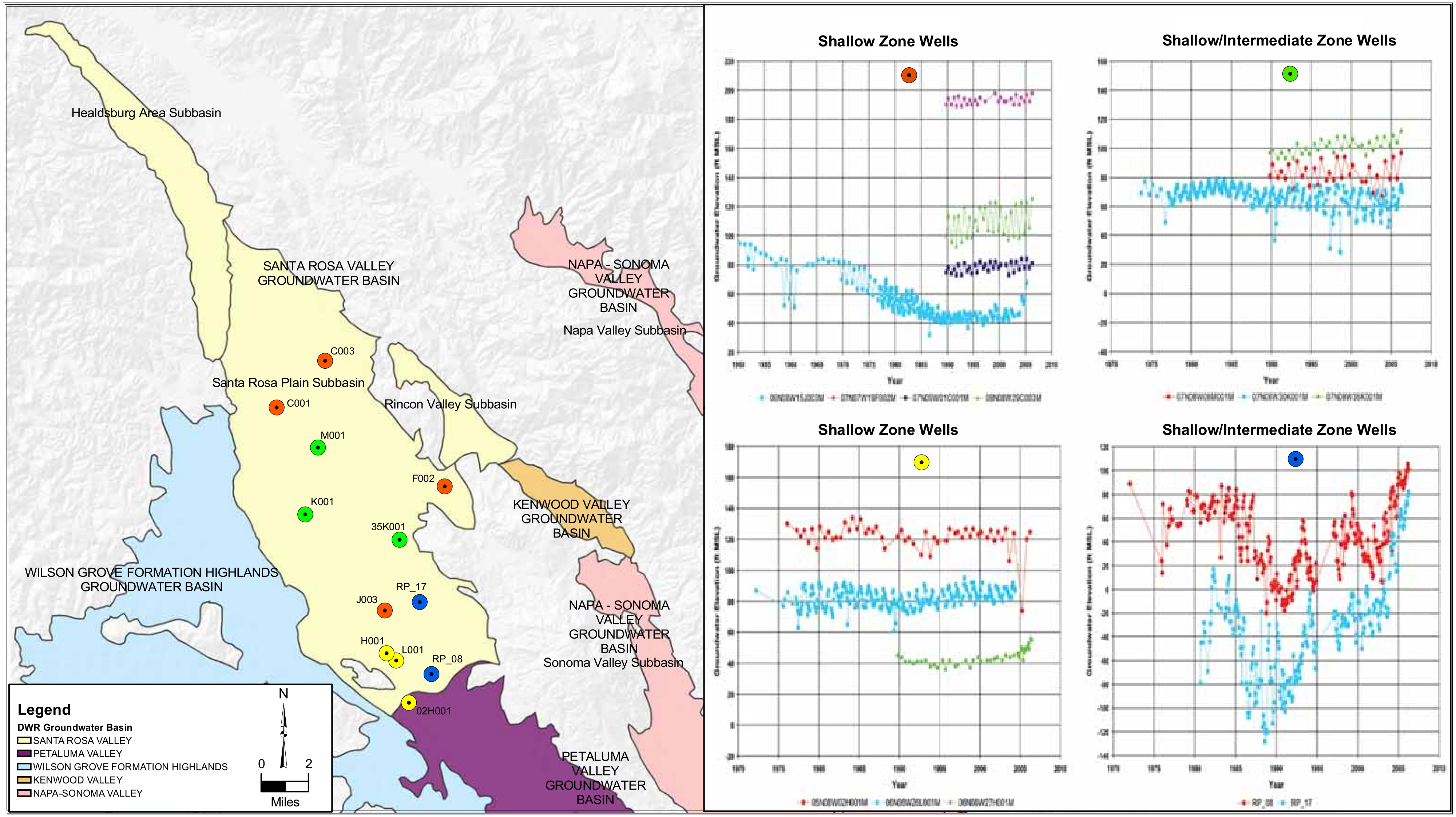

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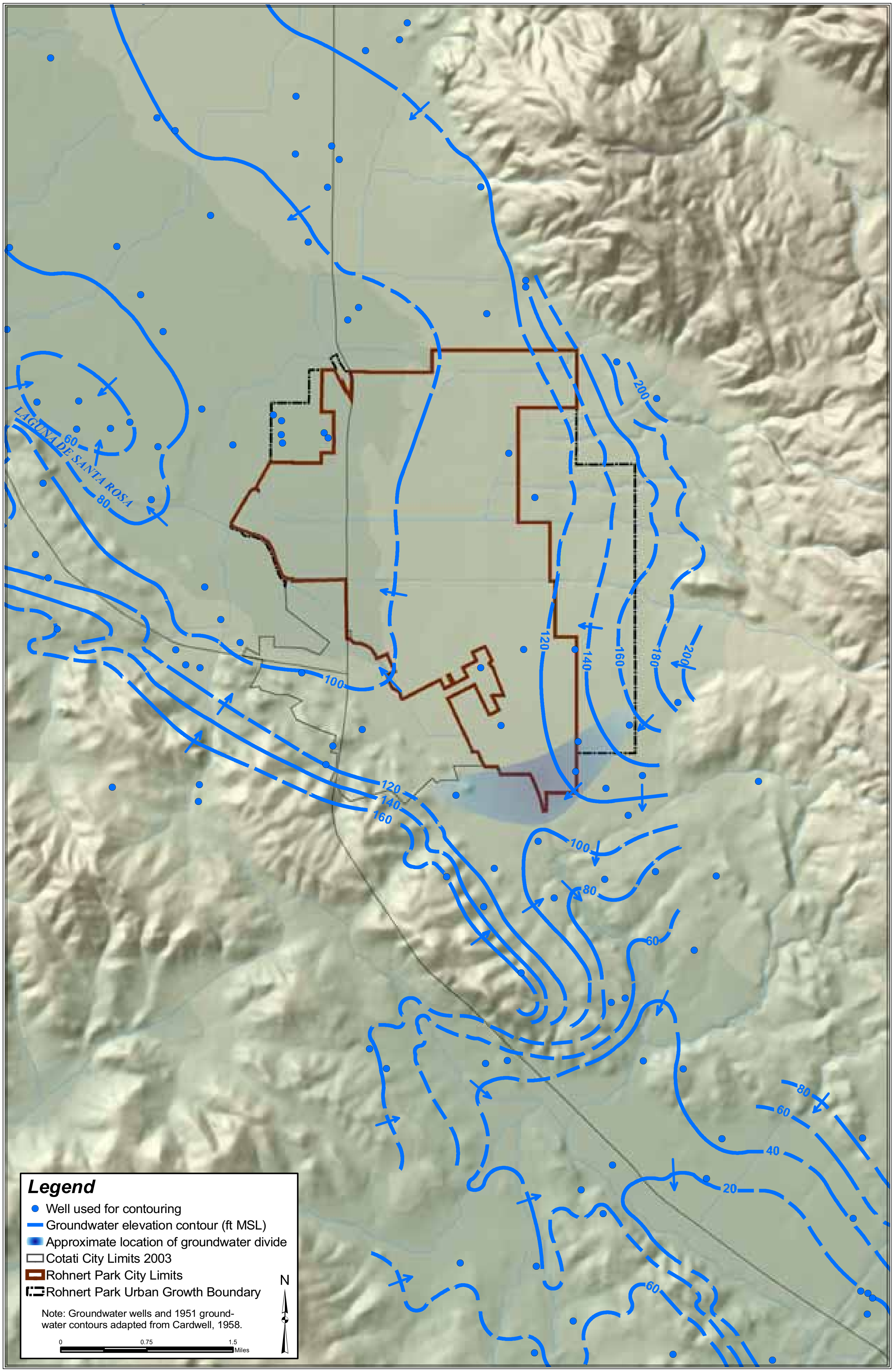
Figure 4-12
Location of Wells with Representative Groundwater Level Hydrographs



Y:\Cotati UWMP 06-1-003\Maps\Figure5-11 Cardwell 1951 Contours.mxd

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Figure 4-13
Spring 1951 Groundwater Elevation Contours
Prepared by Cardwell (1958)

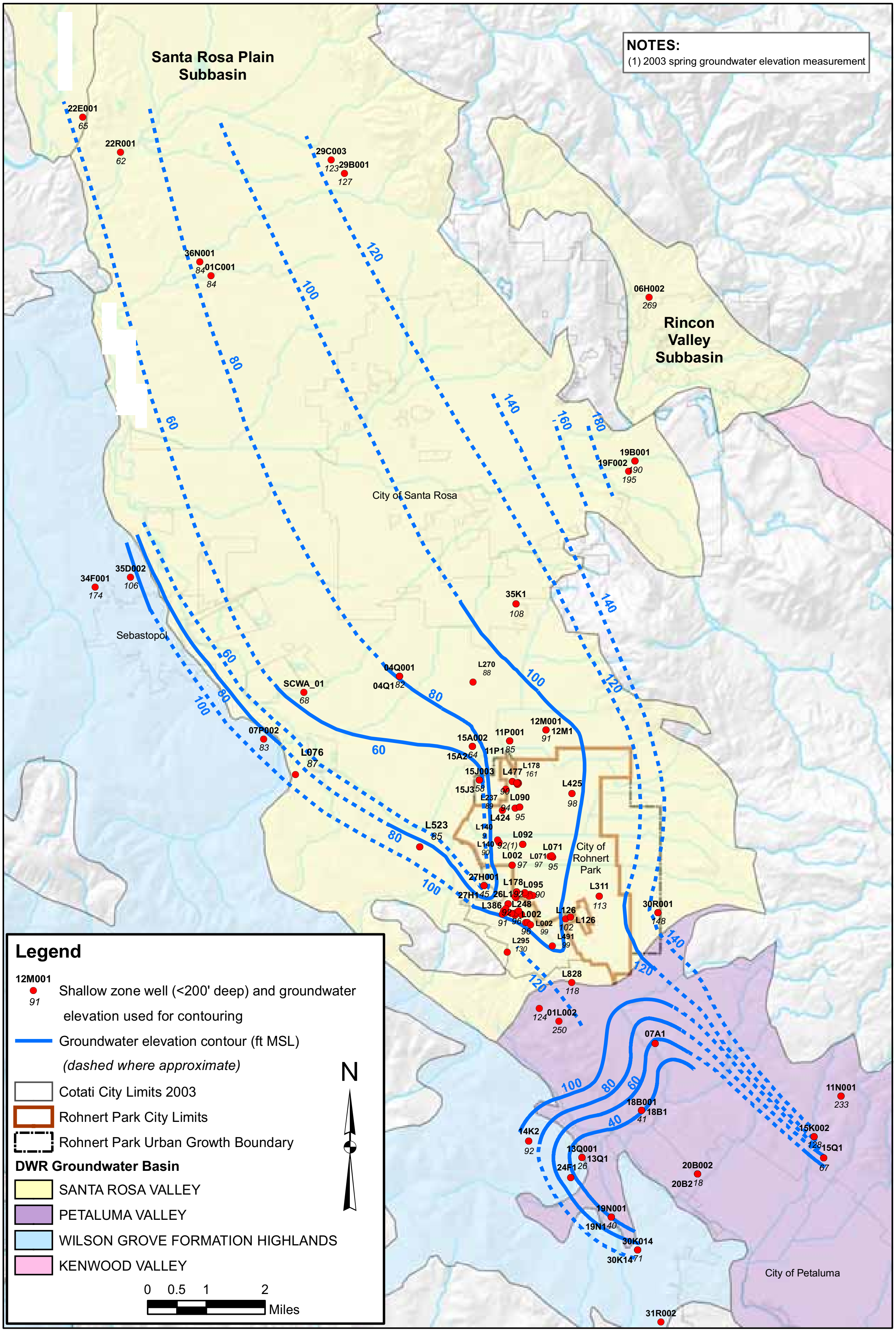

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Figure 4-14
Spring 2004 Groundwater Elevation Contours for Shallow Wells in the Santa Rosa Plain Subbasin and Northern Petaluma Valley Groundwater Basin

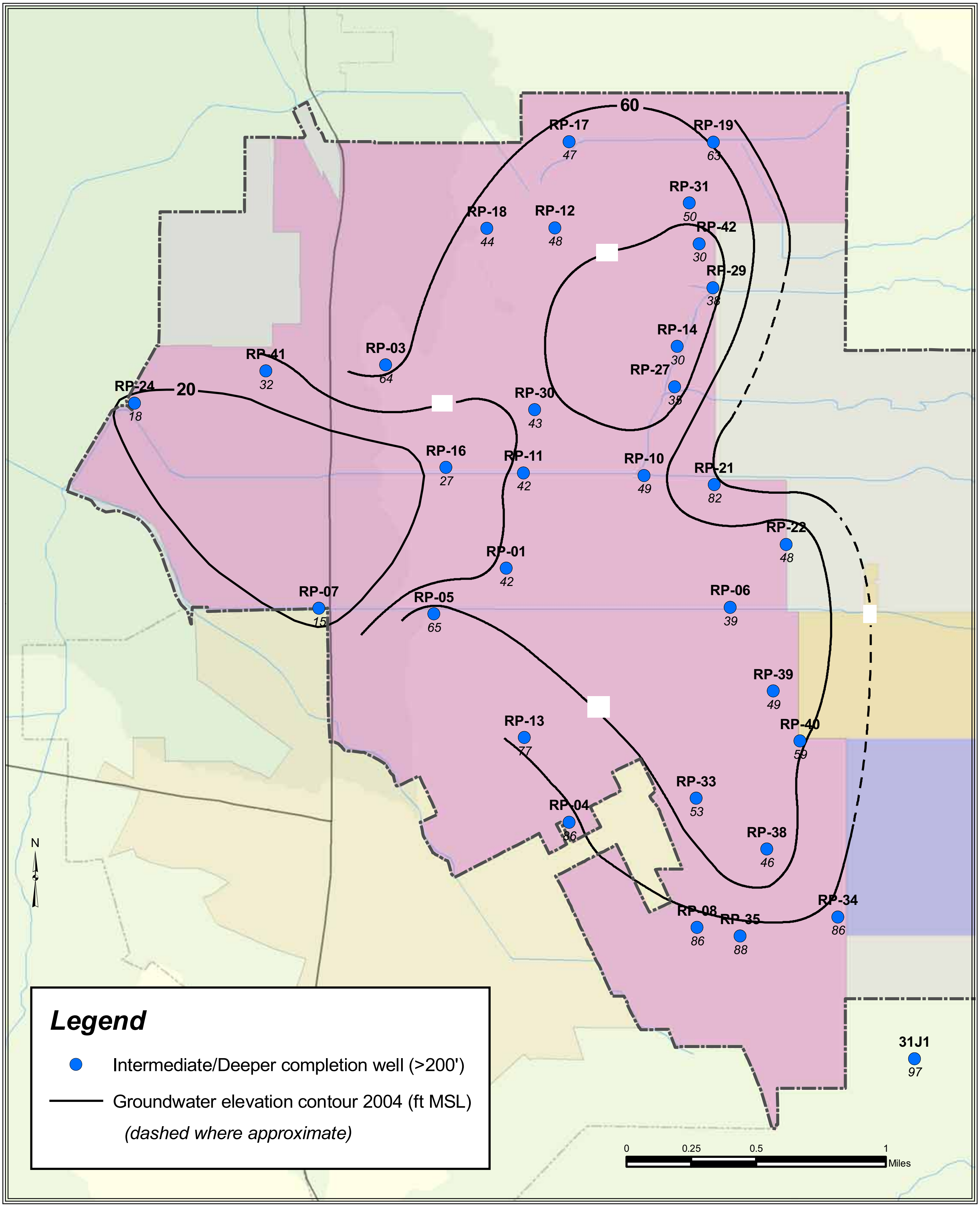

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Figure 4-15
Spring 2004 Groundwater Elevation Contours for Intermediate/Deeper Wells in the Rohnert Park Area

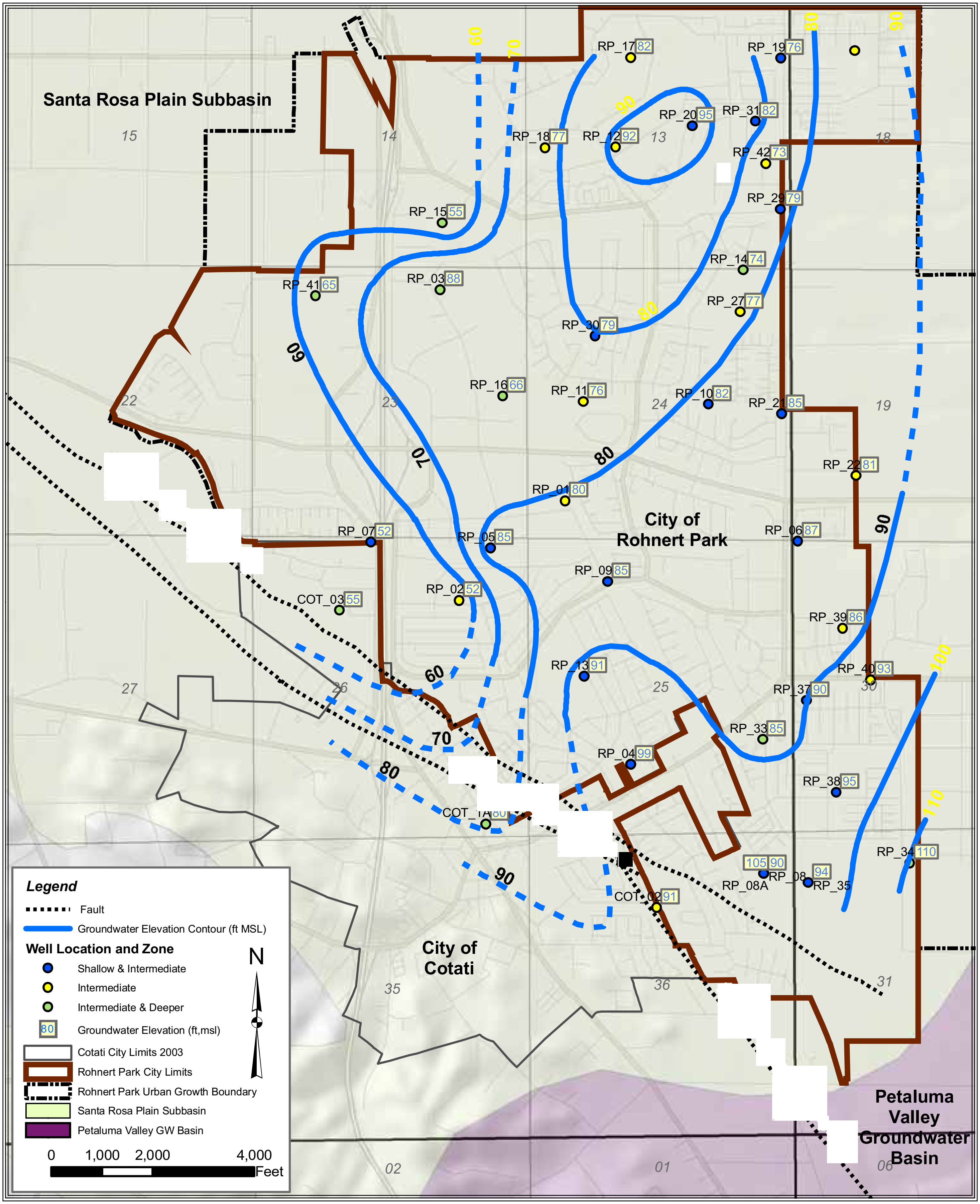

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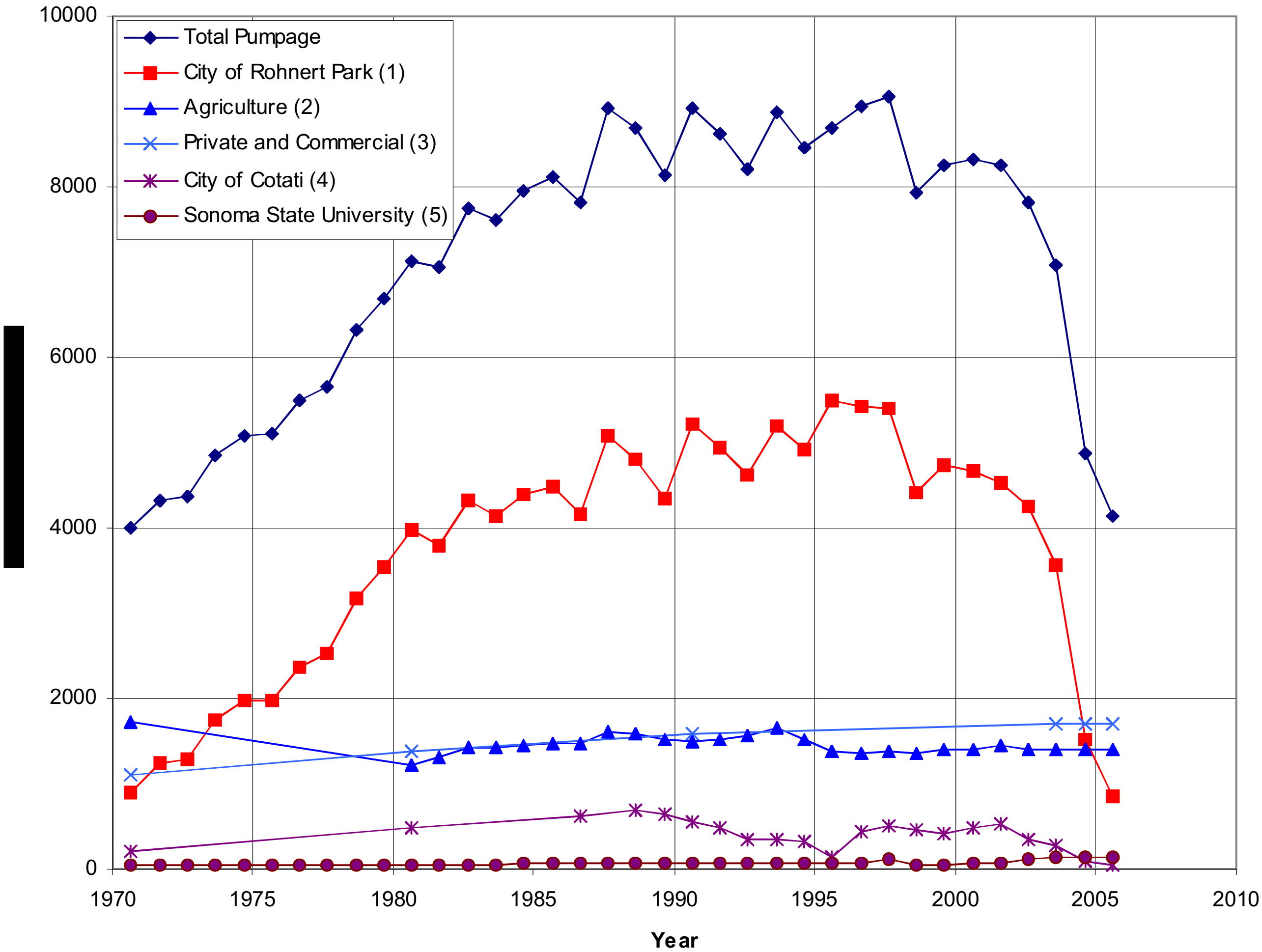
Figure 4-16
Spring 2006 Groundwater Elevation Contours for Intermediate/Deeper Wells in Southern SRP Subbasin



(1) City of Rohnert Park: City provided pumpage totals by well for 1972 to 2005. Todd provided annual pumpage for 1970 and 1971.

(2) Agriculture: 1986 pumpage value reported by Todd (2004). Variation during 1980-2002 based on Figure 3 "Harvested Acreage" (Sonoma County Land Use Audit by Economic Planning Systems, Inc. http://www.epsys.com/client_site/12140 SCLUA/12140draft.pdf). 1970 value based on Sonoma County Farm Bureau crop report. 2002 estimate also used for 2003-2005.

(3) Private and Commercial: Todd (2004) provided a 2003 pumpage estimate (current) also used for 2004 and 2005. The City provided population estimates for 1990 and 2000 for unincorporated watershed area based on census block group maps. 1970 and 1980 unincorporated watershed population percentage increase derived from "unincorporated" population for the county (Economic Planning System, Inc., 2003, Draft Report. Sonoma County land use audit, for: Greenbelt Alliance and Sonoma County Farm Bureau, October 2003). Todd's (2004) multi-family and single-family water demands were applied to the estimated units based on rural population to determine pumpage for 1970 to 2000. Commercial and Accomodations pumpage assumed the same annual percentage change as calculated for private users.

(4) City of Cotati: 1986/1988-1995 annual pumpage provided by Todd, 1996-2005 annual pumpage provided by City of Cotati. 1970 to 1985 and 1987 pumpage based on 1970, 1980, and 1990 census population data. Pumpage estimated by population and reduced for estimated Agency deliveries.

(5) Sonoma State University: 1994-2003 annual pumpage provided by Todd (personal communication). 1970 to 1993 annual pumpage based on SSU student population for 1970, 1980, and 1990 from "System and Campus Enrollment" and an average water use per student (1994-2003). 2003 estimate of annual pumpage used for 2004 and 2005.

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Figure 4-17
Total Annual Metered and Unmetered Pumpage in Study Area: 1970-2005

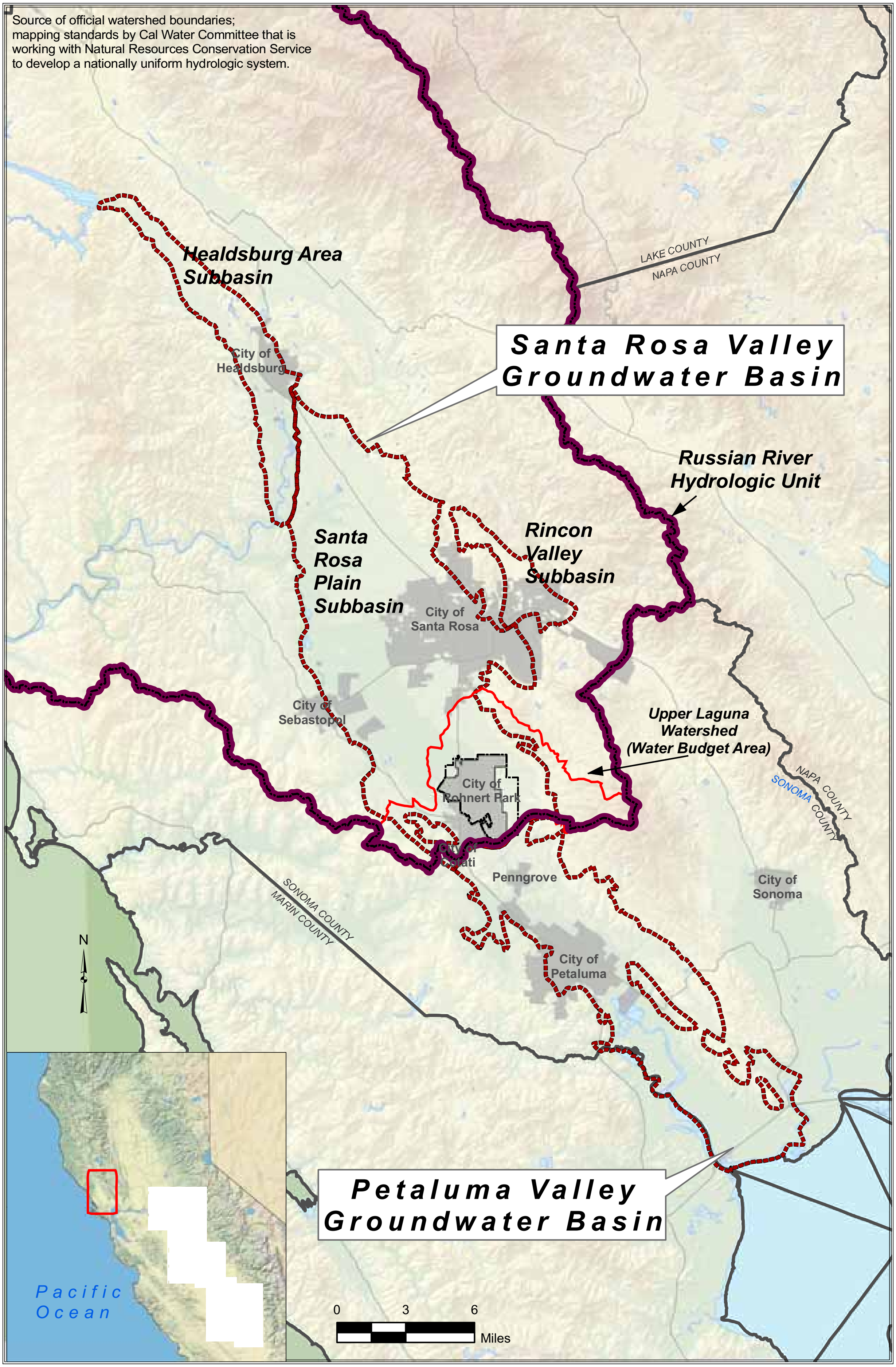

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Figure 4-18
Rohnert Park and Vicinity
Sonoma County, California